

**CHAPTER 20****From Intervention to Innovation: Health Information Technology****Denise C. Tahara<sup>\*,1</sup> and Guy Laufer<sup>2</sup>**

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**Abstract:** Health information technology is changing the way we deliver quality care, and improves our ability to access and treat patients, particularly those in remote or health resource-poor communities and those most at-risk. As healthcare providers, we find ourselves competing with businesses, friends and family members for the patient's attention and time. To develop effective interventions, a systems approach to analysis and improvement is required that considers cultural, human and environmental factors. New models of care will require that physicians take a proactive approach to managing patients' health and wellness, collaboratively. Our patients are constantly assaulted by stimuli, some of them traditional, others products of technology. To enable behavior change, we must devise effective methods of engaging our patients. We propose that healthcare innovations should be developed to focus on the patient's experience and portability. The design of these innovations should promote competence and confidence and provide the requisite level of functionality required by the user. Effective innovations must begin with the patient. As appropriate, designing in certain elements, Gamification, Phygital™, and Social Engagement are essential to engage patients. Integrating these innovations into healthcare delivery can bring about definitive public health benefits.

**Keywords:** Behavior, design thinking, digital, eHealth, EMRs, gamification, global health, health information technology, innovation, lifestyle diseases, mHealth, mobile, obesity, overweight, patient engagement, patient experience, risk, telehealth, wellness.

**INTRODUCTION**

Technology has changed the way we communicate and interact as well as our day-to-day experience. As healthcare providers, we find ourselves competing with

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businesses, friends, and family members for the patient's attention. Advertisers use flashy, moving gimmicks, anything to grab attention. Regardless, as healthcare providers it is incumbent upon us to create an authentic approach, informed by accurate content that will establish a meaningful, long-term relationship with our patients. Our patients are constantly assaulted by stimuli, some of them traditional, others products of technology. This chapter focuses on how to enable behavior change with effective methods of engaging patients. Healthcare innovations that focus on the patient's experience and portability are considered. This chapter discusses why the design of these innovations needs to promote not just competence and confidence, but also provide the requisite level of functionality required by the user.

### **LET'S GO DIGITAL!**

In this digital age, kids are active on social media sites and online games; expanding their community. They seek approval, praise, support, and sometimes just want to share. It is a media they are familiar with and therefore healthcare plans, other interventions, and guidelines should be delivered through this channel. According to a recent survey, 93% teens share a computer or have access to one and 74% of older teens are "mobile internet users" meaning that they access the internet through their mobile devices. Furthermore, 95% of teens use the internet and 82% are on social networking sites. Children, adolescents, and teens spend more time with media, than they do in school [1]. Racial differences persist as 81% of white teens *versus* 64% of black teens own a computer [2].

Health communication and care plans should be designed to engage patients as well as maximize participation and adherence. We propose that healthcare innovations should be designed for the user experience and portability. Unlike traditional product design, the digital product/service constantly needs to be updated to fit the needs and requirements of the user, which simultaneously change over time as well. In this agile process, once the innovation has been launched, the tracking begins to measure patient behavior and feedback on an ongoing basis. After analyzing what can be improved, providers should address these issues, adjust them accordingly, and send the improved version back to the patient. This is an unending feedback/refinement cycle, or Plan-Do-Study-Act, frequently referred to as the Deming Cycle for performance improvement. For example in July 2013, Facebook's Graph Search was launched. Graph Search is an inner search engine within Facebook that helps the user to easily search on Facebook. Sample users tested this product for nearly six months before reaching

the mass audience. Facebook continually refined the service in response to user feedback. For more information click [here](#).

User-centered thinking and design encompasses the following elements: Gamification, Phygital™, and Social Engagement and is illustrated in Fig. (1). These elements provide a holistic blend, combined with the ongoing experience of our patients. At the center of the design of the healthcare innovation is the patient. The core factors: design, purpose, utility, engagement, personalization and friendliness are common to all three spheres of Gamification, Phygital™, and Social Engagement, and are essential to the patient.

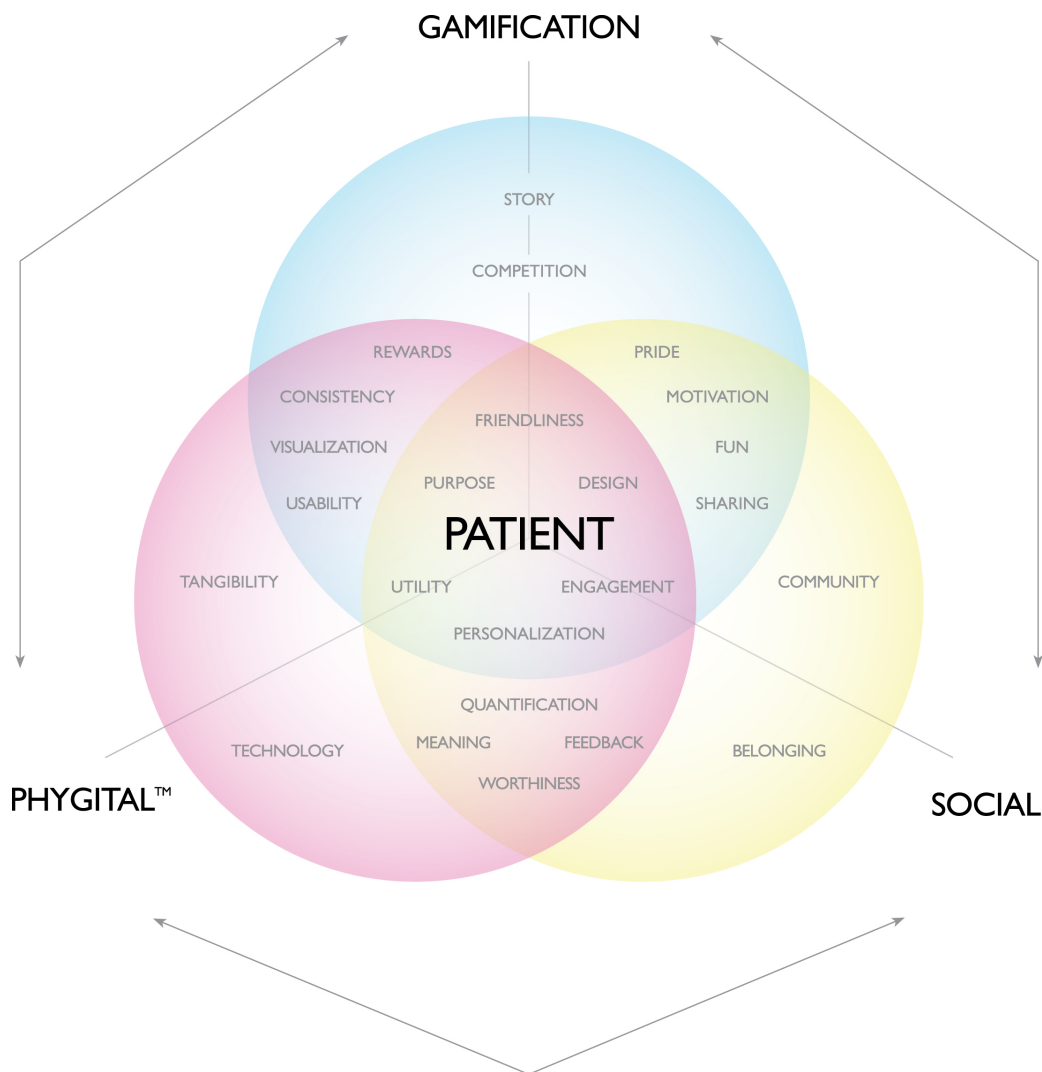
Gamification is the usage of game thinking and design in a non-game environment/context. It adds a layer of game-thinking to create a sense of competition among other patients, or among themselves; it imparts to the user a story line, which creates a rich experience. Phygital™ (the blending of two words, physical and digital) adds a digital layer to our physical environment, which provides additional information, as well as a new way of engaging with one's surroundings. These three elements are not stand-alone, but their interactive combination, coupled with the patient at the center, creates a meaningful and long-lasting engagement. In the patient's experience, he/she should be exposed to these elements in a coherent, clear-cut manner. Our target population continuously Tweets, Shares, and Likes all of this being done on social networks. This branch in the digital sphere is a major element, and should be a pivotal part of our healthcare innovations.

### **Gamification**

Gamification motivates the user to perform mundane tasks or services by providing a dimension of fun. Adding a layer of gamification encourages and stimulates the patient to engage.

The foundation of gamification is built on a perception of human nature; people enjoy competition in a variety of forms, particularly children. People have an inherent desire for self-expression and the achievement of status. Rewards in this competitive process could be points, badges, levels, or any category that provides a sense of pride and accomplishment.

Gamification contributes a layer of enjoyment to tasks that could otherwise be considered burdensome or downright dull. It motivates actions, gives feedback,



**Fig. (1).** From intervention to innovation framework, ©2013, Tahara & Laufer.

and reinforces the user’s involvement with sundry rewards. The user is engaged and motivated to continue to participate. This is a key factor for protocol adherence for children. Feedback highlights a sense of identity and expectation; the urge to improve is a highly desirable psychological and intellectual value. Gamification gives a clear path-in the form of a story line-to ascertain and evaluate outcomes. Status and feedback are essential in prompting the user to continue his/her engagement. Moreover, this story line gives the user a sense of measurable progress vs monitoring and reporting. It promotes the belief that with

more time, effort, and dedication, higher levels of achievement, along with a process of discovery, can be realized; there is an incentive to follow protocols and adhere to care and treatment plans.

Not knowing how the story will turn out strengthens one's sense of curiosity, and moves the patient to want to know more, to continue to participate. This kind of competition also creates a sense of ongoing social interaction. In sum, gamification—a sense of play—has always been a highly valued motivational strategy. Resources include:

<http://www.hopelab.org/>

<http://www.forbes.com/sites/gartnergroup/2013/01/21/the-gamification-of-business/>

<http://mashable.com/category/gamification/>

<http://www.gamification.co/>

<http://www.brandingmagazine.com/2012/04/06/the-principles-of-gamification/>

### **Phygital™**

Phygital™ is a blending of two words—physical and digital—that are often brought to bear in the world of technology, and specifically in the field of marketing and is trademarked by Momentum Advertising Agency. Initial entries into this sphere include exergames such as those developed by Nintendo (Wii), Microsoft (Xbox 360 Kinect), and Sony (PlayStation). For example, the aim of Kinect Training by Nike is to utilize technology to narrow the gap between the physical and digital worlds. Today, the number of smartphone users worldwide is estimated at 1.4 billion, representing nearly one in three mobile phone users, or about one-fifth of the global population. It is estimated that by 2017 more than one third of the human population will use a smartphone [3] placing the digital sphere at everyone's fingertips, thus connecting the two worlds. Some of the best examples of this process are QR codes, Augmented Reality, Nike+ FuelBand, and Google Glass. These innovations provide the user with the benefits of both worlds. Similar to gamification, to maintain an ongoing engagement with the user, a Phygital™ product or service should always provide feedback. Feedback is an essential component of systems thinking and design. It provides important information about the user's experience with both content and delivery. Feedback can be either a single summary or a more sustainable mechanism in the form of a

dashboard, which enables the user to track his or her results, narrowing the gap between the physical world and the digital sphere. Resources include: <http://phygitalien.com/what-is-phygital/> and <http://www.thedrum.com/knowledge-bank/2011/12/19/creating-phygital-ecosystem-between-brands-and-consumers>

## **SOCIAL ENGAGEMENT**

Social Engagement is the interaction between users in virtual communities. It might be expressed in the form of sharing ideas, information, or any other kind of content. User-generated content such as messages, images, and ratings, connects people from around the globe without a middleman. The participants in this process may be followers, friends, and contacts. Each community possesses its own set of ground rules and modes of communication. This, in brief, is the way that the “game” is played. For example, a posting by a mother of a child with diabetes on [www.spoonful.com](http://www.spoonful.com), resulted in collaboration between Eli Lilly and Disney Publishing and the development of Fantasy Diabetes, which is modeled after Fantasy Football [4]. Instead of focusing on NFL scores, children guess the blood sugar level of the child with diabetes. As in Fantasy Football, points are awarded for the best guess.

People spend more time on social networks than on any other category of sites [5]. It is human nature to seek engagement and to belong to a community. Moreover, younger generations feel this need even more urgently and they constantly look for feedback. They value the opinions of their peers. Group identity offers a support system, and it reinforces motivation. According to an eMarketer report [6] nearly one in three people worldwide will use social networks in 2014. We are living in a constantly changing world in which technology is always evolving; however, the need and desire for a sense of community remains intact. <http://www.forbes.com/sites/piyankajain/2013/06/25/6-social-media-insights-bound-to-change-your-customer-support/>

## **INTEGRATING INFORMATION TECHNOLOGY INTO HEALTHCARE**

### **Getting Started**

When integrating information technology into healthcare, there are two elements that need to be synchronized: content and delivery. Questions to consider in the design process include: What do we mean by content? Is it relevant to our patients? Is it personalized to fit his/her needs? At the same time, how do we

deliver the actual content? Is it accessible? What is its format? Is it mindful of the patient's personal habits, health literacy and cultural traditions?

Optimally, in the design of healthcare innovations, our team should consist of analytical "brains" and "design thinkers". Healthcare providers, the "brains" focus on content *versus* messaging. During interactions, communications, and subsequent care, the provider concentrates on the patient's clinical needs; treatment plans are developed to manage the patient's health and wellness. This expertise is essential for every healthcare intervention. Designers tend to emphasize the affective dimension rather than the analytical, because they understand that customers frequently "go with their gut" in the selection of services and products more than upon considerations of utility and cost. Designers translate the product or service simply and intuitively in a user-friendly manner. However, while emotional appeal can initially engage potential users, analysis contributes legitimacy to the process of decision making. Such an approach creates "healthy tension", highlighting a blend of the advantages of both worlds, responding to the needs of the patient.

This process starts with four questions that must be addressed in order to create a complete patient-centered innovation.

***Question #1: "What Is?"***

Explain the project's intention. As providers, what do we need to learn? What is the outcome we want to achieve?

***Question #2: "What If?"***

After understanding both the provider's capabilities and the patient's needs, it is time to identify possibilities and opportunities. Brainstorming, gathering ideas from a cross-section of the team (including providers and designers) is the place to start. Successful brainstorming requires context and structure. Winnowing and combining ideas leads to the next question.

***Question #3: "What Wows?"***

Choose the best ideas. What best captures the user's attention and interest to effectively engage him/her? What are the provider's "in house" capabilities? In this stage you should consider the perspective of the patient in order to provide a different view of the service or capability, in other words picking the best of the

ideas. This phase is equivalent to an editing room with production unit. It looks at what can be done in house and what should be outsourced.

**Question #4: “What works?”**

Now it is time to put the innovation into practice. Present the service or capability to a pilot group. Determine their experience and obtain their feedback. This will enable you to adjust to the specific needs and interests of the patient. This process has been employed by Facebook as previously described.

**Mobile Technology**

There is no doubt about the importance of mobile technology in the near future. Major companies are changing their business models after realizing that the web’s future will be mobile. “We’ve transitioned, and are now a mobile company,” says Mark Zuckerberg [7]. Many more businesses understand that their customers will utilize information through smartphones, tablets, and portable devices. Accordingly, healthcare providers must respond to this new reality by utilizing the mobile platform to communicate with and inform their patients.

For providers the question remains whether to build a mobile-optimized website or a stand-alone mobile app to communicate with their patients. How the patient interacts with healthcare services through the mobile device will determine the manner in which the actual content should be delivered. As recently as two years ago, users spent about 20 or more minutes per day on browser-based sites rather than on mobile apps. However, by last September mobile apps were outdistancing browser-based sites by more than 20 minutes a day [8]. How does this relate to health information technology? Currently only a quarter of all patients are accessing their medical records through websites or mobile devices, although, according to a recent survey, more than 52% are clearly interested in using electronic medical records (EMRs) [9]. This represents a dynamic opportunity for healthcare providers to accelerate implementation of EMR systems, and integrate health information technology into their practices. It also provides an incentive to providers to implement EMR systems with the requisite interoperability to facilitate connectivity to mobile communications. In Fig. (2), we compare the advantages and disadvantages of each approach.



MOBILE SITE	MOBILE APP
STATIC AND LIMITED USER INTERFACE	INTERACTIVE USER INTERFACE
ACCESSED THROUGH BROWSING	ACCESSED AFTER INSTALLED
REQUIRES CONNECTION	AVAILABLE OFFLINE
LIMITED FEATURES	CAN USE OTHER PHONE FEATURES SUCH AS GPS, CAMERA, ETC
FAST	FASTER
NO APPROVAL AND NO REGULATION	MOST APPS REQUIRE AN APPROVAL PROCESS, AND CAN BE FOUND IN THE APP STORE
USES AN EXISTING SITE AND ADJUSTS TO MULTIPLE SCREENS, INCLUDING MOBILE DEVICES AND TABLETS	EXPENSIVE
CONNECTIVITY TO PATIENT ELECTRONIC MEDICAL RECORDS (EMR)	LACK OF CONNECTIVITY TO PATIENT ELECTRONIC MEDICAL RECORDS (EMR)

Fig. (2). Mobile site vs mobile app.

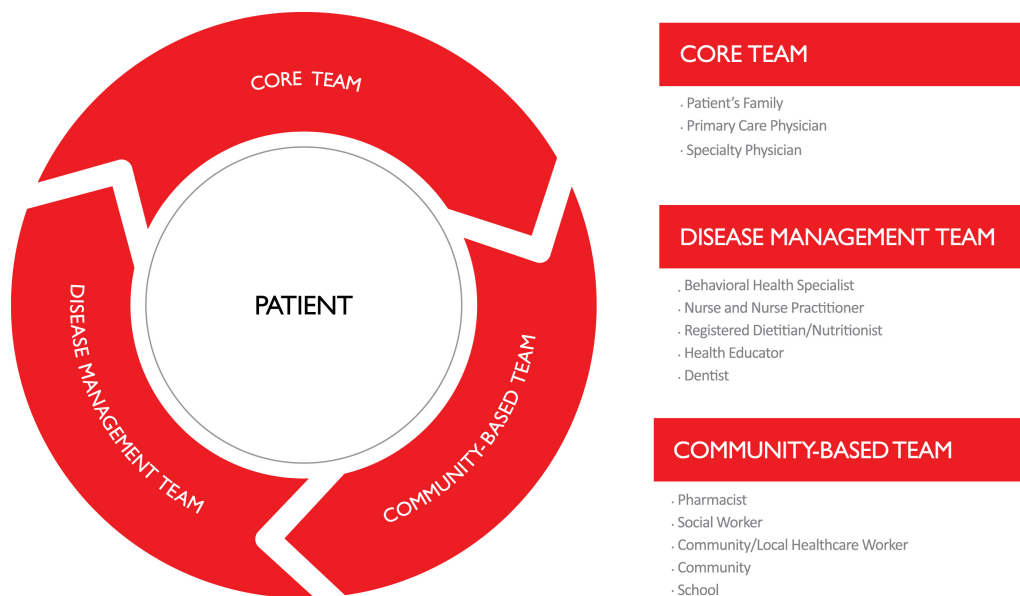
In this chapter we created a framework to maximize patient engagement in their health and well-being. However, this framework will not ensure engagement if not effectively implemented using a systems approach to its design. We discussed the requisite components, being mindful of the patient’s point of view-in effect, asking the question, “*What’s in it for them?*” As we design healthcare interactions, this is the question we should continually ask. Possessing the components does not ensure success; however, in the digital sphere we always have the option to adjust and refine; we are never done.

**A SYSTEMS APPROACH**

To develop effective interventions, a systems approach to analysis and improvement is required. The first step is to understand the existing delivery system by documenting the patient’s experience; identifying barriers and obstacles to engaging them in their care and well-being, including lifestyle and infrastructure failures, and leveraging opportunities to reinforce healthy choices and coordinated care. A systems approach requires both provider-based and

patient-based care which engages the whole patient/family constellation and reorients care from episodic treatment to ongoing health management and well-being; supporting changes in the ecology of place and lifestyle behaviors [10]. This approach also considers the needs of physicians to engage them as champions who can help co-design collaboration and integration efforts, encourage agency in patients and their families, and support parents to advocate as role models and change agents. For more information regarding systems approach and analysis, also see CHAPTER 19: Life-Course Approach to Obesity Management: The Role of Family and Environment.

New models of care will require that physicians take a proactive approach to managing patients' health and wellness, collaboratively. Physicians are curators of their patients' data and will need to coordinate services and deliver care where they will have different roles, responsibilities and accountability; teams will not be organized vertically around the physician, but rather horizontally around the patient's needs [11], as illustrated in Fig. (3). Physician training will need to include new communication and leadership skills to better manage the whole patient, in some cases with multiple diseases. Care will need to be responsive and accessible to patient preferences, needs and values, so that they can actively participate in their treatment, decision-making and care [12].



**Fig. (3).** Pediatric-centered framework of care.

## **Health Information Technology: Where Are We Now?**

Although immunizations have proven to be one of the most effective healthcare innovations to prevent epidemics of infectious and preventable diseases, Mobile Health or mHealth is anticipated to be the next healthcare innovation to transform public healthcare worldwide. Maximizing medical technology capabilities has been an ongoing priority. “In 2005, a World Health Assembly resolution acknowledged e-health’s potential for improving health systems and safety, quality and efficiency in health care” [13]. As more capabilities are developed, providers are embracing the technology and integrating it into their workflow, re-conceptualizing how and where they deliver quality healthcare.

In response to the anticipated healthcare workforce and physician shortage worldwide, eHealth and mHealth afford the opportunity to deliver real-time care to more patients, particularly those most at-risk, who live in remote and healthcare resource-poor communities. With an aging population living with chronic diseases, there is increased demand for health information including self-management and decision support tools to enable patients to age in place, without sacrificing quality of life and quality of care. The result should be more efficient and more cost-effective care.

The definition of health information technology (HIT) is rapidly changing as new capabilities are being introduced. These include institutional systems, systems that facilitate clinical practice, and systems that facilitate care at a distance [14]. Information technology has increased communication of educational and clinical information including diagnostic data among providers who are integrating the use of technology in the daily treatment and care of patients. This chapter focuses on communicating and providing care between practitioners and patients and discusses four domains: telemedicine, patient web portals, social media and mobile health [15].

### ***Electronic Medical Records/Electronic Health Records***

Electronic Medical Records/Electronic Health Records (EMRs and EHRs) are improving the quality and quantity of care provided by facilitating documentation and communication of patient information and diagnoses when patients present to their providers. Large information systems enable the entry and subsequent access of centralized patient data, including basic patient information, treatment records, diagnostic testing, and medication lists. Multiple access points connect providers

and patients so care can be delivered in multiple settings including in the patient's community so that the patient no longer needs to travel to receive care. Point-of-care devices enable care coordination and delivery to patients particularly in remote and difficult to reach areas. Such access to patient data can also improve care across healthcare settings and patient hand-offs.

### ***Telemedicine***

Telemedicine is the use of communications technology to exchange information between providers (between provider sites) or between providers and patients who may not be within a geographic proximity, to improve patients' health status. The term refers to a variety of modalities including telephones, clinical call centers, two-way video, email, smart phones, videoconferencing, digital retinal cameras, secure messaging, wireless tools, store-and-forward imaging, streaming media, and remote monitoring [16-18]. Telemedicine and telehealth are sometimes used synonymously although telehealth does not always include clinical services. Regardless, information is communicated in real-time or stored-and-forwarded (such as use of Picture Archiving Communication System (PACS) for digital imagery). Patient education videos provide information regarding procedures, treatment protocols, and preadmission instructions; demonstrate healthy lifestyle behaviors and medication management. Data can be analyzed using decision support software or physician consultation, and a care plan is then developed and implemented. Telemedicine has been shown to improve access (especially to specialty providers), decrease costs (especially through chronic disease management), improve quality, and enable chronically ill and elder patients to live independently *versus* having to live in institutional settings.

### ***Patient Web Portals***

Patient web portals (PWPs) integrate EMRs. The web-based systems enable patients to communicate with their providers as well as provide access to educational materials to help them manage their disease, conditions, and wellness. Patients and providers have access to the patient's complete medical history *via* internet access. Patients can set up appointments, request refills for prescriptions, submit claims, make payments, receive reminders and alerts, and obtain specialist referrals. After users log in to a secure site, they navigate through their dashboard to access information on their health, disease, and healthcare services, to better manage their health and wellness.

### ***Social Media***

Social media refers to a wide range of online forums, blogs, collaborative websites (Wikis), social networking sites, video and photo sharing, chat rooms, and virtual communities where patients live through avatars. In addition to accessing information about their condition, patients connect with other patients and receive support through their communication.

Available resources include: Incorporating social networks: <http://www.patientslikeme.com/> and <http://www.wellapps.com/patients-helping-patients-help-doctors-help-patients>

### ***Mobile Health or mHealth***

Mobile health or mHealth is the fastest growing and most significant of the health information technology innovations, particularly for chronic disease management and especially for socially disadvantaged populations [19]. mHealth involves using wireless technologies such as Bluetooth, GSM/GPRS/3G/4G, Wi-Fi, WiMax ... to transmit and enable various eHealth data content and services. This enables chronic disease management and reporting of patient indicators such as vital signs, weight and behavioral health, and diagnostics remotely and in real-time. Usually these are accessed by the health worker through devices such as mobile phones, smart phones, PDAs, laptops and tablets [20].

According to a 2012 Pew Research Study on mobile health usage, 31% of cell phone owners and 52% of smart phone owners used phones to look up health or medical information. Further, young adults, Latinos, and African Americans lead the trend [21]. Emerging technologies such as smartphone applications (with email and text messaging (SMS) capabilities), two-way pagers and the internet have improved patient care and self-management of their conditions through monitoring and engagement in protocols that incentivize both the provider and the patient.

mHealth applications have been categorized into the following groups:

- Education and Awareness
- Remote Data Collection
- Remote Monitoring

- Communication and Training for Health Care Workers
- Disease & Epidemic Outbreak Tracking
- Diagnostic and Treatment Support [22]

Multiple studies worldwide indicate that SMS messages and other reminders have improved health behaviors and adherence to treatment guidelines resulting in improved physiological outcomes. mHealth applications have improved the efficiency and effectiveness of care delivery worldwide with corresponding reductions in infant mortality, and the spread of diseases. In rural areas, mobile health applications have effectively been used for surveillance and disease tracking and to improve population health through timelier public health information, increased access to healthcare and healthcare information, expanded access to medical education, and training for healthcare workers [23]. A large-scale and ongoing evaluation of the efficacy of these tools on behaviors and health outcomes is needed [24]. Interim outcome data should be evaluated and shared.

Available resources include:

Epocrates: <http://www.epocrates.com/>

PubMed Mobile: <http://www.ncbi.nlm.nih.gov/m/pubmed/>

AHRQ's Electronic Preventive Services Selector (ePSS):  
<http://epss.ahrq.gov/PDA/index.jsp>

Community Health Data Initiative: <http://www.hhs.gov/open/plan/opengovernmentplan/initiatives/initiative.html>

<http://www.impakhealth.com/emmett-the-robot>

<http://www.imedicalapps.com/>

### **Where it is Working**

Successful uses of health information/communication technology in both the US and abroad integrate technology into the care delivery process *vs* as an add-on. They consider the cultural, human and environmental factors that will ensure utilization and improved health outcomes. These include culturally sensitive language, health literacy, user capability and comfort with the technology. The

goal is to engage the patient and their family so they can manage their health and well-being.

Some examples of what is working include learning networks, virtual grand rounds [25], and chronic disease management tools that include interventions for self-management and decision support such as sites for smoking cessation, compliance alerts, and instant access to health information. This creates a system of healthcare without walls [26].

### ***Text4baby/Text4kids***

Building on the success of Text4baby, Bright Futures™ launched Text4kids, a mobile health messaging system to address children's changing health needs from birth to age 21. Personalized messages are sent to children and parents to remind them to set up and show up at scheduled appointments, comply with immunization guidelines, and provide information on various topics throughout the child's development. Personalized supportive messages are sent to the child to reinforce good choices and healthy decisions. It also provides links to helpful community resources. In 2012 a randomized control study [27] reported that vaccination rates doubled (from 18% to 36%) when parents received text reminders *versus* just paper reminders. More information can be found at: <http://connect4health.net/text4kids.html> or <http://brightfutures.aap.org/>.

### ***Blood Glucose Monitoring Systems (BGMs)***

Blood Glucose Monitoring Systems (BGMs) are wireless blood glucose meters capable of collecting HbA1C levels and sending the data to a server where they are forwarded to a cloud-based web application. The data can then be viewed by patients, families, and providers on their tablets, smartphones, or computers. BGMs have an alert when levels are too high or too low and recommend corrective action [28].

### ***Care Coordination/Home Telehealth (CCHT)***

The need to improve access by United States (US) veterans to the Veterans Health Administration (VHA) healthcare system, a focus on independent *versus* institutional living, and increasing demands of those with chronic disease, drove the conceptualization and development of the VHA investment in information and communication technologies. Care Coordination/Home Telehealth (CCHT) uses telehealth and decision-making points to care for its patients and support their

independent living. The key to its success is the algorithm that the VHA developed to match their patients based on their ability to use technology, access, and care needs [29]. Active case management includes utilizing videophones, messaging devices, biometric devices, and digital cameras to monitor patient health data and update treatment protocols when needed. Case managers educate their patients on how to manage their health at home. Key components include a strong health information infrastructure, strong relationships with technology vendors, staff engagement, extensive training of care coordinators and integrating the technology into the ongoing care and management of the patients and their diseases [30]. More information can be found at: <http://www.telehealth.va.gov/ccht/>.

### ***Project ECHO (Extension for Community Healthcare Outcomes)***

Project ECHO (Extension for Community Healthcare Outcomes) was started in 2004 through funding by the Agency for Healthcare Research & Quality. Since its initial year it has been funded through the state and also through the Robert Wood Johnson Foundation. It is based at the Health Science Center at the University of New Mexico School of Medicine and was created to extend/expand treatment for hepatitis C patients who live in rural and medically underserved areas. In New Mexico, access to care remains a huge challenge. Using teletechnology, Project ECHO trains primary care physicians, nurse practitioners, and community health workers in rural and underserved areas through virtual grand rounds and mentoring using a case-based approach. Through video conference clinics and additional training, patients have access to specialty care for their chronic and complex healthcare needs. The result is a virtual knowledge network with real-time transfer of knowledge and best practices and treatment for patients in rural and underserved communities. Project ECHO's disease management model has expanded to chronic diseases including 19 areas of specialty care. Recently they were funded by GE to integrate behavioral health services into primary care [31]. [Click here for more information.](#)

### ***HealthLine Project***

The HealthLine Project takes a different approach to communicating medical information. As models of care that include community health workers (CHW) expand in both developed and developing nations, there is concern regarding the availability and capability of available workers. In some countries the concern is with low and illiterate CHWs, who are willing to provide care in rural and



underserved communities. Researchers at Carnegie Mellon University and Aga Khan University in Pakistan partnered to address the literacy issue with funding from Microsoft Research. They developed a speech-based telephone information system, HealthLine to provide medical information. The only technology that the CHW needs is access to a telephone (neither smart phones nor landlines are required, and in many cases they are unavailable). The worker calls a toll-free number and using verbal prompts, can access recorded information on a variety of health topics, in their native language. Still in its early stages, HealthLine continues to expand the topics covered from maternal and child health to sexually transmitted infections. More information can be found at: <http://www.healthline.com/>.

### **Barriers to Widespread Use and Efficiencies**

Implementation of EMRs, particularly in the United States has been slow. As of 2012, only 44% of hospitals had adopted EMRs and 29% participated in Health Information Organizations (HIO) [32]. Global healthcare systems are plagued by interoperability issues which prevent providers from accessing important patient information, especially regarding diagnostics, that results in duplication and overuse of services. Additionally, the majority of the mHealth apps are not connected to the existing EMR systems or internet-based systems and therefore the information remains siloed. Limited bandwidths constrain data transfer. An information technology infrastructure to connect these different communication systems must be developed to maximize the capability to provide real-time, cost-effective care. Further, information needs to be communicated over secure exchanges, and from multiple sources and systems. Globally accepted standards need to be adopted, using open architecture, standardized terminology, abbreviations, messaging, and vocabulary so that data can move effectively across systems and applications, transmitted securely to ensure patient privacy. Encryption and authentication protocols need to be employed worldwide.

Socio-economic barriers continue to isolate uninsured or underinsured groups despite healthcare reform efforts [33]. These barriers include infrastructure and transportation challenges, availability and accessibility of specialty providers, including long wait time for appointments, insufficient capacity and resources at community health centers which provide safety-net care, poor health literacy coupled with cultural barriers to access, use and follow-up care [34]. Although applications of mHealth technologies are beginning to address those barriers to

health and well-being, inequalities in access and utilization of healthcare are reinforced by *the great digital divide*.

The biggest challenge facing providers who want to incorporate technology into their practice and care delivery is the *digital divide* where disparities in access to technology mirror healthcare disparities. Patients with lower socioeconomic status, minorities, the elderly, those who are disenfranchised, geographically isolated with poorer health and low health literacy, are less likely to have adequate access to eHealth technologies. In other words, there is a gap between people who have and those who do not have access to internet technology. The World Health Organization (WHO) defines health literacy as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health”[35]. It is the ability to read healthcare materials such as prescription bottles, physician orders, discharge orders, care and treatment plans.

Healthy People 2020 refers to the capacity to interpret and understand basic health information and services, and the competence to use such information to make informed decisions about care [36]. Even those of lower socioeconomic status, who have access, may not be able to assess the accuracy or quality of the information or understand the information itself. Further, this demographic group obtains their information from passive sources such as television *versus* searching the internet. They do not ask the question, “Can I trust this source?” In a 2013 survey, only 35% of adults had gone online to determine a diagnosis for themselves or someone else, and only 54% of them followed up with a medical professional. Whites tend to search for health information online more than Blacks and Hispanics [37]. mHealth technology, using smartphones and mobile apps is reducing this divide and improving access to information and health care. However, the ability to assess and differentiate among accurate and trustworthy websites and mobile apps persists. Additionally, many patients indicate frustration with using the websites or apps including lack of user-friendly navigation, lack of confidence in the functionality, and confidentiality concerns which inhibits access and utilization.

Patients want to be more connected to teams of physicians who coordinate and collaborate their care. Physicians also like the flexibility of responding to patient needs *via* email, patient web portals, or mHealth. However, privacy, confidentiality, and cost are still a huge factor as reimbursement standards and methods for costing services provided have still to be created. Further, protocols

need to be developed to ensure that documentation of the communication is included in the patient's medical record (either paper or electronic) so that patient data and treatment plans are up-to-date. Evaluation of systems developed including cost/benefit analysis and the impact of these innovations on population health is required so best practices can be adopted system-wide and costs can be reduced.

### **The Solution: From Intervention to Innovation**

A 2009-2010 survey by NHANES (National Health and Nutrition Examination Survey) [38] reported prevalence for overweight and obesity was 26.7% for children ages two to five years and an alarming 32.6% for children ages six to eleven years. Racial disparities continue to exist as the rates of obesity for Hispanic children were significantly higher, 33.1% and 39.7% respectively. This further reinforces the urgency for action and to develop culturally-specific innovations-both content and delivery.

Taking a systems approach to improvement, the first step is to understand the existing delivery system by documenting the patient's experience; identifying barriers and obstacles to engaging them in their care and well-being. These barriers need to be addressed to improve access to providers, improve communication and collaboration among care teams, and improve adherence to recommended protocols and treatment plans in the community. As we consider new models of patient-centered care, we need to shift our approach from an encounter or episodic care to a life-course approach. The community in which the patient and the patient's family lives including environmental factors must be incorporated into care plans. Solutions include aligning the necessary systems (such as the technology, analytics, and infrastructure) to support healthy behaviors. Those who live in rural areas or medically underserved communities need to be connected to care.

As we move toward family-centered care, physicians will have new roles and leadership responsibilities. Environmental, social, and economic barriers must be addressed so that patients can take ownership of their health and well-being. Healthcare encounters should be leveraged as opportunities to educate and reinforce wellness and well-being and empower patients and their families. Patient data collection forms (questionnaires) should include questions about the patient's living and built environments such as: access to fresh air (do the windows open?), number of smokers in the home, screen time, after school care,

typical breakfast, lunch, and dinner, access and use of playgrounds and what activities they participate in. This information can guide recommendations for management of chronic illnesses and wellness planning. For example, children who live in single-parent homes and those with two working parents generally eat more meals prepared outside the home, which impacts choices and what the child eats. They will trade off nutrition-rich foods for cost, taste, and convenience. Clever advertising influences snacks and meal choices. Further, this household environment also results in more screen time and sedentary lifestyle.

Communities must support improving health and well-being. Solutions require multi-sector collaboration (partnerships between private corporations and governments). Internationally this is being done through partnerships like the United Nations Foundation and the Vodaphone Foundation, where the carrier is providing network capabilities to programs in healthcare resource-poor and difficult to reach communities. Such partnerships need to be expanded in the U.S. Google Loon is an ambitious new project that aims to provide web access to rural and remote areas. This is being implemented by putting a network of solar air balloons into space to provide access to the internet. [Click here](#) to find out more information about Google Loon. In addition, Facebook partnered with Samsung, Ericsson, MediaTek, Nokia, Opera, and Qualcomm, to launch [Internet.org](#). This project aims to provide affordable access to internet for two thirds of the world population who are not yet connected.

This project features three main goals:

- Making access affordable through cheaper smartphones;
- Using data more efficiently so people do not run up high costs; and
- Companies/partners working together to help mobile devices support more languages to demolish barriers to usage [39].

As Mark Zuckerberg states, “I believe connectivity is a human right, and that if we work together we can make it a reality” [40].

Health information technology is changing the way we deliver quality care, and improves our ability to access and treat patients, particularly those in remote or in health resource-poor communities and those most at-risk. The possibilities are endless. Physicians are utilizing tablets in surgery to guide them through procedures ([click here](#) to see the example), while other surgeons are using Google

Glass to stream the procedures to physicians and medical students in remote locations (more information can be obtained from: Google glass article on Mashable). As providers, we should embrace these tools and capitalize on our relationships with our patients building trust, so they will use the technology and actively engage in their own care. Privacy, confidentiality, security, and accessibility are key concerns. Prompts and training should facilitate good decisions, goal achievement and provide real-time feedback and support.

Tackling the epidemic of pediatric obesity requires a systems approach to the socioeconomic, psychosocial, behavioral and lifestyle factors that affect our patients' health and well-being. This includes addressing barriers in the living and built environments, and access to health information technology. Designing innovations and treatment plans, must move the patient from awareness to actualization of their care, facilitate success and engage them in their health and well-being. Designing the patient experience and leveraging the positive and prosocial effects of media [41] is key to compliance and participation.

“Design thinking is actually a systematic approach to problem solving” [42]. Design combines the “How”, the “What” and the “Who”. Poor design means that the patient will not utilize the technology, and will feel frustrated because he/she cannot get things to work. “Innovation is usually not about producing ideas nobody has ever thought of before; it’s about creating better value for customers-and profit for ourselves-by combining elements into innovative business designs” [43]. Delivering patient-centered care in the digital age enables us to transform patient interactions, both virtual and face-to-face. All systems must be aligned to support improved outcomes. As healthcare providers we need to ensure the requisite support including infrastructure and analytics to encourage access, utilization, and decision-making.

## **CONCLUSION**

The key to ongoing participation and engagement is developing healthcare innovations in a format in which the patient is familiar and comfortable. The design of these innovations should promote competence and confidence, and provide the requisite level of functionality required by the patient. Personalized interventions that incorporate elements of Gamification, Phygital™, and Social Engagement will be most effective in motivating behavior change and improved health and well-being. It must be fun! Healthcare providers must leverage their

expertise with regard to content, and enlist designers to focus on creating messages that will improve health and well-being.

**Additional Resources & Links:**

American Academy of Pediatrics. Prevention and Treatment of Childhood Overweight and Obesity: About Childhood Obesity

<http://www.aap.org/obesity/about.html>

CDC eHealth Metrics Dashboard

<http://www.cdc.gov/metrics/cdc-info/>

CDC Foundation

<http://www.cdcfoundation.org/blog-entry/tackling-obesity-one-school-time>

CDC. Overweight and Obesity: Basics About Childhood Obesity

<http://www.cdc.gov/obesity/childhood/basics.html>

CDC, Overweight and Obesity: Causes and Consequences

<http://www.cdc.gov/obesity/causes/index.html>

National Child Care Information and Technical Assistance Center

<http://www.icfi.com/insights/projects/families-and-communities/national-child-care-information-center>

WHO eHealth Programmes

<http://www.who.int/ehealth/programmes/en/index.html>

EMR capabilities

<http://www.healthit.gov>

Health Information Technology

<http://healthit.ahrq.gov/>

Health Alliance-works with mHealth community

<http://www.mhealthalliance.org/>

Health Unbound- online knowledge resource center and interactive network for the mHealth community

<http://www.hoohub.org/>

eHealth Initiative

<http://www.ehidc.org/>

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## CONFLICT OF INTEREST

The authors confirm that this chapter contents have no conflict of interest.

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