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Integrated System for Monitoring and Prevention in Obstetrics-Gynaecology

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Abstract. A better monitoring of pregnant women, mainly during the third trimester of pregnancy and an easy communication between physician and patients are very important for the prevention and good health of baby and mother. The paper presents an integrated system as support for the Obstetrics – Gynaecology domain consisting in two modules: a mobile application, ObGynCare, dedicated to the pregnant women and a new component of the Obstetrics-Gynaecology Department Information System dedicated to the physicians for a better monitoring of the pregnant women. The mobile application informs the pregnant women about their status, permits them to introduce glycaemia and weight values and has as option pulse and blood pressure acquisition from a smart sensor and provides results in a graphic format. It also provides support for easy patient-doctor communication related to any health problems. ObGyn Care offers nutrition recommendations and gives the pregnant women the possibility to enter a social space of common interests using social networks (Facebook) to exchange useful and practical information. Data collected from patients and from sensor are stored on the cloud and the physician may access the information and analyse it. The extended module of the Obstetrics-Gynaecology Department Information System already developed supports the physicians to visualize weekly, monthly, or on a trimester, the patient data and to discuss with her through the chat module. The mobile application is in test by pregnant women and medical personnel.

Keywords. pregnancy, obstetrics-gynaecology department, android, glycaemia, blood pressure, monitoring, prevention

Introduction

Creating a continuous process between patient, obstetrician and neonatal physicians, in the same time empowering the patient is important for a normal and healthy time during pregnancy [1]. Each part involved is as important in baby survival and healthcare status and may decrease neonatal mortality and morbidity through collecting critical data of the pregnant women. Pregnancy brings about many changes in a woman's body. A pregnant woman should have her weight monitored regularly during pregnancy, because every risk of pregnancy, both to the mother and to the baby, is increased with maternal obesity. Obesity in pregnant women can lead to all sorts of complications, including the death of the mother or of the baby through stillbirth, the baby having foetal abnormalities, the woman suffering pre-eclampsia or gestational diabetes. Around 35 per cent of women who die in childbirth are obese, while 30

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percent of pregnant women are overweight or obese [2]. Measuring the blood pressure is also very important, representing a way of telling how well your pregnancy is going, watching for signs of a potentially serious complication called pre-eclampsia, particularly later on in your pregnancy. Pre-eclampsia isn't fully understood, but it's thought it to happen when the placenta is not working as well as it should. This can lead to high blood pressure and other problems [3]. Another risk factor for a pregnant woman is the gestational diabetes [4]. This type of diabetes is developed during pregnancy. The effect is leading to high blood pressure and too much protein in pregnant's urine. Several of the issues in case that the pregnant doesn't treat and control in time specific symptoms are: low blood glucose right after birth, breathing problems, a higher risk of dying before or soon after birth, may become overweight or obese or getting type 2 diabetes later on [4].

To overcome the previously mentioned issues it is vital to monitor very closely the pregnant woman and also keep her informed with what she must do in order to keep herself and baby as healthy as possible.

We integrated ObGyn Care, a mobile application for Android and IOS operating systems (OS) devices dedicated to the pregnant women by extending an existing application for the Obstetrics-Gynaecology Department (OGD) [5] accordingly with the Internet of things era. This new component of the OGD Information System is supporting better monitoring of patients, especially the ones with risk factors. ObGyn Care has the possibility to send the glycaemia, pulse, blood pressure, weight and contractions values to a database in the cloud. The physician has access to information from the office information system and monitors the pregnant women almost in real time. A component of the system allows the physician to see diagrams with the evolution of all parameters in different periods of time. The system sends notifications to the patient and to the physician if the value is not in the normal range.

1. Methods

The ObGyn Care application uses the related instruments and devices of the Internet of Things concept. It uses JQuery Mobile technology, HTML5, CSS3, Ajax and PHP making it available on smartphones and tablets, sending data to Windows Azure cloud, accessed by the physicians from their office application [6]. The other component is an extended module of the OGD Information System developed in Visual Studio.NET 2013 using ASP.NET pages and C# language. The associated devices are specific smart sensors and a smart phone.

The doctor can access the OGD Information System and can see what data was sent from the ObGyn Care app and if the system sent a notification the physician can contact the pregnant women and give some advices regarding the pregnancy, or if is critical to call the pregnant to come to the consultation.

The ECG smart sensor is a system composed by an Arduino Uno, ECG sensor, a Bluetooth port and has the possibility to send the data regarding blood pressure and pulse to a Smartphone which has the possibility to filter the data and sent to the cloud. This information may be later accessed by the OGD Information System and also by the ObGynCare App.

Figure 1 presents the system architecture.

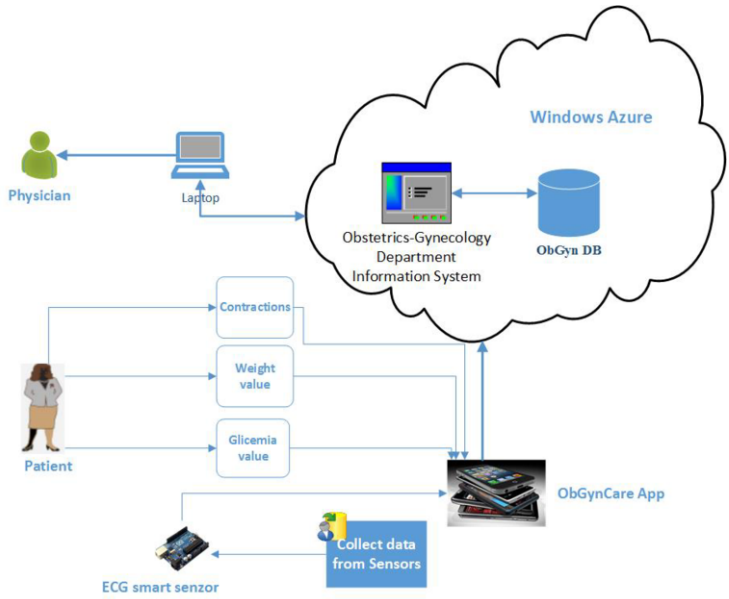

Figure 1. System architecture.

In order to ensure a continuity of care from the mobile application and the hospital department is needed a standardized communication, in this case is used HL7 CDA. HL7 CDA is a document mark-up standard that specifies the structure and semantics of clinical documents and it is represented as a XML document [7].

2. Results

ObGyn Care application is a mobile application which can be used on smartphones with IOS or Android OS. At the first use of the application, the patient must enter her name, her identification number, the pregnancy trimester and week. To other uses the application can be accessed automatically and also it computes and displays on the screen the pregnancy week and trimester.

The pregnant can enter her blood pressure, pulse values, weight and glycaemia in the ObGyn Care application, or to use the ECG smart sensor which measures and sends automatically data to the application. All of these values will be saved into a database on the cloud and can be accessed by the physician through the office application. The pregnant may set an alarm for a specific hour and this will alert her if the data are not entered in that day and recommends filling in. An alarm notifies the patient and the physician if the parameters values are not in the normal limits. Other functionality is that the patient can measure her contraction by using a button for start and stop when the contraction is happening, and can visualize the period between them. For a better communication with the physician, the application has a module where the patient can chat with the physician. The patient can visualize charts with the blood pressure, pulse, glycaemia and weight evolution on every week or for the entire trimester.

When they come to care in pregnancy, women are interested to search a lot of information related to recommended food, liquids as teas and alimentation that are best to consume during pregnancy [8]. A lot of things are restricted to be consumed during

pregnancy because some can do a lot of unwanted modification to the foetus. The proposed tool comes also to help pregnant women with general advice, being personalized for each one. For better information about pregnancy the application has an option where the patient can add meal plans. She can also share info on Facebook and change ideas with other pregnant women. Figure 2 presents six print screens from the ObGyn Care application, with the relevant functionalities.

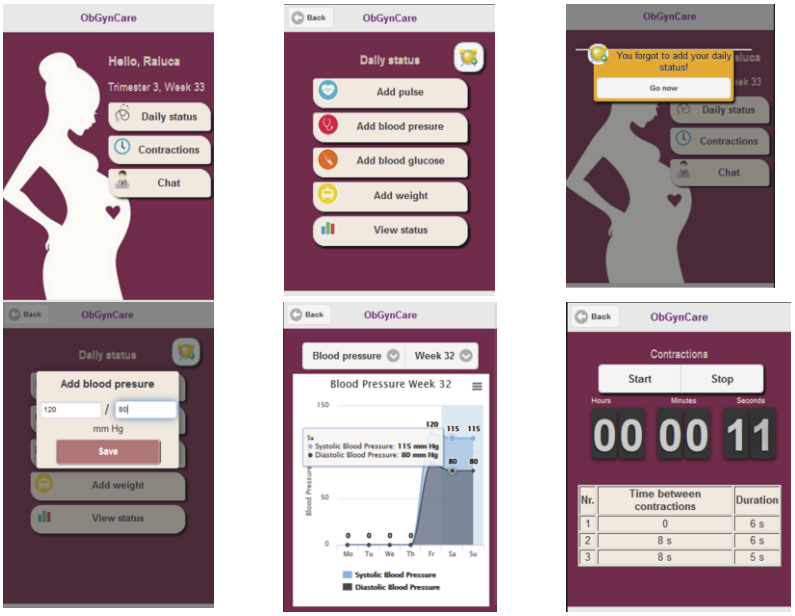

Figure 2. Screens from the ObGyn Care app.

The new component of the OGD Information System allows the physician to better monitor patients. Physicians have the possibility to visualize charts on specific week or trimester where he can follow the evolution of blood pressure, pulse, glycaemia or weight values, these parameters being selected in function of risk factors which can appear on the patient. Fig. 3 shows the blood pressure (A) and glycaemia (B) values evolution on 38th week for third trimester during pregnancy.

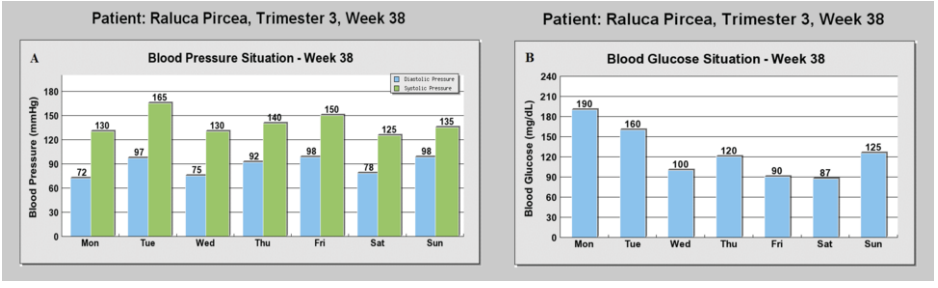

Figure 3. Screen from the Obstetrics-Gynaecology Department Information System

A. Monitoring the Blood Pressure on Week 38; B. Monitoring the Blood Glucose on Week 38.

3. Conclusion

Due to risk factors faced by pregnant patients, such as gestational diabetes, pre-eclampsia and obesity, a better monitoring is absolutely necessary. Collaboration from sides, patient and physician increases prevention of health problems of both the mother and the child, and reduces neonatal mortality. The ObGyn Care application works with two sorts of information: the first one is a general one about pregnancy and the second is a personalized part including the monitoring. The physicians, based on data from the mobile application stored in the cloud, view evolution diagrams of pulse, blood pressure, glycaemia and/or weight values for different periods of time, depending on the patient's risk factors.

The work described in this paper presents an integrated system for prevention and monitoring in Obstetrics-Gynaecology Domain composed by an application for IOS or Android OS mobile devices, called ObGyn Care, which supports pregnant women, and a new component of the OGD Information System, dedicated to the physicians for a better monitoring of patients, using the cloud, smart sensors, mobile devices and applications.

Testing started for the ObGyn Care app on 10 pregnant patients' mobile phones since 3 months. The feedback was registered using a quiz and free talks with patients. Testing in progress includes a usability test. The feedback from patients was positive, and the application is seen very useful for monitoring the health during pregnancy as well as for prevention purposes, ensuring in future mothers a feeling of trust and safety. The patients who suffer preeclampsia during pregnancy often have to go to the hospital to have their blood pressure measured. The feedback using the application is that the number of hospital visits can be reduced, the application ensuring a good monitoring of the health parameters and supporting easy communication with the physician. The application can monitor, among others, the blood pressure values in real time, sending them to the physician. If the values are not in normal range, the application will notify both the patient and the physician. In the future the app will be extended and uploaded on Google Play Store and App Store. As future possibilities due to the fact that the communication is a standardized one, the information may be sent to General Practitioner office and also to other departments (e.g. Neonatology department).

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