

The Potential of Person Centric Wireless Mobile Devices and Telehealth Solutions: Sustaining Rising Healthcare Costs and Providing Quality Care

Ahmad Jubbawey

Vensa Health Limited

PO Box 8349, Symonds Street, Auckland 1010, New Zealand

AJubbawey@vensahealth.com

Abstract

This paper explores new solutions to old health system problems. Currently, the health system loses a great deal of time and money due to two prevalent problems: patients missing scheduled appointments, and the need to monitor patients with long term chronic conditions. This paper explores the use of mobile phone and telehealth technologies to combat these issues. It discusses trials of the technology conducted in the US, UK, and New Zealand, concluding that these technologies are of benefit in reducing missed appointments and reduction hospital admissions in long term chronically ill patients, thus reducing cost and freeing up services for other patients where health resources are bottlenecked.

1. Introduction

The general state of the world presently paints a clear picture of the largest economies in recession with the rising costs of healthcare deemed unsustainable in many countries. The traditional model of direct healthcare delivery in Commonwealth Countries (including New Zealand) has seen a rise in demand due to the recession. This is a huge problem when government spending is tight [1].

This paper will discuss the health sector saving opportunities that lie with using eHealth communication solutions. This includes consumer mobile phones and telehealth for both administrative engagements with patients when they need to be seen by health professionals and for management of long-term conditions in patient homes. It will focus on building a business case based on case studies suggesting direct cost savings to the health system in terms reducing emergency care and missed appointments when a patient is scheduled for a service. This applies to patients with long term chronic conditions such as diabetes, congestive heart failure and chronic obstructive pulmonary disease (COPD) agreeing to allow a healthcare professional to monitor them from a distance. This paper will also cover using text-messaging in primary care focusing on reducing missed appointments undertaken by Vensa Health as well as the current work in progress that supports the telehealth solution in this paper.

Vensa Health (Previously traded as AY Technologies) provides solutions for General Practitioners, Specialists, and Allied Health Professionals, the company has investing substantial resources into developing products and services that offer communication solutions and eHealth service delivery in telehealth. We focus on connecting patients with providers in both primary and secondary health sectors. The company is currently facilitating a number of District Health Board enterprise wide implementations tackling the reduction of missed appointments in outpatient services.

2. Background

Over the last decade we have seen a significant rise in hospital waiting lists and acute hospitalisation of the aged and long term chronically ill population. Long term condition groups often do not comply with their medication and are not optimally managed by their GP provider on high face-to-face consultation rates. Chronic illness is the biggest burden in healthcare spending in NZ, possibly comprising about 80% of government spending and growing [2]. Traditional models of servicing patients across primary and secondary care are proving untenable – particularly when requiring emergency attention or in areas where there is a shortage of Specialists and GPs. In hospital outpatient surgeries, the health system is wasting nearly 60 million [3] dollars in loss of service due to patients not attending their scheduled appointments with an average of approximately 9% [4] missed appointment rate average across all public hospitals.

There is a need to maintain provision of quality care to the patient in their home while encouraging them to be more aware of their own symptoms to effectively manage chronic conditions. International and national trends suggest this can be achieved through consumer based mobile phones and wireless based smart home devices. Communication via text-messages and mobile sites has proven more effective than traditional media in reducing missed appointments, especially with high-needs populations. In conjunction, telehealth based wireless devices have demonstrated the potential in effectively monitoring and managing long-term conditions such as blood pressure, congestive heart failure, diabetes and COPD allowing for reduced hospitalisation and emergency care business cases in some studies. A systematic review of the literature was conducted by group of Professors led by Guy Pare to evaluate existing evidence based on 23 case studies on the effects of home telemonitoring for respiratory conditions. The study found a promising patient management approach that is well received by patients and supports early identification of deteriorations in patient condition and symptom control. Despite minimal evidence on its economic viability, early analyses show promising results and affordability of this approach [5].

Telehealth involves transmitting results to a remote medical centre to be analysed by health professionals. With the proliferation of mobile phones and the uptake of the internet, which has fundamentally changed how businesses and people communicate, communication costs have dropped to make cell phones highly accessible and the internet readily available across all demographics.

The United States of America and United Kingdom have emerged as early adopters of Telecare and Telehealth solutions. Plenty of trials have been undertaken in both countries with positive outcomes. The U.K. Department of Health's Whole System Demonstrator program aims to evaluate how telehealth systems affect the quality of life for users and caregivers. These governments are set to place increased reliance on this technology, given that health system costs are on track to double over the next 15 years. The aim is to evaluate the business case through recruiting 6000 participants in a two year trial. So far 2000 participants have been recruited with trials set to begin in the next two months [6]. Telehealth is allowing health organisations to do more with less and support a greater number of patients. The phenomenon is helping to improve health outcomes and ensure the best use of the healthcare resources [7].

Telehealth brings a win-win situation for all stakeholders involved in the journey of care, including hospitals, GPs, community providers and patients. For the patient, improving their health includes: more accurate titration of medication, improved medication compliance, increased understanding and responsibility of their condition, and reduced travel barriers.

In the United States of America, the annual healthcare spending is \$2.2 trillion dollars, of which \$1.4 trillion is spent on treating long term chronic diseases. The United States government is placing a lot of emphasis on leveraging consumer devices and telehealth solutions, estimating a \$21.1 billion dollar saving per year in emergency care, hospitalisation and nurse home costs if these are adopted nationally [8,9].

3. Defining Wireless Mobile Devices

The scope of wireless mobile devices in this paper will only be covered in the context of utilisation in healthcare. Wireless devices can be classified as consumer mobile phones, medical devices that work in conjunction with the next generation consumer mobile phone, and medical devices that operate within any home premise which transmit information via land-line, internet or mobile phone.

3.1. Basic Mobile Phones

The mobile phone has become the most adopted item in day to day communication over the last decade. Today, even the most basic, outdated mobile phone can make and receive both calls and text-messages. This widespread use makes text-messages and (potentially) 3G mobile internet appropriate media for the health system to take advantage of when communicating with patients. Alerts such as appointment reminders, as outlined in section 4 of this paper, are an invaluable tool. Any mobile phone in New Zealand is currently able to receive a text message over GSM and CDMA networks.

3.2. Next Generation Mobile Phones

Today, the ability to make voice calls almost plays a secondary role to the raft of functionality that has evolved in mobile phones through the convergence of the internet. The next generation of 3G mobile devices, epitomised by Apple's iPhone, include (in addition to the basic phone) high speed internet browsers, high mega-pixel cameras, GPS, wireless email and calendar synchronisation, MP3 music players, WIFI internet access, video playback, application development platforms and significant memory capacity as standard features. The accessibility of this functionality is

no longer limited to consumers of high end, expensive mobile ‘smart phones’, but to all mobile phone users [10]. In addition, the iPhone allows for the development of hundreds of thousands of mobile applications which leverage off its interface.

Devices such as the iPhone allow for easy connection to external medical devices (section 3.3), which can be utilised to measure vital signs, and through the easy iPhone interface, safely transfer the information to the care giver for remote monitoring either via SMS, 3G, GPRS or WIFI.

3.3. Remote Care Clinical Devices

Stand alone medical devices vary in size and complexity in terms of the vital signs they can measure and the interaction required with the patient. In this paper’s context, the focus will be on devices which allow a means of connectivity to healthcare providers rather than stand-alone personal devices. Many of these devices come with software that runs on a PC, PDA or mobile phone.

Highly integrated and high-performance semiconductor chips are enabling growth in personal medical devices. Whether developing a blood glucose meter, digital blood pressure meter, blood gas meter, digital pulse/heart rate monitor or even a digital thermometer there are five system level blocks that are common to each one:

1. power/battery management,
2. control and data processing,
3. amplification and A/D conversion of the sensor input,
4. some type of display and
5. the sensor element(s) itself.

These are controlled by handheld devices that operate on battery power and take measurements using various bio-sensors. The actual implementation topology of these blocks will differ greatly with the sensing, processing and information display demands of the meter type and the chronic condition it measures [11].

Table 1 - Summary of Benefits Nationally

Stakeholder	Challenge	Benefits
DHBs	<ul style="list-style-type: none"> o Missed Appointments in Elective Surgeries o Shortage of Services / Emergency Capacity o Shortage of Specialists 	<ul style="list-style-type: none"> o Reduce missed appointments o Allow patients on waiting list to fill cancelled slots o Reduced avoidable hospital admissions & emergency care o Shorter hospital stays - telehealth
Primary Care Providers (GPs)	<ul style="list-style-type: none"> o Infrequent long term patient triage o Shortage of GPs o Engaging with high-needs patients through traditional media issues o Missed appointments in chronic clinics o Rising costs in traditional media methods of patient contact 	<ul style="list-style-type: none"> o Pro-actively manage patient without face-to-face interactions o Reduced missed appointments o Timely mobile alerts put patients at ease preventing them from calling practice. E.g. lab results normal messages
Patient	<ul style="list-style-type: none"> o Increased waiting times o Unaware of illness and medications o Geographical and transport barriers to meet a health professional 	<ul style="list-style-type: none"> o More accurate titration of patient medication o Improve medication compliance o Increased understanding of their condition o Constantly reassured o Patient stays home where they prefer to be with family and friends o Overcome geographic barriers

4. Wireless Mobile and Telehealth Solution Applications

Telehealth, telecare, telemedicine and assistive technologies are among the many terms tossed around in the health industry. These terms tend to confuse people as they sound similar in what they achieve, however, there is very little overlap with each term. Based on international trends, this paper will focus on telehealth as the process of allowing health care providers to remotely monitor long term conditions to establish whether an intervention is necessary [12].

Increased utilisation of basic and next generation mobile phones can help reduce missed appointments and allows for maximum use of available resources in hospitals. The installment of telehealth solutions with primary care providers monitoring patients remotely has the potential to keep some long term chronically ill patients from being re-hospitalised. International trends suggest the leveraging of consumer mobile phones and employing telehealth medical device solutions has potential benefits for all stakeholders in the health system, as summarised in Table 1.

Table 1 outlines very basic summary for the purpose of this short paper. Case studies which support the above are detailed in section 5.

5. National and International Case studies

5.1. Success found in NZ of leveraging the Consumer Mobile Phone in Primary Health

GP practices currently utilise the TXT2Remind system on daily basis to engage with patients through electronic mobile text-messages. This system interfaces with the practice patient management system (or Electronic Medical Record) to allow electronic mobile text exchanges between health providers and patients. Primary Health Organisations and GP practices have embraced the system as the use of mobile technology has increased health outcomes, reduced health inequalities among high-need groups (known to have the worst health status) by improving access, and reduced costs. Specifically, this includes:

1. Improved efficiency in how healthcare is delivered by GPs.
2. Improved healthcare outcomes by optimising patient appointment attendance through the use of mobile text-message appointment reminders.
3. Improved patient satisfaction and perception of service through timely alerts for pre/post services. E.g. appointment reminders pre service, lab results alert post service.

Traditional forms of communication such as physical mail or calling land lines are proving to be high in cost and often do not achieve desired outcomes. Mobile technology has emerged as the most popular method of patient communication in New Zealand and opportunities now exist to reduce the reliance on traditional ways of engaging with patients.

Text-messaging is instant and personal. Traditional physical mail and land lines are becoming increasingly ignored by the population as they move to the internet and mobile world, requiring a change in how business communicate with their customers. This trend holds true for patients and the mobile phone is now the preferred medium for receiving immediate information about their health..

This solution provides GP practices with the ability to automate the process of appointment reminders. Scheduled patients will typically be reminded of their appointments a day in advance, allowing some to cancel and others to receive the service in cancelled slots. In addition, clinical recalls and lab result messages can be generated within the patient management system, ensuring maximum utilisation and business process integration.

Vensa conducted a survey to all existing clients of which 27 out of the selected 200 practices responded this far via sending their responses by mail. The practices selected utilised the system for over 12 months, the survey was done via mail-outs which asked a series of questions prompting practice managers to answer multi-answer questions and quantify the outcomes of the system, two of which are included below.

5.1.1. Reducing Missed Appointments

Experience shows an up to 50% improvement in reducing missed appointments rates in GP surgeries. Fig 1 demonstrates the answers from 27 practices that were sampled and asked if the service has reduced missed appointments.

From the sample of the 27 practices polled, 15 reported reductions in missed appointments, 2 indicated there was no change, 3 practices have not quantified this and 7 practices don't remind their patients as it is not applicable for their practice.

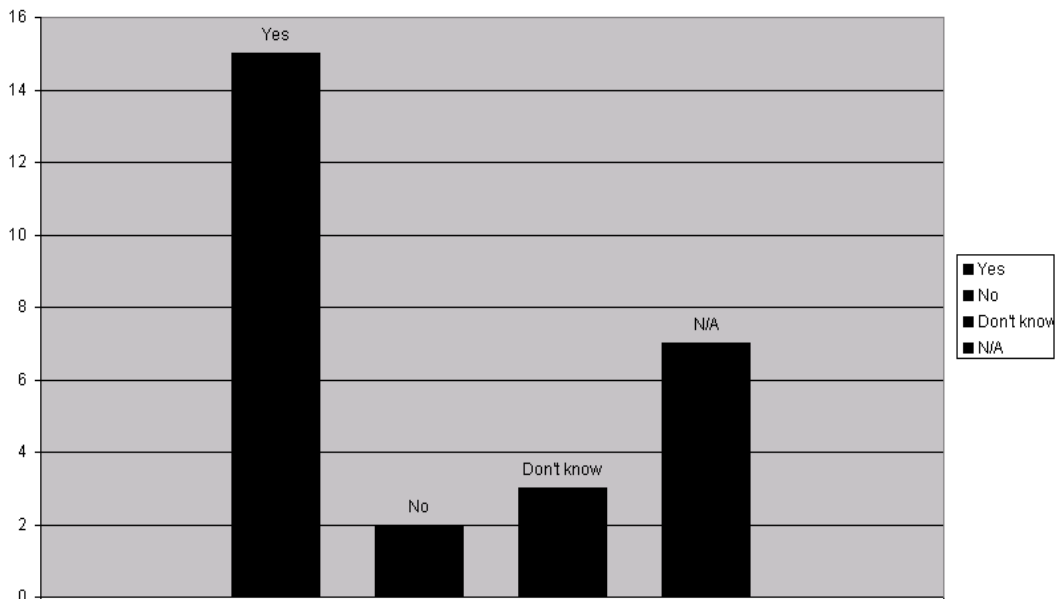


Figure 1 – Service Missed appointments questionnaire

5.1.2. Increased Contact with High-needs Patients

High needs patients are either of the Maori/Pacific Island patient demographic or reside within a quintile “5” suburb within the PHO region. This time we asked our participant practices if they had experienced increased recall for service rates across their high-needs patient demographic as outlined in Fig 2.

From the sample of 27 practices above, 17 reported increased contact and better patient response with the high-needs demographic, none indicated no increase, 5 have not quantified this outcome and 5 do not have much of the high-needs demographic.

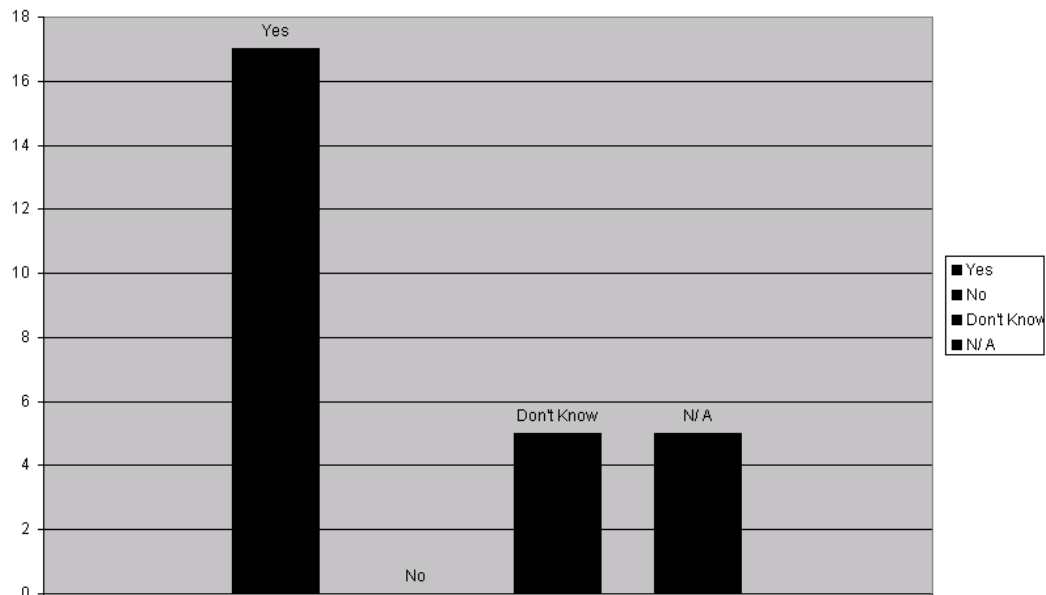


Figure 2 – Service increasing contact with High-needs patients

5.2. Success of Leveraging the Consumer Mobile Phone Found in NZ Hospitals

A national trend of one in every ten outpatient elective surgery appointments missed indicates a high cost burden to the health sector [3]. Counties Manukau DHB trialled a text message solution, attempting to reduce missed appointments and the results have shown tremendous success. Counties Manukau DHB used to have a 20% non-attendance rate. This has dropped by 5%, which equates to 5000 more patients turning up to their appointments per year [13]. Currently more DHBs in New Zealand are evaluating the use of this technology in outpatient specialities.

5.3. International Implementations of Telehealth Solutions

5.3.1. Nottingham City PCT Telehealth Trial

NHS Nottingham City is responsible for the healthcare of a population of 325,000 providing primary health services through commissioning providers. The PCT has outlined the success of the largest telehealth trial in the UK, remotely monitoring people with long term conditions to deliver timely preventative care. The trial showed reductions in hospital admissions, GP visits and community nurse home visits enabling best utilisation of resources. The PCT suggests 22,000 hospital admissions in Nottingham relate to long term conditions. This equates to 40% of all hospital activity. The PCT has agreed to mainstream the telehealth service to 800 patients who will be managed via remote devices measuring vital signs with the aim in reducing hospital admissions [14].

5.3.2. Sheffield PCT Telehealth Trial

NHS Sheffield is responsible for the health and wellbeing of people in the Sheffield region. The prevalence of COPD in the community is considerably higher than the standard PCTs' rate of 8% and there is a focus on reducing hospital admissions for the demographic. Employing the Telemedicine approach has resulted in a COPD-related hospital admissions drop of 50% which allowed secondary care providers to invest in other services [15]. In addition, home visits by community COPD nurses have been reduced by 80% allow better prioritisation of resources.

5.3.3. Telehealth Revolution in Home Care in USA

The demand for home health care services in the U.S. has increased by 20% per year for the last 10 years and is expected to continue at this rate. About 7.6 million Americans receive home care because of acute illness, long term health conditions, permanent disability or terminal illness. Out of 1,000 home agencies, 17% currently use a telehealth system and reported that their two biggest goals were to improve the overall quality and reduce unplanned hospitalization or emergency room visits. 89% of the home care agencies reported that telehealth improved the overall quality of service. Specifically, 77% reported a reduction in unplanned hospitalisation and 77% reported a reduction in emergency room visits. In addition, 43% reported that their telehealth program has led to reduction in costs [16].

There was very positive buy-in from both the staff and patients. 64% of the agencies reported that their care managers were receptive or very receptive to implementing telehealth with the number growing to 77% after one year of providing services, showing staff acceptance increasing with use. Likewise the patients were also increasingly satisfied with over 71% of home care agencies reporting satisfaction [16].

6. MyHealth Network Overview

Over the last two years Vensa has been developing the next generation myHealth network which supports an open architecture in exchange of electronic messages between health providers and patients. The system will support two way exchange of both administrative message types, such as mobile text-messages, as well as clinical measurements generated from a medical device to allow health providers to remotely monitor and intervene (supporting applications in this paper in TXT2Remind and telehealth). In addition, this framework will have the capability to support mobile sites, allowing patients view content on their mobile phone. , E.g. a patient scheduled for an appointment can view outpatient clinic information, contact details, directions and transport information.

Medical devices will communicate with the myHealth network by transmitting data via the internet, 3G technology or text message through a secure, encrypted layer. Messages pushed to the myHealth network from a mobile phone or a medical device are logged and transformed into a specific standard format, which is then routed through a secure encrypted channel to the care provider in Health Level 7 (HL7) message format, ensuring integration with the healthcare provider's system for observation and analysis.

The open architecture will support operation with any managed medical device that adheres to the ISO/IEEE 11073 family of health informatics standards and user acceptance criteria. The IEEE has begun work and approved 7 of 10 telehealth device standards for controlling information exchange among the devices and cell phones, personal computers, personal health appliances and other computer engines [8]. These standards, a part of the ISO/IEEE 11073 family of health informatics standards, will provide clear definitions of what is needed to implement common communication features for personal telehealth devices. The new standards will define a common core of communication functionality for these devices and specify the use of term codes, formats and behaviors in a telehealth environment to favour plug-and-play interoperability.

7. myHealth Network Future Trial

The myHealth network has been developed with clinical input but it is expected that, as we near trialling the telehealth functionality in the primary sector, further input from GP providers and Primary Health Care Organisations (PHO) and District Health Boards (DHB) will be required. Some critical success factors to implementing the trial include:

- Run HISAC through the myHealth network
- “Dummy run” of the user acceptance for the health provider and patient
- Short-listing the chronic conditions to be trailed
- Building the business case for GPs and DHBs and setting targets
- Such a trial will need to be run by the ethics committee
- Ensuring a telehealth solution does not compromise the GP business model, rather add value to it

Auckland PHO have been briefed of the myHealth solution and have expressed interest in participating in a trial at some stage in the future when the network is in a deployment state.

8. Conclusion

In conclusion, it seems clear that the use of new mobile phone and telehealth technologies will be increasingly popular to primary and secondary health providers in the future. Current trends show the world population are adopting mobile technology and that health services and their patients both benefit from their use. The benefits are both financial, in terms of reducing the cost of missed appointments, and medical, in that patients are better able to access resources as a result.

Mobile phone and telehealth use are clearly showing a beneficial promise in today’s health provision market and seem set to become more and more so in the future. To be able to adopt this model in New Zealand, all stake holders from DHBs, PHOs, vendors need to work together to ensure the best outcomes for the patient and the health sector – our progress, must be shared.

9. Acknowledgements

I would like to thank all of our clients who, on a daily basis, inspire us to work hard. They have adopted the technology and are the true innovators.

I would also like to thank the Vensa Health staff, without whom none of this continued innovation would be possible.

Lastly, I would like to thank Auckland PHO who have been early adopters of innovation and their support for us to seek different ways to think outside the box.

10. References

- [1] NZ Herald. Budget 09: Backtrack on long-term health spending. 2009 29 May 2009 [cited; Available from: <http://www.nzherald.co.nz>
- [2] Treasury. Health System Sustainability in the Long Term: Why we need to act today. 2008 [cited 22 May 2008]; Available from: <http://www.treasury.govt.nz>
- [3] NZ Herald. Unhealthy figures. 2007 20 September 2007. [cited; Available from: <http://www.nzherald.co.nz>

- [4] Ministry of Health. DHB Hospital Benchmark Information. 2009 [cited July 2009]; Available from: <http://www.moh.govt.nz>
- [5] Jaana M, Pare G, Sicotte C. Home Telemonitoring for Respiratory Conditions: A Systematic Review. *The American Journal of Managed Care*. 2009;7 May
- [6] Everett C. Testing telehealth and telecare. 2009 [cited 3 June 2009]; Available from: <http://smarthealthcare.com>
- [7] Ellis T. Mainstreaming telehealth and telecare: Similarities, differences and lessons from the WSD trial. Press Release
- [8] McCabe K. IEEE Approves Seven New Health Informatics Standards. 2008 [cited 1 October 2008]; Available from: <http://standards.ieee.org>
- [9] Walls J. mHealth Solutions Play Important Role in Healthcare Reform. 2009 [cited 24 June 2009]; Available from: <http://www.ctia.org>
- [10] Jones C. Consumer led healthcare: The potential for the mobile internet to transform how consumers engage in their healthcare. [cited; Available from: <http://www.hinz.org.nz>
- [11] EE Times India. Interoperability to boost medical devices take-up. 2007 [cited 23 February 2007]; Available from: <http://eetindia.co.in>
- [12] Doughty K, Monk A. Telecare, telehealth and assistive technologies – do we know what we’re talking about?. *Journal of Assistive Technologies*, 2007;1(2)
- [13] One News. Txting saves hospitals millions. 2008 [cited 10 October 2008]; Available from: <http://tvnz.co.nz>
- [14] Coward C. Nottingham City PCT Launches Mainstream Telehealth Deployment. [cited; Available from: <http://www.24dash.com>
- [15] Wireless Healthcare Press Release. GPs and Clinicians Report on Success of Telehealth. 12 June 2009
- [16] Engle W. The Approaching Telehealth Revolution in Home Care. *Telemedicine information exchange*. 2009 [cited March 2009]; Available from: <http://tie.telemed.org>

11. Bibliography

Wireless Healthcare Press Release. mHealth Solutions for America’s Chronic Care Crisis. 18th June 2009.

Wireless Healthcare Press Release. Free Diabetic Testing Meters for Clinical Trials. 19th June 2009.

Wireless Healthcare Press Release. Patients Beat High Blood Pressure with Bluetooth Remote Health Monitor. 18th June 2009.