Case study

WONDER Project

HP technology enlisted to combat maternal mortality worldwide

Industry
Healthcare

Objective
Develop tools and protocols for reducing maternal mortality

Approach
WONDER project leverages HP expertise and solutions to monitor vital signs, providing a clinical decision support system

IT matters
- Integration of wearable biometric devices in the clinical setting
- Use of HP mobile devices in the collection of EHR data
- Use of decision support and alert tools in clinical practice
- Practical applications of print for clinician charting
- Use of multimedia content and digital displays for patient education

Business matters
- Approaches to reducing global disparities in maternal health outcomes
- Clinical care models for the delivery of services to remote populations
- Technology-enabled strategies for the reduction of maternal mortality and morbidity
- Framework for global system of cloud-connected electronic birthing centers

"I want to take this globally. The electronic birthing center could be…anywhere."

– Dr. Narmadha Kuppuswami, Founder and Project Coordinator, Women's Obstetrical Neonatal Death Evaluation & Reduction (WONDER) Project

According to the World Health Organization (WHO), every day around the world about 830 women die from preventable causes related to pregnancy and childbirth. That's staggering at more than 300,000 fatalities per year.[1] Ninety-nine percent of these avoidable deaths occur where resources are scarce and access to healthcare limited.

Dr. Narmadha Kuppuswami, a distinguished obstetrician and gynecologist with nearly 40 years of clinical experience and passionately committed to saving women's lives, founded the Women's Obstetrical Neonatal Death Evaluation & Reduction (WONDER) project to combat such casualties. Along with her team of healthcare and IT specialists, Dr. Kuppuswami is using HP expertise and technologies to gather and act on patient data as never before possible. Together, the WONDER team is making groundbreaking advances on behalf of global healthcare for women.

Although the rate of maternal mortality is significantly lower in developed countries,[5] low-income women in rural areas are still at higher risk.

During her first clinical posting as a medical student nearly a half century ago, Dr. Kuppuswami— now in Downers Grove, Illinois, and affiliated with Advocate Good Samaritan Hospital—met a patient who changed the course of her life. Traveling from a remote village in India, this expectant mother had arrived at the hospital with a ruptured uterus. While doctors and nurses rushed to prepare for surgery, all Dr. Kuppuswami could do was hold her hand. The woman told them she had four other children at home with no one to care for them if she died. She begged them to save her and her baby.

Sadly, they could not.

"I can close my eyes today and still see that lady," Dr. Kuppuswami says. "That's how I got into obstetrics. So, now that I've gathered knowledge and experience, I have to put it to use to see how we can reduce maternal mortality in India—and the world."

Trend Alert: Changes and abnormalities in vital signs warrant assessment

To solve a problem, one first must understand it. WHO reports that the major complications accounting for nearly 75 percent of maternal deaths include severe bleeding or infections after childbirth, high blood pressure during pregnancy, and complications from delivery.[2] Twenty-five percent of the deaths occur during pregnancy; 50 percent during the first 24 hours of labor; and 20 percent between days two and seven after delivery.[3]

Women who die during childbirth rarely go directly from a healthy state to death, Dr. Kuppuswami says. Rather, they go through a transition period of significant changes in their vital signs including pulse rate, blood pressure, and temperature. The key to preventing death is to detect these changes and intervene quickly with appropriate treatments. Phase 1 of the WONDER project therefore devoted itself to creating an electronic health record (EHR) system featuring a color-coded vital signs chart. Called the Maternal Early Obstetric Warning Score System (MEOWS), the chart is highly recommended by the Royal College of Obstetricians and Gynaecologists, which sets standards for clinical practice and advocates for women's healthcare worldwide. The WONDER EHR system sets three color codes: green for normal vital signs, yellow for warnings, and red to indicate danger. An alarm sounds when vital signs appear threatening, and the patient's name and abnormal values appear in red on a clinician dashboard. The system also gives a possible diagnosis and treatment guidelines.[4]

Detection and response are even harder in remote areas

After developing the EHR system and MEOWS chart, the WONDER team wanted to field-test them. To do so, they elected to deploy in India where they tackled complex geographic, cultural, and operational challenges. Monitoring vital signs and delivering timely interventions are difficult enough in a hospital setting where a single doctor on a 24-hour shift can be simultaneously attending to 40 women in labor.

It's even harder in remote rural areas. Patients can't afford to travel. In some settings, roads are treacherous even with four-wheel drive vehicles. Trained clinicians are difficult to recruit. Rural populations don't like strangers telling locals what to do. With such factors compounding resource scarcity, the maternal mortality rate in developing countries was 239 per 100,000 live births in 2015, according to WHO.[5] Although the rate was lower in developed countries, 12 per 100,000 live births,[5] low-income women in rural areas were still at higher risk. This demographic is vulnerable even within industrialized nations such as the United States.[5]

> "People in many of these remote areas don't know about healthcare. Few patients ever go to the hospital. The WONDER project is giving me the inspiration and tools to save lives."
>
> – Dr. Srigowtham Subramaniam, Block Medical Officer, Upgraded Government Primary Health Center, Thalavadi

Persistent in overcoming such challenging conditions, in Phase 2 the WONDER project expanded from one to three general hospitals, from two to five primary health centers, and to sub-centers in remote areas. The WONDER team, which already had initiated a relationship with HP, now turned more deeply to HP for healthcare technology solutions and expertise. HP's Global Healthcare Solutions team, committed to evidence-based innovations,

HP Healthcare Edition Display

HP LaserJet MFP M436nda Printer

engaged as advisers. The team worked with WONDER researchers to discuss project advocacy, patient education, and Internet of Things (IoT) technologies. "HP became an instrumental part of our process," Dr. Kuppuswami says.

HP technology enables IoT, clinical, and educational use cases

The WONDER team had been thinking about gathering patient vital signs through a Bluetooth-enabled, wearable biometric device, and it purchased one roughly the size of a cell phone. Their IT team using Bluetooth incorporated this device into WONDER EHR so that the device checks vital signs and automatically updates the WONDER system. This ensures data accuracy while reducing the burden on clinic or hospital staff. Beyond that, a constellation of HP devices from notebooks to printers helps transform this data into lifesaving healthcare solutions. WONDER built an Android application and installed it on their HP devices to pull data directly from biometric devices via Bluetooth® or USB. In clinic or hospital settings, the data transmits in real time from the HP devices to servers, and then it is sent—in MEOWS dashboard form including red alerts—to HP Healthcare Edition Displays at nurses' stations. In remote areas, the data can alert women to the need to visit a hospital or clinic. Then the information is stored inside HP tablets until the visiting healthcare worker reaches an Internet-enabled spot for connecting to the server.

"We are using two approaches," explains Vinoth Vasanth, a software architect and technology adviser for WONDER. "One is the real time in-house, facility solution, where if anything is abnormal the nurse can see it right away on the display. The other solution is for workers who meet patients in the field, where data gets collected and stored until a network connection is available."

WONDER's devices also include HP desktop PCs in labor-and-delivery areas and HP printers used to print out patient charting information for clinicians. Some of these devices, along with HP mobile PCs, have gone to primary health centers including one in the remotest village of Thalavadi. As a part of Phase 2 trial, the nurses and paramedics are trained to collect labor room data in sub-centers, and accredited social health activists (ASHA) travel to remote areas carrying biometric devices and HP tablets.

Patient education is essential. Dr. Srigowtham Subramaniam, block medical officer, Upgraded Government Primary Health Center, Thalavadi, has traveled miles on bumpy forest roads only to find at-risk women reluctant to accept help. He works patiently, gets to know people by name, and persuades them to accept treatment. "People in many of these remote areas don't know about healthcare. Few patients ever go to the hospital," Dr. Srigowtham says. "The WONDER project is giving me the inspiration and tools to save lives."

As part of its patient-education mission, the WONDER team is making conversational videos for broadcast on HP displays in clinic

Customer at a glance

Application
Women's Obstetrical Neonatal Death Evaluation & Reduction

Hardware
- HP Healthcare All-in-One Desktop PCs with 24-inch monitors
- HP Healthcare Edition Displays (24-inch and 27-inch)
- HP ProBook 440 Notebook PCs, 14-inch
- HP 8 Tablets (Android OS)
- HP LaserJet MFP M436nda Printer

and hospital waiting rooms. "All of these recordings will be done in local languages and in simple terms, without using medical terminology," Dr. Kuppuswami says. "Patients will understand the seriousness of problems such as anemia and sepsis, preeclampsia/eclampsia, and the warning signs." Ideally, they will accept treatment without resistance.

A vision and roadmap for global change

Dr. Kuppuswami's mission is as focused as saving individual women's lives and as broad as changing the world. She envisions electronic birthing centers modeled after electronic intensive care units. Hospital labor wards connected to primary health centers via two-way communication will receive WONDER EHR data for highly trained obstetricians to guide skilled care in remote areas.

"I want to take this globally," Dr. Kuppuswami says. "The electronic birthing center could be in the United States, the United Kingdom, or anywhere. The health center could be in a remote village in Africa. Because this is cloud-based, the data from the health center will be visible to the general hospital within eight seconds. Experienced clinicians can direct care and even arrange to airlift patients if necessary. That is my vision, and with the support of HP we are moving toward it."

Learn more at
hp.com/go/healthcare

[1] World Health Organization Maternal Mortality Fact Sheet http://www.who.int/mediacentre/factsheets/fs348/en/
[2] World Health Organization Maternal Mortality Fact Sheet http://www.who.int/mediacentre/factsheets/fs348/en/
[3] http://www.journals.plos.org/plosone/article?id=10.1371/journal.pone.0020776
[4] WONDER (Women's Obstetrical Neonatal Death Evaluation & Reduction) Smart eHealth Record Solution To Reduce Maternal Mortality Pilot Study-Phase 1 Project Report
[5] World Health Organization Maternal Mortality Fact Sheet http://www.who.int/mediacentre/factsheets/fs348/en/

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