

ORIGINAL RESEARCH

Experiences of midwives and community health workers using mHealth to improve services to pregnant women in rural Burkina Faso, Africa

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Received: June 23, 2019

Accepted: November 5, 2019

Online Published: November 25, 2019

DOI: 10.5430/jnep.v10n3p57

URL: <https://doi.org/10.5430/jnep.v10n3p57>

ABSTRACT

Objective: This qualitative, descriptive study explored the experiences of midwives and community health workers (CHWs) using mhealth to improve the care provided to pregnant women living in the rural Diapangou region of Burkina Faso, Africa.

Methods: Semi-structured interviews were conducted with 4 CHWs and 4 community health center staff. Transcripts were content analyzed.

Results: Despite internet connectivity challenges all participants agreed that mhealth allowed them to provide better maternal care. The service enhanced their practice collectively, through facilitating better follow-up care, promoting communication and collaboration, and facilitated management while simplifying administrative tasks. From a managerial perspective, having access to productivity information allowed for effective oversight and supervision of work-related activities. CHWs perceived additional work responsibilities and an opportunity for growth; however, both CHWs and staff recognized that the exposure to technology allowed them to achieve mastery of basic computer skills.

Conclusions: The 'digital divide' remains a challenge in low resource settings, thus while findings are promising, Burkina Faso will have to wait to reap the full benefits of digital technology until a supportive infrastructure can be put in place.

Key Words: mhealth, Antenatal care, Maternal care, Midwives, Community health workers, Rural healthcare, Burkina Faso

1. BACKGROUND

According to the World Health Organization,^[1] maternal morbidity and mortality remains unacceptably elevated in low-resource settings (LRSs) due to limited access to healthcare services. This is especially true for pregnant women living in rural areas, who are more likely to experience complications related to high blood pressure, hemorrhage, infections, blood clots, or obstructed labor.^[1] To address the problem of accessibility, mhealth or mobile health initiatives are increasingly being used in developing countries, especially in the area of

maternal health.^[2] These initiatives, while showing potential to improve maternal health, often consist of pilot projects that rarely move towards large-scale deployment because of a lack of sustained funding.^[3,4] Despite the type of mhealth applications such as appointment reminders, client education, provider-to-provider communication, etc.,^[5] evidence exists that these interventions improve antenatal care (ANC) attendance, increase utilization of oral contraception,^[6] promote the choice of delivery by a skilled birth attendant thereby reducing home deliveries,^[7-9] and permit early detection and

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timely referral of high-risk pregnancies in remote areas.^[10]

The majority of mhealth studies tend to report on the reproductive health outcomes or the efficacy of these interventions;^[11] however, the experiences of community health workers (CHWs) and midwives using these applications are key to increasing the uptake of mhealth services. Findings have shown that there is high acceptance of mhealth among CHWs as it is perceived as superior to their traditional method of care delivery, in the best interest of their communities, and more aligned with future trends in health systems.^[12,13] Overall, CHWs perceived these applications to be easy to use and useful as they helped them to overcome field-related barriers such as the challenge of balancing multiple priorities, lacking appropriate tools to provide clinical services and collect data, and limited access to training and supervision.^[14] In addition, digital data collection helped CHWs organize data, save time with bureaucratic paperwork, and reduce the weight carried in the field.^[12] Access to patient data and regular mobile phone consultations between the CHWs and midwives were considered to reinforce CHW's knowledge on maternal newborn care and thus boosted their social status in the community.^[15] Conversely, midwives indicated that on the one hand, mhealth improves communication processes and strengthens support structures within the system, and on the other hand, it increases interaction and information exchange between midwives and patients; both contributing to improving midwives' motivation and job satisfaction.^[16] Despite these documented benefits, CHWs and healthcare professionals indicated that the implementation and sustainable use of mhealth at scale would be daunting without first providing ongoing training and technical support, securing mobile network airtime and improving key functions of the larger health system.^[12,17]

Despite general concordance of user experiences originating from across the globe, successful implementation and scaling of mhealth initiatives must be based on an exploration and documentation of the experiences of frontline workers and context-specific challenges in particular rural regions as even in-country conditions can vary greatly. Hence, this qualitative descriptive study explored the experiences of midwives and CHWs using an mhealth remote monitoring platform to improve the care provided to pregnant women living in the rural Diapangou region of Eastern Burkina Faso (BF), Africa.

2. STREAMS: MHEALTH SERVICE DESCRIPTION

Data presented in this paper were collected as part of a wider mhealth research project – STREAMS (Strengthening Re-

lationships and Enhancing Access to Maternal Services), funded through Grand Challenges Canada, that aimed to improve maternal and newborn health outcomes using telemonitoring. STREAMS was implemented in January 2018 for a duration of 12 months in the health district of Fada-N'Gourma and the Centre de Santé et Promotion Sociale (CSPS) of Diapangou. The county of Diapangou, which covered an area of about 573 km², counts 31 villages and 11 hamlets. The village of Diapangou is located 17 km from Fada-N'Gourma and 203 km from the Ouagadougou, the capital of BF.^[18,19] In Diapangou, there are three main ethnic groups (the Gourmantches, the Mossi, and the Peuhls) that practice three religions: Animism, Islam, and Christianity. STREAMS was implemented in four villages, Bianargou, Lityaneli, Comboari and Komanpelgou, which were selected based on furthest distance to CSPS (> 9 km). The CHWs of these four villages were equipped with smart phones and portable medical equipment to measure expectant mother's blood pressure and their blood glucose levels. During their home visits, taking place twice monthly, CHWs entered the clinical data manually in a cloud-based platform, which was transferred wirelessly and monitored by the CSPS midwives, who were equipped with a laptop, facilitating timely intervention. Clinical data consists of physiological values and patient responses to standardized pregnancy-related questionnaires, exploring common symptoms and concerns such as anxiety about labor, bleeding, pain, fatigue, etc. The mhealth service was delivered over and above the standard care in BF, or four ANC visits during the course of their pregnancy. Before launching the project, all participants received intensive, two-day training on the use of laptop or smartphone, medical equipment and the telemonitoring platform; ongoing support was provided by the Research Assistant (RA), for technical assistance and on the study protocol.

3. METHODS

After receiving institutional, ethical approval in January 2017 from entities in both Canada and BF, the CHWs (n = 4), midwives (n = 3) and nurse/director of the CSPS (n = 1) involved in the project were recruited within the CSPS Diapangou. The director of the CSPS was a 32-year-old male with a state diploma nursing degree and three years of experience. The three female midwives, who were fluent in French and lived locally, had an average age of 35, and had a maximal experience of two years in the maternity ward. The CHWs, of whom one was female and three were male, had an age range between 23 and 45 years. Their experience as a CHW within their village varied widely from 3-12 months to 8-10 years. Three of the CHWs completed high school; while one completed elementary school. All participants reported that they

did not have pre-existing knowledge of mhealth, except one who indicated having heard of technological applications to facilitate surgery. At the end of the project, individual semi-structured interviews were conducted by the principal investigators on the project using web-conferencing software. Interviews were conducted in French, or facilitated by an interpreter, lasted approximately 60 min each and were digitally recorded and transcribed. The interview guide included questions such as, What were your initial thoughts about mhealth? How did mhealth benefit your daily work? What challenges did you encounter? Do you have suggestions for improving the mhealth service? An inductive approach described by Elo & Kyngäs^[20] was used for data analysis. Each transcript was supplemented with field notes and a process of open coding was used to assigned captions to as many segments of the transcripts as necessary to describe all aspects of the data. The codes were organized into categories and themes that captured similar concepts, from which descriptive statements were formed and supported by quotes from the transcripts. Appropriate steps were taken to enhance the trustworthiness of the study. In order to respect anonymity of the single nurse, data will be presented in two general categories of CHWs and MWs/Nurse after each participant quote.

4. RESULTS

Despite the overall internet connectivity challenges and lack of previous exposure to mhealth, all participants were in agreement that the monitoring service allowed them to provide better maternal care within their community. Concretely, the mhealth service enhanced their practice collectively, by contributing to maternal health through facilitating better follow-up care, promoting communication and collaboration, and facilitated management while simplifying administrative tasks. From a managerial perspective, working within a layered, hierarchical healthcare system, having access to information about productivity allowed for effective oversight and supervision of work-related activities. Specific to the CHWs, they perceived additional responsibilities in their work and the opportunity for growth that this offers; however, both CHWs and MWs/Nurse recognized that the exposure to technology allowed them to achieve mastery of basic computer skills.

4.1 Provision of better maternal care

Overall, the CHWs and MWs/Nurse had the perception that the mhealth service had a real potential to reduce maternal and infant mortality and as stated by one participant, “The project is beneficial for everyone. It would be interesting if we can extend it to all over Burkina. It would really help to reduce maternal and infant mortality.” This is reiterated

by another MW/Nurse, “We welcome the project, it saves women.” A CHW, explained the motivation to save lives differently, “I am happy and hopeful that the project will be extended to all Burkina and everyone benefits. . . because it is health first, our woman and our children (are our future).”

According to the CHWs, the mhealth service allowed for increased access to care between ANC visits, as communicated by one CHW, “We now have the equipment (to measure blood pressure and blood glucose) . . . we are (situated) next door (and are able) to make home visits, they [women] are very happy, feel safe, and feel accompanied until their delivery.” Additionally, CHWs expressed that the opportunity to be followed from their home is beneficial for deeply-pregnant women, where mobility can be challenging. These frequent interactions allow for the development of a close CHW-patient rapport, where women feel free to express their concerns and created a forum to share their experiences about their pregnancy. This was described by a CHW, “They are at home, they are talking about their pregnancy, (and) it gives them courage”. Another CHW stated it as follows, “while we take the blood glucose and blood pressure, they [women] say everything they feel to us. When they go to the CSPS, there are some things that they are ashamed to say. But when it is at home with us [CHWs], they say it all. And (communication) in their local language also allow them to express themselves better.” In short, CHWs expressed their perceptions that the clinical management of women enrolled in the study was better than before as they saw an increase compliance with ANC visits. This observation was also supported by the MWs/Nurse, as indicated by one participant, “Women who are in the project, they come for their ANC visit as we give them an appointment compared to the women who are not in the project”. Another observation emanating from a MW/Nurse is, “since your project . . . there has been a reduction in home deliveries. Where CHWs work with tablets, there has not even been a (single) home birth.” The MWs/Nurse expressed appreciation for the work of CHWs, as explained by one participant, “the CHWs mobilize and invite them to give birth at the CSPS, and to choose their (birth) companions, before it was imposed, and it was (typically) an old woman or the mother-in-law. They also educate husbands and show them the importance of assisted childbirth”.

4.2 Facilitation of follow-up care

A contributor to better maternal health was identified by the two groups of participants, both CHWs and MWs/Nurse, namely the facilitation of follow-up care via the use of the mhealth platform. The STREAMS project dictated a schedule of regular interaction between the CHWs and the pregnant women, occurring at a two-week interval. This imposed

contact created the conditions for building a relationship in which providers felt that they could follow mothers more easily, closely and could intervene much earlier in their pregnancy. One MW/Nurse commented, “The fact that the CHWs do home visits every 2 weeks allows (us) to follow the women more closely, they take the blood pressure, blood glucose. . . it can quickly identify problems and complications if that happens”. This was reinforced by another participant by way of the following example, “The CHW asked a question (from the platform) . . . (and identified) pelvic pain. The CHW (then) called (the midwife) saying the women will come (for a consultation)”. Computerized access improved follow-up care bi-directionally, both from the CHWs to the MWs/Nurse as seen in the quote above, but also from the MWs/Nurse to the CHWs when follow-up care was necessary for treatments initiated at the CSPS. One MW/Nurse offered an example, “If we see a patient, we treat them first, then the woman returns (to the village) and the CHW meets them to see if they took their medication. Before it was not computerized, so often you had to call to ask if the patient followed the treatment, and if not, then I [MW/Nurse] was obliged to take my bike or motorcycle and go around the village to look for this patient and see if the medication was taken or not. Now that it is computerized, as soon as it [the treatment plan] is recorded, the CHW already knows that there is such a patient who has been registered and knows what he/she has to do (for follow-up).” Another participant reiterated, “now that it is online like this, we can follow them easily. Since the CHWs will follow them at home, we will not lose our patients” (MW/Nurse). Regular glucose monitoring and access to this data allowed for better follow-up care from the midwives’ perspectives. As part of the STREAMS protocol, blood glucose was monitored during every home visit, or every 2 weeks. The MW/Nurse felt that this assessment was appropriate given the contextual realities of life in rural BF. As one MW/Nurse reported, “when it [the blood glucose level] is less than 1.6, it needs to be reported to us. The low glucose level really depends on the diet (that is available to mothers) . . . here we have rice, there is no variation. A pregnant woman can only vary her meals once or twice. It [low blood glucose] is a reflection of malnutrition, where only the baobab leaves are rich (sources of nutrients)”. Being informed regularly as to the blood glucose levels allows the MWs/Nurse to intervene proactively by educating women on adequate intake during pregnancy, “we advise them to eat iron and change their diet” (MW/Nurse).

4.3 Promotes collaboration and support

According to the CHWs and the MWs/Nurse, mhealth allows for the promotion of a collaborative partnership between them and supports knowledge transfer and training; a second

identified contributor to maternal health. All were in agreement that the use of this platform allowed for a strengthening of the relationship between them in terms of the appreciation that one has for another’s work. One MW/Nurse felt strongly that CHWs gained skills through their experience and put it beautifully, “The CHWs deserve a bonus, they were able to manage the phones you gave them, they also took the blood pressure and blood glucose which was a plus (for the follow-up of women), they read the questions, manipulated the laptop, they entered the answers. It is really interesting for the CHWs.” The CHWs’ entry of gathered data into the platform, previously only held in their notebooks, was made transparent to the MWs/Nurse supervising their work, allowing them to intervene when appropriate. As explained by one MW/Nurse, “we contacted the CHWs when we saw extreme values, to know how they took the measures. Often the measures can be wrong. If they take a measure one time and it is not good, we tell them to wait 30 minutes and to take it again to see if it will change”. When a measurement is out of range, the midwives take the opportunity to teach CHWs about expected values and red flags, because according to one MW/Nurse, “it is not about taking the blood pressure (only) and not knowing when there is a danger. We have to give them [CHWs] (advice) as part of the project”. In the same vein, CHWs emphasized that this type of interaction with the MWs/Nurse “made them understand a lot of things” (CHWs) and helped them to improve their knowledge base.

In order to facilitate interdisciplinary collaboration, MWs/Nurse made the suggestion that the regional gynecologist also be a user of the platform; a reflection of their new-found appreciation for the potential of mhealth. As expressed by one MW/Nurse, “It can improve the communication and if there is a problem, he can see it immediately, it would facilitate the referral”. Conversely, MWs/Nurse could see that having the possibility to interact with the regional gynecologist using technology could improve their own practice, as stated by one MW/Nurse “it would reduce our work stress. Sometimes you are in front of a case, you know that if there is such a thing [technology] that could allow you to see the women (yourself) instead of referring her [to the regional physician at the hospital]. This (clinical support) would help to improve our skills. . . and make appropriate referrals because sometimes you can refer a women, then later wonder if it was necessary”.

4.4 Facilitated management and simplified administrative tasks

According to the perceptions of the CHWs and MWs/Nurse, the use of mhealth facilitated management of services and simplified administrative tasks, the third identified contrib-

utor to improving maternal health. Within the hierarchical structure of the CSPA, the role of the head nurse is one of middle management and consists of coordinating and supervising all care activities offered by CHWs and CSPA staff, exploring population needs, mobilizing community leaders, and liaising with district health agencies and government officials. Within this role, it was clear that an mhealth platform would offer timely access to information, and as such would facilitate his work process, as described by the nurse, "It facilitates supervision, it allows to transmit information as quickly as possible, in order to control the work... so it makes my work easier". Before the implementation of the STREAMS project, all clinical data and interventions were documented in paper form, within individual CHW's notebooks and at the CSPA in patients' registries. All participants agreed that the platform had the potential to fully replace the need for notebooks and registries and would allow them to be more efficient in their daily work and as such provide better follow-up care to women in the community, as explained by one MW/Nurse, "If we can integrate this [the platform] in our consultations at the clinic, it would fix a lot. The platform could replace the registries and when a woman comes for a consult, it [her information] is registered directly in the platform. It could really help us." (MW/Nurse). A CHW verbalized it as follows, "This platform can replace the notebook, or the reports we made by hand. We can do it with the platform and it is easier". The CHWs also appreciated that the platform offered them prompting questions to guide them during their assessment of the woman, "we ask the question, we click based on the woman's response, and we see the answers (as an overview of the woman's state of health)".

Despite the positive experiences, one major impediment to the move towards digitalization is the level of baseline computer skills among frontline BF workers. For many of the MWs, the STREAMS project brought their first experience with manipulating a computer, as described by one MW/Nurse, "in the beginning it was not easy because we used the computers for the first time, and then the platform. We didn't feel comfortable with computers. But later (a few weeks into the project), we are doing well". Another went on to suggest, "it would be good to have regular refreshers, as it is the first time we are using a personal computer" (MWs/Nurse). In parallel, the CHWs expressed similar challenges regarding their baseline knowledge of the use of smartphones, "in the beginning, we didn't know how to handle the phones. We would have to call (the research assistant) when we have difficulties. We called him three or four times a day to help us because it was our first time and sometimes he would come to our village. We have never used smartphones before". The same participant expressed the need for more

initial training during project orientation.

4.5 Contextual realities

BF's technological infrastructure, while improving, leaves a lot to be desired. Specifically, in rural areas of BF, there is a lack of access to electricity that is required for charging phones and laptop computers and sporadic internet connectivity. For those that did not have access to solar charging panels at home, the lack of electricity was identified as a burden, which one CHW expressed as follows, "since there is no electricity in the village to charge the phones, we go to the (Diapangou) city, it is 7 km away and takes us at least 30 minutes of cycling (to get there) and it takes 3 hours to charge the phone. During the 3 hours, I talk with friends who are in Diapangou. It costs us 100 francs (CFA). When there is a lot of activity, we have to go every 2 days". During the STREAMS project, internet connectivity was a major challenge in the rural Diapangou area, leaving CHWs/MWs/Nurse to travel to Fada, a neighboring health district in order to enter data and to allow the platform to sync with the cloud. This travel is arduous, and represents a distance of about 20 km, which as explained by a CHW, "it takes 2 hours to get there by cycle or motorbike and this is necessary 2-3 times per week. We cannot get there all the time". The lack of internet connectivity creates the need to travel to input data, which in turn causes a delay in the availability of this data for all that consult the platform. An additional challenge that was identified, resulting from local cultural norms, was that the female CHW had to rely on her husband to bring her to the city several times per week. Despite these frustrations, mhealth is seen positively by participants and they expressed motivation in learning to incorporate technology as it was seen as beneficial to the health of their community. This was expressed by one CHW, "it is beneficial for the whole village, before women suffered a lot. The platform can be used for any sick person, not just for pregnant woman. Since it is in the same village, it is the same family, the whole village is relieved".

5. DISCUSSION

New and emerging digital health technologies are increasingly employed in LRSs to enhance the coverage and quality of healthcare services and the efficient use of resources.^[21,22] The results of this study echoed much of the currently available evidence that the use of mhealth enhanced the care delivered to pregnant women in rural BF. Digital health introduces novel opportunities to address the problems of distance and access to healthcare; however to fully embrace the rapid adoption of technology to strengthen health systems, countries around the globe require appropriate designed and scalable digital health solutions, supportive policies, financing, regulatory environment and infrastructure, and sustainable local

capacity.^[23] Despite the substantial investments in digital solutions to improve health services in Africa,^[24] nation-wide digital health implementations are still relatively scarce and the countries are lagging behind the global averages in terms of digital health ecosystem maturity.^[23] African governments realize that present investments in digital health services will not deliver the benefits promised or expected if the following deficiencies are not addressed; shortage of skilled healthcare professionals, their lack of training and access to education, and the lack of resources, ranging from money to tools to infrastructure.^[25,26]

The critical shortage of skilled healthcare providers in LRSs, which is as much a medical problem as it is social and political, is one of the largest obstacles faced by public health systems in the developing world.^[1] For example, Sub-Saharan countries have between one and two nurses and midwives per 1,000 inhabitants, compared to an average of nine in high-income countries; and have less than one doctor for 1,000 inhabitants.^[27] For years, this crisis has been addressed with success by using the concept of task-shifting or the transfer of responsibilities in which CHWs are providing front-line care instead of physicians and trained nurses or midwives.^[28] The use of mhealth, as indicated in the current study, provides the opportunity to strengthen this collaborative stepped care approach; however to achieve scale it is critical that all end-users are trained and prepared to embrace and utilize any digital health solution.^[29] The importance of human resource capacity cannot be ignored in the scale-up of mhealth programs; more technology schooling at all levels of education, especially in rural regions and for girls, is needed.^[30] The healthcare workers participating in this study demonstrated genuine enthusiasm for the integration of mhealth technology, recognizing its potential in improving the organization and delivery of services for the benefit of their patients, communities, and their country at large. This enthusiasm was manifested in our project as an openness to build on basic computer skills, the willingness to learn new interventions and the commitment to travel vast distances to sync digital information. This is not surprising given that favorable attitudes towards computerization in LRSs is supported in the literature.^[31]

The results of this study also inspired the discussion around the consequence of the 'digital divide' in LRSs on the delivery and quality of healthcare services.^[32] This disparity, which refers to the gap in the usage of network connections, devices, software and applications, is the result of socioeconomic conditions in developing countries. Reliable internet connectivity, currently recognized by the United Nations as a fundamental human right,^[33] is not a given in these countries. Concretely, the lack of internet access limits the applica-

tion and growth of digital technology within the domain of healthcare, which has numerous repercussions for healthcare providers such as limited access to clinical information,^[34] research evidence to support practice decisions, and educational opportunities available online.^[35] Consequently, these barriers dictate the agenda, making international priorities around the use of evidence-based practice, a non-starter in LRSs.^[36] Beyond network coverage, there are other barriers that prevent the further adoption of digital technologies, such as the lack of electricity, especially in rural regions, the unavailability of online content in one own language, the gender divide which shows that women are 50% less likely to be online compared to men, the low level of literacy, and the fact that many people are still living below the international poverty line.^[37]

Fortunately, and in line with the 2015-2030 United Nation ninth Sustainable Development Goal,^[38] the BF government have made great strides recently to improve their country's technological infrastructure, investing in expansion of geographical coverage of broadband networks using a nationwide fiber-optic backbone.^[39] In addition to making this foundational necessity a coming reality, the BF government has also made recent investments in their healthcare network through the employ of nearly 16,000 CHWs, or two CHWs per village, that will serve as the 'face of healthcare' within their communities in providing basic preventative care.^[40] These governmental initiatives show a willingness and concrete commitment to improving healthcare and will lay the foundational groundwork for creating environments in which mhealth services can thrive. In such an environment, it has been demonstrated that mhealth can serve to build local capacity amongst healthcare teams, especially in rural, isolated regions. It is well known in the literature that many funded pilot projects that propose innovative, mhealth solutions never scaled to sustainable services because the require infrastructural support is not widespread or dependable.^[24] While it is evident that mhealth will change care provision positively as it has for numerous countries in the past, and as is demonstrated by the results of the current study, BF will have to wait to reap the full benefits of digital technology until a supportive infrastructure can be put in place.^[37]

5.1 Limitations

Two limitations were identified in this study. The sample size, while adequate for qualitative research, was composed of two smaller, subgroups of participants that had different roles and experiences with the telemonitoring service. The decision to merge the data was made, rather than separate analysis, because it was more meaningful to the purpose of the study, to show the strengthening of the collaboration

between CHWs and MWs/Nurse. Secondly, the dependence on an interpreter for some of the interviews with the CHWs, when they were not fluent in French, made it difficult to ensure that opinions stated came from the participant, rather than the interpreter.

6. CONCLUSION

While increasing access to care in the ‘last mile’ is an important notion in providing universal primary healthcare, ensuring that this care is of high quality is an additional challenge. Pairing CHWs with professionally-trained health care workers promoted informal training and exchange, which enriched the communication and collaboration between the two

parties. Overall, our study contributes to the evidence that such mhealth initiatives hold the possibility of building local capacity of CHWs, an integral component of the existing African healthcare model.

FUNDING

This work was supported by the Grand Challenges Canada under Grant number R-ST-POC-1706-03334. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

CONFLICTS OF INTEREST DISCLOSURE

The author declares that there is no conflict of interest statement.

REFERENCES

- [1] World Health Organization (WHO). WHO guideline on health policy and system support to optimize community health worker programmes. Geneva: World Health Organization. 2018.
- [2] Watterson JL, Walsh J, Madeka I. Using mHealth to improve usage of antenatal care, postnatal care, and immunization: A systematic review of the literature. *BioMed Research International*. 2015. PMID:26380263 <https://doi.org/10.1155/2015/153402>
- [3] Tomlinson M, Rotheram-Bonus MJ, Swartz L, et al. Scaling up mHealth: Where is the evidence? *PLoS Med*. 2013. PMID:23424286 <https://doi.org/10.1371/journal.pmed.1001382>
- [4] Colaci D, Chaudhri S, Vasani A. mHealth interventions in low-income countries to address maternal health: A systematic review. *Annals of Global Health*. 2016; 82(5): 922-935. PMID:28283147 <https://doi.org/10.1016/j.aogh.2016.09.001>
- [5] Labrique AB, Vasudevan L, Kochi E, et al. mHealth interventions as health system strengthening tools: 12 common applications and a visual framework. *Global Health: Science and Practice*. 2013; 1(2): 160-171. PMID:25276529 <https://doi.org/10.9745/GHSP-D-13-00031>
- [6] Lund S, Hemed M, Nielsen BB, et al. Mobile phones improve antenatal care attendance in Zanzibar: a cluster randomised controlled trial. *BMC Pregnancy and Childbirth*. 2014; 14: 29. PMID:24438517 <https://doi.org/10.1186/1471-2393-14-29>
- [7] Atnafu A, Otto K, Herbst CH. The role of mHealth interventions on maternal and child health service delivery: findings from a randomized controlled field trial in rural Ethiopia. *mHealth*. 2017; 3: 39. PMID:29184891 <https://doi.org/10.21037/mhealth.2017.08.04>
- [8] Castaño P, Bynum J, Andrés R, et al. Effect of daily text messages on oral contraceptive continuation. *Obstetrics & Gynecology*. 2012; 119: 14-20. PMID:22143257 <https://doi.org/10.1097/AOG.0b013e31823d4167>
- [9] Sondaal SFV, Browne JL, Amoakoh-Coleman M, et al. Assessing the effects of mhealth interventions in improving maternal and neonatal care in low and middle-income countries: A systematic review. *PLoS One*. 2016; 11(5): e0154664. PMID:27144393 <https://doi.org/10.1371/journal.pone.0154664>
- [10] Menaka B, Kamineni V, Sree MV. The role of m-health in providing antenatal care in rural areas. *International Journal of Reproduction, Conception, Obstetrics and Gynecology*. 2017; 6(9). <https://doi.org/10.18203/2320-1770.ijrcog20174062>
- [11] Lee SH, Nurmatov UB, Nwaru MM, et al. Effectiveness of mhealth interventions for maternal, newborn and child health in low and middle-income countries: Systematic review and meta-analysis. *Journal of Global Health*. 2016; 6(1): e010401. PMID:26649177 <https://doi.org/10.7189/jogh.06.010401>
- [12] Schoen J, Mallett JW, Grossman-Kahn R, et al. Perspectives and experiences of community health workers in Brazilian primary care centers using m-health tools in home visits with community members. *Human Resources for Health*. 2017; 15(1): 71. PMID:28962569 <https://doi.org/10.1186/s12960-017-0245-9>
- [13] van de Wal KR. Acceptability and use of mhealth tools by auxiliary midwives in Myanmar: A qualitative study. Dissertation, University de Montreal. 2016.
- [14] Braun R, Catalani C, Wimbush J, et al. Community health workers and mobile technology: a systematic review of the literature. *PLoS One*. 2013; 8(6): e65772. PMID:23776544 <https://doi.org/10.1371/journal.pone.0065772>
- [15] Ayiasi RW, Atuyambe LM, Kiguli J, et al. Use of mobile phone consultations during home visits by community health workers for maternal and newborn care: Community experiences from Masindi and Kiryandongo districts, Uganda. *BMC Public Health*. 2015; 15: 560. PMID:26084369 <https://doi.org/10.1186/s12889-015-1939-3>
- [16] Barnabee G. Can mhealth strengthen health worker performance? Midwives' experiences using an innovative mhealth program in Timor-Leste. Dissertation, University of Washington. 2014.
- [17] Medhanyie AA, Little A, Yebyo H, et al. Health workers' experiences, barriers, preferences and motivating factors in using mhealth forms in Ethiopia. *Human Resources for Health*. 2015; 13: 2. PMID:25588973 <https://doi.org/10.1186/1478-4491-13-2>
- [18] Moyenga PM. Production cotonnière et développement rural au Burkina Faso: Controverses et réalité. Cas du département de Diabo dans la province du Gourma (Unpublished Master's Thesis). Université de Ouagadougou, Burkina Faso, Africa. 2018. Available from: https://www.memoireonline.com/09/10/3855/m_Production-cotonniere-et-developpement-rural-au-Burkina-Faso-controverses-et-realite-Cas-du-d8.html

- [19] Tourisme au Burkina Faso (n.d.). La commune rurale de Diapangou. Available from: <http://www.burkinatourism.com/La-commune-rurale-de-Diapangou.html>
- [20] Elo S, Kyngäs H. The qualitative content analysis process. *Journal of Advanced Nursing*. 2008; 62(1): 107-115. PMID:18352969 <https://doi.org/10.1111/j.1365-2648.2007.04569.x>
- [21] Abbas JJ, Smith B, Poluta M, et al. Improving health-care delivery in low-resource settings with nanotechnology. *Nanobiomedicine*. 2017; 4: 1-14. PMID:29942391 <https://doi.org/10.1177/1849543517701158>
- [22] Nambiar B, Hargreaves DS, Morroni C, et al. Improving health-care quality in resource-poor settings. *Bulletin of the World Health Organization*. 2017; 95: 76-78.
- [23] Mechael P, Edelman JK. The state of digital health 2019 – Global Digital Health Index. Global Development Incubator, April. 2019
- [24] Stroetman K. Digital health ecosystem for African countries. A guide for public and private actors for establishing holistic digital health ecosystems in Africa. Strategic Partnership Digital Africa. Federal Ministry for Economic Cooperation and Development. 2018. Available from: https://www.bmz.de/en/publications/topics/health/Materilie345_digital_health_africa.pdf
- [25] Obeysekere ER, Mehta K, Maitland C. Bringing community back to community health worker studies: Community interactions, data collection, and health information flows. *The Journal of Community Informatics*. 2017; 13(3): 75-97.
- [26] Ngoc CT, Bigirimana N, Muneene D, et al. Conclusions of the digital health hub of the Transform Africa Summit (2018): Strong government leadership and public-private-partnerships are key prerequisites for sustainable scale up of digital health in Africa. *BMC Proceedings*. 2018; 12: 17. PMID:30540290 <https://doi.org/10.1186/s12919-018-0156-3>
- [27] Lacopino P, Meloan M. Scaling digital health in developing markets. Opportunities and recommendations for mobile operators and other stakeholders. *GSMA Intelligence*. 2017. Available from: <https://www.gsmainelligence.com/research/?file=c581aa43bdb7b7d236bb937698c2d6fd&download>
- [28] Baine SO, Kasangaki A, Baine EMM. Task shifting in health service delivery from a decision and policy makers' perspective: A case of Uganda. *Human Resources for Health*. 2018; 16: 20. PMID:29716613 <https://doi.org/10.1186/s12960-018-0282-z>
- [29] Labrique AB, Wadhvani C, Williams KA, et al. Best practices in scaling digital health in low and middle income countries. *Globalization and Health*. 2018; 14: 103. PMID:30390686 <https://doi.org/10.1186/s12992-018-0424-z>
- [30] Fasher E. Bridging the digital divide in Africa. The Nordic African Institute. 2017. Available from: <https://nai.uu.se/news/articles/2017/09/28/113419/index.xml>
- [31] Kipturgo MK, Kivuti-Bitok LW, Karani AK, et al. Attitudes of nursing staff towards computerisation: A case for two hospitals in Nairobi, Kenya. *BMC Medical Informatics and Decision Making*. 2014; 29(14): 35. PMID:24774008 <https://doi.org/10.1186/1472-6947-14-35>
- [32] Ronquillo C, Currie L. The digital divide: Trends in global mobile and broadband internet access from 2000-2010. *NI* 2020, 2012, 346. 2010.
- [33] Sandle T. UN thinks internet access is a human right. 2016. Available from: <https://www.businessinsider.com/un-says-internet-access-is-a-human-right-2016-7>
- [34] Pakenham-Walsh N, Bukachi F. Information needs of health care workers in developing countries: A literature review with a focus on Africa. *Human Resources for Health*. 2009; 7: 30. PMID:19356239 <https://doi.org/10.1186/1478-4491-7-30>
- [35] Chahhanabhai PN, Holt A. The disparity information and communication technology for developing countries has in the delivery of healthcare information. *The Open Medical Informatics Journal*. 2010; 4(3): 195-201. PMID:21594006 <https://doi.org/10.2174/1874431101004010195>
- [36] Pearson A, Jordan Z. Evidence-based healthcare in developing countries. *International Journal of Evidence-Based Healthcare Banner*. 2010; 8(2): 97-100. PMID:21077397 <https://doi.org/10.1111/j.1744-1609.2010.00164.x>
- [37] Henry L. Bridging the urban-rural digital divide and mobilizing technology for poverty eradication: Challenges and gaps. University of the West Indies, St Augustine. 2019. Available from: <https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2019/03/Henry-Bridging-the-Digital-Divide-2019.pdf>
- [38] United Nation ninth Sustainable Development Goal. 2018. Available from: <https://una-gp.org/the-sustainable-development-goals-2015-2030/>
- [39] TWeb Africa. Burkina Faso govt lauds US\$20.6m fibre optic project. 2018. Available from: <http://www.itwebafrica.com/networks/872-burkina-faso/244565-burkina-faso-govt-lauds-us206m-fibre-optic-project>
- [40] Ouaga.com. Politique. 2016. Available from: <http://news.aouaga.com/h/94447.html>