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Monitoring and Assisting Maternity-Infant Care in Rural Areas (Mamicare)

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Abstract: We present our project called MAMICare that is motivated by the alarming number of maternity and infant deaths in rural areas due mainly to a poor monitoring of pregnancy progress and lack of appropriate alerting mechanism in case of abnormal gestation evolution. We are proposing an information technology solution based on mobile devices, and health sensors such as ECG (electrocardiogram), stethoscope, pulse-oximeter, and blood-glucose meter to automatically collect relevant health data for a better monitoring of pregnant women. In this paper we address the current status of the maternity infant death problem especially in rural areas of Mexico. We review some applications of IT in health systems (known also as Electronic Health or simply e-Health) and discuss how these are related to our proposal and how they differ. In the paper we present our proposed solution and discuss the current status of our work.

INTRODUCTION

The lack of appropriate maternal and child health in rural areas results in an alarming number of maternity and infant deaths (World Health Organization, UNICEF, UNFPA and The World Bank, 2012). In Mexico, although the infant and maternal mortality has been declining (maternal mortality fell from 89.0 to near 50 per 100 000 live births between 1990 and 2010), the states of Chiapas, Oaxaca, and Guerrero have high rates, with mortality rates highest among indigenous children. The leading causes of death continue to be associated with hypertension, hemorrhages, and other complications of delivery (World Health Organization, 2006) that could be avoided. It has been demonstrated in other countries that by means of an information technology approach several medical conditions such as maternity care can be intelligently monitored, managed and treated on a long term (Blank et al., 2013, Mougiakakou et al., 2010). Such approaches can be studied and technology can be adapted to the particular conditions of maternity care and information technologies access in the rural areas of Mexico.

Current health conditions in Mexico present a downward trend in overall maternity and infant mortality. However it is highly remarkable that unequal access to healthcare services prevail as a challenge in the country (World Health Organization, 2006). More specifically rural areas are the ones lacking the high quality services needed to reduce maternal and infant mortality in the whole region. According to a study, health services and human health resources (such as equipped hospitals and well trained personnel) are more valuable for rural communities (Jennett, Yeo, Scott, Hebert, & Teo, 2005), thus the delivery of these services remotely using accessible technology could help to level up the unequal access to health services. Electronic health records, risk assessment systems, and remote monitoring are just some examples of how technology can be applied in the healthcare field.

The objective of our proposed work is to reduce maternity and child mortality rates in rural areas using information and communication technology (ICT) to strengthen the current health delivery practices for both the mother and child during pregnancy. The goal of this effort is to develop an integrated IT solution similar to our Emergency Remote Pre-Hospital Assistance (ERPHA) project (Muñoz, Avila, Lavariega, González, & Grote 2012). A solution that is suitable for rural areas, focused on the maternity care conditions and considering the technology limitations that prevail in the area are key elements to be considered.

The remainder of the paper is organized as follows: Section 2 presents and discusses current e-Health approaches on which we based our work, including our previous project called ERPHA. In Section 3 we introduce our project to alleviate the maternity infant death situation in rural Mexico. Finally, in Section 4 we establish our current status and discuss future work in the short and middle term.

RELATED WORK

In the past 10 years Information technology (IT) has been used to improve the accuracy of patient records, and health monitoring. Benefits and challenging unsolved problems continue to be the outcomes of such attempts (Bates,

2003), such as electronic health records, remote monitoring, tele-health, health data collection and processing, and clinical decision support systems, to name a few. Groups interested in the IT-Healthcare efforts have gathered and exchanged opinions to identify technological areas with the highest benefits. These groups integrated by members of the public, health care provider and private sectors selected tele-health and electronic health records, in this order, as the most valuable IT approaches. The groups of interest also identified as a disadvantage the changes in the current practices and processes in the delivery of health services (Jennet et al., 2005).

The use of electronic health records (EHR) is one of the most successful examples of the application of IT to support health care services. Research efforts state that EHR is a solution with great potential as EHR strengthens the collaboration between public and primary care (Calman et al 2012). Electronic health records offer additional benefits such as improving public health surveillance by documenting patient data, real-time guiding of the physician interventions using statistical data to generate clinical alerts, improving surveillance and management of a communicable disease, etc. (Calman et al., 2012).

Other research effort focuses in supporting the treatment of patients with type 1 diabetes mellitus. This decision support system (Mougiakakou et al., 2010) provides risk assessment for long-term complications. Data exchange between a unit for the patient and a unit for the management of the patient occurs, and data is also stored in a web server. By combining database technologies, simulation algorithms and data mining, the system provides an advanced processing of the stored data to support the decision making for the physician. Although a study to evaluate the user requirements satisfaction, the cost and the effectiveness of the solution is needed, this work has allowed a proper risk assessment for long-term diabetes mellitus complications. Other risk-assessment technologies have been developed allowing the physician to do a smart diagnosis of the patient.

In Ghana, a software solution was designed in response to the rapid expansion of community health workers in Africa and Asia. This was made taking as an advantage the proliferation of mobile devices. The Mobile Technology for Community Health (MoTeCH) offers features such as calculating the schedule for each patient; and notifying both patient and community workers when care is due. The system automates the delivery of information for routine reports and integrates with existing software applications for mobile data collection. The presented project is the initial part of an iterative process and still requires advanced software development skills, attention to standards and configurable design to make it more readily available to groups of interest within the research (Macleod, Phillips, Stone, Walji & Awoonor-Williams, 2012).

From Brazil and Peru, a Windows-based application called "TeleConsult" proposes to reduce the high mortality on rural areas in Latin America. TeleConsults proposes the establishment of a medical network that communicates using satellite. The system acquires images from ultrasound examinations, electrocardiogram and blood imaging and pretends to cover disciplines such as cardiology, gynecology pediatrics and infections from the region (Sachpazidis, Rizou & Menary, 2008).

An effort in the maternity and prenatal care is the 'Prenatal Risk Calculation (PRC)'. PCR is a software solution based on a previously introduced system known as JOY. PCR and JOY work using chromosome data information (aneuploidies), through this analysis prenatal risk could detect symptoms such as Down syndrome and potential cancer cells on the product. The test performance between PCR and JOY gave higher significant results while detecting aneuploidies in the first trimester trial; testing alone, the test performance results of JOY were better than the results of PRC. PRC demonstrated to be a good tool to detect prenatal risk but it still needs to be improved (Hörmansdörfer et al., 2008).

A clinical decision support system on maternal care field was created and implemented for rural health care centers in Africa. The QUALMAT CDSS provides guidance for antenatal, delivery and post delivery care. This guidance is possible by incorporating features such as an orientation process based on set of routinely actions, algorithms to detect situations of concern, and electronic tracking of perinatal and postnatal care. CDSS is a java-based application that incorporates the World Health Organization (WHO) guidelines for pregnancy and childbirth care. The CDSS was first developed in English for the use in Ghana and consist of four parts: a user interface; an XML-database for patient data, a set of algorithms to screen entered values; and a set of training documents. Decision support is implemented by offering guidance trough routine action in maternal and perinatal care, detection of critical situations using clinical data and electronic partograph for observation on the progress of delivery up to 24 hours. This system requires an equipped site with a laptop computer. Staff members in charge receive general software and QUALMAT training and are left in charge of user administration. The implementation presented limitations in complex medical environments leading to a different conclusion than expected. Another challenging issue was the implementation of the system in a resource-poor environment, leading to hardware insufficiencies and user frustration (Blank et al., 2013).

In general, as we have seen in this section, a great deal of effort in applying IT to health systems is based on keeping records and monitoring patients through a network. However, little effort has been set to use mobile

technologies for a better diagnostic in remote areas. One example of applying mobile and wireless computing in health remote health assistance is our previous work called ERPHA.

ERPHA (Emergency Remote Pre-Hospital Assistance) is an example of a IT solution based on mobile technologies to improve remote monitoring under emergency situations like car accidents. ERPHA is an Information Technology solution that enables the continuous monitoring of a patient's condition during the pre-hospital period. ERPHA enhances the pre-hospital care quality by allowing early intervention of specialist physicians with key data such as video, audio and visualization of patient's vital signs. ERPHA collects key health data from patient using body sensors that transfer their data to a mobile device (usually a smartphone) creating a body-sensor-network (BSN). The mobile device processes, displays and forwards the collected data to a hospital or medical center where a specialist physician can remotely assist paramedics in the diagnosis. Additionally, at the medical center the data sent by the mobile device is stored into a database for maintaining historical records of the patient. These records can be later used for identifying patterns for a more effective treatment or for classifying the severity of injuries. The mobile device can resend all collected data from the BSN plus video to a medical center where a physician can provide a better diagnostic of the patient being monitored. The BSN is built with Bluetooth-enabled sensors for vital signs such as ECG, stethoscope, pulse-oximeter, and blood glucose-meter. The mobile device has been implemented using smartphones running Windows Mobile and Android as operating systems. The mobile device currently transmits video, GPS location and data from the BSN to the hospital via Wi-Fi and 3G. Besides the smartphone a tablet can be used as alternate mobile device. At the hospital, the transmitted video, vital sign and patient information are stored and managed using dedicated database and video servers. The hospital front-end is implemented using Microsoft Visual Studio 2010 (ASP.NET) and Microsoft SQL Server 2008 R2. Further ERPHA details can be obtained at (Muñoz, Avila, Lavariega, González, & Grote 2012).

RESEARCH METHODOLOGY

Our research is based on a real case that will describe in the following sections. In the following description some identities have changed to be anonymous. The intention is to highlight the improvement of healthcare quality and accessibility using wireless technology in a rural area.

Our research is in its initial state. A team of colleagues in the demographic area have already performed an evaluation study of the needs and requirement of the people in the selected rural area. From that study several projects were identified; some related to rainwater harvesting; dignified dwelling; reforestation and better use of natural resources; and of course, health improvement. For health improvement we have identified as the key problem maternal and infant care.

In this initial part of the project we will develop, based on our in-site observations, an information technology solution for assisting the monitoring and evolution of pregnancy in the area. Then, we will perform a pilot evaluation of the IT solution and make the required adjustments. As a result, we expect to see a progress in the quality of the information during pregnancy monitoring; an improvement in the quality of the health care services and eventually a downfall in the maternal and infant death indices.

DESCRIPTION OF THE PROJECT

Existing healthcare support systems have been proved to be efficient in the improvement of medical services. Most of these systems are applied in controlled environments like hospitals. Other systems are implemented to be used at home, where patients have access to such technologies and can follow the health recommendations that an expert or experts provide remotely. Also, as shown in the related work, aiming the healthcare problem in rural areas seems to be a growing concern, particularly in less developing countries such as Mexico, Peru, or Brazil in Latin America or Ghana in Africa. However, direct application of similar technologies would result in an inefficient solution for the Mexican communities included in the scope of this proposal. This is mainly because of the limited communication technology to which those rural areas have access. Our project is focused on the Magdalena Peñasco community, a rural area in the state of Oaxaca, Mexico. In that region, the communities lack of current communication systems such as Internet or Cellular Networks. Most of the time, the only communication service to which they have access is civil band radio communication.

Background

The current process for maternity-infant care attention in the community of Magdalena de Peñasco is a manual process. Because primary attention is performed by volunteers, enough documentation exists about the attention protocols to follow. However, it is hard to identify if everyone involved has a full knowledge of the steps to follow when immediate attention is required. Medical assistance, in particular Maternity-Infant assistance, is based in a hierarchy of levels of attention. Attention levels range from the most elemental home visit performed by a social worker (called Rural Volunteer Promoter or PRV) to the most equipped but expensive trip to the Zone Hospital at the capital of the state. In between the PRV and the Zone Hospital there are the Health House, the Rural Medical Unit (UMR), the Basic Services Hospital(HSB) and the Rural Hospital.

In order to understand what those levels of attention represent for anyone in the community a brief description of each level is given. The Social worker has a basic follow up equipment, accordingly to the Mexican Social Security Institute (IMSS). Health houses are a base for the social workers, vaccine campaigns, and have access to a basic medical kit. The UMR is conformed by a medicine practitioner or a general physician as well as an auxiliary worker. The HSB is considered to be fairly similar to an UMR with some additional equipment such as an ambulance and a delivery room, although much of the information is not clearly defined. Only the Rural Hospital and Zone Hospital have all the basic services (pediatric, internal medicine, general surgery, and gynecology) with the difference that the Zone Hospital in Oaxaca also has more special services. However, Oaxaca's Zone Hospital gives services to patients from the whole state and most of the time is over capacity.

In general terms, attention in the rural communities, in particular in Magdalena de Peñasco is very limited. Health services are hard to reach, personnel are sometimes undertrained and most of the time hospitals or health centers are overcapacity or can't cover the full needs of the community. In order to provide a better understanding, a case scenario is described.

Original Situation Scenario

This scenario illustrates in a fair amount the current state of maternity-infant attention in the community of Tlaxiaco. Names and fictitious characters have been developed to illustrate the case.

Maria is a voluntary Social Worker (or PVR) in the region of Chalcatongo; Rosa is a mixteco woman that lives in a settlement 700m far from Chalcatongo. Rosa is 7 month pregnant, this is her fourth pregnancy; her children are 7, 4 and 2 years old. She is a healthy 36 years old woman. Her husband left 3 months ago to continue working in Los Angeles, California (USA); Maria lives 500m away from Rosa's home.

A Health House is 3km away from Rosa's home. UMR is 6km away from the Health House and 12km away from Rosa's. The closest HSB is 48km away. The orography of the zone makes travelling really slow and hard for all those distances.

As part of her duties as rural promoter, Maria performs a home visit to Rosa to check her pregnancy evolution. Maria following her basic training takes the recommended vital sings from Rosa such as blood pressure, cardiac rhythm, and belly size. However, Maria does not remember how to properly use the sphygmomanometer and is hard for her to interpret the attached instructions. Maria skips some measurements, mainly because the form where data is registered does not indicate them. Also, Rosa has been working hard at home moving some heavy objects, and Maria does not know about that. Maria fills the form with normal data and proceeds to finish the evaluation. At that moment, Rosa begins to feel pain in her belly and turns pale. Maria interprets those symptoms as abnormal and proceeds to make Rosa rest while she seeks for help. Rosa's older son runs to the nearest home (100m away). A neighbor goes to the nearest Health House seeking for help, 20 minutes passed, and the place is closed. The neighbor goes to the nearest UMR, an extra 40min passed. Meanwhile, Rosa is feeling worse. People in the community find the kid and decide to help him by driving him to Rosa's home in order to take her to the nearest UMR. 1 hour and 15min has passed since the first symptom appeared on Rosa; she has not gotten any sort of expert medical attention yet. As situations gets worse, they decide to go straight to the HSB looking for better facilities and the possibility of having an ambulance. Thirty minutes of traveling hurt on Rosa's situation because of the ground conditions. Rosa's evaluation takes longer than expected because the doctor was not notified on time about the emergency. He wasn't ready to receive Rosa. Maria stayed and did not travel with Rosa, moreover the forms with information of Rosa's evaluation were missing. Therefore, there is no information that allows the doctor to make a smart decision. Rosa's critic situation forces her to be transferred to the hospital in Tlaxiaco. Fortunately the ambulance was in good conditions, but still it takes 1.5 hours to take Rosa to Tlaxiaco. It was too late by then; unfortunately both Rosa and her baby die on arrival.

This case scenario illustrates that failing to communicate fast and efficiently is a critical factor to solve any emergency of this type on time and effectively. Also the incomplete information is a really big factor in the final outcome of the maternity-infant attention.

MAMICare System Description

It is believed that by using information technology, the above-described problem could be mitigated. The e-Health solution that is proposed aims to generate a positive impact in the community by improving the communication channels and offering the possibility of having reliable information about the patients at the time when it is most needed.

There are special characteristics in the highest needed rural areas that challenge the implementation of a simple healthcare solution. Currently, most of the monitoring is done by social workers without any special preparation and that belong to the same community. In the zone, there is no telecommunication infrastructure (Wi-Fi or cellular networks) - the most advanced technology is civil band radio. Due to the lack of sufficient communication technologies, the proposed solution is an asynchronous support system to assist the social workers in the monitoring process and the physician with reliable information. Also the system aims to work as a data center for patient's information.

MAMICare is the proposed system to cover three mayor setbacks currently present over rural communities in Mexico. First, the proper monitoring and control of the patient's evolution by storing adequate information and following up data required in basic maternity-infant care; second, the failure to detect risk situations on-time due to the lack of a proper knowledge under those circumstances; and finally, the communication gap within the rural communities in relation to the healthcare problem. Those three issues will be covered by MAMICare under different use conditions. The eventual availability in the future of communication infrastructure in the different rural areas would make possible to extend the MAMICare functionalities to forward the recorded information in a live stream fashion to the nearest hospital or medical facility. This functionality provides an additional tool for the social worker by allowing a health professional to check on the patient and a remote physician to give complete feedback on time. Data in the MAMICare will be locally stored and used to properly follow up the patient's record. At the same time and when available, data will be shared to a centralized database in the community center in which data will be properly analyzed for statistics and in-depth knowledge of the illness under medical treatment. MAMICare will have a risk-condition assessment tool that will identify situations and alert the social worker of critical conditions.

MAMICare is integrated by two parts: MAMITa and MAMI Server, as illustrated in Figure1, each will handle part of the previously described functionality. The first part (MAMITa) is a tablet device that will be used by the social worker or physician to record, store and analyze information of the patient. The MAMI Server is a system that allows wireless communications between the tablet (MAMITa) and the community center in which a database system will be implemented for the storage and administration of the data. This paper focuses in the MAMITa part of the project; although MAMI Server may be briefly discussed it is only considered to be part of the long-term solution.

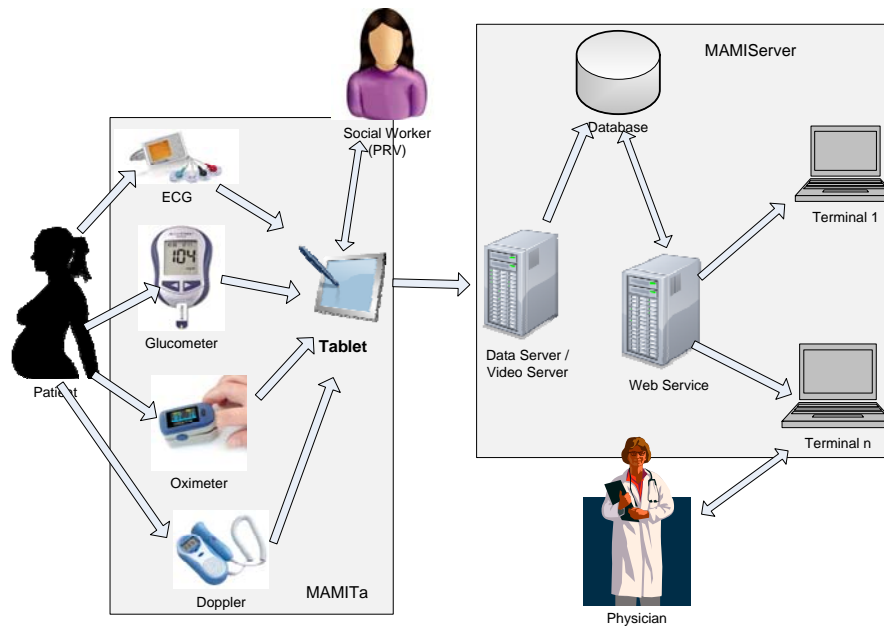


Figure 1. MAMICare Overall Architecture

Following ERPHA architecture as a reference, the MAMITa system is a software solution that integrates different sensor devices (as shown in Figure 1) such as pulse-oximeter, ECG, Doppler, and glucometer. MAMITa is expected to keep valid track records of patients by aiding the social worker in her job through a visual interface. Such interface includes a step-by-step process to be followed in order to avoid any missing information. MAMITa will also include support video on how to use the sensors and follow the exploration protocols in order to avoid missing critical information. MAMITa will consist of a risk assessment tool that will alert if measurements are out of a healthy range and possibly become a risk situation for the patient. The application will incorporate the definition of system priorities to alert the social worker of any maternity-infant risk such as hypertension following norms and standards as the Mexican Official Norm NOM-007-SSA2-1993. This Mexican norm specifies prenatal, during and after labor attention for women and newborn children (Secretaria de Salud del Gobierno Mexicano, 1995). Also the WHO “Pregnancy, childbirth, postpartum and newborn care - A guide for essential practice” provides recommendations to guide health-care professionals in the treatment and management of women during their pregnancy, childbirth, postpartum period or any complications that may arise (World Health Organization, Department of Making Pregnancy Safer, 2006). When the system has been input with some conditions and considers a risk situation, MAMITa gives feedback to the PRV to communicate with and pass the system to the physician. The doctor is then informed by the system on the patient’s current condition allowing him/her to make a smart decision by fully knowing all the details. As described in the original situation scenario, the patient, the social worker and the doctor are the ones that should be in direct contact with MAMITa system.

The proposed MAMITa solution includes a specific list of medical devices such as ECG (electrocardiogram), stethoscope, pulse-oximeter, and blood-glucose meter. Such devices will be synched with the tablet and used for the proper monitoring of the patient. Those devices are considered part of the basic medical kit included with the tablet; other devices will be selected in order to fulfill the requirements in the rural communities. Devices properly synched with MAMITa system allow the system to keep track of the patient’s situation and at the same time to keep an electronic record of patient’s health. Figure 2 illustrates the way in which MAMITa reads the patient measurements through the devices. Also it shows the way in which interaction occurs between the Social Worker, the patient and the device (D). System allows the social worker to input data as well as to receive readings and instructions from the system in order to aid in the process of recording information.

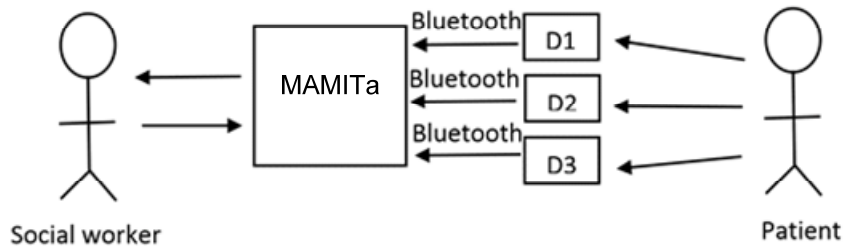


Figure 2: Social Worker, Patient Interactions with the MAMITa through the use of devices

MAMITa interface will be allowed to interact with multiple devices (D’s in Figure 2 and Figure 3). It is expected to use an internal database as well as an internal control layer that interacts with the view layer. View layer is in charge of communications and the tablet to be used is expected to have as well at least one of the Wi-Fi/3G/4G communication protocols that will be used for some external communication activities in a further stage of the project. All these are shown graphically in Figure 3.

While readings are being stored locally in the MAMITa, MAMITA Server complements the functionality by allowing communications between tablets and a data center. Local MAMITa data is synch with the community center database via Wi-Fi whenever communication is allowed or connection is achieved. This scenario happens locally within a single health community center such as the Rural Hospital. MAMITa will be later extended to a wireless environment, when communications are allowed between medical centers. By allowing having patient’s information centralized in one place the doctors or other social workers will have better accessibility to the patient’s information without the original social worker or the tablet being required to travel. Storing the data will also allow further data processing for having statistics or applying algorithmic solutions that allow improving the risk assessment evaluation process.

Figure 4 illustrates the whole MAMICare system interactions. First, the MAMI Server in which different tablets from different patients are being synchronized and data is being centralized in order to be accessible from any workstation. Secondly, the MAMITa system in which medical measurements are input and stored locally in the tablet device.

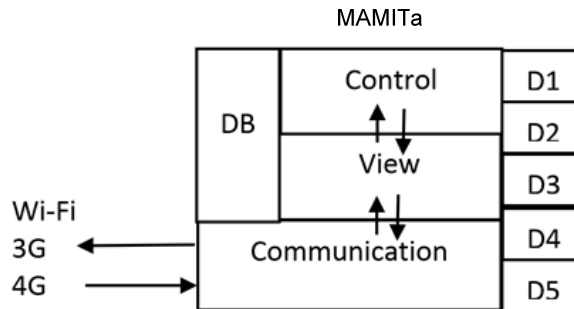


Figure 3: Shows the MAMI tablet (MAMITa) internal interface and communications.

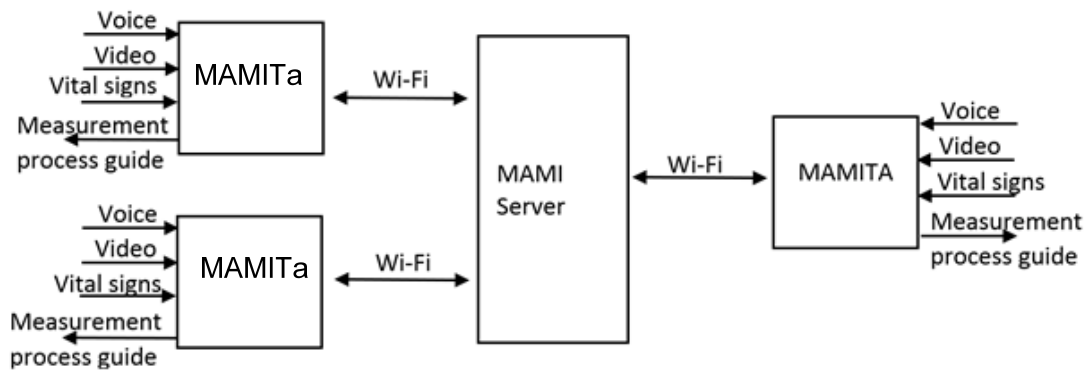


Figure 4: Full 2-part functionality of MAMI Care Project

For the short-term, the Denis cheap CDMA 450/800 Mhz 7 inches Android 4.0 CDMA tablet has been defined as a base development environment due to its inclusion of the CDMA450 communications protocol which has been chosen by Mexican telephone company TELMEX (2008) to be used for expanding the communications services to the rural areas since 2007. However at the moment or writing this paper, there are no communication services yet in the rural area of our attention. The Denis CDMA tablet will also enable a later process of synching the data with a central database, which will help to keep track records of the patient's evolution.

It is important to highlight, that even though MAMICare is a full solution, having only MAMITa available does help to reduce the problems of data accuracy. Of course, current communication limitations still does not allow to have centralized data, but MAMITa still keeps valid track records of patients information. While MAMI Server is unavailable, it is expected that MAMITa will be transported with the patient in case of an emergency; this allows the physician to have access to the patient's information and a proper assessment of conditions and a quick decision-making. In order to have a better understanding of the expected impact of this system, our original use-case situation will be exposed next, this time under the assumption that the MAMITa system is already implemented in the community.

Expected Impact of Health Information Technology Scenario

Considering the same characters, distances, orography and characteristics originally described in the original situation scenario. This time Maria has her full kit including the sensor devices and the MAMITa system.

During her scheduled visit to Rosa's home, Maria activates the MAMITa system. MAMITa guides her thoroughly during the metrics process. Maria uses the stethoscope as required by the system and data is stored in the system using wireless communication. MAMITa shows Maria a set of images/video on how to use the sphygmomanometer properly, the system receives the data and detects an abnormality in Rosa's health. MAMITa asks Maria to write down the anomaly in the form. Maria is asked by the system to make some follow up questions such as what her activities have been during the past days. MAMITa uses a microphone to record and store Rosa's description. Using a Doppler ultrasound, MAMITa stores data being sent by the device, in that moment the system detects another anomaly and asks the social worker to use her radio communication system to notify the Health House, UMR and HSB that a patient in critical situation has to be transferred to the HSB. One of the neighbors with vehicles comes to help move Rosa. Eight minutes later, Rosa is at the HSB, the physician practitioner in charge makes her diagnosis based on the tablet information. Data allows him to decide to move her to Tlaxiaco Hospital. In Tlaxiaco Rosa is timely attended; both Rosa and her baby are safe.

Expected Impact

As shown in the previous use cases, expected impact of implementing MAMICare in the rural areas include having truthful information and thus reducing diagnostic errors. The PVR will be better prepared to act under any circumstance. Another great advantage is the preservation of data. At the UMR, data could remain active from a few hours up to three days. In the Rural Hospital, data could remain relevant from one up to four days. Also inside the Hospital, communication and data transfer occurs immediately between tablets and workstations. MAMITa expects

to reduce the time of capturing the medical records by giving proper instructions, as well as by having available truthful information that allows physicians and social workers to have the best possible scenario for decision-making and even highlighting any considered risk situation.

RESEARCH LIMITATIONS AND FUTHER STUDY ISSUES

As we mentioned before in our research methodology section, our work is based on observation of a real case, therefore there exists some limitations which can reduce our expected impact. First of all the communication issue: the lack of proper communication means is consider in the initial phase of MAMICare, but further versions depend on the availability of communication technologies in the region (WiFi, 3G, or 4G). Availability communication technology depends of federal agencies and findings, which are out of scope of influence. In addition, the adoption or rejection of MAMICare depends of the approval of the state and federal health agency. This approval however is not only based on the technical merit of our project, sometimes, political reasons have more impact that technical benefits. These findings and validity remain to be verified in additional/future research, that we will be reporting as the project evolves.

CONCLUSIONS

MAMICare System is a work in progress that is expected to make a positive impact once it is implemented in any of the rural areas in Mexico. Research demonstrates that MAMICare is a viable solution to the maternity-infant problem that is currently present among the rural community areas in the states of Chiapas, Oaxaca, and Guerrero. Also the use of electronic healthcare services makes possible to reduce attention issues associated with the main causes of death (hypertension, hemorrhages, and other complications of delivery) that are much higher in maternity-infant care. The MAMICare System is a two-part system to be developed both in the short, medium and long term. For the short term, the MAMITa – a tablet system to aid the social workers in the patient's assessment process will be developed. In the medium term MAMI Server should begin development with the possibility of being expanded to become a wireless system in the long-term, when such communication technology is made available in the communities.

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