Center for Entrepreneurship & Technology
University of California, Berkeley

Technical Brief

Virtual Doctor’s Office

Engineering Leadership Professional Program

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I. EXISTING MARKET & GROWTH TRENDS

Telemedicine is coming of age with today’s technological advancements, and high-speed Internet revolution. Healthcare & insurance costs across the world are skyrocketing whereas employee copays continue to see an upward trend. Telemedicine, and remote patient monitoring is slowly becoming a favorable alternative to offset these high costs garnered via traditional models.

High profile businessmen and entrepreneurs are sensing the growth potential of telemedicine segment and are making huge investments in it.

Frost & Sullivan conducted revenue forecast of Telehealth industry by vertical markets for North America region in 2012. Total Telehealth Market revenue in 2012 was $2.39 Billion, with Video Monitoring (@11.4%, $280M), mHealth – Mobile Health (@17.5%, $430M) and Remote Patient Monitoring (@71.1%, $1.74B). Of these verticals, Video Monitoring sector is projected to grow at 16.5% YOY to $600M market by 2017.

On the other hand, global Remote Patient Monitoring is already a $5.5 billion thriving market with promising growth potential. eWeek published an article depicting Remote Patient Monitoring to grow at a healthy rate of 35% YOY to reach $26 billion by 2018. A lot of it is attributed to proliferation of internet access across the world, and adoption of mobile devices such as smartphones, tablets etc.
The feedback from end-users and potential customers has been extremely favorable. In a survey conducted by Frost & Sullivan, correspondents were asked to rate sectors that will have the highest impact on telehealth industry. Home health care & disease management, Remote physician/specialist services and Telemental health sectors appeared to be clear frontrunners with greater than 70% ratings. Other survey findings also revealed consumers showing increased interest and enthusiasm for using mobile devices to engage with healthcare providers.

Promising potential coupled with healthy demand has fueled interest from investors, and companies. What we see today are investor-backed startup companies tried to capitalize the market and meet projected demand. We see a lot of mergers, acquisition and partnering activities in this space. In addition, the low cost telehealth alternative has garnered tremendous interest from employers and insurance companies trying to cut down on employee benefit costs and operating expenses to improve their respective profit margins. Since majority of current market addresses non emergency situations, we see novice and technology savvy doctors signing up to become online medicinal practitioners.
II. CURRENT PLAYERS

The growth trends in this market have spawned many different types of companies trying to capitalize on this trend. There are existing health care providers that are trying to expand their business models with telemedicine as well as newer players coming with their own services. There are companies providing point solutions to others that encompass a much broader spectrum of telemedicine.

We have categorized the current players into three groups:

1. REMOTE PATIENT MONITORING:
   These are the companies that provide services and technology to enable monitoring of patient vital statistics from remote location. This could be a round-the-clock monitoring or need based monitoring. The market for this segment is estimated to be $1.74B.

2. PSYCHIATRIC MONITORING
   There are various companies that are offering counseling for psychiatric evaluations, therapy and non-critical mental care using latest communication technologies. The model is around providing counseling through professionals that can be remote and interact with patients via web, video or mobile devices. This is a growing segment and is currently estimated to be around $430M.

3. INTERACTIVE
   This segment includes companies that are a combination of services and technologies. They provide interactive medical diagnostic using web, mobile and other diagnostic technologies. There are some existing health providers that are providing additional remote and interactive services as well. The total market segment is estimated at $280M.
Some of the key players are:

**Zephyr:** Zephyr (which is now part of Medtronics) is a company providing solutions for seamless remote patient care. It was founded in 2003 and has developed devices and mobile software for remote monitoring.

**SensioTec:** Incubated at the Georgia Tech Advanced Technology center, SensioTec has developed a contact-less patient monitoring platform (VirtualMedicalAssistant). Sensiotec was founded in 2011 and has attracted good investments.

**Preventice:** Preventice builds software that serves the needs of medical community by leveraging the emerging communication and monitoring technologies. Preventice has developed remote monitoring systems, working with establishments like Merck and Mayo clinic to improve the effectiveness and efficiencies of healthcare services.

**MDLIVE:** Founded in 2009, MDLIVE is a telehealth provider of online and on-demand healthcare delivery services and software that benefit patients, hospitals, employers, payers, physician practice groups and accountable care organizations. They provide cloud-based Virtual Medical Office software platform which makes it possible for patients, medical professionals and plan administrators to collaborate seamlessly and securely via voice, video, email and mobile devices. Payers and providers can also utilize the HIPAA-compliant system to collect and share clinical data from patient medical records, lab results and in-home biometric devices for real-time risk assessments, wellness advice, diagnosis and treatment. They also provide affordable, 24/7/365 consultations via a nationwide network of board certified physicians and licensed therapists.

**UPMC Anywhere:** UPMC AnywhereCare offers patients with non-emergency symptoms the opportunity to seek care via an online medical visit from a health care
provider. AnywhereCare consists of a clinical questionnaire about specific symptoms you are experiencing, as well as follow-up secure messaging between the patient and the UPMC provider for any additional information regarding your symptoms as determined by the UPMC provider. Based on your answers to the questionnaire and answers to any follow-up questions, a health care provider will respond via secure messaging or video with a diagnosis and recommended course of action.

**CellScope:** CellScope’s mission is to create the world’s first smartphone-enabled digital tool kit. It’s a recent startup with products that are designed to be accessible and backed by data-driven services to improve delivery and expand access of care. CellScope was part of Rock Health’s inaugural class of healthcare startups and is primarily funded by Khosla Ventures.

**TalkSpace:** Talkspace is making therapy available and affordable by providing remote access to therapists. They have a network of leading therapists that can provide professional advise for various non-critical mental health issues.

Above is a very small sample set of a growing number of companies that have started engaging in this market over last few years and have started gaining a lot of traction.
III: BARRIERS

Although Remote Patient Monitoring revenues are expected to grow at a compound annual growth rate of 35 percent between 2013 and 2018, the remote health monitoring technologies -- the devices that gather a patient’s health data and relay it to a care provider -- have been the subject of much study in recent years. Proponents have praised the potential of this technology to bring down health care costs and improve overall quality of life for patients, while skeptics have raised concerns about lack of concrete evidence supporting any such claims. Although many studies have been conducted to test the effectiveness of remote health monitoring, the results continue to be mixed. There are many questions on who needs RPM, who wants, and who would stand to benefit from remote health monitoring applications.

There are many barriers to adoption of telemedicine in general based on the team’s research. These barriers include –
- Regulatory challenges
- Insurances
- Hospital ambivalence
- Physician workflow challenges
- Patient challenges

Regulatory Challenges -
Difficulty and cost of obtaining licenses across multiple states, malpractice protection and privileges at multiple facilities form the major regulatory barriers.

Insurances –
Lack of acceptance and reimbursement by government payers and some commercial insurance carriers has created a major financial barrier, which places the investment burden squarely upon the hospital or healthcare system, even though the former benefit from more timely access to specialists and their expertise.

Hospital Ambivalence –
An uptake in the use of tele monitoring has the potential to lower hospital readmissions which could disrupt hospital’s traditional revenue models.

Physician workflow challenges –
Among the most formidable barriers to market adoption of RPM would be the physicians. Doctor’s office is the frontline for receiving enormous volume of data emanating from their patient’s health monitoring devices. They would be concerned about receiving this flood of information. The current practices in a majority of doctor’s offices would have enormous difficulty in managing the flow of patient data into their practice unless they fundamentally change the way they store and manage patient records. Electronic health records should be ready to accept these data. Integrating this data with existing health information system they have in-house poses a challenge. Malpractice concerns around lack of response to minor anomalies in health data could potentially slow down adoption.

**Patient Challenges** –
While there is increasing segment of the population in the country that would like convenient, accessible health services, there will be a percentage of the population that will never embrace these devices to monitor their health. They may be suffering from multiple chronic conditions that may not be addressed by a single device or they may simply have a lower level of health literacy. Not all of the population in this country has access to underlying technologies, such as broadband, which is needed to enable remote patient monitoring from their homes.

Jane Sarasohn-Kahn in her report “The Connected Patient: Charting the Vital Signs of Remote Health Monitoring” prepared for California Healthcare Foundation articulates it well. According to her report, “The broad adoption of remote health monitoring hinges on three fundamental shifts in the way health care services are structured and paid for, namely, changes in reimbursement from insurers, a new service model for providers and greater engagement by patients and consumers in managing their own health. Increased adoption of RPM services will require a fundamental shift in the way health care services are structured and paid for.”
IV. TECHNOLOGY

The Ecosystem

In the United States, chronic diseases account for nearly 75% of annual health spending. To successfully manage these conditions, patients need to regularly collect relevant health data and consult with health professionals to monitor the condition. Remote health monitoring is designed to do that. Proponents of remote health monitoring believe that widespread deployment of technology could result in considerable cost savings due to decreased readmission to hospitals, reduction in unnecessary visits to the physicians and improved interaction between patients and the clinics.

Remote Patient Monitoring Process Flow

There are a growing variety of monitoring devices that gather health information which is conveyed via communication technologies to physicians, emergency medical services, health coaches and other care providers. The data can provide real time information necessary for continuity of care and useful patient advice. In addition, it can be stored in electronic health records for later analysis. Several large technology vendors are exploring the markets for such apps and indications are the
volume of products and services in the area of e-health will grow sharply in the next few years.  
(REF: http://www.chcf.org/publications/2011/02/the-connected-patient)

The development of miniature sensors that can be unobtrusively attached to the body or can be part of clothing items, such as sensing elements embedded in the fabric of garments, have opened countless possibilities of monitoring patients in the field over extended periods of time. This is of particular relevance to the practice of physical medicine and rehabilitation. Wearable technology addresses a major
question in the management of patients undergoing rehabilitation, i.e. have clinical interventions a significant impact on the real life of patients? Wearable technology allows clinicians to gather data where it matters the most to answer this question, i.e. the home and community settings. Direct observations concerning the impact of clinical interventions on mobility, level of independence, and quality of life can be performed by means of wearable systems. Researchers have focused on three main areas of work to develop tools of clinical interest: 1) the design and implementation of sensors that are minimally obtrusive and reliably record movement or physiological signals, 2) the development of systems that unobtrusively gather data from multiple wearable sensors and deliver this information to clinicians in the way that is most appropriate for each application, and 3) the design and implementation of algorithms to extract clinically relevant information from data recorded using wearable technology.
V: OPPORTUNITIES

While it is clearly evident that Telemedicine is here to stay and is going to go mainstream in the years to come, the opening this team has identified is the lack of a consistent, widely available, economical method of obtaining vital signs available to the patient or the caregiver that can be communicated to the health care service provider, which is necessary to carry out a meaningful diagnosis and formulate a remedial course of actions. The proposal from this team is that we define and develop an integrated set of medical sensors that can easily be connected to a mobile phone or a laptop computer, integrated with an application, either using a wireless communication protocol such as Blue tooth or a wired communication protocol such as USB. The said integrated sensor device should contain, at a minimum, a stethoscope, a body thermometer, an otoscope which is capable of taking pictures of the throat, a Pulse Ox meter, ECG and Pulse rate and a blood pressure monitoring device. An accelerometer would be an optional sensor. The operation of these sensors should be menu driven from the app that connects the patient or the caregiver to the health care service provider. For example, the menu should guide the patient or the caregiver the order in which measurements needs to be taken, and should help the patient or the caregiver in activities such as where to place the stethoscope to enable the health care service provider to get the correct reading, or how to position the otoscope such that a clean internal picture of the ear can be taken. The cost of the integrated sensor package should ideally be less than 100$, to make it enticing for every household to replace the thermometer that they may have in their medicine cabinet with one of our devices. Marketing the product should include a pitch to not only have one at home, but include one in the travel bag, so wherever a family goes, they take the ability to get connected to their health care service provider in a short period of time and yet be able to provide a clear picture of the patient and the condition. It’s weight nor it’s size should deter potential users from carrying it in their travel bags.

It’s operating parameters should not prevent it from being sold in normal households, independent of altitude, ambient temperature and humidity. The accuracy of the readings from all the sensors should be within 5% of hospital grade
equivalent piece of equipment. The MTBF of the product should be within that of a widely available home medical equipment such as a thermometer or a nebulizer. The sensor package should be designed such that it can be sold to households without a prescription, just like a thermometer can be bought at any pharmacy today. It is conceivable that the product may be offered in different size such that it could be used with children as well as adults.

Built into that sub 100$ selling price should be a meaningful profit margin, in upwards of 40% to make this a viable business. The primary stream of revenue will be direct sales to the general population, which includes chronic patients, elderly citizens, families, patients recovering from recent medical conditions, remote populations who’s commute visit a health care service facility is prohibitively high as well as CDC when encountering infectious diseases, where the affected patients can isolated and can be monitored remotely with minimal supervision from healthy health care professionals, potentially preventing another Nina Pham encounter with Ebola. The proposed company should make every effort to extend the ecosystem such that the product can also be marketed thru employers, insurance companies and telemedicine providers such as MDLIVE to enhance the customer experience. Effort should be made to get the integrated sensor into a list of devices that can be paid using health care spending accounts as well as getting insurance companies to cover the cost for remote monitoring aspects, chorionic and acute care patients. When a patient needs a recommendation as to which doctor to make an appointment with, it is also foreseeable that the app can monetize that, by enforcing a routing fee to the backend health care service provider.

This team does not believe that the technology to build that integrated sensor package is insurmountable. Digital thermometers, otoscopes, ECG sensors, pulse rate monitors, pulse Ox monitors exist today, very close in form factor to what we want them to be. Although our investigations did not find available technology for digital/remote stethoscopes, we do not anticipate that to be a significant challenge, as at a very high level, all that should be included is a transducer, digitizer and the sound from the stethoscope could be transmitted form one mobile to another using normal voice channels. We believe that the challenge will be in gluing all these sensors into a single unit, maintain the strict accuracy requirements and being able to power them with either a battery or a USB power. We also believe that privacy concerns can be addressed with a simple, low cost encryption scheme. Getting this device to be sold over the counter will be a significant challenge and can be a lengthy process. Obviously an early beta test program needs to be run to evaluate the feedback coming from potential end users.
Key metrics to measure the success of this new business model would be the unit sales and sales growth of this integrated sensor package, the number of app downloads, number of insurers integrated and number of backend service providers promoting the sale of the unit to their customer bases.

The cost structure of building this business from ground up includes the App development and maintenance cost, Web hosting, Support Center for the app and the sensor package, integrated sensor hardware development/integration, fees and costs associated with regulatory compliance and promotional and marketing fees.

The key to the success of the company and the product is to be the first to hit the market with a product of this category and to engage the whole ecosystem we mentioned above. Time to market could very easily trump the number of sensors that will be integrated or the number of different sizes in which the product will be offered to the public.
VI. CONCLUSION

The confluence of growing population, rising health care costs and advancements in technology is accelerating the adoption of telehealth services and we expect that this market will grow significantly in the coming years.

We see big opportunities in this space. A company that can close the gaps in existing solutions and provide more comprehensive service could really be a big player in this segment.
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