Applications, devices, services, and infrastructure converge as patients and providers take responsibility for cost, quality, and access to healthcare.
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EXECUTIVE SUMMARY

Mobility in healthcare is finally having a meaningful impact on the way care solutions are marketed, delivered, consumed, and administered. Collaboration, consumerism, generational attitudes about mobile devices, and a wide range of macro-economic trends are driving this change.

Since TripleTree’s initial forays into this sector over four years ago, innovations in Wireless and Mobile Health (mHealth) and the adjacent areas within healthcare and technology have grown markedly. Four years ago mHealth solutions were, for the most part, early stage initiatives geared exclusively toward tech-savvy clinicians and forward-thinking hospitals. Today, both technologies and attitudes are changing, making mHealth approachable to a broader audience including physicians, nurses, patients, payers, healthcare administrators, and consumers.

mHealth is enabling a shift in healthcare communications whereby physicians, hospitals, patients, and even payers are interacting on a more real-time basis. As a result, mission critical information is beginning to flow seamlessly across interoperable health enterprises to optimize patient safety. In addition, healthcare providers and payers are finding more efficient means to store, analyze, and leverage this information to improve the cost, quality, and accessibility of healthcare across the continuum. The proliferation of next generation mobile devices has substantially improved the timeliness and value of data and enabled new services to be delivered in a more cost effective manner. Similarly, the availability of a new generation of technology is quickly enabling nearly all healthcare constituents to achieve the common objective of improved outcomes.

Wireless mHealth value propositions and business models have become more tangible and as a result the willingness of patients and employers to proactively seek and invest in mHealth solutions has grown. Early support for mHealth was primarily driven by industry associations, progressive vendors, and venture stakeholders. Today, the arena is embraced by a more mainstream audience. Because of this foundational work, mHealth is emerging from the four corners of healthcare with a shared interest across medical technology, biopharmaceutical, healthcare provider, and payer sectors to help drive the next wave of innovation and adoption in the wireless and mobile healthcare space. Additionally, we are seeing tremendous momentum from the high-tech sector in driving this next wave of innovation and adoption through joint partnerships from the likes of GE and Intel (a partnership), UnitedHealth Group, Cisco, QUALCOMM, and many others.

Amid the current healthcare reform debate, the U.S. government, the private sector, and consumers are focused on the issues and questions regarding efficiency, cost, and safety of our healthcare system.
On February 17, 2009, President Barack Obama signed into law the **American Recovery & Reinvestment Act**. The health IT component of the Bill is the **HITECH Act**, which appropriates a net $19.5 billion dollars to encourage healthcare organizations to adopt and effectively utilize Electronic Health Records (EHR) and to establish health information exchanges all while ensuring that the systems deployed protect and safeguard the critical patient data at the core of the system. Behind these appropriations are strict guidelines around solution certification, **Health Insurance Productivity & Accountability Act (HIPAA)** privacy and security, and an ongoing effort to establish national standards to insure high degrees of interoperability among all healthcare IT systems. Additionally, the deployment of new systems will be held against “meaningful use” requirements to ensure that the most appropriate solutions are deployed around the industry.

These initiatives are intended to improve quality and efficiency and will reinforce the need for communication and connectivity in healthcare. These trends will increase the use of wireless solutions, encourage mobility, and create expectations around transparency and accountability.

Through our research and investment banking practice, TripleTree has identified hundreds of innovative firms bringing mHealth solutions to the marketplace. Recently, these vendors were invited to participate in a survey and application process to identify best-in-class, commercially available solutions in three categories:

- The growing need for more powerful **clinical applications**.
- Improving **operational effectiveness** in healthcare services.
- Providing a better **consumer experience** to produce more successful patient outcomes.

Select applicants were recognized with a **TripleTree I Award** at the 2009 **Wireless-Life Sciences Convergence Summit** in San Diego. The new approaches, business models, and strategies demonstrated by these firms are indicative of a new generation of mHealth capable of supporting new ‘ecosystems of care’ and more personalized services.

In this report (our fourth on mobile health), we continue our discussion on **Telemedicine 2.0** and **Remote Patient Monitoring** and assess how the evolution of mobile platforms and social tools are legitimizing the growth of mHealth. The report also contains an Appendix outlining the **I Award** survey findings and brief profiles of the 12 Award finalists.

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1 The following analysis was interpreted by TripleTree from H.R. 1, the American Recovery & Reinvestment Act, [http://www.govtrack.us/congress/bill.xpd?bill=h111-1](http://www.govtrack.us/congress/bill.xpd?bill=h111-1)
Triple Tree broadly defines wireless and mHealth solutions as any healthcare application or service that enables a seamless flow of information across cellular, wireless, or other mobile networks and mobile devices that improve clinical care delivery, patient-provider communications, enterprise-wide mobility, and decision support (patient, physician, provider, payer, and others). Wireless and mHealth solutions are ideally but not always platform agnostic and at their core are focused on “unlocking” healthcare information silos and seamlessly (and securely) enabling mission critical access to health information.

It is important to emphasize that mHealth is only a component of telehealth and telemedicine. mHealth solutions can fall into any one of the three areas or, encompass all three:

1. Applications (clinical/institutional, consumer-focused, and content).
2. Devices (mobile phones, sensors, medical devices, and others).
3. Infrastructure (both wireless and supporting wire-line and network services).

Figure 1: Marketplace Convergence Toward mHealth

mHealth’s momentum is occurring within the context of broader digital health initiatives geared toward maximizing patient safety, enterprise-wide health information, bridging the gap between hospital-based and ambulatory care, and linking patients with hospitals, physicians, payers and other managers of care. Additionally, given the low-cost/high-value proposition around medication therapy management (MTM) and the utilization of low-cost generic drug equivalents, the PBM industry is emerging as a relevant player in driving further innovation across the broader mHealth landscape, as it is part of the “first line of defense” for the chronically ill.

Today’s information technology industry is witnessing a sea change as some industry-centric phenomena (like digital health and mHealth) feel the impacts of SaaS and cloud computing. Cloud computing denotes access to shared computer, storage and communication services provided over the web “as needed” to a user; and billed “as used” by the provider. For healthcare, positive
impacts from cloud computing include advances in information management, diagnostics, healthcare imaging, healthcare IT, and the ability to implement HIPAA compliant services “in the cloud.” Benefits include increased user participation, more effective information consumption, and reduced computing costs. The broad IT trends surrounding healthcare services “in the cloud,” along with maturing mobile platforms, social tools, and mHealth features, will advance these initiatives even further and change the delivery of healthcare in profound ways.

As shown below in Figure 2, a number of information sources and motivational drivers influence how mobile devices may emerge as a hub for healthcare communities.

Effective approaches to mHealth go well beyond simply marrying a mobile device to a healthcare need. They require an appreciation for clinical and consumer healthcare workflows and services and the technical nuances of smartphones, mobile operating systems, applications, specialty devices, and wireless networks.

It is widely appreciated that these mHealth services may be supported via wireless connectivity from a cellular, public or private Wi-Fi, personal communication networks (such as Bluetooth), video conferencing, or machine-to-machine communications in forms like RFID. Prior TripleTree research publications on Telemedicine 2.0 and Remote Patient Monitoring include additional reviews of relevant technologies.

Some mHealth solutions are fairly simplistic and leverage commoditized cellular features like SMS (short message service or text messaging) and basic cell phone services. Others boast cutting-edge technologies and powerful
interfaces on next generation smartphones. Toward the emerging end of the mHealth spectrum, solutions may include micro-chip-infused pill monitors, robotic presence solutions, and sensor-equipped clothing connected to mHealth information portals.

Independent of the underlying technology, device, platform, or delivery network, mHealth solutions are designed to improve communications and to better connect people and resources across the patient/provider continuum to enhance patient participation in health-related decisions. As shown below in TripleTree’s mHealth Q-Diagram®, we have divided the mHealth ecosystem into three segments: Applications; Platforms and Devices; and Enablement.

Figure 3: mHealth Q-Diagram®
Marketplace examples of mHealth are increasingly visible as individuals, payers, providers, and governmental bodies recognize its potential. TripleTree is convinced that the “age of mHealth” is here and that the next decade of healthcare innovation will owe much to mHealth. As adoption occurs, mHealth will become so central to communications and delivery that eventually it will not be seen as unique. For now, mHealth evolution will be driven by the convergence of macro-economic needs, exogenous shocks, and social phenomena. Below are a few examples:

Healthcare Expenditures are Growing: The U.S. healthcare system is filled with structural defects and operating inefficiencies that have inflated administrative and healthcare service costs resulting in inadequate care and excessive waste. In 2008, these costs exceeded $2.5 trillion, an increase of approximately 7% from 2007.2 Healthcare spending now represents about 17% of our country’s gross domestic product (GDP), a larger percentage than that of any other industrialized country, according to the Agency for Healthcare Research and Quality (AHRQ).3 Healthcare spending in the U.S. could reach $3.1 trillion in 2012, and $4.3 trillion by 2016, when healthcare spending is projected to equal 20% of the U.S. GDP.4 To restrict such costs, stakeholders will explore every possible avenue.

Mobile solutions offer a new frontier of innovation and solutions to optimize patient safety, which in turn drives costs down, increases access, and impacts quality of care. mHealth connects, informs, and protects patients and caregivers in very powerful ways that ultimately drive costs down without compromising care. Below are several examples.

- **Error Mitigation:** mHealth stands to advance the patient safety movement across the industry given its ability to effectively mitigate adverse clinical care events across the hospital (and ambulatory setting) by unlocking the “information silos” and enabling integration and interoperability between clinical applications and mobile devices, enterprise-wide communication frameworks and health data management and decision support solutions.

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• **Patient/Provider Participation:** mHealth solutions empower patients with access to information and instant feedback on their respective conditions and pressing consumer-based needs (e.g. web-based access to “back to school” immunization reports) without having to rely on a records clerk or set foot in a hospital or clinic. Additionally, providers are increasingly embracing direct electronic communications with patients. This growth is enabled by the accessibility and simplicity of new applications and services, and is driven by patient expectations.

• **Prevention:** In conjunction with population health management initiatives, many consumer-facing mHealth solutions are preventative in nature, obviating the need to seek more expensive forms of care, and providing a face-to-face alternative to telephonic advocacy models.

• **Real-Time Diagnosis:** Ubiquitous, always-on monitoring allows for precise, timely diagnosis of disease states and emergency events, preventing more serious and costly conditions from developing.

**Integrating Fixed and Mobile:** mHealth does not wholly replace the fixed communications healthcare infrastructure but rather it complements existing communications and telemedicine solutions already in place. The real value of mHealth can only be realized when fixed and mobile communications (and workflows) are seamlessly integrated in such a way that lower cost or wider band fixed lines can be leveraged; and when appropriate workflows, communications, and activities can be moved into the wireless realm without disruption.

**Increased Federal Focus on Digital Health Initiatives:** An increased focus on cost controls, innovation, and the shifting trend to patient centrity are all themes germane to the healthcare community and echoed by the U.S. Federal Government. mHealth adoption will be driven in part by government financial incentives to implement digital health solutions. Specifically, the American Recovery and Reinvestment Act of 2009 will direct billions toward healthcare information technology and electronic health record (EHR) adoption. The plan calls for incentive payments of approximately $40,000 per physician and up to several million dollars for hospitals that adopt EHR solutions.

This transition to EHR should foster an environment that will allow mHealth to proliferate. As health records are made available “in the cloud,” enabling them to be accessed anywhere, anytime, and with any connected device, two benefits will be realized. First, providers will become comfortable with the idea of placing medical data outside their respective firewalls. Second, Federal funds will ultimately lay the ground work for a technological infrastructure that stakeholders need to truly leverage mHealth solutions.

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**American Well**
Online Care Solutions
www.americanwell.com

Boston-Based American Well™ has created the Online Care technology, that allows consumers to connect with physicians from their home or office whenever they have a health need. The innovation uses Web-based technologies and telephony to remove traditional barriers to healthcare access including insurance coverage, geography, mobility and time constraints.

**CardioNet**
Remote Cardiac Monitoring
www.cardionet.com

A pioneer of the mHealth space, CardioNet’s Mobile Cardiac Outpatient Telemetry™ (MCOT™), provides real-time analysis, automatic detection and transmission of cardiac ECG data for the diagnosis of cardiac arrhythmias. CardioNet’s clinical leadership and commercial success in mHealth has influenced technological progression in the space.
In addition to the more publicized Federal stimulus money being allocated toward digital health, there are other direct legislative initiatives that could drive mHealth.

- H.R. 2068 for example, also known as the *Medicare Teledigital Health Enhancement Act of 2009*, proposes to expand Medicare reimbursement to urban and suburban areas and allow doctors to monitor patients remotely.
- In recent publicly released statements from government officials and members of Congress, telemedicine solutions were recognized as tools to improve the access and quality of healthcare to a large number of Americans.

It is logical to remain skeptical that governmental intervention and stimulus to digitize medical records will drive a massive shift to connectivity in healthcare. Adoption of EHRs will take time (perhaps as many as five to eight years) – due to lack of standards – and will only foster an environment supportive of mHealth. True drivers of mHealth adoption must be more direct and provide meaningful impacts to payers, providers, and consumers.

**A Massive Shift in Connected Consumers:** TripleTree is convinced that consumers impassioned about their well being, or that of a loved one, will increasingly leverage social software functionality in conjunction with mobile devices to personalize and share their experiences. Networked paradigms are being built on websites such as Facebook, Twitter, and PatientsLikeMe. More and more, people are becoming accustomed to going online to connect and exchange ideas. Approximately 75-80% of U.S. adult internet users have looked for health information online, making internet resources second only to a physician when it comes to gathering trustworthy information about healthcare-related topics.6

Social-based mHealth is a natural extension of meshing social software with existing levels of mobile connectivity. With relatively simple tools, co-workers, parents, children, doctors and patients can interact with colleagues, friends, loved ones, “mommy-experts”, and communities to have conversations, get smart, and feel connected.

These growing demands for information and increased participation in social networking will have a massive spill-over effect on mHealth adoption:

- Patients wanting more access to healthcare information and providers.
- Doctors wanting to interact with colleagues to provide better care.
- Communities wanting to be informed about everything ranging from pandemic announcements to the latest treatments and regimens.

Mobile applications and consumer-facing mHealth solutions will increase the

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6 The Pew Internet and American Life Project.
reliance of consumers on communities relative to their healthcare decisions and have the potential for becoming the “e-wallets” of health information.

**The Power of the iPhone:** The iPhone has evolved into much more than a consumer electronics device; its’ attractive interface, application marketplace, and consumer appeal have contributed to a revolution in mobile computing. Similar to how the iPod created a paradigm shift in the delivery, production, and consumption of music, the iPhone will create an equally if not more dynamic disruption in patient-to-doctor, doctor-to-doctor and patient-to-community interactions – all of which are meaningful for healthcare.

Already dozens of mHealth applications have been made available for download to the iPhone – from basic calorie counting tools to high resolution medical image viewing, to doctor-to-patient video interfaces. Many more will soon emerge. Apple itself is a conduit for this innovation, and beyond the iPhone is applying for patents in healthcare-related technologies like in-home baby monitoring.

More important than the technological barriers that the iPhone breaks down is the powerful distribution channel and social impacts it drives. Ultimately, the most important value proposition of the iPhone for healthcare is its’ ability to influence millions of everyday consumers and doctors by getting them comfortable using their smartphone in a health-centric manner.

Patients and caregivers are also consumers. The inertia that many mHealth vendors struggle to overcome in a hospital, ambulatory, or long-term care setting is being addressed by Apple via its’ approach to consumers and a unique understanding of viral technology adoption.

While other popular smartphone devices like BlackBerry, Google Android, and new health-specific phones emerge, the iPhone has had an important role in mHealth awareness and adoption. Despite this, many questions for healthcare remain:

- Will an industry standard platform emerge or will the healthcare market support multiple devices with different standards?
- Healthcare applications for the iPhone are appearing weekly, but will health-oriented content sites evolve to suit the mobile user?
- Will web searching as we know it today convert to a more personalized search experience where behaviors and preferences are automatically intertwined with a web community?
- Will semantic or predictive search support mobile “look ups” and preferences help to determine which drugs, regiments or treatment protocols are most queried?
- Will seniors adopt smartphones or any other device given their predictable resistance to new technology?
The impact of wireless and mHealth on healthcare mirrors how the telecommunications industry leveraged mobile technologies over a decade ago. The goals of ubiquitous access, improved quality, and cost savings for constituents are the same, yet barriers persist.

Some challenges for mHealth include platform adoption, standards, usability, and security, but many applications and solutions have attempted to tackle these issues and are proving meaningful benefits to a broad spectrum of constituents. Below are a handful of examples of solutions and prevailing themes in mHealth.

**Enterprise Patient Safety:** Documentation and medical safety at the bedside is a greenfield opportunity for mHealth solutions and healthcare providers. Provider error at the bedside is a multi-million dollar annual drain on the healthcare system. Firms like [IntelliDOT](http://www.nehi.net/publications) enable hospitals to meet a variety of medical standards centered on patient identification, safety, and treatment. Such solutions are enhanced significantly by wireless interfaces and devices that allow for ubiquitous access anywhere on the medical campus.

**Asset Management:** Stakeholders are beginning to leverage location-based tracking technologies which provide an ability to locate medical equipment and other healthcare assets. Integrating these wireless systems into healthcare information systems optimizes inventory controls, reports on equipment maintenance, patient safety, and workflows.

**Drug Adherence and Compliance:** Adherence is a challenge for a vast majority of patients and non-compliance to treatment is estimated to cost the healthcare industry approximately $300 billion annually. The reasons for non-compliance are many and as shown in Figure 4, care providers are focused on instructing patients about proper and safe medication by using guidelines like the Five Rights of Medication Safety. [IntelliDOT](http://public-healthcare-issues.suite101.com/article.cfm/five_rights_of_medication_safety) has built upon this list by adding the Five Additional Rights of mHealth. These new Rights attempt to address adherence issues with approaches focused on costs and an assertion that improved compliance through innovations like wireless-enabled pill boxes and “pushed” text messages can lead to better health outcomes.

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7 [http://www.nehi.net/publications](http://www.nehi.net/publications).

**Content and Search:** Web 3.0 is also known as the semantic web. These solutions enhance search experiences that allow for better targeted, more accurate searches. Increasingly available on wireless handsets, healthcare specific Web 3.0 search and content tools allow clinicians to easily access information from any location to improve decision making at the point of care.

**Electronic Health Records (EHR)/ Personal Health Records (PHR):** A clear indicator of how far U.S. healthcare institutions must go to modernize their operations is conveyed in a survey in the April 16, 2009 issue of the *New England Journal of Medicine* which found that only 1.5% of the U.S. hospitals have a comprehensive electronic records system (i.e., present in all clinical units) in place, and just 7.6% have a basic system (i.e., present in at least one clinical unit). The hospitals that participated in the survey cited capital requirements and high maintenance costs as the primary barriers to implementation. These are barriers that cloud computing technologies in conjunction with an effective mobile strategy can readily solve, thus driving adoption.

**Patient Monitoring:** As previously noted in our prior reports, RPM solutions have quickly become the poster child for mHealth applications. Firms such as Medtronic, GE, and Philips are addressing the needs of home health monitoring and telemedicine. According to many industry sources, the market for these services is currently over $3 billion and will grow to over $8 billion by 2012. mHealth vendors are leveraging wireless technology to deliver non-invasive blood pressure monitors capable of providing ubiquitous reporting of the five primary vital sign indicators. With the premise of identifying adverse conditions at their inception, products from vendors like Triage Wireless send wireless alarms to caregivers when abnormalities occur. The Triage Wireless system also incorporates accelerometers that enables tracking of the patient’s activity level, posture, and if the patient has fallen.

**Patient and Provider Tracking:** Tracking the location of a patient during a treatment is a critical process that is often overlooked, typically leading to bottlenecks for in-patient care. mHealth solutions leveraging location-based solutions based on geospatial information or near field communications and RFID, offer visibility into a hospital’s workflow. Patient flows can be timed, tracked, and staff resources can be alerted as needed. Picture Archiving and Communication Systems (PACS) solutions support the storage, retrieval, distribution, and presentation of images. Consuming large amounts of computing power, storage, and communication bandwidth, these medical images can be efficiently stored in the cloud. mHealth vendors are developing applications that can interface with most PACS to send data to any smartphone, giving clinicians instant access to patient data from x-Rays, scans, and other monitoring devices.

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**Awarepoint**
Real-Time Awareness Platform - RTLS
Hospital Asset Tracking
www.awarepoint.com

Awarepoint’s wireless sensor network (WSN) and real-time location systems (RTLS) include its real-time awareness platform, firmware, RFID tags, sensors, and bridges. It’s technologies collect raw sensor data and transform that data into high-value positioning information that can be used to add RTLS awareness to a variety of healthcare and business applications.

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**Note:**
Two examples of RPM Solutions:

- **Home Health Monitoring:** Home health systems can help track rehabilitation, monitor care, and maintain a personal touch point with caregivers. The U.S. government is the largest payer of homecare services and continues to enforce regulation for reimbursements based on better compliance and positive patient outcomes. Increasingly, mHealth solutions are improving the ability of case managers to improve patient conditions and are paving the way for reimbursement.

- **PERS (Personal Emergency Response Systems):** According to government estimates, by 2030 about 71.5 million Americans will be over 65 years old, up from 37 million in 2006. It is estimated that about 40% of all seniors will fall in 2009. These falls represent a leading cause of accident-related deaths among seniors (fifth overall). According to the American Association of Homes and Services for the Aging (AAHSA), 95% of people aged 65 and older would prefer to live in their own home as long as possible, even when faced with declining health. PERS and mPERS solution providers allow seniors to notify emergency response teams and loved ones in the event of a fall, reducing response time and ultimately saving lives and giving seniors increased peace of mind.

**Remote Presence and Robotics:** Scarcity or limited access to care providers is a persistent problem within the healthcare system, especially in remote and congested metropolitan areas. Companies such as InTouch Health are working to solve this problem through the use of Remote Presence (RP). By leveraging next generation robotics and wireless technologies, InTouch allows physicians to be multiple places at once, extending their reach and decreasing time to care.

**Wireless Sensors:** Advances in sensor technologies, especially the ability to connect the sensors to a network wirelessly, enable the benefits of mHealth to be realized. TripleTree is following advances in wearable sensors, wand-like technologies, advances in textiles and sensor enabled fabrics, and other remote sensing technologies. For example, wireless stethoscopes have several advantages over conventional technology, including protecting the care provider at a comfortable distance from contagion, transmitting stethoscope data to a remote location for monitoring, retaining that data, and supporting volume adjustments depending on background noise. Additionally, these devices may ultimately be used by patients for self-diagnosis.
Care Access: mHealth expands telemedicine's promise of improved access to healthcare resources. Populations in rural areas and developing countries are obvious beneficiaries, but not the only ones. Mobility allows doctors more flexibility in scheduling workflows, providing patients in urban areas access to specialists in different cities, and provides easier access to health information around the clock from virtually any location.

Chronic Care Management: According to the Center for Disease Control (CDC), patients with chronic disease account for 75% of the country’s $1.7 trillion healthcare spending. While there are numerous examples of where mHealth solutions can address chronic care management needs, diabetes offers the most prevalent example. mHealth providers are developing platforms that provide ubiquitous monitoring, access to providers, and real-time alerts – easing the management of disease states and increasing patient adherence.

Community Safety: The University of Colorado at Boulder offers a workshop on Emerging Technologies in Disaster Management, and points to Facebook, Twitter, and mass text message alerts as tools governments can use to aid in disaster preparedness, response, and recovery. By leveraging mobile devices and solutions, health officials are better able to use mobile information technologies to support a sustainable information flow in developing countries and to break down the barriers to data utilization.

Crowd-Sourcing: Crowd-sourcing leverages the internet to aggregate data from a large group of participants in order to solve a complex and challenging problem. The University of Wisconsin has a study underway that tracks asthma patients with micro-GPS technology on a mobile device. Researchers are using mobile technologies and crowd-sourcing in an effort to learn more about how asthma attacks originate and whether there are correlations between asthma outbreaks and environmental conditions.

Information Access: With all the discussion of potential cost savings, innovative new applications, and improved workflows, perhaps the most fundamental change that will occur within healthcare over the next decade will be a shift to a patient-centric, participatory healthcare system.

The digital revolution enhanced consumer participation by providing a much better and more comprehensive access to information on particular medical conditions. HIPAA regulations have given patients rights to see their own medical files. As the use of phone-based platforms for adoption continues and accelerates, patients will have better access to their health information and that information will become increasingly portable.

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10 https://www.medica.com/C13/C5/NewsClinicBasedChronicCare/default.aspx
11 www.DataDyne.org; www.colorado.edu
The mobile phone and other cellular devices will eventually become the key platform for accessing health information and empower greater participation by providing improved information access, better visibility into medical records, and improved communication – all of which will lead to patient empowerment and better decision making.

**Safety for Seniors:** In addition to improved access and emergency response implications, health and safety challenges are escalating as medications become more powerful and our population grows older. Two-thirds of people over age 65, and almost three-quarters of people over 80, have multiple chronic health conditions.

While medication is an efficient therapeutic strategy for treating chronic disease, especially among the elderly, the average rate of medication compliance is only 50% after one year and continues to decline. mHealth providers such as GreatCall’s Jitterbug provide a unique handset with a limited set of keys and a user-friendly interface that includes a simple-to-use platform for the elderly, including medication reminders.
Relative to long-term consumption of mHealth solutions, the U.S. is at risk of becoming a laggard to developing nations. These nations typically have little or no formal healthcare networks or technology infrastructure, potentially allowing developing nations to leapfrog the U.S. with government-planned and funded initiatives. Moreover, cell phones, instead of computers are the central means of accessing information and technology. Access aside, many of these countries are rushing to implement mHealth technologies as the benefits of better access and decreased cost become attainable. As a highly scalable means of providing basic care to under-served patients, remote presence, mass notification of epidemics, and crowd-sourcing of disease patterns are a few of the many examples where mHealth will benefit developing nations.

In February 2009 the United Nations Foundation and the Vodafone Foundation published a paper “mHealth for Development: The Opportunity of Mobile Technology for Healthcare in the Developing World”. The 70-page report examines issues and the impact that mobile technologies will have in developing nations as they relate to meeting health needs and improving healthcare. An excerpt from the introduction of this report follows:

“Though mHealth is still in its early stages, it has already begun to transform delivery. Projects throughout the developing world are demonstrating concrete benefits, including:

- Increased access to healthcare and health-related information, particularly for hard-to-reach populations
- Improved ability to diagnose and track diseases
- Timelier, more actionable public health information
- Expanded access to ongoing medical education and training for health workers.

[The] report profiles more than 50 mHealth projects taking place in the developing world. The long-term goal is that such programs will make healthcare more effective, and have a demonstrable and significant positive impact on clinical outcomes such as reduced infant mortality, longer life spans, and decreased contraction of disease.”

Some examples of the positive impact mHealth has made to developing regions mentioned in the report include the following:

- In Uganda, a pilot program used wireless-enabled PDAs for disease surveillance, collection, and reporting. The program produced a 24% cost savings over the traditional paper approach.

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• In the Philippines, a pilot program designed to improve patient compliance with tuberculosis medication found that patients who received daily SMS text medication reminders jumped to over 90% adherence versus a typical 22% adherence for those patients who did not receive the text message.

• In Peru, healthcare workers used mobile phones to aggregate data on symptoms experienced by clinical trial participants, which allowed more accurate tracking of trial results and immediate responses to adverse symptoms.

The potential for mHealth to improve patient care in developing nations is enormous. Increasingly, because of investments in cellular networks and low-cost mobile devices, tens of millions of people who have no other computing or communications technology are beginning to use mobile phones to access health information and interact with healthcare workers. mHealth has the ability to improve health service delivery on a massive scale within developing nations.

**mHealth Opportunities:** mHealth opportunities in developing countries are not just centered on patient-centric communications over a cell phone. The limited fixed line and networking infrastructure in many developing countries puts facilities at a significant disadvantage in implementing more modern healthcare information technology and medical infrastructure. Rather than inefficiently retrofitting hospital and other care facilities with fixed network infrastructure, wireless broadband and near field communications solutions frequently provide the only opportunity to modernize voice and data communications.
ADOPTION CHALLENGES

TripleTree’s 2007 Telemedicine 2.0 and 2008 mHealth Remote Patient Monitoring reports optimistically reviewed many of the trends and opportunities surrounding wireless clinical applications, internal hospital campus wireless networking, and personal wireless solutions. Today, we remain just as bullish and believe momentum in mHealth is accelerating. However, we also recognize the challenges that must be addressed in order for mHealth to receive more mainstream adoption:

Adversity to Technological Change: One of the most important hurdles that mHealth faces is that the financial incentives in the U.S. healthcare systems have not historically rewarded early adoption of new technologies, changes, and workflows.

Because of the technological inertia that plagues the medical community, mHealth innovation must be driven by consumers, non-traditional players, the general IT community, and more entrepreneurial, forward-looking healthcare participants. Web developers, HIT vendors, global technology giants, mobile device makers, and telcos all have instrumental roles to play in advancing mHealth. Some of these groups have not focused on specific healthcare vertical solutions, but given the large market opportunity being driven by themes such as mHealth and cloud computing, more vendors will create healthcare specific solutions. Google, Apple, Intel, GE, and Microsoft have all recently announced increased participation in the digital health space. As healthcare continues to serve as a battleground for next generation technology solutions, TripleTree expects other vendors such as IBM, HP, and Nokia to respond with major announcements of their own.

Traditional healthcare players will follow suit. Successful mHealth application development and deployment will require a deep understanding of clinical issues, healthcare workflows, existing HIT environments, and the revenue/reimbursement cycle, all of which are plagued by inefficiencies and excess cost. By leveraging process specific expertise and a refined understanding of the healthcare system, traditional HIT players will begin to partner with emerging mHealth providers to create new ways to drive value to stakeholders.

Security and Compliance: Security and compliance is another major inhibitor of mHealth proliferation due to sensitivities around patient data. Any technology that transmits or stores sensitive medical information outside the firewall will face scrutiny regarding patient privacy, data security, and healthcare compliance. HIPAA guidelines place arduous policy restrictions on healthcare providers, sets high standards for data security and personal health information, and requires that states each have their own information compliance initiatives. Vendors have responded both by including workflow to address specific information compliance related issues and by advancing mobile security to ensure protection.

mHealth innovation must be driven by non-traditional stakeholders, the general IT community, and more entrepreneurial, forward-looking healthcare participants.
Wireless Technology and Standards: Wireless standards are continually changing. Although there are clear roadmaps for cellular, Bluetooth, and Wi-Fi, standards for newer technologies are for the most part non-existent. mHealth providers will continue to invest in resolving technological issues such as network interoperability and Radio Frequency (RF) interference.

Lack of standards is a common excuse skeptics reference when dismissing mHealth benefits. Waiting for standards could become the straw-man argument for postponing mHealth investments. Standards are continually evolving and are never concrete. TripleTree is of the opinion that most mobile applications are robust enough to support investment in solution development.

There are other technology areas where development and innovation would benefit mHealth and healthcare in general. Among these are:

- Improved battery performance for mobile devices, which is closely coupled with a need for focus on low-power radios to reduce RF interference and increase battery life
- Better integration between wireless technologies such as cellular and Wi-Fi
- Integration with legacy devices that are not wireless-enabled
- Standards and better shielding for RF interference in the clinical environment
- Lower cost devices such as disposable sensor technologies.

Regulatory Issues: As we noted in Telemedicine 2.0, regulatory issues are far from resolved in mHealth. In the aforementioned section, we also discussed the potential interference mobile devices can cause in hospital environments. Two federal agencies – the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA) claim jurisdiction rights over mobile devices in the healthcare arena. The FCC oversees all spectrum related issues and must approve mobile devices, while the FDA must approve all medical devices. Within mHealth there is a high degree of probability that any mobile device used within a medical environment will require FDA approval.

Consider this example: If an iPod includes an application for diabetes tracking or another medical use, does Apple need FDA approval before selling an iPod?

Beyond this, some other unresolved questions surrounding mHealth devices include regulations from state medical boards, regarding wireless communications spectrum interference, the role of governmental regulatory bodies in overseeing mobile devices, and global market applicability and compliance.
**Cost:** Much of this report highlights the potential benefits of mHealth, including cost savings for delivering healthcare. However, many mHealth clinical solutions require large, up-front costs to implement. These costs go well beyond the solution itself and include upgrading out-dated IT systems and infrastructures, as well as hospital and clinic workflows. Industry-wide and global discussions need to intensify around mHealth cost benefit, and encourage investment in mHealth initiatives. Without this focus, adoption will be slow to proceed. Industry initiatives from groups like the **CTIA Wireless Association**, the **Wireless Life Sciences Alliances**, and **Continua Health Alliance** offer important contributions to the mHealth dialogue and the encourage industry investment. These discussions must grow considerably.

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13 Link to http://www.ctia.org
14 Link to http://wirelesslifesciences.org
15 Link to http://www.continuaalliance.org
The progress mHealth has made over the past four years will be eclipsed by even more mHealth advancements in the next 18 months. We predict that by the end of 2011, mHealth will become part of the everyday dialogue of healthcare rather than an interesting side note of digital health. As mHealth initiatives take shape and its benefits are proven in both advanced and developing healthcare markets, investment and participation from well capitalized players will position it as a top area of focus within the healthcare value chain.

This value chain will include consumer-centric approaches to improving the cost, quality, and access to healthcare, and require mobile applications and platforms to be medical grade, scalable, and secure yet approachable.

The explosive adoption of mobile devices is converging headlong into many of the technological, business related, clinical, and regulatory problems facing healthcare. Similar to the positive impacts made in business settings, mobile platforms will bring the best of consumer mobile to the healthcare market. These attributes include:

**Motivation and Communication:** TripleTree is convinced that health plans will gravitate toward mHealth approaches and tools that enhance member communications by making it easier for them to take ownership and a more active role in their healthcare.

**Observe, Listen and Share:** TripleTree believes that the influence of social tools is growing exponentially and that it needs to be incorporated into product development and customer experience management disciplines. mHealth presents a unique opportunity to merge social applications and health-centric communities and empower healthcare providers and payers to treat patients with compassion.

TripleTree has a strong appreciation for the consolidation opportunities on the horizon as mHealth matures. On the following page is list of key considerations and questions mHealth executives and their investors should consider over the next few quarters.
**Application Ecosystems & Platform Maturity:**

- How will mHealth impact telehealth? Is there still a role for fixed network infrastructure or will everything go mobile?
- How will the falling cost of cellular service influence the price of medical grade technology?
- Because of the sheer variety of mobile devices, will patients be forced to accept a “lowest common denominator” of functionality and features?

**Integration of Healthcare Technologies:**

- How will providers integrate remote diagnostics to drive more patient dataflow, better patient telemetry, and drug dose targeting?

**Business Models:**

- Given the disparate mHealth pricing models, when will stabilizing macro-forces emerge?
- Will mobile applications simply be web applications in mobile clothing?
- Will the mHealth marketplace need to define an educational role for sales professionals, similar to the model that define much of the life sciences and pharma industries?

**Social Tools & Communities:**

- Will consumer-based collaboration tools continue to proliferate in the workplace?
- How will the healthcare master brands react as their marketing messages give way to community representations of their product or service?
- Will social identities follow users from one website to another?

As an investment bank and strategic advisor, TripleTree is committed to helping emerging companies and global leaders understand how to take advantage of macro-trends and optimize strategic opportunities through M&A or with growth capital.

We look forward to learning more about your organization, answering any questions you may have about this report, understanding the opportunities and challenges shaping your vision, and how we can help accelerate your success.

The next section of this report includes findings from our Spring 2009 nomination and application process for the **TripleTree I Award**, recognizing insight, innovation, and initiative in disruptive technologies.
The I Award program was created by TripleTree to showcase companies developing and delivering disruptive technologies and services demonstrating insight, innovation, and initiative in the wireless-life sciences sector. For 2009, recognition was presented in three categories.

OPERATIONAL EFFECTIVENESS SOLUTION:
Best mobile or wireless solution for reducing costs and improving operational efficiency

CLINICAL SOLUTION:
Best mobile or wireless-life science solution that enriches clinical care

CONSUMER EXPERIENCE SOLUTION:
Best mobile or wireless experience to the consumer or patient

The winners were announced at the 4th Annual Wireless-Life Science Alliance Convergence Summit in San Diego, May 2009.

See pages 30-33 for finalists and winners.

I AWARD APPLICATION SYNOPSIS

The following summarizes data provided by I Award applicants, TripleTree primary research, and other public sources as noted.

**TripleTree’s I Award** application and survey (Q2 2009), was sent to over 250 senior executives across numerous healthcare segments. Thirty-two companies responded. Participants were asked a broad array of questions designed to canvass the evolving mHealth vendor landscape to capture trends and to identify best-in-class solutions. The applicants were asked questions regarding their wireless and mHealth solution:

1. The problem addressed by the solution.
2. The innovative and disruptive qualities of their solution.
3. The measurable results and effectiveness of their solution.
4. The long-term impact and implications their solution has on the healthcare industry.
5. High level questions about their business model.

Given the early stage nature of the space and context of the award, TripleTree was pleased with the response rate and the quality of applications submitted. The majority of the completed applications were thorough. Many respondents validated their answers by citing scientific journals, clinical trials, and patent filings. All respondents were told their responses would be used for research purposes and were ensured that their individual responses would be kept in confidence. Below are the summaries of the responses.

**COMPANY AND RESPONDENT PROFILE**

**Respondent’s Organizational Role:** The majority of respondents were key executives and chief technologists at independently operated, emerging mHealth firms. The respondents came from a diverse range of functional backgrounds; most were engineers, academics, doctors and serial entrepreneurs, while others had been traditional business operators.

- 66% identified themselves as the CEO, President and/or Founder.
- 19% identified themselves as a VP or manager of marketing, business development or public relations.

**Figure A-1: Respondents Reported Position/Role**

<table>
<thead>
<tr>
<th>Role</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEO, President and/or Founder</td>
<td>66%</td>
</tr>
<tr>
<td>Marketing Role</td>
<td>19%</td>
</tr>
<tr>
<td>Other</td>
<td>15%</td>
</tr>
</tbody>
</table>
**Segmentation:** All of the respondents were asked to classify their solutions as one of the three aforementioned mHealth segments (Clinical, Consumer and Operational Effectiveness). Forty-one (41%) of the applicants identified themselves as clinical application vendors, while 22% and 37% categorized themselves as providing operational effectiveness or consumer effectiveness solutions, respectively.

Figure A-2: mHealth Segmentation

<table>
<thead>
<tr>
<th>Segment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical</td>
<td>41%</td>
</tr>
<tr>
<td>Consumer</td>
<td>37%</td>
</tr>
<tr>
<td>Operational</td>
<td>22%</td>
</tr>
</tbody>
</table>

**Geography and Ownership:** Most of the companies represented (94%) were privately held, U.S. companies. Of those companies that were private, there was an even split between those with institutional funding and those without it.

Figure A-3: Geographic Location

- USA: 90%
- Canada: 6%
- Western Europe: 4%

Figure A-4: Ownership

- Private: 94%
- Public: 6%

**Reported Annual Revenue:** Many of the respondents could be categorized as emerging vendors, with 38% reporting less than $1 million in revenue and 28% reported being pre-revenue. There were few vendors, 12%, who reported more than $10 million in revenue. Drawing from our database of over 250 companies that have mHealth solutions, we felt the survey was fairly representative of the overall market, slightly more representing the number of pure-play mHealth vendors over $5 million in revenue.

Figure A-5: Annual Reported Income

- $50m: 6%
- $10-50m: 6%
- $5-10m: 9%
- $1-5m: 9%
- <$1.0m: 38%
- Pre-Revenue: 28%
- No Response: 3%
MOBILE PLATFORMS CAPABILITIES

Many of the I Award finalists differentiated their solutions by delivering strong analytics, administrative, collaborative, compliance, and content or workflow management capabilities. As content and the ability to derive meaningful data through mHealth platforms emerge as key value propositions offered by most applicants, robust back-end analytics capabilities and dashboards will eventually become a necessity.

Figure A-6: Solution Features

<table>
<thead>
<tr>
<th>Function</th>
<th>Clinical</th>
<th>Consumer</th>
<th>Operational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytics</td>
<td>34%</td>
<td>34%</td>
<td>13%</td>
</tr>
<tr>
<td>Administration</td>
<td>3%</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>Collaboration</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Compliance</td>
<td>3%</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>Content</td>
<td>9%</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>Workflow</td>
<td>9%</td>
<td>9%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Analytics: Dashboards and analytics were by far the most common feature among the wireless and mHealth vendors surveyed. Eighty-one (81)% of respondents leverage a back-end analytics component. These capabilities were common in both clinical and consumer-oriented platforms. While real-time patient monitoring and patient compliance were key value drivers with caregivers, having instant access to key biometric data and the ability to independently and easily track progress were key themes that resonated well with consumers. Relevance of data and ease of interpretation were top-of-mind issues that resonated with applicants when considering the design and use of mHealth analytics capabilities.

Administration: Very few of those surveyed leveraged administrative capabilities like online billing or metering services, yet the market for such features will begin to take shape as approaches to wireless clinical and operational effectiveness matures. Of the solutions surveyed, capabilities that allow caregivers and hospital administrators to customize the solution to their specific needs and restrict access were central.

Collaboration: As transparency, communication, and patient access become increasingly important to healthcare, collaboration functionalities begin to permeate into mHealth solution platforms. Several of the companies surveyed boasted collaborative capabilities.
Most existing solutions centered on providing avenues for the patient to communicate directly with his or her caregiver or with other patients via social networks. Not only does this drive value by extending the doctor-to-patient relationship, it fosters an environment that encourages patients to take more ownership of their health and lifestyle.

**Compliance:** HIPAA compliance and other regulatory mandates governing healthcare have historically lacked enforcement, obviating the need for technologies that enhance healthcare compliance. As penalties have increasingly become more rigid, healthcare IT providers have begun integrating features and functionalities that better manage workflow and align healthcare processes with compliance mandates. Examples of how mHealth providers fill this role include enhancing security for wireless communications, leveraging wireless handsets to verify provider procedures, and integrating asset tracking into workflow and processes.

**Content:** Proprietary content specific to the patient conditions and provider needs will be key in differentiating how a host of mHealth vendors separate themselves from more commoditized legacy solutions. How companies take user-generated data and provide meaningful feedback and prescribe tangible, easy to understand, actionable items will be central to creating value to the end-user. On the clinical side, data management and document management were other themes that resonated with applicants.

**Workflow:** Workflow capabilities were moderately prevalent in operational effectiveness platforms but virtually non-existent in consumer suites. The most effective solutions leveraged location-based services or Wi-Fi technology that tracks patients and/or employees, allowing administrators to monitor and assign resources appropriately. Vendors are looking to leverage wireless handsets to tie workflow to document management and compliance suites to further extend the value chain.
TARGET MARKETS

Broadly speaking, mHealth vendors target either clinical or consumer markets. These two markets have distinct demands, often posing major challenges for mHealth vendors seeking to sell into both markets. Not only must they compete with the engineering and scientific prowess of Medtronic, Boston Scientific, and St. Jude, but they also match the consumer brand and appeal of Nike, Philips, and Apple. On one hand, vendors must deliver solutions that are both medical grade and appealing to consumers. On the other, most mHealth solutions are paid for by out of pocket, non-subsidized dollars, severely limiting the amount of money consumers can ultimately pay.

Clinical Markets: Just over half of mHealth companies surveyed sell directly to providers. This is not surprising as the clinical market is the more mature of the two. Many medical device makers and healthcare IT providers are beginning to figure out how to integrate wireless capabilities into their product roadmaps. As healthcare providers continue to recognize the value propositions afforded by wireless communications and hospitals continue to embrace wireless infrastructures, TripleTree expects this market to continue to grow. Examples of clinical provider solutions include:

- Asset and Patient Tracking
- Wireless Robotics
- Electronic Medical Records
- Document Management
- Informatics

Currently, most mHealth vendors have chosen to target only one of the two aforementioned markets. Of the mHealth vendors that respondent to the I Award survey, only 12.5% indicated they served both the consumer and clinical markets.

Source: TripleTree, LLC
**Consumer Markets:** Just under half of the mHealth vendors surveyed are targeting or planning to target the consumer market. TripleTree expects the ratio of consumer-to-clinical offerings to increase over the next 12-18 months given the infusion of consumerism into healthcare and the advent of various Web 2.0 and mHealth delivery models that specifically target consumers. As consumer handsets have matured and value propositions have become more tangible, global retailers such as Best Buy and Walgreens have begun to realize the size and relevance of mHealth, and are actively exploring ways to participate in the market. Examples of consumer solutions include:

- PHRs
- Fitness Applications
- Social Health Communities
- Smartphone mHealth Applications

**DISCRETE MARKET OPPORTUNITIES AND ADOPTION RATES IN NEXT GENERATION HEALTHCARE**

The graph below compares a sample of discrete mHealth markets in terms of technological market readiness and adoption against more established healthcare IT solutions. The size of the respective circles represents the number of independent vendors in these particular markets. As TripleTree predicted in Telemedicine 2.0 and reinforced in this report, mHealth is still emerging and not yet ready for mainstream adoption. Although several discrete markets are showing signs of increased adoption, overcoming the healthcare industry’s slowness to adopt new technologies and proving a justifiable ROI to patients and providers will prove to be the most substantial barriers to growth.

The extent to which existing incumbent healthcare vendors can cross-sell mHealth solutions and the extent to which healthcare juggernauts such as GE and Siemens can evangelize the benefits of wireless will be the primary drivers for adoption of these particular solutions.

**Figure A-10: Discrete mHealth Market**

Source: TripleTree, LLC
The following summaries of mHealth vendors are those firms who were selected as finalists for the 2009 I Award program. TripleTree was highly impressed with the quality of applicants and their solutions and looks forward to reviewing another slate of applications for the 2010 I Awards.

**BeWell Mobile**  
Chronic Disease Management Applications  
www.bewellmobile.com

BeWell offers a disease management platform that allows patients and providers to better manage chronic conditions by improving adherence and increasing doctor-patient collaboration. BeWell differentiates its technology platform by enabling collaboration through its ‘patient’ and ‘provider’ interfaces. One of the main features of its patient interface is its mobile diary which prompts a patient to enter biometric, symptomatic and environmental data. The provider interface then allows doctors to review this information and determine whether a patient is adhering to their regimens or requires additional treatment.

**CellTrak Technologies**  
Homecare Automation  
www.celltrakgps.com

CellTrak provides mobile solutions for homecare providers. CellTrak's mobile solution increases compliance, productivity and the operational effectiveness of home care providers by improving workflow, ‘getting rid of the paper’ and providing caregivers with additional patient information. The solution enables homecare administrators to manage staff more efficiently and reduce fraud by tracking workers and mapping out routes by using the cell phone's GPS chip. The solution also provides caregivers the ability to complete visit records and view additional information regarding the patient on site.

**Diversinet**  
Data Security  
www.diversinet.com

Diversinet solves critical pain points that plague the mHealth and the broader healthcare market: transparency and data security. The company provides wireless authentication solutions that secure sensitive transmitted by mHealth solutions and other mobile devices. By maintaining secure connectivity, Diversinet allows subscribers to safely and ubiquitously access personal health information, secure transactions, and prevent identity theft. This environment helps facilitate the transparency required to deliver more collaborative and compliant healthcare. By providing consumers and providers with safe, real time, access to medical information, Diversinet helps to expedite the time to treatment process.
Epocrates
Rx Drug and Formulary Reference
www.epocrates.com

Epocrates offers mobile information and decision making tools that enable healthcare providers to respond to questions and make decisions more quickly. Its solution consists of a mobile application that provides doctors with drug and other non-patient medical information. Epocrates, like many other mHealth vendors, is leveraging smart phones (particularly the iPhone) to deliver their solutions, making them highly accessible and more mobile. Epocrates’ solutions are available on multiple mobile platforms and online.

Great Call/Jitterbug
Increased Independence
www.jitterbug.com

Through the Jitterbug brand, Great Call delivers cellular-based health and emergency response services to the geriatrics market. Great Call is relevant because it is the largest independent mHealth vendor that solves the ‘who pays’ problem by creating a direct to consumer model for an in-demand health services offering to a large, established market. Jitterbug phones feature push-to-talk live support and an intuitive design making them simple, easy-to-use and ideal for seniors seeking to establish a greater degree of independence. As part of their subscription, seniors have 24-hour unlimited access to registered nurses, reducing the cost and dependence of physical care.

IntelliDOT
Bedside Administration/Safety
www.intellidotcorp.com

Human error at the bedside is a serious problem in healthcare administration that kills thousands and severely injures hundreds of thousands more. In addition to the human cost, the economic impact is also a significant burden for affected hospitals. Centered around a wireless handset, IntelliDOT applies a workflow manager that integrates with pharmacy and healthcare information systems at the point of care. With the goal of eliminating human error, IntelliDOT enhances patient safety by putting processes in place to verify patients receive the right medication and documents while automating documentation and follow-up.
MedApps
Mobile Wireless Health Monitoring
www.medapps.net

Patient adherence through usability and ubiquity are MedApps’ primary goals. Usability leads to better compliance which leads to better patient outcomes. Leveraging Microsoft’s HealthVault Electronic Health Record, the MedApps platform extends from their proprietary remote patient monitoring devices to a web-based provider portal. By utilizing carrier agnostic cellular communications, MedApps eliminates several barriers patients usually face when seeking a truly ubiquitous remote patient monitoring solution.

MicroCHIPS
Implantable Glucose Monitoring System
www.mchips.com

Wireless implantable platforms are the ultimate manifestation of providing always on, ubiquitous biometric monitoring. MicroCHIPS is attempting to transform the way diabetics manage long term conditions and replace “finger stick” testing with implantable, continuous glucose monitoring solutions. By providing patients and caregivers a richer, more accurate data feed, MicroCHIPS enhances self management by giving patients and providers timelier, relevant alerts.

PhiloMetron
Wireless Calorie Monitoring
www.philometron.com

Successful weight management is based upon the consumer’s ability to understand and correctly estimate their daily food intake and energy expenditure. PhiloMetron is transforming this space by developing a weight management system based around a behavioral feedback system driven by a proprietary monitoring platform that measures the actual number of calories the subscriber consumes and expends. By integrating monitoring and behavioral feedback, PhiloMetron’s system mitigates the guess work involved in weight management and eliminates several underlying barriers typically associated with health management.
Proteus Biomedical
Electronically Observed Pharmaceutical Therapy
www.proteusbiomed.com

Proteus is disrupting the market with an ingestible event marker (IEM) sensor technology. This technology solves the problem that most implantable therapies face when inserted into the body, disintegration electronics off electronics. IEMs, activated once swallowed, sends signals to a microelectronic receiver, extracting patient specific physiological information which ultimately leads to more customized therapeutic care.

Tagnos
Patient Flow Management
www.tagnos.com

Tagnos provides a solution to help manage patient flow in hospitals, surgery centers and other medical facilities. Tagnos’ solution monitors the patients using sensors placed throughout the hospital, allowing medical staff to more easily locate patients. As a result, administrators can more efficiently schedule appointments, increase overall productivity and optimize staff resources. Tagnos has differentiated itself from other operation effectiveness solutions by having strong workflow, administrative, and dashboard capabilities, which allow administrators to reduce patient wait time and increase doctor efficiency.

Triage Wireless
In Hospital Vital Signs Monitoring
www.triagewireless.com

Most hospital systems currently fail to detect preventable, yet life-threatening conditions that arise in the hospital setting. Leveraging wireless body-area network communications (WBAN) and wearable sensors, Triage Wireless provides continuous vital signs monitoring to hospital-bound patients. With the ability to detect and notify caregivers when clinical deterioration is still in its early stages, Triage targets the hundreds and thousands of unnecessary deaths a year that originate while patients are in the hospital.
Kevin Green, Co-Founding Managing Partner
- Co-founded TripleTree, LLC
- 30+ years of operational, M&A and capital raising experience having advised over 100 companies
- Over 2 decades of healthcare operating experience in both public and private companies; two as CEO
- Active with numerous associations and boards, including BCBS-MN
- BA and MBA, University of San Diego

David Henderson, Co-Founding Managing Partner
- Co-founded TripleTree, LLC
- Former COO of a $90 million telecom company
- 30+ years in venture capital and operating expertise
- 7+ years in public accounting with Arthur Andersen
- Active Board of Director on several public and private companies
- BA, Moorhead State University; Certified Public Accountant

Peter Erickson, Managing Partner
- Joined TripleTree in 1998
- Special emphasis on life sciences, consumer health, health and wellness, mobility, and human capital management
- Engaged in more than 30 engagements with leading companies such as HCSC, Fiserv and Microsoft; client representation across both technology and healthcare sectors
- BA, DePauw University; MBA, Carlson School of Management, University of Minnesota

Joseph Schiesl, Managing Partner
- Joined TripleTree in 2007
- 30+ years experience in software and technology services in the healthcare industry; senior executive roles in public and private companies
- Senior executive and operating roles at CyCare Systems, MCS at Diversified Pharmaceutical Systems, ValueRx Pharmacy Benefit Management Services, and UHS
- BA, Loras College

Scott Tudor, Managing Partner
- Joined TripleTree in 1998
- Specializes in IT Outsourcing & Managed Services and Healthcare IT
- Engaged in more than 40 transactions with leading and global companies such as Experian, HCSC, UnitedHealth Group, HP, Compaq Computer, Verizon, Cardinal Health, Avanade, and Ciber. Served as TripleTree’s research chairman
- Previously practiced law
- BA and JD, University of Illinois; MBA, Carlson School of Management, University of Minnesota
TRIPLE TREE’S WIRELESS & MOBILE HEALTH TEAM

Rob McCray, JD – Senior Advisor
• Chairman, Wireless-Life Sciences Alliance
• 25+ years experience as a business owner, senior operating executive and legal and transactional advisor to public and private companies
• Chairman and one of the founding members of the Wireless-Life Sciences Alliance
• Active Board of Director with several public and private companies
• Graduate of the University of California, Davis School of Law and the University of California, San Diego

Thomas (Tad) O’Donnell, III – Senior Advisor
• Co-Founding Managing General Partner, TT Private Equity
• 15+ years investment experience in healthcare service and healthcare information technology
• Previously General Partner at HLM Venture Partners, a healthcare focused venture capital partnership with over $400 million in capital commitments
• Began career as an investment banking analyst in the Health Care Group at Smith Barney and moved on to Greylock and General Catalyst
• BA and MBA, Harvard University

Chris Hoffmann, Senior Principal & Research Director
• Joined TripleTree in 2005
• 20+ years of experience as an operating/sales executive, consultant, and analyst in the technology industry
• Former President of Tier 1 Research; executive positions at Gartner, GE Capital, and IBM Global Services
• 2006-Present SIIA Software Division Board member
• BA, University of Minnesota-Duluth; advanced studies through the University of Minnesota and Michigan State University

Ryan Stewart, Senior Principal
• Joined TripleTree in 2009
• 15+ years of healthcare industry experience
• Senior healthcare banker with Lazard; senior research analyst with Piper Jaffray; corporate strategy executive with UHG. Began career with Horizon Blue Cross Blue Shield of New Jersey
• Founder/CEO of a venture-backed pharmaceutical technology company
• BA, Lafayette College

Team continued on next page...
TRIPLE TREE’S WIRELESS & MOBILE HEALTH TEAM

Scott Donahue, Principal
• Joined TripleTree in 2006
• 15+ years financial strategy analysis and business development consultation including marketing, operations support, and technical product development
• Expertise in technology operations and services delivery approaches
• Previous Wall Street experience
• BA, University of California – Santa Barbara; MBA, University of Michigan

Jason Grais, Senior Associate
• Joined TripleTree in 2006
• Special emphasis on healthcare analytics, mobility, life sciences, and workers' compensation
• Previous experience at Fair Isaac, Arthur Andersen, and BearingPoint
• BBA in Finance, University of Wisconsin; MBA, Carlson School of Management, University of Minnesota

Michael Boardman, Senior Analyst
• Joined TripleTree in 2006
• Specializes in research and analysis of industry trends and investment opportunities within Software and IT services
• Previous experience at Merrill Lynch
• Held a Cisco Certified Networking Associate Degree (CCNA)
• BA, Carlson School of Management, University of Minnesota

Judd Stevens, Senior Analyst
• Joined TripleTree in 2008
• Primary focus on healthcare services and technology
• Previous corporate experience at Honeywell
• BA in Finance, Carlson School of Management, University of Minnesota

Jonathan Sass, Analyst
• Joined TripleTree in 2008
• Primary focus on technology with an emphasis on SaaS and Cloud Computing
• BS, Applied Physics, Bethel University
TripleTree, LLC is an independent, middle market investment banking firm focused on mergers and acquisitions, financial restructuring, principal investing, and strategic advisory services for healthcare and technology companies. The firm specializes in growth businesses, vertical industry specialization, and disruptive technology delivery models.

For over a decade, TripleTree Research has been a cornerstone of our investment banking model.

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