Use of Mobile Health (mHealth) Applications in Medical Practice Operations to Improve Performance and Patient Experience

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SECTION I
Introduction

*Developments in medical technology have long been confined to procedural or pharmaceutical advances, while neglecting a most basic and essential component of medicine: patient information management.*

- John Dolittle
  Former Member of the House of Representatives

Healthcare today has seen an explosion of technology infusion in everyday medical practice. This research paper explores the interface of mobile applications in clinical practice as it benefits patients and providers and its influence on everyday culture where mobile life also known as mLife has become a normal part of everyday life. The purpose of this paper is to explore the evolution of mobile health (aka mHealth), its related applications in medicine both from the clinician and patient perspective, its current and future capabilities as well as regulatory concerns tied to patient privacy as mHealth continues to change the way physicians practice and engage their patients in medical practice.

According to the Foundation for the National Institutes of Health (FNIH), mobile health (m-Health) is defined as “the delivery of healthcare services via mobile communication devices”¹. Review of professional journals, industry articles and case studies by experts in medical information systems and practice operations indicate that m-health has been embraced by Americans regardless of age and trust mobile technology to help manage their health care services thanks to advances in smart phones technology. Companies such as Apple with the I-revolution (i.e. I-Phone, I-Pad, etc.) along with their rivals such as Google and Microsoft have created convergence of mobile technology and internet for personal hand held phones and tablets (just as powerful as personal
computers) and patients are using them to run their lives including managing the health care they are receiving. IBM recently has launched mobile health company for consumer use (called Healthico); from a business perspective it is projected that by 2017, half of the world’s more than 3.4 billion smart phone users will have downloaded health-related applications. The impact of this convergence of internet, phone and mobile phones has impacted everyday living and medicine is not exempt.

Americans expect the application of technology in their experience with businesses and physician practices are not exempt from this expectation. Developments in mobile health applications have made major impact on disease management such as diabetes intervention, cancer management and overall patient education for prevention and intervention. It is important for medical practice administrators, physicians, and staff to understand this powerful evolution in personal technology and impact on their medical practice, providers and most especially their patients regardless of age, race or location or even medical specialty. One thing is sure mHealth is here to stay as mlife on smartphones have empowered consumers to address their needs due to mobile health wide range of capabilities from banking to medicine. From a compliance standpoint the Food and Drug Administration (FDA) has made moves to regulate medical applications and some third party payers have also acknowledged the role of mhealth and is reimbursing providers and patients for some use of mhealth in the delivery of healthcare services from treatment, intervention to monitoring.

SECTION II

Background Information
We’re moving to this integration of biomedicine, information technology, wireless and mobile now - an era of digital medicine. Even my stethoscope is now digital. And of course, there’s an app for that.

-Daniel Kraft, MD
Inventor, Scientist, Physician

History and Impact of Mobile Technology

The purpose for this paper is to explore the impact of the Internet and mobile applications on patient-practitioner relationship. It acknowledges the increasing use of the Internet by patients in guiding their healthcare experience and will discuss the sources of technology, how they are used and the future through mHealth applications and supported devices. ³ This is currently seen in the number of mobile applications readily available in the market to download medical references and marketing related to physician services. The two popular operating systems for smartphones are iOS (Apple) and Android, both have embraced the concept of providing medically-related applications (categorized under ‘medical’ or ‘health and wellness’) and there are approximately 20,000 medical apps available for iOS compared with 9,000 medical apps available for Android.⁴

These applications have moved past just being a medical reference tool to become practice solutions for both patients and practitioners with capabilities such as scheduling, viewing and paying medical bills and viewing medical records although limited in scope for most PMS with mobile capabilities due to the Health Insurance Portability and Accountability Act of 1996 (HIPAA) that requires patient privacy for all transaction of medical information and consent to release information to entities inside and outside of the healthcare industry on patients. HIPAA hasn’t stopped the explosion of medical
applications in the market but has forced vendors to be innovative in their creation and focus on useful applications that empower both practitioners and their patients.

**Patient Expectations of Technology in Medical Practices**

In several patient satisfaction surveys the key elements patients are interested in are patient access (how long it takes to get an appointment pre-visit and how long it takes to see the doctor during a visit), and they look for resources that give them freedom to view appointments, and book and make changes with the use of technology. Another area of patient satisfaction is empowerment to self-monitor progress and technology that allows their doctor to conduct ‘virtual’ assessments. Patient monitoring tools powered by technology are presenting opportunities to improve access, monitor patients real-time and offer a ‘hybrid’ of human interaction and technological monitoring. In support of high tech-high touch, patients want to have a relationship beyond the office with their doctors. Social media has provided an opportunity to keep up with the news of their doctors and share their satisfaction (and dissatisfaction) on sites that involve their friends, relatives and co-workers. This creates a sense of community with their physicians and other patients through mobile life and is a great extension into patient lives that benefit the physicians who have embraced technology as part of their practice infrastructure.

**Provider Expectations of Technology in Medical Practice**

Capabilities of mHealth in public health and medical practice operations include the following applications: 1. Mobile technology designed to improve diagnosis, investigation, treatment, monitoring and management of disease; 2. Assist in delivery of treatment; 3. Assist in design of disease management programs to patients; 4. Provide patient education and health promotion interventions, to include those designed to ensure
treatment compliance; 5. Enable patients access to their care provider schedules; 6. Receive reminders to improve health care processes such as appointment attendance, result notification, and vaccination reminders.\(^5\)

As a part of mHealth’s ability to improve the investigation, treatment and monitoring of illness, several technologies are being used in primary care, mental health and public health settings. These provide access to almost ‘real-time’ monitoring of patients who can communicate with their providers either through self-reporting functions using smartphones or using monitoring devices that report information back to providers. Additionally, the wide range of mHealth application continues to expand rapidly in the market with some technologies developed to streamline and expedite scheduling and records management functions. Other applications have been developed to aid the practitioner in illustrating or demonstrating states of patient health or procedure and treatment options\(^6\).

**Mobile Life (mLife) And Today’s Patients**

**Role of internet: Beyond Websites and Patient Portals**

Many medical practices around the country have great informational websites that are useful for general information on the practice and some might go a bit further with their patient engagement by providing online forms to speed up office visit and make patient in-take easier on the patient. Some highly innovative organizations such as Springfield Clinic in Illinois have created patient portal (called myhealth@SC) is an interactive web--base patient portal that is user enabled to make requests, review records and communicate with their providers and drive their own care.\(^7\) The use of patient portals have revolutionized the concept of patient access and the ability for providers to share
information with patients thereby increasing patient satisfaction and real or perceived quality since patients feel like their care is taken seriously if they can access their information easily without a lot of red tape and steps for record release.

Patient portals play multiple roles in patient-provider communication and engagement through the web and mobile platforms. Several studies have been conducted detailing the benefits of patient portals for both providers and patients and are listed as follows: 1. Decreased unnecessary office visits; 2. Increased Healthcare Effectiveness Data and Information Set (HEDIS) scores; 3. Improved provider productivity and reduced cost of services rendered through the use of secure messaging, electronic requests and transmission of patient information with less manpower resources.8

**Use of Vendor websites**

Medical suppliers of equipment, pharmaceuticals, and durable medical equipment are all participating in direct patient communication. Many have developed social media sites, and online commercials and electronic mail blasts to engage patients directly. Many are very active in patient education as it relates to the types of solutions they provide patients and this has created a culture of patients making demands of procedures, medication and intervention based on these supplier advertisement further putting pressure on providers to stay abreast of the latest interventions due to the real time sharing of these information to eager patients who are tech savvy and want to get the latest information on their conditions.

Pfizer one of the world’s premier pharmaceutical companies has engaged patients using websites such as the “Ask me 3” provided through the National Patient Safety Foundations (NPSF) was designed to improve communication between patients and health
care providers, and encourage patients to become active members of their health care team, and promote improved health outcomes. The focus on patient communication allows suppliers such as Pfizer to influence both patients and providers and the use of websites such as this empowers this influence.

Novartis UK division has created a patient mobile application to monitor their multiple sclerosis symptoms and relapses called Gilenya supported by the UK's National Institute for Health and Clinical Excellence (NICE). This level of commitment demonstrated by global suppliers such as Pfizer and Novartis to direct patient communication, U.S and other western countries will continue to promote suppliers that provide mobile applications to their populations.

**Medical reference websites**

A study of the use of smartphones and medical applications by primary care providers affiliated with medical centers recognized by the Accreditation Council for Graduate Medical Education (ACGME) discovered that the use of medical applications by primary care providers is on the rise with residents and junior medical consultants compared to those with established medical practice. The adaptation of smartphones by younger physicians is not surprising as the impact of this technology is promising in building their confidence in medical practice and provides time-saving opportunities when looking for timely information for their patients. The most popular use of smartphones by the +3K medical providers surveyed by email is for medication guides, followed by medical calculators, billing and coding references and pregnancy related information. In essence medical providers are increasing their use of medical reference libraries and information that makes their practice more effective.
Role of mobile smart phones and tablets

_Smart phones and social media expand our universe. We can connect with others or collect information easier and faster than ever_

-Daniel Goleman
Psychologist

Android technology

Made by Google, android technology is the world’s most popular operating system (OS) and very practical for Google users. The recent explosion of android phones in the market due to improvements to the android technology and recent interface with Microsoft Windows mobile operating system (OS) such as HTC phones (recent HTC One) has opened doors to millions of users who like Windows or are fans of Google. A world of possibilities exists in the use of android smartphones to access medical applications that will be available to consumers today and in the future. The advantage of Android technology phones is the plethora of options in handsets and the affordability compared to iPhones the main rival for both Android and Windows based phones. In review of preferences of smartphones by providers, Android phones were preferred next to iPhones with 48% of providers preferred iPhones and 19% preferred Android phones.

I-Revolution and Apple technology

Undoubtedly the idea of using mobile applications was revolutionized by Apple for the general population while Blackberry focused only on working professionals and didn’t market to the general population which was eventually captured by Apple’s iPhones along with the cultural revolution it inspired through the focus on the individual (hence the “I” preface to all of Apple’s products). This marketing strategy that speaks to the core of Americanism and individual empowerment drove the sales of smartphones and the use of applications. Based on this trend, most providers still prefer iPhones as
their smart phone of choice and iPad as the tablet of choice when using electronic health record (EHR) systems to manage their patients’ charts and to share information with other consultants on same platforms.\textsuperscript{12}

\begin{center}
\textbf{Physician’s smartphone preferences}
\end{center}

\begin{center}
\includegraphics[width=0.6\textwidth]{physician_smartphone_preferences.png}
\end{center}

\textbf{Fig 1. Results of survey of 3,306 unique responses from 1,397 residents, 524 fellows, and 1,385 attending physicians among 27 different specialties (Franko, Orrin I., and Timothy F. Tirrell, 2012)}

The same study of physicians asked providers what applications they used the most and the table below identifies that Epocrates is still the favorite for all users\textsuperscript{13}. Modernhealthcare.com also did a survey of the top medical applications and some of the same names were on their list however other noteworthy medical applications not included in the ACMGE study identified by modern healthcare survey include iTriage (Aetna subsidiary, free to providers and very reliable), and WebMD, a popular patient focused medical application that compliments the web-site version that provides information on every disease state that currently exists. A leading Chief Medical Information Officer Dr Aiken predicts that as mhealth matures patients will get used to having drug prescription and information on medical applications they can use with their
provider’s practice or at their local hospital with the ability to self-manage information and check status of their care, which inevitably will lower cost of health service delivery and improve communication between providers and patients.  

### Examples of mHealth applications and related technology

<table>
<thead>
<tr>
<th>Ranking</th>
<th>App Name</th>
<th>% of respondents reporting use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Epocrates</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Medscape</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>MedCalc (medical calculator)</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>Skyscape Medical Resources</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Lexicomp</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>BMI Calculator</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Micromedex Drug Information</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>DynaMed</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Citrix Receiver</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Red Book</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1. ACMGE study reveals the top medical applications used by medical providers and this list was similar to the modernhealthcare.com website survey of popular medical applications used by provider.  

### Interface of practice management systems

Options to use practice management systems (PMS) that have mobile applications to ensure efficient practice management operations continue to rise. One of the most popular PMS with small to large medical groups with a mobile application by Athena Health called athenaClinicals mobile that allows providers to manage their work-flow, schedules, prescribe medications, send messages and provides real time updates on practice operations. Others that use cloud technology provide complimentary mobile applications such as Practice Vitals also provided by Athena Health and acts as a benchmarking tool among other Athena Health providers.  

NexGen has customizable
systems and better suited for multi-specialty or surgical specialties also has a fully integrated electronic medical records management system that offers a mobile platform to compliment the in-office system called NexGen mobile which is also both ICD-10 and MU phase II ready. Epic or Cerner are better suited for large scale integrated health systems or hospital based systems also have mobile platforms to manage populations and improve care coordination within an integrated delivery network (IDN).

These examples are well respected EMR systems and having mobile applications to complement their electronic health products provide opportunities for providers to take control of their medical practice at their fingertips. It also acts as a resource multiplier without additional manpower costs when providers are out of office and they have the ability to manage patient issues while not in the office.

**Interface with patient portals**

From academic medical practices, hospital based practices and physician owned practices, patient portals have gained popularity with patients and have become a hallmark of quality care when organizations have patient portals available for their patients to have greater access to their personal health record (PHR), test results, appointments and can send information or messages to their providers through secure user enabled networks. Some providers have dramatically increased communication, improved trust through direct communication with their patients on patient portals and have cut down the administrative time used to answering phone calls when patients want to reach them. Associated benefits also include patient’s ability to discuss issues prior to face-to-face encounters further saving office time for both patients and providers. This has major implications in provider productivity and ability to generate more access for
patients if this technology is used by patients to manage their communication with their providers.

It also means medical practice can further influence their patients by sharing patient education and mass announcements on updates on important information to their patients and can act as an extension of their practice marketing. Even more important is the role of patient patients in rural medicine where patients are limited to accessing specialists and IDNs that offer telemedicine can extend their reach using patient portals to communicate once a relationship has been established with rural patients. Practically all major EMR companies have patient portals available as part of their suite of products available to both inpatient and outpatient settings for providers to engage their patients.

**Deployment of health information exchanges (HIE)**

Health information exchanges (HIE) have become a must have when several organizations manage the same population and can affect the overall cost of care and related burden to taxpayers especially for elderly patients on Medicare or low-income patients on Medicaid. Care coordination is a vital aspect of care delivery as patients move in and out of different phases in receiving health care services. The movement of patient records is not as timely and the information shared between providers can be inaccurate as more hands touch patient records through a paper, electronic or a hybrid of paper and electronic for the same patient population. Usually patient records don’t necessarily move with the patients and is subject to delays in administrative processing when records are requested by several entities in the referral pipeline for patients including hospitals and skilled nursing facilities.
Larger health systems that have the ability to implement patient management systems that allow for movement of records have started to participate in what is called the Beacon Community program sponsored by the federal government through [www.HealthIT.org](http://www.HealthIT.org). This is a program that demonstrates how health IT investments and Meaningful Use (MU) of electronic health records (EHR) advance the vision of patient-centered care, while achieving the three-part aim of better health, better care at lower cost. Primary mission of these beacon communities is to solve the problem of organizational silos that is prevalent in healthcare organizations which unfortunately contributes to the increased cost of care coordination due to lack of communication across organizations. Table 2 below describes the successful deployment of HIEs around the country and their respective areas of focus.

**Bottom-line:** The ability for providers to share information about the same patient through HIEs is improving care coordination and reducing inefficiencies and patient dissatisfaction because primary care providers are more connected to the specialists and better hand-offs are occurring due to HIEs being used as a tool.

### Examples of regional HIEs and patient communication

<table>
<thead>
<tr>
<th>Beacon Community</th>
<th>Award Amount</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangor Beacon Community, Brewer, ME</td>
<td>$12,749,740</td>
<td>Improve the health of patients with diabetes, lung disease, heart disease, and asthma by enhancing care management; improving access to, and use of, adult immunization data; preventing unnecessary ED visits and re-admissions to hospitals; and facilitating access to patient records using health information technology.</td>
</tr>
<tr>
<td>Beacon Community of the Inland Northwest, Spokane, WA</td>
<td>$15,702,479</td>
<td>Increase care coordination for patients with diabetes in rural areas and expand the existing health information exchange to provide a higher level of connectivity throughout the region.</td>
</tr>
<tr>
<td>Beacon Community</td>
<td>Award Amount</td>
<td>Goal</td>
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</tr>
<tr>
<td>Central Indiana Beacon Community, Indianapolis, IN</td>
<td>$16,008,431</td>
<td>Expand the country's largest Health Information Exchange to new community providers in order to improve cholesterol and blood sugar control for diabetic patients and reduce preventable re-admissions through tele monitoring of high risk chronic disease patients after hospital discharge.</td>
</tr>
<tr>
<td>Colorado Beacon Community, Grand Junction, CO</td>
<td>$11,878,279</td>
<td>Demonstrate how costs can be reduced and patient care improved, through the collection, analysis, and sharing of clinical data, and the redesign of primary care practices and clinics.</td>
</tr>
<tr>
<td>Crescent City Beacon Community, New Orleans, LA</td>
<td>$13,525,434</td>
<td>Reduce racial health disparities and improve control of diabetes and smoking cessation rates by linking technically isolated health systems, providers, and hospitals; and empower patients by increasing their access to Personal Health Records.</td>
</tr>
<tr>
<td>Delta BLUES Beacon Community, Stoneville, MS</td>
<td>$14,666,156</td>
<td>Improve access to care for diabetic patients through the meaningful use of electronic health records and health information exchange by primary care providers in the Mississippi Delta, and increase the efficiency of health care in the area by reducing excess health care costs for patients with diabetes through the use of electronic health record.</td>
</tr>
<tr>
<td>Greater Cincinnati Beacon Community, Cincinnati, OH</td>
<td>$13,775,630</td>
<td>Develop new quality improvement and care coordination initiatives focusing on patients with pediatric asthma, adult diabetes, and encouraging smoking cessation, and provide better clinical information and IT “decision support” tools to physicians, health systems, federally qualified health centers, and critical access hospitals.</td>
</tr>
<tr>
<td>Greater Tulsa Health Access Network Beacon Community, Tulsa, OK</td>
<td>$12,043,948</td>
<td>Leverage broad community partnerships with hospitals, providers, payers, and government agencies to expand a community-wide care coordination system, which will increase appropriate referrals for cancer screenings, decrease unnecessary specialist visits and (with telemedicine) increase access to care for patients with diabetes.</td>
</tr>
<tr>
<td>Hawaii County Beacon Community, Hilo, HI</td>
<td>$16,091,390</td>
<td>Improve the health of the Hawaii Island residents through implementation of a series of healthcare system improvements and interventions across independent hospitals, physicians and physician groups. Engaging patients in their own healthcare is also a primary focus.</td>
</tr>
<tr>
<td>Keystone Beacon Community, Danville, PA</td>
<td>$16,069,110</td>
<td>Establish community-wide care coordination through the expanded availability and use of health information technology for both clinicians and patients in a five-county area to enhance care for patients with pulmonary disease and congestive heart failure.</td>
</tr>
<tr>
<td>Rhode Island Beacon Community, Providence, RI</td>
<td>$15,914,787</td>
<td>Improve the management of care through several health information technology initiatives to support Rhode Island’s transition to the Patient Centered Medical Home model, which create systems to measure and report processes and outcomes that drive improved quality, reduce health care costs, and improve health outcomes.</td>
</tr>
<tr>
<td>San Diego Beacon Community, San Diego, CA</td>
<td>$15,275,115</td>
<td>Expand electronic health information exchange to enable providers to improve medical care decisions and overall care quality, to empower patients to engage in their own health management, and to reduce unnecessary and redundant testing.</td>
</tr>
<tr>
<td>Beacon Community</td>
<td>Award Amount</td>
<td>Goal</td>
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</tr>
<tr>
<td>Southeastern Michigan Beacon Community, Detroit, MI</td>
<td>$16,224,370</td>
<td>Make long-term, sustainable improvements in the quality and efficiency of diabetes care through leveraging existing and new technologies across health care settings, and providing practical support to help clinicians, nurses, and other health professionals make the best use of electronic health data.</td>
</tr>
<tr>
<td>Southeastern Minnesota Beacon Community, Rochester, MN</td>
<td>$12,284,770</td>
<td>Enhance patient care management, reduce costs associated with hospitalization and emergency services for patients with diabetes and childhood asthma, and reduce health disparities for underserved populations and rural communities.</td>
</tr>
<tr>
<td>Southern Piedmont Beacon Community, Concord, NC</td>
<td>$15,907,622</td>
<td>Increase use health information technology, including health information exchange among providers and increased patient access to health records to improve coordination of care, encourage patient involvement in their own medical care, and improve health outcomes while controlling cost.</td>
</tr>
<tr>
<td>Utah Beacon Community, Salt Lake City, UT</td>
<td>$15,790,181</td>
<td>Improve the management and coordination of care for patients with diabetes and other life-threatening conditions, decrease unnecessary costs in the health care system, and improve public health.</td>
</tr>
<tr>
<td>Western New York Beacon Community, Buffalo, NY</td>
<td>$16,092,485</td>
<td>Expand the Western New York network, close gaps in service, and improve health outcomes for patients with diabetes.</td>
</tr>
</tbody>
</table>

**Table 2.** List of participating regional HIEs to drive improvements in care coordination and information exchange to affect change in their communities (Reprinted from [http://www.healthit.gov/policy-researchers-implementers/beacon-community-program](http://www.healthit.gov/policy-researchers-implementers/beacon-community-program))

The government’s investment in HIEs through the Beacon community is directly tied to the ability to track healthcare delivery by region and impact the overall efficiencies and cost tied to managing unique populations around the country. Since medical groups are a fundamental part of communities, it is important to understand these resources are available and find leverage opportunities to participate through participating hospitals so as to improve patient engagement. Limiting factors for providers is the cost of using the same EHR systems as these large systems however where opportunities exist
larger medical groups should pursue HIE integration with other health care organizations in their region that are already participating.

Technology Convergence- What is it?

“Website + mobile applications + smart phones/tablets = Freedom”

The concept of convergence is basically the marriage between different aspects of mobile technology and medical operations to empower today’s patient relative to the things they do in their daily lives on the go. Examples such as appointment scheduling applications on a smartphone that can also be accessed on the Internet, or making payments to a medical office using an application from the practice that is linked to online payment systems such as PayPal are examples of how convergence in mobile technology continues to create more freedom and options in managing care for both patients and their providers. Use of mHealth is not restricted to the wealthy patient and has been deployed in health plan communication strategies with Medicaid patients.

With 22 million plus Americans armed with smartphones, mHealth and has been described as a pervasive, effective, and cost-efficient tool that, as part of a well-planned strategy, can help reduce medical error, ensure consumer compliance, and improve health outcomes.

*A simple formula for convergence is: website+mobile applications+ smart phones or tablets= freedom to engage (providers and patients)*

Mobile technology is going through an evolution where web and TV is merging to cause real time consumerism for example and healthcare through telemedicine, tele-monitoring, mobile applications and a host of other technologies will eventually merge together to create even more innovative solutions as society gets more connected to
electronic communications. So where does regulation fit in all this information sharing? There are staunch critics of mHealth and the use of electronic communications, health records management systems and HIEs due to conspiracy theorists such as the government ultimate aim of accessing all patient records for more control of the general population to the economic incentive corporate healthcare has in creating these technologies for profit with little regard to healthcare itself.

**mHealth, Patient Privacy and FDA regulation**

The early 1990s give birth to greater privacy laws with HIPAA regulations, HITECH initiatives all aimed to improve healthcare delivery and maintain patient privacy through the use of IT tools. Today, many Americans continue to pressure the government for greater regulation of these systems and monitoring of providers when adopting technologies to address their healthcare needs. As with anything that gains consumer popularity, medical applications have become a major part of medicine in the U.S and globally. With that trajectory in use, the Federal Drug Administration (FDA) has put out guidelines for use based on category of mobile application, complexity and use in patient care as part of their overall responsibility to provide oversight of its use and assess related risks to patient populations. Industry experts predict that 500 million smartphone users worldwide will be using a health care application by 2015, and by 2018, 50 percent of the more than 3.4 billion smartphone and tablet users will have downloaded mobile health applications.  

According to the FDA the types of mHealth applications used for medical education, references, or as an extension of a medical practice or portal are currently not subject to FDA monitoring and regulations. Medical applications that are used in more
direct patient care such as monitoring and telemedicine are considered medical devices and subject to regulation. Medical applications used in the diagnosis of disease may be under FDA regulation as they pose a minimal risk to patients, but this is currently under review as the use of medical applications in diagnosis and treatment of disease evolves. 22

SECTION IV
FUTURE CAPABILITIES OF mHEALTH

Enabler of population health management

Population health management is a shift in mindset of providers who are used to managing patients one at a time. It is no longer an exclusive topic for health plans and large healthcare systems but all providers including small practices should have a means to manage their patient population. Meaningful Use (MU) has empowered physicians with this ability for participating providers internally, and the ability to further manage patients using mobile technologies tied to MU certified systems will make it easier to manage patients regardless of community. Many healthcare professionals see population health management as solely a financial exercise in controlling cost, however if patient needs and satisfaction tools are incorporated into MU criterion it can serve as both financial and quality of care tool when all providers are participating in a meaningful way. Example is the ability to account for the diabetics within a practice and have relationships with their other care providers within a local community; this enables collaboration in community engagement, education, and intervention.

What mHealth does well is to compress time and improve access including remote access and sharing of critical patient education information. Its implication in the US healthcare delivery system in terms of population health management holds tremendous promise if provider embrace technology as a part of their medical practice and not an enemy of how they render care. Times are changing and reducing cost usually tied to over-management of administrative functions and under-management of clinical process in healthcare management is no longer sustainable. Patient experience at a medical office, hospital or skilled nursing facility is still local and within localities.
mHealth can be deployed for their citizens through the use of local medical applications from these providers that patients and providers can use to be a part of normal communication and practice operations.

**Capabilities within Accountable Care Organizations (ACOs)**

ACOs since its inception targeted larger healthcare systems to manage care in an accountable manner and having integrated IT systems related to patient services is a mandatory component for ACO formation and management of patients. While several organizations participated in the government’s shared savings plan (aka ACO program), it is still left to be determined its overall impact on the nation’s healthcare system. Many organizations are beginning to see the benefits of ACOs however the ability to gain greater gains will depend on the use of mHealth technologies in every level of patient care to truly gain the momentum needed to render healthcare services in a transparent and accountable manner. MU, EHR, mHealth, all sound like ‘vegetables’ in the ‘salad’ called healthcare, however all of them are truly interconnected and if managed within integrated systems, communities and practices presents opportunities for all healthcare organizations regardless of size to operate as ACOs whether they are designated as such.

**Influence patient behavior**

Today’s patient in the US and around the world (i.e. the rest of the 500 million smartphone users) are very much on the web, checking out new mobile applications and most of the younger populations known as millennials (born between 1977-1993) in the U.S continue to prefer to stay with medical practices that use mobile technology as part of their practice operations. Psychologically and culturally millennials with an estimated population of 80 million in the U.S represent 25% of the U.S population and part of the
growing working class are focused on using technology to improve and simplify their lives, to engage in social communities, and to find the best information on their health and wellness.  

On the other end of the spectrum baby boomer patients many who are just entering into retirements have also embraced the use of mobile applications and continue to use mHealth as part of their daily experience. Born between 1946-1954 over 75% of baby boomers have downloaded at least one mHealth app for their smartphones, and almost half have downloaded six or more. Boomer also have the largest purchasing power and desire to maintain longevity so the use of mHealth is expected to grow with their engagement with providers using mobile applications, smartphones, social media and internet for health care information and resources to enhance this goal. So whether it is the very young or the maturing patient, mHealth is a major part of the daily lives of U.S patients and mHealth will only continue to grow at a fast pace with the hope that innovation and ingenuity within the IT industry will follow to address the needs of patients through technology.

**Impact on patient education**

Patient education which helps with prevention of disease and lifestyle management can be transformed through the continued use of mobile applications. Information is power when shared in a timely fashion especially in preventing spread of preventable diseases or viruses such as Ebola, HIV and communicable diseases. Other major healthcare challenges such as increased prevalence of cancer and diabetes can be controlled in the future if greater emphasis is placed on patient outreach through the use of technology. Patient education and general population health awareness through mobile
health is a great investment by government and corporate healthcare organizations to
directly impact the overall health of our communities and mHealth becomes a weapon of
prevention when it is used as part of the overall strategy in patient education. Medical
practices can also participate in this strategy if they adopt mobile applications as a means
to educate their patients and participate in local mobile health outreach programs.

**Impact on clinical outcomes**

Technology does not necessarily provide cures but they are instrumental in the
administration of medical treatment and mHealth is no different. FDA regulation of
mobile applications that are involved in treatment and intervention is necessary for
patient safety but innovation in the development of new mobile applications that improve
healthcare outcomes is needed to encourage the use of mobile applications by providers
and patients alike further improving access and reducing cost to society. The verdict is
still out on the impact of mHealth and clinical outcomes especially in the monitoring
capabilities of mobile applications, however it is unquestionable that patients who need to
be home and can engage their providers through the use of mobile technology are
embracing this option and their healthcare outcomes are better since their state of mind is
trusting of the technology.
Conclusion

Technology as the backbone in the delivery of healthcare services is vital in achieving the Institute for Healthcare Improvement (IHI) concept of the triple aim in patient care services which focuses on these three areas: 1) Improving the patient experience of care (including quality and satisfaction); 2) Improving the health of populations; and 3) Reducing the per capita cost of health care. Empowering patients and providers alike to be actively engaged in seeking and providing healthcare services respectively through the use of mHealth is not only innovative but practical. The multiple ways for patients to engage with their doctors is shifting as healthcare reform is forcing health plans, physicians, and hospitals (the three legged stool controlling patient-physician engagement) to use mHealth in all their processes in patient relationships, management and operations of medical practices. Ultimately, this trend is here to stay as the next generation of Americans who ‘live’ on the Internet will continue to do so ‘on the go’ with their mobile devices and access their doctors, their records and health insurance on a smartphone.

Summary

The speed of change in technology is mind-boggling. Everyday life is impacted by the advancement in web-technology like windows based phones and interface of TV on smart phones! The rate of change in this era is faster than even a decade ago where technology took time to mature and saturate the market before becoming obsolete such as flip phones for example. Mobile applications now dominate all platforms of communications in both information technology and telecommunications, windows based
phones allow for real time surfing of information, medical references, access online tools for patient scheduling, patient portals to view limited records.

Mobile technology also impacts the ability to virtual manage patients with the use of monitoring tools connected with both patient and provider, telemedicine is impacted positively to manage either hard to reach patients because of their limited mobility or geographic limitations in accessing certain specialists depending on the market.
ENDNOTES

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