Impact of mHealth on Quality and Patient Care Outcomes
Quality, Cost Safety Committee
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This Fact Sheet defines how mobility (mHealth) creates an environment of continuous engagement addressing wellness and care. Level of engagement provides opportunities for enhancing safety and quality in care across all settings. This effect captures the ability for mHealth to facilitate integrating clinical information with patient reported data across the care continuum. Result is linking patient + person in creating a holistic participant for wellness and care.

Potential in realizing continuous engagement further creates the need for redefining paradigms addressing both evaluation and deployment with mHealth as a component of overall care. Revising these paradigms creates a framework that supports defining two elements essential for achieving sustainability in use for mHealth. These are –

- A unified strategy for enterprise systems leveraging mHealth; and
- Business models applying mHealth that generate ongoing positive ROI

Intent of the Fact Sheet is furthering development and integration for mHealth into applications for wellness and care. One point is imperative in understanding the potential mHealth – continuous engagement does not stand alone. mHealth is an element of the broader system employed to achieve goals for wellness and care as well as engagement and satisfaction. Defining how best to realize this integration establishes the pathway for sustainability in use.

The Fact Sheet –

- Establishes the rationale’ for defining a new paradigms in evaluation and deployment
- Defines the links between evaluation and creating sustainable business models
- Proposes a new framework for evaluation
- Illustrates implication for use – Overview and in detail
- Redefines deployment
- Creates a topology for use; and
- Sets a path forward

Intent is building an architecture that supports applying mHealth across the care continuum. Goal is realizing application thru business models achieving sustainable ROI in use. This applies for continuous engagement with individuals as well as a strategy setting enterprise applications across health systems.

Rationale’ for the New Paradigms

Ongoing patient engagement spans activities across patients, consumers, caregivers, providers and payers. Essential in understanding the role for mHealth to enhance outcomes associated with wellness and care is recognizing the need for new paradigms addressing evaluation and deployment. Using mHealth charges the model for services from discontinuous point-to-point focusing instead on scheduled direct interaction to ongoing access with unified information. That perspective of engagement facilitates integrated behavioral and attitudinal metrics with clinical markers. The result is adding a new dimension –
Engagement and Satisfaction for consumers and patients – to the current clinical and financial measures used to assess value as well as ROI in wellness and care.

Applying mHealth further necessitates refining the model for deploying services. Continuous engagement supports dynamic interaction among all parties involved in a process that increasingly combines wellness and care. The effect is building a dynamic system for activities and that system supports prospective and retrospective use of information in real time. The increased use of analytics facilitates predictive modeling, driving communication, and providing updated information regarding clinical status, behavior and attitude. The cycle is ongoing. This facilitates meeting desired outcomes for the patient and the consumer as well as provider and caregivers. Result is moving away from sequential deployment and use to a model allowing both sequential and parallel use of capabilities. A linear model yields to a dynamic matrix.

**Evaluation and Business Models for mHealth - Links**

Critical in defining the role for mHealth in wellness and care is assessing the business models generating a ROI sustaining continuous engagement. Current assessments for mHealth predominantly rely on a two-dimensional construct assessing clinical and financial outcomes vs. current standards of care. This model generally segments or stratifies populations under evaluation. Not included in today’s paradigm is explicit recognition for the role of continuous engagement and effect upon behaviors and attitudes among consumers and patients. Generally missing is the linkage between the patient + person as the participant in wellness or care. Implicit in this link is unifying clinical information with patient reported data. mHealth directly recognizes that link. The evaluation of business models for mHealth needs to assess implication of the third dimension in defining outcomes versus current standards of care.

**New Framework for Evaluation**

Figure 1 provides a simple representation of this change in the evaluation paradigm.

![Figure 1](mHealth Comparative Value Construct Adding the Third Dimension Compared with Current Standard of Care)

Intent of the new paradigm is not to diminish the importance of meeting clinical and financial metrics supporting use. Goal is proposing an approach that captures value inherent in applications using mHealth. This is in realizing continuous engagement. Further point is directly assessing implications in
addressing wellness and care holistically by unifying the patient + person. A next step is gauging the effect of adding this dimension in context with current assessment of mHealth.

**Implications in Use for mHealth**

Current – somewhat conflicting – findings on the value of mHealth illustrate the need to consider a new evaluation paradigm. Extremes for comparison include the Brookings Institute published in the Archives of Internal Medicine. The Brookings reports notes the potential for as much as $197 Billion in saving derived thru the application of remote care monitoring technologies over the next 25 years (West, 2012). Counterpoint is findings from a randomized controlled trial noting the lack of demonstrated differences in hospitalizations or ED (emergency department) visits between groups of older patient using tele-monitoring compared with usual care (Takahashi, et.al., 2012). Confounding these findings are positive results from work in Canada (University of Ottawa Heart Institute, 2011) and the UK (Department of Health, 2011).

*Case Study – Text4Baby* – More than 85% of Americans have a cell phone and 72% receive or send text messages. An increasing number of reports find that “trusted source” messaging with patients can improve adherence to recommended therapy, patient knowledge and the provider patient relationship. This dynamic is the basis of continuous engagement.

One example in practice is *text4baby*. The program arose thru activities within the HHS Maternal Child Health Bureau with underwriting by corporate philanthropy. Program goal is reducing premature birth. *text4baby* provides three (3) educational messages per week to enrollees customized by the estimated due date. Success of this program created a secondary mission to provide educational content for mothers during the first year of their baby’s life. Mothers receive several messages weekly that encourage age appropriate well childcare, nutrition and note the normal presentation age of crucial developmental milestones. *text4baby* messages are free thru underwriting by The Wireless Foundation. *text4baby* currently sends several hundred thousand messages weekly.

Building on this case is a recent article and editorial in Science makes the case for mHealth as a strategy to assist in combatting the most important and refractory health conditions. This work calls for an open source coordinated effort to establish standards for health care integrating mHealth.

“Chronic diseases like diabetes, asthma and obesity account for 46% of global disease burden (1). The traditional model of episodic care in clinic and hospital-based settings is suboptimal for improving chronic disease outcomes (2). Mobile communication devices, in conjunction with Internet and social media, present opportunities to enhance disease prevention and management by extending health interventions beyond the reach of traditional care—an approach referred to as mHealth (3). However, mHealth is emerging as a patchwork of incompatible applications serving narrow, albeit valuable, needs, and thus could benefit from more coordinated development (4). A public-private partnership to define and instantiate an “open” mHealth architecture in the context of economic incentives and enabling policies, could support medical discovery and evidence-based practice about managing and preventing chronic disease.”

The *text4baby* program is an excellent example of the public-private partnership and aligned economic incentives. Payment is thru waivers of fees with the intent and focus placed largely on patient engagement and wellness. While the benefits of *text4baby* are difficult to quantify presently in terms of return on investment, or this case philanthropy, the example provides insight into the future challenges of assessing value associated with mHealth via a change in orientation addressing public health and the associated value achieved by decreasing the cost of maternal health and infant health.
**Case Study – mHealth and Diabetes Care** – Diabetes care abroad is commonly supported by mobile technologies most notably Canada and the United Kingdom. A recent paper reported on the technological and clinical outcomes from these efforts for diabetes from the UK and Canadian perspectives. This study found mHealth effective blood pressure control, but less effective at managing blood glucose control. This paper too called for a generic platform for mobile diabetes management. A more recent review and meta-analysis (27 articles) from the UK prompted authors to conclude, “Telemedicine appears to be a promising alternative to conventional therapy”. Only 2 of the 27 found no difference with the technology intervention.

There is good reason to believe that technology can facilitate a provider-patient alliance since automated Reminder systems and coaching have been proven efficacious in adults with chronic conditions such as coronary artery risk factors, second myocardial infarction and Type II Diabetes PM:20809820.

It is useful to consider how and where such interventions relate to an overall system. Figure 3 (BMC Res Notes. 2010; 3: 250) illustrates how such communication and alliance effects a system of research, health services and outcomes. Researchers have access to an entirely new information source – patient entered data. This data has the potential to speed as well as improve accuracy in health care delivery. Result is producing improved outcomes. Combining increased adherence to treatment plan and appointments with access to personalized information appears as improving health literacy and outcomes. Envisioned are several collaborative improvement “mini cycles” (PDSA). Figure 3 further demonstrates the potential gains in fostering enhanced relationships between coaching interventions and stakeholders.

Results from a recent diabetes intervention in the US reinforce the need to assess a new paradigm for evaluation as well as deployment. The program implemented combined behavioral and clinical resources. Results note a significant and meaningful change in protocols for care among participants leading to corresponding reductions in hemoglobin A1c compared with current standards (Quinn, 2012 (WellDoc)). An express intent of the program is creating a unified approach to care linking the patient + person. This approach highlights the potential value in combining clinical information with patient reported data. Study also focuses on value derived thru linking clinical with behavior intervention. The combined approach highlights the basis for understanding potential gains derived thru mHealth. Approach also illustrates the apparent meaningful effect in considering a new model for deploying mHealth as a component of care.

**Redefining Deployment**

A matrix model supports this new approach to deployment integrates activities with as well as for the participant. Using the term ‘participant’ is purposeful. Intent is focusing on the patient + person in engagement thru mHealth. Participation further reflects the ongoing interaction supported under mHealth. Figure 2 is an example of the matrix approach to deployment providing the potential to link elements as most appropriate given goals and objectives for each participant.
The role for mHealth within the context of care and care management highlights potential gains in operations and outcomes thru linking new paradigms for evaluation and deployment. Mobility is one element of the series of services required to meet goals for wellness or care. Technical infrastructure, protocols, analytics and overall processes in delivering services all affect costs and outcomes derived thru using mHealth. One assessment (NEHI, 2012) illustrates the need for a dynamic paradigm in assessing mHealth across deployments. This assessment identifies eleven model technologies across four classes having the potential to enhance clinical outcomes solely addressing chronic care. Not considered are other technologies affecting service delivery, costs and results across wellness and post-acute or non-chronic care. The classic two-dimensional approach assessing costs against outcomes potentially lacks robustness required to capture dynamics in care and wellness facilitated thru mHealth.

Creating a Topology for Use

The continuous engagement created via mHealth technologies creates the basis for establishing an integrated approach for research, evaluation and use across wellness and health care. Dynamic interaction supports addressing multiple elements in clinical, behavioral, social and psychological outcomes. This replaces the sequential, incremental approach embodied in many current models for care. Overall effect is moving the design and management of wellness and care services from a linear model to a matrix. This matrix further integrates with the proposed paradigm for assessing value. Optimal services build upon the ability to now ‘mix and match’ options in best addressing direct intervention. Approach directly integrates the behavioral, social and family elements that define success – clinically and financially.
The purpose of defining the new paradigms for evaluation and deployment is creating a framework defining business models integrating continuous engagement. Intent of these models is realizing sustainable ROI. This applies for independent organizations as well as in defining an enterprise strategy with health systems. Value in mHealth arises concurrently addressing multiple requirements across multiple applications as well as audiences. The topology illustrates this affect. Realizing that value requires evolving integrated models for wellness and care generating a positive ROI. Measuring that ROI involves assessing results along clinical and financial parameters as well as metrics capturing effects upon engagement and satisfaction with participants.

**Moving Forward**

Realizing the value in continuous engagement necessitates evolving the concept of a user to that of a participant. This recognizes that continuous engagement creates the ability to unify activities targeting the patient + person. Implicit is the means creating value thru unifying clinical information with patient reported data across the care continuum. The holistic approach provides a means to link clinical and financial metrics with measures defining engagement and satisfaction. Resulting is the proposed new paradigms for evaluation and deployment.

Business models that create sustainable ROI need incorporate the proposed constructs for evaluation and deployment with recognition for the changed character of the target. Participation is different from use. Continuous engagement differs from reporting or monitoring. mHealth creates a means for realizing the value of continuous engagement only given changes to application, deployment and evaluation. Incorporating these new elements establishes the basis for building business models integrating mHealth.
into operations generating sustainable ROI. Not following this path stands to continue the perceived conflicts around value in use for mHealth. Result stands as compromising the ability to enhance outcomes – clinical, financial and across engagement and satisfaction for all participants.

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