iti Techmedia

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MARKET INTELLIGENCE REPORT
REMOTE HEALTH

Remote healthcare is defined for our purposes as those technology components which enable the delivery of treatment and monitoring of the condition by a medical professional who is at a different location from the patient

Version 1.0

iti Techmedia

CONTENTS

EXECUTIVE SUMMARY

This document provides market intelligence into the sector defined as Remote Health by the Intermediary Technology Institute (ITI) in Techmedia. With the ever increasing universe of digital communications and the increasing capacity and decreasing costs of complex devices, it has become possible to communicate medical data in new and exciting ways. Although in the past it has been possible to reach out to patients over the telephone or through other basic channels, new monitoring and networking technologies now enable richer and more sophisticated remote healthcare.

For the purposes of this study, and taking account of the focus of ITI Techmedia, the definition of remote healthcare is:

"Remote healthcare is defined as those technology components which enable the delivery of treatment and monitoring of the condition by a medical professional who is at a different location from the patient."

The report describes the future market opportunities, challenges, key drivers and the potential functional needs of the Remote Health sector.

Using this acquired knowledge as the base input, the ITI will select those functional needs that have strongest potential market 'fit', and the greatest potential to be a success when utilised within the identified target markets. The functional needs will be used to define potential technology platforms which will then be used as input to ITI Techmedia's programme selection process.

During this process, ITI Techmedia will continue to report to its Membership on progress and results. Members are encouraged to provide comment and input to this process, and to become actively involved in programmes.

A number of possible segmentations exist

It is possible to segment the market for remote health by considering:

- where these technologies might be used;
- who the users will be;
- what the technologies will be used for;
- what patients and conditions will be treated.

Within this report the key segmentation is defined to be in terms of the users of the technology since they would have very different functional needs. The two classes of user considered are defined as follows:

- **Clinical user** – in this situation a doctor, nurse or other trained user is making use of networked devices. As a result these devices can be relatively complicated to use. Although the person using them is not in a position to interpret the data properly – hence the need for a remote clinician – they will be able to follow relatively complex processes to electronically gather it;

- **Self care** – in this situation, the patient is making use of the monitoring equipment to record and transmit the data. This obviously places very different demands, both on the usability of the technology in the remote location and on the systems that manage that technology.

…which exhibit a number of key trends

There are three main trends in the overall healthcare market that have helped to create the market conditions for a substantial rise in the adoption of remote health technologies:

- an aging population and the resulting increase in the demand for healthcare;
- increasing consumer demands on healthcare systems;
- technology that is rapidly increasing in power and reducing in cost.

The drivers of homecare based remote health following from these key trends are:

- **Reducing costs** – Reducing the cost of chronic care is an important target for all the healthcare systems facing the explosion in elderly population;
- **Improving clinical outcomes** – Spotting problems earlier increases the probability of a positive outcome for the sufferer;
- **Improving quality of life** – Improved monitoring also has the capacity to spot non-life-threatening quality of life issues that can be adjusted with improved care.

The most important drivers of clinical remote health are:

- **Geographical spread of population** – Remote health technologies offer a way for distant specialists to treat patients in remote places;
- **Scarcity of experts** – Remote health has the ability to make the most of resources, in the form of consultant experts in a particular field;
- **Scarcity of resources in general** – In the developing world, there is often a general scarcity of medical personnel, not merely of local experts in a particular field.

These trends will create opportunities for new technology providers. However, a number of barriers to market entry exist for new technology providers. Such barriers include:

- **Up-front cost of solutions** – Although the costs of these systems are declining all the time, the up-front investment needed for either type of system is still high;
- **Protocols for care** – For all drugs in use, there will be protocols that dictate how they can and should be used, but for remote health technologies these protocols have yet to be established;
- **Privacy and security** – Both professionals and the public will have concerns about the privacy of the data being collected and its security as it travels over the network.

Primary research confirmed the view that this is a nascent market

Remote health is only at a very early stage of development and hospitals in particular remain relatively unfamiliar with this technology and its applications. Raising awareness of the possibilities of the technology will be a crucial first step for vendors in this market. Unsurprisingly, given the low levels of familiarity, few have well defined plans to implement at this stage. Where they do, these plans will often not really qualify as remote health under the definition and may simply be video conferencing systems. Remote consultation and disease management were believed to be the most important applications.

Rapid growth is expected in the remote health sector

The nascent state of the market means that it is currently relatively small, with a total market size for the developed world of £394 million ($687 m US$) in 2005. However, as can be seen clearly in Figure 1, this will allow for very rapid growth in the sector, particularly in the homecare sector.

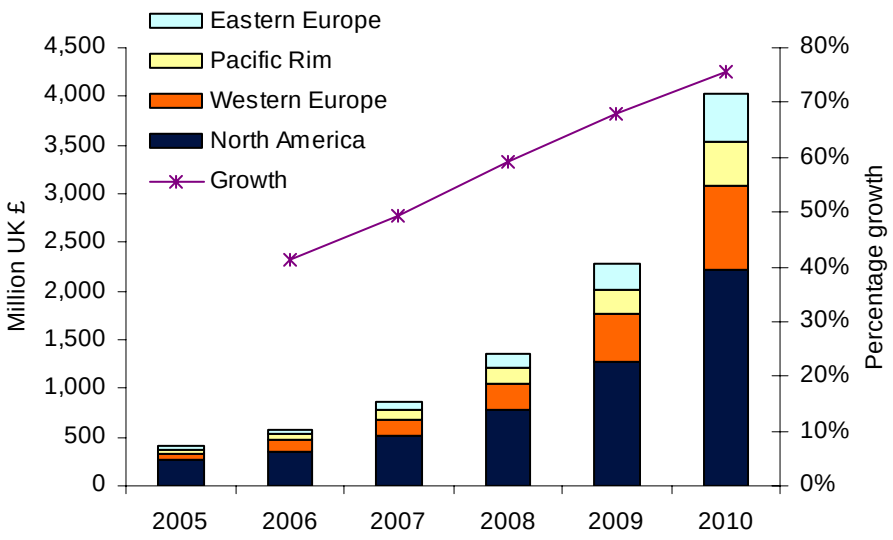

Figure 1: Total remote health market by region, 2005 to 2010 [Source: Datamonitor]

Market opportunities exist in both home and clinical setting

One way to profit from this market is to find the correct technological gap to plug. Datamonitor has identified the following areas of opportunity:

- Managed services – by building the right combination of managed services, a vendor can help to mitigate the risk for the healthcare purchaser while pursuing a best of breed technology strategy;
- Component innovation – vendors can attempt to produce a superior product in a specific area;
- Analytics – there is an opportunity to create software specifically targeted at analysing the medical data produced by remote health;
- Focused telehealth offerings – a vendor might attempt to directly compete with existing telehealth vendors by producing solutions focused on the needs of a particular local market.

ITI Techmedia will use these key trends to identify appropriate R&D Programmes

Using the acquired knowledge in this report as input, ITI Techmedia is undertaking further analysis of these opportunities to select those with the strongest Scottish 'fit' and the greatest potential to be a success when utilised within the identified markets. The selected functional needs will be used as input to define potential technology platforms as part of the ITI Techmedia programme selection process.

1 INTRODUCTION

1.1 Document Purpose

The purpose of this document is to provide a 'snapshot' view of the Remote Health sector in order that the ITI Membership:

- has visibility of the market analysis activities undertaken in this sector by ITI Techmedia;
- can gain access to market information relevant to the sector;
- is provided with an indication of the functional needs that ITI Techmedia will explore further to identify the technology platforms which may form the basis of ITI Techmedia research and development programmes in this area.

This document should not be considered as providing a comprehensive analysis of the competitive environment within the Remote Health sector. Such an analysis is beyond the scope of this document. This report aims to provide an understanding of remote health and its applications. It also aims to give those who wish to act as players in any part of this space an appreciation of the dynamics and potential scale of this market.

1.2 Structure and Content

This document provides market intelligence into the sector defined by the Intermediary Technology Institute (ITI) in Techmedia as Remote Health (see Section 2.1 for the definition of Remote Health). The information captured within the document has been obtained following the principles of market intelligence gathering (otherwise known as foresighting) established by ITI Techmedia.

During the process of developing this market intelligence report, both primary and secondary market data were acquired and collated. Primary data was collected using a survey-based approach to gather attitudes from the head of the IT function within hospitals in order to try and discover how institutions view remote health. This was supplemented by face-to-face interviews with key potential suppliers in the sector. The primary data gathering process was augmented by desk research which was used to obtain secondary data from internationally-recognised market analysts. Where possible, the source of any data used in this report has been identified.

Section 1: Introduction. This Section covers the background, aims and scope of the Intermediary Technology Institutes (ITIs). It also provides a high level description of the 'Techmedia' areas of focus. Further background information can be obtained on the website www.ititechmedia.com.

Section 2: Market Overview. This Section provides a working definition of the Remote Health sector, highlights the main characteristics of the sector, identifies the main trends, drivers and barriers, and describes generic value chains representing current business practice. The Section provides a framework for the subsequent presentation and analysis of data in Sections 4.

Section 3: Market Assessment. This Section provides an assessment of the market opportunities identified during the foresighting process. It presents the results from the primary research survey together with the expected technology requirements that will meet market needs.

Section 4: Market Data. This Section contains the relevant market size data for each market opportunity identified in Section 2. This type of data is traditionally derived from historical figures, and therefore market projections are best viewed as providing a base reference level from which informed extrapolations can be drawn. Where possible and appropriate, the segments identified in this report are matched to existing market data; where a new market opportunity is identified, a potential market size has been projected. Finally, the high-level functional requirements for the segments identified in this report are presented.

1.3 Background: Intermediary Technology Institutes (ITIs)

1.3.1 Economic Context

A global driver for economic growth is the development and exploitation of technology both for present needs and future requirements. Successful economies are underpinned by a vibrant research base which extends from basic science through to pre-competitive research and development, with a clear focus driven by global market opportunities. Scotland has a reputation for world class research in many fields and already undertakes significant research activity in several areas which have the potential to be strong future market opportunities. In addition to the research base, most developed economies have institutes or organisations that promote knowledge generation and increase commercial exploitation capacity. The establishment of such organisations has had significant economic impact over the long term.

1.3.2 ITIs

The Scottish ITIs are aimed at increasing the effectiveness of Scottish businesses in the key global market sectors of Communications Technologies and Digital Media ('Techmedia'), Life Sciences and Energy, all targeted to address the particular (research) strengths and (company) weaknesses of the local economy. The ITIs also interact with each other to identify potential overlap or "white space" market opportunities between Techmedia, Life Sciences and Energy. Founded in September 2003, the creation and development of the Scottish ITIs is a long-term initiative, and will be supported for a significant period of time.

The ITIs are, in essence, a centre or "hub" for:

- identifying, commissioning and diffusing pre-competitive research that is driven by an analysis of emerging markets;
- managing intellectual assets to maximise commercial and economic value for Scotland.

An active Membership is core to the activities of the ITIs. They are open for Membership to companies and research institutions across the globe, and all Members are encouraged to actively participate in its activities. It is essential to attract and retain Members with a broad global perspective on markets and new technology directions, as well as a local focus, to ensure that propositions are transferred effectively into the Scottish economy.

1.4 Definition of the Techmedia Sector

ITI Techmedia is centred on the development and creation of commercial opportunities in digital media and communications technologies. The activities of the ITI will bring Scotland's economy to the cutting edge of emerging markets by allowing local companies to access and build upon pre-competitive technology platforms developed by the ITI.

The term 'Techmedia' arose out of the need to reflect the market evolution of communications technologies and digital media. The overall trend in the marketplace is one governed by a value chain ranging from content/application generation through delivery to consumption. Content is no longer considered in isolation from service provision, service provision in isolation from delivery channels, or delivery channels in isolation from enabling and managing technologies.

The following elements are examples of the areas which fall within the Techmedia remit. These elements are best viewed as illustrations and represent some of the over-arching philosophies. Nevertheless, these are global drivers which help to place the output of the ITI in context:

- broadcast content: ultimately the product for which the customer is paying, either directly or indirectly;
- service provision: the mechanisms for providing customer-driven content and applications;
- delivery: technologies and infrastructure required to transport the digital content service to the end-user, as well as providing the feedback channels for interactivity;
- enabling software and systems integration: technologies and infrastructure required to condition, control and manage the delivery of content/service to the end-customer.

One globally accepted trend is the delivery of content and services over multiple channels e.g. the provision of same (or modified) content to be received over mobile devices, through TVs or via PCs. Content consumption is the key revenue generating stream in many of the markets, and is thus central to many of the drivers that affect future market evolution in the Techmedia sector.

The Techmedia sector is potentially very broad and hence a phased approach to market foresighting has been adopted. The first phase of market foresighting carried out during 2004 concentrated on five major market areas:

- Health
- Commerce and Finance
- Learning and Education
- Communication Services
- Entertainment and Leisure

Based on member feedback on these topics, remote health was chosen as a desirable area for a more detailed analysis building on the first stage analysis of the Health sector.

1.5 Next Steps

This report describes the results of the market analysis activities undertaken by ITI Techmedia in the Remote Health sector. As such, the report describes the future market opportunities, challenges, key drivers and functional needs identified as applicable to this sector.

Using this acquired knowledge as its base input, the ITI will select those functional needs with the strongest potential market 'fit', and the greatest potential to be a success when utilised within the identified target markets. The selected functional needs will be used as input to define potential technology platforms, and these platforms will then be used as input to the ITI Techmedia programme selection process.

During this process, ITI Techmedia will continue to report to its Membership on results and progress. Members are encouraged to provide comment and input to this process, and to become actively involved in programmes.

ITI Techmedia intends to further develop its knowledge base in this sector. In order that the Membership gain visibility to ongoing developments identified by ITI Techmedia, this report will be subject to periodic review and re-issue.

2 MARKET OVERVIEW

2.1 Market Definition

With the ever increasing universe of digital communications and the increasing capacity and decreasing costs of complex devices, it has become possible to communicate medical data in new and exciting ways. Although in the past it has been possible to reach out to patients over the telephone or through other basic channels, new monitoring and networking technologies now enable richer and more sophisticated remote healthcare.

For the purposes of this study and taking account of the focus of the focus of ITI Techmedia, remote healthcare is defined as

"Remote healthcare is defined as those technology components which enable the delivery of treatment and monitoring of the condition by a medical professional who is at a different location from the patient."

Often this market and associated technology are known as telehealth, as telemedicine or as remote monitoring. The lack of consistent terminology reflects the fact that this market remains immature. The applications it involves have yet to find a place at the heart of clinical practice. It is not even clear precisely which of the possible uses that might fall under this definition will become widely established.

2.2 Market Segmentation

This section will flesh out the definition of remote healthcare and provide a segmentation of the market for the technologies falling under this definition. It will consider:

- where these technologies might be used;
- who the users will be;
- what the technologies will be used for;
- what patients and conditions will be treated.

2.2.1 How remote is remote health?

Figure 2 illustrates the differences between the potential locations at which a patient might make use of remote health applications. In each case the reasons for making use of remote health will be slightly different. In parts of the world that are remote from urban centres and the medical facilities that they provide, remote health provides a way to take medical expertise over vast distances without the physician having to be with the patient. In these contexts, typically a relatively low-level clinician will digitally record patient data and transfer it to the remote doctor for assessment. This might be used to diagnose conditions or simply to monitor an existing condition in situ.

In contrast, in a hospital, although the goals might be similar, the reasons for using remote health are different. In this environment, being able to compile the data from patients with the same condition and supply it to the relevant expert will be more about efficient use of resources than overcoming physical obstacles to travel.

Figure 2: Location and remote health [Source: Datamonitor]

2.2.2 Who is operating the devices?

Another way of subdividing the usages of remote health is by considering who will be operating the devices used to monitor the condition of the patient. Figure 3 shows how we might divide the market into two types of user:

- **Clinical user** – in this situation a doctor, nurse or other trained user is making use of networked devices. As a result, these devices can be relatively complicated to use. Although the person using them is not in a position to interpret the data properly – hence the need for a remote clinician – they will be able to follow relatively complex processes to electronically gather it;

- **Self care** – in this situation, the patient is making use of the monitoring equipment to record and transmit the data. This obviously places very different demands, both on the usability of the technology in the remote location and on the systems that manage that technology.

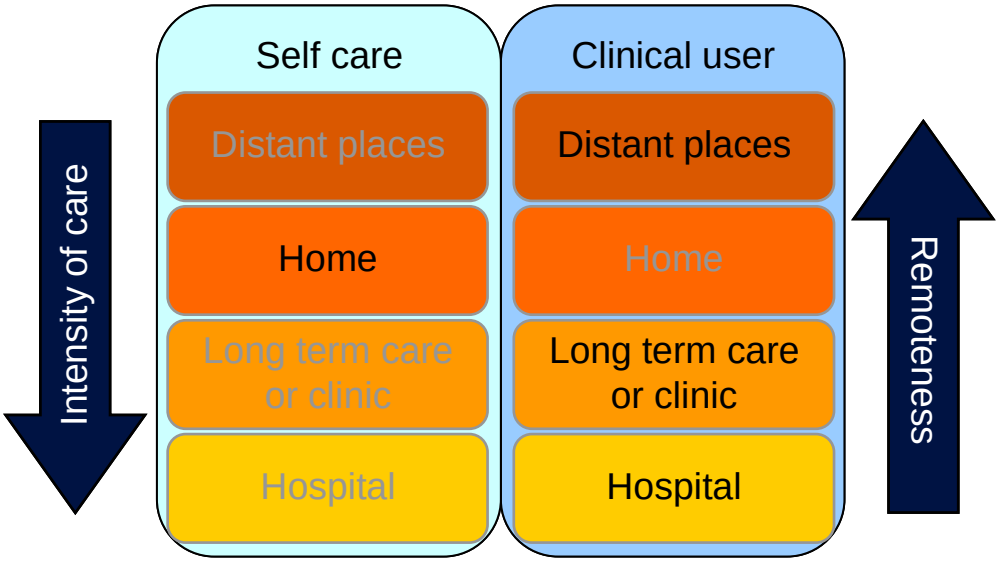

Figure 3: Locations and users [Source: Datamonitor]

As shown in Figure 3, for the most part self care and clinical care will map onto the location the patient is in. Although in a home monitoring context, sometimes it might be a visiting nurse who takes the data it will be, for the most part, either the patient themselves or a family member. Equally, although it is possible that a patient might take their own readings in hospital it will usually be done by a nurse or nursing auxiliary.

The difference between these two contexts creates a clear difference in the functional needs of these sectors. Everything from the way that an onsite monitoring device is used to the software used to analyse the data will have different functional requirements placed upon them. Because of the technological differences between these two segments of the market, this will be the main segmentation that we will use in this report.

2.2.3 What are the applications?

Remote health can be used to fulfil a variety of clinical roles. These applications can be roughly categorised into five broad types

- **Compliance** – ensures that patients remember appointments they have been given and that they correctly make use of their treatments. A typical scenario might involve sending a message to a patient to remind them to take their medication;
- **Disease Management** – monitors the condition of chronic patients and intervenes as necessary using communication over a data network. An example of this might be to monitor the blood sugar levels of patients with diabetes;
- **Acute Expert Monitoring** – allows the monitoring of non-chronic (perhaps post-operative) patients by an expert who is not physically present. For example, an intensive care consultant might monitor the patients in a hospital ICU from an office elsewhere;
- **Remote Consultations** – facilitates consultations with a doctor or other clinician over the network. This would typically involve video conferencing, perhaps in combination with the ability to collect data from medical monitoring devices;
- **Advanced Remote Medication** – allows more complex medical interventions by clinicians who are not available at that location. An example of this might be remote surgery.

Obviously, some of these applications will have a more significant impact on healthcare than others. In addition, some will present greater opportunities for providers of advanced technologies and hence fit more closely into the picture of remote health that we have constructed.

Compliance and remote consultation applications can be relatively unsophisticated in the technology that they use. Compliance, for example, might make use of the outbound calling systems already in use for telesales. Remote consultation might use something as simple as a video conferencing system. The extent to which these applications can genuinely be considered applications of remote health technology will depend on their use of new technology opportunities. A remote consultation application becomes significantly more sophisticated when combined with the networked monitoring devices that are providing data on the patient in question. This can enable the clinician to perform a diagnosis rather than merely have a video chat.

Disease management, acute expert monitoring and advanced remote medication, on the other hand, will make use both of specialised devices and of software for managing the medical data collected. Hence, it is these applications that form the core of future remote health development and much of the focus of this report.

In section 3.1 below, we give details of a survey conducted by Datamonitor on behalf of ITI Techmedia which asked hospitals which of these applications would be most important.

2.2.4 What conditions might be treated or monitored?

Having segmented the market into self care and clinical user environments, it is important to ask what conditions the technology might be used to treat or monitor. Figure 4, cross-references the locations and operators of remote health technology with a selection of possible conditions.

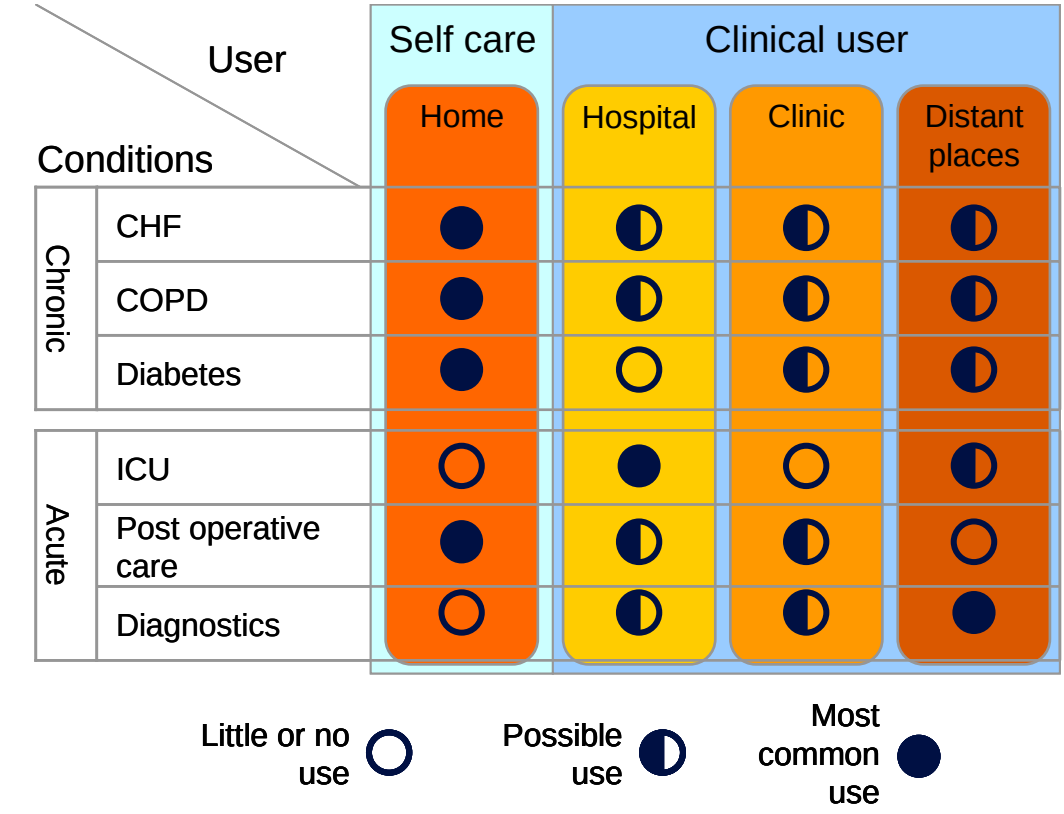

Figure 4: Conditions, locations and user [Source: Datamonitor]

The conditions mentioned in the diagram have been divided into chronic or long-term conditions and acute or short-term. The conditions, and the stage which those conditions are at, will have an impact on where that patient is located. The more serious the condition, the more likely it is that the patient will be in a hospital, thus the diagram reflects not only how useful remote health technologies will be at those locations, but how useful they are dependent on the severity of the patient's condition.

Chronic conditions will often be managed in the patient's home – as mentioned below, the increased ability to do this is one of the main drivers of uptake. Some of the most common chronic conditions are shown in the diagram:

- Congestive Heart Failure (CHF) – this condition would typically be monitored using a blood pressure cuff and weight scale. This configuration could be used to monitor these patients in any of the environments but has its most obvious applications in homecare. About 3.6% of Americans currently suffer from CHF and even more from other forms of coronary heart disease (CHD), making this a potentially huge market;[1]
- Chronic Obstructive Pulmonary Disease (COPD) – this could be monitored with a blood pressure monitor, a weight scale, a pulse oximeter and a spirometer. Again, as a chronic condition, it is one which is generally monitored from the patient's home. The condition affects between 4 and 5% of the population in developed countries;[2]
- Diabetes – this could be monitored with a blood pressure monitor, a weight scale and a blood glucose meter. This is a condition affecting about 4 to 6% of the population in the West.[3]

Acute conditions are more likely to involve immediate medical intervention and, hence, to place the patient in the care of some kind of clinician. Also, as the condition is short in duration, it is not always going to be worth the effort of installing devices in the patient's home only to take them away again shortly afterwards. However, one can imagine an easily portable remote health product.

- Intensive Care Unit –
  - Here, remote monitoring would be used mainly to supplement onsite monitoring by gathering very detailed data and being able to make judgements which are only possible by an expert in possession of superior information;
  - However, there are situations in remote places, such as battlefields and distance exploration stations, where the conditions of an ICU would have to be mimicked at a distance from a real hospital.
- Post operative care –
  - This refers to those post-operative patients well enough not to be in ICU conditions where there is often the need to monitor for potential problems. The patient is very likely not to justify the individual attention he/she would get in ICU. Hence, it is easy to see an application for automated monitoring which would alert staff to potential problems;

[1] Datamonitor report "Pipeline Insight: Chronic and Acute Heart Failure" (DMHC2085)

[2] Datamonitor report "Pipeline Insight: Asthma/COPD/Allergic Rhinitis" (DMHC2068)

[3] Datamonitor report "Pipeline Insight: Non-insulin Antidiabetics" (DMHC2000)

- This might also be a situation where some home monitoring might be desirable, provided that units of sufficient simplicity and portability were available and that the cost and lifestyle benefits could justify the expense.

- Diagnosis –
  - Initial diagnosis is obviously not a condition as such, but as a short-term intervention it, too, would find it hard to justify automated home monitoring;
  - This, however, is one of the main applications of remote health technologies in distant places. Careful readings are taken from a patient locally and the details are uploaded to a doctor who can make a diagnosis;
  - As the digitisation of medical information in clinical contexts becomes more common, so the use of remote health devices to consult experts who are not present will become more common for doctors conducting examinations in hospitals or clinics. This is discussed in more detail in section 3.2.1 below.

There are currently offline devices in use which record patient data at a remote location and are then physically returned to the clinic or hospital in person. These devices would typically be cardiac monitors which the person wears during their normal day. These devices would only count as remote health technologies if the data from them was uploaded remotely, over a network and so most current systems are excluded.

2.3 Market Structure

2.3.1 How does remote health operate?

Figure 5 gives a picture of what remote healthcare might look like. The chain of operations involves a series of devices that enable the doctor – or other clinician – at a remote location to see data collected from the patient. This data might be collected from monitoring devices such as a blood pressure monitor. It might also be entered by a patient using a keypad or might be a video feed of the patient themselves.

The device is connected to a client who is able to transmit data over a network to a data store and, in the case of a live consultation, the clinician in real time. In other circumstances, the data monitoring system may simply alert the clinician once the data supplied by the patient moves outside a recognised threshold, or it may simply be stored for later review.

In response to this data, treatment can be delivered in a variety of ways:

- **Call in** – if the patient is not being monitored in a clinic or hospital then he/she can be asked to go to one. If the situation is more serious,

transportation can be sent to the patient or he/she may simply be asked to make an appointment for a clinic visit;

- **Simple instructions** – if some small change in the behaviour of the patient is required, this can simply be communicated directly to the patient;
- **On-site clinician instruction** – medical staff at, or near to, the location of the patient can be given instructions on how to treat him/her, by the more senior or specialist person using the data;
- **Automated device treatment** – the device itself could be given instructions to treat the patient in a certain way. An example of this might be remote pain monitoring where a pain specialist can raise the dosage of painkiller via an automated dispenser. This obviously raises all kind of potential problems and remains, for the most part, a theoretical option only as yet.

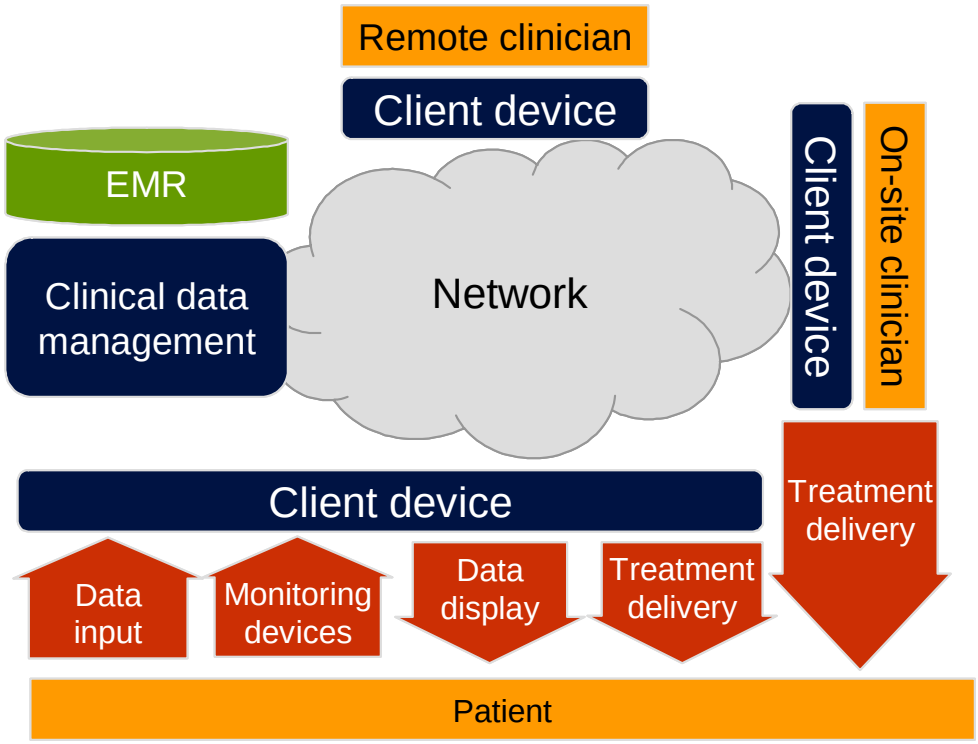

Figure 5: Understanding the remote health technology chain [Source: Datamonitor]

2.3.2 The remote health value chain

There are roughly four categories of vendor who currently provide or potentially offer solutions in this space:

- Telehealth technology vendors;
- Managed services vendors;
- General healthcare applications vendors;
- General IT vendors

Each of these is further composed of various subcategories of vendor. Most of the players in this space will fall into more than one subclass, and many into more than one of the larger classes listed. The variety of different players' footprints reflects the fact that this market is at an early stage of its evolution and the most successful business models are yet to be finalised.

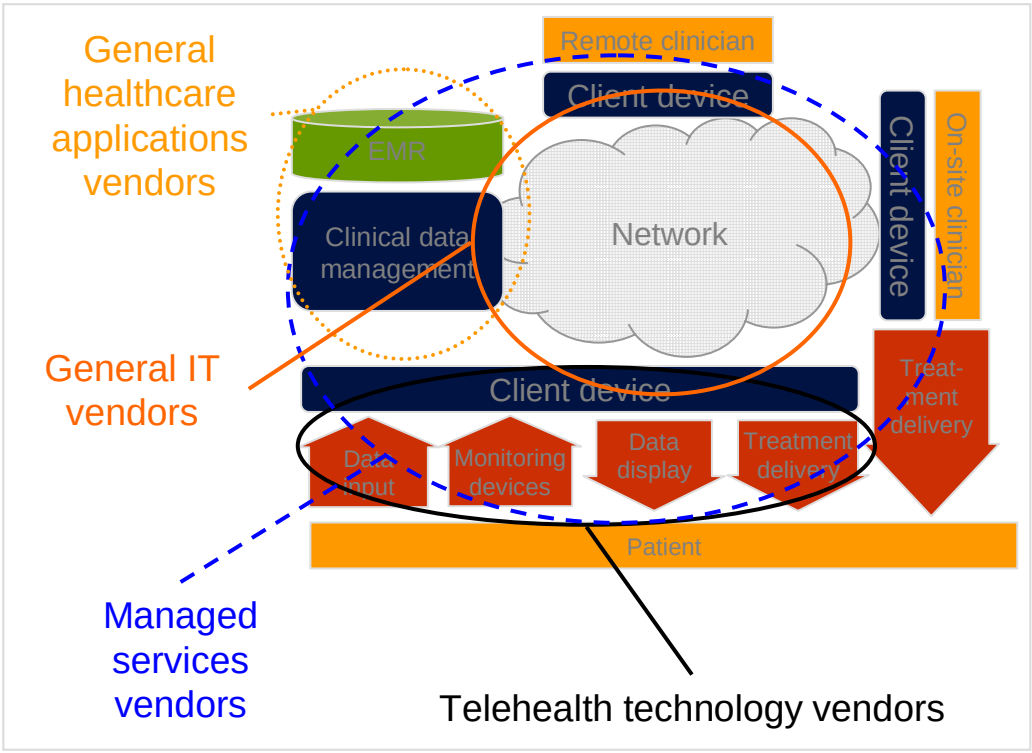

Figure 6: Where vendors fit into the remote health technology chain [Source: Datamonitor]

2.3.3 Telehealth technology vendors

These vendors are those providing the parts of a remote health solution which are unique to remote health. The vendors of these modules fall into the following categories:

- Software for communicating with the remote device and managing the data – this includes both the software that sits on the remote client and the server controlling that device;
- Monitoring devices and client hardware – this includes the devices that sit in the remote site and gather and communicate the data being monitored. They will also communicate the data being transmitted to the remote site. Although many vendors produce these products for both home and clinical environments, the requirements for such devices are obviously very different. As a result of this, many vendors specialise in one or the other market segment;
- Monitoring components that are OEMed into the above hardware – although the above vendors will manufacture the field units, they will invariably do so using monitoring components from an OEM. The OEM will typically make components for a variety of devices and not just for remote health.

While separate vendors could, in theory, provide the first two of these products, in practice, the same vendors tend to provide both. The many vendors in this group include: Honeywell HomMed, AMD Healthcare, Health Hero, Cybernet Medical, Alere Medical, Viterion and Carematics.

2.3.4 Managed services vendors

One way for healthcare providers to avoid the maintenance and other technology issues that might be involved in remote health is to make use of a managed service. Managed services vendors might provide any combination of the following:

- Hosting and networking – dealing with the provision of all technology on a rental basis;
- ASP software (if they are also a software vendor) – vendors who are combining being a telehealth vendor with managed services can choose to provide an ASP version of the software. This enables easier management as this rapidly evolving sector develops;
- Onsite maintenance – a straightforward repair service;
- Nursing/clinical staff – in a fully outsourced service, the vendor might also provide online nursing staff who would review patients and provide medical support via video phone.

2.3.5 General healthcare applications vendors

General healthcare IT vendors, outside any role they may have in either of the above, will provide linkage to other healthcare IT systems such as:

- EMR – as discussed in some detail in section 3.2.1, this will be a vital integration for remote health. Vendors who fall into this category include: Cerner, McKesson, iSoft, GE Medical Systems and Eclipsys;
- PACS – this is the system for digitally recording medical images, primarily from radiology. In situations where the remote healthcare system is generating images, it will have to interface with the PACS;
- Billing and reimbursement – as the healthcare payers may be heavily involved in the roll-out of homecare remote health, such systems may have to interface with billing or reimbursement systems, depending on how the systems are being paid for.

2.3.6 General IT vendors

General IT vendors who have a role to play in the remote healthcare space include:

- Networking – as systems become larger and more complex, so there may be an increasing role for the major networking vendors. Companies like Siemens, Cisco, Avaya, Alcatel and Nortel are anxious to find applications that make use of advanced networking features such as SIP and IP video telephony. Remote health is such an application. Although as yet not deeply involved in remote health, they might well become so if and when it becomes a mass market;
- Computing hardware – these include the servers and clients used to manage the systems but may well also include PCs OEMed into the telehealth clients mentioned above;
- Systems integration – this forms the largest part of all major IT projects. Systems integrators generally have ownership of the relationship with the client. As such, their importance in any healthcare IT project is likely to be significant.

Other general IT vendors who may have the opportunity to become involved in telehealth as the sector develops include:

- Enterprise application vendors – as remote health becomes more established, increasingly it will touch upon the other enterprise functions of healthcare providers, such as ERP, CRM, procurement and SRM. For example, these vendors provide the HR systems that managed the nursing staff working in large health systems and, hence, there is the potential need to integrate remote health applications into these systems;

- Analytics applications vendors – as systems generate ever increasing volumes of data, the opportunities for data-mining increase. This has the potential to provide both clinical and operational benefits. Analytical systems will be able to spot patterns that are able to provide more accurate alerts on patient conditions. They may also be able to provide improvements in the way in which nursing staff are used, freeing up valuable resources.

2.3.7 Mapping IT vendors to technologies

Figure 7 shows how the technology vendors described in sections 2.3.3 to 2.3.6 map to the more general technology categories used in the market projections in sections 4.1 to 4.1.4.

Technology vendor	Hardware	Software	Services
Telehealth technology			
Communication and data management software	○	●	◐
Monitoring devices and client hardware	●	◐	◐
OEM monitoring components	●	○	○
Managed services vendors			
Hosting and networking	○	○	●
ASP software	○	●	●
Onsite maintenance	○	○	●
Nursing/clinical staff	○	○	○
General healthcare applications vendors			
EMR	○	●	◐
PACS	○	●	◐
Billing and reimbursement	○	●	◐
General IT vendors			
Networking	●	◐	◐
Computing hardware	●	◐	◐
Systems integration	○	○	●
Enterprise application	○	●	◐
Analytics applications	○	●	◐

Product coverage of the vendors	None	Some	Main
	○	◐	●

Figure 7: Mapping technology vendors to product types [Source: Datamonitor]

2.4 Market Trends and Drivers

This section explores the main background trends in the provision of healthcare and how they are driving and restraining the market for remote health technologies. The description of these developments is based on a number of sources which include:

- the opinions of hospital IT managers described in the data from the survey referred to in section 3.1;

- interviews with a large range of vendors who currently operate in this market;
- Datamonitor surveys of physician attitudes to remote health and other technologies;
- other Datamonitor surveys and existing research.

Although these sources provide a large range of data, the overall priority given to the various market features described below is ultimately the result of Datamonitor's analysis and judgement.

2.4.1 Trends

There are three main trends in the overall healthcare market which have helped to create the market conditions for a substantial rise in the adoption of remote health technologies:

- an ageing population and the resulting increase in the demand for healthcare;
- increasing consumer demands on healthcare systems;
- technology which is rapidly increasing in power and reducing in cost.

Ageing population and rising costs

The developed world will see a sharp rise in the proportion of its population over 65 in the next few years. Over 65s are, unsurprisingly, the most intensive users of healthcare. There will be, therefore, a vast expansion in the demand for healthcare and in the number of patients, which will be disproportionate to the growth of the population overall. In turn, this will place upward pressure on healthcare expenditure whilst at the same time reducing the pool of working people to pay for it. As a result of this, we will see:

- an expansionary phase for the health sector in all geographies;
- increased pressure for efficiency, as the pool of working people paying insurance premiums and taxes decreases.

This, in turn, will mean that:

- there will be extra money to invest in new technologies;
- IT will form a higher proportion of budgets as healthcare tries to achieve the efficiencies seen in other industries;
- there will be demand for technologies which can reduce the cost of chronic treatment for the conditions that are typical amongst older people.

Consumerism

The recent past has seen a considerable improvement in the standards of customer service demanded by consumers across developed markets. As the quality of other

goods and services improves, consumers of healthcare are no longer willing to tolerate the levels of service which were deemed acceptable previously.

While quality of clinical care remains the first priority, healthcare consumers are beginning to 'shop around' for providers who will offer the same level of customer service they would receive at their bank or supermarket. Such consumerism has led to a more competitive and 'customer-focused' healthcare market as providers are increasingly rewarded for considering a patient's overall customer experience.

In other words, healthcare providers who had previously examined success purely in terms of customer survival, now need to give greater consideration to the features of care which customers see as important.

Technologies enabling people to stay in their own homes, or perhaps in assisted living accommodation rather than a hospital or long-term care institution, will provide a considerable increase in quality of life. However, the usability of such systems is vital. The equivalent of the unintelligible user interface of the VCR will not only be impractical in such contexts, it will also not be acceptable to healthcare consumers and, in fact, negatively impact patients' health.

Improving technology

Healthcare places very high demands on the reliability of technology. It also has very tight budgets and expanding demand. It is vital, therefore, for any technology product that is going to be widely adopted to be affordable, robust and effective.

Traditionally, although healthcare has been at the forefront of many technology areas, it has lagged behind in the adoption of information technology. Thanks to the relatively rapid development of IT solutions across the board, with declining costs and improved effectiveness, health is prepared increasingly to depend on solutions rooted in mainstream IT.

In particular, improvements in networking and in the components used in remote health have made remote healthcare increasingly desirable and affordable in technology terms.

2.4.2 Drivers of homecare-based remote health

Reducing costs

Reducing the cost of chronic care is an important target for all the healthcare systems facing the explosion in elderly population. There are several ways in which homecare remote health can reduce the cost of chronic and post operative patients.

- Reducing stays in hospital – by enabling patients to receive the right level of monitoring in their own home without having to be in hospital;
- Reducing the number of readmissions – by being able to notice changes in the condition of the person being monitored before it is necessary to admit him/her;

- Lowering nursing costs – by reducing the number of nurse home visits that are necessary to keep an eye on the patient.

Improving clinical outcomes

Obviously, many of these cost-reducing factors will also have clinical benefits. Spotting problems earlier also increases the probability of a positive outcome for the sufferer. Not only might changes in condition be noticed earlier, changes that would have been missed altogether can also be picked up. Previously, the person in question may have died before any alteration was observed.

In this way, remote health can also increase hospital admissions, but for those patients whose problems would otherwise have been irreversibly or fatally missed.

Improving quality of life

Improved monitoring also has the capacity to notice non-life-threatening quality of life issues that can be adjusted with improved care. These might be problems that the patient would be able to live with for years but, if spotted, can be addressed with considerable benefits to them.

However, the main potential improvement in the quality of life for sick or elderly people is enabling them to live in their own homes. Remote monitoring has the potential to remove them from hospital or even long-term care and, hence, give them greater comfort and independence.

A potentially large market for remote monitoring will be those older people living in the class of accommodation half-way between nursing care and a standard home, known as assisted living or sheltered accommodation. This is a rapidly expanding sector for property developers and, as remote health becomes more established, it has the potential to become a pivotal part of the managed services offered by these providers.

Of course, these environments and long-term care homes present a very similar opportunity for more complex monitoring performed by trained staff. This would also count, therefore, as a driver for the other category of remote health as we have segmented it.

2.4.3 Drivers of clinical remote health

Remoteness or distance

There are three main types of remote environment which have the conditions that promote remote health:

- Sparsely populated parts of developed countries – in places such as the Australian outback or the remote islands of Scotland, the dispersal of population means that it is hard for diagnostic or monitoring clinicians to reach people economically;

- Countries with very poor infrastructure – here the problem is partly distance, but mainly the difficulty in travelling caused by poor logistics;
- Extreme environments – many of the remote health technologies now in people's homes found their first application in systems designed for astronauts or for the scientific stations in the Antarctic. In those situations, it is not merely difficult or uneconomic for a doctor to visit, but physically impossible. Equally, many more cutting-edge applications are used by solders in battlefield environments. In both types of context, more extreme applications, such as remote surgery, are easier to justify as other alternatives may be unavailable.

Scarcity of experts

Remote health has the ability to make the most of resources, in the form of consultant experts in a particular field. Applications where this is the motivation for using remote health technologies include:

- Hospital ICU – patients in the ICU are already under very intense observation with typical nurse to patient ratios of one to one. In this context, the use of telehealth technologies is to try and extend this one to one care beyond nurses and junior doctors to the most highly trained person available;
- Global experts – being able to make use of the consultation skills of experts in another hospital or even another country.

Scarcity of resources in general

In the developing world, there is often a general scarcity of medical personnel, not merely of local experts in a particular field. In some of these countries, policy makers or providers are trying to make the most of limited healthcare resources by using electronic diagnostic equipment rather than local GPs. Here, remote health is replacing the need for local doctors and enabling a smaller number of reviewing physicians to deal with much greater case loads.

Rather than seeing this as a stop-gap on the way to a full medical service, such providers might instead see this as skipping a stage in development. They would be moving straight to a high tech environment, where the improved detail given by digital monitoring equipment more than compensates for the absence of a doctor. For example, a digital ENT-scope will provide a much more detailed view of a patient's ear than the optical equivalent found in many doctors' offices.

Of course, the prospect of replacing a doctor with electronic devices would be completely unacceptable to most people in developed countries, but represents a massive leap forward for many in developing countries. Whether it can really permanently replace the initial diagnosis role of GPs or family practitioners remains doubtful. One of the challenges will also be in educating those in less developed markets about the benefits of technology as they may be less comfortable with it.

2.4.4 Restraints

Up-front cost of solutions

Although the costs of these systems are declining all the time, the up-front investment needed for either type of system is still high. In the case of homecare, this acts as a particularly large factor as this kind of deployment involves multiple units.

The typical cost of purchasing a monitoring system involving one or more simple attached devices might be anything from $1,000 to $3,000 (about £600 to £1,700). This does not include the cost of installing and supporting or maintaining the system afterwards.

Healthcare providers will need to be convinced that the promised cost savings justify this outlay.

Maintenance and control of devices

Medical devices need to provide accurate data and, hence, to be in a good state of repair at all times. Tracking the status of these devices, either in people's homes or in the field, will create costs. Providing on-site support and maintenance will cost even more.

Devices will have to be relatively easy to use and hard to break. In addition, they will have to stand up to significant wear and tear without need for replacement or ongoing repairs. Only if devices can display these properties will they be widely adopted outside controlled environments.

Funding structures and homecare

One of the biggest potential barriers to the adoption of homecare specifically is the question of who is responsible for bearing the costs involved. Although chronic illnesses increase the cost of care overall, often it is not the providers of care who bear those costs.

In the US, the payers – insurers, managed care providers or Medicare – bear the cost, but the providers of care do not necessarily have a financial incentive to lower costs: in fact, quite the opposite. In this case, the attitude of Centers for Medicare & Medicaid Services (CMS) – the body responsible for these publicly funded programs – will be crucial to the development of the sector. As CMS allows more remote health programs to qualify for funding, so the sector will expand. It may also decide to take a more proactive approach to promoting these solutions, if and when they are proven to be effective both clinically and financially.

Although the funding situation is very different in other countries, similar problems remain. Funding for healthcare systems is designed primarily to pay for individuals when they become ill and not to stop them becoming ill. As a result, the attitude of public health policy makers will be crucial across the developed world and will need substantial modification in some cases.

At present this problem is the one most frequently reported by vendors to be a restraint on the market, although that perhaps reflects the US focus of most of those technology providers.

Protocols for care

As with any new medical approach, it is important for the clinician to know how to use it. For all drugs in use, there will be protocols to dictate how they can and should be used. For remote health technologies, these protocols have yet to be established. Until best practices for how to use the data gathered in a remote context are laid down, clinicians will have a certain leeway.

This exposes them to legal liabilities that they may not previously have had. Now they may find themselves held accountable for not acting on information of a type to which they would not previously have had access. Obviously, this acts as a restraint on the adoption of any medical product, but it will continue to affect these products until this use has been more widely trialled.

Consumer resistance and technophobia

There are two forms of resistance that the patients using these systems might have:

- Don't want the system – resistance to being monitored from their home or to being remotely monitored in hospital;
- Don't use the system – no up-front resistance, but in practice they fail to actually use the system to gather the data.

In turn, this resistance can be for a number of reasons, including:

- Technophobia – this is often used by vendors and others as an excuse for poor design – older people will be quite capable of using devices that are clearly and carefully designed;
- Concern about efficacy – consumers of this technology need to be convinced that it works and that their data really is being monitored;
- Inertia or poor motivation – research consistently indicates that patients often fail to use drugs or equipment. Either they don't understand the instructions or they fail to appreciate their importance. Often, they simply believe that they are fine and hence can stop inconvenient treatment;
- Simple conservatism – some patients will only have confidence in a doctor taking readings from them directly and simply be resistant to any change to that model.

If patients believe that they will be able to stay at home, that will serve as a powerful motivation to accept the technology. However, getting patients to actually use it will require careful encouragement and good design.

Professional resistance

It is not only the public who can display a conservative attitude towards change. Some in the clinical profession will also have doubts about the effectiveness of remote health. These doubts will only be overcome by positive evidence of the success of carefully scrutinised implementations.

Privacy and security

Both professionals and the public will have concerns about the privacy of the data being collected and its security as it travels over the network. Not only will careful safeguards need to be put in place, but these safeguards will have to be well understood by all users.

Patients need to be able to trust the system that they are giving data to and to have the same trust in the confidentiality that they do when in conversation with their doctor. At the same time most of security is in the behaviour of the user and so all parties need to understand how to use the system so as not to jeopardise confidentiality.

However, these concerns will have to be addressed in any case to proceed with the implementations of EMR which are in progress across the developed world.

3 MARKET ASSESSMENT

3.1 Attitudes from the Survey

As part of the research for this report, Datamonitor conducted a survey of hospitals in the United States, the United Kingdom, France, Germany, Italy and Spain. Datamonitor spoke to the head of the IT function within those hospitals, in order to try and discover how institutions view remote health. The interviews were conducted between the 1st and the 13th of February 2006.

As yet, the purchasing points for remote health have not been fully defined. It is likely that hospitals will be only one of many institutions who will be customers for this technology. Hospitals were chosen as the focus for this relatively small study, as they hold the largest proportion of the technology budget within most healthcare systems and they encompass a wide variety of usages. As the most experienced purchasers, they will have more refined views on technology procurement. Being potentially responsible for both clinical uses and homecare uses, they are also able to give some insight into both areas.

Other healthcare provider institutions, such as primary care or long-term care, would be limited to a smaller range of applications or contexts and, in the past, have had less responsibility for IT procurement. However, these may be important markets for these technologies and their opinions will differ from those expressed by hospital IT managers.

3.1.1 Familiarity with remote health

Question: How familiar do you feel you are with the technologies that enable telemedicine or remote health?

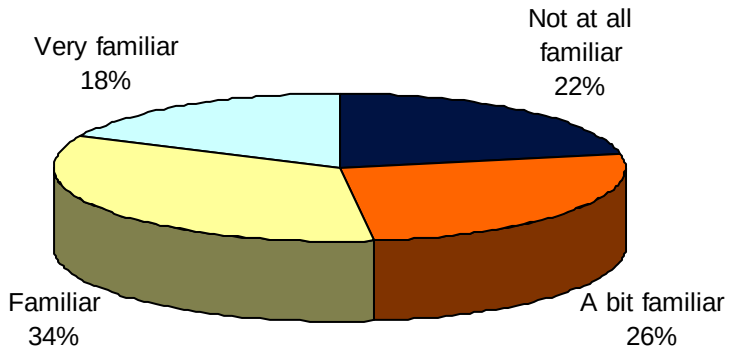

Figure 8: Familiarity with remote health [Source: Datamonitor survey]

Remote health remains a very nascent market. As can be seen in Figure 8 above, only 18% of respondents felt that they were “very familiar” with remote health technologies, compared to 22% who were not at all familiar.

Given that respondents have a tendency to over- rather than underplay their familiarity with new technologies, it is clear that we have some way to go before these technologies form a core part of medical IT.

Question: Please indicate which of these statements best reflects how well-informed you feel about each of the following as an application of remote health technology?

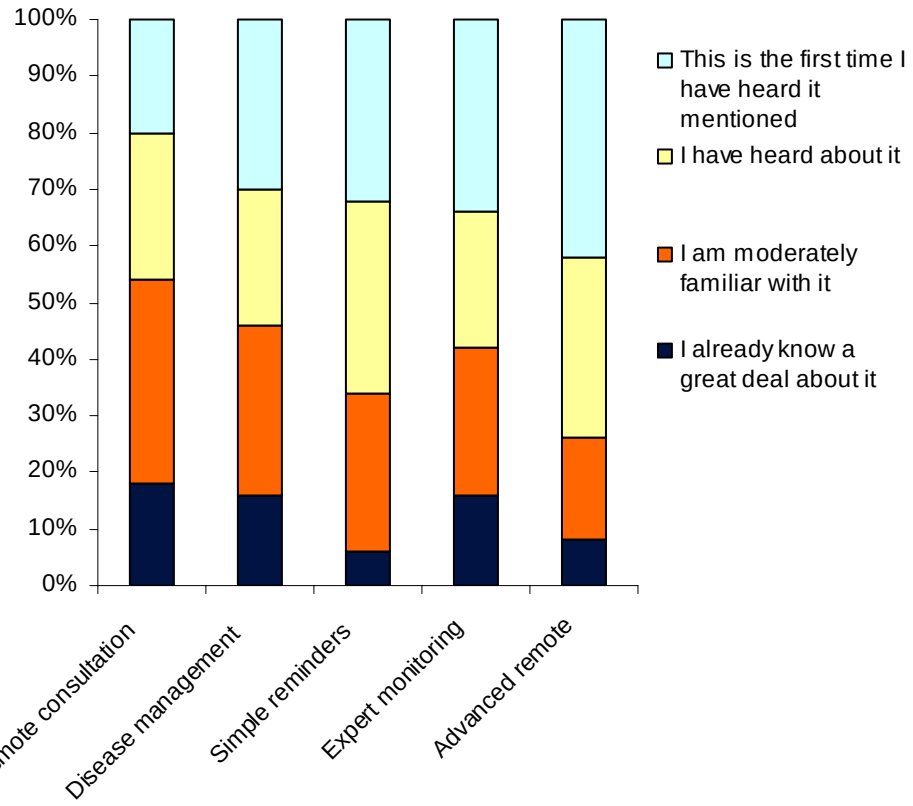

Figure 9: Hospitals’ understanding of the applications of remote health [Source: Datamonitor survey]

Figure 9 above shows how familiar respondents felt with each of the potential applications of remote health which are outlined in section 2.2.3 above. Unsurprisingly, they were least familiar with the most advanced applications of remote health, with 42% of them saying that this was the first time they had heard of them.

Remote consultation and disease management showed higher levels of familiarity. Disease management is going to be a key focus of all parts of the healthcare system as the number of people living with chronic conditions continues to rise. As indicated above, this area will generate the most significant applications for remote health technologies and this familiarity reflects that.

However, the respondents had a relatively low knowledge of all of the individual applications. The most recognised application had still never been heard of by 20% of respondents.

3.1.2 Plans for remote health

Question: Which of the following applications do you think will be most important for your institution over the next 3 to 10 years?

Respondents were asked to rate each of the application areas 0 (not at all important) to 4 (vitally important). The diagram shows average scores given to each of the choices.

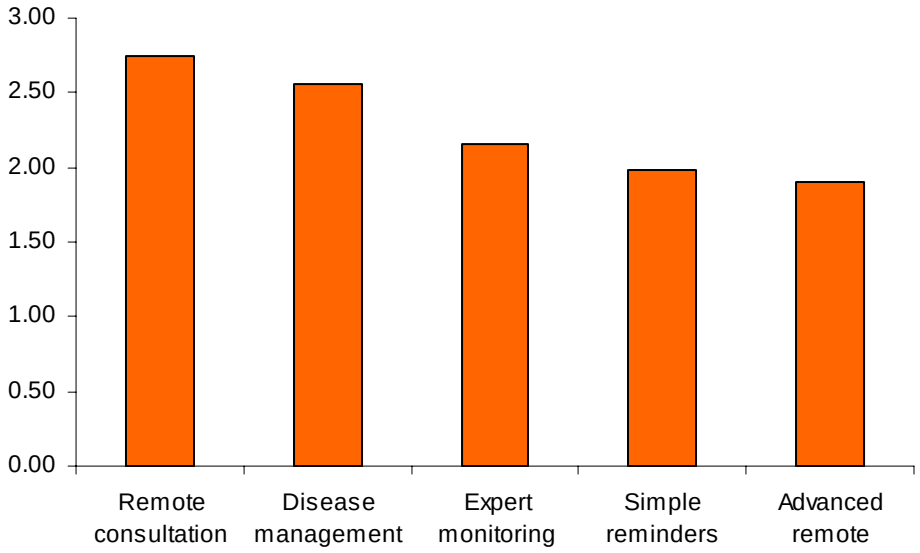

Figure 10: Applications by importance [Source: Datamonitor survey]

After the applications had been explained to the respondents, they were asked how important they thought each of them would be. This followed a similar pattern to that shown in Figure 9, with the scores given to the applications, shown in Figure 10, closely reflecting the relative familiarity that respondents had with them.

Respondents clearly found it easier to see significance in those applications with which they were most familiar. However, this does not mean that the two most significant applications do not reflect a genuine opportunity.

As mentioned above, remote consultation, in the most liberal interpretation, could be a relatively simple application and basic video conferencing usages are already widespread. However, despite its slightly lower rating, it is disease management which will represent the largest growth market.

Question: Has your organisation implemented or does it have plans to implement any projects that fall into this category?

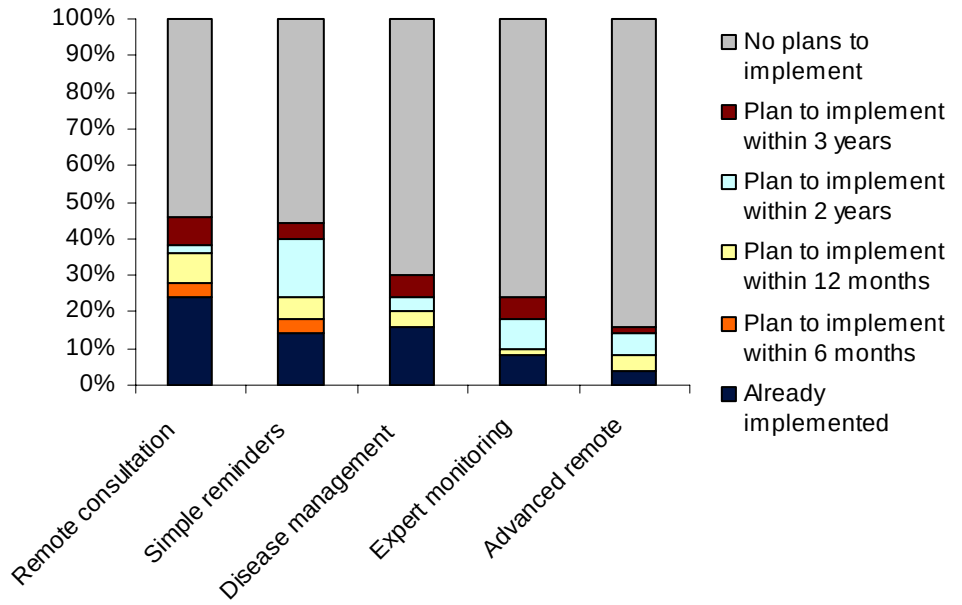

Figure 11: Plans for remote health applications [Source: Datamonitor survey]

The relatively undeveloped status of this sector is clearly reflected in Figure 11. Here, we see that there is no application which more than half the respondents have any plans to implement in the near future. In the case of remote consultation, it is likely that many of the implementations mentioned by respondents may not really qualify as remote health under the definition, and may simply be video conferencing systems.

However, it is important to take into account the fact that the respondents are hospital IT managers. As discussed above in section 2.4.4, for implementations of homecare remote health the money is unlikely to come directly from hospital IT budgets. Hospitals will have to interface with such systems, but it is likely to be the case that community disease management is organised elsewhere. This is clearly reflected in the relative difference between those respondents who thought that this application would be important and those who are involved in implementations.

3.1.3 Reported motivations and inhibitors for remote health adoption

Question: What are or will be the main motivations for making use of remote health applications in your organisation?

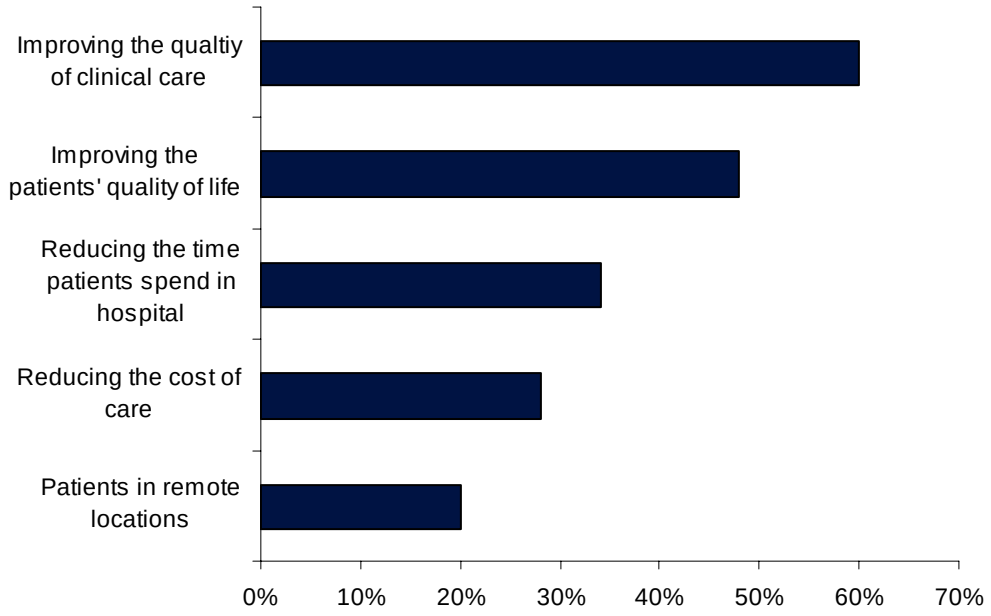

Figure 12: Motivators for remote health [Source: Datamonitor survey]

A clear focus on the quality of clinical care is evident in Figure 12. 60% of respondents said that improving the quality of care would be the main motive behind any adoption of remote health technology. A close second was improving quality of life, with 48%.

The clear patient focus illustrates that remote health will have to prove itself as a clinical solution to gain acceptance in the medical community. While cost savings may impress insurers and policy makers, it is clear that clinical practices will have to be the focus of any successful technology.

Question: What are or will be the main factors which will inhibit the use of remote health applications in your organisation?

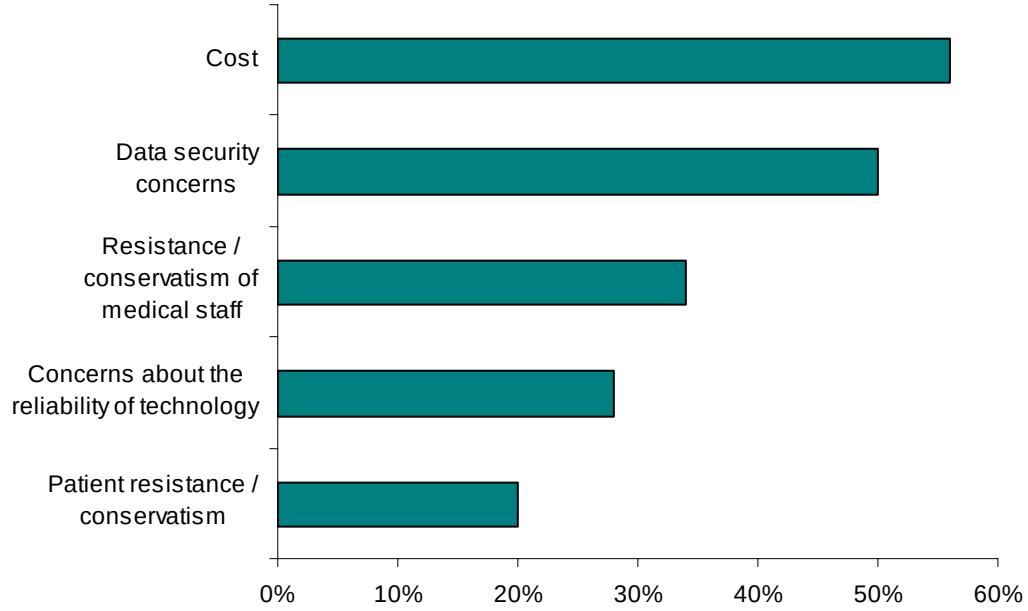

Figure 13: Inhibitors of remote health [Source: Datamonitor survey]

The cost pressure on hospital IT departments is demonstrated by the clear selection of cost as the main inhibitor to adoption, as shown in Figure 13.

As mentioned above, although they have the potential to create substantial medium-term cost savings, the upfront costs of these systems could be very high. However, given respondents' lack of familiarity with the technologies on offer, this impression of the cost of the solutions must be rather speculative.

Data security is clearly a top concern for all IT decision makers, and in few places is data integrity as important as in a hospital.

Interestingly, IT managers see the conservatism of medical staff as a more important barrier to adoption than that of patients. This reflects, perhaps, the greater influence that this group has over purchasing policies.

3.1.4 Understanding the systems themselves

Question: Thinking of remote health overall, which of the following technologies are or will be most critical in remote health?

Respondents were asked to rate each of the application areas 0 (not at all important) to 4 (vitally important). The diagram shows average scores given to each of the choices.

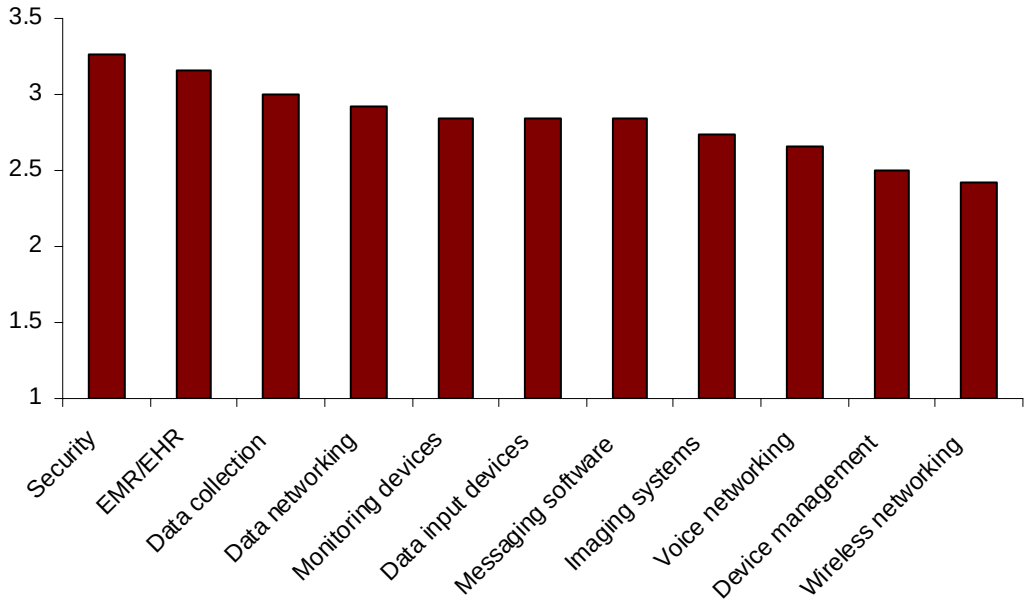

Figure 14: Important individual technologies [Source: Datamonitor survey]

Figure 14 shows the average scores given to the different technologies that might form components of a remote health solution. Respondents saw those pieces of technology that ensure security as most important, reflecting the high prominence given to this issue as an obstacle to adoption.

There is a clear focus on the management of the data collected, shown in the 2nd, 3rd and 4th ranked technologies in order of significance. The result of another question reveals that EMR projects are easily the most important current focus of IT departments in the survey. The current centrality of this topic helps to explain why this is seen as the second most significant technology.

However, the placing of data management and EMR in particular ahead of the devices used to collect that data reflects the correct emphasis within any implementation. The collection of data is futile without the ability to put that data in context and hence act upon it. The importance of EMR is further discussed below in section 3.2.1.

Question: Where will the patient receiving this type of remote health service be located?

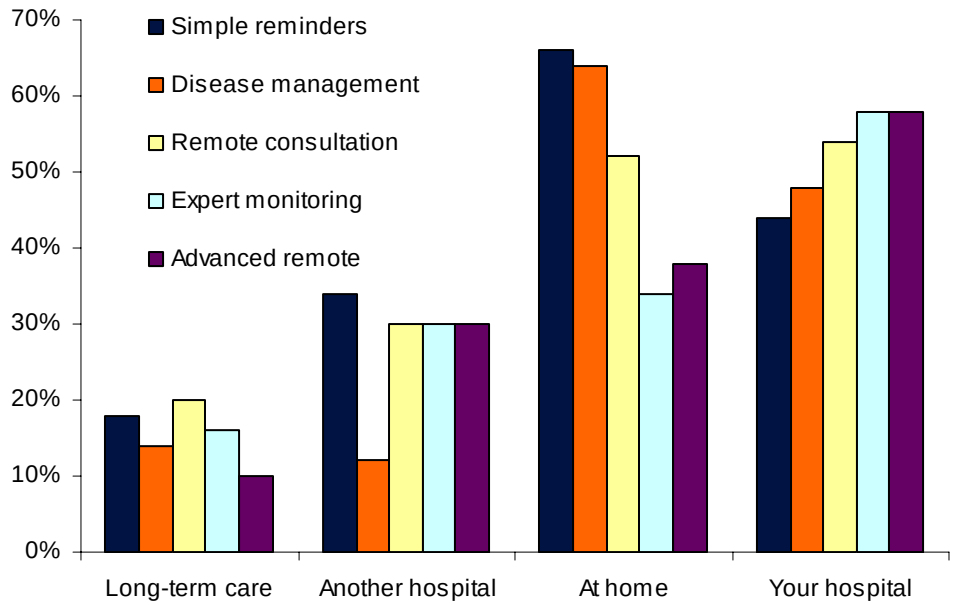

Figure 15: The location of patients [Source: Datamonitor survey]

Figure 15 shows where the respondents thought that patients making use of remote health were likely to be located. They saw the primary applications as being either in the home or in their own hospitals rather than in other environments. Unsurprisingly, they were more likely to see simple reminders and disease management as homecare applications, while seeing expert monitoring and advanced remote medicine as hospital-based.

3.1.5 Lessons from the survey

In summary, the key conclusions from the primary research were as follows:

- Remote health is only at a very early stage of development, and hospitals in particular remain relatively unfamiliar with this technology and its applications. Raising awareness of the possibilities of the technology will be a crucial first step for vendors in this market;
- Unsurprisingly, given the low familiarity, few have well defined plans to implement at this stage. Where they do, such plans will often not really qualify as remote health;
- Remote consultation and disease management were believed to be the most important applications. Disease management is chiefly a homecare application and the fact that it is given such a high rating by IT managers

primarily concerned with a clinical context shows its overwhelming significance in healthcare as a whole;

- Security was seen as one of the two main inhibitors for uptake, and was also seen as a core technology area. Addressing these natural concerns will be crucial for vendors selling this technology.

3.2 The Development of Remote Health

3.2.1 Electronic medical records

The importance of electronic medical records will vary depending upon the countries and healthcare systems in question. Although all of the developed markets are moving towards the creation of electronic medical records (EMR), they are all evolving different systems and, perhaps of more relevance, these systems are all developing in different ways. Those countries, such as the UK, with very centralised systems of care are often developing centralised data repositories for every citizen. Those with more distributed models, such as the US, will often have more localised hospital-based EMR systems, at least for the moment.

Most systems for remote health create their own independent EMR. There are two reasons for this:

- they are designed to be used in environments which don't have existing EMR systems and, hence, need a stand-alone repository;
- in situations where an EMR system is present, it is not always suitable to place all of the data from the remote health system into that repository.

Integration between these individual systems and the larger-scale centralised EMR schemes should be relatively easy provided that both adhere, as most systems do, to HL7 standards. However, telehealth providers recognise that, as a client system, they must be ready to integrate almost out-of-the-box with all of the major solutions offered by the major EMR vendors whose systems are currently being installed across the world.

Remote health technologies and EMR have an intertwined relationship with each other. One will generate vast quantities of monitoring data; the other provides a way to manage and understand data from patients. As a result, the rapid adoption of EMR currently taking place will act as a driver of remote health in two ways:

- Enabling data management – the data from the remote systems will have to be cross-compared with other medical information on that patient. Without EMR, this will be difficult and time-consuming as paper-based and online sources have to be used at the same time;
- Creating demand for digital data – once an EMR system is established, it creates a demand for digitised data on that patient, in order to make the

most of the investment. In addition, data not taken by networked devices will have to be entered separately by hand or will go unrecorded.

The demand for digitised data may well create a second market for digital monitoring technologies. Doctors' clinics – such as GP surgeries – will potentially adopt the same kinds of clinical solutions which are now taken only to remote areas. Devices such as a digital stethoscope, normally used to enable doctors miles away to hear a patient's heart sounds, can be used instead to record those heart sounds in the EMR for future reference. Although this is not, as such, a remote health market, it is another possible market for many remote health vendors' products and increases the overall opportunity, as well as the attractiveness for vendors of further extending boundaries for the types of products they develop.

3.2.2 Evolving technologies

As remote health continues to develop, both in the home and other locations, the range of technologies in use will expand. Already, a large range of more advanced devices are being trialled and it is an open question which of these will be most successful. This section looks at several of these technologies, both those in use and those which remain slightly theoretical.

Video calling

Video calling is already widely used in implementations of homecare remote health. Many vendors believe that this will become a core part of all solutions of this type. This is the case with clinical remote health, where the sophistication and cost of the equipment are higher. Also video will form a vital part of the monitoring in more intensive contexts, such as the ICU.

However, the expense of installing video calling for home-based solutions will mean that it is not necessarily a default choice for those systems. The high cost involved is not that of the technology itself: rather, it is the cost of the clinician – usually a nurse in this context – on the other end of the video link which adds significantly to cost.

In some contexts, there will be clear value in adding that extra element of personal distance monitoring. In particular, where there are mental health problems, or the patient has multiple conditions to manage, the extra value of being able to see and talk to that patient will be substantial. Whether video systems are valuable for the vast majority of patients is something that remains to be determined by clinical practice.

Wireless monitoring devices

At present, most systems connect whatever monitors they have to the client device by wire. However, there is an obvious value in making use of some kind of wireless technology. This has the potential to reduce maintenance costs and to make the systems easier to use.

At present Bluetooth is commonly used for such devices, although vendors will look seriously at newer protocols, such as ZigBee, as they become available.

IP vs mobile/cellular

At present, most systems used in the home or at distant locations communicate over the wired telephone network (PSTN). However, in the future, these devices may make use either of the expanding broadband networks in most countries, or of the GSM/CDMA/3-G mobile telephone networks.

Which of these options seems the more attractive will vary, based on:

- Coverage – the extent of ADSL or DSL penetration varies significantly by country as does the coverage given by the mobile phone networks. The more extensive the coverage, the easier it is for the remote health system to make use of that network;
- Bandwidth – wired broadband obviously has a data rate advantage over most mobile phone-based systems. Although 3-G will eventually speed up mobile communication, the coverage will remain patchy for some time. However, the amount of bandwidth needed to transmit remote health data might be relatively small depending on the application. At present, mobile bandwidth is mostly adequate, at least for home monitoring without video. The question will be whether newer monitoring devices demand increased bandwidth faster than mobile can provide it;
- Mobility – making not only the monitoring devices, but also the network client itself "wireless" by using mobile, would give an added level of flexibility to users. In the homecare context, they could move the unit between rooms or even take it on holiday without concern. It raises additional possibilities when considered in combination with trying to monitor more mobile patient,s as discussed below.

Devices for more mobile patients

As mentioned above in section 2.2.4, at present there are many offline monitoring devices which cardiac patients wear and return. Most homecare remote health applications have been focused on those patients who are the largest consumers of healthcare, who tend by their very nature to be less mobile.

However, as the sector becomes more established, monitoring devices aimed at other types of patient can be integrated into the system. These might work by storing the data, as now, but then transmitting it when the patient returns home, either by plugging it in or using wireless connectivity. Alternatively, they could make use of mobile phone networks as mentioned above.

While cardiac monitors are the most obvious application, there might be examples of other small portable monitors that could provide valuable data. For example, a simple activity monitor which could track how much exercise the patient is taking might help the patient and doctor to control a number of conditions.

Going the other way – treatment

Most of the applications discussed so far would make use of instructions, given either to the patient or to an on-site clinician, to provide treatment in response to the data

gathered. There are obvious concerns about having an automated response directed by the off-site doctor. Taking information is one thing and injecting drugs quite another.

However, it is possible to imagine very controlled situations, such as those found in an ICU equipped with remote health systems, where small adjustments to care might be made in this way. Small adjustments to automated drug doses might be possible without using onsite personnel to manage them.

In more extreme circumstances, such as battlefield surgery, the remote surgeon has to find ways to convey very complex instructions to relatively untrained personnel on the ground. Here a certain degree of automation, in particular of the anaesthetics function, might actually add to rather than detract from patient safety.

In the more distant future, this kind of partially automated and heavily instructed situation might become more common in civilian contexts as well.

3.3 Opportunities in the Market

The market for remote health technologies is still at an early stage in its evolution. As a result the market is crowded with players and incompatible business models. This section looks at where the opportunities lie within this complex picture.

3.3.1 Finding a technological gap

One way to profit from this market is to find the correct technological gap to plug. Datamonitor has identified the following areas of opportunity:

- Managed services – healthcare providers will want to be able to trial remote health in a low-risk way. By building the right combination of managed services, a vendor can help to mitigate the risk for the healthcare purchaser while pursuing a best of breed technology strategy.
- Component innovation – vendors can attempt to produce a superior product in a specific area
  - Making new tests available – by producing products that are able to test features of a patient's condition that were previously only measurable in a hospital or could not be measured at all. For example, this might be a new on-site blood test, in addition to the blood glucose testers already available;
  - Making existing systems better for home use – this might be by making them more rugged and hence cheaper to maintain. Alternatively it might be by creating innovative user interfaces designed around the needs of older people.
- Analytics – there is an opportunity to create software specifically targeted at analysing the medical data produced by remote health. In the homecare

setting, this might be designed to spot patterns in the mass of health data supplied. In the context of a remote area, it might be an offline system designed to mimic the analysis a physician might provide, and give an immediate idea of urgency before the remote doctor has had time to review the data

- Focused telehealth offerings – a vendor might attempt to compete directly with the telehealth vendors mentioned above, by producing solutions focused on the needs of a particular local market. Given that most of the vendors use OEMs for many of the pieces of their solutions, it is possible for a vendor to put these pieces together with its own software in a way that is tightly localised to a given market such as Scotland.

3.3.2 Finding the right markets

Success with remote health products will also be determined by the choosing the correct sub-markets on which to concentrate. In doing this, a vendor may choose the largest and most important market, or choose to pursue profitable niches that are currently under-exploited.

The main markets

It is Datamonitor's view that the following will be the primary markets for remote health:

- Home care for chronic conditions – this will be easily the largest market as can be seen clearly in section 4;
- Diagnostics for remote locations – this is the most established market for remote health and providers covering remote parts of developed countries will continue to upgrade as new technology becomes available;
- Intensive monitoring for hospitals – this market is specialised and addresses a specific need to intensify the monitoring. It will prove a test bed for a much wider range of networked monitoring devices.

Potential under-exploited markets

These markets are under-developed even in comparison to other areas of remote health. As a result they represent more of a gamble, offering the prospect of first mover advantage and rapid growth:

- Doctors' offices – as mentioned in section 3.2.1, as EMR becomes all-pervasive, ordinary GPs or family doctors may want to digitise data previously only recorded impressionistically in written notes. This is potentially a large market for relatively high specification products. However, it remains to be seen how great the pressure to put information online will be and how valuable this more detailed data will prove to be;
- Assisted living accommodation – as mentioned in section 2.4.2, assisted living or sheltered accommodation also presents a clear opportunity. By

partnering with the providers of this service remote health vendors can establish themselves as the default platform in this environment;

- Developing world – as mentioned in section 2.4.3, the developing world offers another distinct opportunity. Here, the goal would be to create systems which act as force multipliers, making the most of doctors by helping to replace primary care electronically. Obviously this requires a focus on cost and ruggedisation, but also on systems complex enough to take a full range of diagnostic information.

4 MARKET DATA

This section contains projections of the future size of the remote health market in the major developed markets. The countries covered in the model and their regional groups can be seen in Figure 16. The total market figures that follow only include the countries mentioned here, and no others that might be argued to be part of those regions.

Eastern Europe	Cyprus	Western Europe	Austria
	Czech Republic		Belgium
	Estonia		Denmark
	Hungary		Finland
	Latvia		France
	Lithuania		Germany
	Malta		Greece
	Poland		Iceland
	Slovak Republic		Ireland
	Slovenia		Italy
	Turkey		Luxembourg
			Netherlands
North America	Canada		Norway
	Mexico		Portugal
	United States		Spain
			Sweden
Pacific Rim	Australia		Switzerland
	Japan		United Kingdom
	Korea		
	New Zealand		

Figure 16: Countries covered in the market projections [Source: Datamonitor]

4.1 Market Projections

4.1.1 Overall market opportunity size

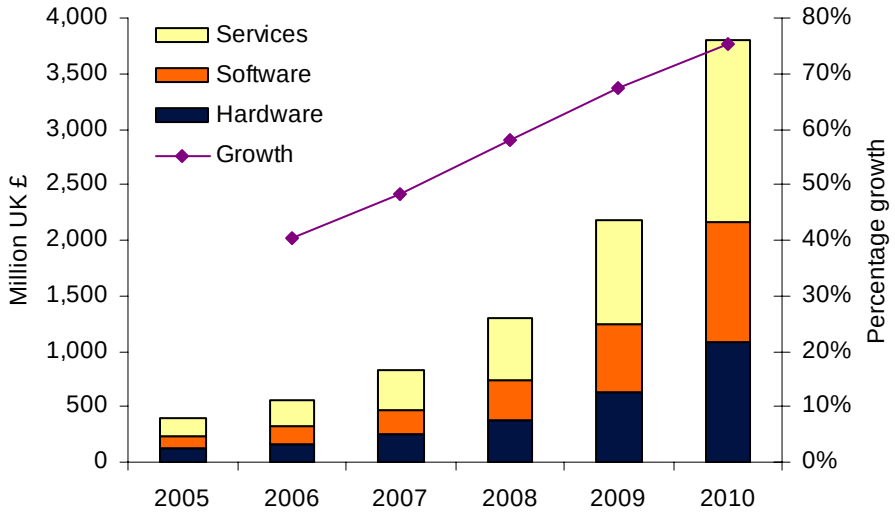

Figure 17: Total remote health market by hardware, software and services, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
Hardware	123	170	248	387	635	1,089	55%
Software	107	151	225	360	610	1,081	59%
Services	164	233	348	552	929	1,639	58%
Total	**394**	**553**	**821**	**1,298**	**2,174**	**3,809**	**57%**

Figure 18: Total remote health market by hardware, software and services, 2005 to 2010 [Source: Datamonitor]

The nascent state of the market means that it is currently relatively small, with a total market size for the developed world of £394 million ($687 m US$) in 2005. However, as can be seen clearly in Figure 17 and Figure 18, this will allow for very rapid growth in the sector.

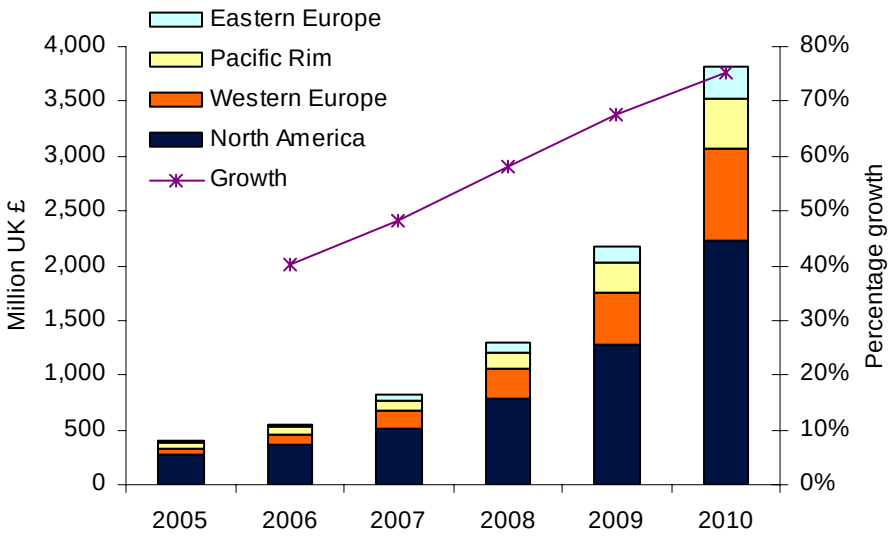

Figure 19: Total remote health market by region, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
North America	265	357	508	778	1,276	2,220	53%
Western Europe	70	106	169	280	483	854	65%
Pacific Rim	45	64	98	156	262	455	59%
Eastern Europe	15	26	47	84	153	280	80%
Total	394	553	821	1,298	2,174	3,809	57%

Figure 20: Total remote health market by region, 2005 to 2010 [Source: Datamonitor]

As shown in Figure 19 and Figure 20, North America will form the bulk of this market, both now and over the next 5 years. However, its slight head start in this market will ensure that other markets will see even more rapid growth. Eastern Europe will see the fastest levels of growth, thanks to very low levels of current spending and improving investment in infrastructure caused by many of the constituent countries' accession to the EU.

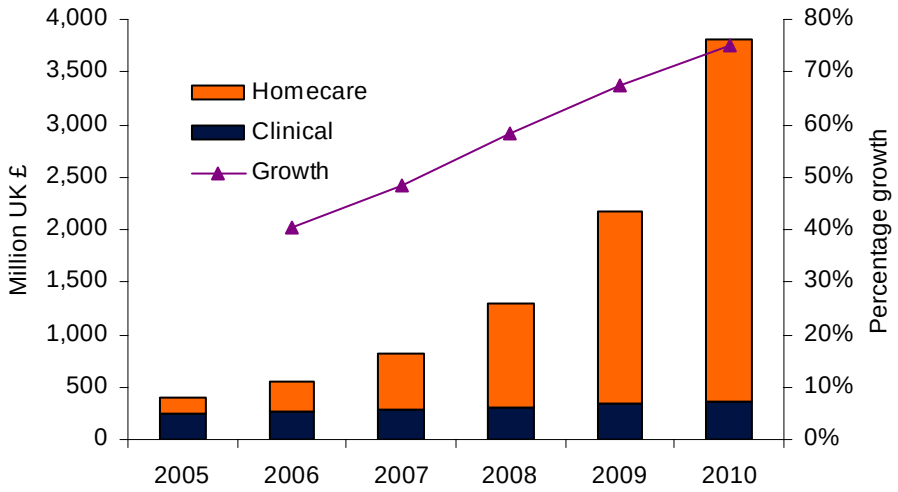

Figure 21: Total remote health market by sector, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
Clinical	242	265	289	310	336	361	8%
Homecare	152	288	532	988	1,838	3,448	87%
Total	**394**	**553**	**821**	**1,298**	**2,174**	**3,809**	**57%**

Figure 22: Total remote health market by sector, 2005 to 2010 [Source: Datamonitor]

Figure 21 and Figure 22 show the relative growth of remote health where there is a clinical operator and remote health in the home. At present, clinical remote health is the larger and more established market. Although this segment will show significant growth with a CAGR of 8%, it is homecare that will rapidly become the dominant sector.

4.1.2 Clinical remote health

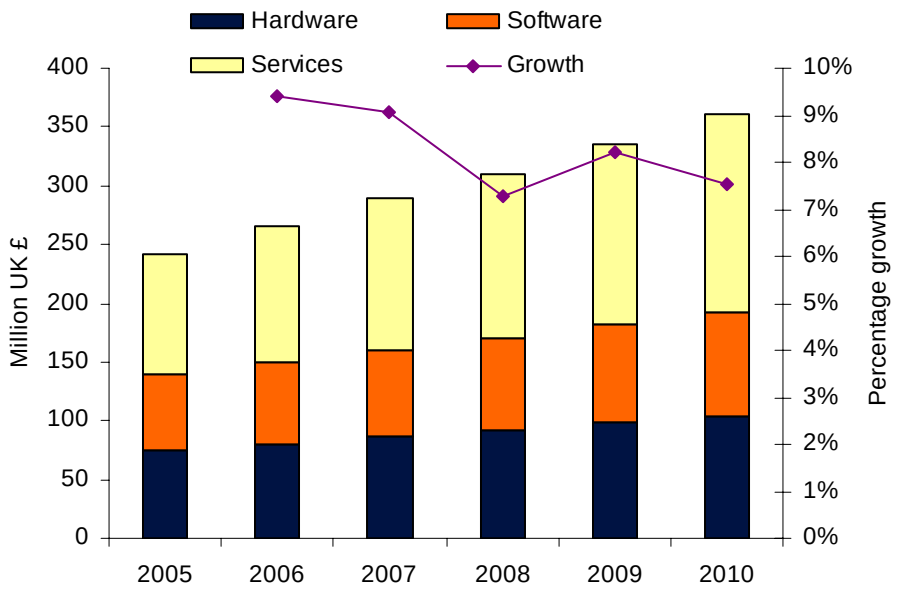

Figure 23: Clinical remote health market by hardware, software and services, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
Hardware	75	80	86	92	98	104	7%
Software	65	70	74	79	84	89	7%
Services	103	115	129	140	154	168	10%
Total	**242**	**265**	**289**	**310**	**336**	**361**	**8%**

Figure 24: Clinical remote health market by hardware, software and services, 2005 to 2010 [Source: Datamonitor]

Clinical remote health will continue to grow steadily over the next five years, as shown in Figure 23 and Figure 24. Growth will be greatest in services, as these solutions steadily become both more sophisticated and require more integration with new EMR systems.

The bulk of spending in this sector will continue to come from providing healthcare to remote communities. According to Datamonitor projections, the overall spending on IT by healthcare providers in these geographies will have a CAGR of 7.4% over the same

period. Clinical remote health will grow slightly faster as the range of technologies for reaching out to distant regions expands. In addition, the increasing use of remote health in hospitals themselves, to provide monitoring of ICU patients, will help to increase the proportion of IT spending in this area.

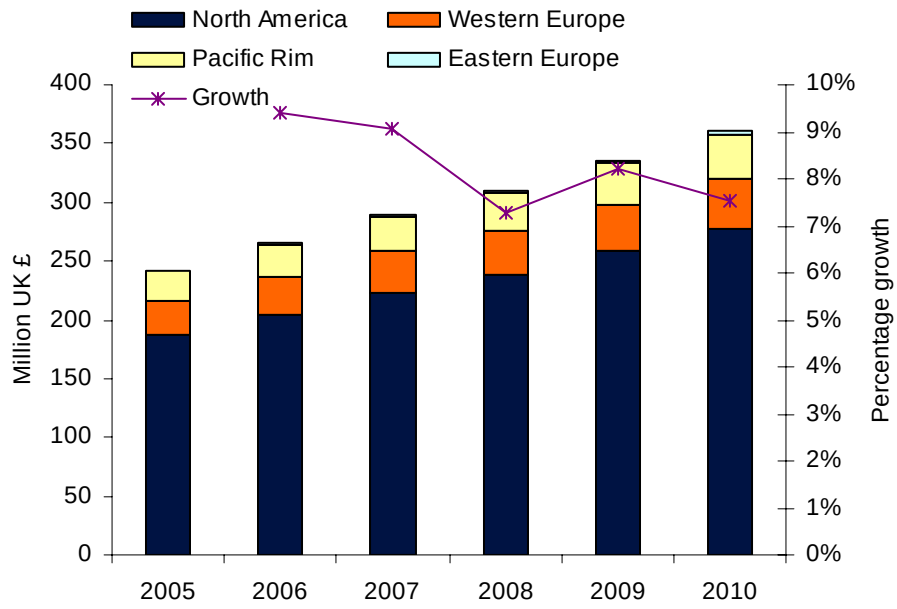

Figure 25: Clinical remote health market by region, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
North America	187	204	222	238	258	277	8%
Western Europe	30	33	36	38	41	43	8%
Pacific Rim	25	27	29	32	35	38	9%
Eastern Europe	1	2	2	2	2	3	15%
Total	**242**	**265**	**289**	**310**	**336**	**361**	**8%**

Figure 26: Clinical remote health market by region, 2005 to 2010 [Source: Datamonitor]

Figure 25 and Figure 26 show the growth in the clinical market by region. The largest demand will continue to come from those countries within these groups with large remote rural populations. However, hospital-based telehealth will form an ever-increasing proportion of solutions.

Eastern Europe will show the most rapid growth, but remains a relatively small market. The Pacific Rim will also show strong growth, with Australia being easily the largest market. In North America, Canada will spend almost half as much on remote health as the US, well out of proportion to its relative size. This is driven primarily by the large proportion of the population living in remote areas.

4.1.3 Homecare remote health

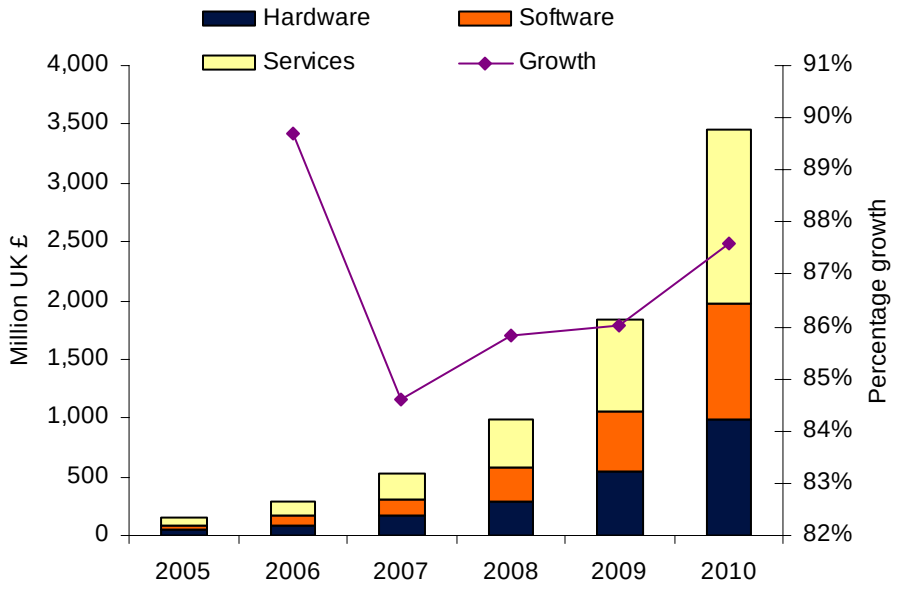

Figure 27: Homecare remote health market by hardware, software and services, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
Hardware	48	89	162	295	538	985	83%
Software	42	81	150	281	526	992	88%
Services	61	118	219	412	775	1,471	89%
Total	**152**	**288**	**532**	**988**	**1,838**	**3,448**	**87%**

Figure 28: Homecare remote health market by hardware, software and services, 2005 to 2010 [Source: Datamonitor]

As can be seen in Figure 27 and Figure 28, homecare remote health will show dramatic growth throughout the period. The large number of new units being installed throughout the period ensures that the proportion of spending on hardware will remain relatively constant, despite the service costs associated with the installed units. In 2010, Datamonitor estimates that still only about 14% of CHF patients will have monitoring units in their homes.

The overall growth in homecare remote health will be driven by the large and increasing number of people in the developed world living with chronic conditions. Within this group are some of the most expensive and intensive users of healthcare. The overwhelming case for reducing the hospitalisation of these people will lead penetration rates to rise rapidly from a base of less than 1% today.

COPD will form the largest share of the market, thanks to the relatively high cost of the systems required to monitor these patients and the fact that about 52 million people in these geographies will suffer with this condition by 2010. However, CHF will have the highest penetration as these patients have much higher risk of return to hospital.

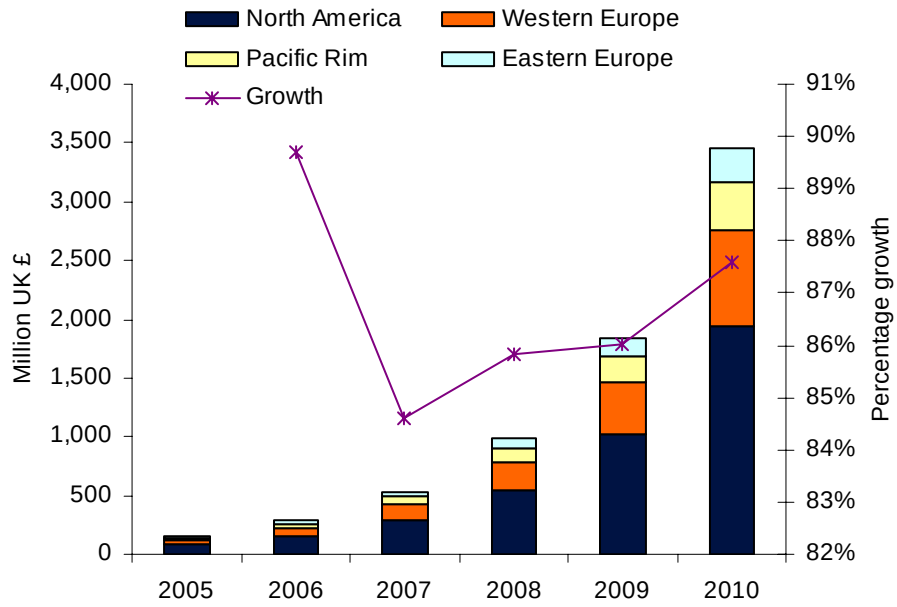

Figure 29: Homecare remote health market by region, 2005 to 2010 [Source: Datamonitor]

Million UK £	2005	2006	2007	2008	2009	2010	CAGR
North America	79	153	286	540	1,018	1,943	90%
Western Europe	40	73	133	242	442	811	83%
Pacific Rim	20	37	68	124	227	418	83%
Eastern Europe	13	25	45	82	151	277	83%
Total	**152**	**288**	**532**	**988**	**1,838**	**3,448**	**87%**

Figure 30: Homecare remote health market by region, 2005 to 2010 [Source: Datamonitor]

Figure 29 and Figure 30 show the regional distribution of the homecare remote healthcare market. North America will not only be the largest market, but also the fastest growing. This will be driven by the high proportion of the US population living with chronic conditions, such as CHF or other CHD. The explicit cost-cutting drive of the US payers will also help them to justify the investment more easily than in other geographies.

4.1.4 UK specific projections

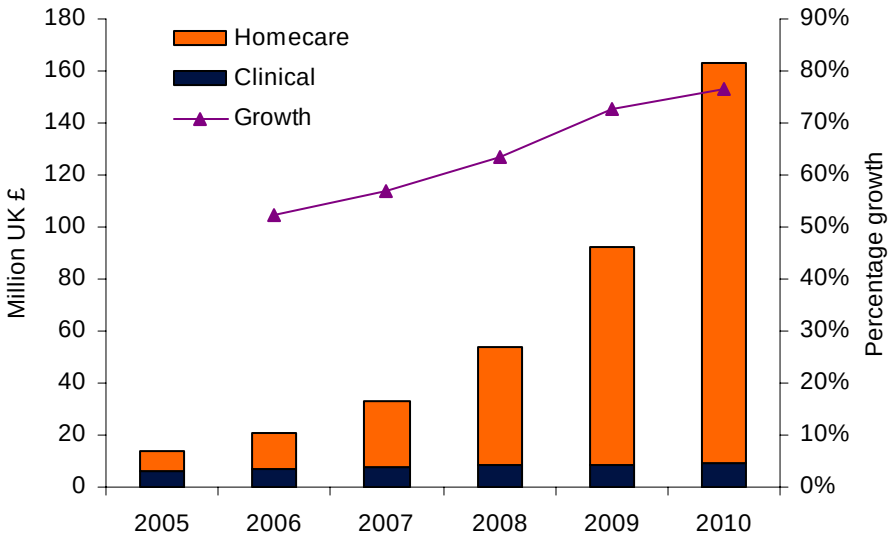

Figure 31: Total remote health market in the UK by sector, 2005 to 2010 [Source: Datamonitor]

Million UK £	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*CAGR*
Clinical	6.3	7.1	7.9	8.3	8.8	9.3	8%
Homecare	7.4	13.8	24.8	45.2	83.5	153.7	83%
Total	13.7	20.9	32.8	53.5	92.3	163.0	**64%**

Figure 32: Total remote health market in the UK by sector, 2005 to 2010 [Source: Datamonitor]

The UK market for remote health will show more rapid than average growth with a CAGR of 64%, as shown in Figure 31 and Figure 32. This rapid growth will be the result of two main factors:

- The UK has a high instance of CHF and other CHD;
- The investment in EMR across the UK NHS will provide the necessary infrastructure to get the most out of the data produced by remote health.

4.2 Functional Needs for Clinical and Homecare Remote Health

The functional needs that support remote health applications, together with their applicability to the user type and area of application within the value chain, are illustrated in Figure 33 below.

Functional need	*Clinical*	*Homecare*	*Hardware*	*Software*	*Services*
Monitoring physiologic data					
Better-than-eye monitoring	●	◐	●	○	○
High reliability monitoring	●	●	●	○	○
Mobility in monitoring	◐	●	●	◐	○
Wearable monitoring	○	●	●	◐	○
Monitoring interaction					
Branching investigation logic	○	●	○	●	●
Intuitive user interface	○	●	◐	●	◐
Diagnostics					
Combination with EMR	●	●	○	●	◐
Data analysis tools	◐	●	○	●	●
Video link-up	◐	●	●	●	○
Treatment					
Communication to onsite clinician	●	○	◐	◐	◐
Emergency call-out	◐	●	◐	◐	◐
Automated dosage alteration	●	○	●	●	●
Complex intervention	●	○	●	◐	●
Providing clear guidance to the patient	○	●	○	●	●

Relevance of technology or context	*Limited*	*Moderate*	*High*
	○	◐	●

Figure 33: Functional needs for clinical and homecare remote health [Source: Datamonitor]

APPENDIX 1: GLOSSARY OF TERMS

3-G	Third generation mobile phone standards
ADSL	Asymmetric digital subscriber line
ASP	Application service provider
CAGR	Compound annual growth rate
CDMA	Code division multiple access – cellular phone standard
CHD	Coronary heart disease
CHF	Congestive heart failure
CMS	Center for Medicare and Medicaid Services
COPD	Chronic obstructive pulmonary disease
CRM	Customer relationship management
DSL	Digital subscriber line
EHR	Electronic health record – equivalent to EMR
EMR	Electronic medical record
ENT	Ear, nose and throat
ERP	Enterprise resource planning
GP	General practitioner
GSM	Global System for Mobile Communications – cellular phone standard
HL7	Health level seven - http://www.hl7.org/
HR	Human resources
ICU	Intensive care unit
IP	Internet protocol
NHS	National health service
OEM	Original equipment manufacturer
PACS	Picture archiving and communications system
PSTN	Public switched telephone network
SIP	Session initiation protocol
SRM	Supplier relationship management

APPENDIX 2: FUNCTIONAL NEEDS DESCRIPTION

Monitoring physiologic data	
Better-than-eye monitoring	The ability to monitor or record a patient's physiological condition in more detail than would be possible with standard medical tools or the naked eye
High reliability monitoring	The capability to cope with the rigours of use either in the home or in extreme environments
Mobility in monitoring	The capacity to transmit data without needing to be physically connected to a network client
Wearable monitoring	Features enabling the patient to wear a monitor that can then upload data to a remote location
Monitoring interaction	
Branching investigation logic	The ability to respond appropriately to the user's responses and being able to quickly acquire the most relevant data
Intuitive user interface	An interface that allows the full range of users to interact effectively and doesn't create antipathy or frustration in that user
Diagnostics	
Combination with EMR	The capacity to integrate with other EMR and to use the full range of patient data to provide diagnostic support
Data analysis tools	Tools that enable the dissection and analysis of medical data
Video link-up	The functions necessary to provide a live video link between a clinician and the patient
Treatment	
Communication to on-site clinician	The ability to prove feed-back on the data transmitted to a clinician in the same location as the patient
Emergency call-out	Communications that enable the off-site clinician to summon emergency aid to the patient's location
Automated dosage alteration	The capability to alter the medication of a patient through altering the setting on a device delivering this medication from a remote location
Complex intervention	The ability to intervene in the patient's condition in more complex ways than the above, for example operating surgical equipment remotely
Providing clear guidance to the patient	A means of delivering to the patient clear instructions on how to alter their self-care in such a way as to improve their condition