

# Experiences of women receiving mhealth-supported antenatal care in the village from community health workers in rural Burkina Faso, Africa

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## Abstract

**Objective:** This qualitative study explored the experiences of women receiving mhealth-supported antenatal care in a village, from community health workers (CHWs) in rural Burkina Faso, Africa.

**Intervention:** CHWs entered patient clinical data manually in their smartphone during their home visits. All wireless transferred data was monitored by the midwives in the community clinic for arising medical complications.

**Methods:** Semi-structured interviews were conducted with 19 pregnant women, who were housewives, married and their age ranged from 18 to 39 years. None had completed their formal education. Depending on the weeks of gestation during their first antenatal care visit, length of enrollment in the project varied between three and eight months. Transcripts were content-analyzed.

**Results:** Despite the fact that mhealth was a novel service for all participants, they expressed appreciation for these interventions, which they found beneficial on three levels: 1) it allowed for early detection of pregnancy-related complications, 2) it was perceived as promoting collaboration between CHWs and midwives, and 3) it was a source of reassurance during a time when they are concerned about their health. Although not unanimous, certain participants said their husbands were more interested in their antenatal care as a result of these services.

**Conclusion:** Findings suggested that mhealth-supported visits of the CHWs have the potential to increase mothers' knowledge about their pregnancy and, as such, motivate them to attend more ANC visits. In response to this increased patient engagement, midwives approached women differently, which led to the mothers' perception of improvement in the patient-provider relationship. Results also indicated that mhealth may increase spousal involvement, as services are offered at home, which is an environment where spouses feel more comfortable.

## Keywords

mhealth, antenatal care, rural healthcare, community health workers, patient engagement, male involvement, Burkina Faso

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## Background

In today's digital environment, mobile health (mhealth) is increasingly used by expectant mothers worldwide, to access information, monitor fetal development, track individual health indicators and obtain reassurance,<sup>1–3</sup> in order to support the adoption of a healthy lifestyle behaviors during pregnancy. Within the array of

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available mhealth applications, the main trends in services are: health education or promotion, physical or bio-data monitoring, and reminders usually in the form of ‘short message service’ (SMS) interventions. The use of app-based versus SMS interventions is unevenly distributed across the world due to varying levels of Internet connectivity, reinforcing geographical social inequalities in health in developing countries.<sup>4</sup> In African countries, many SMS-based mhealth projects, such as ‘MAMA SMS’,<sup>5</sup> ‘Text4Baby’<sup>6</sup> and ‘MomConnect’,<sup>7</sup> have been successfully implemented to improve maternal and child health,<sup>8,9</sup> mostly by utilizing low-cost cell phones. Results of these projects indicated that expectant mothers were enthusiastic about receiving messages; it made them feel empowered and better prepared in their role as mothers.<sup>6,7</sup> In addition, some studies showed that the use of SMS increased the number of antenatal care (ANC) visits from two to four per pregnancy as women were encouraged to see the midwives in the clinic.<sup>10</sup> This had a positive effect on the rate of delivery by skilled health personnel.<sup>11</sup> With regard to family health in the neonatal period, SMS improved rates of exclusive breastfeeding practices and early contraceptive use<sup>12</sup> and enhanced the communication with and involvement of husbands around family planning.<sup>13</sup>

Moreover, even in industrialized countries, smartphone-based pregnancy applications, either for self or telemonitoring purposes, are ‘few and far between’ and mostly in early stages of development.<sup>14</sup> However, preliminary evidence indicates that telemonitoring in high-risk pregnancies reduces healthcare costs,<sup>15,16</sup> unscheduled face-to-face visits, low neonatal birth weight and admission to the neonatal intensive care unit, as well as improving feelings of maternal satisfaction.<sup>17</sup> In low-risk pregnancies, self or telemonitoring has been recommended to reduce the number of medical appointments,<sup>18</sup> facilitate adherence to gestational weight gain goals<sup>19,20</sup> and achieve optimal glycemic and blood pressure control in pregnancy.<sup>21,22</sup> Pregnant women report a willingness to self-monitor their blood pressure and glucose, stating that they felt reassured and empowered, and that this intervention reduced their level of anxiety,<sup>23</sup> especially for those with previous experience of pre-eclampsia.<sup>24</sup> In addition, self-monitoring made them more knowledgeable about the risks of pre-eclampsia in pregnancy, and it provided family members with an opportunity to observe abnormal trends while at home.<sup>25</sup> In parallel, the use or implementation of maternal and fetal health monitoring in low-resource settings (LRSs) is hampered by financial constraints and women’s ability to access and use mobile technology.<sup>26,27</sup> Irrespective of these obstacles, the pilot project ‘Bliss4Midwives’ (B4M) used an mhealth device to facilitate non-

invasive screening of pre-eclampsia, gestational diabetes and anemia at the point-of-care in Northern Ghana. Women expressed that this intervention was valuable and made them feel listened to and cared for.<sup>28</sup> Despite promising preliminary findings on the use of self and telemonitoring in industrialized countries on maternal knowledge, behavior change and perinatal health outcomes,<sup>29,30</sup> more research is needed to understand expectant mothers’ experiences regarding the use of these applications in LRSs. Therefore, this study explored the experiences of women receiving mhealth-supported ANC in a village from community health workers (CHWs) in rural Burkina Faso, Africa.

### STREAMS: mhealth service description

Data presented in this paper was collected as part of a mhealth pilot project – STREAMS (Strengthening Relationships and Enhancing Access to Maternal Services), funded through Grand Challenges Canada, that aimed to improve maternal and newborn health outcomes using mhealth. 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 covers an area of about 573 km<sup>2</sup>, 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 Burkina Faso.<sup>31</sup> 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 four CHWs of these villages were equipped with smartphones and portable medical equipment to measure expectant mothers’ 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 for red flags 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 cloud-based mhealth platform used in this project was developed by a Canadian-owned software company. All women received mhealth-supported care over and above the standard care in Burkina Faso, or at least four ANC visits starting from the first trimester of their pregnancy. A minimum of four ANC visits was recommended by the World Health Organization

until 2016,<sup>32</sup> after which they changed their recommendation to a minimum of eight visits, with the first visit taking place as early as possible and no later than the end of the first trimester.<sup>33</sup> CHWs in Burkina Faso constitute an important resource in improving maternal and child health. They are positioned at the front line to identify pregnant women, provide health education, screen for health conditions that require a referral to a higher level of care, and promote up-take of facility-based health care.<sup>34</sup>

Education and informational support for the CHWs and midwives were provided both initially and throughout the project. While the initial plan was to offer two days of training on the use of the mhealth platform, it became evident that a workshop on basic computer skills was also required to prepare them for the training. For example, how to turn on and off a computer or smartphone properly, how to enter the platform via the vendor's desktop icon, how to log in to their monitoring profile using their password, how to access the keyboard on the smartphone and the difference between the numeric and alphabetic keypads, how to use the @ symbol in an email, et cetera. On the second day, theoretical sessions were provided on how to use the blood pressure monitoring device and glucometer. To reinforce training, practice sessions on the use of the mhealth platform and reinforcement of previously learned skills were incorporated.<sup>35</sup> Overall, the challenges that arose during the implementation were mainly due to problems of internet connectivity and a lack of participants' baseline computer skills, which had negative consequences on the initial training sessions and subsequent service delivery.<sup>35</sup>

## Methods

After receiving institutional, ethical approval in January 2017 from a Canadian University and the Ministry of Health of Burkina Faso, interviews were conducted with all 19 pregnant women who participated in the mhealth pilot project. Participants were approached by the midwives during their first ANC visit, and subsequently recruited by the local research assistant after giving consent. The inclusion criteria for pregnant women were: 1) having had no more than one ANC visit; 2) living in one of the four selected villages belonging to the CSPS Diapangou, 3) fluent in French or a local language spoken by the CHW and the research assistant, and 4) capable of giving informed consent. All women were housewives, married and their ages ranged from 18 to 39 years (mean = 28 years). None had completed their formal education, except for one who had finished elementary school. The majority ( $n = 15$ ) were living with their husband/partner and children. Three were living with

the parents of their husbands. The youngest participant, who was 18 years of age, was living with her husband/partner and this was her first pregnancy. Except for this young woman, the number of children per women ranged from one to seven. None reported a miscarriage; however, three mothers had undergone one or two abortions. Depending on their weeks of gestation during their first ANC visit, length of enrollment in the study varied between three and eight months. The one-time semi-structured interviews were conducted in their homes or at the CSPS by the local research assistant in French or facilitated by a local interpreter at the end of their pregnancy. Interviews varied between 30 and 60 min and were audio-recorded and transcribed. The interview guide included questions such as, 'What were your initial thoughts about this mhealth project?', 'How did you perceive this telemonitoring service provided by the CHWs and the midwives?', 'How was this service beneficial to your health?' and 'Do you have suggestions for improving the mhealth service?'. Each transcript was thematically analyzed using the inductive approach, described by Elo and Kyngäs,<sup>36</sup> and supplemented with field notes. A process of open coding was used to assign 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, which captured similar concepts, from which descriptive statements were formed and supported with quotes from the transcripts. This process was repeated until consensus was reached between the first and second authors.

Appropriate measures were taken to enhance the trustworthiness of the study. Credibility was established through a process of member checking. During the interview, the local research assistant restated and/or summarized information and then questioned the participant to determine accuracy.<sup>37</sup> Regarding the aspect of applicability, the first author provided a detailed description of the research process, participant and settings. This allows readers to make the transferability judgment to their own specific settings. To address confirmability and dependability, the third author, who conducted the interviews, wrote reflective notes immediately after each interview and documented personal feelings, insights, possible biases and preconceptions. In addition, the first author provided a complete set of notes on decisions made during the research process, research team meetings, emergence of the findings and information about the data management.<sup>38</sup>

## Results

Despite the fact that mhealth was a novel service for all participants, they expressed appreciation for these interventions, which they found beneficial on three levels: 1) it allowed for early detection of pregnancy-

related complications, 2) it was perceived as promoting collaboration between CHWs and midwives or ‘working together for my health’ and 3) it was a source of reassurance during a time when they are concerned about their health and well-being or ‘promotes peace of mind and engagement’. Although not unanimous, certain participants also expressed the fact that these services were suitable to their spouses, or ‘service acceptable to husbands’.

### *Allows for early detection of pregnancy-related complications*

The home visits conducted by the CHWs, which occurred every two weeks, were experienced by all participants as a significant change and improvement in services. As Participant 14 (P14) explained, ‘there is really a big difference, because during my first pregnancy, I never had someone come to my home to ask me about my health’. This was reinforced by Participant 4, ‘because before, when you did not come to the dispensary, they [healthcare workers] did not take care of you. Now you are at home and people are coming to take your measurements’. Participants described the traveling that was required to go to the CSPS as a hardship in the past, as expressed by Participant 11, ‘You have to travel for miles before arriving at the CSPS. It was not easy. But now you rest at home and they come to visit you’. This was contrasted with previous services by Participant 1, who reported that in the past she only travelled to the CSPS when she was sick or when her husband had the time to take her, ‘Now I have support at home, [in the past], no one knew I was sick’. The mhealth services were considered much more convenient, as described by Participant 16: ‘when the CHW comes to take measurements, she comes here and does not even take a lot of time. We discover everything [about my health] there is [to discover]’. Mothers felt that the opportunity for early ‘discovery’ when something was wrong was beneficial, since in the past this would only be known during a scheduled ANC visit, as stated by Participant 3: ‘midwives gave ANC appointments, but you can get sick before the day of the appointment and now the CHW comes and will discover that [earlier]’. Participants were able to communicate certain symptoms or ‘red flags’, such as dizziness, abdominal/pelvic pain, burning upon urination, headache, fever, etc. (P4, P9, P12, P14, P16, P19) through their responses to the pregnancy-related questions; this information served as a mechanism for early detection of pregnancy-related complications.

When comparing the ‘big difference’ between past and current services, all participants described being happy related to the new, supportive role of the CHW in their care. Mothers appreciated that all

information gathered during the visit is ‘put into the phone’, as reported by Participant 1: ‘everything I do goes into the laptop and it [this information] goes to the people involved in the project’. Having the medical equipment at their disposal during the home visit was also appreciated, since they felt it enabled the CHWs to figure out if anything was wrong, as explained by Participant 11: ‘I appreciate the tool because without a tensiometer, we cannot know if there is disease. It is the same thing for glycemia, before all of that [equipment] was not there. Today, we have all the equipment to measure women’s health’. Despite the fact that some mothers (P2, P4, P9) did not previously know the CHW of their village, they gave the CHW their trust because he/she would take the time to sit with them and give them information about their health through the pregnancy-related questions that were asked, as voiced by three participants (P3, P15, P19). This remained a rather one-sided communication since the mothers did not report asking questions of the CHWs, as expressed by multiple participants: ‘He comes to the house to inform me [about my health]’ (P9). ‘He asks questions, takes my blood pressure, takes a sample of blood, and I just answer, I don’t ask questions’ (P14). The support the CHWs provided took the form of reminders about their upcoming ANC visit, as oftentimes the mothers would forget the scheduled date. In addition, CHWs offered advice, for example, ‘he said that every morning I need to eat and not to do that hard work’ (P15). Another mother voiced it as follows: ‘the CHW called my husband in front of me. He said that with the age [progression] of my pregnancy, I should work less and rest more since it is too painful. I respected his advice for three days and since that time, it [my pain] really changed’ (P14). Also, the CHWs played the important role of informing mothers when they needed to be referred to the CSPS for care (P7, P8), as reported by Participant 1: ‘he asks questions, takes measurements and after all of that, he says if everything is okay. If it is not good, he gives me a piece of paper and tells me that I have to go to the CSPS’.

### *Working together for my health*

Participants commented on the fact that they were happy to provide their clinical information to the CHWs as it all ‘contributes to their health’ as expressed by one participant, ‘everything I said is put in the phone and that is great because we want to be healthy’ (P14). Mothers saw that the act of providing information resulted in the identification of symptoms and referrals to the midwives when appropriate. They prefer this type of model because there is the sense that the providers are collaborating, as explained by Participant 2: ‘the two work together now, they all work for our health’.

In addition, it was perceived by participants that the midwives' access to their clinical information, through the telemonitoring platform, improved their relationship with this healthcare provider. Participants (P2, P3, P10) were pleased that their health information was being monitored by the CSPA midwives and that they were aware of their clinical information immediately upon arrival at the clinic for their ANC visit. The mothers commented that they noticed a number of changes in the midwives' approach to their ANC visit upon implementation of the project, for example, there was alignment in the measurements taken by the CHWs, as expressed by Participant 2: 'when I arrive at the CSPA, they [midwives] are doing the same things [as the CHWs]. They weigh and take my tension [blood pressure]. That was not done before'. In addition, the midwives asked a lot more questions about their pregnancy (P2, P16) and there was a sense that they took more time to talk with the mothers, as expressed by Participant 16: 'it is thanks to the project, it is easier to communicate with the midwives, it is an easier approach. Now the midwives seek me out and talk to me much better'. This difference in communication was also commented upon by Participant 1: 'Previously, when I came [to the CSPA], they only look and say it is good and to come back in a month. Now I explain if something hurts or if something is wrong'. Participant 15 described the difference in relationship with the midwives compared with mothers that are not enrolled in the project, 'talking with midwives is easier for those in the project. We ask questions and they are answered. Before, we could not say anything to them'. This was supported by Participant 6, who commented, 'I get to talk with the midwife [now]. When I arrive [at the CSPA], the midwife recognizes me from afar'.

### *Promotes peace of mind and engagement*

Overwhelmingly, all mothers embraced the service that was proposed as it reflected genuine interest in and concern about their health and pregnancy and as explained by one participant, 'I never had any reluctance from the beginning. I knew that the machine would make me healthy' (P13). No concerns were voiced regarding data confidentiality. In addition, when appointments were made, participants looked forward to the interaction with the CHW with anticipation; one participant described it as follows: 'When I hear noise, I look at the road to see if he is coming' (P13). Others expressed that when they got a call confirming the CHW's appointment, they waited patiently for his/her arrival (P1, P2). The act of being regularly followed by the CHWs and knowing that this data was being monitored by CSPA staff created, for all participants, a sense of reassurance that if there is

something wrong, they will be made aware. This was explained by Participant 9 as, 'as we put it [information] into the machine and send it far away, if there is a disease, we will know and that is why I am happy'. Another participant explained it as follows: 'Everything is going into that system and I know that if there is something, they will manage it quickly' (P3). Being reassured created a sense of safety (P5), which in turn reduced worry, doubt and anxiety while promoting confidence and 'helping them to sleep at night' (P16); this was especially true for the young woman who was having her first child: 'It gave me a sense of peace [to be followed by the CHW] because I am scared about the delivery' (P6). Jokingly, one participant commented on the faith that is put into the mhealth project as, 'I am not afraid anymore because God is beside me...today, I am not afraid anymore because you [the project] are standing next to Him' (P11). Peace of mind also came from the fact that they now felt comfortable disclosing information to the CHW, even when he was male, and '...not feeling ashamed or embarrassed...' to talk about personal or pregnancy-related topics (P4). This was true for their interactions with the CSPA midwives also, as described by Participant 1: 'They ask me questions and are open, the taboo to talk about my pregnancy is leaving'. The services associated to the project also seemed to promote patient engagement or deepened the mothers' knowledge on their pregnancy and normal/abnormal symptoms to watch for from repeated exposure to the pregnancy-related questions. With this increased engagement and knowledge, mothers felt more inclined and were more motivated to go for their CSPA ANC visits (P2, P11, P12), as expressed by Participant 1: 'Now I know something about my pregnancy before arriving at the CSPA. It is because of the project that I have followed all my ANC visits'.

### *Service acceptable to husbands*

This new form of service delivery seemed to have a ripple effect on those close to expectant mothers, especially their husbands. Within a traditionally paternalistic culture, which can be found in areas of Burkina Faso, it is the norm that husbands give permission for their wives to receive healthcare services. The participants' husbands generally reflected an acceptance of this service as they allowed their wives to be assessed by CHWs, even when the worker was male. This was reinforced by Participant 12: 'He [husband] appreciates it [the service] and he even allows the [male] community health worker to come'. In addition, husbands often facilitated the visit by allowing for privacy in leaving the room upon the arrival of the CHW, as reported by Participant 3: 'when the CHW comes, my husband

goes out and lets us talk. He does not ask me questions about it [the visit]. One could make the inference that when husbands do not ask about the visit, they are trusting in the community worker. Others choose to stay for the visit, but indicate that they are happy with the service, as described by one mother: ‘When the CHW put the tensiometer on my arm, he told us [my husband and I] the blood pressure. I was very happy, and so was my husband’ (P2). Another explained that while her husband is not available to attend the appointment, he calls her later to ask how it went and enquire as to which questions were asked. ‘I know that he is happy with the service. He does not prevent it [the service]’ (P4).

## Discussion

Without a doubt, and in line with previous findings, mhealth services increase access to healthcare for expectant mothers and have the potential to transform care by improving maternal health outcomes for women in LRSs.<sup>39</sup> In addition to this potential, mhealth offers the opportunity to change health-seeking behaviors, or the actions that patients pose as consumers of healthcare services.<sup>40</sup> The complexity involved in changing these behaviors is well recognized in the literature. Moreover, it is not simply a question of educating individuals or providing advice, but, rather, it requires sustained personal engagement and motivation, within a context that is supportive of this change.<sup>41</sup> In our study, participants indicated that the mhealth-supported visits of the CHWs, where they were regularly assessed, increased their knowledge about their pregnancy and related complications and as such served as a motivation to attend more ANC visits when compared with their previous pregnancies. Being regularly assessed by the CHWs and knowing that midwives were following their health status between ANC visits through the telemonitoring platform created a supportive context in which women felt increasingly comfortable and confident opening-up about their concerns or symptoms, overcoming initial shyness. In response to this increased patient engagement and activation, in return, CSPS midwives approached women differently, which led to the mothers’ perceptions of improvement in the patient–provider relationship and communication.

While receiving mhealth services from the CHWs created opportunities for the engagement of mothers, our findings suggested that it can also provide ‘space’ for spousal involvement, which, according to the literature, may improve maternal health outcomes in LRSs.<sup>42</sup> In addition, women in our study seemed pleased that their husbands approved of their participation in the project, and simultaneously showed an

interest in the CHW’s assessments of their pregnancy using the mhealth application. These findings are in contrast to the literature around male involvement in more paternalistic societies, which tends to describe behaviors of passivity stemming from various cultural barriers such as traditional gender roles, the stigma associated with women’s issues, lack of knowledge, and negativity regarding their participation in more traditional ANC services.<sup>43,44</sup> Although reproductive health is considered a female domain, women cannot and do not decide on their own to seek care. The spouse, brothers-in-law or senior family members are usually the ultimate decision-makers on care-seeking.<sup>45</sup> Few men join their pregnant partners for the ANC visits at the healthcare facilities and have scarcely any contact with healthcare workers. Some community clinic infrastructure may not be suitable for couples due to a lack of privacy or opening hours that are inconvenient; however, men do not perceive it as their role to accompany their partners.<sup>46</sup> We assume that the increased spousal involvement in the present study is created due to the fact that the mhealth services are offered in the participants’ homes, an environment where they may feel more comfortable participating to varying degrees. Some women indicated that their spouse was present for CHW visits, while others left the room, allowing their wives privacy with the CHW. Overall, mhealth holds the potential to create opportunities for male involvement in issues important to women such as antenatal care, family planning, et cetera. However, further studies are needed to document the impact and magnitude of the relationship between the provision of mhealth services and the active participation and involvement of spouses in antenatal care.

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**Contributorship:** AA is the principal investigator. AA and NP have developed the research protocol, conceived the study, gained ethical approval and coordinated all components of the study implementation. AA and NP did the coding of all transcripts; ZD and SA were involved in preparing the final draft of the manuscript. MMM was involved in patient recruitment, data collection and the transcription of the interviews. NGN was involved in the coordination of this study locally in Burkina Faso. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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