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How Advances in Digital Health Benefit Pregnant Women

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Abstract:

Pregnant women can use Smartphone apps, social media, and remote health monitoring devices to provide security, confidence, and information about the condition of not only their own health, but also that of the baby. Pregnant women can easily gain information about nutrition, complications, and fetal development using current technologies that can provide tips and alerts for preventive care, emergency-care, post-delivery support, and information about emerging risks. Remote monitoring of high risk pregnancy and prevention of preterm labor can now be done in the patient's home using telehealth devices. Remote monitoring of high risk pregnancy and prevention of preterm labor can now be done in the patient's home using telehealth, as well as the non-stress test (NST) is a common test done on patients with high risk pregnancy to identify fetus heart rate (FHR) for fetuses that are in immediate danger . Several apps are available on smartphones for pregnant women that offer support and track the health of both the mother and the fetus. The Dyno, a remote health monitoring system can track the mother's health and alert caregivers if action is required.

Keywords: Smartphone apps, remote health monitoring devices, high-risk pregnancy, non-stress test (NST), fetus heart rate (FHR), Dyno.

I. INTRODUCTION

The rapid advances of internet and communication technologies have evolved into an essential need, and both city-dwellers and those living in remote areas have equal opportunities to use these technologies to improve their health [1]. Technology is key in healthcare improvement due to (i) cost reduction, (ii) patient safety and satisfaction improvement, and (iii) reduction of potential errors [1]. Recently, mobile technology has vastly evolved into an established platform, with up to 4.6 billion mobile phones being used globally [1]. Thus, many experts in the healthcare industry and health organizations, such as the World Health Organization, are seeking to tap into mobile technology's potential to reform healthcare management and delivery, especially that which is vital to pregnant women [1]. Pregnancy is one of the most common life situations that might intensify the need for more health related specifics among women [2]. Pregnant women can use Smartphone apps, social media [1], and remote health monitoring devices, to provide security, confidence, and information about the condition of not only their own health, but also that of the baby. Pregnant women can easily gain information about nutrition, complications, and fetal development [2]. Current technologies can provide tips and alerts for preventive care, emergency-care, post-delivery support, and information about emerging risks [1].

Women undergoing complicated pregnancies often have a lot of concerns and questions. One solution is teleconsultation, which may provide immediate answers and creation of a personal healthcare plan [3]. Patients and physicians can interact via a video monitor and discuss concerns and answer questions through the use of "pictures, diagrams, models or videos" [3], including advice about nutrition. A number of pregnancy complications, such as anemia, miscarriage or stillbirth, can be avoided by proper nutrition and maintenance of an active lifestyle [1] [4].

II. APPS

Several apps are available on smartphones for pregnant women that offer support and track the health of both the mother and the fetus. The Yukon Baby smartphone app engages women, men and their families and supports them during pregnancy [1]. Pregnant women can also benefit from Bloomlife, an application and device that detects the intensity of each contraction, as well as creating a history of all the changes that have occurred in the long term [5]. My Pregnancy app has features, such as fetal development images, which are shown by expert medical illustrators [2] [6]. Daily use of apps available on smart phones, iPhone, iPod Touch and Android guide women to prepare for their baby's birth by providing answers based on the child's due date [2]. Internet-based behavioral programs can augment prenatal care which may lead to improved pregnancy outcomes [1].

III. HIGH RISK PREGNANCY AND REMOTE HEALTH MONITORING

Remote monitoring of high risk pregnancy and prevention of preterm labor can now be done in the patient's home using telehealth for tracking (1) uterine activity, (2) management of obstetrical diabetes (blood sugar testing and administering insulin), and (3) management of obstetrical hypertension (blood pressure and urine collection) [1]. Pregnancies can be high-risk for many reasons, such as twins, triplets, or multiple fetuses, due to a heightened chance of premature labor [2] [9]. Other conditions considered high-risk are high blood pressure, chronic illness, history of preterm labor, and gestational diabetes [2] [9]. The risk of premature labor, which is uncontrolled uterine contractions causing

cervical dilation, can be identified early on in the pregnancy and can be monitored in the home by using telehealth devices [2].

Physicians advise women with high risk pregnancies to have complete bed rest in their homes because it may lower "the gravitational stress on the uterus and cervix and increases blood flow" [10] [11] . Home bed rest creates less stress than hospitalization, which may lead to feelings of confinement, lack of privacy, depression, anxiety, and separation from family [10]. Remote home health monitoring provides women with control over their lives and the ability to perform self-care activities [10]. Previously, women who were prescribed bed rest at home could not participate in support groups with fellow patients; however, due to advanced technologies, patients can connect with online support groups from the comfort of their own homes [2]. Telehealth equipment in the home can monitor preterm labor risks using home uterine activity monitors (HUAM) and non-stress test monitoring [2]. The identification of early uterine contractions has been used for preterm birth prevention for the past twenty years [12]. Home monitoring systems transmits data that is collected two or three times daily to a round-the-clock nurse who reads uterine contractions and all data that is collected is transmitted to the woman's primary physician [13]. The physician can prescribe self-administered medications that stop contractions or advise the patient to go to the hospital for supplementary evaluation [13]. HUAM research shows that home uterine activity monitoring can detect preterm labor, "pregnancy prolongation and improved pregnancy outcomes" [13], which leads to improved outcomes for the child, such as reduced nursery stays, "increased birth weights and gestational age " [13]. The advancement of technology has made possible a more detailed and precise follow-up, used at the request of specialists, since they are essential to determine in the first months of gestation, if the child has a genetic disease, and thus be warned, for the entire gestational process [7]. Remote health monitoring provides mothers with real-time data on their child's heart activity; collected data can be processed live into the cloud using proprietary algorithms. Users can access the data on their smartphone or on the website of the company where they can record and then share the heartbeat of the baby with family and friends. Each device contains a set of sensors that provides doctors with a wide range of statistics, from the heartbeat rates of the mother and baby, kicks, sleep state and contractions [8]. The Dyno, from DynoSense Corp., is an integrated remote health scanner which can capture a wide range of health metrics from the pregnant woman in her home [8]. It can track up to 33 health metrics containing all basic vitals, for example (i) ECG (electrocardiogram), for all the irregularities related to heart and heart parameters, (ii) photoplethysmography which extracts blood oxygen, (iii) pulmonary plethysmography which extracts the respiration rate, breathing efficiency, and breathing volume, (iv) oral body temperature, (v) and non-cuff blood pressure tracking [8]. The Dyno can do all this easily in less than 60 seconds just with one action by the user.

IV. HOME NON-STRESS TEST

The non-stress test (NST) is a common test done on patients with high risk pregnancy to identify fetus heart rate (FHR) for fetuses that are in "immediate danger of deterioration and compromise" [14]. Patients can perform the NST in the home daily using a FHR monitor and transmit the data to a caregiver who can reassure the patient that there is no risk or refer the patient to the hospital for further observation [14]. Studies show that home FHR monitoring is safe at all stages of gestation and is so easy to use that it can benefit even "socioeconomically disadvantaged patients" [14]. Home monitoring alleviates patients having to find transportation to a physician's office, and also encourages them to comply and be an active participant in their own health care [14].

V. CONCLUSION

Pregnant women can benefit from current digital technologies for finding apps that monitor health, provide information, or connect to caregivers. High-risk pregnant women benefit from home bed rest and enjoy self-control of their pregnancy health using home remote health monitoring devices. Smartphone and other devices that provide pregnancy monitoring and information apps help connect patients to others in similar circumstances. Remote health monitoring devices that can easily be used in the comfort of a patient's own home are a preferred alternative to hospitalization that is costly, isolating, and depressing. Today's advances in digital and remote health monitoring are becoming more sophisticated, easy to use, and turn a pregnant woman's health data and that of her fetus into actionable and meaningful information for caregivers. All pregnancies can benefit from continuity of care, continuous monitoring, data collection, and access by physicians.

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