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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Gestational diabetes, Hypertension, eHealth, Digital health, Pregnant women, Pre-eclampsia.

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- controlledhypertensionmakingthempronetopre- 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 amother.

1. INTRODUCTION

Gestational Diabetes Mellitus (GDM) is a medical condition affecting over 15% [1] of pregnant women globallywhichresultsindramaticincreaseinlevelsof blood glucose due to incapability of body for producing adequate insulin addressing theadded needs of fetus, or hormonal variations which lower downitssensitivitytowardsinsulin[2].Thefrequencyof GDM is significantly reported higher in the region of South Asia [1]. If left untreated, the fetus may face growthcomplications,increasingtheriskofmorbidity 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,datafromsmallscaleregionalstudies based on different contexts and criteria foridentifying 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 inPakistan [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 throughouttheir 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 at theportalwhichofferscliniciansvirtualmonitoring 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 preeclampsia 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.

Figure 1: Connected healthcare model of RAH@H
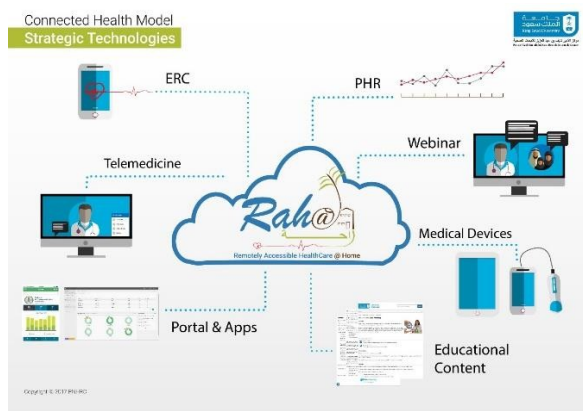
2. METHODOLOGY

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 May2017 and has addressed 34 patientsto-date.

An informed consent has been sought from each pregnantwomangettingregisteredinthestudy.Allthe patientdataandinformationwerekeptconfidentialwith regards to the privacy concern ofpatients.

2.1 Enrollment ofPatients:

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 computerand internet literacy; their acquaintance with smartphones and technology; whether they possess their own mobile phone; and internet accessibility at

home.Ifalltheseconditionsweremet,thepatientwas consid-ered eligible to be recruited in the project.Prior to complete project explanation to them, an informed consent has been sought from eachpatient.

2.2 Training ofPatients:

For training, tailored user-guides, manuals and video share-damongtherecruitedpatients.Thepatientswere trainedforus-ingthemedicaldevices(includingdigital 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 in-stalled on their own smart phones which were in turn ob-tained by the clinicians on the RAH@H staff portal in real-time. Through this framework, patients wereremotely moni-toredbytheirconsultantusingRAH@Hweband mobile appfea-tures.

In case, if patients did not check their vitals for more than two days or having difficulty in taking their readings, re-minders were sent in terms of messages using RAH@H mes-saging web feature or telephonic calls were made periodi-cally 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 con-ditions 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, satisfac-tion, experience, and engagement level of patients and pro-vider 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 poten-tial risk of developing pre-eclampsia and post-partum dia-betes ensuring patient safety; out of overall 46 current ac-tive 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 satis-faction on the basis of usefulness, compliance, and experi-ence. Below are some of the key responses from patients andprovider:

"RAH@H is extremely convenient and cost-effective accessi-ble home-based healthcare to pregnant women. This con-nected health model saves her from day-to-day hassle of attending the health facility and provides them better con-trol and compliance of their parameters such as glucose, blood pressure, monitoring of mothers and fetal sounds monitoring in thecomfortoftheirhomesandsimultaneously-keeping their healthcare connected24/7".

Consultant Gynecologist.

"It is an excellent program; this program should continue-forever.Itreallyhelpsthewomentobeaware about her child each and every moment. I thank RAH@H; it is a perfect pro-gram 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.

Figure2: Correlation of GDM and age-group
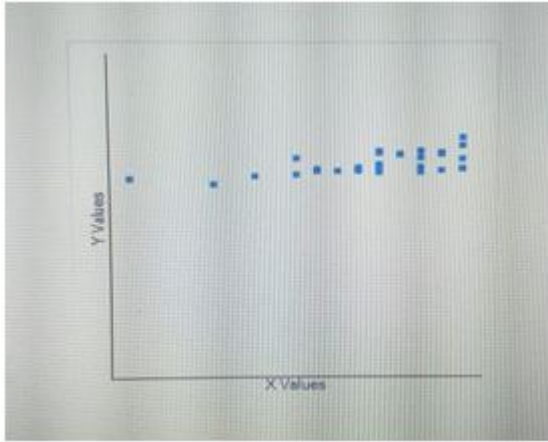
Moreover, the P-Value is .000284 which further shows the result is significant at p < 0.05.

We thank the project team based in King Saud University Medical City (KSUMC) in Saudi Arabia for leading and con-

4. CONCLUSION

In a setting where larger proportion of communities arede-privedofaccessibleandsafehealthcareservices 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 viewof 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.

5. ACKNOWLEDGENT

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