

# Delivering Healthcare in the Mobile Environment

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## ABSTRACT

This paper suggests the idea of designing and developing a health and wellness vehicle that can be used by nurse practitioners to serve remotely located patients.

## Categories and Subject Descriptors

B.0 [Hardware]: General

## General Terms

Management, Measurement, Performance, Economics, Human Factors

## Keywords

Nurse practitioner, health and wellness vehicle, Patient Protection and Affordable Care Act, mobile health, doctor shortage, nurse shortage

## INTRODUCTION

Today's healthcare environment is at a crossroads. Access to care, meaningful use, HCAHPS scores, accountable care, interoperability and improved outcomes are all demanding the attention of the healthcare industry... SIMULTANEOUSLY! What is the answer to these complex issues? Parallel to the growing healthcare crisis is the innovation and development of mobile technology devices and applications. It is in these concurrent complex healthcare and technology industries that innovation and alignment can create the solution. Healthcare is moving to a more transparent, primary care model that is mobile and creates improved access for patients. This convergence has created a new mobile healthcare platform that lends itself to a new generation of creativity and innovation. The nurse practitioner serving as the primary care giver is the next face of healthcare delivery. Equipping the caregiver for a "mobile practice" is the solution for improving the delivery of care, diagnosis, treatment, and follow up. Creating a continuum of care in the patient's environment will lead to better patient follow up, improved education and compliance, decreased readmissions, and improved

outcomes. Development of the smart healthcare vehicle will enhance and expand the role of the nurse practitioner to improved patient care and ultimately improve patient outcomes.

## ARTICLE

With the advent of the smart meter, smart phone and other technological devices, the possibilities of performing "in-field" diagnostics by consumers have grown expeditiously and are converging to create an eclectic mash-up that is redefining health and wellness. These possibilities come at an appropriate time during the discussion of the nation's health programs.

"With the Patient Protection and Affordable Care Act now set to move into full swing, the healthcare market is bracing itself for the good and not-so-good impacts that are around the corner. As of 2014, this far-reaching reform will attempt to cover a lot of ground. Obama Care not only aims to expand access to affordable health coverage to millions of Americans while increasing protection against exclusionary insurance practices, it also sets in motion a series of incentives that may fundamentally shift the nation's long-standing fee-for-service healthcare system.<sup>1</sup>"

One of the positive effects the PPACA will produce is encouraging the development of new techniques in telemedicine and new technology in patient care:

"The Telehealth market is projected to benefit as hospitals and Accountable Care Organizations (ACOs) seek for better ways to manage their increased patient populations, reduce in-patient costs and readmission penalties.<sup>2</sup>"

But, at the same time, the new health initiatives may produce some negative results, such as "increased patient load and burden on existing services."<sup>3</sup>

"We have nearly 30 million uninsured people about to get medical coverage under the health law come January. And we have a projected shortage of 45,000 primary care physicians by 2020."<sup>4</sup>

"Vinod Khosla, co-founder of Sun Microsystems, predicted last year that technology eventually could replace 80 percent of physicians. Accountable care organizations and other payment reforms – as well as changing consumer preferences – are going to force healthcare organizations to reevaluate how they deliver care in the next dozen years or so," says Greg Caressi, senior vice

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<sup>1</sup>In Medica, 2013 Predictions in the Medical Electronics Industry.

<sup>2</sup>In Medica, 2013 Predictions in the Medical Electronics Industry.

<sup>3</sup>In Medica, 2013 Predictions in the Medical Electronics Industry

<sup>4</sup>AARP "Nurse Practitioners: The Answer to the Doctor Shortage?" March 29, 2013

president for healthcare and life sciences at market analysis firm Frost & Sullivan.

Caressi also states: “Primary care, not the physician, is the focus, and the most important individual in the entire equation is the patient.”<sup>5</sup>

Combining a forecast of a doctor shortage with a predicted increased difficulty in obtaining an office visit, the current healthcare professional will be thrust into new and more expanded applications in the short and long term future. The nurse practitioner (NP) is in the process of moving to the forefront of healthcare providers.

The NP treats both physical and mental conditions through comprehensive history taking, physical exams, and ordering tests for physicians to interpret. Most importantly, NPs can serve as a patient’s primary health care provider and see patients of all ages, depending on their specialty (family, pediatrics, geriatrics). Depending on state laws governing scope of practice, it’s estimated that an NP can handle about 80 percent of the work of the primary care physician – while earning a 50 percent smaller salary and requiring far less money to educate. Using NPs to handle routine treatment is an attractive solution to physicians, who can delegate a large portion of time-intensive tasks in exchange for increasing their load of more complex (and more lucrative) procedures.

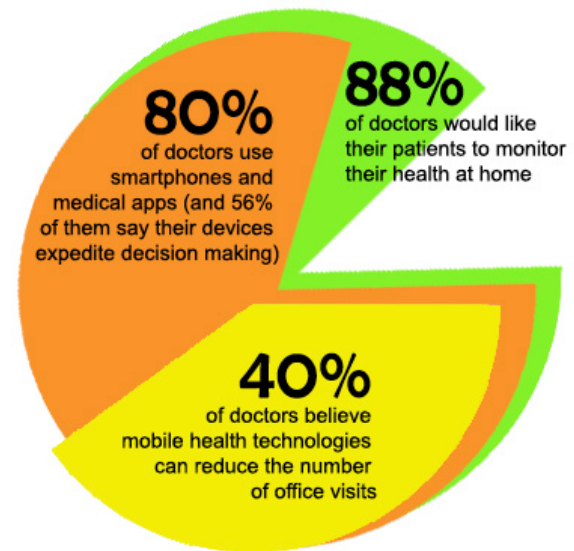
Although the professions of nurse anesthetists and nurse midwives were established in the 1940s, with psychiatric nursing following in 1954, the first official training for nurse practitioners was created in 1965 by Dr. Henry Silver and Loretta Ford, a nurse. Ironically, their vision for the NPs was to: help balance rising health care costs, increase the number of health care providers, and correct the inefficient distribution of health resources.

But, the most important aspect of the new role for NPs is that they are going to be mobile. Reflective of the days that most seniors remember, health care will once again be making house calls. Whether it is your home, care facility, or practically anywhere, the nurse practitioner can go to the patient for diagnosis and treatment.

In doing so, they will need to be outfitted with the most current (and future) technologies that will enable them to perform comprehensive counseling and treatment from the road. Just as the doctor’s traveling black bag became an icon for mobile health care of the past, the medical van with an array of technology will become the tools of this next era of health providers.

To be clear, we aren’t advocating the large 18-wheel tractor-trailer test vehicles with portable MRI imaging, but a vehicle like the Ford Explorer or Chrysler Pacifica. Vehicles this size are manageable by a single NP and do not make a large visual statement to the entire neighborhood about its intended use.

New tools and devices are beginning to edge their way into the medical marketplace, and offer wireless health devices that will empower people with information and guidance that can directly address their most important health concerns. These areas will be strengthened and propelled by children who have reached adulthood and have grown up using web, gaming, and other technology platforms.



**Doctors surveyed about use of mobile health technology  
(Statistics from Float Mobile Learning)**

Using a similar analogy to the past days of the doctor and his “black bag,” the vehicle that will be used for mobile healthcare must be configured to handle current and future diagnostics equipment, lab/specimen collection and transfer to lab, a broad array of tools to provide primary and specialty care services, care for patients in acute and critical care settings, performing minor surgeries and procedures (dermatological biopsies, suturing, casting) post operation treatments and evaluation, and more.

The justification of the development of the smart health vehicle lies in the myriad technologies and their convergence that has taken place, most of which over the last five years. Bluetooth, Wi-Fi, RSS, GPS, and other technologies are now being bundled together in a number of automotive “infotainment” packages to be marketed to the consumer. These applications will enable the driver to avail themselves to a cornucopia of new applications such as navigation, phone, email and texting content, directories, and other information-providing tools. These same resources will provide the backbone of the wellness vehicle that can travel from dense city centers to remote rural patients without the fear of encountering blind spots, dropped signals or without the proper resources. They will be able to send and receive data, process specimens, and lab work while obtaining health scenarios from huge data based medical information catalogs that may address any known diagnosis and treatment.

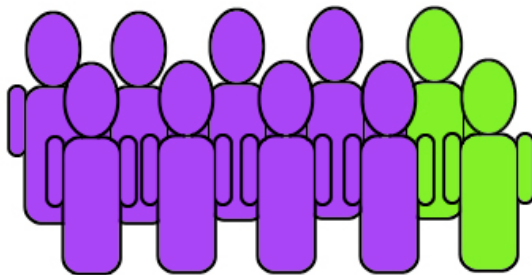
In addition, as a mobile “hot spot,” the vehicle will have the ability to send/receive audio and video, enabling it to do remote video conferencing with a physician or medical center for real-time consultation with the NP and/or patient, should the need arise.

Vehicle manufacturers are already becoming more interested in their customers’ personal health and the devices that can help them track or model it. Ford is most likely to be the leader in this with its own “health and wellness” area that is developing some far-reaching applications. The company has already announced a prototype vehicle seat that can monitor a driver’s heart activity and could one day reduce the number of accidents and fatalities

<sup>5</sup> Mobihealth News, April 4, 2013

that occur as a result of motorists having heart attacks behind the wheel. The seat also could be linked to the Ford SYNC's Emergency Assistance function to inform emergency response teams of the driver's heart condition before, during and after an accident. Ford is working in other health related areas in partnership with Medtronic to develop health and wellness solutions and apps, aimed at helping consumers with chronic illnesses or medical needs such as diabetes, asthma or allergies manage their conditions while on the go. This includes glucose monitoring capabilities, location-based allergy and pollen reports, and voice-controlled health management services. Ford is expanding their partnerships in other research to include WellDoc, SDI Health, and more. Other vehicle manufacturers are looking at health and wellness research as well. General Motors has provided millions of dollars to Carnegie Mellon to advance development of improving security and driver-vehicle interfaces by building a car that is capable of analyzing the driver's intention and watching the physical and mental status of the driver for any impairments or information overload.

So the concept of loading a vehicle with smart technology and tools is not a new one, but to specifically develop it for the expanding role of the NP is new. As insurance coverage changes, so must the way patients access their health provider. A health and wellness vehicle is an obvious outcome of the age of connectivity, the technology that allows us to integrate the many different forms of applications, and most important, delivery to the patients who cannot schedule the traditional doctor's office visit either because they are not ambulatory, live in areas that do not have good medical resources, or do not have the level of insurance needed to monitor/provide the level of care needed.



**1 billion visits by Americans to doctors' offices in 2011**  
**78% of consumers are interested in mobile health solutions**  
**(Statistics from Float Mobile Learning)**

With several well-known companies, a national nursing organization, a medical research facility, several industry affiliates in the area of medical devices, the development of the Nurse Practitioner Health & Wellness Vehicle is now beginning to be assembled at the Center for Design Research.

As a glance into the future, imagine an NP with a primary care practice, operated primarily out of a "smart healthcare vehicle." The day begins by reviewing the schedule of patients on the vehicle's smart touch screen. Each patient is identified with GPS location, history and medications, remote monitoring data and other vital patient data. The smart vehicle software arranges logistics for travel and efficiency as well as weather, allergy alerts and other environmental factors. The software (synchronized to a tablet) has already sent visit reminders and instructions to the

patient and/or family. A text is sent to the patient as soon as the nurse arrives, perhaps a minute or two ahead of time to give the patient time to prepare. The nurse proceeds to the home and begins the patient assessment and evaluation. The nurse uses a tablet to take photos of the patient's environment that are then saved in the patient's record.

The NP collects blood samples and urine samples, placing them in a specialty collection compartment in the vehicle. As the nurse completes the visit, the vehicle screen or tablet presents patient healthcare information for charting and follow up. Information on medication, education and follow up are printed or sent to the patient by email or text. An automated billing process is then triggered. Other information is identified for local pharmacy interaction, medication care coordination and patient education.

Other important features of the vehicle can extend to telemedicine for specialty consults, minor treatment capabilities, portable EKG, etc., all fully integrated with the patient's health record and continuum of care.

According to the Affordable Care Act Advanced Nursing Education Expansion Initiative, there is an effort to increase the number of students enrolled in accredited primary care nurse practitioner and nurse midwifery programs. (The smart healthcare vehicle can also accommodate the midwife.) The 2012-2013 NP enrollment and graduation data collected by the National Organization of Nurse Practitioner Faculties and the American Association of Colleges of Nursing show an eight percent increase in NP completions (Master's level and Post-Master's level) and a more than doubling of post-baccalaureate DNP nurse practitioner graduates over the previous year.

In January 2013, the Nurse Practitioner Roundtable compiled a "Bibliography of Articles & Reports Relevant to Quality, Outcomes, Access, & Patient Satisfaction of Nurse Practitioner Services." This collection of more than 37 articles and reports demonstrates and validates the changing role of the NP in the healthcare landscape today and in the future. These articles focus on the underutilization of the NP for health reform, the improvement of patient satisfaction, the growing preference for the NP and the reinventing of primary care by the NP.

As the number of NP's grows, their collaborative voice will be instrumental in health policy reform and innovative healthcare delivery models. Another initiative of the Nurse Practitioner Roundtable is the healthcare reimbursement structure. A call for reform of policies on healthcare payment and reimbursement has been issued to ensure the true costs associated with providing quality care align with the effective and efficient utilization of the healthcare provider workforce. The following recommendations have been issued:

- 1) Support efforts that increase patient access to the full primary care provider work force and patient choice in provider selection.
- 2) Re-engineer reimbursement systems to reflect the true costs of care to ensure that all practice settings, including primary care practices, nurse-managed health centers and emerging delivery models, can be self-sustaining.
- 3) Promote reimbursement based on services provided.
- 4) Track provider-specific services and outcomes; linking outcomes to specific providers will promote accountability in care.
- 5) Recognize outcomes of care as critical indicators in effective reimbursement models.

6) Include nurse practitioner-led practices, and use NPs as full partners in medical home, Accountable Care Organizations, insurance exchanges and other developing organizations.

7) Continue to remove the outdated legislative and regulatory barriers that impede the utilization of NPs at the top of their education and abilities in addressing patient care needs.

These concurrent complex issues are searching for ways to drive down the current cost of healthcare and develop new models for

efficient and effective primary care delivery. Adopting a continuum of care philosophy, identifying quality indicators, and empowering the patient and NP can bring welcomed reform, improved patient outcomes and lower healthcare costs. This proposed care delivery model equipped with efficient and effective tools such as the “Smart Healthcare Vehicle” can reform the dismal state of healthcare in our nation.

#### *About Gregory Thomas*

Professor Gregory Thomas came to the University of Kansas in 2004 as the chair of the design department in the KU School of Fine Arts after a distinguished professional career as the principal of Gregory Thomas Associates (GTA) in Los Angeles. Since 2010, he has served as Director, Center for Design Research, KU School of Architecture, Design and Planning and developer of industry sponsored projects.

Prior to joining KU, Professor Thomas was an adjunct professor at the School of Fine Arts and the Annenberg School for Communication at the University of Southern California and served as the acting chair of graphic design at Art Center College of Design in Pasadena for three years. Professor Thomas is a graduate in design from the Kansas City Art Institute (BFA), California Institute of the Arts (MFA) and Yale University (MFA).

Professor Thomas is currently working with colleagues in the KU School of Engineering on energy and sustainability, with a specific focus in vehicular/transportation safety initiatives. Current research focuses on integrating design in health and wellness initiatives, using design together with engineering on automobile dash and consoles, developing smart grid, electric vehicles and energy applications funded by the KU Transportation Research Institute. In addition to his research on adaptive information displays, he is also working on the interconnectivity of the smart home and smart car and mobile healthcare.

#### *About Debbie Gregory*

Debbie Gregory is a registered nurse and interior designer. Debbie is Co-founder and President of the Nursing Institute for Healthcare Design and is currently the Senior Clinical Consultant for Communication and Technology Services at Smith, Seckman, Reid, Inc. She has 26 years experience in nursing as a clinician, healthcare consultant and entrepreneur. As a nurse and interior designer with a healthcare focus, she provides education for clinical leaders, designers, architects and construction professionals. She serves as a liaison between the clinical community and the design and construction community to improve efficiency and effectiveness through healthcare design.

Debbie has recently embarked on providing educational Summits that bring healthcare leaders, technology experts, and visionaries together to discuss the future of the healthcare delivery model and the integration of technology. OR Integration, telemedicine, healthcare apps, eICU, FDA guidelines, and physician and hospital liability are all emerging topics. These discussions focus on the impact of mobile healthcare technology and practice transformation for the inpatient and outpatient care environments. Improving clinical operations, work flow, process improvement, patient safety, satisfaction and outcomes are Debbie's primary objectives on any project she serves. Being the eyes and voice of the patient and clinician with an understanding of the design and construction process has proven to be a unique and valuable asset in all healthcare settings.