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Obstetrics Care Robot Implementation

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Technology has made great advancements in the healthcare industry and the delivery of care. According to the American Hospital Association (2017), telehealth has provided immense benefits such as prompt access to providers and specialists, reduced costs, increased care options, and the ability to monitor patients remotely while in the convenience of their homes. Pregnant women require frequent monitoring during pregnancy and many are placed on bed rest as they are considered high-risk due to complications such as vaginal bleeding, gestational diabetes, high blood pressure, carrying multiples, and much more (American Pregnancy Association, 2019). The purpose of this report is to explore the feasibility of implementing care robots to assist with blood pressure readings for pregnant women on bed rest, especially those without constant help from friends or families. The robot is expected to report the trends back to the healthcare provider to facilitate effective monitoring of the patient from home.

Problem and Goal

Preventing gestational hypertension and preeclampsia are among several indications for bed rest. Monitoring of blood pressure, and fetal heart rate are often required during this period. The current state is that bed rest can be burdensome on the pregnant woman and her family. The woman might experience self-blame and depression while the partner experiences fatigue and anxiety due to increased financial burden, and overall added responsibilities (McCall, Grimes, & Drapkin Lyerly, 2013). This may make the partner unavailable to render assistance, ultimately leading to decreased compliance with bed rest instructions. The future state seeks to provide support to such women through an in-home care robot that will be provided by the Health Care System ABC (HCSABC). The goal is for the care robot to obtain the woman’s blood pressure reading, transmit the information to the care providers seamlessly, and thereby improve compliance. The robot may also help with other daily activities.

Technical Requirements

There are many robots serving the healthcare industry, and people in their private homes as healthcare or social companions. For example, Pepper, a humanoid robot is used in businesses, schools, and healthcare facilities worldwide. It has unique abilities to engage and interact with people. Its features include the ability to move freely and naturally turning 360 degrees. It has speech recognition with ability to converse in over 15 languages, perception modes that enables it to recognize the individual it's interacting with, LED, speakers, microphones. Pepper also has tactile sensors, cameras and infrared sensors, and it's able to be programmed to do much more (SoftBank Robotics, n.d.). Figure 1 consists of several features and functionalities required in the care robot to be implemented by HCSABC. Some of the specifications listed are based on features that already exist in Pepper. Enhancements are needed to meet the requirements that align with the patient care robots to be provided to pregnant women on bed rest. Such can be achieved by having a HCABC app that the patient can use to achieve care requirements of taking blood pressure readings, and the data obtained can be transmitted to the providers with ease.

Feature/Functionality	Requirement	Comment and Reference
Height	4.0 feet	Adequate height for adequate visibility with patients
Width	19 inches	Adequate width not to consume much of patient's living space
Battery	Lithium-ion battery	Rechargeable, 8-12 hours battery life

Weight	45lbs	Lightweight but sturdy to prevent falling over
Connectivity	Wi-Fi, Bluetooth enabled, Secured connectivity Interface with other home functions: TV remote, Alexa, Google	To facilitate wireless data transmission; ease for patient to set commands for home functions
Hardware	Quad core CPU, RAM >4 GB, Flash Memory >8GB	Fast processor and large storage capacity due to compilation of patient data
Interaction	Cameras, sensors, LEDs, microphones, speakers	Ability to video call, record data and play back
Communication	Multilingual capabilities, voice and text capable	Able to translate/interpret patient's programmed language
Mobility	Multi-surface movement, ability to turn 360 degrees, arms to perform tasks	Capable of free movement around patient's home including climbing stairs
Functionality	Able to take vital signs including blood pressure, retrieve various objects as directed, set reminders for medications	High functionality to be able to accomplish the goal of taking patient's BP, and assist with several daily activities

Figure 1. Technical requirements. This figure consists of some specifications needed in the ideal care robot to be implemented. Adapted from http://doc.aldebaran.com/2-4/family/pepper_technical/index_pep.html

Measurable Criteria for Project Success

The success criteria of a project can be measured by the satisfaction of the customers, team members, and stakeholders. The comparison of the pre and post implementation outcomes can be used to evaluate the quality of the project (Eskander, 2018). Regarding the patient care robots, measureable criteria can be obtained from the patients by conducting a survey of their level of satisfaction with the robot care. Patients can rate how supported they feel with having the robot around, and how complaint they are with keeping to bed rest restrictions. Data obtained from information gathered by the robot will not only reveal the frequency of its use but also provide substantial data, which providers can use to trend the patient's health activities. Analysis can be made comparing current state of bed rest requirement compliance of obtaining blood pressure readings without having help and support around to post robot implementation.

Risks and Limitations

The patient care robots are being implemented to support pregnant women on best rest with priority to those without family and friends support. One can imply that such a patient might be a single mother, or perhaps married with other small children in the house. It is also possible that extra help cannot be made available due to financial constraints. Social and psychological limitations ought to be considered as dependence on technology can reduce social interactions due to increased reliance on the product. Also, usability, the ability of the patient to operate the robot based on their level of cognition, has to be factored in (Demiris, 2010). Risks exist in the potential for erroneous deletion of the data gathered by the care robot, and also in the transmission of the data to the providers.

Security and Privacy

The safety, security, and satisfaction of patients are of most importance to all involved in the implementation of this robot care telehealth program. The use and access of a patient's personal health information have been held in higher standards since the Health Insurance Portability and Accountability Act (HIPAA) was passed in 1996 (Demiris, 2010). Because the robot will have functionalities of Bluetooth and Wi-Fi connections with the use of various applications that facilitate data transmittal and connection to health care providers, added security programs will be installed on the robots. This is to ensure that HIPAA regulations are not violated but more crucially, that the safety of the patient is not in any way compromised.

Implementation Timeline

In an implementation timeline, the overview of the major aspects of the project is laid out for the project committee member's awareness (Douglas & Celli, 2015). Figure 2 depicts key phases in the implementation of the care robot project.

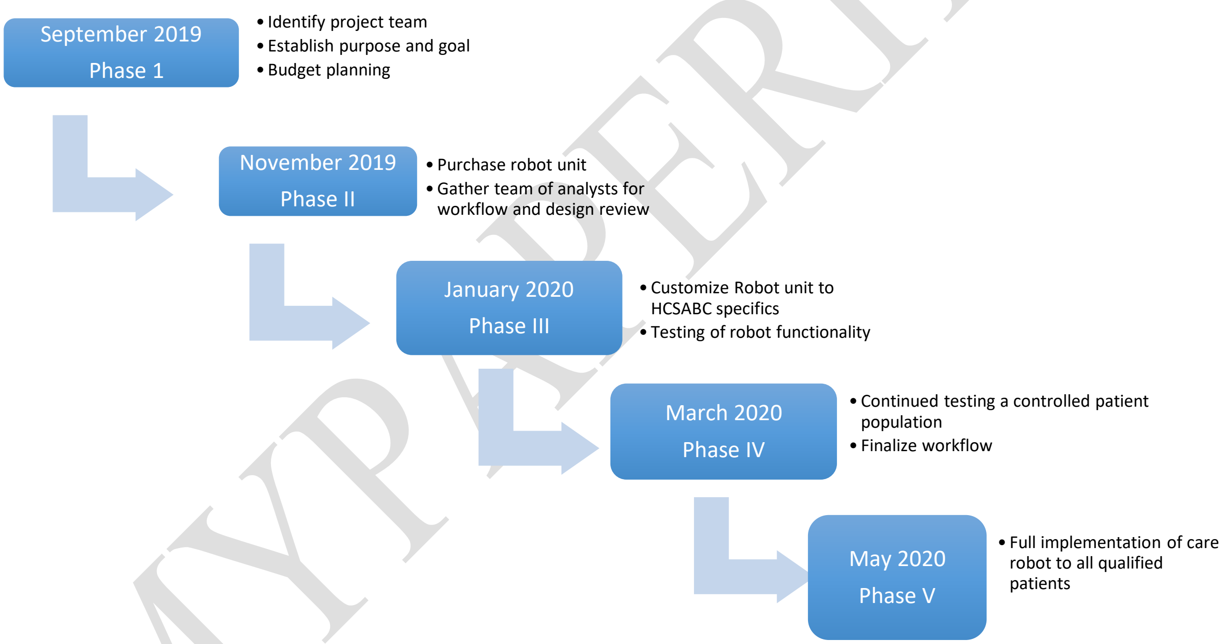

Figure 2. HCSABC Implementation of care robot. This figures illustrates the projected timeframe for the telehealth care robot project.

Project Committee

According to Douglas et al. (2015), the steering committee of a project are those with great oversight of how the organization operate daily which affords them the ability to be key decision makers in the implementation process. The authors identify the Nurse informaticist as the project manager who oversees the project as a whole with different teams and leaders from various departments. For this HCSABC care robot project, the Chief Nursing Officer (CNO), Chief Nursing Informatics Officer (CNIO), and the Director of the Women's Health will serve as the steering committee. The Informatics Nurse Specialist will manage the project while working hand in hand with department leaders from Nursing, Health IT, Health Informatics, Network Security, Quality and Safety, and Finance departments. All personal involved have a goal of implementing a safe and effective care robot for pregnant women on bed rests.

Care Robot Budget

As mentioned earlier, Pepper the humanoid robot created by SoftBank costs over $14,000 after purchasing it with a 3-year subscription of equipment insurance, and a data plan; singularly, the robot is estimated at about $1,600 each (Tobe, 2016). Figure 3 below depicts a simulated cost projection of the care robot to be implemented by HCSABC based some cost estimated from Pepper's price range. Having such budget analysis provides the steering committee an insight into the financial commitments involved in the implementation.

Projected Expenses/Materials and Systems for 1 Robot Year 1	**Costs for 1 Care Robot Year 1**
Cost of 1 robot as direct purchase ($1700)	$1,700
Maintenance for robot for 1 Year (12 X $180)	$2,160
Insurance for robot for 1 Year (12 X $100)	$1,200
Internet (Cloud Subscription) for 1 Year (12 X $120)	$1,440
Cost to deliver and retrieve 1 robot ($200)	$200

Education and training for 1 MA (20 hours of training at $15/hour)	$300
Education and training for 1 RN (20 hours of training at $40/hour)	$800
Education and training for 1 NP (20 hours of training at $75/hour)	$1,500
Education and training for 1 MD (20 hours of training at $100/hour)	$2,000
Education and training for 1 patient by RN (10 hours of training at $40) Assume this is not a reimbursable expense	$400
Total Budget	**$11,700**

Figure 3. HCSABC care robot cost estimate. This figure shows the projected costs that will be allocated to 1 unite of robot in a year.

Project Justification

A study conducted by Perry, Sheehan, Thilaganathan, & Khalil (2018), explored the effect of home blood pressure monitoring in pregnant women with gestational hypertension, on the reduction of antenatal visits. These visits are such that necessitates the pregnant woman to visit the outpatient maternity unit of the hospital over two times a week to monitor the patient's urine and blood pressure. The results of the study indeed showed a reduction in these visits saving the patient money without comprising the patient's health and safety. In considering the relationship between the cost and benefit of implementing the care robot for the population of pregnant women on bed rest, this study provides substantial evidence to prove that compliance with home blood pressure monitoring increased. This thereby causes a reduction of hospital/outpatient visits and adverse events, ultimately lowering overall costs for patients and the health system.

Workflow Diagram

Communication is an important tool when implementing a telehealth program. Without the fluidity in communication, project members can be confused about the workflow process resulting in unnecessary delays in what should otherwise be a simple to flow. In figure 4 is a swim lane diagram created to give a visual to care robot workflow. The diagram shows the persons responsible for key aspects assisting pregnant women with the care robots.

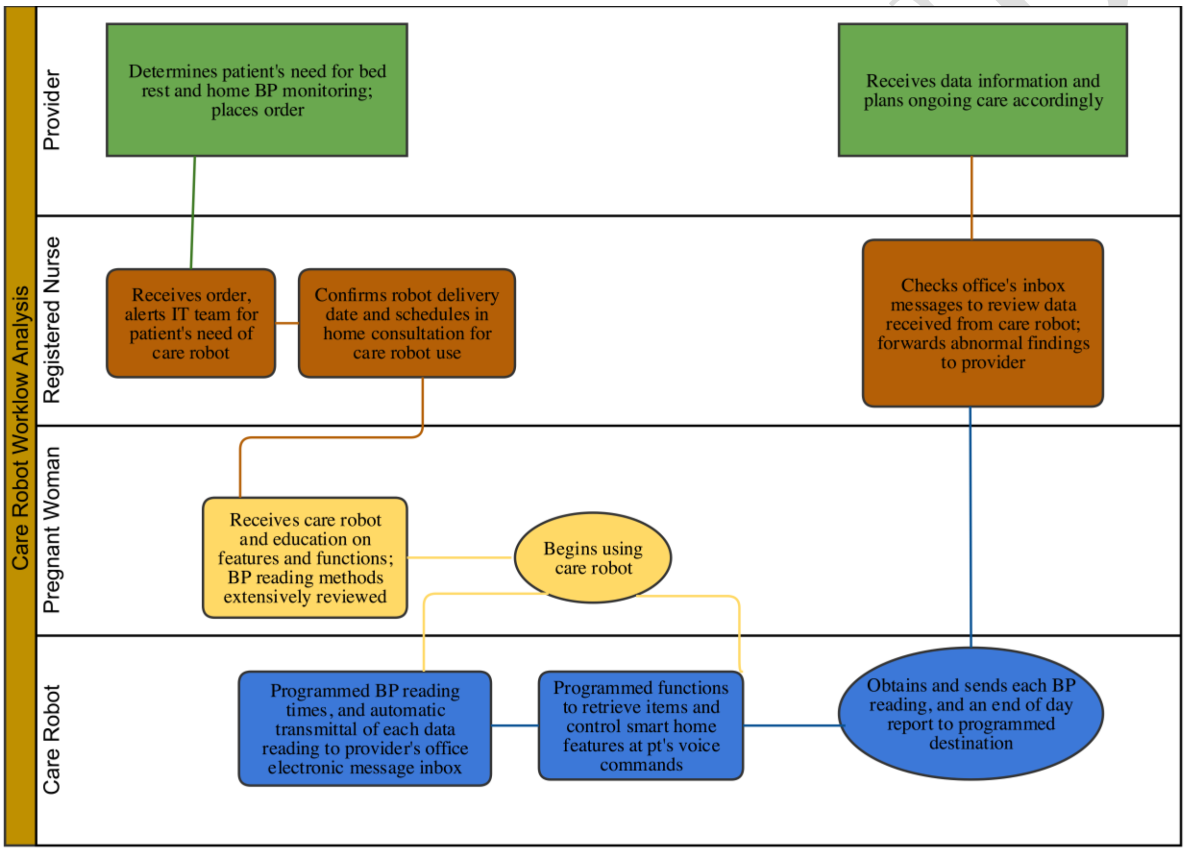

Figure 4. Care robot workflow analysis. This figure consists of participants crucial to the seamless workflow to be implemented in this project.

Conclusion

The expansions and advancements in healthcare technology have progressively become beneficial to health systems, and patients. The undertaking of the care robot telehealth implementation by HCSBAC to provide adequate monitoring and support for pregnant women on bed rest with priority given to those without consistent support exemplifies the immense capabilities that exists in information technology as we know it. The information provided in this feasibility project implementation report reveals that compliance with bed rest instructions of frequent blood pressure monitoring will increase. Furthermore, the benefits such as reduced office visits, reduced medical costs, and increased patient satisfaction, and safety outweigh potential risks posed to the implementation of the care robots.

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