IMPACT OF RAH@H – A PATIENT-CENTRIC CONNECTED HEALTH MODEL, ON OUTCOMES IN PREGNANT WOMEN WITH GESTATIONAL DIABETES MELLITUS AND HYPERTENSION IN PAKISTAN.

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ABSTRACT
According to current evidence, Gestational Diabetes Mellitus (GDM) is a global phenomenon by which large number of pregnant women have to suffer through adverse medical conditions in their gestational age include poor blood glucose levels in their blood and un-controlled hypertension making them prone to pre-eclampsia; both of these diseases are contributing towards threatening the health of the fetus throughout their pregnancy. This study demonstrates the impact measured by a pilot study in Pakistan towards addressing GDM eliminating the risk of morbidity and mortality by establishing a patient-centric remote healthcare model called RAH@H (Remotely Accessible Healthcare at Home). This involve integrating Information and Communication Technological aspects for remote monitoring and treatment of gestational diabetes and hypertension in pregnant women via project-provided digital medical devices at home for a safe and secure delivery; thus, promoting a sustainable perinatal period while improving the quality of fetus health and life of another.
1. INTRODUCTION

Gestational Diabetes Mellitus (GDM) is a medical condition affecting over 15% [1] of pregnant women globally which results in dramatic increases in levels of blood glucose due to incapability of the body for producing adequate insulin addressing the added needs of the fetus, or hormonal variations which lower its sensitivity towards insulin [2]. The frequency of GDM is significantly reported higher in the region of South Asia [1]. If left untreated, the fetus may face growth complications, increasing the risk of morbidity or painful delivery. Given the recent technology revolution, delivery of quality healthcare by use of Information and Communication Technology is creating an impact especially in vulnerable communities where inhabitants at-large are prone to compromised healthcare and patientsafety [3].

Unlike other countries of the South Asian region, no such study has been conducted in Pakistan on national level to determine the prevalence of GDM. However, data from small-scale regional studies based on different contexts and criteria for identifying GDM shows mixed prevalence as higher as 26% from Peshawar [3], >8% from Karachi [4], 22% from Balochistan [5], 15% from Hyderabad [6], and >14% in Bahawalpur [7]. However, we believe that true prevalence is much higher considering the current maternal and neonatal healthcare disparities in Pakistan [8].

RAH@H (Remotely Accessible Healthcare at Home) is a patient-centric online portal introducing a connected healthcare model in Pakistan, focusing on engaging and empowering pregnant women with gestational diabetes and hypertension throughout their gestational age with an aim of reducing hurdles at the time of birth; through project-provided medical devices at home. These devices send frequent data to the portal which offers clinicians virtual monitoring and treatment of GDM and hypertension by personalized feedback include dose adjustment while addressing associated medical complications. The project aims to monitor pregnant women for key causes of mortality and morbidity during pregnancy and childbirth, such as pre-eclampsia and gestational diabetes [2, 9, 10]. This connected healthcare model of RAH@H delivering the remote healthcare facilities at home empowering patients while ensuring patient safety employs a wide range of digital health features as represented in Figure 1.

2. METHODOLOGY

RAH@H is originally the project of King Saud University Medical City (KSUMC), Riyadh, Saudi Arabia; and is being operated in Karachi, Pakistan as a proof of concept with patients developing hypertension and diabetes mellitus throughout their gestational age. The project was commenced and started recruiting patients on 12th May 2017 and has addressed 34 patients to-date.

An informed consent has been sought from each pregnant woman getting registered in the study. All the patient data and information were kept confidential with regards to the privacy concern of patients.

2.1 Enrollment of Patients:

Appropriate triage and referrals were performed on each pregnant woman on their visits to the consultant gynecologist on the basis of diabetes mellitus and hypertension. These patients were then referred to RAH@H to determine whether the patients or their care giver at home were eligible to participate in the study based on multiple factors. The selection criteria included: their capability to comprehend and communicate in English language; their computer literacy; whether they possess their own mobile phone; and internet accessibility at home.
home. If all these conditions were met, the patient was considered eligible to be recruited in the project. Prior to complete project explanation to them, an informed consent has been sought from each patient.

2.2 Training of Patients:

For training, tailored user-guides, manuals and video share-damong the recruited patients. The patients were trained for using the medical devices (including digital Bluetooth-enabled blood pressure monitor, Bluetooth-enabled glucometer and RAH@H mobile application) by RAH@H team at their facility. These devices send frequent and updated data whenever patients tested their vitals to the mobile app of RAH@H installed on their own smart phones which were in turn obtained by the clinicians on the RAH@H staff portal in real-time. Through this framework, patients were remotely monitored by their consultant using RAH@H web and mobile app features.

In case, if patients did not check their vitals for more than two days or having difficulty in taking their readings, reminders were sent in terms of messages using RAH@H messaging web feature or telephonic calls were made periodically in order to assist them. Biweekly teleconsultations were done by the consultant gynecologist and remote follow-ups were scheduled to monitor the development of health conditions of patients based on the data received on RAH@H staff portal; which were also examined for drug adjustment.

Special counseling of registered pregnant women was also provided as part of scheduled follow-ups about prevention of falls, continuing nutritional supplements for strengthening pregnancy and fetus health.

A qualitative survey tool was developed for patients and the consultant to analyze the overall comprehension, satisfaction, experience, and engagement level of patients and provider with the RAH@H project. The tool was then validated among these participants and responses were retained to publish.

3. RESULTS

To-date, RAH@H has addressed 34 cases eliminating potential risk of developing pre-eclampsia and post-partum diabetes ensuring patient safety; out of overall 46 current active patients which are registered in the RAH@H project. The measured values of these vitals of patients by project-provided digital medical devices were transferred to the RAH@H portal and these values were then monitored and managed by their provider in terms of dose adjustment and teleconsultations on biweekly basis; as discussed.

The initial qualitative results from the patients/caregiver and provider revealed high level of engagement and satisfaction on the basis of usefulness, compliance, and experience. Below are some of the key responses from patients and provider:

“RAH@H is extremely convenient and cost-effective accessible home-based healthcare to pregnant women. This connected health model saves her from day-to-day hassle of attending the health facility and provides them better control and compliance of their parameters such as glucose, blood pressure, monitoring of mothers and fetal sounds monitoring in the comfort of their homes simultaneously-keeping their healthcare connected 24/7”.

Consultant Gynecologist.

“It is an excellent program; this program should continue-forever. It really helps the woman to be aware about her child each and every moment. I thank RAH@H; it is a perfect program forme”.

Patient ABC.

“Very easy to use and helpful devices. It is indeed a good program”.

Patient XYZ.

Further, Pearson’s Coefficient statistical analysis technique was used to measure the correlation of variables; GDM and age-group. As shown in Figure 2, The value of R calculated is 0.6084. This is a moderate positive correlation, which means there is a tendency for age >27 of pregnant women at high risk of developing GDM.

Figure 2: Correlation of GDM and age-group
Moreover, the P-Value is .000284 which further shows the result is significant at $p < 0.05$.

4. CONCLUSION

In a setting where larger proportion of communities are deprived of accessible and safe healthcare services during pregnancy, we believe RAH@H can bridge a critical gap in providing quality healthcare to the expectant mothers using an evidence-based approach which will demonstrate the value of the program making it more evidence-based in terms of delivering quality healthcare promising patient safety. In view of the initial observation of the responses that indicate high level of acceptance among the patients and providers, we aim to expand the services on a larger scale in future by enrolling more patients into the program.

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6. REFERENCES


