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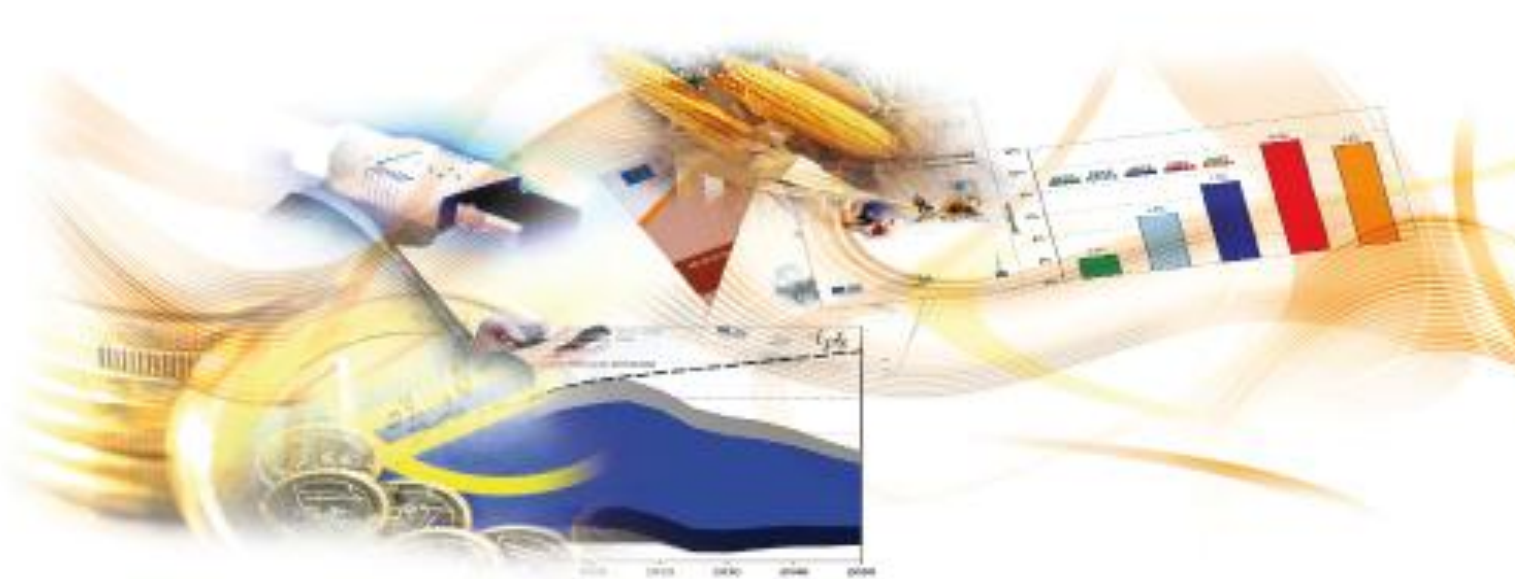
Strategic Intelligence Monitor on Personal Health Systems,  
Phase 2:

## **Market Developments – Remote Patient Monitoring and Treatment, Telecare, Fitness/Wellness and mHealth**

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# 1 Introduction

## 1.1 Background

SIMPHS1 investigated the market for Personal Health Systems (PHS) focusing on the Remote Patient Treatment and Monitoring (RMT) segment with the aim of providing an understanding of the type of products and services offered, the size of the market and the strategies of the actors involved. In order to get a picture of the RMT market, we reviewed a number of market reports and interviewed stakeholders which helped discuss the issue of PHS segmentation and assess the PHS/RMT market size.

One of the main conclusions of the SIMPHS1[1] research was that the RMT market was fragmented, still small in size and hampered by a series of social, institutional, economic and technical barriers. At the same time, the market estimations found in market reports were thought to be understating the real size and value of RMT.

A further conclusion of SIMPHS1 was that defining a meaningful market segmentation[2] was fraught with difficulties (blurred conceptual and market boundaries from an industry perspective, blurred frontiers between social and healthcare, no way to distinguish clearly separate type of users and overlap between healthcare, social care and wellness from a patient perspective). This led to the definition of a pragmatic, hybrid classification based on the dimensions "health status" and "product/service sophistication".

Last but not least, SIMPHS1 detected two emerging trends which have shaped the focus of SIMPHS2 and impact this deliverable, that of convergence between social and health care and that of mobile health or "mHealth".

As a result of all the above, SIMPHS2 focuses on Integrated Personal Health Services which are defined as "addressing the health and/or social care needs of individuals outside of care institutions and supporting the work of care providers in an integrated fashion; they can integrate assistance, remote monitoring of chronic diseases, wellness and fitness; they are produced as a result of integration of different institutional and information systems. They are personal and possibly personalised in the way they gather process and communicate data and in terms of technological components..."

## 1.2 Objectives and approach

Deliverable 2.2 aims to provide an overview of market developments in RMT as well as in the new areas of Telecare, mobile Health, Wellness, fitness and independent living, based on the review of market reports acquired from market research companies and other sources like industry newsletters.

In addition this report also contains an updated and expanded overview of companies active in the IPHS market with short company/product/services description including market strategy information and geographical focus where appropriate. We started from the sample of 50 companies identified in SIMPHS1 which has been selected out of a total of 200 companies involved in eHealth. These 50+ companies fulfilled four criteria:

- The company played a significant role on the PHS market.
- The company had a clear European focus.
- The overall sample covered as many products and services as possible.
- The overall sample covered all parts of the PHS value chain.

As we checked the 50 companies again we decided to take some of them out of the list because of their limited relevance in the broader context of IPHS and included instead more than 50 new companies that help convey a more accurate picture of the whole range of products and services available in IPHS, thus addressing prevention, fitness/wellness and telecare offerings besides RMT/Telehealth. The companies selected also help identify market developments such as

consolidation, internationalisation strategy, partnerships and emerging business models as well as strategies adopted to enter new market segments and capitalise on successes to expand market revenues. A number of companies included in the review are located in the US, a few in Japan/Asia, but we deemed it important to include them alongside European companies as they are often market leaders in their segment, do not work in isolation but partner with other companies thus selling on European markets and contributing to market innovation and growth. In addition, the production of medical or fitness related devices are often outsourced to original equipment manufacturers (OEM) in Asia and subsequently integrated by European companies offering IPHS under their own brand. Hence ignoring market participants from other regions would give a distorted picture of what is going on.

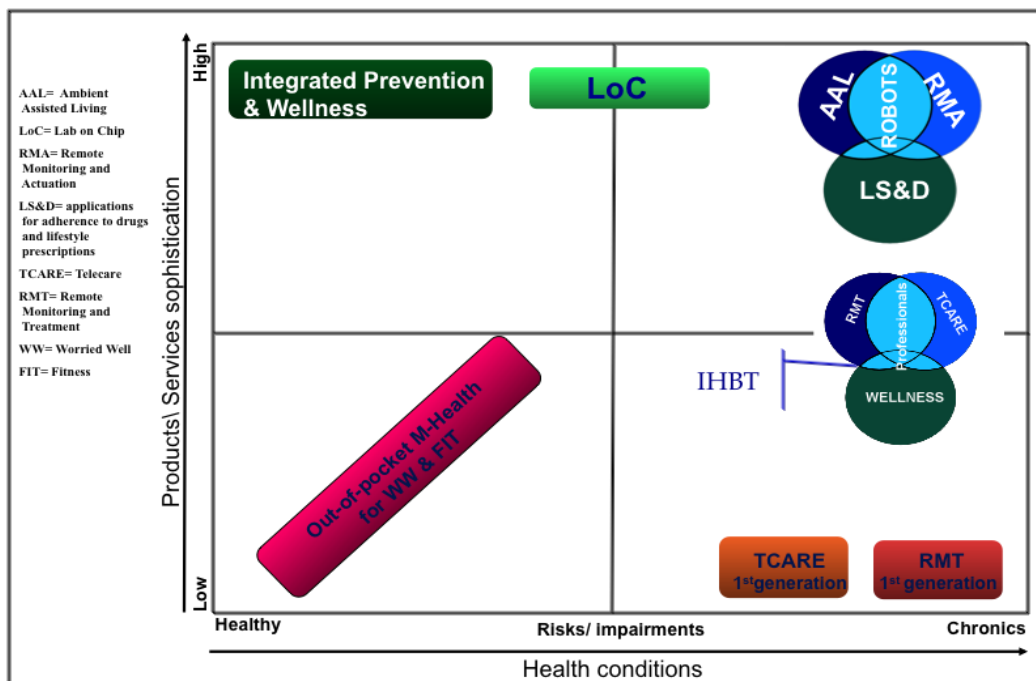
### 1.3 IPHS market segmentation

As referred to in Section 1.1 (Background), and as confirmed by experts in the SIMPHS2 validation workshop<sup>1</sup> there is no clear cut way of segmenting the IPHS market, because of blurred market boundaries and overlap between social and healthcare in particular.

The market reports purchased from market research companies in SIMPHS mostly use a technology driven market segmentation, along the lines of technology applied without taking the place of use into account and thus these report do not indicate whether the market is composed of sales of systems/devices for use in hospital or at home, or both. In addition, what units are actually counted in sales figures is unclear and the distinction made in SIMPHS between healthy or chronically ill patients does not always appear in these reports. Last but not least with the extended definition of IPHS as defined in SIMPHS2 there is a need to look beyond the market of Remote Patient Monitoring and Treatment (RMT).

Taking the pragmatic approach suggested in SIMPHS1 (see Figure 1 below), we can distinguish four segments within IPHS along the two dimensions of product sophistication and health status:

**Figure 1: Proposed hybrid typology for PHS segmentation**



Source: SIMPHS1 Report on Typology/Segmentation of the PHS Market

<sup>1</sup> See <http://is.jrc.ec.europa.eu/pages/TFS/SIMPHS2.html> for more details.

The two top quadrants cover sophisticated solutions which in SIMPHS1 were considered as still belonging to the R&D domain, hence with no actual market. However we find that Integrated Prevention and wellness is starting to develop as a market and therefore include it in our analysis together with the two lower quadrants which cover less sophisticated technology solutions for both the healthy (e.g. through mHealth applications), and those with chronic diseases who benefit from telecare or RMT solutions.

Within those segments we can distinguish on the one hand institutionalised purchases for products and services with curative and preventive objectives i.e. a more health and care related market with involvement of health/care professionals and on the other a market created by the demand for services and products for wellness, fitness and training purposes which exists outside of the direct influence of institutional care. Here the consumer electronics model prevails with out-of-pocket spending. Criteria for purchase decisions follow a different logic and security criteria need understandably not to be tested as stringently as for health applications.

It could be argued that the above two segments – for the healthy vs. for the chronically ill - are actually two distinct markets. We argue that the technologies used and services offered in both segments are similar, their main differentiation lying in the way they are brought to market. The companies involved are often the same and a majority of companies serve both the health and wellness markets. On the other hand one could argue that if players are active on both markets the boundaries between those segments may not be relevant. This goes back to the difficulty of drawing clear lines on a market with unstable boundaries.

We see the delivery of healthcare services via mobile communication devices as a major bridge between the above two segments, as elaborated in section 5 on mHealth. Since SIMPHS1 mHealth has witnessed a surge in wellness and lifestyle applications for smart phones – commonly called “Apps” - and more activities in health related apps. The mHealth sector has emancipated from pilot projects and gadgets for technophile end-users and tech savvy healthcare professionals to become a market with increasing acceptance among physicians, nurses, patients, payers, healthcare administrators and consumers. A healthy consumer is more likely to get acquainted with mHealth services for wellness purposes, which eventually can contribute to prevention by prompting healthy lifestyle changes such as increased activity levels.

#### **1.4 Players active on the IPHS market**

The following stakeholders play an active role on the IPHS market, many of them targeting several or all of the four segments tackled in SIMPHS2:

- **Telecommunications companies and mobile operators** actively target healthcare as a field to compensate for dwindling market shares and decreasing margins on traditional communications markets. Healthcare related products are a premium segment, where quality and security override price concerns. Many services these market players offer require higher bandwidth and regular data uploads which stimulate the usage of their networks. In particular image and video based services (e.g. remote consultation) require the transmission of high definition pictures and thus larger bandwidth: from a telco point of view such usage simulates traffic thereby contributing to revenue growth. On the other hand, some simple RMT services may require lower bandwidth but guarantee continuous cash flows. Customer loyalty is further enhanced as changing telecommunication provider becomes more complicated for the individual in an integrated system. Last but not least, advanced sensor technologies generate larger sets of data, healthcare being one of the fields concerned with “Big Data”[3] which represents both challenges and market opportunities.
- **Classical ICT vendors, consultancies and system integrators** are attracted by the possibility to apply their core competences to healthcare such as managing data and structuring workflows. From Small and Medium Sized Enterprises to larger players, many companies enter healthcare under the prospect of gaining a significant share of this growing market. Their core competences relevant for this report are the ability to integrate legacy systems and the

management of health related data as well as the integration of IPHS into reimbursement schemes. Expertise acquired in the health arena through pilots and projects becomes important for the provision of IPHS, as these companies hope to roll out projects on a larger scale. Their business strategies resemble that of network infrastructure providers: software creators and system integrators develop complementary products to their established ones and couple them with service-orientated business models. Network infrastructure vendors can use their expertise in system integration and managed service business models. These business models rely mainly on revenues for the service offered and equipment sold. For an ICT vendor, IPHS increases the attractiveness of their own ecosystem and becomes a further argument for selling their products to health care institutions.

- A new generation of smart phones and tablet computers using apps has been a game changer for **mobile device manufacturing**: the lead position of former champions has been contested in the mass market and health-related services have turned into an interesting alternative to gain or maintain market leadership. Easy access to platforms and applications allows third parties to contribute while new alliances emerge between content providers and sensor producers. Mobile device manufacturers bet on their ability to integrate their software into existing systems and announcing their own distinct ecosystem becomes a prime concern for mobile device manufacturers today. On the other hand, challenges with security and safety remain which may override popularity of systems like the iOS and Android on the mass market.

The availability of applications defines the attractiveness of a platform for developers and customers alike, together with security and ease of implementation. Developers from outside a company contribute their own expertise and help to attract additional investment into an ecosystem. Android and iOS dominate the end-consumer market and expertise in the health domain can be a selling argument for competitors. All other mobile device manufacturers in the SIMPHS2 sample follow a similar trend, the rapid growth in the popularity of the android smart phone operating systems being a clear driver of growth for the health and fitness market segments. Smart phones themselves have reduced the dependency on development of hardware, and lowered market entrance barriers for new companies.

- **Medical engineering companies** address the IPHS market building on their experience with products used in extramural delivery of care. The demand for quality on these products is high which is reflected in the high demands on staff qualification especially R&D staff.
- **Manufacturers of medical / monitoring devices** which may have started with products for usage in institutional settings extend their market scope by targeting the RMT market and home use, independent living as well as wellness and fitness. They often proceed by modifying existing products to enable use by laymen. **Medical device manufacturers** further team up with **sport equipment** manufacturers to produce a wide range of biomedical products, from everyday use products like dressing material to surgical instruments, implants and diagnostic products. Many of these products now include software and are enhanced with RMT features and connectivity to EHR for instance. These companies are of course motivated by growing sales revenues, even after RMT should become a well established market. Through miniaturisation and connectivity producers of e.g. of ECG enter this new market while sport equipments manufacturers enhance their products with sensors and connectivity. Main drivers besides increased sales revenues include brand loyalty and image as cutting edge technology provider.
- **Original Equipment Manufacturers (OEM)** have come into our radar because of the extended scope in SIMPHS2. These companies manufacture products for other companies which can repackage and integrate them into their own offering selling them under their own name and logo. It seems to be common practice in industries relying on a consumer electronics business model such as the wellness sector. However, OEM also address the RMT market and may be found across all segments of the IPHS market.

- An additional type of actors has entered the eHealth and the mHealth arena, which was not clearly the case in SIMPHS1: as a major sector the **pharmaceutical industry** is recognising the potential of eHealth and in particular mHealth for their strategies. Medical and pharmaceutical innovation has proven to extend life expectancy[4] yet progress in research and development in the pharmaceutical industries is stagnating. In general the biopharmaceutical industry is characterised by long investment cycles and dependence on regulators for product approval. Market success depends furthermore on payers' decisions to include new drugs in reimbursement schemes. Pharmaceutical companies find themselves in a quagmire: increasing cost for new developments cannot be as easily passed on to the health insurer, pharmaceutical companies need to justify higher prices against generic producers. This translates into dwindling pipelines for future medication in pace with increased competition from generic medications. eHealth and mHealth become an attractive path to achieve new revenues sources. An analysis of their business model follows in the mHealth section under O (Box 1). Pharmaceutical companies' strategy in IPHS focuses on improved drug delivery logistics, treatment adherence and business intelligence.
- Last but not least **Private and public hospitals, social and health care providers, practitioners, insurance companies, housing cooperatives and public health institutions** deserves being mentioned as they come into the IPHS value chain as potential customers. As such they can turn into champions heralding the use of IPHS or on the other hand their resistance can impede roll out. Potential motivation for them to use IPHS include the need for streamlining services offered, cost reduction as well as increased efficiency, e.g. hospitals and care institutions need to increase their throughput or productivity in light of demographic changes and increasing lack of healthcare professionals. Public authorities responsible for remote or sparsely populated areas can benefit from providing health and social care through remote monitoring and telecare. Housing cooperatives often cater for the needs of their aging tenants by introducing telecare facilities and ICT to enhance living conditions both in terms of comfort and safety, e.g. through alarm systems and tele-surveillance. Such systems eventually evolve into more advanced forms of telecare, such as Ambient Assistant Living, which often remain in the realm of show cases and experiments. The motivation for housing cooperatives is to attract wealthier clients, to generate additional service fees, as well as to provide social services in accordance with their mission.

## 1.5 Definitions

### IPHS

"Integrated Personal Health/Care Services address the health and/or social care needs of individuals outside of care institutions and support the work of care providers in an integrated fashion: a) they can integrate assistance, remote monitoring of chronic diseases, wellness and fitness; b) they are produced as a result of integration of different institutional and information systems. They are personal and possibly personalised in the way they gather, process and communicate data (for feed-back/action) and in terms of technological components they can include all of the items illustrated under letters a) through c) of the PHS2020 definition of Personal Health System. (Source: SIMPHS Technical Annex)

### Telecare

'Telecare is the continuous, automatic and remote monitoring of real time emergencies and lifestyle changes over time in order to manage the risks associated with independent living. Devices range from those where the user presses a button that raises an alert at a control centre, such as a pendant alarm or medical alert/personal emergency response service (UK and US terminology respectively), to systems that monitor the person's well-being, environment, or both, and which trigger - without, if necessary, the person's conscious involvement - a warning that the well-being has deteriorated or that an untoward event has occurred. There is a rapidly growing interest in using mobile phone (cell phone) technology to enable such monitoring to take place outside the home.

Some systems give the person immediate feedback so that memory problems in particular can be accommodated and the person's dignity and independence maintained.

In all cases except the latter, procedures for delivering an appropriate response from an external person (carer, neighbour or statutory service, etc.) are vital to the whole system. In the UK, telecare alarms are mediated by routing through dedicated call centres, whereas in the USA it is possible to purchase devices that communicate directly with emergency response services. (Source <http://www.telecareaware.com/index.php/what-is-telecare.html>)

### **Vital signal monitoring**

Vital signals are to be understood as a set of physiological indicators, which reflect the overall status of the body. With the help of technologies they can be checked regularly to assess body functions of an individual making it possible to remotely monitor the patient or user status, without the need of a care giver to be present. The measurement and the resulting data are either collected discretely meaning at predetermined intervals called spot checking or continuously.<sup>2</sup> Originally automated vital signal monitoring was used in Intensive Care Units (ICUs), Cardiac Care Units (CCUs) and Operating Rooms (ORs). Today spot checking certain parameters forms part of the procedures for most medical physical examinations. In addition it can be used to determine training effects.

### **Remote Patient Monitoring and Treatment**

Our understanding of Remote Patient Monitoring and Treatment (RMT) builds on the definition elaborated during the SIMPHS1. It is understood as systems to help patients with chronic diseases monitor vital signs (e.g. blood pressure, heart rate, blood glucose, weight, oxygen contents, ECG and others) thus improving the quality of care, the quality of life of the patient and enabling the prediction of aggravations and exacerbations of their chronic condition. It is conceived as a system to facilitate patients to keep control over their health conditions and are able live independently or with limited need for care.

### **Wellness**

Under wellness we understand a condition of good physical, mental and emotional health, facilitated by maintaining by an appropriate diet, exercise, and other lifestyle modifications. It has an element of subjective self-perception. In the context of this report, we consider IPHS or related products and services as wellness related insofar as they are not used for curative purpose, but maintain or reach a general state described above.

### **Lifestyle**

A clear cut distinction between services and products catering clients striving for an amelioration of their wellbeing or to support a certain way of life is hard to make, the concept are blurry. Lifestyle here is used to describe products supporting constellation of habitual activities or their change, in a broader sense than wellness

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<sup>2</sup> From an orthodox methodological point of view nearly all of the current systems are actually to be labelled discrete. Princeton's Wordnet defines discrete as *constituting a separate entity or part*. The vital signals and their corresponding datasets are collected or saved and transmitted at discernable moments, which makes them discrete. The underlying vital signal is continuous, yet as the time gap between two measured events is minimal, as such with a sufficient high number of measures a series of discrete events can be considered continuous.

## **eHealth**

The EC eHealth Action Plan defines eHealth as “the application of information and communications technologies across the whole range of functions that affect the health sector” and including “products, systems and services that go beyond Internet-based applications”.

According to a report drafted by the eHealth task force for the Lead Market Initiative, there are four eHealth domains:

- 1) Clinical information systems (specialized tools for health professionals within care institutions, tools for primary care and/or for use outside the care institutions);
- 2) Telemedicine and homecare systems and services;
- 3) Integrated regional/national health information networks and distributed electronic health record systems and related services; and
- 4) Secondary usage non-clinical systems (systems for health education and health promotion of patients/citizens; specialised systems for researchers and public health data collection and analysis; support systems for clinical processes not directly used by patients nor by health care professionals.

## **mHealth**

mHealth or mobile health care can be defined as the delivery of healthcare services through mobile communication devices. It comprises mHealth as a concept for the delivery, facilitation and communication of health-related information by means of mobile technologies including mobile phones, smart phones, tablet computers as well as devices with integrated communication abilities. It can be understood as portable eHealth services, which accompany the user in his daily life.

## **Ambient Assistant Living**

The term Ambient Assistant Living (AAL) refers to a set of technologies, methods, concepts and electronic systems to allow users to conduct their daily activities in place, while being supported through necessary care. As a vision AAL emerged from concepts like the internet of things, ambient intelligence and ubiquitous computing combining it with the need for the assistance for more frail citizens. Technology here should not be perceived as invasive or intrusive by users in their daily lives. It combines RMT technology, smart household appliances and advanced (3<sup>rd</sup> generation) telecare with a back-end and related service and care provision. Since 2008 a European technology platform called Ambient Assisted Living Joint Programme has been supporting AAL activities.

### **1.6 Sources**

Main sources used for this market overview include reports by Frost & Sullivan, Datamonitor, Juniper and IN-Medica as well as reports and briefs from consultancies like AD Little, Deloitte and PWC. Further sources have contributed to our understanding of the IPHS market and are listed in section 9 References.

Implicitly market reports produced by market research companies are based on the somewhat simplifying assumption that despite complex institutional arrangements healthcare resembles other economic sectors which have been transformed by the usage of information and communications technologies (ICT) and have benefited from enormous efficiencies and improved outcomes. Furthermore some of these companies, like Frost & Sullivan[5] note that E-Healthcare has generally been considered as ICT investment rather than healthcare investment and recommends therefore to promote it as a technological revolution, while the evidence in SIMPHS1 showed that PHS/ RMT market uptake requires much more than a technology focus rather organisational change and outcomes such as improved quality of life and reduced hospitalisation for instance are what can drive RMT.

This perception of the market is probably due to the fact that such studies, market reports and the information made public by the companies themselves are often targeted at telecommunication companies, device manufacturers and investors, and based upon a simplified conceptual design of

healthcare compared to that taken as reference in SIMPHS2 in a policy context. The primary purpose of market reports is not to guide policy makers but to provide a basis for more informed corporate strategies and thus take the perspective of industry investors which explains this simplified approach.

An overview of the market reports considered in this analysis is provided in Annex 1: Overview of market reports.

For the extensive review of companies active in the segments of IPHS mentioned earlier, IPTS has drawn on information from market and scientific reports, company websites, health IT newsletters and other online sources.

## **1.7 Structure and content**

The main body of the report covers the following items:

Section 2 deals with the RMT segment within IPHS, looking at market size and growth potential, type of players active in this segment and the evolution since SIMPHS1 both in terms of market growth, barriers and drivers and type of system considered within RMT.

Section 3 gives an overview of the Telecare segment, starting from a definition of 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Generation telecare products, looking at market data, recent trends, barriers and drivers and geographical considerations.

Section 4 focuses on the Fitness/Wellness segment, starting with some background on what is covered under this label, moving to market data, market dynamics with three main areas (professional market, sports amateurs and corporate fitness).

In Section 5 an overview of overall developments with mHealth is given, with details on the types of services that are found in this segment, focusing more specifically on Smartphone Apps and market projections for mHealth overall and Apps in particular. This section also looks into the type of players in this segment including a special focus on pharmaceutical companies.

This leads to the depiction of an IPHS ecosystem and its value chains in Section 6.

Section 7 then provides an overview of the characteristics of the companies reviewed and presented in Annex to this report, the type of services and products they offer, and the positioning of IPHS that results from this review.

Finally, the results are summarised in a concluding section.

## 2 The RMT MARKET

### 2.1 Market size and potential for growth

Before taking a look at the evolution of the RMT market, it is important to recall that SIMPHS1 raised some questions about the apparent tiny significance of the RMT market as estimated in market research reports, compared to the overall value of the eHealth market, the ICT market and total Healthcare expenditures in Europe. Difficulties to arrive at reliable estimates were linked to the fuzziness of the PHS/RMT market structure and the lack of clear cut segmentation as well as the difficulty to collect data on sometimes very small scale operations. The following section has to be read bearing these constraints in mind.

**Figure 2: RMT devices**



*Source: ZigBee Alliance*

Market size estimates and growth predictions which were taken into our analysis of the RMT market in SIMPHS1 had been published before the financial and economic crisis. One of the questions that comes to mind is how the crisis might have affected subsequent market values and estimations and whether earlier short term predictions have materialised.

**Frost and Sullivan (F&S)**, as stated in SIMPHS1, estimated that the total Remote Patient Monitoring market in Europe was worth €127.9 million in 2007 and was expected to reach €292.3 million in 2014.[6] The forecast for 2009 at that point was €156.9 million.

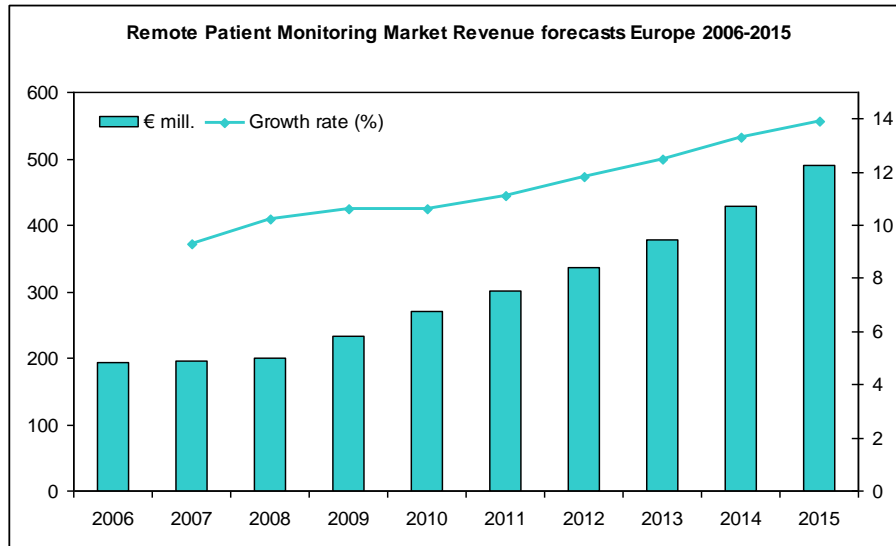
F&S data[7] published in 2010 indicate that the European Remote Patient Monitoring market registered total revenues of €233 million in 2009 i.e. nearly 50% more than the above forecast, while the expected market value for 2014 is now €429 million i.e. 47% more than what was forecasted in 2008 for that year.

Revenues are foreseen to continue to grow in 2015 with an expected market size of €489 million, i.e. a market double the size that of 2009. In terms of growth rates, the 2010 F&S Report foresees a CAGR of 12.2% over the period 2009-2016. Main drivers for these developments according to F&S are increased awareness about RMT, customisation of products and services and governments' initiatives and funding.

The above shows that the total Remote Patient Monitoring Market is exceeding expectations and that the economic crisis has not affected revenues in 2009 nor growth expectations for the future. This may be explained by the demographic and healthcare related drivers for RMT deployment which remain unchanged, the expectation that RMT can contribute to more efficient healthcare delivery and cost cutting in a context of strained state budgets.

As to market structure, for F&S the RMT market in 2009 was still in a development stage characterised by a medium price sensitivity and a medium degree of technical change with a competition degree of 4 compared to 8 in the previous report which reflects a lower number of competitors.

**Figure 3: Total Remote Patient Monitoring Market Revenues forecasts Europe - 2006-2015**



*Source: Adapted from Frost & Sullivan*

The above figure shows expectations of steadily growing market revenues until 2015 with a CAGR of 12.2% for the period 2009-2015 and an actual average growth rate of 10% from 2006 to 2009.

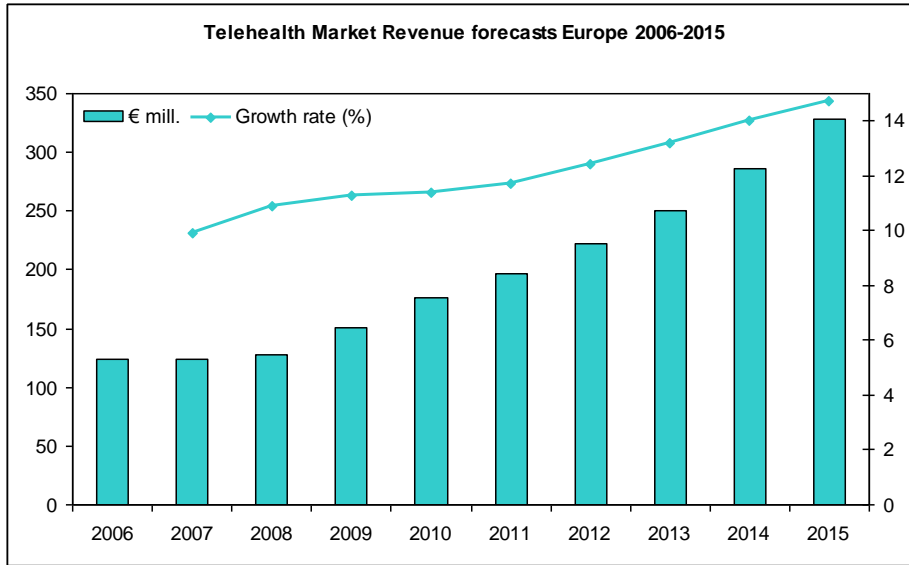
It should be noted that the F&S 2008[8] report on European Patient Monitoring Markets considers Remote Patient Monitoring as the equivalent of Telehealth, while the 2010 report makes the following distinction:

- Telecare: real time monitoring of emergencies and social care directly to the user
- Telehealth: remote monitoring of vital signs through devices customised by healthcare service providers.

For the sake of consistency and comparison with SIMPHS1, the figures discussed and the chart presented above refer to total Remote Patient Monitoring, encompassing both Telehealth and Telecare.

In reality, as for SIMPHS2 we consider Telecare and Telehealth as two separate segments, we now need to take a closer look at actual RMT market revenues.

**Figure 4: Telehealth Market Revenues forecasts Europe - 2006-2015**

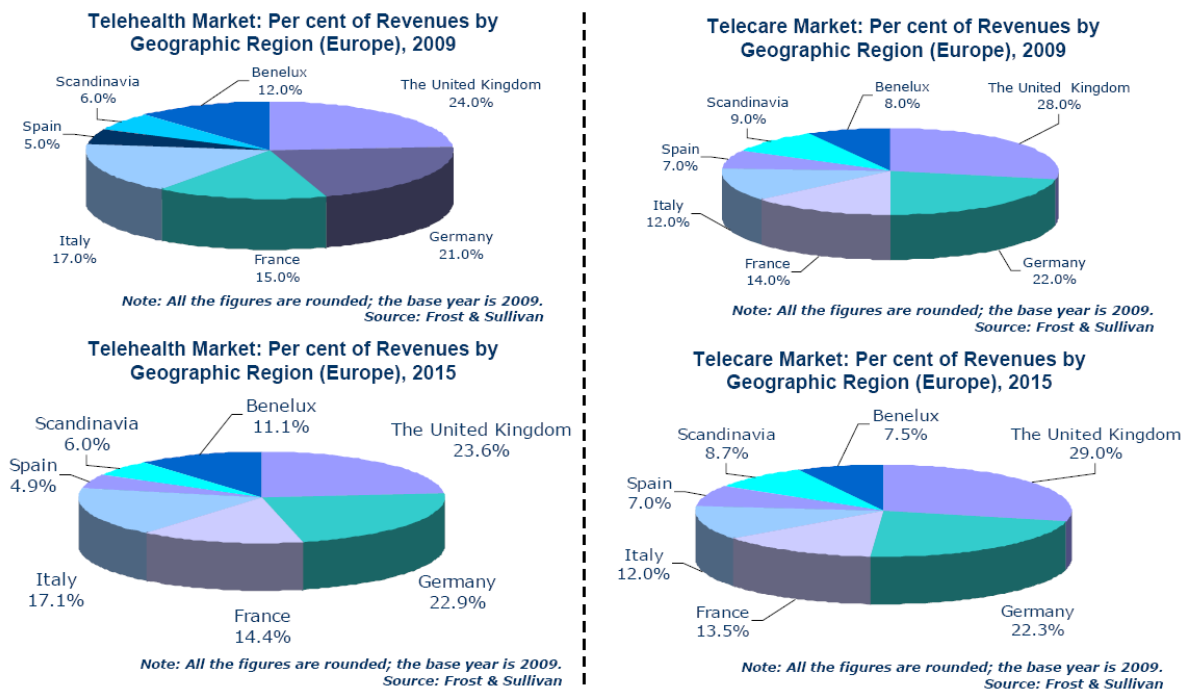


Source: Adapted from Frost & Sullivan

As for the total Remote Patient Monitoring Market, Telehealth (RMT) growth expectations are confirmed, in fact at a higher rate than the total market with a CAGR of 12.9% over the period 2009-2015 while actual growth was 10.7% between 2006 and 2009, a figure slightly higher than that of the total market. This indicates that it is Telehealth (i.e. RMT in the terminology used in SIMPHS) rather than Telecare that is pushing the overall Patient Monitoring Market growth. It reflects the fact that Telecare is a more established market, with a higher penetration than RMT technologies but cheaper technologies as well.

The following charts from F&S give an overview of how telehealth and telecare market revenues are split across Europe.

**Figure 5: Telehealth and Telecare market revenues overview**



The UK and Germany were the two leading countries in terms of market revenues both in the telecare and telehealth markets in 2009. F&S foresees further consolidation of the UK and German market shares by 2015 with respectively 29% and 22.3% of revenues. Italy followed with 17% of revenues for Telecare in 2009 and 12% of revenues in telehealth, figures which are expected to remain stable until 2015. For France which accounted for 15% of telecare revenues in Europe in 2009 and 14% of those of telehealth, F&S foresees a slight step back with respectively a 14.4% and 13.5% share of revenues in the two segments.

According to another report by Frost & Sullivan[9], the European Cardiac Monitoring Market was worth €251.43 million in 2008. The figure includes cardiac monitoring devices (such as for electrocardiogram (ECG), non-invasive blood pressure, intravascular pressures, cardiac output, oxygen saturation of the arterial blood, and blood temperature) and monitoring services. This goes beyond our definition of RMT, as it includes services for vital signal transmissions within hospitals, such as Critical Care and Intensive Care units.[9] As the market we are interested in consists of products used in a Homecare setting, the figures we look at forms only a part of the market. However we mention them here as it is a growing market driven in particular by out of hospital care facilities. More and more sophisticated cardiac devices are increasingly capable of transmitting data that enable remote monitoring thus becoming a driver for RMT.

Another market report by Datamonitor published in 2007 covering selected European countries<sup>3</sup> foresaw a CAGR of 41.1% for investments in Telehealth solutions both in hospitals and home setting for the period 2006-2012. The overall market of Telehealth solutions was estimated to be worth €133.9 million in 2006 and expected to reach €1,146 million in 2012. As the SIMPHS definition of RMT does not cover hospital settings the above figure is higher than what would roughly correspond to RMT spending. Taking out the clinical share of Telehealth spending, the homecare Telehealth spending were €57.4 million i.e. less than half of total Telehealth spending while the projections for 2012 lead to a radically different picture with homecare Telehealth spending reaching a value of €999 million vs. €146.9 million for clinical Telehealth spending.

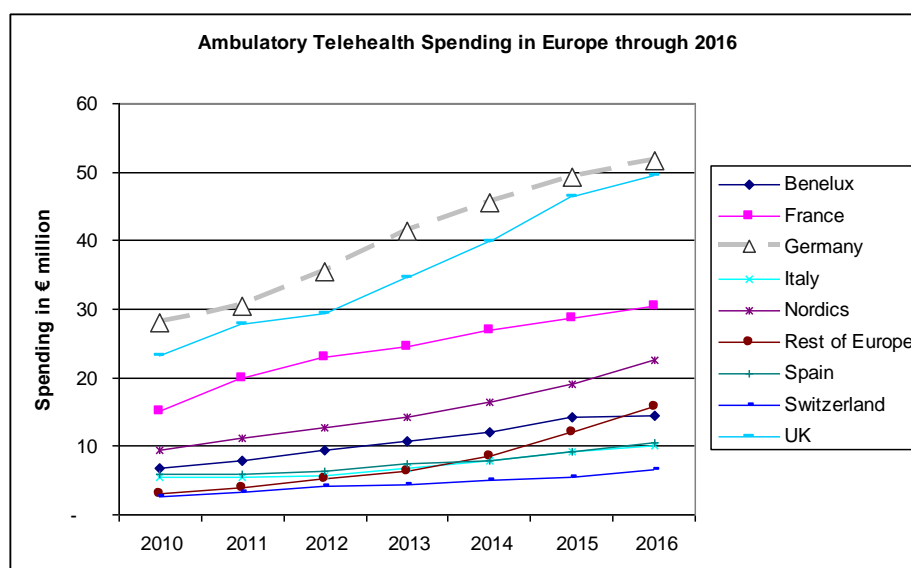
Datamonitor provided an update of overall market figures for 2010 and projections until 2016, distinguishing between hospital and ambulatory telehealth, rather than homecare telehealth to better take account of mobile developments within non hospital telehealth. Comparing with data from their 2007 report, the telehealth market as a whole had a value of €323 million in 2010, while the projection for that year in 2007 was €660 million. The projection for 2012 in 2007 was €1,146 million as mentioned above while new projections foresee a value of €425 million only with ambulatory telehealth making up €131 million, i.e. 30% of the total telehealth market value. For 2016, the telehealth market should reach a value of €670 million, with ambulatory telehealth accounting for about 31% of that total value. CAGR for the period 2010 – 2012 would be 17.1%, much lower than the 41% CAGR given for the period 2006-2012.

The following chart shows market values estimated from the period 2010-2016 for ambulatory healthcare.

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<sup>3</sup> France, Germany, Italy, Spain, Switzerland and United Kingdom shown individually. 10 new EU Member states grouped under NEU; Benelux; Nordics; RoWE grouping Austria, Greece, Ireland and Portugal

**Figure 6: Ambulatory Telehealth Spending in Europe through 2016**



Source: Derived from Datamonitor 2011

The above figure shows Germany as a leading country for ambulatory Telehealth (overall) spending, followed by the UK, then France and the Nordic region.

## 2.2 Market players on the RMT segment

Activities of RMT market players can be distinguished along two axis, hardware and services. For the hardware associated with the delivery of IPHS we find:

- Medical engineering companies that build on their experience with products used in extramural delivery of care. The demand for quality on these products is high which is reflected in the high demands on staff qualification such as R&D Staff.
- Producers of monitoring devices for usage in institutional settings, which wish to extend their market scope. They often proceed by modifying existing products to enable use by laymen.
- Pharmaceutical companies enter as new players. As an industry big pharmaceutical companies faces a "patent cliff", declining R&D return while their products are exposed to pricing pressure and higher demands on compliance with drug safety regulations. Their role has changed from SIMPHS1, where the focus was mainly on companies selling strips for diabetes and offering enhanced capabilities for glucose meters to store and transmit data. RMT allows pharmaceutical companies to package drugs together with value added services.
- Original Equipment Manufacturers (OEM), which manufacture products for other companies who can repackage them, integrate them in their own offering selling them under their own name and logo.

In terms of the services dimension, the major categories of RMT services include providers of system integration, telecommunication operators (traditional Telcos and mobile operators) as well as "health hubs" or specialised call centres for RMT data analysis.

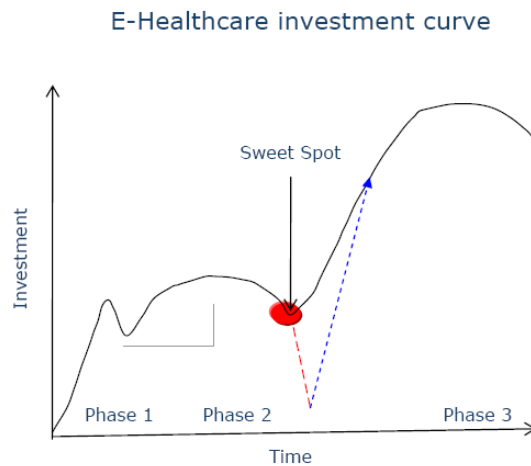
## 2.3 Has anything changed?

### 2.3.1 Market analysts' expectations

As shown in the above section, expectations are still high for RMT market growth in years to come. In spite of all the difficulties identified in SIMPHS1 and the slow pace of deployment, it seems that

optimism among analysts still prevails, supported by the belief in strong drivers like demographic developments and the need to make healthcare delivery more efficient. Market participants witness an increased awareness of the possibilities that services falling under our definition of IPHS offer, in particular thanks to design taking better into account the needs of non technology-savvy people which increases the acceptance of RMT technologies. Optimism among analysts, producers and providers reflect this assumed higher acceptance.

**Figure 7: E-Healthcare investment curve**



*Source: Frost & Sullivan*

The above chart from Frost & Sullivan shows the relation between the amount of financing over time starting with a steep curve for the initial investment into new infrastructure. RoI in that first phase will be slow which impacts the investment in phase 2 which do not increase much. Then comes what F&S calls the sweet point where either eHealthcare has shown positive outcomes and investment will take up again over a long period time (phase 3) or outcomes are not meeting expectations and investments will fade away.

While this curve applies to eHealthcare it can be transposed to the RMT market segment where considerable investments are required in the start phase to set up the infrastructure and where results are not immediately visible which can lead to either increased investments if there is trust in potential benefits (phase 3) or rolling back if key actors on the supply and demand side do not have sufficient confidence in benefits.

**2.3.2 Scarcity of market data**

As in SIMPHS1 sources of data on the RMT market are still limited, and few market research companies provide RMT dedicated reports. Most market reports in this field address the broader area of eHealthcare, Telehealth or Monitoring (as opposed to Remote Monitoring) which indicates that the RMT market is still in its infancy. This does not come as a surprise as the SIMPHS1 research revealed the nascent stage of development of this market and the huge barriers that need to be overcome for its take up. In that sense hoping for a revolution in terms of market growth and market size since SIMPHS1 would be unrealistic.

As market reports from research companies are generally targeted at investors, the scarcity of reports reveals that RMT on its own is probably not attractive enough for more providers to focus on it and that the target audience for such investments is still limited.

As in SIMPHS1 Frost & Sullivan seemed to be the most adequate resource both in terms of coverage and depth of data hence we opted for acquiring full access to their healthcare database this time, hoping to find further insights both on RMT and the further segments of telecare, wellness and mHealth.

In SIMPHS1 in an attempt to get the best coverage possible reports were acquired on sub-segments of RMT like the GMD Europe Patient Remote Monitoring 2009 and the Global Self- Monitoring Blood Glucose market 2009. However these reports focused on monitoring devices including blood strips for the latter, which did not allow us to grasp the full extent of RMT solutions which imply much more than the sales of devices. As such the reports contributed only marginally to providing a better understanding of the RMT market. We therefore decided not to buy any updates of the latter, but rather to acquire new sources of data like Juniper and In Medica, which we hoped would offer valuable insights into IPHS and the four sub-segments defined within it.

### **2.3.3 Barriers and drivers**

The barriers and drivers identified in market reports and in SIMPHS1 continue to be valid. Demand pushed by increased incidence of chronic diseases, lack of skilled healthcare professionals, ageing populations and the need to contain hospital expenses are mentioned by F&S<sup>4</sup> as drivers of RMT<sup>5</sup> market growth. Main restraints include lack of common European standards, high costs of deployment of RMT systems, lack of information on funding and reimbursement practices as well as resistance to IT from healthcare professionals.

In spite of these daunting challenges, F&S concludes rather optimistically that there are huge opportunities for market players and describes the RMT segment as one with rapid growth expectations. F&S believes that the pressure coming from ageing, increasing hospital spending and government actions across Europe is pushing RMT giving it more and more importance. In terms of competition, F&S warns that new entrants face the biggest challenge on a market witnessing the presence of some global players and few regional players. Their capability to provide price competitive solutions will determine their chances of success as users are very price sensitive.

The 2007 Datamonitor report only gives brief comments on drivers and barriers for the Telehealth market, underlining that adoption rates will remain low while growth will be merely driven by demographics (ageing and chronic diseases increase). They further expect the homecare telehealth segment to become the main component of the whole Telehealth market.

The only difference between the above analyses and the findings of SIMPHS1 lie in the degree of optimism as to market development perspectives. Analysts share the view that the market will expand rapidly due to external factors. However we are more cautious as the time it takes for the barriers identified in those reports as well as in SIMPHS1 to be removed may delay the ROI meaning that the RMT market could face a negative scenario as in Figure 7 above.

### **2.3.4 Geographical focus**

F&S rate Germany and the UK as the best short term opportunities as revenues are currently highest but they expect the market to develop in France and Italy where prospects are good. In the longer run they foresee smaller markets to offer growth prospects. In the UK, growth is linked to government commitment to deploy telehealth and telecare. As evidenced in the UK country study carried out for SIMPHS2 future prospects for RMT deployment are uncertain as government spending cuts in the public sector including healthcare may well affect the future of trials like WSD.

### **2.3.5 Type of applications**

Datamonitor only refers to a generic telehealth market that will eventually grow to €1,146 Million in 2012 with a Compound Annual Growth rate of 41.8% evenly distributed between hardware software and services. For home applications the market research company suggests €999 Million in 2012. No further details are given on the type of applications and services offered today or that

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<sup>4</sup> See footnote 8

<sup>5</sup> The F&S report focuses on Telecare and Telehealth and defines the latter as "remotely monitoring a patient's vital signs through the use of devices customised by healthcare service providers" which corresponds to the SIMPHS definition of RMT. For the sake of consistency we stick to the terminology adopted in SIMPHS and only refer to RMT where F&S refers to Telehealth.

may emerge tomorrow, yet in discussion with an analyst the authors found out that RMT is considered to contribute significantly to the growth.

### 3 The Telecare market

#### 3.1 Background

Telecare in this report covers alarm services that are activated in case of emergency or of an event occurring. The definition of telecare used in market reports is rather fuzzy which makes it difficult to find data exclusively dealing with the Telecare market segment as opposed to Telehealth. If one takes a step back and looks at the origins of telecare, defining its boundaries from a product perspective appears to be rather simple. However as Telecare becomes increasingly embedded in mobile phones and smart phones, or gets bundled with other services, the boundaries of Telecare as a segment become difficult to draw.

Historically, hospitals and institutional care institutions have been the first to establish bedside alarms for patients to be able to call nurses. The use of such systems was subsequently extended to sheltered housing enabling residents to call the warden if in need or distress. Coupling these alarms over fixed telephone lines and the inauguration of centres to manage these alarms and initiate respond chains created the first generation of Telecare services, while the addition of short distance radio capabilities extended the range of use further to include home setting. These services evolved alongside technology into more sophisticated systems. An alternative label used for these sets of technologies is social alarm, in particular if the use of these technologies is not about security related applications in alarm systems against e.g. intruders or burglars.

Telecare today is closely related to fall prevention, which constitutes a major problem for the elderly and chronic ill population. In 1987, the Kellogg international working group on the prevention of falls in the elderly defined a fall as:

*“unintentionally coming to ground, or some lower level not as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure”.*

The burden of these events or falls is significant for those affected and they have severe consequences as well from a public health perspective.[10] In Europe falls are the dominant cause of injuries among the elderly, accounting for 29% of fatal injuries amongst those over 60, with a sharp increase after the age of 70.[11] Telecare covering fall detection can contribute significantly to the peace of mind of the users and their families while prevention of falls helps reducing hospitalisation and hence healthcare costs.<sup>6</sup> The European Innovation Partnership on Active and Healthy Ageing recognises the importance of prevention and monitoring of falls. A roll out in EU member states depends on how cooperation across traditional system and professional boundaries can be initiated. A consequence is the establishment of organisational, social and health care innovations as well as new business models.

#### 3.2 Different generations of Telecare products

In the telecare field, the distinction between first, second and third generation is often being made. They can be defined as follows:

- 1<sup>st</sup> generation refer to simple devices like social and emergency alarms. One important feature is the necessity for the user to actively initiate the emergency call. In an emergency situation he must be in a state to make an active and conscious decision and furthermore still be physically able to reach and press the trigger. A user needs to carry a device for triggering the alarm all the time, historically early systems triggers to initiate warden calls were placed in the rooms of institutional care facilities. Today the activation of an external alarm and the resulting communication for assistance or emergency response either rely on a health hub at home with a landline telephone connection or a mobile connection via mobile phone. Specially designed handsets of mobile phones include an alarm function targeting senior citizens, these handsets feature a large distress button, the user needs to press. First generation telecare therefore does not require the use of sensor technology.

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<sup>6</sup> IPTS SIMPHS2 Country Study France (forthcoming).

- 2<sup>nd</sup> generation systems use sensors to track and report changes. These kinds of alarms are either worn by the user or are permanently located in the vicinity and within reach of the user so as to determine changes. Such Telecare systems use more or less sophisticated sensors whose main distinctive feature is their capability to automatically trigger an alarm. This constitutes a major improvement over 1<sup>st</sup> generation telecare systems in those events or for diseases, in which the user or patient becomes unconscious or unable to initiate the alarm himself. Response protocols determine the steps to be taken in a response, including asking feedback from the user to verify the event to exclude false alarms, contacting informer carers or relatives and take further necessary action and an appropriate action, such as sending an ambulance or the fire brigade. Second generation telecare devices can also respond to an alert with appropriate remedial action and can be considered reactive rather than just preventive, although for the sake of this report they fall under preventive measures, as they can contribute to preventing further complications.[12]
- 3<sup>rd</sup> generation systems comprise smart systems including advanced forms of Smart Homes and Ambient Assisted Living (AAL) technologies. They can be considered as an evolution of first and second generation telecare which relies on an array of more sophisticated sensors that monitor the "living environment". While 2<sup>nd</sup> generation sensors in general have to be carried by users or relate to the user, 3<sup>rd</sup> generation sensors measure environmental variables, which indicate a potential harmful event to trigger an alarm. An additional distinction to the second generation is that the sensory capacities are not stand alone solutions, but integrated into a holistic care concept. While sensors for the second generation are used to raise an alarm, third generation systems are more advanced as they incorporate the data collected by sensors into care concepts. A communication link between the patient and care givers is established not only for triggering an alarm response but to communicate monitoring results as well.

Such monitoring includes physiological monitoring<sup>7</sup> to determine abilities of the user and emergency detection and response.<sup>8</sup> The capabilities of the sensors also extend to non-medical areas such as safety monitoring and assistance to detect potential hazards due to smoke, fire, or inundations. Security alarms and assistance can be integrated as well. Security<sup>9</sup> monitoring and assistance as well as social interaction monitoring<sup>10</sup> and assistance are further monitoring features.<sup>11</sup>

The integration of diverse technologies, including white goods, sensors and medical appliances with supporting services allow users to live in a controlled environment. Mobile applications can extend the radius of the controlled environment further. The distinction between RMT and third generation telecare becomes blurrier the more applications and technologies become integrated leading to overlapping concepts of functionalities.

Both 2<sup>nd</sup> and 3<sup>rd</sup> generations of telecare systems depend on more advanced algorithms in order to automatically detect incidents. For fall detection the most widely available commercial systems use a specific set of rules to calculate and determine a fall. The limitation to only a few proven algorithms limits the applications to a wider set of fields and can lead to a higher rate of false fall

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<sup>7</sup> Collection and analysis of data pertaining to physiological measurements such as vital signs of pulse, respiration, temperature, and blood pressure, as well as blood sugar level, bladder and bowel output, etc.

<sup>8</sup> This includes the collection of information general activity level, motion, gait, meal intake, and other activities of the daily life. Emergency detection is enabled through the collection of data that indicate abnormal or critical situations (such as falls).

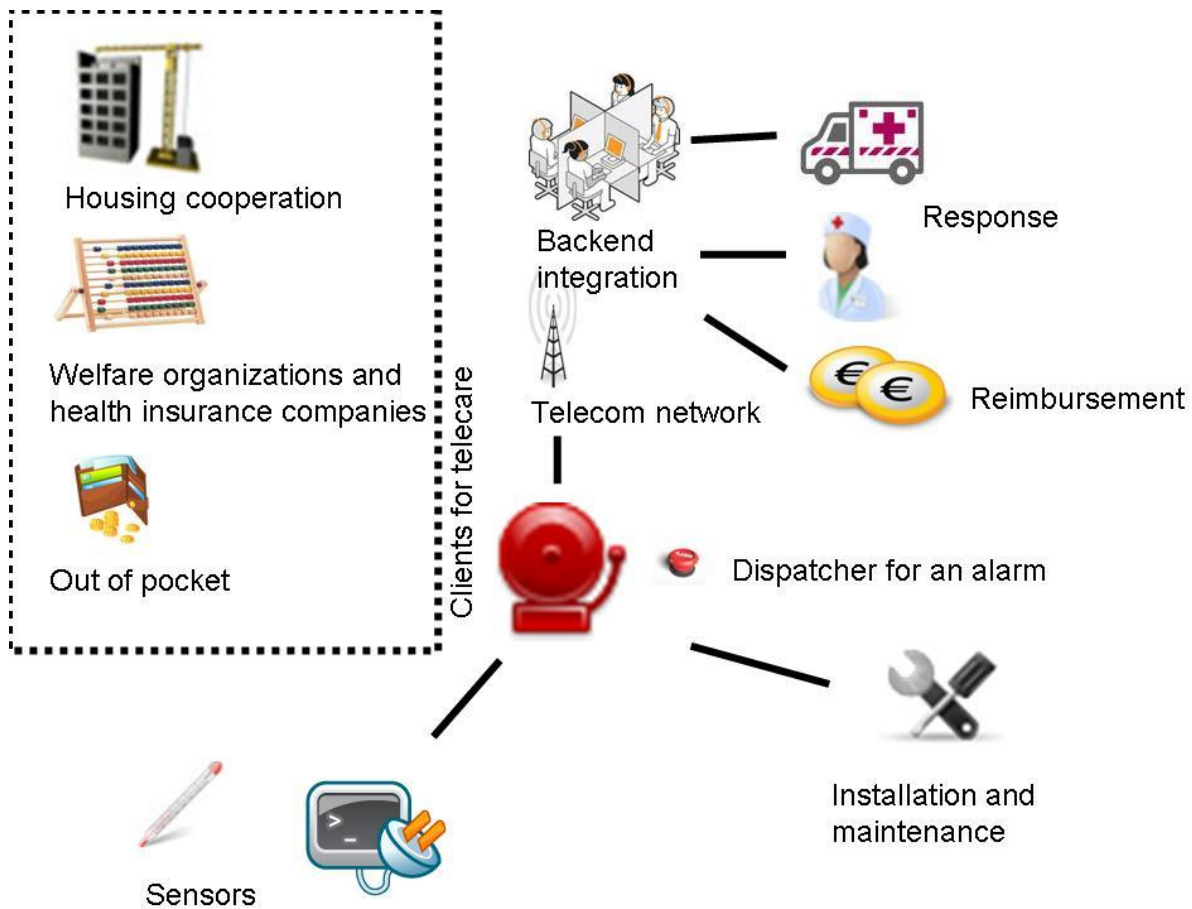
<sup>9</sup> This includes measurements that detect human threats such as intruders or burglars and alarming assistance to responses to such identified threats.

<sup>10</sup> Collection and analysis of data pertaining to social interactions such as phone calls, visitors, and participation in activities

<sup>11</sup> The list has been elaborated based on the distinction of different sensory capacities for smart homes in Demiris et Hensel 2008 13. Demiris, G. and B. Hensel, *Technologies for an aging society: A systematic review of "smart home" applications*. Yearb Med Inform, 2008: p. 33-40.

detections for specific groups of users. False alarms contribute to higher costs, and undermine the trust in a telecare system both for the care giver as well as the user.[14]

**Figure 8: Components of Telecare systems**



*Source: Authors' own elaboration*

### 3.3 Telecare market data

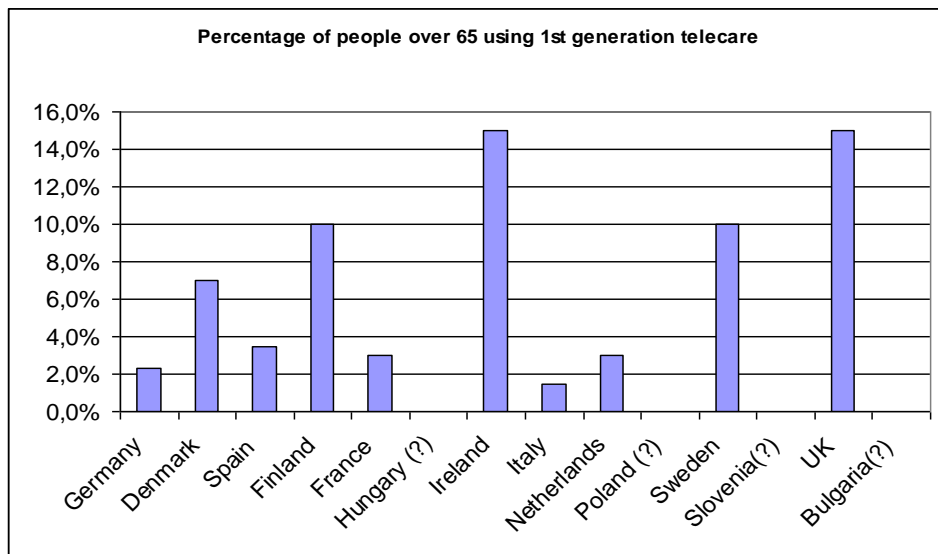
The fuzziness between the concepts of Telehealth, Telecare and Remote Patient monitoring resulting from the integration of technologies mentioned above make it difficult to obtain market data exclusively dealing with the Telecare market segment as opposed to other IPHS market segments. Frost & Sullivan is the main source we could identify so far.

The F&S reports make a clear distinction between the telehealth and telecare segments. In 2006 they estimated that only slightly less than 5% of all potential end users - defined here as people over 65 years of age - in Europe employ a telecare<sup>12</sup> system.

Information from a 2009 European study on ICT and Ageing [15] on the use of first generation telecare draws a similar picture. According to a study by empirica the United Kingdom and Ireland are the countries with the highest percentage of people over 65 using telecare, followed by Finland and Sweden. Further, as shown below, in countries like Bulgaria, Slovenia and Poland no data is available, and existing telecare programmes are either completely privately funded or are run by charities.

<sup>12</sup> The term social alarm has been used by F&S in this context in 2006, but it denotes what later was called telecare.

**Figure 9: Percentage of people over 65 using 1<sup>st</sup> generation telecare systems**



Source: empirica, 2009

A similar distinction between different generation systems has also been drawn by others like Frost and Sullivan [16] which define:

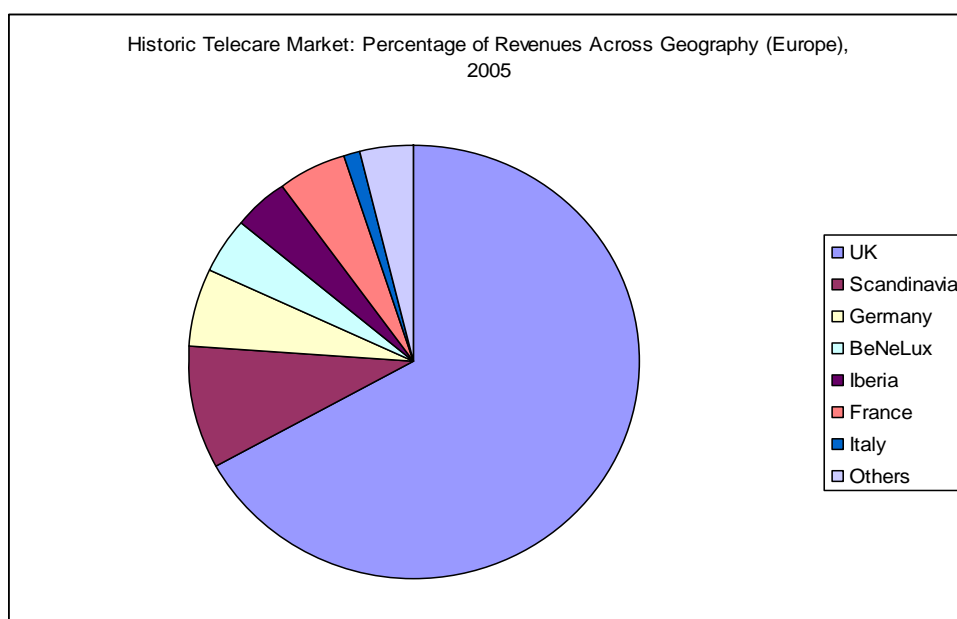
- 1<sup>st</sup> generation: simple devices like social and emergency alarms,
- 2<sup>nd</sup> generation: systems using sensors to track and report changes,
- 3<sup>rd</sup> generation: smart systems like AAL which support data collection and interpretation.

In 2006 the market research company estimated the total market for social and medical alarm to reach €177 million in Europe for the year 2005, with 734,000 units sold. These figures include alarms used within an institutional setting as well as alarm for the use in the home of the patient. They are thus not completely in line with the scope of our research. The market has been projected to grow in the six year period till 2012 to €268 million.<sup>13</sup>

The market for first generation systems has been characterised already in 2006 as a mature market with replacement as the main market drivers, with the second generation considered a growth market and the third generation as an embryonic market. Over 80% of the total revenues for telecare in Europe has been attributed to simple triggers of the first generation, sold both to independent homes and sheltered housings. This technology has been in place for nearly over four decades. The United Kingdom had a market share of over 60%, followed by Scandinavia with 9% share and Germany with 6%; the remaining countries covered had a combined market share below 5%. The overall market has been dominated by the incumbent champions at the time the report was written. The report identifies the support of the NHS as a main success factor in the United Kingdom and increased acceptance and awareness of telecare services as another driver. The market back in 2005 was dominated by Tunstall, which sold around 60% of all telecare systems in the UK, followed by Bosch and the CTT Condig.

<sup>13</sup> The report uses US dollar, for consistency reasons we have used 2006 exchange rates for both 2005 and 2012.

**Figure 10: Telecare in Europe - Market shares per country, 2005 (in %)**



Source: Frost and Sullivan 2006

**Table 1: Historic Telecare Market – Percentage of revenues across geography (Europe), 2005**

Country	Share of revenues
UK	67%
Scandinavia	9%
Germany	6%
BeNeLux	4%
Iberia	4%
France	5%
Italy	1%
Others	4%
Total	100%

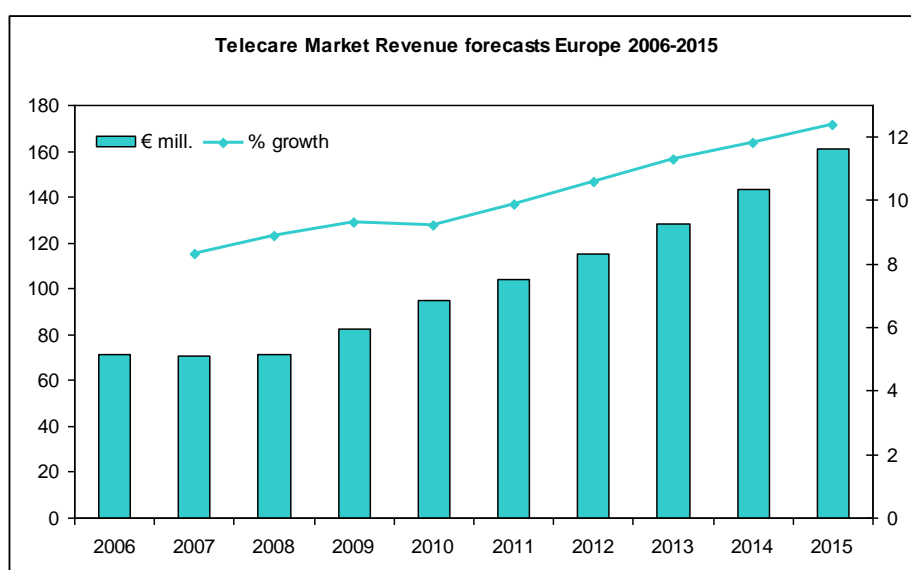
Source: Frost and Sullivan 2006

Outside of the United Kingdom, Scandinavia and Germany the use of alarm systems has been limited mainly to hospitals and institutional care. Back in 2005 most of the telecare equipment used Dual-Tone Multi-Frequency (DTMF) tones for communication over analogue telephone lines, a switch towards an IP base network raises safety concerns for telecare applications.

In spite of the distinction between 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> generations of telecare, F&S does not provide data for each of the three categories. The section below therefore deals with Telecare in general.

In a different report from the same market research company the value of the telecare market was estimated to be worth €82.45 million in 2009[17]. For this estimation the company only took into account telecare solutions outside of institutional care. The estimated value is expected to nearly double in value until 2015 to reach €160.75 million. The CAGR for the period 2009-2015 is estimated at 10.8% which is somewhat lower than the total Remote Patient Monitoring market, confirming that the overall market will be driven faster by Telehealth than Telecare albeit with a steady contribution of Telecare. The expected CAGR also shows an acceleration in market growth compared to the period 2006-2008 where this segment grew at a compounded rate of 8.8%. Compared with the Telehealth market segment, Telecare can be considered a more established market especially for 1<sup>st</sup> generation telecare (e.g. social alarms) which may explain the lower growth rates than for Telehealth.

**Figure 11: Telecare Market Revenues forecasts Europe - 2006-2015**



Source: Adapted from Frost & Sullivan

In terms of value, according to F&S, the Telecare market revenues in 2009 were worth 55% of those of Telehealth and the projections for 2015 show that the relative value of Telecare will decrease slightly to below 50% of Telehealth market revenues. This is a logical development following from the lower expected CAGR for Telecare up to 2015. However it comes as a surprise to the authors of this report that Telecare revenues are so much smaller than those of RMT. One explanation could be the low cost of Telecare applications, especially 1<sup>st</sup> generations ones, compared to expensive RMT equipment but this finding requires further investigation. Additionally telecare applications like alarm systems are often included for free with other services making it difficult to estimate the actual market size from a revenue perspective.

The United Kingdom is the leading country for Telecare revenues with a value of €19.4 million in 2009 and a forecasted value of €49.1 million by 2015, followed by Germany, France and Italy. F&S estimates that 1<sup>st</sup> generation telecare are in a growth phase in the UK with second and third generation telecare slowly penetrating the market. F&S foresees a CAGR of 11.5% over the 2009-2015 period. The leading position of the UK is explained, according to F&S, by the strong commitment of NHS to deploy telecare which has been translated by favourable funding and policy conditions so far.

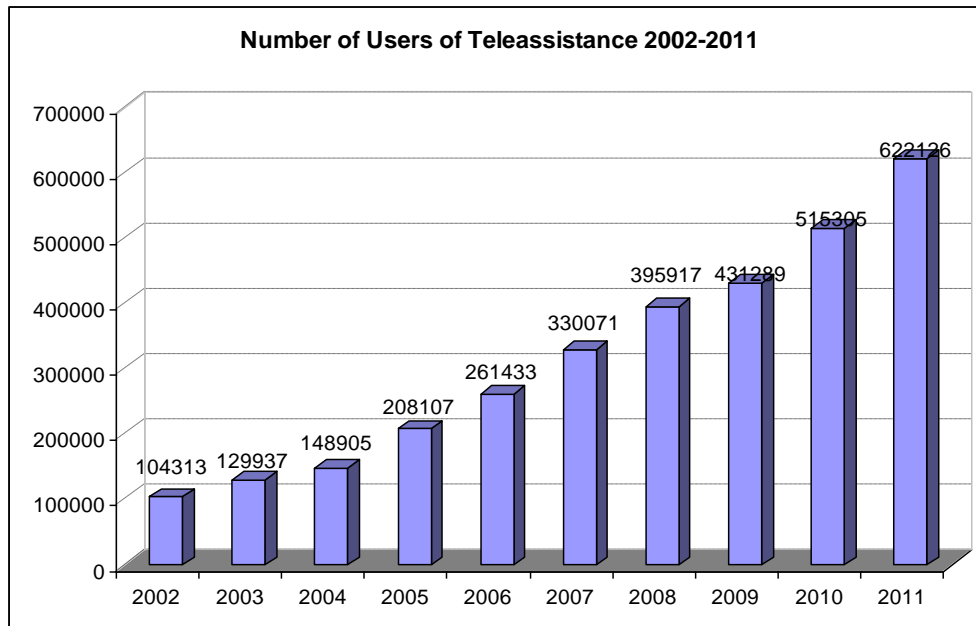
F&S considers the German Telecare market to be in a growth phase even if 2<sup>nd</sup> and 3<sup>rd</sup> generation systems are used mainly in pilots. Again government support and commitment to pilots in the AAL and Ageing area seem to drive growth even though mainstreaming is still very limited.

France is in a position similar to that of Germany and is considered by F&S to be the most promising market for Telecare services in Europe, driven by government support to pilots and research.

F&S finds that the Italian Telecare market is in its infancy with little deployment of 1<sup>st</sup> generation telecare and next to no mainstreaming of 2<sup>nd</sup> and 3<sup>rd</sup> generation Telecare systems.

The Spanish Social Security Administration Body IMSERSO is responsible for handling Social Services supplementing Social Security System provision and deals with older and dependent people. A report from 2008 provides information on the total 65+ population in Spain which amounted to 7.63 million people[18]. Among those there were nearly 400,000 users of telecare which represented a coverage of 5.2%. 76% of the users of telecare were women and 58% of all users were over 80 years of age; 54% of all users lived alone and the mean age was 80. According to IMSERSO, the average price of telecare in Spain was €253.9 per user per year in 2008 (ranging from €466 in the Rioja to €99 in the Navarra region).

**Figure 12: Growth of the public telecare service in Spain from 2002 to 2011**



Source: IMSERSO, Spanish Ministry of Health, 2011

The above chart shows the considerable increase in numbers of telecare users over the period 2002-2011. An attempt was made to collect similar data in other countries, including the eight countries for which specific SIMPHS country studies have been developed<sup>14</sup> with a view to comparing coverage and in combination with prices of telecare services draw conclusions on the served market and potential market. However it was not possible to find such data.

### **3.4 Market dynamics: recent trends**

The market is subject to both push and pull elements. Demography shifts towards nuclear families result in geographically fragmented living conditions for families and looser ties for the elderly making the informal care traditionally provided by families more difficult. Different policies which complement or anticipated these demographic developments aim at promoting the development of services and technologies that enable an aging population to live longer in their own home and include expenses of telecare in reimbursement schemes if the elderly are enabled to stay longer at home.

The first generation of telecare alarms served the need of the elderly for living safely on their own in their accustomed environment. Some authors argue that the market is still dominated by a combination of push initiatives by the industry, in particular technical suppliers and policy measures. According to this body of research a rather inadequate understanding of the needs of the elderly and chronic ill in terms of services which fall under our understanding of telecare and more advanced features as ambient assisted living<sup>15</sup> [19, 20] hampers market development. In support of such claims are the fact that a majority of the market demand is generated by charities, NGO, welfare institutions, system integrators and health insurances.

Market players increasingly start to recognise the importance of products for out of pocket payments, the additional perk of alarm systems embedded in other technology which boosts the sales of associated services and the benefits of designing specific electronic devices targeting the elderly, e.g. modified handset of mobile phones. Understanding demand by private end-users is particularly decisive in countries where neither health nor social insurance reimburse the costs for

<sup>14</sup> The results of which are presented in SIMPHS2 Deliverable D3.1.

<sup>15</sup> The study Chen et al (2009) refer to Smart Homes, which equals the definition of Ambient Assisted Living.

the telecare service and device. As of 2010, the market research company Frost and Sullivan states that this was the case in Italy among those countries responsible for a larger part of the overall European telecare market.

Housing and real estate developers increasingly supply their compounds with telecare systems and care related services which are complemented by security services such as closed circuit television - sets of cameras monitoring a specific protected area- and other safety relevant products. To address the demand of the elderly wishing to live independently a business model that seems to be gaining importance is the provision of housing compounds not offering care services but nevertheless providing some amenities like support in housekeeping, social warden, social activities or sport activity for independent older people. In many cases such houses dedicated to older people lay in the vicinity of areas populated by younger populations. These houses can easily be transformed to cater for the demands of people in need of care while still retaining a partial independence. Such assisted living communities or housing facilities with care services offer varying levels of assisted living for largely independent older people who may need minor assistance or some services. Care homes or shelter homes offer the same services options but to a lower price. Co-housing of several generations in one house, mostly family members, provide social and basic health care. Telecare, alarm systems and corresponding response chains form decisive elements in such housing arrangements, accordingly real estate developers and housing providers use these alarms in their offers targeting ageing customers or to keep older tenants in their existing housing arrangements. Telecare has been applied both in rural as well as in more densely populated areas.

### **3.5 Barriers and drivers**

More generally barriers and drivers on the Telecare market as highlighted by F&S are similar to those on the RMT or Telehealth segment. Ageing, need for continuous care, deployment of AAL programmes and government action promoting awareness of telecare as well as more conducive regulatory and policy frameworks are mentioned by F&S as main drivers for the segment, while lack of interoperability, lack of public funding and unclear perception of benefits hinder its development. The Telecare market is characterised by a diversity of device suppliers and service providers but competition remains low as there is no mainstreaming happening yet, according to the analysts.

Alterations in family structures and demographic change in general will decrease the number of people available for care related activities. Ageing in place becomes a policy imperative and a goal for frail elderly. In particular as families do not necessarily live any longer in the same area, the pool of potential informal carers decreases and only a slight need for support can eventually determine the ability to live independently. To ease worries, more people can use telecare systems to initiate a response in case of emergency. With an increase in the number of elderly, under certain conditions an increase of demand for telecare systems is likely to happen for a couple of reasons, both as a pull and a push market.

Demand for telecare will be driven by an affluent group of elderly which has been labelled *silver agers* or the *silver economy*: people with the means to purchase themselves services and products allowing them a level of freedom they have been used to from times when they were younger. In particular mHealth related alarms are becoming an interesting field for those active elderly. It can be expected that the not so affluent segments of the elderly generation will imitate the consumption patterns of the better off and thus the out of pocket payments for telecare services may trickle down. By targeting the initial affluent members of the silver economy, providers follow a push approach. Upgrading their services to the market segments composed of elderly can be done by simply adding features like a telecare alarm. This trend can be witnessed in many segments, most visible with mobile phones targeting elderly incorporating emergency alarm buttons for first generation of telecare or fall detection devices for the second generation. From an organisational point of view the increase in elderly population eventually spurs the growth of organisations and personnel involved in delivering services for elderly and allowing ageing in place.

Legal requirements and official plans become a driving force and an important factor facilitating the uptake of telecare. As field research revealed in Scotland a programme has been launched in August 2006 to help more people living at home independently for a prolonged period of time while

enjoying a higher level of safety and security through the use of telecare. A development fund and associated support has been set up to integrate telecare into community care services across Scotland.

The British example shows as well barriers deriving from a top down approach, where a centralised buyer creates a monopsony position and has an incentive to issue only a few easier to manage contracts to several larger suppliers. Such larger suppliers would need to be able to provide comprehensive services on a spatially inclusive, comprehensive and nationwide basis to lower transaction costs for the management of the contracts. Yet by focusing only on larger suppliers such an approach discourages innovation by excluding more flexible smaller suppliers that excel in specific field, though do not have the capacity to serve such contracts. The hindrance to a broad uptake of telecare seems to mirror the obstacles we discovered for uptake of PHS and IPHS. In some areas telecare services are under-developed and alarms are not integrated with the delivery of social care. The institutional set-up only allows activating an emergency response, yet in many non-critical cases a social care response would provide the necessary assistance. An inadequate response to the needs of the user and the higher costs can impede an uptake. Lack of awareness amongst potential users may also be a factor.

Further, users may perceive the ability of tracking movements and vital signals to trigger an emergency alarm rather as an intrusion of their privacy. Aesthetical concerns should not be underestimated, the design of some telealarms system clearly identify the wearer as someone in need of help. Even if they are proven technology, to wear a rugged and bulky telecare device may not appeal to everyone, in particular the generation of ageing babyboomers who developed a more distinct taste in fashion than previous generations of elderly people. Industry has already reacted and introduced mobile phones with an integrated alarm button or integrated alarms in jewellery or watches which is less intrusive.

### **3.6 Geographical considerations**

In some countries the market for telealarms is highly concentrated, in Germany for instance six charity and welfare organisations are active nationwide<sup>16</sup> and organise their own service centres. Ireland and the United Kingdom have the highest penetration of telecare. As of 2010 no uniform systems for telecare provision was in place in some Central European Countries including Poland and Bulgaria. Anecdotal evidence indicates that there is a cleavage between rural and urban areas. The setup and the maintenance of a response chain is less demanding in urban areas, distance becomes an additional hurdle. In remote areas not all settlements are necessarily equipped with a landline; thus mobile networks in particular gsm play a more important role in the provision of telecare. Finland was among the pioneers to use mobile phone networks to equip inhabitants of sparsely populated areas with a telealarm. Response chains in remote areas need to be adapted as well, as shown by interviews carried out in Scotland for the SIMPHS project. Generally countries with sparsely populated areas should benefit from telecare systems. If migration trends of younger people from rural areas into urban areas continue, the availability of carers in more sparsely populated areas will aggravate. The Nordic countries have been among those early adopters of telecare with mHealth.

For Spain a geographical distribution of usage among those over 65 years and cost per users is available for 2008 (see Annex 2). One can find a negative correlation between the cost per user and the percentage using the service, in those areas with the lowest usage. The numbers refer to reimbursed telecare services of the first or second generation. Our assumption is that fixed costs borne by fewer users are the reason for the higher costs. Additionally in more rural areas of Spain costs may also be higher because of the longer travelling time it takes for emergency services to reach a user in case of alarm.

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<sup>16</sup> The Umbrella organisation *Bundesverband Hausnotruf* unites Arbeiter-Samariter-Bund (ASB), Arbeiterwohlfahrt (AWO), Johanniter-Unfall-Hilfe (JUH), Malteser Hilfsdienst (MHD), Deutsches Rotes Kreuz (DRK), Volkssolidarität (VS).



## 4 Wellness/Fitness and prevention

### 4.1 Wellness/fitness in the IPHS context

For an ageing population to remain active and healthy preventive medicine plays at least as important a role as curative medicine. Products and services which help delaying or preventing the onset of chronic conditions or impairments and improve the general wellbeing fall under the wellness market segment as we see it in the context of IPHS.

Fitness and sport related devices and services benefit from much looser safety requirements than for instance RMT systems. This makes them an ideal market place to test new technologies. For companies active on the PHS market, experiences from healthy and motivated users can contribute to improving product design and achieving economies of scale which in turn helps reduce the costs of purely health-related applications.

One of the first target groups for wellness product is the Baby boomers generation which is now slowly reaching the age of retirement. As acknowledged in an article from The Wall Street Journal online affluent baby boomers are increasingly important as a target group for health related electronic services, home improvements and home services. Wellness but also telecare devices will have to fulfil certain aesthetic qualities, on which this generation puts more emphasis than the previous ones. Their design will have to reflect a lifestyle choice. It may even act as a status symbol, rather than stigmatise the user as old, weak and feeble as is the case for most of these products today.[21] The so called *worried-wells* form an important target group. While they enjoy a high level of health, the *worried-wells* are highly concerned about their wellbeing, and take all the necessary action for prevention.

Another important target group for wellness related IPHS services and products is athletes and sport enthusiasts striving to improve their performance. The sports industry is highly innovative and willing to apply the newest scientific research for a variety of products.

Such wellness and training related services fulfil a preventive function and tend to be financed through out of pocket payments as opposed to institutionally managed demand that prevails in Telehealth and to a large extent in telecare. For the sake of this report we will focus mainly on tools supporting the physically active, excluding from its scope interior design related devices falling under the label of wellness, such as the Philips product line of advanced lightning for wellness and living healthy.<sup>17</sup>

The rationale for looking into training and wellness related products is the assumption that an increased acceptance of digital tools e.g. for training could lead to economies of scale for both device prices and related services enabling further innovation and market uptake in adjacent segments of RMT, Telecare and mHealth.

From companies originating in the sport industry, video game producers and watch manufacturers to companies analysed in SIMPHS1, it seems that a broad variety of stakeholders are entering the wellness market. This market segment appears to have already reached a more mature level, and is expected to grow substantively in the near future.

As a common denominator the covered products support lifestyle choices, leading to a more active life and associated health benefits. This includes the elderly or ageing population, who do not need medical support yet but strive to delay the onset of diseases. For many sport enthusiasts measuring body functions and storing the results of sports activities has become integrative part of their training. Emerging social computing communities and web 2.0 now enable people engaging in different sports to exchange their experiences, tips and warnings. One should note that some of these community platforms for sharing tips on training predate the hype around web 2.0. For

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<sup>17</sup> The success of Philips wellness lightning product line, can be seen as a clear indicator that certain segments of customers are willing to pay a premium prices for goods enhancing their wellbeing. More information can be found at [http://www.newscenter.philips.com/main/lighting/news/press/2005/welness\\_lighting.wpd](http://www.newscenter.philips.com/main/lighting/news/press/2005/welness_lighting.wpd) Accessed February 2011.

instance geo-coaching emerged as a GPS supported treasure hunt, and now combines online elements with a search in real locations. Sport has become an activity strongly moving towards digitalisation and forms important part of a digital lifestyle. Physical activity has been recognised as prevention to the main lifestyle related conditions. Being physical active increases the metabolic energy usage and has very positive health consequences, such as reducing the risk of obesity and all subsequent ill-health implications. Yet being active is not part of daily routines in modern societies. Changing work patterns especially under the influence of ICT (e.g. telework, use of PCs) do not facilitate physical activity and busy schedules do not leave much space for training. Using mobile apps as a full replacement for a trainer or sport instructor bears some risks (e.g. injuries). Yet for people who are not able to visit a sports club regularly, fitness apps can yield health benefits. Useful and easy to understand information can eventually have an impact on behavioural change.

RMT for non-medical purposes surges among technology savvy users. Collaboration among people tracking their activities and sharing these experiences has led to the creation of communities such as the *quantified self*.<sup>18</sup> Given the high prevalence of insomnia, one of the first new fields emerging from this movement has been measuring sleep and support. Over the last year a variety of companies that offer devices for sleep tracking has mushroomed.

#### **4.2 Market data**

The global market for sport applications overlaps with the garment and fashion industry. A different proxy for approaching the global market for consumer-focused health and wellness devices can be to use the related market size for self-improvement and self-help which amounts to €7,300 million and the global market for weight loss of €4,300 million in 2010.[22] This market attracts an increasing interest by venture capitalists and entrepreneurs. Available market data for vital signs monitoring for consumer fitness purposes showed a initial clear dominance of the Finnish company Polar in the US in the late 2000s.[23] As early as 1977 the company pioneered heart measuring devices, which evolved later into arm wrist and watches for endurance sport during training and it has offered connectivity to a PC for over 25 years with newer versions recording findings and using algorithms for training analysis. Polar's target group includes ambitious hobby athletes and increasingly normal active people. Over the last few years more and more companies have tried to enter this market increasing the level of competition. [24]. Unfortunately at this stage we could not find market data focusing on Europe.

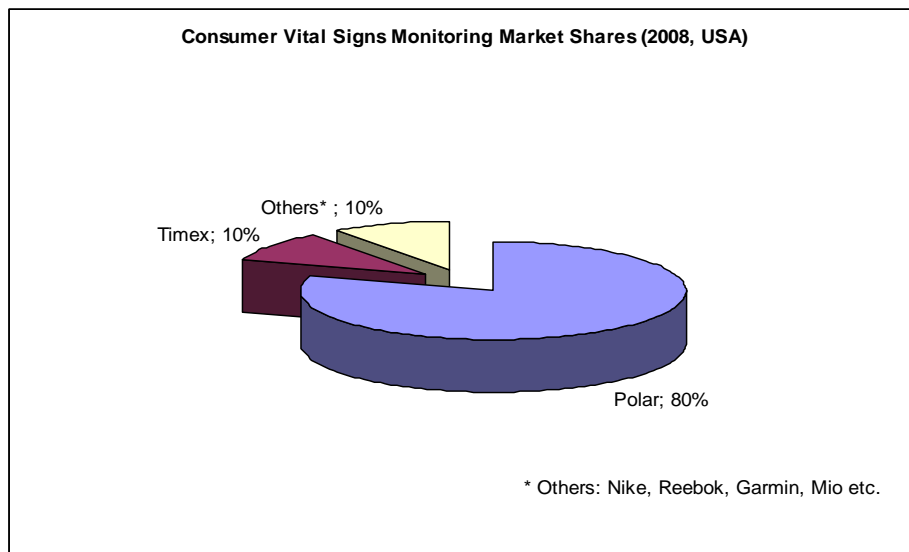
European market data for the sport market in general or the use of ICT for training purposes is not readily available. Contacting some research centres in sport science has not enabled us to obtain more data than asking market research companies, the latter reported however having received similar requests recently but having no report on the subject. All we can say is that the sport scientists contacted confirmed the general trends observed in our analysis of the market dynamics.

For the sake of giving an idea of existing players and their importance, we have included below an overview by Frost & Sullivan of what they label the Vital Signs market in the US, to be understood as Fitness Vital Signs Monitoring.

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<sup>18</sup> This community does not necessarily rely on ICT to track self-measurements, a pen and paper is considered a useful tool as well. A trend towards using RMT sensors and using smart phones is recognisable <http://quantifiedself.com>

**Figure 13: Percentage of Market Share for Consumer Monitoring for Fitness**



Source: Frost and Sullivan, 2008

### 4.3 Market dynamics

The market has expanded in particular in the area of endurance training and in recent years a very broad variety ICT based systems and gadgets has emerged. Wireless telemetry capabilities are employed beyond hospital walls on the track fields. It has become possible to better organise the training, capturing and processing of vital signals and – importantly from a sport medical point of view- to provide feedback on training activities. Classical sport garment and equipment companies, producers of chronographs, consumer electronics and video games are entering the market offering new personal fitness monitoring products or even serious games specific to various sports activities, such as running, cycling or even bowling. The market can be divided into a booming consumer market and a more restricted market targeted sport professionals with more complex products. Additionally under the third category we increasingly find services targeting corporate clients keen on inducing behavioural change among their employees promoting healthier and more productive lifestyles.

#### 4.3.1 The professional market as a hotbed

The first group - professional athletes - is a highly competitive segment, where small improvements can determine success or failure. Training efforts rely more and more on research results of sports medicine and exercise physiology increasingly integrating the newest technologies. Athletes are thus early adopters of high tech innovations, such as new composite materials for equipment. Increasingly to improve their performance physiological data is recorded and analysed through remote monitoring or sensors during exercise and recovery. It is often a dedicated team of applied sport medical practitioners or athletic trainers which evaluates the collected data to draw conclusions for the improvement of the performance of the athletes and their trainings. These tasks are increasingly supported by a broader range of algorithms to calculate the best outcomes. In the area of professional athletics research institutes and universities are often involved to carry out research and engineering, combining different domains of knowledge, such as informatics, mechanical/electrical engineering and medicine. In other words the competitive environment of professional athletics functions as a hotbed for new technologies which are useful from a PHS perspective. In Europe team sports have been slower in applying vital signals monitoring than individual endurance sports. Even financially highly profitable sports, such as soccer only in recently years started to adopt vital signal sensing, whereas American football has used sensors for longer. One reason is that in a complex sport involving tactics and strategy quantitative data does not provide a major competitive advantage. In American football the motivation to employ sensors was to avoid or detect injuries caused by tackling the players.

#### 4.3.2 Sport enthusiasts as a driver of growth

The use of advanced technology is not restricted to professionals, more and more hobbyists and spare time athletes rely on technical support. A distinct market for products targeting these customers has emerged. Entertainment for people while doing sports has been a market for consumer products for a long time and it has developed in parallel with the popularisation of endurance sports and running; adding features has allowed the tracking of training. As a result endurance sports enthusiasts can choose from a wide array of devices and gadgets, monitoring for these sports easily provides results enhancing training and training plans. Sport garment and shoe manufacturers integrate motion sensors in their products enabling them to be connected to smart phones or advanced digital music players and to record their trainings, such as NIKE products using Apple mp3 or phone devices. Navigation system producers, such as Garmin or the Finnish sport computer producer Polar serve this market with an increasing variety of products. Whereas professional athletes know their body well and have a high level coenaesthesia, amateurs and beginners often tend to overestimate their abilities and overdo training and sportive activities leading to injuries. Resulting inconveniences such as unpleasant muscle ache can become an obstacle to maintaining sportive activities, these experiences can lead to negative associations regarding sport and undermine the long term motivation necessary for exercising. Fitness applications monitoring movements can contribute to avoiding such negative outcomes.

Athletes and hobby sport enthusiasts alike have always been keen on creating new products and some industries like windsurfing, snowboarding and skateboarding have emerged from hobbyists' creation as evidenced in the literature.[25] With the smart phone an easily programmable tool has become popular, for which a surge of health, sport and training related apps have become available. The smart phone approach has lowered significantly market entrance barriers for new actors who instead of having to produce and sell new devices can rely on the existing smart phone which can be programmed through an app at a nearly marginal price, so that there is no need for a critical mass of users to bring prices down as was the case before.

The health and sport community also welcomes the possibilities created by Microsoft's new motion and voice controller Kinect which surveys various points on the body to detect movements and translates these body movements into actions or instructions on the screen, which is additionally equipped with a voice controller. Communities of users are deploying the Kinect capabilities of advanced video conferencing system further for personalised training and feedback by trainers. The device is rather simply linked to a TV set, which is already familiar to elderly people. Research from SIMPHS 1 indicated a higher acceptance for a health hub by elderly, if the device facilitates communication with family members and peers through a TV set. Microsoft purchased SKYPE and is now in the position to transform the Xbox into a health hub linked with the Health Vault. The first generation of programmes already demonstrate the potential of the Kinect to "game-ify" health related activities, as with *Your Shape: Fitness Evolved* a game developed by game publisher Ubisoft. Features and tasks necessary for home rehabilitation can be performed by the game console. The identity of the patient can be validated by facial recognition and the cameras can record and enable feedback on different aspects of motions by different parts of the body. Similar programmes under development will allow doctors and patients to connect through a Xbox Live social network as well as survey prescribed rehabilitation courses which are graded and assessed according to a schedule. Kinect<sup>19</sup> offers an off-the-shelf system and hardware for advanced Ambient Assistance Living and telehealth solutions, which previously had to be developed independently making their price prohibitive. Many of the functions of specialised sensors can be replaced by the Kinect system, e.g.

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<sup>19</sup> The Israel based Start up PrimeSense has developed the method behind Kinect and licensed it to Microsoft. The sensor generates a detailed topographic map (3D depth map) by analyzing the deformation in the coded light as it is reflected back from the different objects in the scene. Its components are based on standard electronics already in high-volume production - including standard image complimentary metal oxide semiconductor CMOS sensors-, and purportedly offers superior resolution and dynamic range and is most resilient to ambient light.

a wheelchair has already been modified to become auto corrective and more collision proof.<sup>20</sup> It is an Israel-based Start up called PrimeSense which licenses the controller to Microsoft. It has opened the technology to a wider audience from PC manufacturer Asus to sport and health interested enthusiasts who enjoy experimenting for different purposes including health and wellness applications.[26]

#### **4.3.3 Corporate fitness: a new niche**

Corporate fitness and wellness programmes are a further sub-segment of Fitness and Wellness falling into the scope of SIMPHS 2 as ICT is starting to play a role in the delivery of wellness and training related services capable of delivering feedback and track performance. The accounting and consulting company Deloitte estimates good chances for the fitness industry to establish a new market segment for general corporate fitness programmes. Corporations and public authorities in Europe increasingly provide schemes to keep their employees fit and improve their general well-being, reduce absenteeism and improve productivity. In some European Countries tax breaks incentivises companies to contribute to sports activities of their employees. Additionally to the establishment of gyms in office buildings or the reimbursing of membership fees, companies are being offered a broad variety of ICT supported services that nudge people to become physically more active. One example is the Dutch Fitness provider High five which targets the market for services catering for the health needs of employees. Additionally to its standard training courses it offers an online repository to manage training efforts and foster healthy lifestyle choices combined with feedback. The British holding Virgin is marketing to corporate customers a health-miles bonus programme as an incentive similar to frequent flyer programmes to encourage employees to increase their level of physical activity. The tracking functions happen over a motion detector and a web interface. It is worth noting that the industry focusing on corporate wellness and fitness seems to have remained rather resilient to the economic crisis. [27]

All the above shows that it becomes possible and easier for both the professional athletes and the amateur to record high quality physiological data during exercise and during recovery periods and that new developments supported by ICTs open up market opportunities not only by expanding the reach of health related systems to the consumer market as a whole but also to companies and corporations who are increasingly interested in their employees general health and well-being.

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<sup>20</sup> GeckoSystems International Corporation, offers mobile robot solutions for safety, security and service has build a prototype of a modified the Xbox Kinect sensor attached to an electric wheelchairs. This helps to avoid obstacles and make the chairs easier and safer to operate. <http://www.amsvans.com/blog/5462-geckosystems-to-kinect-wheelchairs-with-collision-proof-technology/>



## 5 mHealth

### 5.1 What is mHealth?

mHealth or mobile health care can be defined as the delivery of healthcare services through mobile communication devices. It comprises mHealth as a concept for the delivery, facilitation and communication of health-related information by means of mobile technologies including mobile phones, smart phones, tablet computers as well as devices with integrated communication abilities. It can be understood as portable eHealth services which accompany the user in his daily life. As it is based on the use of mobile communication networks for health related tasks, telecom companies and handset producers are very active in this market. It has emerged from the use of portable computers and PDA in institutional care to facilitate administrative tasks and enable access to health related information and EHR by care professionals. First and second generation of telecare functionalities have been enhanced and such alarm systems also function through a connection with a mobile communication network outside the home of a user. A surge in interest in smart phones and related apps has created a market for health and wellness related apps as well. In particular here, the lines between wellness and healthcare are very blurry.

### 5.2 Overall market developments

Mobile health (or mHealth) embraces the ubiquitous aspects of being healthy. mHealth is to be understood in the SIMPHS context as the delivery or provision of healthcare and social care related services through mobile communication networks and portable devices outside of institutional healthcare settings. It involves the ability to create, store, retrieve and transmit data via mobile communications. The main difference with stationary IPHS is the ability for the patient to use the service on the move. mHealth tools enable capturing vital signs to monitor patient related data,<sup>21</sup> note changes in activity levels, verify that medications have been taken, without having to see a patient face to face which helps reduce office visits and even hospitalisation contributing to better use of healthcare resources. Educative content can also be transmitted through the same means.

For many people, mobile phones have already become part of everyday life. The success of smart phones and their ecosystem for downloading apps is linked to their ease of use. This being said, complex hierarchically structured menus can sometimes still be hard to navigate and visibility issues contribute to usability shortcomings for mobile phones and Apps for Smart phones. Age and condition related changes in psychomotor, sensory and cognitive capabilities enhance the demand for usability.[28, 29] Once usability issues are solved a wider acceptance of mHealth services can be expected. Better displays, tactile functions and adapted menus systems contribute to making Smart Phones attractive devices for mHealth.

mHealth can facilitate health education through feedback on daily activities thus inducing behavioural changes similarly to the way mobile phone has already altered fundamentally everyday live and behavioural patterns. Once smart phones become an integrated part of daily routines, mHealth services will have the chance to promote healthier lifestyle or adherence to a therapy for instance.

In terms of market development mHealth seems to be bridging the gap between institutional healthcare markets and the consumer electronics model under which individuals are willing to pay out-of-pocket for some healthcare services. Some of the devices in the mHealth segment are

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<sup>21</sup> DG Information Society provides a useful definition of mhealth at the following website, our understanding of mhealth is based upon this definition: *mHealth is a term that refers to the provision of medical services through the use of portable devices with the capability to create, store, retrieve, and transmit data via mobile communications. In technical terms, small devices are used to monitor patient-related data and actively communicate with a central information system; in most cases, communication takes place either over a mobile telephony or fixed line network (e.g. ADSL) coupled with WiFi. Standing at the crossroads of eHealth, Mobile Devices and Wide Area Networks (WANs), mHealth has found itself in the middle of an explosive growth that these sectors have experienced in the last few years and which is continuing strong, even in the midst of the global recession.*

[http://ec.europa.eu/information\\_society/newsroom/cf/itemdetail.cfm?item\\_id=6426&utm\\_content=tpa-23](http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=6426&utm_content=tpa-23)

directly marketed to customers rather than health care institutions following the business model of consumer electronics, associated with rapid change and relatively low prices. Companies embracing the wellness market give an additional impetus to the consumer business model.

### **5.3 Types of services offered**

The following are examples of mHealth services currently found on the market.

#### **Remote diagnostics and consultation**

mHealth solutions allow patients to stay in contact with their healthcare professionals through telephone calls, data transfer and video. According to market research by Frost & Sullivan systems enabling tele-consultations are more commonly marketed and sold to healthcare professionals and physicians rather than to patients. In Austria for instance legal constraints forbid such services. [30, 31]

#### **Health monitoring via portables**

More advanced fitness apps record not only timing and workouts, but they also use the mobile device's global positioning system to map the run and have an accelerometer to count steps and even estimate a workout's incline and topography with the resulting calories consumption. Unbiased recording by the built-in sensors is more accurate and honest than training logs filled in by the trainer.

#### **Patient record keeping and access for care personal at the point-of-care**

By facilitating access to information at the point-of-care mHealth supports critical decision making, ensuring better accuracy of clinical information and thus contributing to better patient outcomes while reducing medical errors. Thus mHealth is a key component of decision support systems reducing the need for in-depth medical knowledge for care givers, formal or informal.

Some applications enable access to EHR on portable devices at the patient's home by the caring person. Such systems target not only health care professionals, but end users as well. By handing over access and partly the ownership of the information these systems encourage empowerment of patients. Examples include BlueCross, Microsoft Health Vault, Google health Dossia and Tolven. The consultancy company Arthur D Little has estimated the impact of health care professionals accessing data at the point-of-care accumulating to €14.7 billion annually in the US in 2010 through acceleration and enhancement of care services. It is important to note that this figure includes institutionalised care which goes beyond IPHS as defined in SIMPHS2. However it shows a significant potential for savings for health care systems in industrialised countries.[32]

#### **Logistical support for the provision of care**

Portable ICT enables the redesign of workflow processes for homecare by professional caretakers. It is used to tag inventory and allocate resources thus improving care provision and logistics. In combination with electronic health records it allows to adequately document the care taking process and share relevant information among involved parties.

In theory technology can reduce administrative burden for the care taker, in reality the process of documenting can be another cumbersome task.

#### **Educational and Information Services Using SMS**

The high acceptance of mobile phones and sms as a mean of communication enables an dissemination of information. Text messaging has been proven to be a powerful tool to deliver public health messages. Examples include Text4Baby in the US and various educational campaigns used in developing markets by governments and healthcare providers to alert and educate the population of different types of health risks. Often they form part of Corporate Social Responsible activities of companies. Revenues of this market are minimal. SMS can be as well used to remind patients of appointments or guide them through a change in behavioural change.

## **5.4 Smart phone applications as a dynamic emerging field**

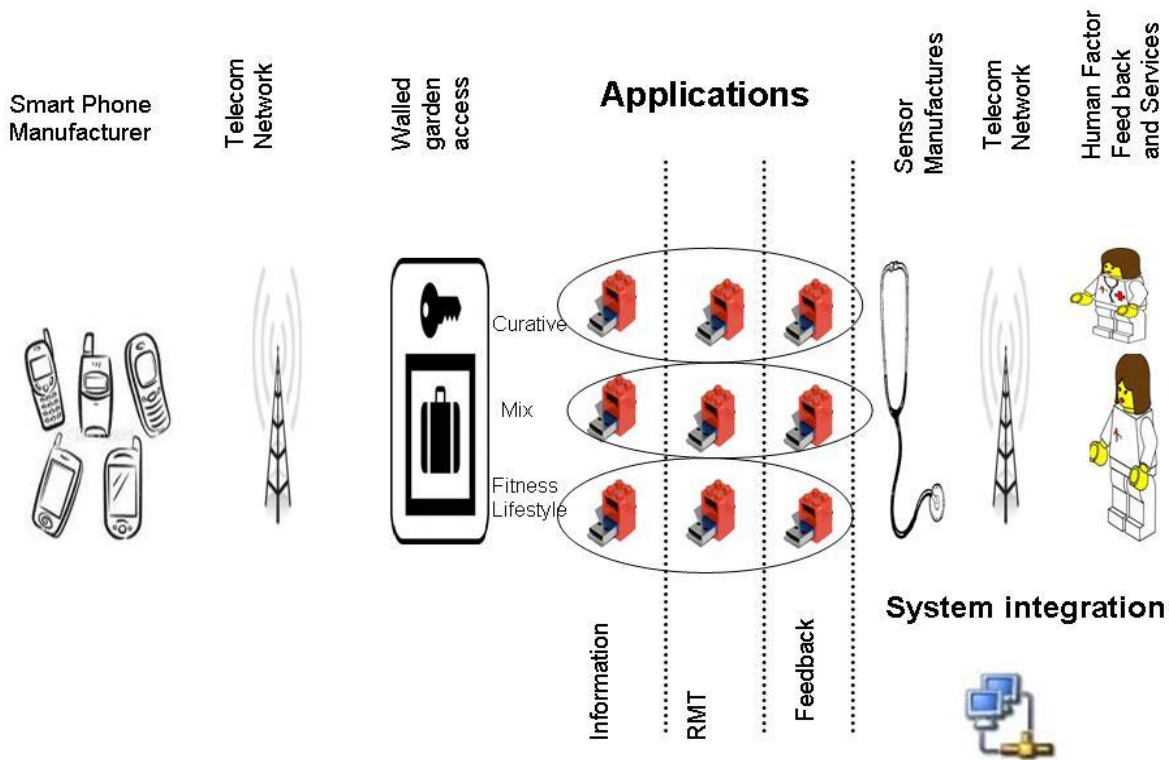
### **5.4.1 Market trends**

Smart phone applications have been responsible for the strongest dynamic in the ICT market at large. Applications and download platforms have already changed the traditional business models of the ICT industry. They promote models based on small payments for downloads while making smart phones and tablet computers central devices. Apple took the lead with its family of smart phones and tablet computers combined with the sale of apps through the unified Apple Apps Store. Its success has encouraged similar initiatives from Android, with the Android Market Place, Orange and its Application Shop and Palm with its Software Store, not to mention Telefonica's Litmus, Samsung's Mobile Applications and Blackberry's App World. Eventually Nokia is currently joining forces with Microsoft on the mHealth market.

In general information based apps simply provide health and fitness related information, from nutrition facts and advice to health and sport related topics. Such apps include references for care taker, as of March 2011, for instance the most popular app under the category healthcare is a medicine reference system called Epocrates, used mainly in the United States by care givers, most commonly used on mobile devices at the point of care to check medication and to make more informed prescribing decisions. A free version provides information to the laymen. The storing, transmitting and sharing of personal health information is part of these kinds of apps. From a SIMPHS perspective such information retrieval tools are of less importance, they fulfil complementary functions for the setup of an IPHS. However information-based apps empower patients and as such contribute to better formal, informal and self-care. More advanced apps using sensors are also emerging.

The dynamism of the apps is spilling over to the wellness and health related field, eventually apps are expected to steer the mHealth and eHealth markets as well. One advantage is so far the fact that it does away with the need to develop bespoke embedded software and purchase its accomplishing custom-build hardware for eHealth services. Apps use a standard item for computation, which in most cases have already been purchased, the additional cost for downloading a programme is minimal for the user and for the supplier, in short Applications lower the marginal costs for mHealth services.

**Figure 14: Smart Apps value chain without companies**



*Source: authors' own elaboration*

The above figure shows the value chain for smart phone applications starting from the various manufacturers of smart phones to the left. The acceptance of their handsets depends on the availability of a large choice of applications to attract customers. Telecom operators who provide the network coverage are responsible to a certain degree for the distribution of the handset, in some cases they subsidise the price of the handsets as well. Subscription based business models prevail, with additional fees charged for the traffic. Exclusivity for certain mHealth devices and the associated applications can increase the attractiveness for some telecom operators. Of crucial importance for the applications business model are the platforms to distribute the applications: they are run and organised by the manufacturer of either the smart phone or the operating system, like in the cases of Apple and Google (Android). Some telecommunication operators run platforms to download smart phone applications as well. User charges are becoming an important source of revenue for the companies. As a walled garden, the platform grants the access of programmes to the smart phones or the tablet computer and exercise some sort of quality control necessary for health and fitness related applications.

**5.4.2 Type of Applications offered**

From the health related smart phone applications three distinct principles can be distinguished: apps can have a curative goals, they can be related to lifestyle and fitness or a mixture of both. In the level of complexity these applications differentiate between simpler applications providing only information and those capturing vital signals either through built- in sensors or externally connected ones. The last class of applications can provide feedback to the user, either automated or via a health care or fitness professional. A broad variety of companies offer applications, their business model entails either charging for the programmes or some secondary benefits, such as selling advertisements in their applications or increasing loyalty to a product. In particular for preventive or fitness related applications, the business model involves savings due to behavioural changes, e.g.

health insurance companies offer apps for smoking cessation. Interestingly enough a research conducted by Price Waterhouse Coopers, indicates that Consumers who self-reported to be in very good health and shape are the most likely to incorporate an application into their cell phones to monitor their health, while consumers with chronic diseases are the least likely.

Those companies producing or distributing the peripheral sensorial capacities are mostly medical devices manufactures or sport equipment producers, which connect in some way to the smart phone. The prevailing business models here are revenues from sales of the product or renting it. The sales of strips (diabetes) are important as well for some companies. For those apps which provide feedback or a regular update of information, the generated additional traffic can be of interest as a source for revenue for the telecommunications operators, if the fees charged depend on the volume of downloads. The last category of players involved in the value chain for applications (to the right of the chart) are related to external expertise in case feedback is provided to the users. Either health care professionals or specialist trainers counsel the user of the apps individually.

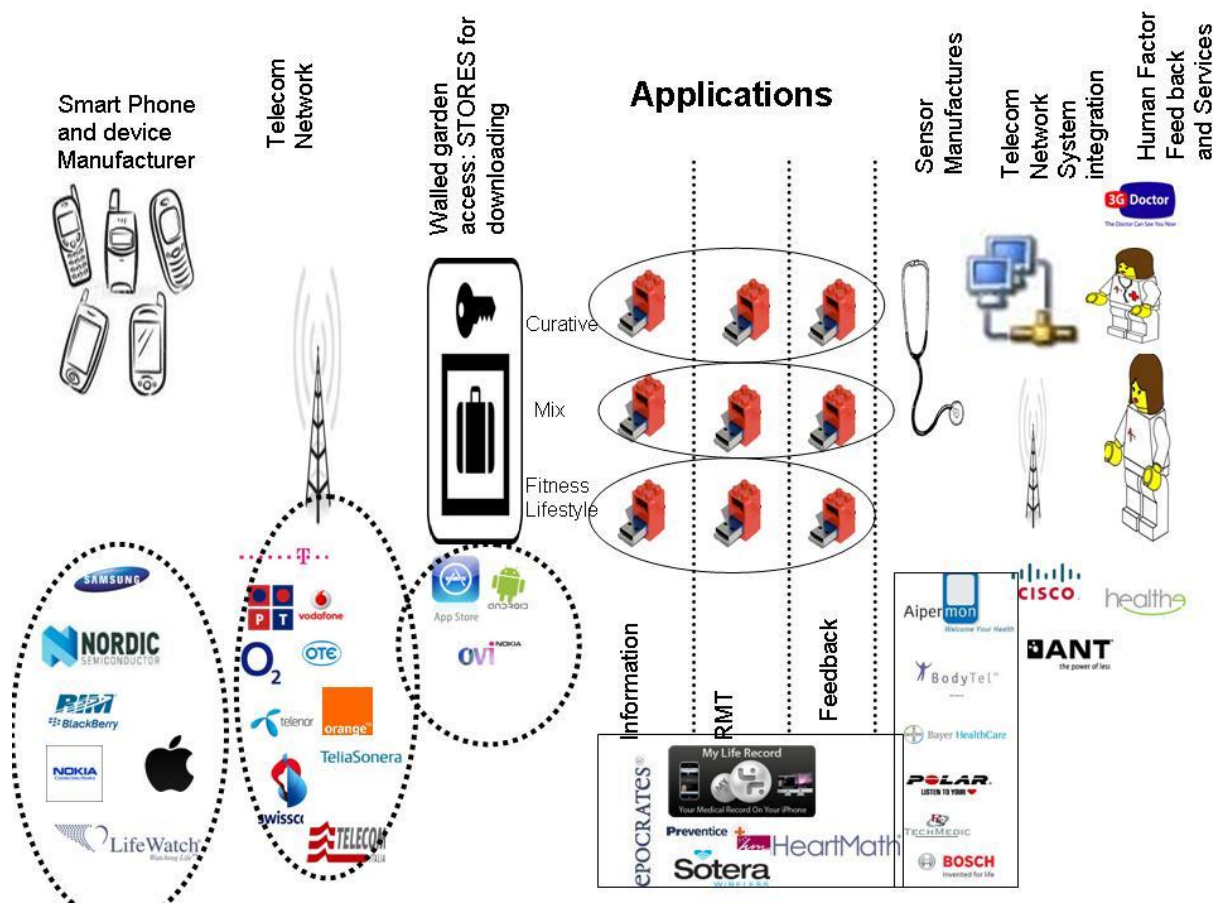
Not directly visible in the chain are societal benefits as aggregated vital signals from a large sample may help to spot early epidemics, identify common characteristics of those more likely to be affected and take corresponding precautions for those individuals in general.

Charging small sums for downloading programmes on handheld devices has been pioneered in the late 1990s by Palm handhelds, mobile gaming quickly gained popularity on these palmtops. Selling games became together with ring tones some of the first successful business models for additional services for mobile phones and hand held devices. Through the emergence of Research in Motion's (RIM) BlackBerry class of products, enterprise applications gained a momentum, followed by the now obsolete Symbian OS and Windows mobile OS. Different stores operated more or less as "walled gardens", meaning they offered closed and exclusive accessibility of their applications. According to market research the pioneer store "Handango" had in 10 years over 100 million download, with an average price of 20\$ for each non-free application. The advent of the Apple's App Store in 2008 popularised downloads for the iPhone or iPod touch and later the iPad. Apps need the approval of the store and fall under an exclusive licensing system. Android Market serves Google's increasingly popular Android operating System for Smart Phones. Google is licensing Android to a variety of manufactures and this makes the operating system in particular interesting for the manufacturing of niche smart phones targeting elderly, users suffering from chronic disease and other medical related customers.

Market research has identified applications downloadable for allergy/immunology, anaesthesiology, cardiology, dentistry, dermatology, emergency medicine, endocrinology, family practice, gastroenterology, genetics, geriatric, infectious disease, obstetrics, gynaecology, paediatrics, psychiatry and a host of other medical use cases. [33-36] Smart phone applications for fall detection are under development using Google's Android-based smart phones with their integrated tri-axial accelerometer. Data on the position together with several thresholds within the algorithms determine when a fall has taken place. Height, weight and the normal level of activity are taken into account as parameters.

According to market research published by Juniper in April 2010, there have been around 5,000 health and fitness related applications downloadable for various smart phones and portable handheld computers from a variety of application stores. Apple has been identified most prominent and popular in 2010, though Android as an operating systems and platform for apps has witnessed a surge of interest by developers. We want to distinguish here between one category of apps which use smart phones for dissemination of information between care taker and patients and more sophisticated applications. If we introduce a representative part of our sample into the above diagram, we can get an initial overview of the companies involved in the market as shown in Figure 15. Market entrance barriers are small, different regimes for safety regulations and necessary equipment dwarf the necessary investment for technology aiming at the health market. As a result so called "copy cats" of successful applications emerge.

**Figure 15: Smart Apps value chain with examples of companies**



*Source: authors' own elaboration*

Revenues from selling applications are not the only advantage, companies like Lifewatch or Bayer healthcare further benefit from selling stripes to diabetes patients. Telecommunication companies do not only provide the network for communication, but are very often involved in the system integration as well. Yet as in the telecare market, emergency response is handled by call centres staffed with qualified health care professionals, some apps initiate a communication to a peer of the user to verify an emergency. This shifts not only the burden of keeping a call centre staffed, but also the burden of responsibility for calling an ambulance and it can thus lower the overall costs for such a service.

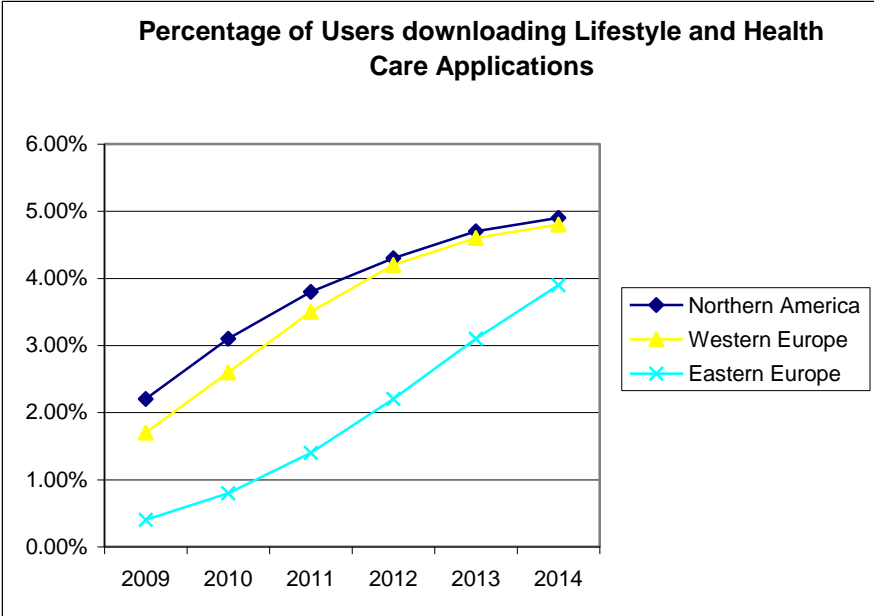
### 5.4.3 Market statistics on the emerging apps economy

Adoption by the end-user is crucial for the success of wellness, fitness and healthcare related apps and mHealth. According to estimates by Arthur D. Little in its Telecom & Media Viewpoint the Global market for health related Apps will reach €1.28 billion by the end of 2014. Furthermore in this scenario more than half a billion people are expected to receive health or social care through their mobile applications on their smartphones by 2015. This would represent about one third of the smart phone subscribers worldwide. [32]

Market research by Juniper also reveals increasing acceptance of lifestyle and Health Apps on Smart phones. Lifestyle Apps are defined in a broader sense here as they include for example personal development and growth, purchase decision supporting budget-conscious shoppers with apps and other categories not relevant for this report. The market estimates show that around one in 50 subscribers of mobile phones has been downloading a lifestyle or health care related apps in the year 2009 in the Western Europe and Northern America regions. By 2014 this will have more than doubled to around one in 20 subscribers. Less than one subscriber in 200 will download such

apps in the not as affluent societies in Eastern Europe respectively. It is worth noting that the gap between Western and Eastern Europe will be narrowed in 2014, one in 25 subscribers compared with one in 20 for the Western part. Even if the ratio does not directly captures only apps falling under the scope of this report, the statistics on downloads can serve as an proxy for a general acceptance of apps in everyday life.

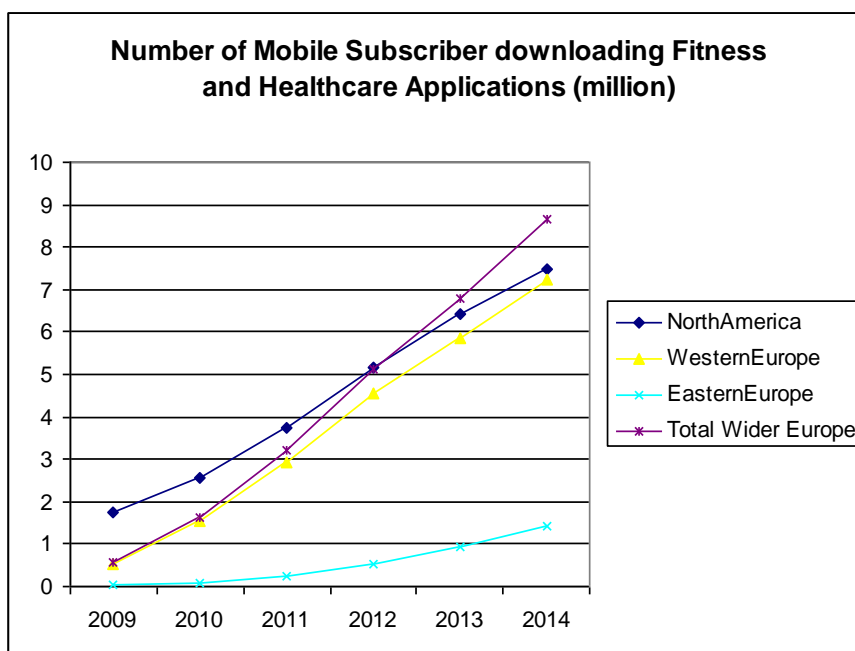
**Figure 16: Percentage of Users downloading Lifestyle and Health Care Applications**



Source: adapted from Juniper

Figure 16 above shows the estimated percentage of all downloaded Lifestyle and health care apps. A clear trend is identifiable which underlines the increasing popularity of fitness and health care in the apps domain. In 2009 a bit more than one in four downloads of Lifestyle related apps were fitness or health related in North America, by 2014 this is expected to represent half all Lifestyle related downloads. In Western Europe we will go from one in 16 downloads in 2009 towards a bit more than one in four by 2014. As Northern American Market is home to more technology savvy sport enthusiasts than Western Europe hence we mention it here as it shows early trends likely to apply to Europe. Eastern Europe will start from much lower levels with around one in 59 downloads in 2009 but by 2013 it will have reached the level of Western Europe in 2009.

**Figure 17: Estimated No. of mobile subscribers downloading fitness & healthcare applications 2009-2014**



Source: adapted from Juniper

Figure 17 above shows the estimates for numbers of Mobile Subscribers downloading apps, which fall under the scope of this report. The total number for wider Europe according to Juniper is estimated reach 8.7 million, with 7.23 in Western Europe<sup>22</sup> and 1.44 In Eastern Europe by 2014. A global trend is visible, according to Juniper, with developing countries lacking infrastructure contributing to the increasing popularity of mHealth in general and to apps in particular. mHealth is expected to bridge missing infrastructure and serve the health care needs of the population in less developed countries, Corporate Social Responsibility, low cost and used smart phones are expected to fuel the success as well as the need for mobile health care. This trend is confirmed in a recent Euractiv<sup>23</sup> article reporting that "True innovation in mobile healthcare comes from emerging markets, whereas it used to be Silicon Valley, because real need is driving it, and telecommunications companies in emerging markets are really proving that"... and that "the traditional model of healthcare in the US and Europe, in which either the state or insurance companies pay for the provision of services to the medical community, provides less fertile ground for development of eHealth".

These trends indicate a widespread availability and acceptance of universally programmable devices, a high enthusiasm among ICT professionals to produce apps for these smart phones eventually can pave the way for mHealth solutions take up. This has the potential to change market entry strategies for device manufacturers, and can become a game changer to a point where some observers of the market already predict smart phone ad apps to make obsolete a variety of medical devices, even suggesting that they will replace the Stethoscope[35].

<sup>22</sup> Please note that the definition used in the market report are not congruent with EU10 to denote New Member states in Central Europe and EU15 to describe the Member states in Northern and Western Europe. Juniper defines Western Europe as Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden, UK and include the Non-EU members Norway, Switzerland, Liechtenstein Iceland. Eastern Europe is comprised of Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and the Non-EU Members Albania, Belarus, Croatia, Russia, Bosnia Herzegovina, Macedonia, Moldova, Turkey, Serbia/Montenegro, Ukraine.

<sup>23</sup> See <http://www.euractiv.com/specialreport-broadband-driving-recovery/europe-us-lag-developing-world-ehealth-news-511136> - 28/02/2012.

Market research companies, such as Juniper and Frost & Sullivan, as well as the Authors of this report believe in a growing importance of apps, which leads to the growth of two distinct markets developing at a different pace and following two different segments. One category of apps targets rather the fitness and training purposes the second category of apps targets a genuinely health market.

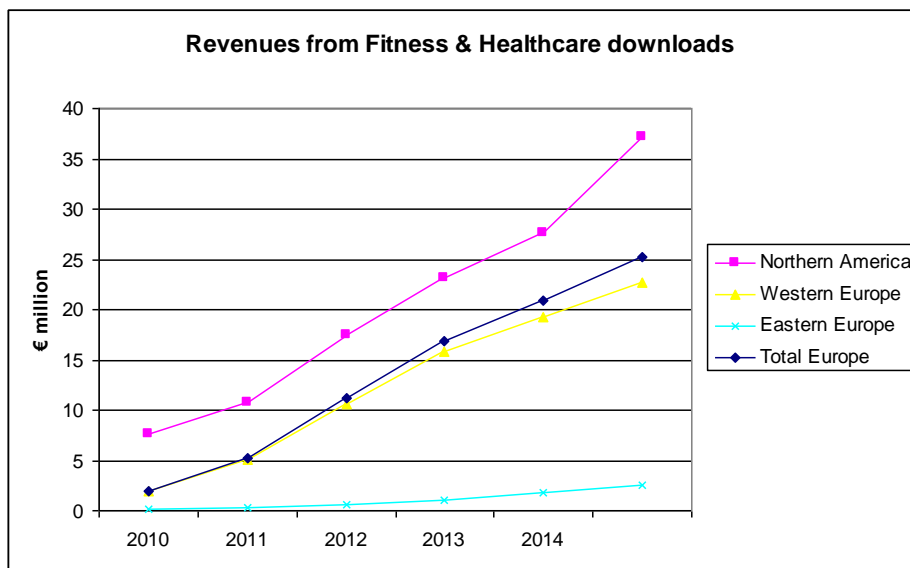
### 5.5 Market size for mHealth in general

Frost and Sullivan estimated the total European "mobile and wireless healthcare technologies" market[37] to be worth €1,005.7 million in 2008 with a CAGR of 24.3% over the period 2008-2015. However, the estimations are based on the definition of mHealth/wireless healthcare technologies as covering mobile infrastructures, software applications (like PalmOS), client software (i.e. for end-user such as clinicians), devices and services developed for healthcare. This definition does not enable to draw any conclusions on the mHealth market as defined in SIMPHS2.

According to another source - the consultancy Arthur D. Little - mHealth revenues will amount to €7.5 billion within the next five years globally.[32]

Juniper in its Mobile Healthcare Opportunities 2010-2015 estimates that there will be 231 million individuals worldwide downloading fitness and healthcare applications by 2014 with 7.5 million in Western Europe. Revenues from healthcare and fitness applications are expected to reach €100.3 million globally by 2014, out of which 22.5% (or €22.6 million) would originate from Western Europe and 37% (or €37 million) from the US, as shown in Figure 19.

**Figure 18: Revenues from Fitness and Healthcare downloads**



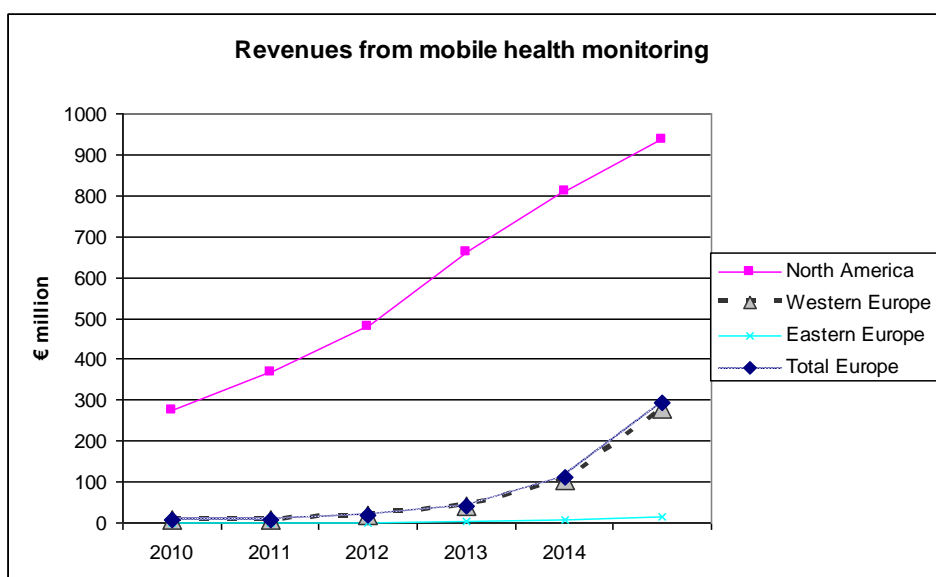
Source: Juniper, 2010

As to what Juniper calls advanced applications such as Smartphones that are connected to a health monitor through various technologies, they foresee that the market will start only in 2013 and therefore the number of advanced applications were remain small. Revenues from advanced applications are expected to reach €104.8 million by 2014, out of which Western Europe would account for €20.7 million.

A February 2012 press release from Juniper states that "a burgeoning market for healthcare peripherals and increasing smartphone processing power will result in the number of patients monitored by mobile networks to rise to 3 million by 2016".<sup>24</sup>

<sup>24</sup> See <http://www.juniperresearch.com/viewpressrelease.php?pr=285>

**Figure 19: Service revenues from mobile health monitoring**



Source: Juniper, 2010

Above Figure 19 shows expected service revenues for Europe vs. the US from mobile health monitoring.<sup>25</sup>

Service revenues from mobile health monitoring are expected to be three times more prominent in the US than in Europe by 2014 (€935.4 million vs. 278.3 million), while revenues from fitness and healthcare downloads in Europe would reach 67% of the value of US revenues (see above Figure 18). A higher acceptance of paying for applications in North America and the lower overall purchasing power in Central and Eastern Europe can explain the gap among North America and Europe overall. Additionally the self-improvement market in the United States is estimated to be bigger than the European one. In US based healthcare institutions EHR are often accessed through smart phones or PDA both by patients and health care professionals. Europeans in general do not have access to their EHR, thus the market for applications granting access or managing patients data is not as developed in Europe as in the United States.<sup>26</sup> This is reflected in the lower number of subscribers that download health and fitness related content and applications. Juniper estimates the percentage of users downloading such applications as significantly smaller in European countries than in the United States.

Last but not least, a report published by the GSMA and PwC[38] in February 2012 and focusing on mHealth opportunities foresees worldwide mobile health revenues reaching “US\$ 23 billion across all stakeholders – mobile operators, device vendors, healthcare providers and content/application players - by 2017” with Europe holding 30% of the market on equal footing with Asia-Pacific and ahead of the US and Canada. The report identifies RMT as the largest contributors to market revenues (65% or USD 15 billion) with chronic disease management and independent ageing as drivers. The latter would represent 30% of the RMT market with revenues of over US\$ 4.3 billion in 2017. According to the report, patient treatment and RMT solutions constitute almost 60% of the total mobile health deployments in Europe today and solutions that increase the efficiency of the healthcare workforce and systems make up nearly 15% of overall deployments, alongside health- and wellness-oriented mobile apps which have been pushed by the increasing adoption of smart phones. In terms of segmentation, the report distinguishes two main areas, “Solutions across the Patient Pathway” and “Healthcare Systems Strengthening” which refer respectively to services and

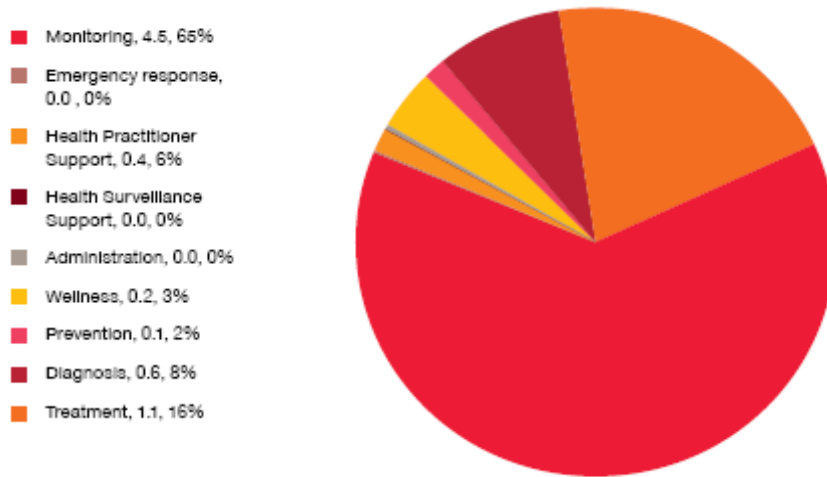
<sup>25</sup> This is defined as RMT using mobile technologies by Juniper and includes telecare.

<sup>26</sup> The rationale to explain the lower number of downloads has not been provided by the market research company, but derives from observation of the market through the authors.

applications for patients and solutions aimed at improving the efficiency of healthcare delivery by healthcare providers.

Figure 20 and Figure 21 below show the mobile health market opportunity by service categories in Europe and worldwide, respectively in 2017. RMT is also expected to be the largest contributors to mobile health revenues in Europe, with USD 4.5 billion revenues (or €3.4 billion) expected in 2017.

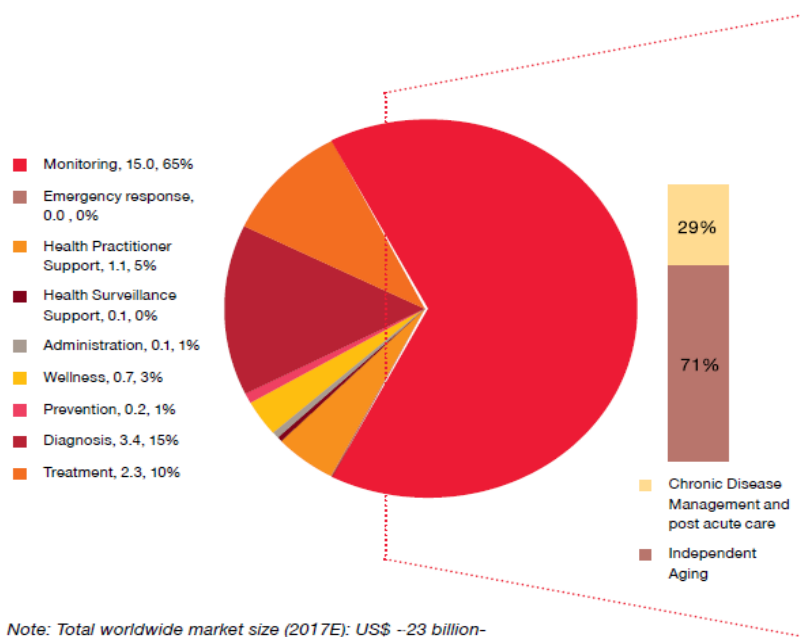
**Figure 20: Mobile health market opportunity by service categories in Europe in 2017**



Source: PwC analysis

Source GSMA/PWC 2012

**Figure 21: Expected global mHealth revenues by service categories by 2017**



Note: Total worldwide market size (2017E): US\$ ~23 billion-  
Source: PwC analysis

Source GSMA/PWC 2012

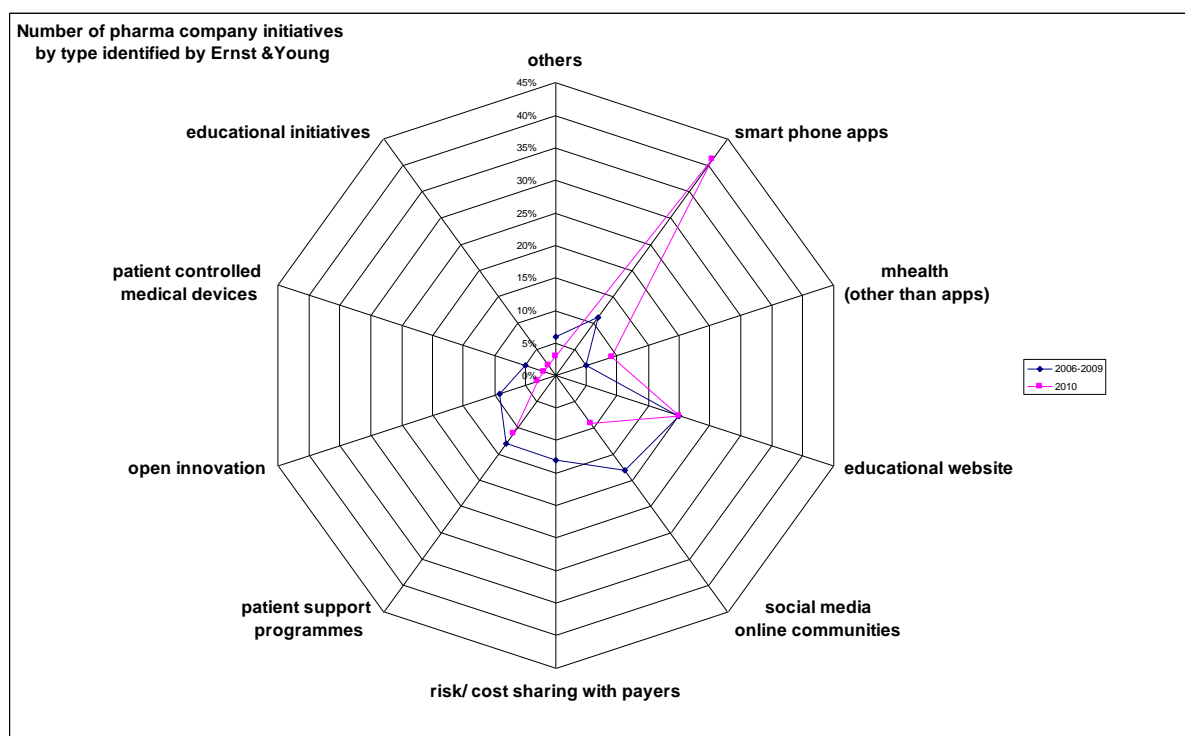
Mobile operators are expected to benefit most from mHealth growth getting 50% of the overall market revenues in 2017.

## 5.6 Actors on the mHealth market

Among the types of actors presented in the introductory section of this reports, the following play a key role on the mHealth market:

- a) **Mobile operators and telcos** at large are key actors on this market, eHealth and mHealth representing opportunities for market expansion. As seen earlier, many mHealth services require higher bandwidth and a regular upload of data, stimulating the usage of mobile networks. Examples include Deutsche Telekom, which is active in a variety of health related trials and as a result is bringing on the market a mobile phone based glucometer. The operator Orange offers a similar product, and most of the telecom operators in the SIMPHS2 company sample are active in the medical field. As evidenced in a SIMPHS2 workshop with industry selling arguments for large mobile operators include scalability through large retail networks, managed services through cooperation with third parties, B2B as well as B2C solutions based on user paying for the services/technology and end-to-end solutions. While current mHealth solutions are still rather simple, it is expected that more complex solutions will emerge in the future.
- b) **Mobile device manufacturers** consider the health market in general as an attractive market. Their strategy is about establishing themselves as market leader for health and fitness solutions, and become the reference in the field. One example of success stories is Research in Motion (RIM), the company behind the BlackBerry phone known for its success in business setting. Their success as a provider for smart phones has been based on their ability to establish secure communication and integrate these smart phones rather easily into existing infrastructure. RIM for example plans to expand their market by serving healthcare professionals, in particular by enabling secured access to EHR following data protection legal requirements. The rapid growth in the popularity of the android smart phone operating systems spurs the market further, another example is Samsung which uses the android platform for the fitness market.
- c) **Classical ICT vendors and system integrators** which leverage their expertise in system integration and data management to tackle the health market also have an interest in targeting the mHealth market. The French company Alcatel-Lucent has developed a RMT platform and a platform for the management of telecare and healthcare delivery which is being used in cooperation with local care providers and telecommunication companies e.g. in the "Healthe" cooperation between Arbeitersamariterbund (Association of workers Samaritans) and Orange in Austria. Microsoft is another example of ICT vendor active in IPHS through its Microsoft's Health Vault, an EHR solution with a suite of services offered to healthcare institutions. Google Health ventured into a similar path with Google Health, addressing health markets from a patient perspective. However, the closing of Google Health in 2011 has brought to light the difficulties of overcoming barriers on the eHealth market. Nevertheless, Google may continue to address IPHS markets as the provider of an operating system for smart phones thus targeting the mHealth segment.
- d) **Medical device manufacturers** and sport equipment manufacturers extend their products with RMT abilities and connectivity to EHR.
- e) As mentioned earlier **pharmaceutical companies** enter both the eHealth and the mHealth arena to seek new revenue streams. Figure 22 below illustrates the type of activities undertaken by these companies.

**Figure 22: Number of pharma company initiatives by type identified by Ernst &Young [39]**



From a conceptual point of view the strategies of the pharmaceutical industry with eHealth and mHealth deal with:

- Supply chain and logistics,
- Adherence,
- Business intelligence,
- Therapeutic outcomes,
- Business point of view.

In reality all of these aspects are intertwined.

**Box 1: Pharmaceutical companies' interest in mHealth**

- Mobile technologies facilitate the management of **logistics**, allowing the elimination of stock-outs of medication by using smart phones or even simpler phones with a camera to scan stock. A rather simple yet very flexible setup can replace more sophisticated connected warehouse management systems used in pharmacies and hospitals. A SIMPHS2 workshop with industry showed experiences made in regions lacking institutional capacity to distribute drugs efficiently like the "sms for life" in Tanzania, a partnership between the pharmaceutical company Novartis, IBM and Vodafone as well as the Ministry of Health. By scanning QR-Codes on packages a system tracks the stocks in medications and ensures refills are carried out on time. The costs of the system are minimal and it actually enables savings by streamlining the logistics, advantages for pharmaceutical companies outweigh the investment and running cost. Under the umbrella of Corporate Social Responsibility many of these activities strive to serve the so called bottom of the pyramid, a market of millions of people with very limited resources. ICT bridges the lack of organization and available information, while improving access to medicine for patients. In the context of IPHS in Europe, mobile apps to support logistics can help coordinate nursing services for health and social care at home while pharmacies even in the poorer areas of Europe tend to be equipped with some ICT to track their inventory and stock.

- mHealth logistic applications can be used to **control the handing out of pharmaceutical products** to patients: corruption and informal payments are a serious issue in several EU Member States, in particular because of the payment of bribes to access quality drugs. With end-users verifying that they actually have received the medication with their own phones, transparency can be increased and corruption in the supply chain can be reduced. A related challenge is that of **counterfeit medication**. WHO estimates that more than 10% of medicines on the global market are forged. While this mostly affects developing countries, the increasing use of alternative distribution channels in industrialised countries requires more control. Mobile applications can be used to verify a drug authenticity
- **Compliance with medication and adherence** to the prescribed doses are further issues that mobile applications can help control. At the SIMPHS2 workshop with industry the usefulness of mHealth for specific medications with a narrow therapeutic margin was highlighted. For such substances compliance becomes highly important, as only if administered correctly such medication fulfil their function, if not they can even be harmful. Through mHealth applications pharmaceutical companies offer additional services increasing the efficiency of their products and supporting patients' adherence. Pharmaceutical companies are expected to move from simply selling drugs to offering related services that may justify higher costs in exchange of better health outcomes.
- **Reaping the benefits from a converging understanding of genetics, lifestyle and environmental factors** – Knowledge of the underlying relationships between genetic, molecular and cellular mechanisms causing common diseases remains limited and has been identified as a major bottleneck for further advance of a more personalised medical care. Combining lifestyle and personal genetics has the potential to improve the efficacy of current drugs therapies and increase the success rate of new drugs development. Both RMT and mHealth can be used to collect crucial information on habits and circumstances of a target population.
- In **clinical trials** mHealth facilitates the collection of clinically meaningful information such as actual daily habits as a source of potential variability in drug response as differences between reported and actual habits of participants can skew outcomes. Eventually smaller Randomised Controlled Trails can translate in cheaper and faster clinical studies.
- **Pharmacovigilance** – mhealth applications facilitate the detection, assessment and understanding of unexpected side-effects of medicines. Again in particular RMT plays a crucial role while mHealth solutions allow pharmaceutical companies to quickly gather such information from a large group of users potentially located in different areas.
- **Sales perk** - Among medical professionals smart phones and tablet computer become increasingly popular. It can be expected that sales representatives of pharmaceutical companies will distribute tablet computer and smart phones as a further perk among health care professionals as part of their incentives.

## 6 Ecosystem and value chains

### 6.1 Ecosystem perspective: Value chains and business models

A diverse range of companies operate in the market for telehealth, telecare, wellness and mHealth. SIMPHS1 revealed that the market for RMT was still in its infancy which has not changed dramatically over the last 12-18 months. Even though most technologies have already reached a certain level of maturity, a great variability among vendors' solutions still prevails. IPHS business models are largely unproven and there is no clear benchmark model. As identified in a SIMPHS industry workshop, no single player in the field has all the necessary capacities to provide IPHS, partnerships are therefore necessary to bring solutions to market. Business models depend on the selection of partners and will be further determined by technological issues, alongside the commercial, regulatory and organisational environment in which the services are offered.

In order to understand the market, we took an ecosystems perspective and classified products according to their place in a value chain, including further technologies geared to the scope of IPHS and the segments analysed in this report.

Deriving from *Allgemeine Systemtheorie* -the General System Theory- we apply the term techno-economic ecosystem here to a subset of self-regulating and interdependent relationships between all the actors involved in the provision and usage of IPHS evolving around technological subsystems [40]. As Moore defines an ecosystem as "An economic community supported by a foundation of interacting organizations and individuals—the organisms of the business world." This economic community produces goods and services of value to customers. Their clients form part of such an ecosystem "The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they co-evolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies." [41]

Within such a complex net of self-regulating relationships it becomes difficult for the observer to determine a value chain.

**Figure 23** helps locating the activities of a company involved in the delivery of IPHS. One division is along the distinction *device* vs. *service*<sup>27</sup> and the other is along the distinction *ICT related* vs. *social/health care* related. Of course a company could be active in several, even all fields. Activities that create value for a company fall either under the category service, such as the provision of medical expertise in a call centre, the delivery of care or for an instance the integration of automated payments within a health care facility. Or they fall under the category tangible device, such as medical equipment or a computer.

Within such an evolving ecosystem we distinguish between three categories of entities:

- Service providers and supplier, which can be distinguished between provision of care related entities, who have medical knowledge (Call centres, Medical Staff and formal carers, Clinical Service providers) and entities with more technical competencies (Device manufactures, ICT Service providers, Telecom network providers, Mobile operators, Systems integrators, Business Process Management ).
- Purchasers and regulatory bodies (Payers, health insurance, Health care authorities, Government),
- Patients, users and communities of users.

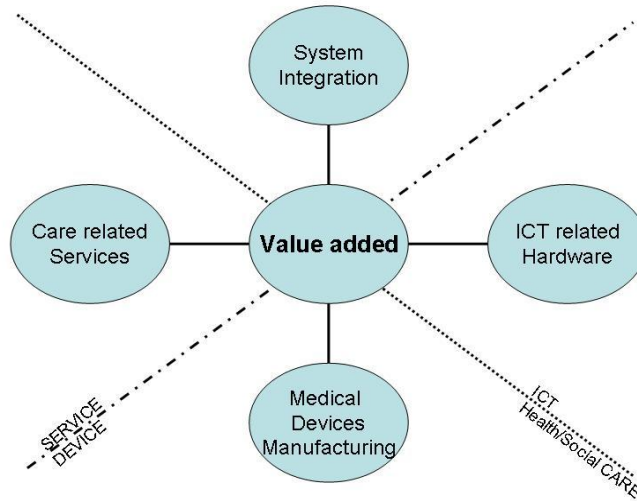
Only activities by actors in the first category (suppliers and service providers) are placed within the coordinate system for the value creation as described in Figure 23. A company that provide both a service and a device falls under both categories, an example is the company Vitaphone whose

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<sup>27</sup> Software has a hybrid character, it is intangible and thus software does not qualify for the label device. On the other hand code and programmes are sold similar to a tangible good and they are increasingly embedded into tangible products.

revenues come from selling devices as well as providing the service of a back office where the collected data is analysed by qualified medical staff.

**Figure 23: Coordinate System for Value creation among IPHS service providers**

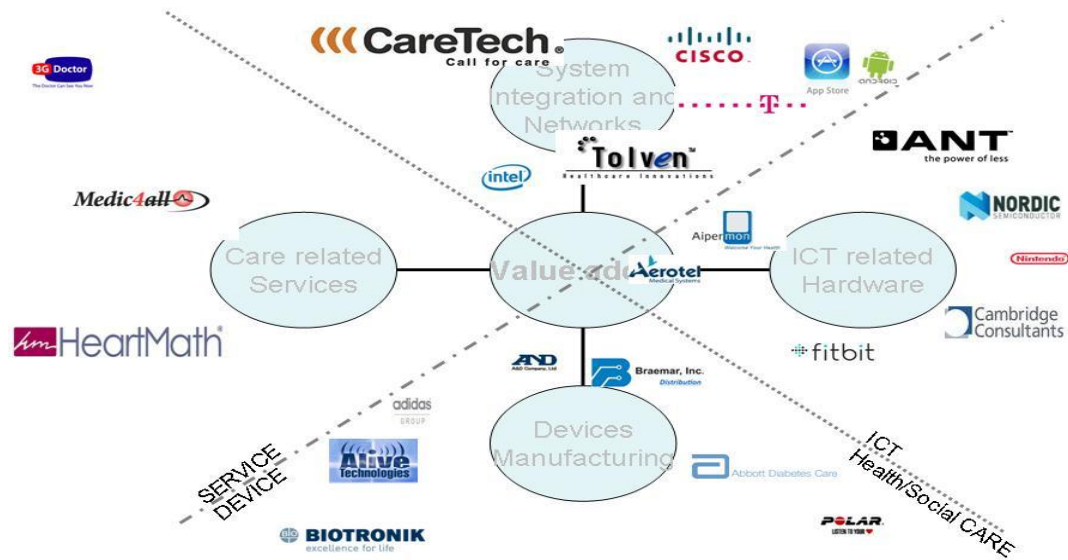


*Source: Authors'elaboration*

Complex systems like IPHS depend on the interoperability of components to enable service integration. SIMPHS1 revealed how cooperation and interoperability shaped the nascent RMT market. A typical patient benefiting from remote monitoring and treatment uses a variety of components from different manufacturers such as glucose meters, blood pressure monitors, weighing scales, pulse oximeters, ECG monitors, peak flow meters and other devices. Each of these components can be purchased from a variety of distributors, it the task of the system integrator to combine those elements to establish functioning services. Interoperability between the different components and devices forms a crucial precondition for establishing an ecosystem. For SIMPHS 2 this perspective extends to mHealth and wellness related services.

An integration of a sample of the companies presented in Annex 3 provides the following picture, most companies actually being active in all four areas of the matrix.

**Figure 24: Coordinate System for Value creation of IPHS service providers with Sample Companies from annex**



*Source: authors' own elaboration*

As a starting point we wanted to assess how the value chain has evolved since SIMPHS1 and find out whether the market for the different stakeholders has developed, stagnated or even contracted.

For this we conceptualised a simplified value chain, which represents various processes involved in delivering Integrated Personal Health/Care Services outside institutional settings. It includes the notion of value-added at the core of the service, from creation or modification of hardware and devices, to system integration and auxiliary technical services, provision of telecommunication, software for data processing and care related services. The business model determines where a product or service is located in the value chain.

Actors in the specific IPHS ecosystem include telecom players, major and smaller software companies, health hubs and OEM manufacturers, ICT management and ICT consultancies. The boundaries between consumer sport electronics suppliers and consumer medical device suppliers are increasingly blurred. Component suppliers and interface device manufacturers, as well as consumer-driven telehealth and wellness service providers, wireless chip producers and smart phone producers are included as well. With a shift towards the demand side and taking the empowerment of patients using social computing into account, we include the user as an important actor. We understand as user the end user benefiting from a service, any health care professional using an ICT based device to deliver better care would in our value chain be classified as health related services.

This distinct ecosystem consists of services and products emerging around communication standards. In particular standards for short range and long range communication have an influence. System providers need to integrate a great variety of devices monitoring and measuring different vital signals to cater for the needs for a wide range of conditions.

Compatibility issues extend beyond the integration of devices into a working system. Researchers from Philips stress the importance of compatibility issues for collected data. This health related information needs to be incorporated into database systems, which are to be used by different applications and persons. So far no universally accepted standard for the storage of dynamic and static health information in electronic and personal health records has emerged. This leads to the

need for vendors to develop tailor made interfaces with all of the main providers of EHR /PHR to transfer the collected data into the systems.

Connectivity in itself is shaping the ecosystem and products. Devices exchange their collected data over different sets of cables or wirelessly. Connecting wirelessly to a health hub or smart phone allows a much higher degree of mobility. For vision impaired people it can be easier to handle wireless connection than fiddling with connectors and cables. Leading a normal daily life becomes more likely thanks to regular monitoring without the need to be wired to a health hub.

Examples of standards include the wireless standards Bluetooth, Wi-Fi and ZigBee; their popularity has led to economies of scale and lowered their cost. Wi-Fi is typically used to connect several devices in a home or office environment and connect them to the internet through so called hotspots. In the context of SIMPHS Phase 2 Wi-Fi is mainly used to transmit the patient's data to a physician or a call centre for further processing. Low energy consumption is one major advantage of the ZigBee standard, resulting in either longer lasting performance of devices without recharging or cheaper prices due to less expensive batteries. The ZigBee Alliance focused in particular on the health care industry for growth opportunities.

One set of technologies not mentioned in SIMPHS 1 but encountered several times in SIMPHS2 is Near Field Communication, or NFC, a very short range technology in use for mHealth applications. Both Apple Inc, and Google Android use or intend to use this technology for various reasons, the most prominent and promising being for payment transactions [42]. In a health and social care context this technology can be useful for logistics tasks, such as the management of assets. Collected information can be gathered in a central place, like a PHR or EHR. NFC is an alternative to other wireless technologies mentioned above, which consumes far less energy.

An example of NFC is the tracking of treatment adherence and compliance with prescribed medication. The medication package contains a RFID chip, so that before taking the medication, the user simply has to move the package near the phone for automatic recording, thus helping to reduce medication errors. Vision impaired can also benefit from audio instructions. NFC can help overcome the challenge of having to type in for the elderly or less literate population. Such tools take care of safety concerns such as conflicts and contra-indication, they display progress feedback and give reminders for medication schedules. They further allow reminding the user of recommendations for intake, such as avoiding milk or alcohol, or taking the medicine with food. On a smart phone it is possible to display drug and therapy related information and additional support resources, reminders or even advertisement. [43, 44]

Many of the mHealth applications do not necessarily require high bandwidth to transmit their data. More sophisticated mHealth applications generate more data and depend on 3G networks, in particular mHealth applications using image and video. One example is the Irish company *3G doctors* which offer supplementary consultations over a 3G networks to subscribing users. The company does not replace face to face doctor visits, but enables to respond to emergencies for patients on the move.

One example of standard is the ANT+ standard by the navigation system operator Garmin, which offers a whole set of wellness/training devices and more interestingly services.

Component suppliers and original equipment suppliers play a crucial role in creating electronic devices used in infrastructure for health care services outside of hospital. Their products have to undergo more rigorous testing than consumers electronics due to the "life depending function".

No specific business models currently dominate the market, on the contrary they vary greatly between vendors. Depending on the needs of the client or the institutional framework, vendors need to adapt their business model.

According to INMEDICA[45] over 80% of the telehealth business model in 2009 were either capital purchase or to leasing arrangements. In 2018 the renting business model is expected to grow into the biggest chunk with nearly half of the revenue. Under this model health care service providers

purchase the equipment and the software upfront and pay a licence for the use of the server solution. Leasing is here to be understood as longer term contractual arrangements.

Still according to InMedica "The telehealth industry is still in its infancy in terms of market development; the technology is still immature, with high degrees of variability in existing vendor telehealth solutions. In addition, there are several different types of applicable business models in the industry. (For more details refer to the discussion on 'Technology, device and business model variations complicating the market' in Section 2.3.7). Different technology providers in the industry use different business models with different clients. Technical device variations combined with wide-ranging pricing models make vendor evaluation and selection a complex process. Based on InMedica's discussions with executives, a technology vendor bills the healthcare agency for one or more of the following:

- Cost of equipment including health hub and peripheral devices (peripherals depend on the parameters to be monitored and patient's disease condition)
- Cost of ancillary services like installation, training, maintenance, customisation for different disease packages etc.
- Cost of equipment/equipment transfer, fitting and maintenance for new users.
- Cost for hosting the data on secure web server and the use of the clinical triage software - Home telehealth monitoring incurs ongoing service fees, usually billed monthly. This cost covers the use of the server systems that collect, manage and disseminate data collected from patients. It often includes access to web-based tools and integration with electronic medical records.

**One-off device costs** include the purchase of all required devices including the main appliance (or health hub) and any additional peripherals (blood-pressure monitors, pulse oximeters, weight scales, etc.). The cost of telehealth devices varies substantially based on the level of sophistication. Advanced devices, which may include two-way audio, a larger viewing screen, increased memory capacity, and video capture capability, are likely to cost several thousand Euro. At the lower end of the cost spectrum are the devices that do not have any interactive capabilities and act only as a base station to transmit data to the server.

**Leasing Model:** If healthcare service providers wish to defer the cost of equipment purchase they go for the leasing model. Leasing involves a longer term contract (say 3-4 years); the healthcare agency is then responsible for all the hardware bought, but makes fixed monthly payments.

The **Rental Model** is one of the most flexible business models used in telehealth. By renting the equipment for shorter durations (say 2-3 months) the healthcare service providers can use the telehealth resources they have available in a more flexible way, and pay for it from month to month depending on the number of patients. For example, companies like Philips, Cardiocom, Viterion, Honeywell Hommed amongst others charge between USD50-USD150 per month as rental charges. It is important to note that the rental fees varies depending on factors like the conditions monitored, the amount of equipment rented, the services offered etc. The business models mentioned above are not standard and InMedica is aware that there is a lot of variation within each one of these. Most of the time, the models used in the industry are designed case by case. For instance, "some companies might include charges for ancillary services in monthly rental payments, some might not and other might use a partner for these services. It is important to note that the costs of telehealth must be considered inclusive of device and service fees, and over an extended period of time."<sup>[46]</sup> It is often unclear whether market reports considered in this deliverable take account of both devices and services revenues.

## **6.2 The role of acquisitions, alliances and industry groups**

Within an ecosystem perspective, cooperation and competition plays a crucial role. As part of the market is consolidating, acquisitions and alliances play an increasing important role. A special focus is given to observe different patterns in the market segments listed above. Acquisitions also play an important role, the most evident examples are the acquisition of the health hero product, the network and the customer base by Robert Bosch. Honeywell also acquired Hommed to gain access

to its expertise and customer base. Philips bought the telecare provider LifeLine and the RMT provider Raytel to complement its portfolio.

### **6.3 Threats for companies active in the IPHS field**

A reliance upon unproven and risky revenue models combined with excessive anticipation of benefits led to the internet bubble in the end of the 1990s and the early 2000s, which also translated into business failures in the eHealth area. A first wave of medical services offered online had been web-based pharmacies and portals dedicated to health information. Growth of the online pharmacies business model has been hampered by trust and legal issues as well as missing acceptance by insurers. The revenue model for the health information portals has been based on banner advertisements and in many cases has not been successful. The fate of companies in that area has been sealed when revenues streams decreased with dropping advertising rates. The exception is MDConsult.com, which relies on subscriptions instead of add revenue. An exception in the first wave of failures is webMD which provides information and is financed through advertisement and contributions by third parties. The competing business model of the epocrates<sup>28</sup> is based on selling premium subscriptions for online access and handheld devices to medical professionals while users can consult simplified information. We have taken into account here the US based Transoma Medical to exemplify the challenges a start-up may face at the crossroads of medical device manufacturing and ICT enhanced service provision. Despite a promising product – a FDA approved wireless implantable cardiac monitor – and a secured €30 million the company could not consolidate its success. After a successful IPO in 2007 the company run out of funds.[47] For medical devices acceptance forms a threefold hurdle: next to the approval by the responsible agency and an introduction into the benefit catalogue of a health insurance, a device needs to find the acceptance of medical or private end users. Managing these three hurdles simultaneously can be mission impossible. Further, start-ups in the medical field have a higher demand for capital than in other fields, and it can take a long time before the first cash flow is generated. Successful companies depend on strong backing by an angel investor.

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<sup>28</sup> Epocrates has been popular among nurses at house calls as a reference tool, and thus it has been included in the list of company.

## 7 IPHS Market: companies review

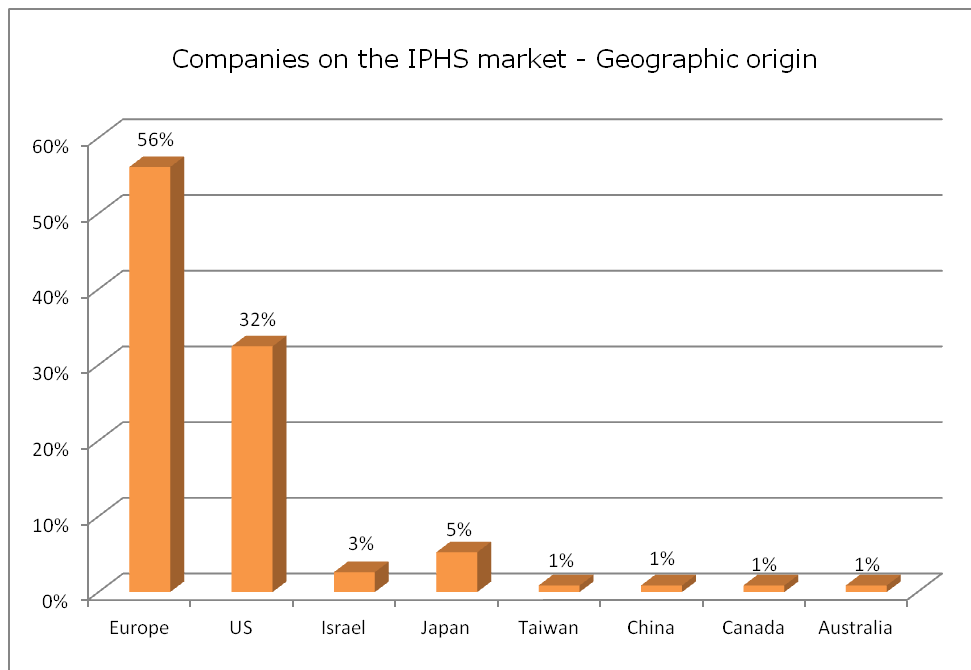
A description of each of the 115 companies identified on the IPHS market is provided in Annex 3.

### 7.1 Geographical spread

The companies reviewed in SIMPHS2 are not based in the EU only, contrary to the sample in SIMPHS1, so as to give a more accurate account of what is going on globally as IPHS market developments do not happen in isolation. Looking at other regions allows detecting some emerging trends and spotting the impact of alliances and strategies adopted by market players to enter the European and other markets. As a result just over half of the companies considered in this report originate from a European country, a third being from the US and remainders from Australia, Israel, Canada and Asia (China, Japan, Taiwan).

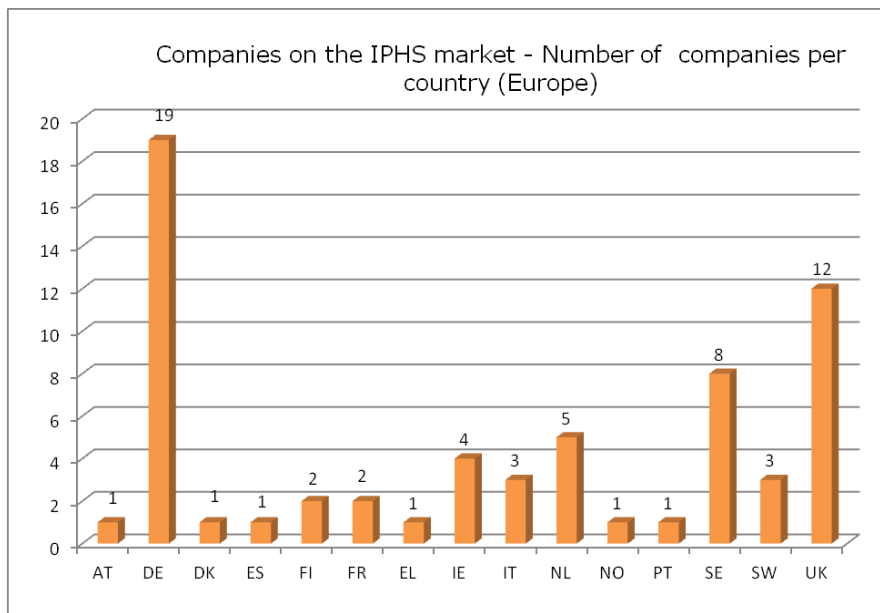
Figure 25 below shows the geographic distribution of the 114 IPHS companies considered in the SIMPHS2 review while Figure 26 shows the number of companies in the various European countries for the total of 64 countries originating from Europe.

**Figure 25: Companies on the IPHS market - Geographic origin**



Source: IPTS

**Figure 26: Companies on the IPHS market – Number of companies per country (Europe)**

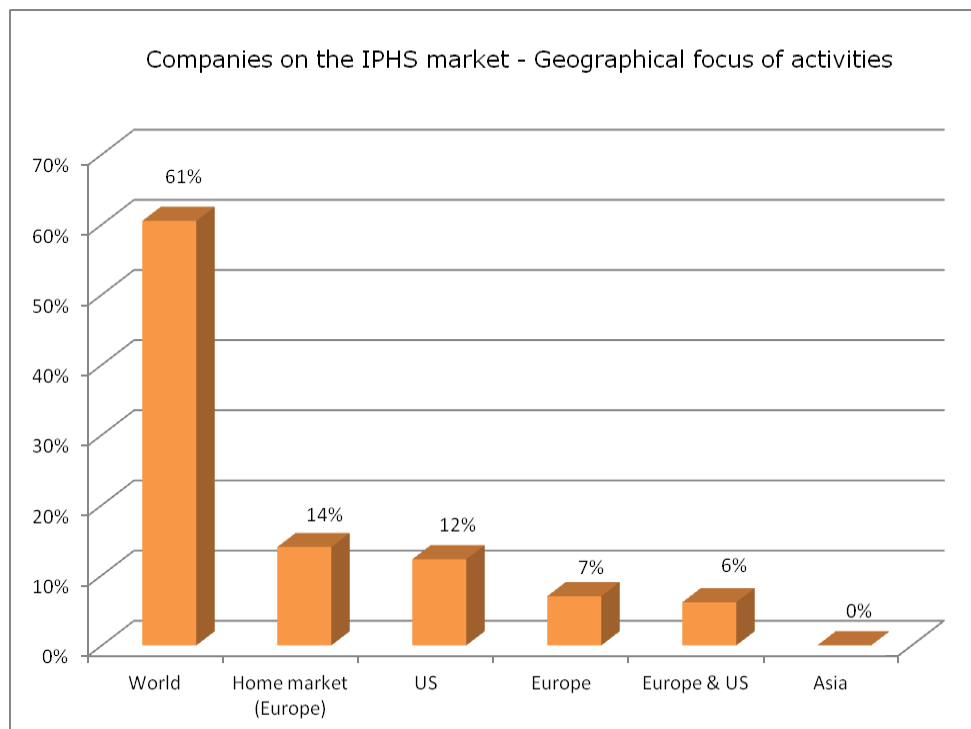


Source: IPTS

**7.1.1 Companies characteristics**

Figure 27 below shows the geographic areas of activity of the companies reviewed. A majority of IPHS companies (61%) are active across borders and beyond one single region referred to as worldwide operations here. 14% of companies (all of European origins) operate in their home market only i.e. within national boundaries, 7% operate in Europe (sometimes only in two countries) and 6% operate both in Europe and the US. While 12% of the reviewed companies originating from the US only operate in the US, all other non-European companies (e.g. from Israel, Asia, Canada and Australia) operate across their national borders, generally operating worldwide.

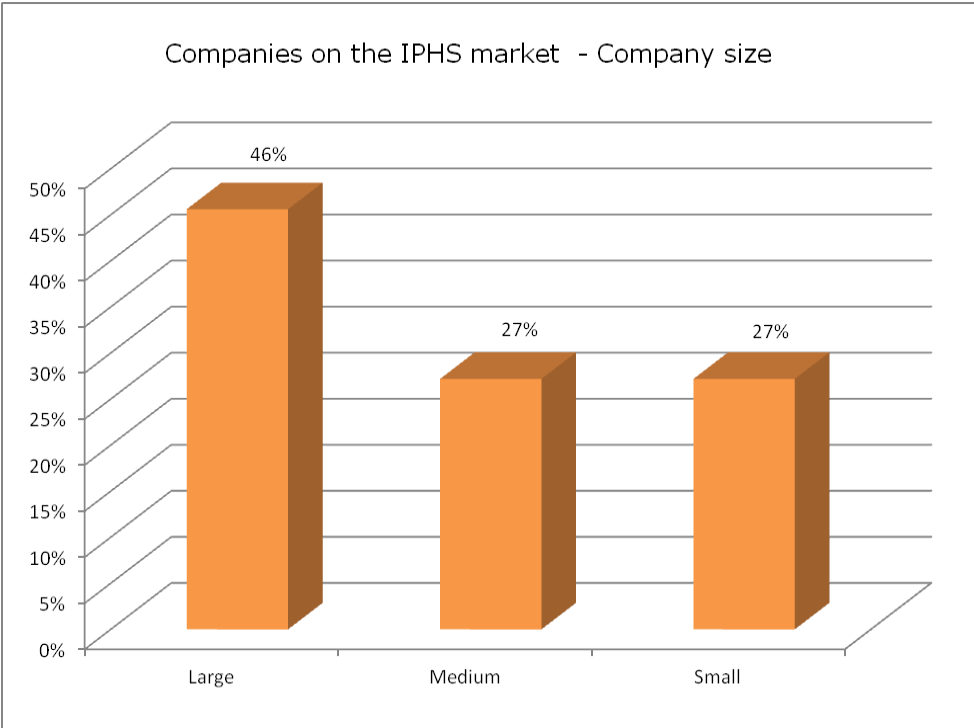
**Figure 27: Companies on the IPHS market – Main geographical focus**



Source: IPTS

The size of companies in sample is shown in Figure 28 with nearly half the companies reviewed being large companies, the remaining being spread evenly between small and medium sized companies.

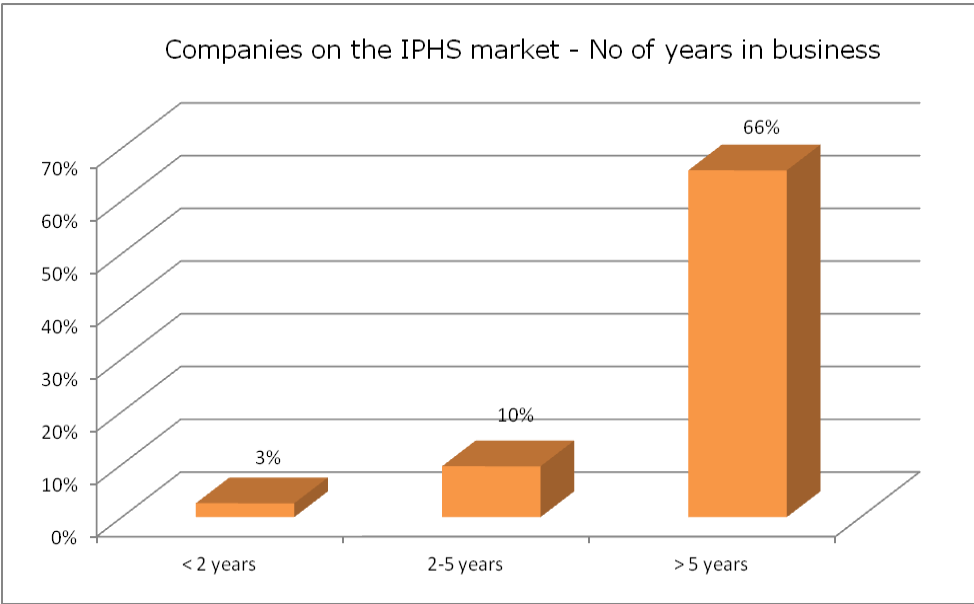
**Figure 28: Companies on the IPHS market – Company size**



Source: IPTS

Most of the companies studied have been in business for more than 5 years (66%) while only 3% of the companies in the sample have been established in the last two years, as shown in Figure 29 below.

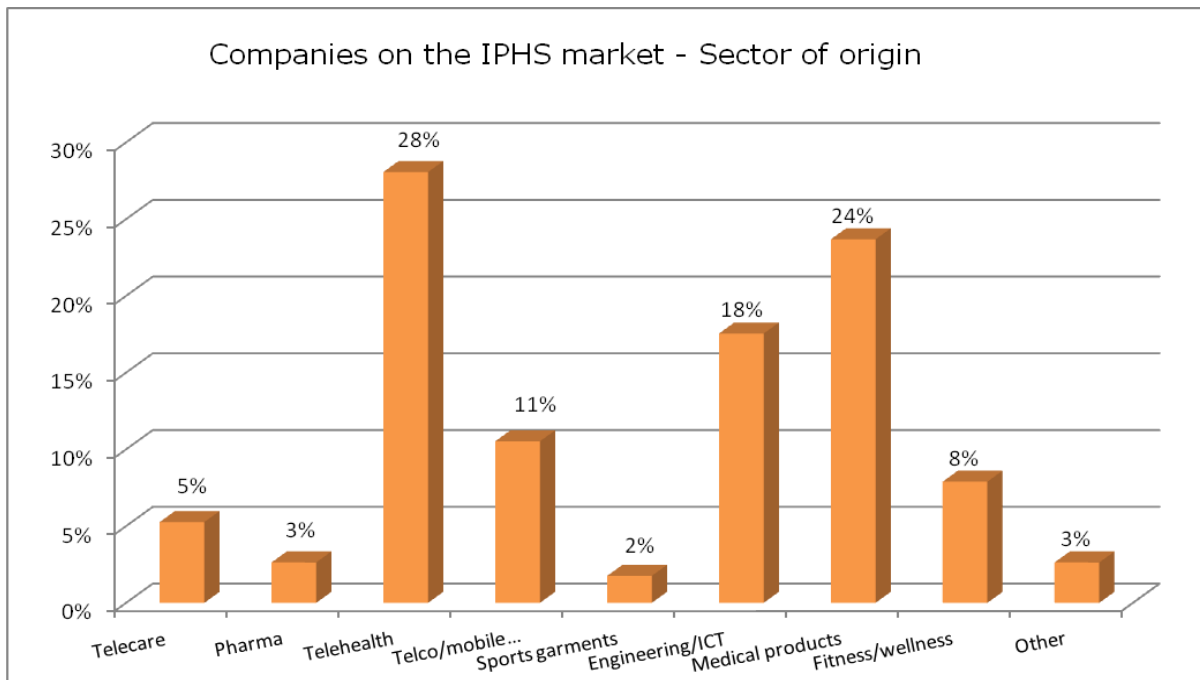
**Figure 29: Companies on the IPHS market – No of years in business**



Source: IPTS

Figure 30 shows the sector of origin of the companies reviewed. Telehealth is the first sector of origin, for 28% of the companies studied, followed by that of medical products (24% of companies), and Engineering and ICT (18 % of companies).

**Figure 30: Companies on the IPHS market – Sector of origin**



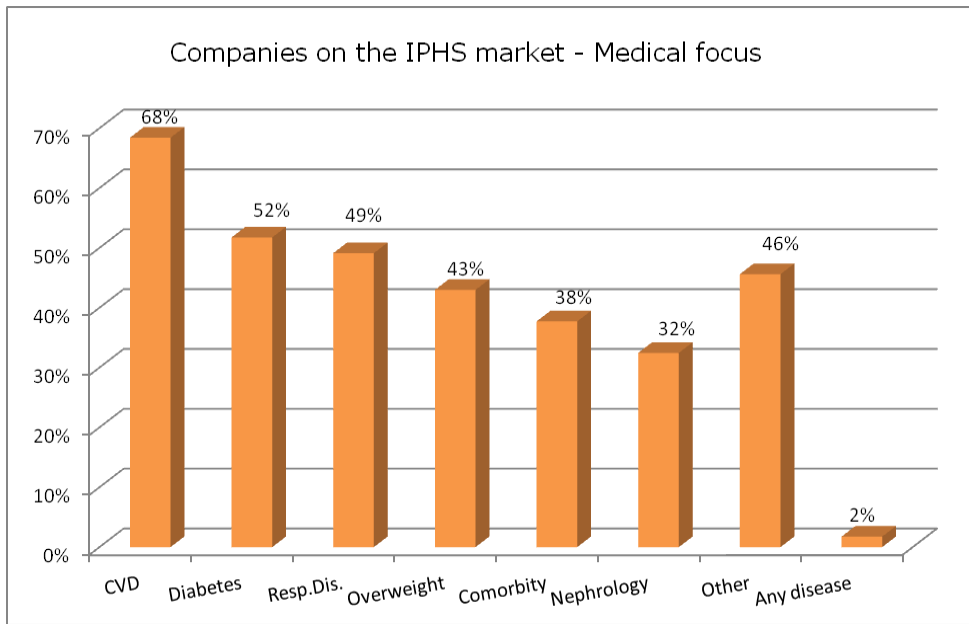
Source: IPTS

## 7.2 Product and service characteristics

### 7.2.1 Medical focus

Figure 31 below shows the medical focus of the companies reviewed. The SIMPHS2 research has been focusing on companies that tackle cardio-vascular diseases, diabetes, COPD as well as related conditions such as overweight, co-morbidities and other diseases. Cardio-vascular conditions (including CHF) are addressed by the highest number of companies, which reflects a slight bias in the research design. In addition, endurance sports have been among the first activities to popularise the use of RMT for training purposes and products and services from companies dealing with cardiac training have been classified here as prevention within heart conditions, the same goes for the increasingly popular pedometers tracking daily movements. Hence, by looking into IPHS including the fitness/wellness segment we have included a number of companies that tend to focus on the cardiac segment. The second and third most targeted conditions are diabetes and respiratory diseases. The ranking of most targeted conditions was similar in SIMPHS1. Interestingly there seems to be a move by companies addressing cardiac conditions to also serve the overweight segment i.e. one common cause of cardiac problems. On the opposite side, i.e. not looking into causes but consequences of a chronic condition, but reflecting the same strategy to expand into adjacent markets a number of companies dealing with diabetes seems to go into other conditions like nephrology, which is a consequence of diabetes. Only 2% of the companies studied offer services or products not related to particular diseases (e.g. mobile GP consultation services).

**Figure 31: Companies on the IPHS market – Medical focus**

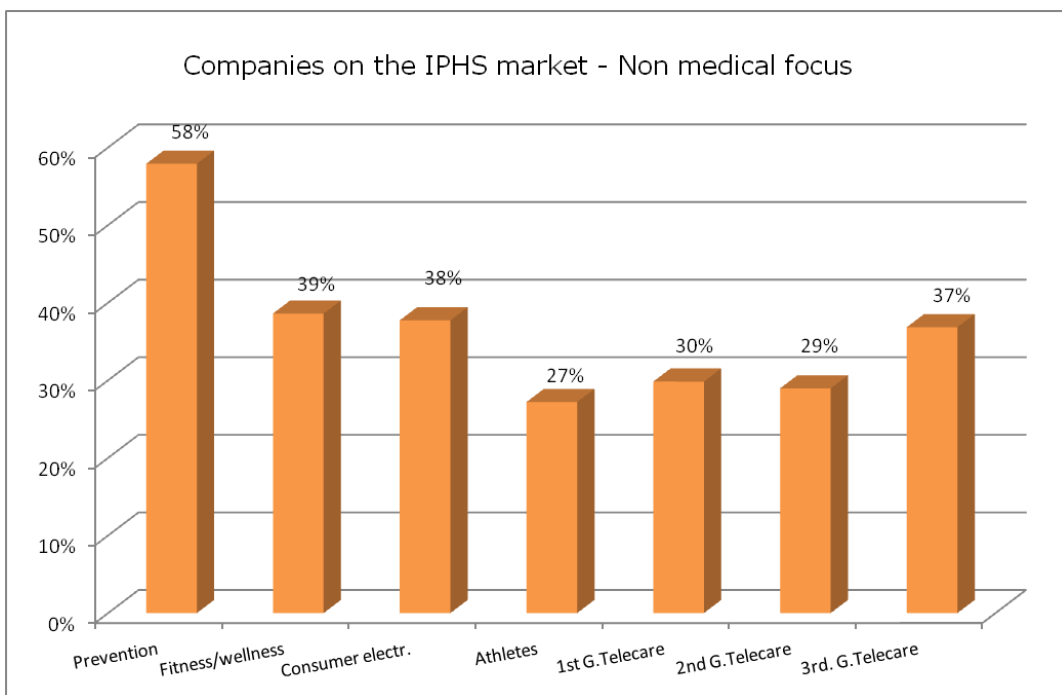


Source: IPTS

**7.2.2 Non-medical focus**

Figure 32 below shows the type of focus of services and products offered by the companies reviewed besides medical focus. 58% of the IPHS companies target the segment of prevention, while 39% and 38% respectively target fitness/wellness and consumer electronics for health purposes. Athletes are the target of activities for 27% of the companies studied.

**Figure 32: Companies on the IPHS market – Non-Medical focus**



Source: IPTS

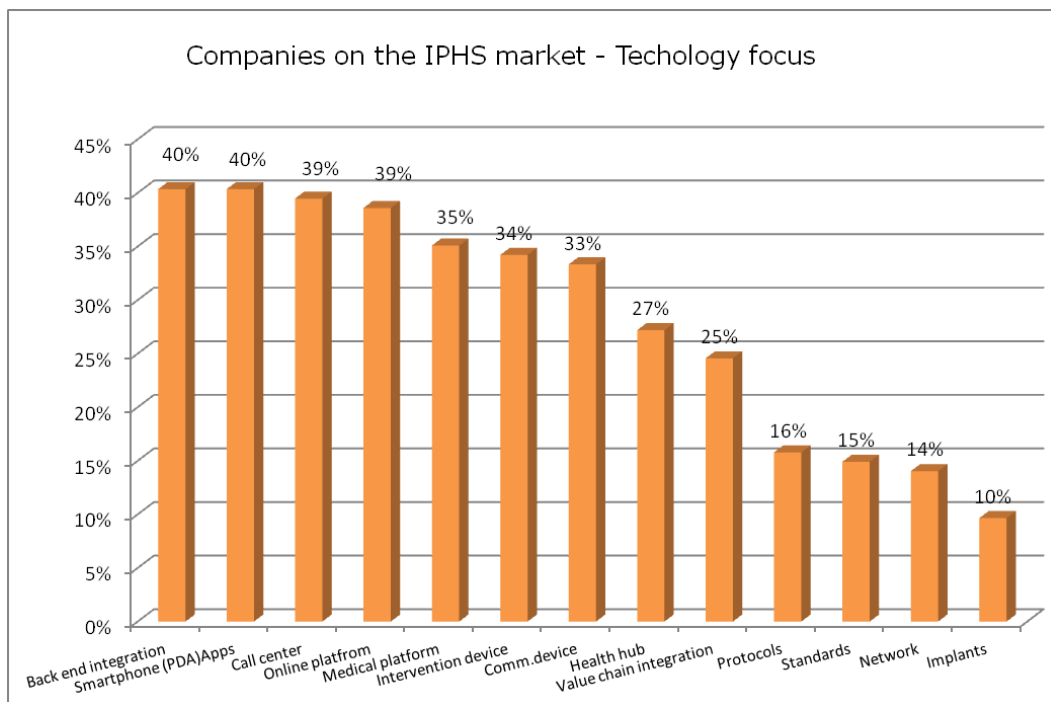
Out of the companies taken into account in this review, 34 (or 30%) offer 1<sup>st</sup> generation telecare systems and services (mainly alarm systems). All companies offering telecare products or services target the elderly, but focus their marketing on chronic diseases as well. This indicates that some companies diversify by offering telecare services on top of their core activities.

**7.2.3 Type of products and services offered**

Figure 33 below shows the various technology solutions offered by the companies reviewed, while Figure 34 shows the type of devices offered.

The most offered products and services are back end integration and mobile apps (offered by 40% of companies), closely followed by call centres and online platforms (offered by 39% of companies). Intervention devices are proposed by 35% of the companies studied, against 10% offering implants. Technology solutions like networks, protocols and standards are being developed by 14-16% of the companies studied.

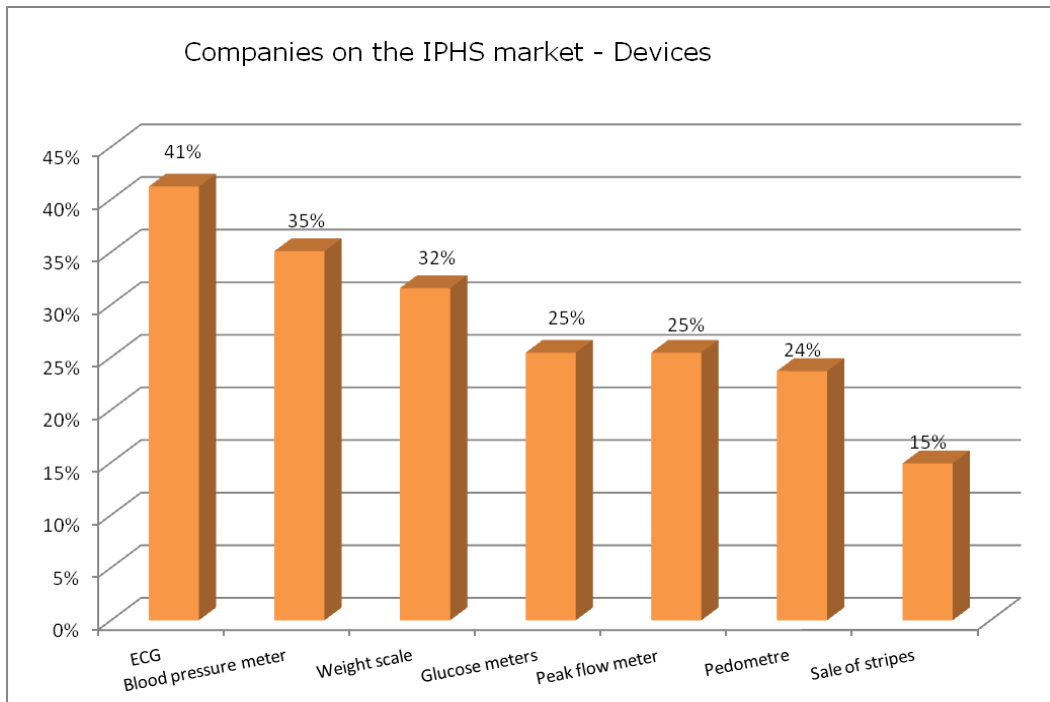
**Figure 33: Companies on the IPHS market – Technology focus**



Source: IPTS

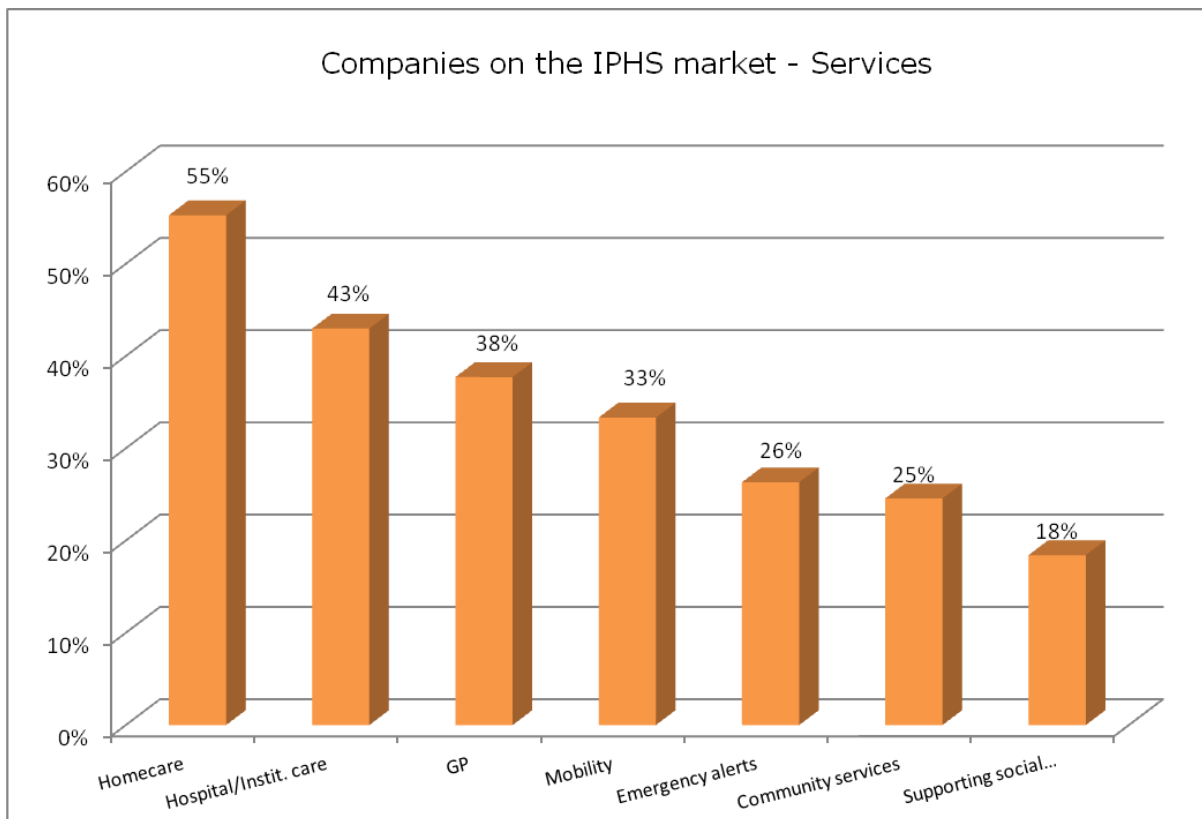
As to devices ECG are offered by 41% of the IPHS companies reviewed, blood pressure meters by 35%, scales by 32% and glucose meters by 25% on an equal footing with peak flow meters and pedometers. Stripes (diabetes) are being sold by 15% of the companies reviewed.

**Figure 34: Companies on the IPHS market – Devices**



Source: IPTS

**Figure 35: Companies on the IPHS market – Services**



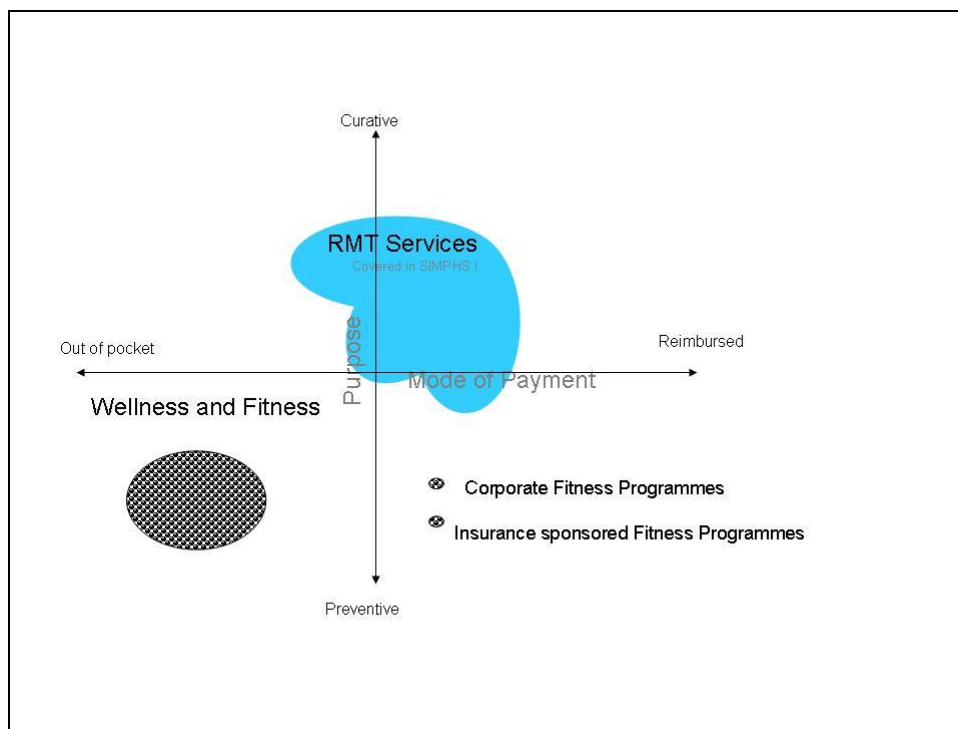
Source: IPTS

In terms of services, Figure 35 above shows that over half of the companies (55%) address home care, 43% hospital or institutional care and 38% GPs. Another 33% offer services enabling mobility, 26% offer emergency alerts services, 25% community services while 18% of companies offer services that support social care services delivery.

### 7.3 IPHS Market positioning

The fact finding of SIMPHS1 concentrated mostly on companies offering personal health services; their business models relied on reimbursement through health insurance and their services were designed and used for curative purposes for the benefit of chronically ill patients. With wellness and fitness related services and products being included in the scope of the SIMPHS2 research, the company review has included undertakings whose services have - from a public health point of view - preventive benefits. Customers on this segment are more willing to pay out of their own pocket for an array of technologies nearly identical to those used in RMT such as vital signs monitoring devices covered in SIMPHS1. Regular monitoring of activities and personalised or automated feedback appear to trigger behavioural changes. Besides companies who see the benefits of running corporate fitness programmes, public health and social care authorities as well as health insurances are also starting to reap these benefits for their own institutional goals and start covering the cost for service subscription or devices.

**Figure 36: IPHS Market positioning**



*Source: authors' own elaboration*

The market for vital signal in fitness and wellness appears to be booming, given the strong interest from industry and the high level of activity noted in the field. This current surge of activities can be explained by the widespread availability of smart-phones and greater abilities of a new generation of videogame consoles. Initially sport professionals and ambitious amateur athletes have been tracking their performance and training efforts through vital signal monitoring. Most of the marketing and pricing structure of vital signals monitoring still suggests that the target group is rather a wealthier customer strata. Yet the built-in capacity for geo-location and motion sensing now found in most smart phones is lowering the hurdle for a wider uptake of vital signals monitoring for training. Eventually the next versions of the most popular smart phones are expected to include more sensorial capacities, which will allow more tailor made applications using those.

Another important point is that companies active in the field of RMT are repackaging their products, avoiding more stringent and costly testing for medical equipment, and bring their technologies to the wellness/fitness market by directly targeting customers. One example is the company Vitaphone which uses a pedometer to capture the physical activities of a client, combined with an online diary; the company uses its back office medical expertise to provide personalised feedback on lifestyle. For a monthly €20 fee, experts provide subscribers with support to behavioural changes. Once the behavioural change has led to the desired outcome e.g. weight loss, the service stops.



## 8 Concluding remarks

The challenge for this report has been to find robust data and figures proving or disproving the claims and promises made by stakeholders on the market of RMT, Telecare, Fitness/wellness and mHealth (i.e. IPHS). According to industry sources these technologies have the potential to bring a significant Return on Investment and facilitate healthcare delivery by generating savings in resources and increasing healthcare efficiency. Market reports reviewed in this deliverable draw an optimistic picture of the market potential and provide positive revenues growth forecasts. Independent market data is difficult to come by. It is interesting to note that RMT – which as we found out in SIMPHS1 is only a tiny part of eHealth as a whole – is considered an important driver of growth for out of hospital telehealth.

Institutionalised purchase of products and services is dominated by oligopsonies or monopsonies, i.e. a limited number of buyers or in case of a single payer healthcare system only one buyer can dictate the conditions to which products and services are purchased. Additionally the market is characterised by extensive government intervention, as the responsibility for public health remains the remit of the governments of EU Member States, and therefore the conditions for Health ICT purchase vary greatly from country to country. With this background in mind it becomes understandable that SMEs succeeding with the provision of IPHS are often local champions. They excel in providing health care according to the local institutional settings and legal frameworks, while they cater for the demand shaped by local needs. There is only limited evidence about such companies succeeding in going from local to national markets, and international operations often remain a distant objective. However universally applicable assets like specialised knowledge on medical conditions are present among smaller companies as well. Some SMEs provide call centres and backend integration across borders, with multilingual experts serving request from abroad. Partnerships with service providers in other countries allow them to access further markets. For larger players already active in the medical field, these restrictions are less relevant. In case in-house competencies are lacking larger companies tend to acquire and absorb start-ups that have a proven product. Unfortunately this can eventually lead to talent losses as non-European companies tend to be the most active in such acquisitions.

SIMPHS2 focuses more on prevention through wellness and fitness than previously, a field which does not have the same rigidities as a medical market. Smart phones have been a game changer, a standardized computing power which fits in a palm has freed companies from the cost of developing hardware by themselves. As a result small and medium sized companies providing applications in the wellness field are mushrooming as well. Dynamism is higher in this segment and one can observe a boom, in particular as regards fitness related applications where the amount of products is expanding drastically. One can foresee a future consolidation in this field. The advent of relatively low cost standardised sensors like the Kinect from Microsoft may eventually initiate a similar development regarding Ambient Assisted Living services. Corporations and health insurance companies start using reward schemes based on pedometers to motivate participants to increase their physical activities with all the associated benefits. We expect more of such schemes and even more so with more advanced sensors.

Housing cooperatives have been identified to be major clients for telecare and components of Ambient Assisted Living which makes their real estate more attractive to elderly. Welfare organizations cooperate with system integrators under the auspices of housing cooperatives: this cooperation is often only rather local. The backend integration can be supplied by telecommunications companies. The costs are borne by a health or social insurance, often they form part of the general service charges.

Telecommunications companies play a pivotal role in creating the market, not only do they build the communication networks upon which both eHealth and mHealth solutions are based. To establish new business areas telecoms have also been venturing in the field of health and social care related products and services. While during SIMPHS1 we were under the impression that the activities

mainly have the character of pilots, now IPHS related services have started reaching the market through telecommunications companies. For example Orange in France and Deutsche Telekom in Germany have started distributing advanced glucose meters through their retail shops, sales being based on out of pocket payments in a market that follows a consumer electronics business model.

## 9 References

1. IPTS, *Strategic Intelligence Monitor on Personal Health Systems (SIMPHS): Market Structure and Innovation Dynamics*. 2011.
2. IPTS, *Strategic Intelligence Monitor on Personal Health Systems (SIMPHS): Report on Typology/Segmentation of the PHS Market*. 2011.
3. McKinsey, *Big data: The next frontier for innovation, competition, and productivity* 2011.
4. Lichtenberg, F.R., *The Impact of New Drug Launches on Longevity: Evidence from Longitudinal, Disease-Level Data from 52 Countries, 1982–2001*. *International Journal of Health Care Finance and Economics*, 2005. **5**(1): p. 47-73.
5. Frost&Sullivan, "E-Healthcare in Western Europe - A huge Market Opportunity for Wireless Technologies." in *Report Nr. .9838-65*. 2009.
6. Frost & Sullivan, *European Remote Patient Monitoring Markets*. 2007, Frost & Sullivan: London, UK. p. 84.
7. Frost & Sullivan, *European Remote Patient Monitoring Market*. 2010.
8. Frost & Sullivan, *European Remote Patient Monitoring Markets*. 2008.
9. Frost & Sullivan, *Emerging Technologies in Cardiac Monitoring*. 2009.
10. Elderly, K.I.W.G.o.t.P.o.F.b.t., et al., *The prevention of falls in later life: a report of the Kellogg International Work Group on the Prevention of Falls by the Elderly*. 1987: Published for the Medical Faculties of the Universities of Copenhagen and Aarhus, and the Danish National Board of Health by Ugeskrift for Læger in cooperation with the University of Michigan and the University of Copenhagen.
11. European Commission, *STRATEGIC IMPLEMENTATION PLAN FOR THE EUROPEAN INNOVATION PARTNERSHIP ON ACTIVE AND HEALTHY AGEING STEERING GROUP WORKING DOCUMENT FINAL TEXT ADOPTED BY THE STEERING GROUP ON 7/11/11 STRATEGIC PLAN*. 2011: Luxembourg.
12. Stowe, S. and S. Harding, *Telecare, telehealth and telemedicine*. *European Geriatric Medicine*, 2010. 1(3): p. 193-197.
13. Demiriz, G. and B. Hensel, *Technologies for an aging society: A systematic review of "smart home" applications*. *Yearb Med Inform*, 2008: p. 33-40.
14. Rocha, A., et al., *Innovations in health care services: The CAALYX system*. *International Journal of Medical Informatics*. In Press, Corrected Proof.
15. Cullen, K. and L. Kubitchke, *ICT & Ageing European Study on Users, Markets and Technologies*. 2009: Bonn.
16. Frost & Sullivan, *European Social Alarms Markets*. 2006, Frost & Sullivan: London, UK.
17. Frost & Sullivan, *European Remote Patient Monitoring Market*. 2010.
18. Diaz, M.R., *Las Personas Mayores en España Datos Estadísticos Estatales y por Comunidades Autónomas*. INFORME, 2008. i 2008.
19. Chan, M., et al., *Smart homes -- Current features and future perspectives*. *Maturitas*, 2009. 64(2): p. 90-97.
20. Milligan, C., C. Roberts, and M. Mort, *Telecare and older people: Who cares where?* *Social Science & Medicine*, 2011. 72(3): p. 347-354.
21. Hill, C. *Can a Medic Alert System Be Stylish?* *Smart Money* 2011; Available from: <http://www.smartmoney.com/spending/technology/now-in-vogue-grandpas-gadgets-1299712884177/>.
22. Dembosky, A., *Invasion of the body hackers*, in *Financial Times*. 2011.
23. Frost & Sullivan, *The race has just begun*. 2008.
24. Honsel, G., *Die Software schwitzt mit (Software is sweating as well)*. *Technology Review (german edition)*, 2010. 5: p. 62-67.
25. Shah, S.K., *From Innovation to Firm Formation: Contributions by Sports Enthusiasts to the Windsurfing, Snowboarding & Skateboarding Industries*, in *The Engineering of Sport 6*. 2006, Springer. p. 29-34.
26. Ubisoft. *Yourshape fitness evolved*. 2011; Available from: <http://yourshapegame.us.ubi.com/>.

27. Ludwig, S., *The fitness Market*, Deloitte, Editor. 2009: Düsseldorf, Germany.
28. Alagöz, F., et al., *From Cloud Computing to Mobile Internet, From User Focus to Culture and Hedonism The Crucible of Mobile Health Care and Wellness Applications*. 2010.
29. Nischelwitzer, A., et al., *Design and development of a mobile medical application for the management of chronic diseases: methods of improved data input for older people*. HCI and Usability for Medicine and Health Care, 2007: p. 119-132.
30. Frost & Sullivan, *The European Market for Disease Management Systems (M54A-48)*. 2009. p. 51.
31. Barlow, J. and J. Hendy, *Adopting integrated mainstream telecare services: Lessons from the UK*. Eurohealth, 2009. 15(1): p. 8-10.
32. Taga, K., et al., *Capturing Value in the mHealth Oasis*, in *Telecom & Media Viewpoint*, A.D. Litte, Editor. 2011.
33. Cox, A., *Mobile Healthcare Opportunities Monitoring, Applications & mHealth Strategies 2010-2015*. 2009: Basingstoke, UK.
34. Ryberg, A., *mHealth and Home Monitoring*, B. Insight, Editor. 2009: Gothenburg. p. 130.
35. 3G Doctors, *Is it the threat of obsolescence that will eventually wake up medical device manufacturers to mHealth?* 3G doctors blog, 2011.
36. mobileStorm Inc., *2011 mHealth Report Mobile Healthcare Technology Trends and Innovations*, in *mobileStrom Reports Digital Marketing Reports*. 2011: Van Nuys, CA, USA.
37. Frost&Sullivan, *Mobile/Wireless Healthcare Technologies in Europe 2008*.
38. GSMA/PwC, *Touching lives through mobile health - Assessment of the global market opportunity*. 2012.
39. Jaggi, G., *Progressions: Building Pharma 3.0*, in *Ernst & Young Global Life Science Center*. 2011, Ernst & Young GM Limited.
40. Von Bertalanffy, L., *General system theory*. 1973: George Braziller New York.
41. Moore, J.F., *The death of competition: leadership and strategy in the age of business ecosystems*. 1996: HarperBusiness New York.
42. Kharif, O., *Apple Plans Service That Lets iPhone Users Pay With Handsets*, in *Bloomberg* 2011, Bloomberg: New York.
43. Isomursu, M., M. Ervasti, and V. Tormanen. *Medication management support for vision impaired elderly: Scenarios and technological possibilities*. 2009: IEEE.
44. García-Vázquez, J., et al., *Supporting the strategies to improve elders' medication compliance by providing ambient aids*. Personal and Ubiquitous Computing, 2011: p. 1-9.
45. InMedica, *The World Market for Telehealth – A short and long term Analysis*. 2010.
46. Khandelwal, N., *The World Market for Telehealth - A Short and Long Term Analysis*. 2010, InMedica: Wellingborough, Northants.
47. Gormley, B. *Turning Out The Lights: Transoma Medical, Onetime IPO Hopeful*. Wall Street Journal 2009; Available from: <http://blogs.wsj.com/venturecapital/2009/12/07/turning-out-the-lights-transoma-medical-onetime-ipo-hopeful/>.
48. Frost & Sullivan, *Handbook of Key Participants in the European Healthcare IT Industry*. 2005, Frost & Sullivan: London, UK.
49. Guide, The S. *Medisense® and Therasense®*. 2011; Available from: <http://www.themedsupplyguide.com/glucose-monitors/abbot.html>.
50. Bourzac, K. *Stretchable Silicon Could Make Sports Apparel Smarter*. Technology Review 2010; Available from: <http://www.technologyreview.com/computing/26872/?ref=rss&a=f>.
51. Aerotel. *Aerotel Company website*. 2011; Available from: <http://www.aerotel.com/>.
52. Anker, S. *Klinische Studie von Partnership for the Heart vorgestellt*. 2010; Available from: [http://www.partnership-for-the-heart.de/en/press/news-details/tt\\_news/23/1/?cHash=e4d0617b65](http://www.partnership-for-the-heart.de/en/press/news-details/tt_news/23/1/?cHash=e4d0617b65).
53. Alive Technology Corporate Website. 2011; Available from: <http://www.alivetec.com/>.
54. Breuer corporate Website. 2011; Available from: [www.beurer.com](http://www.beurer.com).
55. website, Bodytek C., [www.bodytel.de](http://www.bodytel.de). 2011.

56. BT. *BT positioning on UK telehealth*. 2009; Available from: <http://www.btplc.com/Health/Clinical/Thoughtleadership/index.htm>.
57. Frost & Sullivan, *E-Healthcare in Western Europe: A Huge Market Opportunity for Wireless Technologies*. 2009.
58. Website, Cambridge Silicon R.C.C., [www.csr.com](http://www.csr.com). 2011.
59. CeBIT: Deutsche Telekom adds mobile healthcare measuring devices to product range. 2011; Available from: <http://www.medisana.de/corporate/1/123-1-CeBIT-Deutsche-Telekom-adds-mobile-healthcare-measuring-devices-to-product-range.html>.
60. *E-Health - Gesundheit digital*. 2011; Available from: <http://www.telekom.com/dtag/cms/content/dt/de/674564>.
61. Dolan, B. *Carriers pushing mHealth in Spain, France*. 2010; Available from: <http://mobihealthnews.com/8437/orange-uk-helps-patients-call-doctors/#>.
62. Dolan, B. *Orange UK helps patients call doctors*. 2010; Available from: <http://mobihealthnews.com/8437/orange-uk-helps-patients-call-doctors/#>.
63. Business Intelligence Service Alacra. *Polar Electro*. 2011; Available from: [http://www.alacrastore.com/mergers-acquisitions/Polar\\_Electro\\_Oy-3387158](http://www.alacrastore.com/mergers-acquisitions/Polar_Electro_Oy-3387158).
64. HealthTechWire. *Roche Diabetes Care and ICW announce Technology Partnership*. 2010; Available from: <http://www.healthtechwire.co.uk/The-Industry-s-News-unb.146+M51a9d4df09d.0.html>.
65. Companario, I. *Telefónica I+D busca socios para gestionar sus proyectos*. el corroweb 2010; Available from: <http://www.elcorreoweb.es/economia/087538/telefonica/id/granada/proyectos/socios/locales/patentes>.
66. CSR Europe. *MYDoctor@Home*. 2007; Available from: [http://www.csreurope.org/solutions.php?action=show\\_solution&solution\\_id=510](http://www.csreurope.org/solutions.php?action=show_solution&solution_id=510).
67. Telenor. *telenor Hungary helps keep doctors and patients connected*. 2011; Available from: <http://www.telenor.com/en/news-and-media/articles/2011/telenor-hungary-helps-keep-doctors-and-patients-connected>.
68. Telenor. *Telenor's telecom top 10 in 2010*. 2011; Available from: <http://www.telenor.com/en/news-and-media/articles/2011/telenors-telecom-top-10-in-2010>.

## Annex 1: Overview of market reports

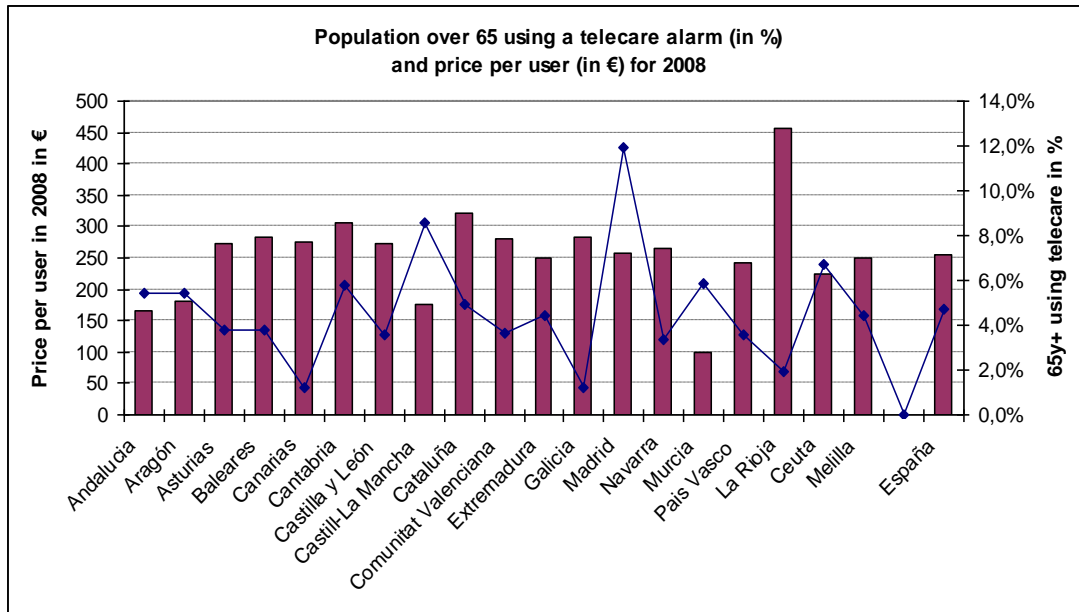
Provider	Title	Definition	Focus	SIMPHS Segments	Geo Scope
F&S	European Remote Patient Monitoring Market - Sept 2010	RPM = Telehealth + Telecare	<ul style="list-style-type: none"> <li>- Revenues &amp; forecasts 2006-2015</li> <li>- Market dynamics (barriers and drivers)</li> <li>- Technology trends</li> <li>- Geographical analysis</li> <li>- Competitive analysis</li> </ul>	<ul style="list-style-type: none"> <li>- RMT</li> <li>- Telecare</li> </ul>	UK, DE, FR, IT, SP, Nordic, Benelux
	E-Healthcare in Western Europe Oct 2009	E-Healthcare: EHR; PACS; ePrescription etc.	<ul style="list-style-type: none"> <li>- Overall trends in E-Healthcare markets with section on Telehealth covering RMT, Telecare and Telemedicine;</li> <li>- National initiatives; Service provider initiatives; monitoring devices; market forecasts; recommendations to market players/investors;</li> </ul>	Partly: <ul style="list-style-type: none"> <li>- RMT</li> <li>- Telecare</li> </ul>	Western Europe, incl. UK, DE, FR, IT, SP,
	Reimbursement trends for the Remote Patient Monitoring Sector Dec 2009		<ul style="list-style-type: none"> <li>- Drivers &amp; barriers</li> <li>- Deployment &amp; reimbursement in UK, DE, FR, IT, SP (mostly projects)</li> <li>- Growth perspectives</li> </ul>	RMT	UK, DE, FR, IT, SP
	European Markets for Disease Management systems	DMS defined as part of Patient Monitoring	<ul style="list-style-type: none"> <li>- Market dynamics</li> <li>- Key market participants</li> <li>- Product offerings</li> </ul>	No clear overlap with SIMPHS segments	-

<b>Provider</b>	<b>Title</b>	<b>Definition</b>	<b>Focus</b>	<b>SIMPHS Segments</b>	<b>Geo Scope</b>
	Emerging Technologies in Cardiac Monitoring	Cardiac Monitoring	<ul style="list-style-type: none"> <li>- Revenues in Europe</li> <li>- Companies</li> <li>- Devices</li> <li>- Strategic recommendations</li> </ul>	No clear overlap with SIMPHS segments	-
	Mobile Wireless Healthcare Technologies in Europe	All mobile healthcare technologies for	<ul style="list-style-type: none"> <li>- Classification (infrastructure, software, device, service markets)</li> <li>- Revenue forecasts</li> <li>- Technology trends</li> <li>- Challenges for vendors</li> <li>- Barriers and drivers</li> <li>- Scenario of growth and decline</li> <li>- Overview of market players</li> </ul>		Worldwide
F&S	Vital Signs	Fitness monitoring (consumer) Professional Fitness vital signs monitoring	<ul style="list-style-type: none"> <li>- Overview of market, products and competition, end user demand</li> <li>- US revenues</li> </ul>	Fitness and wellness	US
Juniper Research	Mobile Healthcare Opportunities Monitoring, Applications and mHealth Strategies		<ul style="list-style-type: none"> <li>- mHealth market structure (developments, technologies)</li> <li>- mHealth cases, drivers and barriers</li> <li>- Mobile RMT in Healthcare context</li> <li>- Costs savings</li> </ul>	mHealth	World regions including Western/Eastern Europe

Provider	Title	Definition	Focus	SIMPHS Segments	Geo Scope
			<ul style="list-style-type: none"> <li>- Smartphone Apps for mHealth</li> <li>-Company interviews</li> </ul>		
Datamonitor	Telehealth spending in Europe through 2012 (2007)	Telehealth as clinical and home telehealth	- market revenues per country/group of countries	Partly RMT	Benelux, FR, DE, IT, Nordic, New EU10, RoWE, SP, CH, UK
In Medica	The World Market for Telehealth – a Short and Long Term Analysis - 2010	Telehealth Telecare Telemedicine	<ul style="list-style-type: none"> <li>- Telehealth market revenues and forecasts</li> <li>- Market trends, Barriers and drivers</li> <li>- Market statistics (sales of equipment, health hubs, devices used in Telehealth)</li> <li>- Business models and ecosystem</li> <li>- Market shares per country (US, UK, DE)</li> <li>- Company profiles</li> </ul>	<ul style="list-style-type: none"> <li>- RMT</li> <li>- Telecare</li> </ul>	<p>World regions</p> <p>Some EU countries</p>
GSMA/PwC	Touching lives through mobile health - Assessment of the global market opportunity - 2012	mHealth	- Assessment of mHealth opportunities per region and globally	mHealth	World regions

## Annex 2: Telecare cost data Spain (2008)

Figure 37: Population percentage over 65 using a telecare alarm and price per user in € for 2008



Source: IMSERSO, Spanish Ministry of Health, 2008

Table 2: Percentage of population over 65 using a telecare alarm and price per user for 2008

Region	Percentage of users among 65y+	Price per User (€)
Andalucía	5,5%	166,93
Aragón	5,4%	180
Asturias	3,8%	274,06
Baleares	3,8%	283,73
Canarias	1,2%	276,24
Cantabria	5,8%	306,54
Castilla y León	3,5%	273,96
Castill-La Mancha	8,6%	176,76
Cataluña	5,0%	320,6
Comunitat Valenciana	3,6%	281
Extremadura	4,4%	250,76
Galicia	1,2%	283,67
Madrid	11,9%	258,44
Navarra	3,4%	265,2
Murcia	5,9%	99,09
País Vasco	3,6%	241,24
La Rioja	1,9%	456,8
Ceuta	6,7%	223,56
Melilla	4,4%	250,44
Spain	4,7%	253,9

Source: IMSERSO, Spanish Ministry of Health, 2008

## **Annex 3: Companies on the IPHS market**

The following section presents a short company description for 114 selected companies active on the IPHS market, including the type of products and services they offer.

### **3G DOCTORS**

The Ireland based Company 3G doctors has been offering video consulting services with accredited and registered GPs independently from location and time using a 3G Video Smart phone since 2005. Each consultation costs GBP 35 and is paid by the user. The services also contain EHR available independently from their location, including outside of Ireland and the UK. In addition this SME offers consulting services for health equipment manufacturers entering the market. It is worth mentioning that the company maintains some blogs offering comments from the perspective of practitioners on recent developments regarding mHealth.

Address: Tubber, Lisle County Kerry, Ireland

Website: [www.3gdoctor.com](http://www.3gdoctor.com)

Blog: [mHealthinsight.com/](http://mHealthinsight.com/)

### **A&D Company, Limited**

The Japan based A&D Company established in 1977 develops, manufactures and distributes electronic blood pressure monitoring equipment and health care products for home and institutional settings. Japan and the United States are their main markets although they sell in Europe as well. Its medical division produces advanced weighing and medical devices targeting both professional and consumer markets. Its newer products fall within the scope of IPHS as A & D has developed a lot of monitoring devices to support home monitoring. However, the company supplies systems providers and health care institutions but does not seem to actively market its products to end users. In terms of IPHS related products, A&D Medical provides a wireless blood pressure monitor and Wellness Connected™ wireless automatic blood pressure monitor. These devices enable patients to measure and upload blood pressure readings to health hubs or to a computer for transmission to caregivers. One of its blood-pressure monitor, which relies on the Bluetooth standard, has obtained certification from the Continua Health Alliance (CHA). The A&D wireless precision scale allows the user to record measurements and calculate values such as BMI. The information is transferrable. The scale is also certified by CHA. Other products include automatic blood pressure, manual blood pressure, wrist blood pressure, and professional blood pressure monitors; stethoscopes, dual head, and single head stethoscopes; thermometers, which include digital, fast-read digital, flex-tip digital, and instant-read thermometers.

Address: 3-23-14 Higashi Ikebukuro Toshima Ku, Tokyo 170-0013, Japan

Website: [www.aandd.co.jp](http://www.aandd.co.jp)

### **Abbott**

Abbott Laboratories is a US based pharmaceuticals health care company. Under the umbrella of this company, Abbott Diabetes Care markets glucose monitoring systems and test strips targeting both in-home and hospital settings. Abbott Diabetes caters for the problems associated with Diabetes and provides the entire line of products needed for diabetes care from test kits and needles, diabetes management solutions for institutional and private care. The company has been through a spate of mergers and acquisitions beginning with Medisense, a company specialised in glucose monitoring and producer of glucose meters, in 1996. Medisense is now the division of Abbott that is in charge of diabetes monitoring. More recently the company has acquired i-STAT (2003), which produces an advanced handheld blood analyser. Therasense was then acquired in 2004. Their FreeStyle Tracker combines a blood glucose meter with a diabetes manager in one compact device. Initially the device used the now defunct Handspring Visor personal digital assistant (PDA). Part of this product line now consists of devices for continuous monitoring which connect wirelessly to a health hub. According to the company continuous monitoring can reveal changes in the glucose

level which traditional punctual monitoring may miss, it thus has the potential to reduce time patients spent in hypo- and hyperglycaemia and the associated health risks. The monitoring results can be send to a database provided by Abbott. Abbott is among those players holding larger share of the global market of the blood glucose monitoring business, their products include software for includes data management systems. [48, 49]

Address: Abbott Park, Illinois, United States

Websites: [www.abbott.com](http://www.abbott.com)  
[www.abbottdiabetescare.co.uk/](http://www.abbottdiabetescare.co.uk/)

### **Adidas/Reebok**

The sports outfit company Adidas is entering the market for activity monitors with a personalised training device. The product is called miCoach, its core is a Pacer combining a pedometer, a heart rate monitor, a calorie counter and real-time coaching information available which can be used with mp3 players and smart phones. It started as a cooperation with Samsung whereby Adidas initially only provided the hardware. The associated online coaching tool is key for user motivation as it enables to keep track of performed workouts and plan training for beginners and advanced users. The sensors offered by Adidas can take different forms such as sports bra and compression shirt. It targets the ambitious but non-professional market.

Reebok which has been part of the Adidas group since 2005 strives to cater for the professional athletes market for training. It has teamed up with the flexible sensor start-up MC10 to develop apparel with embedded electronics to keep a track of the vital signals and health performance of athletes. This joint venture aims to develop shirts for athletes with incorporated sensors and a microprocessor to monitor a variety indicators, such as impacts on the body, electrical information from the heart and nervous system, sweat pH, blood pressure, gait and strain on joints.[50]

Address: Adi-Dassler-Str. 1 91074 Herzogenaurach Germany

Website: [www.adidas.com/com/micoach/#](http://www.adidas.com/com/micoach/#)  
[www.adidas-group.com](http://www.adidas-group.com)

### **Aerotel Medical Systems**

Aerotel Medical Systems is a subsidy of Aerotel Ltd and was founded to ease the burden of rising costs and diminishing efficiency of primary health care services. This Israel based company manufactures modular, mobile and home based telemedicine and telecare solutions. It offers a range of data communications hubs for remote monitoring and homecare application. Aerotel's telehealth business unit produces and sells health hubs, monitoring peripherals and remote monitoring software for managing patient care. The devices can connect and transmit over different wireless standards as well as wired connections. The company provides a complete disease management package; including transfer per telecommunications devices designed for a variety of remote diagnostic, emergency services and monitoring applications, hardware and software platforms for remote monitoring call centres, as well as phone and web-based monitoring software. The RMT Systems are designed to mainly be used by health care professionals. The Aerotel telecare or distress alarms use GSM based wrist-wearable mobile monitoring and communication devices for children, elderly and chronically ill, as well as GPS-based location tracking of rescue teams in dangerous situations. The company's products include blood pressures measuring and weight scale devices connecting over the telephone to a call centre set up by Aerotel Medical. Within Europe Aerotel has a strong presence in the German speaking markets, it targets as well Russia, France, Italy and Spain. Additionally the company provides services in Turkish.[46, 51]

Address: Head Office Address: 5 Hazoref St., Holon 58856, Israel

Website: [www.aerotel.com](http://www.aerotel.com)

## **Aipermon**

The German based company Aipermon is a spinoff of Infineon Technologies. It is active in the field of telemonitoring and monitoring of physical activity, with applications in both for medical purposes and the wellness/fitness realm. It uses sensor technology, miniaturization, encryption and wireless transfer technologies, and also provides back office and computing facilities for eHealth solutions. Telecare alarms are part of their portfolio as well.

Aipermon has been involved in the *Partnership for the Heart* project, a cooperation between Aipermon, the Charite Hospital in Berlin, the Robert Bosch Hospital in Stuttgart and GPs. In this trial a remote patient monitoring system was used and evaluated with 710 patients with chronic heart failure. Physicians and cardiologists at a telemedical centre evaluated data transmitted into the electronic patient records for further action. For a certain patient profiles, the mortality rate due to heart diseases decreased by half during the trial.[52]

Aipercare is an Aipermon product using Ambient Assisted Living technologies at home and in care institutions to support care givers and patients. Using the Gallileo satellite system AiperCare detects critical situations prior to any event, e.g. the movements of patients follow different patterns which may raise alarm. Aipermotions is another of the Aipermon product line, which comprises a calorie counter combined with a motion sensor supporting diets for health and lifestyle reasons. It enables a personalised feedback with a trainer which helps trigger behavioural changes. AiperSunny follows the same idea but only registers the movements to calculate calorie consumption. Aipermon also offers tele-monitoring services via its health hubs, its backoffice and its telehealth centre to monitor own vital signs received from their own systems and that of other providers..

Address: Zamdorfer Str. 100 81677 München, Bayern Germany

Website: [www.aipermon.com/](http://www.aipermon.com/)

## **Alive Technologies**

Alive Technologies is an Australian company that develops, designs and produces wireless RMT systems for screening, diagnosis and management for a variety of diseases. Applications include the management of atrial fibrillation and heart failure, cardiac rehabilitation and fitness monitoring. Its products are sold in Australia, Europe and the USA. It currently offers the following medical devices of relevance to IPHS:

The Alive Heart and Activity Monitor is a wireless RMT system for screening, diagnosis and management of chronic diseases and for consumer health and fitness. Applications include the management of atrial fibrillation and heart failure, cardiac rehabilitation and fitness monitoring. It is designed for use in institutional care settings at home or at the gym. The monitor uses wireless Bluetooth technology and mobile phone networks to immediately transmit ECG and accelerometer data to a mobile phone, computer, or central monitoring centre. The company uses new electrode technology combined with Bluetooth for optimum signal quality. Its products feature a distress button for telecare applications.

The Alive Pulse Oximeter is a wearable RMT device to remotely monitor respiratory symptoms. It uses wireless technology for real time transmission to a call centre over the internet. The data is displayed locally as well.

The Alive Diabetes Management System provides wireless transmission of blood glucose readings to a central web based database using Bluetooth, GPRS and SMS [53].

Headquarter Address: 11 Technology Drive, Arundel, Queensland 4214 Australia.

Website: [www.alivetec.com](http://www.alivetec.com)

## **Bayer**

The Germany based Bayer AG is a global leader in pharmaceuticals, biosciences, and medical devices manufacturing and sales. The company is structured along several business groups including Bayer Healthcare AG which deals in particular with consumer health products, diagnostics

and pharmaceuticals as well as diabetes products. Part of its blood glucose meters can be connected to a computer for data transmission. Its DIDGET meter is targeted at children and links to the portable game console Nintendo DS. It has motivational features to help children with diabetes manage their condition by rewarding them for consistent testing and meeting personalised glucose target ranges.

Address: Bayer AG 51368 Leverkusen Germany

Website: [www.bayerdiabetes.com](http://www.bayerdiabetes.com) , [www.ascensia.com](http://www.ascensia.com)

### **B. Braun**

The Germany based company B. Braun provides hospitals with all sorts of supplies including infusion and injection solutions, as well as other disposable medical products. It has become a major systems supplier for equipment used in hospitals, clinics and in a home setting. Its "Out Patient Market" division supplies medical products for use outside of the hospital market as the name indicates, as well as for chronically ill and long-term care patients. B. Braun caters for diabetes patients through a variety of products. B. Braun has a separate OEM division through which alliances with major suppliers and manufacturers have been established. B. Braun can develop and manufacture products to be used for services falling under the IPHS definition. The company has formed alliances with Paul Hartmann AG which offers logistical services to hospitals and care institutions. B. Braun has also developed application for care givers on tablet computer helping them to take care of orthopaedic problems arising with long term care, rehabilitation and sport medicine. The latter can be used at the point of care both in an institutional setting as well as at home.

Address: Carl-Braun-Straße 1,34212 Melsungen, Germany

Website: [www.bbraun.com](http://www.bbraun.com)

### **BD (Becton Dickinson and Company)**

BD started as one of the global leaders in the manufacture of syringes and other infusion systems and medical disposables. The company has been able to translate this advantage to areas such as diabetes care and now provides blood glucose meters and strips. The company has an identification system called BD.id to verify the identity of both the care giver and the patient. The system works with a handheld computer or smart phone with a built-in scanner, the BD.id System confirms the healthcare professional's identity, the healthcare professional uses the handheld device to confirm the patient's identity by scanning a bar-coded wristband or badge. The system allows the provision of care both in a hospital and outside of hospital settings. It appears that the company main activities are in the United States, though some services are offered within Europe.

Address : 1 Becton Drive, Franklin Lakes, NJ USA 07417

Website: [www.bd.com](http://www.bd.com)

### **Beurer**

The Germany based Medium Sized company Beurer was established in 1919 to produce electric blankets and similar sanitary products. Over the years the company diversified into various domains. According to the market research company Juniper Beurer medical became one of Europe's largest suppliers of blood pressure monitors. The company's portfolio consists of over 120 products ranging from health to fitness monitors targeting athletes and chronic patients. The company also sells tailor made RMT products for babies monitoring. Additionally its product portfolio includes blood glucose and pressure monitors, heart rate monitors and weight scales which communicate with a call centre. The company markets telecare and social alarm systems. Beurer is a member of the ANT+ Alliance. [46, 54]

Headquarter's address: Soeflinger, Strasse 218, 89077, Ulm, Germany

Website: [www.beurer.com](http://www.beurer.com)

### **BiancaMed**

BiancaMed is an Irish medical technology company specializing in non- contact respiration, movement and sleep monitoring. The company started as a spin-out from Dublin UCD School of Electrical, Electronic & Mechanical Engineering. The company targets the self monitoring and self-medication market, bearing in mind the high prevalence of sleeping disorders in modern societies. It has two main products: a monitor for adult sleep monitoring and BiancaBaby aimed at parent's reassurance for baby movement monitoring. BiancaMed also provides its technology on a service basis for sleep trials, sleep monitoring services for care institutions, and to fast- moving consumer goods companies, OTC and regulated drug manufacturers as well as their Contract Research Organizations (CROs).

Biancamed was acquired by ResMed in July 2011

Address: ResMed Europe, Fjordveien 1, N- 1363 Høvik, Norway. Website: [www.resmed.com](http://www.resmed.com)

### **Biotel Inc. /Cardionet**

The US based company Biotel provides outsourcing services for medical corporations additionally it offers medical companies the possibility to contract the development of medical devices, related software and outsource clinical research and the contracting medical devices, software and research services primarily. Biotel holds three operating subsidiaries consisting of Braemar Inc., the corresponding Braemar Inc. Distribution Center, and Agility Centralized Research Services Inc. Agility provides event, Holter and twelve-lead ECG monitoring services for medical device producers and pharmaceutical industries, through Agility these companies and academic can contract research to research organizations worldwide.

Biotel's Braemar subsidiary designs, manufactures and services patient-worn battery powered diagnostic cardiology devices. The portfolio includes 24- and 48-hour Holter recorders and 30-day cardiac ECG event recorders which other companies use RMT and IHPS services. Other manufactured or marketed products include diagnostic electrocardiography devices, event monitors, ambulatory cardiac monitoring devices, holter monitors and playback systems, cardiac arrhythmia monitors, digital and analogue holter recorders, advanced biosensors, a computer based diagnostic monitoring systems, a family of different holter, an ambulatory blood pressure systems, a computer based exercise stress/ECG and a variety of spirometry equipment. The Braemar vertical line of products and solutions enables the integration and management of cardiac data collected through their holter monitors which fits into IPHS. Avanced Biosensor is a brand distributed -by US-based Braemar Distribution. This SME is involved in the wholesale of hospital equipment and supplies. It provides ambulatory electrocardiography devices or holsters and technology for sensors for resting. The market research company Frost and Sullivan has identified the company as a major player in the field of RMT for the United States with some activities in Europe. The company's continuous glucose monitors are coupled with insulin pumps, a concept that comes close to an 'artificial pancreas.' It is powered by a MEMS Fabricated, nano-processed, micro-biosensor platform, and its cellular connectivity alerts patients and others of pending crisis events before they occur. The micro-sensor platform can also be applied to other markets, including lactate measures for athletes, glucose and urea for kidney dialysis patients as well as veterinarian applications [17]

In November 2010 Biotel and the Pennsylvania based Company Cardionet announced a definitive merger on their websites. Cardionet offers RMT services for hospitals and patients on the move. According to their website, Cardionet claims to have been the first company to use mobile networks to monitor cardiac performance through wireless communications. After obtaining FDA approval in early 2002 the company offered service to patients locally. Currently the CardioNet Center monitors over 300 000 throughout the United States based on the CardioNet System combining sensor, monitor and a communication hub. The patient wears the sensor continuously, the latter detects and transmits ECG (electrocardiogram) information to the communication hub. The rationale behind the merger was to provide an entry for Cardionet into the clinical services market through Biotel's subsidiary, Agility Centralized Research Services.

Address: 227 Washington Street #300, Conshohocken, PA 19428

Website: [www.cardionet.com](http://www.cardionet.com)

Company Name: Biotel Incorporated

Address: Biotel Incorporated, 11481 Rupp Drive, Burnsville, Minnesota 55337

[www.biotelinc.com/](http://www.biotelinc.com/)

Address: 400 Arbor Lake Dr 450b

Website: [www.advancedbiosensor.com/](http://www.advancedbiosensor.com/)

### **Biotronik**

The Germany based Biotronik is active in the field of biomedical technology focusing on electrotherapy of the heart and vascular intervention. The Company established itself as an OEM supplier for active implants, electrodes and vascular intervention devices used in cardiology. Its portfolio includes RMT, implantable cardioverter defibrillators (ICDS) and pacemakers with home monitoring capability. On its website the company claims to have pioneered the use of mobile phone and mobile networks for transmitting RMT related data. The Biotronik products are marketed under the brand names Kronos, Lexos, Belos, Philos, and Cardiomessenger home monitoring system. In 2008 the company launched a new home monitoring device offering remote, wireless advanced patient management and providing daily protection for patients with life-threatening cardiac conditions, which falls under our understanding of IPHS. The system has been designed for continuous automatic daily data transmission of the patient's cardiovascular status. Through wireless connection the information is then sent directly online to the patient's physician, allowing her to continuously check their patients' cardiac status and inform caretakers if heart irregularities are detected. The system can also upload heart monitoring data to the internet.

Address: BIOTRONIK GmbH & Co. Woermannkehre 1, D-12359 Berlin. Germany

European Headquarters: Website: [www.biotronik.com](http://www.biotronik.com)

### **Bodymedia Inc**

BodyMedia is a US- based company which has developed a weight management system based on a wearable multi-sensor technology to collect information on activity, calories and sleep patterns. The system is composed of a so called "BodyMedia Armband" monitor, a web portal to access the data, an optional display and some free downloadable applications for Smart phone users. The BodyMedia FIT Armband automatically tracks the calories burned during daily activities and sports. With the monitored quality of sleep, sport or daily activities and calorie intake provided by the user through the online portal, the daily calorie consumption is calculated. By tracking and visualising both nutrition patterns and physical activity, the system supports behavioural changes and helps users create an efficient weight loss program. Obesity is a major health concern in European countries and worldwide hence the inclusion of this company in this Annex.

Address: One Gateway Center. 420 Fort Duquesne Boulevard Suite 1900 Pittsburgh, PA 15222, United States

Website: [www.bodymedia.com](http://www.bodymedia.com)

### **BodyTel**

The Germany based company BodyTel specializes in RMT and management systems for chronic diseases, in particular diabetes. Its products are designed for easy usage and monitoring at home and to communicate vital signals to healthcare professionals and carers. A web interface facilitates patients self-management, it helps them visualise their glucose levels and enables automated transfer of data. Body Tel's products are used in a variety of pilot studies, including the TCity pilot for Independent Living in Friedrichshafen led by Deutsche Telekom. The products GlucoTel, PressureTel and WeightTel collect blood sugar levels, blood pressure and weight, they use Bluetooth to connect the medical devices to the user's mobile phone for transmitting to an internet secured database. GlucoTel became the world's first blood glucose meter to wirelessly transmit results. The technology used for the phones is based on java and does not require users to have the newest

generation of Smart phones. [30, 46, 55]. As per 17 May 2011 an ad from BodyTel on the American Telemedicine Association home page<sup>29</sup> indicated that Glucotel wished to liquidate its IP rights over Glucotel which may indicate that BodyTel is pulling out of the US market.

Headquarters Address: Schlachthofstr. 1, 34537 Bad Wildungen, Germany

Website: [www.bodytel.com](http://www.bodytel.com)

### **British Telecom (BT)**

British Telekom (BT) has a long tradition and experience in the field of health care. Since the NHS was established in 1948 BT has constantly collaborated to improve communication between and within health care institutions. The company has identified the field of telehealth, telecare and telemedicine as a strategic field for further development and expansion. Interestingly the rationale for their strategy makes explicit reference to SIMPHS1. BT is currently setting up a national database and transactional messaging service called SPINE for the NHS, which allows authorised persons to access a database with key information about patients' health. The database will build the backbone for expansion of health related services including an EHR solution which contains information on e.g. allergies, current prescriptions and any adverse reaction to specific medicine. Ahead of a nationwide rollout BT planned to first supply the EHR to a small number of Early Adopter Primary Care Trusts in England. The messaging system combines many new services such as Electronic prescription service, booking of appointments. BT also integrates these services with billing and reimbursement. BT has further built an interactive personal health system by managing the technical services related to the Intel Health Guide. A resulting round of trials in cooperation with the NHS Wakefield District Community Healthcare Services (WDCHS) have been announced in early 2011, for patients suffering from chronic heart failure. The trial uses the Intel Health Guide personal health system to help patients manage their condition from home through integrated care. The RMT device gives personalised feedback based on vital signals and if necessary connects the patients with a health care professional. BT is reorganising its logistics into several communities such as ICT systems for mobile carers, which enables better service provision to out of hospital patients. In parts of London a so called Virtual Community Hospital has been created aiming at providing more efficiently integrated care [56], [57]

Address: BT Centre, 81 Newgate Street, London, EC1A 7AJ

Website: [www.btplc.com/health](http://www.btplc.com/health)

### **Cambridge Silicon Radio (CSR)**

As the Name indicates Cambridge Silicon Radio (CSR) is based in Cambridge, UK. The company designs single-chip wireless devices, in the context of SIMPHS phase 2 the company is important as a supplier of semiconductor solutions to various markets including medical devices. The company was founded in 1998 and has been the first to offer a Bluetooth single-chip solution combining radio, baseband and microcontrollers. Initially, CSR was entirely dedicated to Bluetooth, however since November 2004 it has diversified into other wireless technologies, including WLAN, GPS, FM, Bluetooth low energy and UWB. The company is a member of the Continua Health Alliance, the Bluetooth SIG and the WiMedia Alliance. For the medical market it relies on Bluetooth and Bluetooth Low Energy. Its Bluetooth technologies are used among others in A&D's wireless blood-pressure monitors and weight scales. [58]

Address: Unit 400, Cambridge Business Park, Milton Road, Cambridge, CB4 0WH, UK

Website: [www.csr.com](http://www.csr.com)

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<sup>29</sup> <http://www.americantelemed.org/i4a/pages/index.cfm?pageID=3773>

### **Cambridge Consultants**

Cambridge Consultants is a product design and development firm which belongs to Altran (technology consultants group) and which among other fields offers complete turn-key wireless medical device development, or apply wireless technology to enhance an existing medical device design. It has designed VenaHub, a data collection and aggregation system for personal health management. VenaHub employs a small pocket device to capture data from a user's ecosystem of wireless medical devices, which it then integrates into a customizable online health information portal.

Address: Science Park, Milton Road Cambridge, CB4 0DW England

Website: [www.cambridgeconsultants.com](http://www.cambridgeconsultants.com)

### **Card Guard Group**

The Switzerland based Card Guard AG develops, manufactures and markets advanced telehealth systems and maintains monitoring services for high-risk and chronically ill patients. Card Guard specialises in the manufacture of devices for cardiology, hypertension, diabetes and pulmonology. Cardiology products include ambulatory cardiac telemetry, wireless cardiology, event recorders communicating with through the phone, looping and non-looping recorders and pacemaker follow-up monitors. Card Guard's hypertension products include wireless and desktop blood pressure and pulse rate monitors as well as weight scales. Diabetes products consist of the PMP4 SelfCheck Gluco system. The pulmonology products include spirometers and oximeters. Products under the label OBGYN comprise portable fetal/maternal monitors for high risk pregnancies. In addition, it offers a wireless healthcare system, PMP4 Web-based Medical Centre that provides the tools to screen, monitor and manage the health of average consumers as well as of high-risk and chronically ill patients. Card Guard's target group include the wellness and fitness communities. Over the years all products have evolved to include advanced communication technologies, such as Bluetooth, Internet, Wi-Fi and GPRS. The company started in the mHealth segment through an agreement with the South Korean Samsung Electronics to use the Samsung software applications and mobile handsets in the data transmission systems. The compatibility has subsequently been extended to other phones and smart phones.

Address: Rundbuckstrasse 6, CH – 8212, Neuhausen am Rheinfall, Switzerland

Website: [www.cardguard.com](http://www.cardguard.com)

### **Cardiac Science Corporation**

The US based Cardiac Science Inc. is a company that develops, manufactures, and markets life-saving external cardiac defibrillator devices that monitor and treat patients that suffer life-threatening heart rhythms in hospitals and public places. The company also provides Automatic External Defibrillators for other market participants such as Nihon Kohden, Quinton, and GE healthcare. One of their bedside monitor defibrillator, (Automated External Defibrillator) is a FDA-cleared therapeutic patient monitor that after being triggered instantly and automatically treats cardiac patients suffering from life-threatening heart rhythms.

Address: 1900 Main Street, Suite 700, Irvine, CA 92614

Web site: [www.cardiacscience.com](http://www.cardiacscience.com)

### **Cardiocom**

Cardiocom was founded in 1997 in the United States. The company develops, manufactures and markets patient telemonitoring and disease management solutions. Its main fields of activity are cardiovascular diseases and diabetes care. The latter is marketed under the label GlucoCom™, providing blood glucose monitoring products. Its activities in telehealth related fields evolve around home telemonitoring equipment and telehealth services. Its products include a health hub device. It can be connected with multiple peripherals, such as glucometer, blood pressure cuff, pulse oximeter, peak flow meter, weight scale. The health hub allows an interactive two-way patient communication. The company offers Telescale® and Compact Telescale®, some interactive home

telemonitoring devices integrated with a precision electronic scale. Glucom™ is a diabetes management system which remotely monitors daily blood glucose, BP, vital signs, symptoms and patient compliance. The system also includes a patient glucose test kit, called Autolink™ for an automated transmission of blood glucose data. Based on these readings detailed summary reports are generated and trends are highlighted. The System allows interacting with a specialised nurse in diabetes management. A complete system for the patient includes the Omnivisor patient management software and hardware system. Other products include the interactive bariatric and obesity/weight management system Thin-Link™ which remotely monitors the user's weight, diet, exercise and other lifestyle elements and sends this information to health care professionals. For patients suffering from Cardiovascular diseases the service Cardioplan™ allows daily monitoring and management. The service uses home monitoring devices including a scale and transmits the data to a health specialist nurse. If deemed necessary the systems allows feedback to the patient and the nurse can link the patient to the medical team responsible for them.

Address: 7980 Century Blvd. Chanhassen, MN 55317, USA

Website: [www.cardiocom.com](http://www.cardiocom.com)

### **CAS Medical Systems**

The United States based CASMED provides medical products and supplies related to remote monitoring to hospitals, emergency medical services, home care providers and original equipment manufacturers (OEMs). The OEMs in turn produce devices used in the provision of IHPS, which is why this company appears in this report. The company's product portfolio includes: Absolute Tissue Oximeter, Blood pressure measurement technology, Vital signs monitors and supplies for neonatal care. Its OEM Services includes the production of blood pressure monitoring and other respiratory monitoring systems including bedside monitors to portable monitors.

Address: 20925 Crossroads Circle, Waukesha, Wisconsin 53186

European Headquarters:

Web site Address: [www.casmed.com](http://www.casmed.com)

### **CardioMEMS Inc.**

CardioMEMS is a US based medical device company. The company has developed wireless sensing and communication technology in the form of implants. The corresponding technology platform is designed for the management of severe chronic cardiovascular diseases, including chronic heart failure and aneurysms. These miniature wireless sensors can be implanted using minimally invasive techniques via a catheter and transmit cardiac output, blood pressure and heart rate data. The sensors are permanently implanted into the cardiovascular system of the patient, they work independently from a battery and require no wires. According to the company's website their sensors are fabricated in the range of millimetres with internal features in the nanometre to micrometre range. The data is exchanged via an external module when it is in the vicinity of the implant. The data can then be exchanged with carers and physicians. The medical device producer St. Jude Medical made a minority equity investment in the company and obtained an exclusive option to acquire the entire company in 2010.

Address: 387 Technology Circle NW Suite 500 Atlanta, GA 30313

Website: [www.cardiomems.com](http://www.cardiomems.com)

### **Cardioscan GmbH / Energy Lab Technologies GmbH**

Energy-Lab Technologies GmbH was founded in 1998 in Munich by a researcher in sport and movement science before it moved to Hamburg in 2001. The company develops medical equipment for use in cardiac and stress prevention, i.e. measuring devices which make the current cardiac stress load visible and which can be used for prevention. The company targets what they call the secondary health market which corresponds to the wellness/fitness segment in SIMPHS. Its portfolio includes Cardioscan, a mobile device which carries out ECG measurements faster and easier than traditional ECG and Cardioscan Checkpoint, a more sophisticated version of the latter, which

provides heart check, stress index, cholesterol measurement, blood pressure, metabolism analysis enabling the creation of a complete health profile for training and prevention purposes.

Cardioscan target groups are doctors, end-users and sport and fitness studios. Cardioscan's selling point towards doctors is the possibility to obtain easily a complex overview about important parameters upon which medical advice can be given to patients for prevention purposes. Towards end users Cardioscan promotes the advantages of being healthy, feeling in good shape and attractive, which the Cardioscan products support in combination with advice from a health or fitness expert who can create individual training plans based on the Cardioscan measurements.

Energy Lab Technologies GmbH started with a staff of two in 2001; in December 2010 it was taken over by Cardioscan GmbH which employs 25 people today. Cardioscan gets support from the City of Hamburg. It markets its products in Germany, Benelux, Scandinavia, United Kingdom, Austria and Switzerland.

Address: Hamburg, Germany

Website: [www.cardioscan.de](http://www.cardioscan.de)

### **CareTech**

The Swedish CareTech AB develops and markets telecare, alarm and safety products. The company supplies health hubs and devices for triggering an alarm for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> generation telecare systems for elderly and chronic ill in home care situations, their products target as well as for other public and private applications. The company offers mobile alarm receivers, inter interface units, nurse and warden call systems, mobile communication units, internal systems, room panels, base alarm receivers, and servers for the care management. It also provides accessories, including portable and fixed alarm transmitters, personal alarm buttons, smoke detectors and IR detectors, and door alarms; and alarms for beds and wheelchairs, as well as offers a logging software solution. The company sells its products through dealers and agents. CareTech AB was founded in 1988 and is based in Kalix, Sweden with additional offices in Stockholm and Falun, Sweden; and Frankfurt, Germany.

Address: Nyborgsvagen 197, Kalix, 952 27, Sweden

Website: <http://www.caretech.se>

### **Cirrus Communication Systems**

The British based Cirrus Communication Systems Ltd. has been included as an example of the many companies which are engaged in the design, supply, installation, maintenance, and repair of safety and security products and services. The company is active in the field of telecare targeting the for the extracare and retirement market in the United Kingdom. It provides additionally telecommunication and security solutions, fire alarm systems, and monitoring services to organizations involved in the commercial, residential, and care services markets. The company's systems include warden call, telecare, PBX, broadband and distributed data, door entry and access control, CCTV, fire alarm and emergency lighting, digital terrestrial television, and nurse call systems. The market for Cirrus Communication Systems Ltd. Consists of local authorities, housing associations, house builders, developers, landlords, and blue chip commercial enterprises. Cirrus Communication Systems Ltd. operates as a subsidiary of Peverel Limited.

Address: Oregon House 19 Queensway New Milton, BH25 5NN, United Kingdom

Website: [www.cirruscom.co.uk](http://www.cirruscom.co.uk)

### **Cisco**

US based Cisco started its activities in the field of computer networking and is a major player in this field. Healthcare is one of the strategic fields the company strives to grow. Cisco has identified a lack of connection between different actors in the health care sector. It applies its technology to offer secured connectivity taking the higher privacy and safety demand of the health care sector into account. The company offers its own EHR system and their management, and the data

intensive management of medical images. Their technology for online team meetings and telephone conferences has been adapted to the health care industry. Due to the acquisition of the Norwegian Tandberg, the company is consolidating its telepresence technology which has been modified to meet the needs of practitioners. The resulting Cisco HealthPresence is a technical platform which can be connected with medical diagnostic equipment, such as stethoscopes and otoscopes. Additionally devices for RMT can be connected, e.g. for the measurement of blood pressure, temperature, pulse rate and pulse oximetry. In addition the company provides services to operate the medical devices on behalf of the remotely located caregiver as well as to maintain the technology in good operating condition. The Service has been pioneered in Scotland at the Scottish Centre for Telehealth.

Address: 170 West Tasman Dr. San Jose, CA 95134 USA

Website: [www.cisco.com](http://www.cisco.com)

### **Corscience GmbH**

Founded in 2001 in Germany Corscience GmbH specialises in medical engineering, telemedicine, development services, product development and manufacture of OEM products, tele-monitoring, and tracking systems with a focus on cardiac diseases, for emergency and home care use.

Corscience develops, produces and sells innovative products and solutions in the field of ECG devices. Its product portfolio includes ECG systems, pulse oximeters, AEDs, blood pressure devices, telemetry units and location based services. Sensors are used for measuring vital signs for COPD, asthma, heart failure, heart arrhythmia, data can be transmitted via fixed or mobile connection into a database of patient records for storage and further processing. Patient data can be analysed and visualised via graphic programmes. In addition, the company offers full fledged RMT solutions based on their ECG devices, sensors, ECG server and software for data analysis. Corscience products can be integrated into products from other companies under their own name.

Corscience has about 50 employees. Its location in Erlangen was chosen because of the relatively high concentration of companies dealing with medical technologies in the area as well as its proximity to specific universities and higher education centres.

The Corscience products are sold through a network of partners in Germany, France, Greece, Austria, Switzerland, Slovak Republic, Spain, Czech Republic, Hungary, as well as in Asia (China, South Korea) and South America (Brazil).

Address: "Innovationszentrum für Medizin und Pharma" (IZMP), Erlangen, Germany

Website: [www.Corscience.de](http://www.Corscience.de)

### **Custo Med GmbH**

The Germany based Custo med GmbH is a supplier of cardiopulmonary diagnostics which offers computer-aided diagnosis systems both stationary and ambulatory, for pulmonary and cardiovascular diseases, including software solutions for analytics and surveillance. In the field of prevention the company offers a flash memory based EHR for rehabilitation and prevention; the system is designed to support efforts to lose weight. The company offers a line of treadmills and cardiovascular training devices that connect to hospital information or EHR systems, incorporate a continuous ECG and has an integrated alarm system in case of an event.

Address: Leibnitz Strasse 7, 85521 Ottobrunn, Germany

Website: [www.customed.de/en](http://www.customed.de/en)

### **Danmeter A/S**

The Danish company Danmeter applies its technological expertise to the field of measurement of neurological signals and sedation management. Accordingly hospitals are its main market. Its brain function monitor products include small, handheld, battery operated devices featured with wireless technology to be connected to a healthhub which can potentially be used for the delivery of IPHS.

Address: Falen 18 B DK-5000 Odense C Denmark

Website: [www.danmeter.dk](http://www.danmeter.dk)

### **Deutsche Telekom**

The Germany based Deutsche Telekom is an integrated telecommunications companies, with over 129 million mobile customers, around 37 million fixed-network lines and approximately 16 million broadband lines. According to Deutsche Telekom's future strategy the healthcare sector becomes one of the core sector the company strives to generate revenues from. Deutsche Telekom focuses on providing secure networking services for physicians, hospitals, patients, and health insurers. It aims to reduce the costs of healthcare, improve healthcare provision, and ease the lives of elderly and chronically ill people. As of 2010 the operator is running two large scale trials for health related services, one of these being in the experimental T-City in Friedrichshafen which includes the diabetes management system GlucoTel and a programme for remote patient care. Within this interactive care of people with chronic illnesses which focuses in particular on cardiovascular diseases the system enables care givers to carry out their visit rounds virtually. It has been used in T-City since 2007 and thus represents one of the first telemedicine projects in Germany which falls under the definition of IPHS. In cooperation with the German Red Cross (DRK) and St. John's Ambulance (JUH) Deutsche Telekom further sets up a tracking system for missing or injured persons in the T-City Friedrichshafen. The service is called *derButler*, which triggers a response chain when the user falls, the device automatically establishing a voice link to the emergency call centre.

Another service provided by Deutsche Telekom is CardioMessenger, a cardiovascular diseases related service which connects the patient's pacemaker to a service centre and a specialised iPad app for the doctors. The application unites data from the different hospital systems - the central information system, the radiology unit and laboratories. Deutsche Telekom also plans to sell from mid-2011 onwards VitaDock mobile healthcare modules in their T-Shops retail outlets in Germany. These devices allow patients to read, store, evaluate and relay their blood glucose, blood pressure, pulse, temperature and weight data via smartphones and tablet computer. In Hungary, representatives of Cisco Hungary and Deutsche Telekom's subsidiary Magyar Telekom have been handed over a state-of-the-art connected hospital infrastructure at Bethesda Children's Hospital in Budapest with the mission to develop a new communication infrastructure that will help in streamlining medical services and improve the efficiency of treatment, including the delivery of care outside of hospital settings [59, 60].

Address: Friedrich-Ebert-Allee 140, 53113 Bonn Germany

Website: [www.telekom.de](http://www.telekom.de)

### **Docobo**

The British health care solutions provider Docobo was chosen for a case study in SIMPHS1 and an interview had taken place with its founder. The doc@home system was trialled by the City University, London in June 2003 and received initial EU founding through the eTEN programme. Today the company serves the healthcare solutions providers segment. For this purpose it has developed RMT services around their telecommunication hub for patients suffering from chronic conditions and is expanding services. Their service portfolio includes a variety of integrated solutions for the collection, management and analysis of patients' vital signals and related data. Their main products are the HealthHUB used to transmit relevant patient data and enabling a two-way communication while the doc@home services are used to analyse these data and enable the support of patients through a web portal from a variety of locations.

Address: 21 High Street Bookham Surrey KT23 4AA

Website: [www.docobo.co.uk](http://www.docobo.co.uk)

### **Dossia**

Dossia is an open-source web based EHR which contains aggregated information including health data from doctors offices, health plans, pharmacies and labs, and data entered by the user. The initiative has been launched by some of the major companies and organisations with a large workforce in the US. According to the website of the consortium only the user determines who has access to the data and decides with whom they want to share the information.

Address: 210 Broadway 3rd Floor Cambridge MA 02139

Website: [www.dossia.org](http://www.dossia.org)

### **Dräger Medical AG & Co**

The German Company is a joint venture between Drägerwerk AG and Siemens AG. It has a comprehensive product portfolio of patient monitors for emergency, perioperative, critical care, perinatal care and homecare. According to their own website, Draeger is among the largest patient monitoring companies globally. Its portfolio comprises various vital signs monitors for central station monitoring and low acuity monitoring and ventilators as well as wireless monitors to be worn by the patient. The latter is the reason for which Dräger Medical has been included in this report, as it can potentially play a role in the delivery of IPHS.

Address: Drägerwerk AG & Co. KGaA Moislinger Allee 53-55 23542 Lübeck

Website: [www.draeger.com](http://www.draeger.com)

### **Dr. Gerhard Schmidt GmbH**

The medical device supplier Dr. Gerhard Schmidt, a company set up in 1995, is based in Germany and offers small, portable ECG and blood pressure monitors for long term or continuous use. The company has developed software for the evaluation of the results and the service of remote maintenance of the service.

Address: Wellesweiler Str. 230 D-66538 Neunkirchen Germany

Website: [www.computerkardiographie.de](http://www.computerkardiographie.de)

### **Epocrates**

The US based tool and database Epocrates provides information on medications and conditions. Due to legal constraints and legislation the company mainly targets the Northern American market. According to the company themselves one third of the practitioners and medical doctors in the US use the mobile Epocrates applications for accessing health and drug related information. Different yearly subscription models are available. A slimmed down free software is the second most popular health application in the Apple's Apps Store, even outside of the United States. Patients use it to better manage their disease and understand their medication. The product enables evidence based medicine and medical care at the point of care and helps care givers to make better informed decisions, even if they are providing the services outside an institutional setting. Additionally the company offers mobile phone-based test support solutions, tools for students for the preparation of exams in medical schools and programmes facilitating the basic understanding of science related to medicine. As of 2010 the company announced a cooperation with the pharmaceutical company Pfizer

Address: 1100 Park Place Suite 300 San Mateo, CA 94403

Website: [www.epocrates.com](http://www.epocrates.com)

### **ERGO-FIT**

ERGO-FIT is a German manufacturer of equipment for fitness studios and rehabilitation for cardiovascular diseases. Some of their home trainers and exercise bikes include RMT for pulse frequency. The training programmes can be adjusted according to the rehabilitation needs and the collected data can be transmitted to a computer or health hub via a serial cable (RS-232).

Address: Blocksbergstraße 165, 66955 Pirmasens

Website: [www.ergo-fit.de](http://www.ergo-fit.de)

### **Fairbanks Scales**

The US-based scale producer Fairbanks has a long tradition in the production of industrial weight scales and precision scales for hospitals and consumer health purposes. The TeleWeigh™ Health Scale has sensors and scales for measuring, recording and transmission of the user's weight, it uses the Bluetooth technology for the transmission of data to a health hub, mobile phone or computer.

Address: 821 Locust Street, Kansas City, MO 64106, US

Website: [www.fairbanks.com](http://www.fairbanks.com)

### **Fitbit**

The US based start-up Fitbit produces a small clip, which contains a triaxial accelerometer to record the movements of the user. It can be attached to cloth, belts or wristbands. The device calculates the calories burned according to body measurement already provided, it records sleep periods as well. While recharged the device connects over its base station wirelessly with the website over a health hub or a computer and uploads the information that does not only track the user's steps; it calculates the intensity level of the user's movement, the distance travelled and the calories burned. Its online platform displays overviews of activity levels and allows the user to add data about food intake.

Address: 625 Market Street, Suite 1400 San Francisco, CA 94105

Website: [www.fitbit.com](http://www.fitbit.com)

### **Fold**

Fold is a housing association in Northern Ireland which provides a range of housing and auxiliary services, amongst which social alarms, telecare and telehealth services throughout the whole of Ireland. Fold activities are marketed under the label of Telecare to formal and informal carers for a more efficient use of social and health care organisations' resources through ICT technologies. According to their website Fold caters for 20 000 homes across Ireland, the company makes 100,000 morning calls and is handling 240,000 emergency calls a year.

Address: 3-7 Redburn Square Holywood BT18 9HZ

Website: [www.foldgroup.co.uk/](http://www.foldgroup.co.uk/)

### **Fukuda Denshi**

The Japanese Company Fukuda Denshi produces cardiology instrumentation, patient monitoring and ultrasound technologies, with its main line of product markets catering to the needs for monitoring equipment for critical care and diagnostic ultrasound equipment. Additionally the company produces portable and rugged ECG and digital holter recorder, which is waterproof and can be worn by the patient in their daily life. A software allows cardiologist to assess the data and compile reports, the transmission is done either directly at the cardiologist's or via third party health hubs.

Address: 3-39-4 Hongo, Bunkyo-ku, TKY 113-8483 Japan

Website: [www.fukuda.co.jp/english](http://www.fukuda.co.jp/english)

### **Garmin and Dynastream Innovations**

In 2006 the Switzerland based Garmin acquired the Canadian company Dynastream, The GPS equipment manufacturer purchased this company specialised in the motion sensing technology to expand into the medical and training market. Dynastream motion sensors can be found in particular in foot pod systems used to record training and wellness, their first major customer has been Nike for their NIKE+ line of smart running shoes. Their sensors are now used in a variety of products such as from Nike, Polar, and Suunto (a designer and manufacturer of sports precision instruments). Dynastream owns the property rights of the so called ANT standard and its open-source Version ANT+; these wireless communications protocol stack and associated chips can be found in devices targeting the fitness and wellness market in particular, like heart rate monitor, speed and distance

monitors, bike speed and cadence sensors, bike power sensor, weight scale including BMI and percent body fat calculation, fitness equipment data sensors and temperature sensors. The company attempts to promote ANT+ in the promising fields of health care and home automation putting forward its low energy consumption compared to e.g. Zigbee.

Address: #201, 100 Grande Blvd. Cochrane, Alberta Canada T4C 0S4

Websites:

[www.thisisant.com](http://www.thisisant.com)

[www.dynastream.com](http://www.dynastream.com)

[www.garmin.com](http://www.garmin.com)

### **Google Health**

The incumbent market leader in search engine has developed a wealth of services, among which a service for centralising personal health information online. The information is entered voluntarily, allowing the user to organise, track and share health information online and thus monitor their health status. It allows the merging of separate health records into one centralised profile. Initially Google cooperated with the renowned Cleveland Clinic for testing their system and partnered with a number of pharmacies to allow patients to download their medication regimens. Through this partnership it became possible to search for potential interactions and alternative medications. Google is also cooperating with insurance companies using codes as a proxy for patients' conditions. The company has the declared goal to build an ecosystem around this service and uses an open API standard to attract cooperation. As one of the founder Larry Page returned as the CEO of Google there have been rumours about the fact that the initiated consolidation process may slash services like Google health.

Address: 1600 Amphitheatre Parkway, Mountain View, CA 94043

Website: [www.google.com/health/html](http://www.google.com/health/html)

### **HeartMath LLC**

US based HeartMath uses feedback on physiological signals to manage stress, employing breathing techniques through a portfolio of services which include training programs, coaching, publications, licensing programs and ICT based technologies. Such feedback should enable the user to control better their emotions; according to the company this has beneficial results for the overall wellbeing of individuals and reduces stress imposed on the heart. The products allow to visualise certain vital signs on a screen, and teach the user how to influence these. Their emwave handheld device reads the user's heart rhythms through a finger or ear sensor and gives immediate feedback. With a software package the device can be used at home and is designed for potential integration in a prevention scheme managed by health care professionals. Their institutional client base is mainly located in the United States and includes Stanford Business School, Stanford Hospital, Scripps Center for Integrative Medicine and Kaiser Permanente.

Address: 14700 West Park Avenue, Boulder Creek, California 95006 USA

Website: [www.heartmath.com](http://www.heartmath.com)

### **High Five Health Promotion**

The Netherlands based company High Five Health Promotion maintains fitness studios and is specialized in making and keeping employees fit through customised services and supervision. It offers a web-based application called Health Platform with a built-in individual health monitor. Employees can access their personal health details and personalised feedback from health specialists. The structure of the service encourages physical activity and training using a motion monitor.

Address: Schinkeldijkje 18 1432 CE Aalsmeer

Website [www.highfive.nl](http://www.highfive.nl)

### **Honeywell Hommed**

The medium sized company Hommed is based in the United States and was acquired by Honeywell in 2004. It now forms part of the Honeywell Life Safety business unit. It is active in telehealth and remote patient monitoring where it offers a system with a home unit that collects patient vital sign measurements and poses qualitative health-related questions. The vital signals and the health data is then automatically transmitted via wireless technology or internal modem. The device can also prompt the patient to measure her vital signals or take her medication. The Hommed system supports multiple simultaneous-use peripheral attachments for measuring a variety of signals, the connected devices include weight scales, blood-pressure monitors, blood-glucose meters, pulse oximeters amongst other. A Central station reviews and assesses the data. According to the Market research company InMedica, Honeywell Hommed held around one fourth of the market for RMT services outside of hospitals in 2009, yet new market entrants reduced their share in this expanding market.[46] It has a large home health customer base serving over half a million patients globally. Within the EU the company serves over 40,000 patients in the UK. HomMed is also active in Italy, Germany and in the Netherlands. The integrated insurance company Kaiser Permanente in the US is their biggest client, Honeywell provides Kaiser Permanente with a closed system. HomMed further analyses the data with its own software tools and provides software for data analysis via its LifeStream Platform Software. This software combines EHR with analytical tools allowing practitioners to manage and prioritize care as well as view nursing or physician notes, log patient contacts, analyze trends, and print or fax reports.

Address: 3400 Intertech Drive, Suite 200, Brookfield, Wisconsin 53045, US

Website: [www.hommed.com](http://www.hommed.com)

### **Inotive Solutions B.V**

Inotive Solutions B.V. describes itself as a start up in the area of "Connected Wellness" located in the Netherlands. It was founded in 2007 by two people with longstanding experience in consumer electronics and telecommunications. The company develops and produces Youw8 (you-weight'), an online personal coach which helps people reach and keep their desired weight. The "Youw8 Easy" scale enables to calculate BMI and follow up fat and muscle evolution. The scale is internet enabled, data is transmitted automatically to a secured account by radio frequency and users access their data on internet. The product can be used by the whole family by giving access to several user profiles.

Youw8 promotes its system as supporting weight management motivation and healthy lifestyles. A personal trainer or nutrition specialist can follow the evolution of measurements and advise users. The scale is easy to use, as data are transmitted (via a router) without needing to connect a PC nor use any specific software.

Address: Inotive Solutions B.V., Aardappelesterssteegje 4a, 5671 CV Nuenen, Netherlands

Website: [www.inotive.com](http://www.inotive.com)

### **Intel**

Intel is a global ICT company, its main customer base include OEMs and ODMs who produce computers, cellular handsets, PDAs, telecommunication equipment and networking equipment. The company has recently entered the Health Care market. The main target group is senior citizens and patients with chronic diseases, who want to continue to live as independently as possible. [46]

General Electric and Intel have announced an alliance called *Care innovations* with the aim of developing and bringing to market home-based health technologies. One outcome is the Ambient Assistant Living product line called GE QUIET CARE, which allows vital signal and motion monitoring at the home of the patients without intrusive visual surveillance technology. The Intel Health Guide is an RMT based care management tool, which targets health care professionals who are responsible for the care of patients with long-term chronic conditions. It records important patient information including vital signs such as blood pressure, oxygen levels and weight and sends them for analysis. It enables communication between patients and health care professionals. Access to

EHR is included. As a personalised care management tool it provides facilities such as vital sign collection, patient reminders, surveys and video conferencing. This device is used to monitor the various vital signals and communicate them to the physician through an online interface.

Address of Care Innovation: 1900 Prairie City Road Folsom, CA 95630

Website: [www.careinnovations.com/](http://www.careinnovations.com/)

Address Intel: 2200 Mission College Blvd, Santa Clara, CA 95054 -1549, US

Website Intel: [www.intel.com](http://www.intel.com)

### **LifeWatch**

The Switzerland-based producer of telemedicine products and service provider LifeWatch AG designs, produces and sells electronic heart monitors. They wirelessly transmit patient data to technicians and physicians for remote evaluation. Their business model is based on a subscription fee for the signal monitoring, data evaluation, and notification services. Additionally the company profits from selling products under a variety of different brand names including LifeStar, PMP4, and Card Guard. The company has several centres globally to monitor patients. Their customers include cardiologists, diagnostic clinics, and hospitals. Their offer covers ambulatory heart monitoring and the company is expanding into home sleep testing services. [33]

Address: Rundbuckstrasse 6 CH – 8212 Neuhausen am Rheinfall Switzerland

Website: [www.lifewatch.com](http://www.lifewatch.com)

### **Life Record**

Life Record Inc. offers a variety of healthcare applications and started as an online EHR in the late 1990s. Its features include e-prescriptions, billing, in-lobby enrolment, real time patient updates, messaging technologies, voice recognition and dictation, transcription, online patient interactivity, and advanced imaging. It allows practitioners to stay in touch with their patients and communicate via smart phones or SMS, using encrypted communications. Part of the portfolio is *ChartAnywhere*, which enables a physician to refer and share information on a patient's medical record, including notes, labs information, imaging, prescriptions and active medication. The iDiag application on smart phones is only one example of the many health related application currently available. The latter has been designed for medical professionals and is not intended for end user self-diagnosis. It is an ICD9 index and reference system facilitating diagnosis for practitioners and is *the* reference in that field.

Address: 403 West Broadway Suite 133 Bloomfield, NM 87413-5977, United States

Website: [www.idiag.liferecord.com](http://www.idiag.liferecord.com)

### **Lifescan**

US based Lifescan belongs to Johnson & Johnson and has expertise in diabetes management. It is one of the global leaders in the area of continuous blood glucose monitoring systems. The more advanced part of its ONE TOUCH product line can upload the data to a computer and share it with carers. Their business model is based on the sale of test strips.

Address: 1000 Gibraltar Drive, Milpitas, CA 95035

Website: [www.lifescan.com](http://www.lifescan.com)

### **Linde Respiratory Homecare section**

The Linde Group produces industrial gases and provides engineering services, its Healthcare division is fast growing according to the information published on their website. The care program REMEO specialises in the care of long-term ventilated patients, bridging the gap between the time when a patient no longer needs monitoring in an Intensive Care Unit and when homecare is not yet possible. The patient is then taken care of in a specialised centre. When the patient qualifies for returning

home, REMEO staff will continue to provide full medical and technical support. RMT and telecare services help the patient at home to avoid readmission in hospitals or ICU. The service is currently offered in Germany, Italy, Portugal, United States, Chile, Argentina and Venezuela.

Address: Linde Gas Therapeutics GmbH Landshuter Straße 19 D-85716 Unterschleißheim

Website: [www.linde.de](http://www.linde.de)

[www.remeo.com/en](http://www.remeo.com/en)

### **Medtronic**

The US based Medtronic group provides pacemakers and neuromodulation implants. Its portfolio includes solutions to handle emergency cardiac problems with automated external defibrillator and defibrillator monitors as its core offer. The newer generation of pacemaker can be remotely monitored through wireless communication.

Under its Minimed brand Medtronic offers integrated diabetes management systems after having identified the potential of using its expertise in diabetes management by creating a lifelong wearable pump. The company has a complete range of products for the management of diabetes including insulin pumps and personalised diabetes data management systems connecting the patients through a web interface with its professional carer. Minimed offers continuous glucose level monitoring with an inbuilt alarm system that notifies the patient or the caregiver when the insulin levels are high or low.

Address of Minimed: Route du Molliau 31, Case postale, Tolochenaz, Switzerland

Website Address: [www.minimed.com](http://www.minimed.com)

Website: [www.medtronic.com](http://www.medtronic.com)

### **Medic4All/Telcomed**

Medic4All is a holding company active in the field of telemedicine, with origins in Israel it is now based in Switzerland, the Irish Telcomed belongs to the holding. Their activities split into two branches: services and technology. The Israel based technology branch develops and manufactures medical monitoring devices, gateways and software and applications while it is in Italy that specialised services are developed around their technology to provide complementary telemedicine services for its products.

The company has specialized in a wide variety of wireless wearable home-care products. Its service offering includes end-to-end remote medical monitoring platforms, integration and development services. The vital signals it captures include Blood pressure, 1 Lead ECG, Heart rate, Heart rhythm regularity, Respiratory rate, Oxygen saturation (SpO2), Body temperature, Blood sugar levels (glucose) and Weight. The company sells wireless peripheral devices, blood-pressure monitors, blood-glucose meters, health hubs and gateways, both using a fixed line and a mobile phone. The holding Medic4All markets the different products to a broader client base, including insurance companies and companies active in the fitness and wellness market, such as fitness studios sport societies and athletic associations.

Address: Hamefalsim 10, P.O.B 4222, Petach Tikva 49000, Israel and 14 Merrion Square

Dublin 2, Ireland

Website: [www.telcomed.ie/](http://www.telcomed.ie/)

Address Medic4All Services – Switzerland Via Peri 17 Lugano 6900

Website: [www.en.medic4all.it](http://www.en.medic4all.it)

### **Meigaoy**

This Chinese company develops, manufactures and sells medical devices. Its portfolio includes Holter System, Multifunction PC-ECG System, Stress Test ECG System, Telemetry ECG Monitoring System, Ambulatory Blood Pressure Monitor, Personal ECG Monitor, ECG Network Information System. As an OEM manufacturer it sells its products under different names and these can be used for the provision of IPHS.

Address: No.21, Chaoqian Road, Changping Science Park, Beijing, 102200, China

Website: [www.meigaoy.com](http://www.meigaoy.com)

### **Microlife**

The Swiss based company Microlife develops and manufactures medical diagnostic equipment for both home monitoring and institutional care. Their health care activities started through the introduction of a digital clinical thermometer. Blood pressure monitors, digital thermometers, asthma monitors and flexible heating are Microlife's core business. Today it has become one of the largest suppliers of blood pressure monitors and digital thermometers in the world, yet so far just a few of their products are wirelessly connected to a health hub or PC. Microlife is a member of the Bluetooth SIG and the Continua Health Alliance. Its product portfolio also includes peak flow meters and weighing scales.[33, 46]

Address: Espenstrasse 139, CH-9443 Widnau, Switzerland

URL: [www.microlife.com](http://www.microlife.com)

### **Microsoft**

The software giant Microsoft ventured into the health care market and launched an online EHR in 2007 called HealthVault which helps end users and health care professionals consolidate and coordinate different EHR from disparate pieces of health-care information, including lab results, prescription records, X-rays, allergy information and vital signals. Investment and maintenance costs for the HealthVault hardware and databases are borne by Microsoft, similar to e.g. Google health. The company hopes to overcome the reluctance of e.g. smaller practitioners to use ICT for costs reasons. Microsoft hopes to generate revenues through sponsored links on an integrated medical search function independent from their own Live.com or other search engines. Additionally a whole ecosystem of products and services is expected to emerge around HealthVault, linking health and fitness devices to HealthVault. As an example a glucose meter transmits data directly allowing the diabetes patient's endocrinologist to access the data immediately. Products which are compatible include among others, blood pressure meters, weights and glucose meters by A&D Medical and Bayer, handheld ECG by DailyCare BioMedical, personal trainers by Fitbit Inc., PulseOximeter from Nonin and HeartRate from Polar. Microsoft's own Kinect sensor which captures body movements to control the video game console xbox also supports the use of the HealthVault through sport and fitness themed games. By using additional sensors to measure the heart beat and breathing, training efforts and effects can be tracked and transmitted into Microsoft HealthVault.

As part of Microsoft's cloud computing strategy new service Amalga centralises digital information from multiple clinical and administrative systems across organizational boundaries. It aggregates data and delivers comprehensive patient information to healthcare professionals into a regularly updated repository. Through HealthVault the patient can contribute to this repository. The service can be seen as complementary to the healthVault and targeting health care institutions. From a SIMPHS 2 perspective the combination of these two is interesting as it can serve as the backbone for setting up IPHS related services. Microsoft itself actively targets Telecommunication providers as partners for the provision of such services.

Address: One Microsoft Way Redmond, WA 98052-7329

Websites: [www.healthvault.com](http://www.healthvault.com)

[www.microsoft.com/amalga](http://www.microsoft.com/amalga)

### **Nihon Kohden**

Nihon Kohden is a Japan based manufacturer, developer, and distributor of medical electronic equipment. The portfolio includes supplies products for patient monitoring, neurology, sleep assessment, and cardiology. While their products target institutional care, their wireless ECC can be connected through a health hub and records events in case the patient is moving out of the wireless range. It can be used in a home setting and thus integrated into the offering of IPHS.

Address: 1-31-4 Nishiochiai, Shinjuku-ku, Tokyo 161-8560, Japan

Website: [www.nihonkohden.com/](http://www.nihonkohden.com/)

### **Nike**

The sport and lifestyle brand Nike integrate acceleration sensors in their running shoes and connect them with music players from Apple. This allows athletes to track their training progress, measure the distance covered and corresponding pace as well as calories burned, which contributes to their motivation. The technology has been extended to cardiovascular work outs in sport gyms. Initially the system was based on Nike and Apple products exclusively, yet the two companies have grown apart and the system has become more open to third parties. Nike+ is a clear example of how a consumer electronics business model can work in the health area by targeting wealthier customers and offering a product that helps motivate users through structured feedback.

Address: One Bowerman Drive, Beaverton, OR 97005

Website: [www.nike.com](http://www.nike.com)

### **Nintendo**

Nintendo has realised the Wii home video game console released its main feature distinguishing it from other consoles at the time of its first release is its wireless controller, which can detect movement in three dimensions. The target group for the device expand to broader parts of the society than other game consoles market their product. Its games can be controlled by movement, an increasing set of games are dedicated to health and prevention, they offer the possibility to store and compare training results. Some additional controllers are available to support gymnastics and e.g. yoga. Address: 11-1, Kamitoba hokotate-cho, Minami-Ku, Kyoto, 601-8501 Japan

Website: [www.nintendo.com](http://www.nintendo.com)

### **Nonin**

Nonin is a privately owned company based in the United States; it was founded in 1986 and entered the healthcare market with a pulse oximeter. The company has since then expanded its portfolio with a full line of proprietary pulse oximeters and supporting products and has become one of the world's largest suppliers of pulse oximeters. The company has pioneered with the introduction of a pulse oximeter which is able to communicate wirelessly with similar devices. Their products can be integrated in different setups for the provision of medical and social care, their fingertip pulse oximeters have been designed according to the Continua™ Version One Design Guidelines. Nonin is a member of the Bluetooth Special Interest Group and has been a founding member of the Continua Health Alliance.

Address: 13700 1st Avenue North, Plymouth, Minnesota, 55441 5443, US

Website: [www.nonin.com](http://www.nonin.com)

### **Nordic Semiconductor ASA**

The Norwegian company Nordic Semiconductor ASA produces low cost and ultra low power (ULP) wireless chips and semiconductors. The company started as a spin-off from the university of Trondheim and specialises in design solutions at microchip level, in the areas of wireless communication, consumer electronics and multimedia.

The Nordic Semiconductor chips are used in a variety of solutions in the medical and fitness related industries due to their low energy consumption. The company explicitly mentions their use in Wrist top hubs / watches, Blood glucose meters, Blood pressure meters, Pulse oximeter meters, Heart-rate belts, Blood glucose sensors, Blood pressure sensors, Pulse oximeter sensors, Activity sensors,

Weight scales. As to the fitness market their semiconductors are used for Heart-rate belts, Speed-distance foot pods, GPS pods, pedometers, activity sensors, bike cadence sensors, bike speed sensors, bike power sensors and weight scales. Nordic Semiconductor is a member of the open source Bluetooth Special Interest Group and the ANT+ Alliance.

Address: Otto Niensens veg 12, 7004 Trondheim, Norway

Website: [www.nordicsemi.com](http://www.nordicsemi.com)

### **Orange**

Orange Group is the mobile arm of France Telecom, the former state national telecommunications company. FT created a "Orange Healthcare" division in France to ensure that in the future medical practices in both urban and rural areas will be able to benefit from advanced communication thus solving the problem of isolation. According to its strategy the company aims to become a leader in European eHealth solutions. Its first E-Healthcare offering to hospitals is called Connected Hospital which aims at improving patient comfort and quality of life, a solution involving terminal for patients and for healthcare professionals. Some of these terminals are mobile terminals for voice data exchange, interactive terminals, GPS patient wristbands and devices that enable monitoring or even assisting healthcare workers in isolated situations. In terms of IPHS an interesting initiative from Orange and its partner the medical device manufacturer Sorin Group aims at developing remote monitoring for patients with implanted, cardiac rhythm management (CRM) devices.[61] To make the work of caregivers easier, Orange, along with Sorin Group has introduced a CRM device that would send data to a non-invasive monitoring system at the patient's home. This will be integrated with the Orange Business Services' capabilities to manage the transmission of data to the physician. This system has two advantages. One is that the data gathered through the process will help doctors to monitor the progress of the cardiac disease and give immediate feedback. This avoids unwanted hospitalization and improves the quality of life of the patient. Secondly, the data recorded at home will provide appropriate results about the patient's condition to all involved caregivers. Further to this initiative, the company has also started a telemedicine service called Diabeo, allowing type 1 and type 2 diabetics to track their own treatment for diabetes. The service which is being implemented in France in a pilot is available on certain mobile phones of the company HTC in partnership with a healthcare provider called Voluntis. It is composed of a mobile app, a web portal for clinicians and a web portal for patients.

Websites of the service [www.voluntis.com/en/our-solutions/telecare/diabeo.html](http://www.voluntis.com/en/our-solutions/telecare/diabeo.html)

In French: [www.diabeo.com](http://www.diabeo.com)

In Austria Orange and Lucent Alcatel pioneered with Arbeiter Samariterbund in creating the mobile health service "healthe". At the core of this subscription based service is an easy to use mobile diary which can securely upload information into the EHR of the care providers and automatically sends email/SMS alerts for missing data inputs or alarms if readings fall outside a predefined range. A €10 monthly subscription fee is paid by the user. The project relies upon a consortium of highly integrated partners. Alcatel-Lucent brings technical expertise to the medical platform, as well as the mobile applications; the device manufacturers, Nokia and Lifescan, have enabled their respective mobile handsets and medical devices for "healthe". Arbeiter Samariterbund provides the medical expertise and runs the medical hotline and backend. The offer is sold in the Orange Shops throughout Austria.

Website in German: [www.healthe.at](http://www.healthe.at)

In 2010 Orange's UK subsidy (Orange UK) launched a mobile health service called Orange "smartnumbers." The service enables organizations to handle calls made to mobile numbers in accordance with specific service needs. In the health care context it aims at reducing the time it takes to contact a particular healthcare professional and also grant users instant access to the best placed person or healthcare team available to take a particular call. The service targets both patients and formal and informal carers.[62]

Website: [www.business.orange.co.uk/home/public/products-and-services/applications-and-solutions/orange-smartnumbers](http://www.business.orange.co.uk/home/public/products-and-services/applications-and-solutions/orange-smartnumbers)

### **Omron Healthcare**

The Japanese Omron Healthcare is a subsidiary of Omron Corporation. The company focuses on healthcare products for both home and professional use. It was founded in 1933 and has become a leading marketer and distributor of medical, home healthcare, and wellness products. According to market research it is the world's largest suppliers of blood pressure monitors. The company is a member of the Bluetooth SIG, the WiMedia Alliance and the continuous health alliance. Its products include blood pressure monitors, temperature measurement monitors, respiratory therapy, weight management, step counters, toothbrushes, electro cardiograph. The more advanced products of each category have the technological ability to be included in the IPHS.

Address: 3-4 -10 Toranomon, Minato-ku, Tokyo 105 – 0001, Japan. Website: [www.omron-healthcare.com](http://www.omron-healthcare.com)

### **Qualcomm**

The Californian Qualcomm specializes in the design and sale of hardware devices and semiconductor chips while it outsources the fabrication of the devices to a specialized manufacturer. The company has been active in the mHealth segment since the year 2000, together with Corventis the company develops wireless disposable band aids, which use Bluetooth. These band aids have physical sensors incorporated to measure vital information such as heart rate and skin temperature. Its early venture in the mHealth market LifeComm was a mobile phone based health care service which failed in 2008 due to funding problems, yet some of the products designed and developed for this service are still available on the market. [33]

Address: 5775 Morehouse Drive San Diego, CA 92121 USA

Website: [www.qualcomm.com](http://www.qualcomm.com)

### **OBS Medical**

The British company OBS Medical was formed as a spin-off from Oxford University and initially developed signal processing solutions for the healthcare sector and algorithms for monitoring jet engines. After a merger with an other Oxford based spin-off - t+ Medical - the resulting company was renamed OBS Medical. It offers a range of solutions for in hospital monitoring, RMT and telecare; in addition the company conducts clinical trials. For asthma, blood pressure, COPD and diabetes the company is offering software and hardware solutions to manage patients with long term conditions at home; the service includes a call centre manned by nurses who conduct and supervise the RMT. An mHealth solution to track results during trials is included as well.

Address: 174 Milton Park Abingdon OX14 4SE

Website: [www.obsmedical.com](http://www.obsmedical.com)

### **OTE**

The Hellenic Telecommunications Organization (OTE S.A.) is the largest telecommunications provider in Greece, and the company forms together with its subsidiaries one of the leading telecom groups in South Eastern Europe. According to the market research company Frost and Sullivan OTE offers high resolution for video conferencing targeting medical staff, in particular in rural or sparsely populated areas. OTE offers a nationwide four digit number, which allow users to make an appointment in public hospitals or access health resources and information. The service uses sophisticated voice recognition and integrates alarm systems for telecare. [57]

Address: 99 Kifisias Av., Marousi, Athens

Website: [www.ote.gr](http://www.ote.gr)

### **Portugal Telecom**

The Portugal Telecom's (PT) subsidiary Inovação has developed a diagnosis platform through PC for distance medicine care. By using UMTA the service allows a higher degree of mobility. The platform is used as well to serve as an instrument for training doctors and other health professionals. The social care service PT Emergency provides remote support at home to persons at medical risk. It is

an ambient assisted living service composed of a fixed telephone base and sensors with an integrated automatic alarm activation with predefined numbers. Portugal Telecom operates a corresponding terminal with a 24hr connection to the Portuguese Red Cross, called TeleAlarm. In the field of EHR PT cooperates with Philips and the Coimbra Hospital Centre, and runs the Central Archive Platform, a system for central storage of medical images and distribution of radiological information, so far only for use within the hospital [57].

Address: Av. Fontes Pereira de Melo, 40, 1069-300 LISBOA

Website: [www.telecom.pt](http://www.telecom.pt)

### **POLAR Electro**

According to their website the Finland-based Polar Electro OY pioneered the first wireless heart rate monitor (HRM) in 1977. The company now operates internationally in more than 80 countries and employs around 1355 people globally. The Polar heart rate and fitness assessment technology is used to guide training efforts both by professional athletes and hobbyists. Its additional software provides automated and personalised feedback enabling individuals to improve their fitness level and sports performance. Polar technology is employed by fitness facilities, athletic teams, corporate wellness facilities, health insurance providers and physical education programs. In September 2010 the company actively entered the market for preventive health. It introduced the Polar Active activity monitor to students in the United States, a pedometer which is designed to be easier to use than the company's other training computer. The device which allows students to measure and record their physical activity level can be connected to the website PolarGoFit.com, which is an online web service for teachers and students to monitor and track activity. This flexible portal allows for documentation of all activity data, tracking daily and long-term progress and sharing reports with students, parents and school administrators. Already in the year 2000 a US branch of the company acquired HealthFirst Corp., a New Mexico-based developer of software and Web-based products used in health and fitness assessment, risk appraisal and nutritional programming.[63]

Address: Professorintie 5, FIN-90440 Kempele Finland

Website: [www.Polar.fi](http://www.Polar.fi)

### **POWERbreathe**

This UK based company was founded in 1997 to commercialise the inspiratory muscle training tool which was developed through a research pilot. The company focuses on respiratory diseases and offers a tool to train the lung function. The device gained popularity among athletes in endurance sports. The product line of POWERbreathe thus targets the sport and fitness market as well as the independent living and medical market. The sophisticated devices offered in each category can be connected to a computer to transmit the data to health care specialists or professional trainers. Besides POWERbreathe offers software for the analysis of breathing patterns by users themselves.

Address: HaB International Ltd. Northfield Road, Southam, Warwickshire CV47 ORD,

Website: [www.powerbreathe.com](http://www.powerbreathe.com)

### **Philips Healthcare/ PHILIPS DIRECT LIFE**

Royal Philips Electronics of the Netherlands readjusted its strategic focus on health and well-being and as such operates professional and consumer markets through three overlapping sectors: Healthcare, Lighting and Consumer Lifestyle. Its subsidiary Philips Healthcare is among the top global makers of medical imaging equipment, patient monitors, resuscitation products, and telehealth monitoring products and solutions. Regarding eHealth solutions in general the company is believed to have a global market share of 19.7% according to the market research company In-Medica[46]. Its product portfolio includes health hubs (TeleStation and Motiva), peripheral measurement devices and web-based clinical review software. The TeleStation is a hub for the transmission of automatically or manually entered selected vital signs data that acts as a medium for interactive communication between health and social care providers and patients at their home. The Motiva health hub uses a broadband internet connection and the patient's own television set as

an interactive healthcare platform, a medium with which patients are familiar and which they have accepted. Philips offers a broad variety of in-home monitoring devices that enable the patients to take their vital signs reading and transmit them to the care givers via the TeleStation or Motiva platform ranging. Those devices range from weight scales, blood-pressure monitors and blood-glucose meters to pulse oximeters.

Philips' portfolio of products included software to store and organize patient data for later review, as well as important contact information, including family members, primary care physician and specialist, to facilitate a rapid response. The clinical application also presents trends and generates reports. It is the backend for the Motiva and TeleStation home services.

Philips is active in the prevention and wellness market as well. The DirectLife product line strives to stimulate behavioural changes through a 12 weeks activity plan and the use of a small portable activity monitor which can transfer data to an online portal for processing. The service includes coaching through professionals and peer group impression and pressure. A personalised website tracks the progress.

For the safety of elderly and to enable the possibility of living independently longer Philips has launched a medical alert service that automatically detects if a person has fallen and then calls the emergency services for help. The Product extends its Lifeline emergency products with an automatic fall detection capabilities in the same pendant. The acquisitions Philips conducted over the last five years shows that the company strives to expand further in this field. The company acquired the personal medical alert emergency response service LifeLine in 2006. Then in 2007 the company purchased Raytel Cardiac Services) and other ancillary operations from the Israeli SHL Telemedicine Ltd to expand further in the home cardiac monitoring market. In same year the sleep and respiratory care company RESPIRONICS was acquired, which provides solutions to monitor and supplement the patient with oxygen in a home setting.

Address: Amstelplein 2. Breitner Center P.O. Box 77900 1070 MX Amsterdam The Netherlands

Website: [www.philips.com](http://www.philips.com)

### **Preventice**

The US based company Preventice develops Smart phone applications. It cooperates with pharmaceutical companies, medical device producers, healthcare providers, and healthcare payers providing integrated Mobile Health Solutions. Its portfolio includes several mobile health applications based on joint initiatives with a pharmaceutical company and health care provider. They relate to cardiac treatment, chemotherapy, medication management, migraine headaches, birth control, skin care and diabetes.

Address: 1652 Greenview Drive SW Site 200 Rcheater, MN 55902

Website: [www.preventice.com](http://www.preventice.com)

### **Research in Motion's (RIM)**

The smartphone producer Research in Motion is based in Canada; the company targets mainly healthcare professionals. It regards the Healthcare sector as an important industry to expand into. Its smart phones and tablets focus on doctors, nurses and other caregivers. Different applications integrate the process of care vertically and allow access to data for health care professionals. The company's strategy is to also include community midwives and ambulant care givers. According to one of their spokesmen, the potential for cost savings through the streamlining of the care process is tremendous. A major sales argument for RIM is the security inherent to their back-end solution Enterprise server, when dealing with sensible patient data. Its new tabloid computers allows the application to be downloaded, medical themed application form one major group [33]

Adresse: 295 Phillip Street Waterloo, Ontario Canada N2L 3W8

Website: [www.rim.com](http://www.rim.com)

### **Robert Bosch Healthcare**

In 2007 the German company Robert Bosch Group acquired the Californian Health Hero Network and its health Buddy system. This system functions as an interface to provide health and social care at home and connect with health care professionals. The system allows access to historic patient data and facilitates the empowerment and self-management of patients with chronic conditions. Initially the system was aimed at Veterans of the US Army under the auspices of the US Department of Veterans Affairs. The care offered by the system initially reflected the specific health needs of this constituency. The system comprises Healthhubs at the patients' home connected with clinical information databases, Internet-enabled decision support tools, health management programs and content development tools. Through regular and increased communication the system strives to spur behavioural changes and thus contribute to prevention. In April 2009 as a further step in its strategy to strengthen its hold on the Telehealth market, the Bosch group acquired Visual Telecommunication Network Inc., also known as ViTel Net. This company is active in the field of RMT and has developed novel technologies and innovations. In the US both ViTelNet and Health Hero Network are leading suppliers for IPHS related technologies to the US Department of Veterans Affairs. Health Hero Network also has a prime contractor for a Medicare demonstration program that began in 2006. Starting with the client base of the Veteran Association the market research Company InMedica assessed that Robert Bosch in 2009 had a market share of 19, 7% in the United States and became the second largest telehealth provider after Honeywell Hommed. [46]

Address: Robert Bosch Healthcare GmbH Postfach 1127 D-71301 Waiblingen

Web: [http://www.bosch-telemedizin.de/content/language2/html/55\\_ENU\\_XHTML.aspx](http://www.bosch-telemedizin.de/content/language2/html/55_ENU_XHTML.aspx)

### **Roche**

The Swiss company F. Hoffmann-La Roche AG or better known as Roche focuses on the healthcare market with its two divisions pharmaceuticals and diagnostics. It produces various medical devices including blood glucose meters under the brand Accu-Chek. The company became one of the world's largest suppliers of blood glucose meters and in-vitro diagnostics.

Roche has further developed the Accu-Check monitoring system and included wireless capabilities for the transfer of the results. The company claims that the device which enables self-testing of the blood sugar level is more comfortable and convenient than the discomfort of a puncture which has been identified as an obstacle to regular testing. The Accu-Check product family consists of blood glucose systems for patient self-testing, comprehensive glucose monitoring systems and diabetes data management software. The devices are designed to be reliable and need to ensure the transmission of patient results, they allow diabetic patients to use their mobile phones and smart phones to transfer their collected vital signal including sugar levels to physicians. The system includes a reminder service for medication. Roche Diabetes Care teamed up with InterComponentWare (ICW) in 2010 to form a multi-year, global partnership for the development of IPHS with web-based solution for diabetes management. The products and services resulting from this cooperation are planned to consist of structured evaluation and communication of blood glucose monitoring and insulin data.

The technological partnership will be using the software already used by the Accu-Chek devices, the Accu-Chek product class and ICW eHealth Framework (eHF) as well as other solution components. The software already allows visualising patients blood glucose and insulin levels and thus facilitates better management of diabetes by patients and carers alike. Roche Diabetes Care and ICW will jointly develop a complementary technology platform that enables the secure sharing of data and communications between healthcare professionals and people with diabetes via the web. [46, 64]

Roche is a member of the Continua Health Alliance

Address: Grenzacherstrasse 124, CH-4070 Basel, Switzerland

Website: [www.roche.com](http://www.roche.com)

### **Rossmax**

The Taiwan based Rossmax International Co. Ltd manufactures medical and healthcare devices, its portfolio includes blood pressure monitors and nebulisers. The company has been the first non-Japanese manufacturer of digital blood pressure monitors made for consumer to use at their homes. The company recently entered the training and wellness market with its portfolio dedicated to prevention in addition to operating in the monitoring and therapy fields. Some of the blood-pressure monitors are Bluetooth enabled to be integrated in an IPHS.

Address: 12F, No. 189, Kang Chien Road, Taipei 114, Taiwan

Website: [www.rossmaxhealth.com](http://www.rossmaxhealth.com)

### **RS TechMedic Ltd. (MHealth CVD)**

RS TechMedic Ltd. is based in the Netherlands and is a developer of medical technology. Its portfolio of products includes medical software targeted at the Telemedicine and Remote Patient Monitoring markets. The company offers RMT devices that perform real-time cardiac monitoring and transmit the data via mobile phone networks. The RMT monitoring capabilities include 3-,5-, and 12-lead ECG, heart rate, plethymograph/SpO2, Pulse rate/ Respiration rate, and 3 Axis accelerometer for an alarm system or fall detector. Their devices are Bluetooth and GPRS compatible and can be connected to smart phones. Their product Dyna-Vision™ was according to the company the first patient monitor in the world with built-in cellular technology. The touch screen layout of some other of their devices is adaptable to the needs of the patients. Physicians can monitor their patients real time through a data stream on a laptop or on a Google android compatible smart phone.

Address: Broeker Werf 6 1721 PC Broek op Langedijk, Netherlands

Website: [www.dyna-vision.com](http://www.dyna-vision.com)

### **Sanvartis GmbH**

Starting as a Call Centre providing information for health insurance companies the German based Sanvartis now also provides prevention and safety information for enterprises, backend services for RMT, Disease management programmes, management of medication and coaching. It covers a broad variety of diseases, including COPD, asthma, diabetes and cardiac diseases. Sanvartis provides modular call centre solutions for different needs, it also supports the implementation of RMT, telecare and AAL in the home of the final user. Its customer base consists mainly of Germany health insurance funds and corporate customers.

Address: Dr. Albrecht-Herrhausen-Alle 9-11

Website: [www.sanvartis.de](http://www.sanvartis.de) (German language only)

### **Schiller**

The Swiss based company SCHILLER develops, produces and distributes medical devices for cardiopulmonary diagnostics, patient monitoring and emergency medicine. Its product portfolio includes portable ECG device, a pocket defibrillator and multi-functional diagnostic systems. In terms of RMT the company offers a Portable holter, for a diagnostic 12-lead ECG with real-time display of all 12 leads. These devices can be integrated in and monitored by the monitoring network run by SCHILLER which is also capable of sending alarms. The company offers analytical software and service for diagnostic management and defibrillator management.

Address: Altgasse 68 CH-6341 Baar, Website: [www.schiller.ch](http://www.schiller.ch)

### **Scottcare**

The US based "The ScottCare Corporation" provides solutions for non-invasive external counter pulsation (ECP) therapy and cardiopulmonary rehabilitation telemetry. In this field the company has developed, manufactured and marketed quality medical devices. Some of their products can be integrated into a IPHS, e.g. their TeleSentry™ system is composed of a feature-rich, patient-friendly recorder which can be combined with a back-end software solution. The Software is designed to

manage large amounts of patient data. The device enables a wireless transmission of arrhythmia events, through mobile networks. The system features an automated alarm system. In 2007 the company completed the acquisition of the operations of privately held Rozinn Electronics, Inc., which produces cardiovascular diagnostic equipment.

Address: 4791 W. 150th Street Cleveland, Ohio 44135

Website: [www.scottcare.com](http://www.scottcare.com)

### **SHIMMER**

The Irish Shimmer Research has developed a small wireless sensor platform which can be used to record and transmit physiological and kinematic data in real-time. Often embedded into a wearable sensor, Shimmer's technology incorporates wireless ECG, EMG, GSR, Accelerometer, Gyro, PIR, Tilt and Vibration sensors. The platform is open and configurable allowing it to be tailored to the user's specific requirements. It is found in health care, rehabilitation and fitness applications, Ambient Assisted Living and sensors in buildings.

Address: Clonsaugh Technology Park, Dublin

Website: [www.shimmer-research.com](http://www.shimmer-research.com)

### **SenseCore**

The Start up SenseCore has been established as a Joint Venture between the Swiss sports marketing agency SUI and the Swiss technology and innovation incubator Centre Suisse d'Electronique et de Microtechnique (CSEM). It provides biomedical monitoring tools for sport and healthcare. It uses advanced wearable technology and combines them with software for analysis. It has the capacity to record training efforts during endurance and recreational periods. SenseCore's product comprises dry electrodes integrated in e.g. a compression shirt that captures, processes and transmits multiple physiological and kinetics data. It uses a specific compression apparel of tailor-made tops for each sports discipline, for everyday life and a night recovery monitoring version for health care purposes is available as well. Part of the offer is a software package, incorporating medical knowledge and the experience of sports trainers. The software enables short and long term period planning, performance analysis and benchmarking, as well as guidance and feedback. The products have been developed for the sport market, yet they are applied for medical purposes for Cardiovascular diseases (heart arrhythmias, angina pectoris/ ischemic diseases/ coronary diseases), respiratory diseases and adult type diabetes. The vital signals collected include, Electrocardiogram ECG, of medical grade, Heart Rate, Heart Rate Variability, EPOC, VO2 max, Respiration, Core body temperature, SpO2 blood oxygen saturation, Speed, Distance, cadence, Altitude, External temperature, Activity classification,

Address Kreuzstrasse 26 8008 Zurich, Switzerland

Website: [www.sense-core.com](http://www.sense-core.com)

### **Senslab**

Founded in 1995, Senslab is a German company based in Leipzig which develops and produces chemical and enzymatic sensors - both reusable and disposable - for use in bio-technology and human diagnostic. Its 15 highly qualified scientists work on current products as well as international R&D projects. The company which produces its sensors itself has patents covering the most important technologies in Germany, Europe and the US.

In 2005, the German company EKF diagnostic became a shareholder of SensLab. Both companies combine their strengths in the development of new products, such as wet chemistry analyzers, photometers and test strip devices for future market demand.

SensLab uses original innovative solution for „Point of Care" (POC) measurement systems. New approaches, especially from micro-system technology, bio-technological material research as well as from nano bio-technology and information technology, are used in order to further expand the

core technologies of the company and to convert them into innovative products. SensLab targets doctors' practice, emergency centres and the home care sector.

Senslab sells its products in Germany, Austria and Switzerland as well as Belgium, Denmark, Finland, France, Italy, Luxembourg, Netherlands, Norway, Spain, Sweden, Turkey and the UK.

Address: SensLab Gesellschaft zur Entwicklung und Herstellung bioelektrochemischer Sensoren mbH, Bautzner Str. 67, 04347 Leipzig

Website: [www.senslab.de](http://www.senslab.de)

### **SHL Telemedicine**

The Israeli based SHL Telemedicine LTD is listed on the Swiss Stock exchange and develops and markets personal telemedicine systems. It provides related medical call center and services, focusing on the field of cardiology. The business model of the company is subscription based. The Services - Home Care Center™ - allows users to benefit from RMT services at home coupled with surveillance from a medical centre. RMT services for Blood pressure and weight are available as well which automatically measure and transmit heart rate and blood pressure read-outs to a remote medical monitoring centre. The company claims to be the only one globally providing devices that can transmit a complete personal 12-lead ECG from any location in the world. Additionally the company offers managed care for diabetic patients through a glucometer that connects through a modem, SHL provides the set up and the back office.

Address: 90 Igal Alon St., Tel-Aviv, 67891, Israel

Website: [www.shl-telemedicine.com](http://www.shl-telemedicine.com)

### **Smiths Medical PM Inc**

Smiths Medical PM, Inc. is a designer, manufacturer, and distributor of the BCI® brand of patient monitoring equipment and a distributor of the PneuPac® brand of MRI compatible transport ventilators. The RMT related product portfolio of the company comprises both bedside devices for an institutional care and portable RMT devices for the use outside of a hospital. The products include capnographs Multi-Parameter Monitors, blood pressure, oximetry, Pulse Oximeter. Their Insulin Technology System is a complete system of insulin infusion and blood glucose monitoring, pump programming and features integrated data management for patients everywhere.

Address: 5200 Upper Metro Place, Suite 200, Dublin, OH 43017, U.S.A

Website: [www.smiths-medical.com/](http://www.smiths-medical.com/)

### **ST-Ericsson**

In 2009 the activities in the wireless business of the two semiconductor companies Microelectronics and NXP were put together with the mobile platforms division of Ericsson. The resulting company ST-Ericsson develops a broad range of wireless platforms and semiconductors for smart phones and mobile entertainment; the production is outsourced. The company offers platforms, solutions and technologies covering power management, RF, baseband, modem chipsets and platforms, multimedia and application processors, FM radio, GPS and a full range of Bluetooth and other connectivity technologies such as WLAN, UWB, and USB, as well as full access to a license for NFC technology. ST-Ericsson is a member of the Bluetooth SIG, the WiMedia Alliance, the Zigbee Alliance and the Continua Health Alliance. In the context of SIMPHS the company is worthwhile mentioning as their products are used in a variety of devices sold by other companies and in light of the expected growth of low energy consuming wireless data transmission, such as NFC or Bluetooth Low energy.

Address : 39 Chemin du Champ-des-Filles, CH 1228, Plan-les-Ouates, Switzerland

Website: [www.stericsson.com](http://www.stericsson.com)

### **St. Jude Medical**

St. Jude Medical is a US based medical devices developer. The company is specialised in the development and manufacturing of ICDs, CRT devices, pacemakers, electrophysiology, catheters, mapping and visualisation systems, vascular, closure devices, heart valve replacement and repair products, and neuro-stimulation devices. According to the Market research company Frost & Sullivan St. Jude Medical has notable presence in the cardiac monitoring market in terms of market share. Their digital, wireless pacemakers can transmit vital signs allowing patients and doctors to continuously monitor a patient's progress following operation. Complications with the implant after an operation are a major reason for readmission. Future generations of these pacemakers are planned to include monitoring of high blood pressure, measuring glucose or heart failure. [9]

Address: St. Paul, Minnesota USA

Website: [www.sjm.com](http://www.sjm.com)

### **STT Condigi**

STT Condigi is a Nordic supplier elderly care solutions and is the result of the merger between the Danish Condigi Televagt A/S and Swedish STT Care. The majority of the company is owned by the Swedish 6th Pension Fund, which has objective to investing in Swedish small and medium-sized growth companies. The company offers telecare solutions for institutional and private care, independent living and security of employees.

Website: [www.sttcondigi.com](http://www.sttcondigi.com)

Address: STT Condigi AB Agnesfridsvägen 113 A, S-212 37 Malmö

### **Sorin**

The Italy based Sorin Group has introduced a device for Cardiac Rhythm Management (CRM) that would send data to a non-invasive monitoring system at the patient's home. It can be integrated with Orange Business Services' capabilities to manage the transmission of data to the physician. This system has two advantages. One is that the data gathered through the process will help doctors to monitor the progress of the cardiac disease and give immediate feedback. This avoids unwanted hospitalization and improves the quality of life of the patient. Secondly, the data recorded at home will give a good picture of the patient's condition to the caregiver.

Address: via Benigno Crespi 17 Milan 20159 Italy

Website: [www.sorin.com](http://www.sorin.com)

### **Sotera Wireless Inc**

The start up Sotera Wireless Inc., formerly Triage, is developing a new method for measuring continuous blood pressure without a cuff and a platform for wireless body-worn patient monitoring, which allows practitioners to follow their patients' body signals throughout all stages of their treatment. The company offers an accompanying software package for analytical purposes. The company is funded and supported by a group of investors that include Qualcomm Ventures, Intel Capital, Sanderling Ventures, and Apposite Capital. Through iPod apps, Sotera is targeting the fitness and consumer market as well.

Address: 9444 Waples Street, Suite 280, San Diego CA 92121

Website: [www.soterawireless.com/](http://www.soterawireless.com/)

### **Suunto Oy**

The Finland based Suunto Oy does not target the medical market but sells its products to athletes and people who want to stay or become physically fit. Their products can facilitate behavioural changes and promote preventive activities. As Suunto has a long experience in collecting and aggregating vital signals, the company is included in this report, reflecting the broader scope of IPHS. Suunto's core business is the design and manufacture of sports precision instruments for diving, training, mountaineering, hiking, skiing and sailing. Their sport-specific computers are often worn at the arm and thus resemble watches. Their heart rate and calorie consumption monitors

gather a variety of vital signals and can be transmitted to a health hub. Suunto's software allows trainers to check and compare their performance, an online community allows professional and amateur athletes to compare their results. The company offers fitness studios a software solution to monitor and report upon the training of their guests. Since 2005 Suunto belongs to the Finnish Amer Sports holding, which own several sport equipment manufactures group.

Address: Valimotie 7 FI-01510 Vantaa Finland

Website: [www.suunto.com](http://www.suunto.com)

### **SwissCom**

SwissCom, the Swiss incumbent Telecom operator, is active in the field of EHR. The company has developed a universal and remotely accessible archive called E-Archives. Relevant patient information can be accessed through a secured network by authorised carers. As of 2009 a subsidiary called Evita has been founded, the electronic health record serves as the backbone for several other services. The service "medical gate" allows individuals to access medical advice based on their sickness history from any location. A tailor made version of Evita for diabetes patients and other chronic diseases exists, social care services are also included. SwissCom offers telecare systems including first generation alarm and second generation fall detection systems are currently extended into fully fledged Ambient Assisted Living systems sold to clients in Switzerland. SwissCom itself actively promotes Emporia phones among the elderly and vision impaired, these handsets include emergency buttons and fall detection; furthermore the company develops a range of special services for disabled users such as directory services for the blind. Additionally to serving patients, Swisscom targets health care providers with billing services called 'curabill'. From an IPHS perspective the supports of integrated support networks with a reimbursement system and the access to the EHR EVITA is of most relevance.

Address: Evita AG, Service Center, CH-3050 Bern

Website [www.evita.ch](http://www.evita.ch)

Address curabill AG Hardturmstrasse 3, CH-8005 Zürich

Website: [www.curabill.ch/](http://www.curabill.ch/) (only in German and French)

Address: Ostermundigenstrasse 99 3050 Bern

Website: [www.swisscom.com](http://www.swisscom.com)

### **Tanita**

The Japanese based Tanita Cooperation manufactures precision, electronic measuring devices and health-related diagnostic tools. It markets its products both to the professional and home-use segments. Since its foundation in 1923 the company has become one of the world's leading manufacturers of precision scales, now in electronic version. It increasingly caters for the wellness market with wirelessly connectable health and fitness monitors. Part of Tanita's portfolio is a Bluetooth enabled body composition monitor, the BC 590 BT as well as a broader range of body composition monitors with no wireless capability, some of which can be connected via a cable to a healthhub or computer. Some of the weight scales integrate Bluetooth connectivity technology. Tanita also offers a wide range of other products including body fat and water monitors, home owner bathroom scales, baby scales, health monitors and fitness monitors.

Address: 14-2, 1-Chome, Maeno-Cho, Itabashi-Ku, Tokyo, Japan, Website: [www.tanita.com](http://www.tanita.com)

### **TBS Group**

The Italian TBS group offers eHealth and eGovernment services and products, its Medical ICT products include services and solutions for healthcare. The company supplies and manages integrated systems for clinical services in hospitals and social assistance facilities. Its Telecare and telemedicine services and solutions include telediagnosis and RMT for continuity of care for patients leaving social and healthcare facilities. Its offer includes remote consultation services using the television set of the patients for communication with specialized physicians, remote booking of

diagnostic services, management of help desk related services for social and healthcare, agendas for general practitioners and communication between on-call doctors and homecare assistance. The company claims that its services cater for the need of local authorities, pharmacies, homecare service providers and private citizens. It is active in Austria, Belgium, France, Germany, England, India, Italy, the Netherlands, Portugal, Saudi Arabia, Serbia and Spain. Its customers or patient base includes over 35000 patients according to the information available on their website.

Address: AREA Science Park, Padriciano 99 - 34149 Trieste, Italy

Website: [www.italtbs.com](http://www.italtbs.com)

### **Telefónica/O2**

In its home market - Spain - Telefónica is currently testing a service called “mi familia,” in cooperation with the private insurance company Mapfre Quavita. The service enables Alzheimer’s patients and their families to track the patient’s movements through an Internet portal. The patient’s phone is also programmed to call automatically prefixed numbers of the family, physician or a taxi. Telefónica hopes to reach over 700 000 customers in the next few years, after a European wide roll-out.

A service for the remote monitoring knee braces is offered by: Telefonica. The company is working with Barcelona’s Hospital de la Esperanza on motions sensors which are embedded in a knee brace. They will allow physicians to remotely monitor patients’ rehabilitation after they have been discharged. According to mobile health news the product is still being tested. From the processed data physicians can watch avatars simulating the patient’s movements. Physicians can monitor patients from their PC or mobile phone. Telefónica hopes to sell the device to hospitals worldwide after trials in the upcoming years.

A further trial focuses on using eHealth solutions in the hospitalization for cardiac patients at Hospital del Mar (Barcelona) and Hospital Costa del Sol (Málaga) On the Canary Islands the company is testing a Personal Health Station with USP Hospital La Colinas in cooperation with Intel. [18,[61, 65].

Furthermore, under its commercial brand O2 the Telefónica group has several on going projects in Europe which are of relevance to IPHS. O2 offers a wide range of GSM and GPS devices that provide tracking, two-way communications and emergency response with the touch of a button. It offers text appointment reminders and prescription reminders to be sent to patients’ mobiles via the O2 health messaging service in several European Markets. O2 strives through its own inhouse Telecom consultancy service to design, deploy and manage health related services. Telefonica cooperates with various medical institutions in Europe to set up a pilot to create a hotline for patients suffering from cardiac problems. Telefonica is also involved in improving the quality of life of elderly people using new technologies. Users have several biomedical sensors through which their health status can be easily checked and monitored by entering in contact with geriatric services through a remote control device and an ISDN line that supports TV video conferencing. Telefonica is involved in developing applications to monitor health conditions such as asthma, diabetes and cystic fibrosis.

In the United Kingdom the company delivers bespoke services to NHS: 'Voice and messaging ', 'Mobile Data and Applications' and 'Total Mobile Solutions'. O2 is also introducing the Digital Pen technology into the Health sector in the UK. Digital Pen enables the integration of services with a back-end database systems in real-time. These services promise to provide savings in forms of reduced processing costs and increased pace of data availability to the health sector. [18,[33, 61, 65].

Address: Calle Gran Via 28 Madrid, Madrid 28013 Spain

Website: [www.telefonica.com](http://www.telefonica.com)

### **Telekom Austria**

Telekom Austria is active in the provision of IPHS in its home country Austria, and in Central and Eastern Europe as well as in South East Europe. The “DaMe” is a domestic medical data network that connects hospitals, medical practitioners, specialists, labs as well as other health-care institutions. This service is based upon the nationwide EHR called ELGA. It is used for the electronic transmission of medical records, clinical findings, therapy results and documentation between health care professionals. The initiative “Videofon” has been jointly developed in cooperation with the social services of the Austrian province of Styria and the company Zyadcron. It enables people in need of care to contact the closest medical care-centre or a family member via their TV set at the push of a button. A special bed for the sick enhanced with multimedia features and connection capabilities allows the patient to manage their entertainment electronics (e.g. DVD player) and enables medical staff to store and retrieve patient records via the sickbed. Though this type of bed is mainly used in institutional care, it can be used as well in a home care setting. In cooperation with the “Austrian Research Center” (ARC) an NFC-based mobile solution has also been developed, it allows the encrypted transmission of health data such as blood pressure values to a medical database via mobile phone.

As mentioned in D2.1 Annex Country Fact Sheets there is a high resistance in Austria towards eHealth and electronic health records among both patients and health care professionals, privacy concerns being the main reason for rejecting EHR.

The Telekom Austria subsidiary Mobilitel in Bulgaria offers a SMS alert service to remind patients about medical and vaccination appointments and displays test results. In Slovenia subsidiary Si.mobi has launched a service for diabetics which allows the dissemination and retrieval of information about carbohydrate exchange contained in a certain meals and food via text messages.

Address: Lassallestraße 9, Vienna, 1020 Austria

Website: [www.telekom.at](http://www.telekom.at)

### **Telecom Italia**

Telecom Italia offers infrastructures, platforms and services for mobile and fixed phones, internet, ICT solutions and media content. While Telecom Italia does most of its business in Italy, Latin America is a key international market.

Since 2007 Telecom Italia has been involved in the development and delivery of RMT services at the home of the patient. The platform evolves around a health hub called MYDoctor@Home which started as part of their corporate social responsibility activities. MYDoctor@Home strives for data integration and interoperability while maintaining a high security level, enabling data sharing between patients and healthcare structures. It allows vital signals such as blood pressure, pulse, electrocardiogram and weight to be collected through a variety of linked devices, which are linked over Bluetooth to the mobile phone of the user. The data can then be transmitted to an associated doctor or a specialized centre for interpretation and decision about further action to be taken. It targets patients suffering from chronic illnesses or in post-hospital care. The services offered include reminders on medication and therapy. The RMT services rely on technologies developed by Telecom Italia with the standard medical electronic apparatus available on the market. Trials are conducted by the University Hospital of San Giovanni Battista in Turin (Ospedale Molinette) based on signed agreements. The objective is to assess the benefits in terms of both the improvement of the patient’s quality of life and the optimisation of costs for the health organisation. The service is under trial in Brazil as well in a number of health centres across the country. Collaboration between the Brazilian authorities and the Telecom Italia Group is key for the dissemination of this technology. The Line@Medica Diabetes service allows the visualization of glycaemia data on a BlackBerry which is included in the pack marketed by Telecom Italia in cooperation with the company Semplice. A patient’s diary is updated automatically. The service is exclusively reserved to members of diabetes associations which have signed a framework agreement with Telecom Italia. In 2011 the service had a price tag of €17.50 per month. Elderly and vision impaired customers can benefit from the Big Angel service by using dedicated phones which include a social alarm and are

furnished with fall detection and other safety related functions. The system warns e.g. the owner and a carer as well when batteries are about to run out. [66]

Address: Piazza degli Affari 2, Milan 20123, Italy

Website: [www.telecomitalia.com](http://www.telecomitalia.com)

### **Telenor**

The Norwegian Telecommunications incumbent Telenor has dedicated several research projects to the theme of mHealth. According to their own website the company is currently testing Ambient Assisted Living in the City of Tromsø. The technology includes wireless-enabled motion sensors and pill boxes. Patients' caregivers can be alerted for necessary intervention and assistance. Among the research projects there has been a pilot in Hungary whereby the Telenor group developed a connected electrocardiogram (ECG) solution. Patients were remotely monitored by sensors that collected cardio data. A legacy of small electro medical producers existed in the country, these SME have been acquired by international companies such as General Electric, Omron and LaRoche. These then turned to Telenor to add connectivity to their products. Hungary serves as a testing ground for future mHealth applications, the government supports these tests in order to reduce costs. On the Telenor value chain Telenor Hungary has the role of developer while Telenor Connexion delivers the connectivity and the system integration division Telenor Objects provides the platform, the business units representing the sales channels. This set up is part of their Corporate Social Responsibility activities and contributes to a better positioning in an emerging market.

Telenor Serbia offers minority populations in cooperation with UNICEF an mHealth service with advice and the ability to make appointments for social and health care support.

To serve remote and sparsely populated areas in Norway the company also coordinates a so called Wireless Health and Care centre (WsHC) for wireless vital signs collection and ad hoc data distribution among healthcare workers on site in case of accidents. The service allows the monitoring of health parameters, exemplified by blood sugar measurements for persons with diabetes, and wireless transfer of physiological parameters during surgery through RFID.[30, 67, 68]

Address: Snarøyveien 30 N-1331 Fornebu, Norway

Website: [www.telenor.com/](http://www.telenor.com/)

### **TeliaSoneria**

The Swedish telecommunication TeliaSoneria is active mainly in the Baltics and the emerging economies of the Newly Independent Countries and provides wireless phone services to about subscribers. TeliaSonera is as well a leading ISP in the Baltic and Nordic regions. Additionally, the company provides television services over Internet connections. It has a long history in providing telehealth solution, even before joining the European Union in 1995 the company cooperated with EU partners and Swedish universities. It has been pioneering RMT and mHealth solutions since 2005 through a service called BodyKom, which has been developed by TeliaSonera in association with Hewlett Packard and a Swedish software company called Kiwok. BodyKom functions by means of a communications device that is connected wirelessly to a number of sensors on a patient's body and it can trigger an alarm. TeliaSoneria cooperates as well with the Karolinska university hospital and Israeli companies Tadiran LifeCare and aerotel in developing a portable equipment to monitor, e.g., pulse and oxygen saturation. The device can be worn like a larger wristwatch.

Address: Stureplan 8 Stockholm SE-10-6 63 Sweden

Website: [www.telesonera.com](http://www.telesonera.com)

### **Texas Instruments**

The American company Texas Instruments pioneered with large scale sales of silicon transistors in the 1950s. It has been identified for many years as one of the world's leading semiconductor suppliers. It also offers solutions that adhere to other short range wireless standards including Bluetooth, Zigbee, 802.11 and UWB. TI is a member of the Bluetooth SIG, and the WiMedia, ANT+

and Zigbee Alliances. In the context of SIMPHS the integrated circuits by TI are used in a broad variety of medical devices, including UWB, Bluetooth and Bluetooth Low Energy.

Address: 12500 TI Boulevard, Dallas, Texas 75243, US

Website: [www.ti.com](http://www.ti.com)

### **Thecarrot.com`**

As the name indicates, thecarrot.com is an internet-based information service accessible through smart phones designed to facilitate the understanding and management of personal health fitness and well-being, thus providing an incentive to change behaviour. It has been created by the US-based Company Health Analytical Services. Thecarrot.com tracks and monitors activities such as diet, exercise, medication, child growth and much more. Based on the data collected it creates reports which can be shared. It supports behavioural change for a variety of purposes, such as fitness and quitting smoking.

Address: Corte Madera Town Center #689, Corte Madera, CA 94925

Website: [www.thecarrot.com](http://www.thecarrot.com)

### **Tolven**

The Tolven Institute develops on an open source basis a healthcare information platform, electronic Clinician Health Record solutions (eCHR), electronic Personal Health Record solution (ePHR). The institute create an analytical tool using these data stored in the platform health records.

Website: <http://www.tolven.org>

Address: 18955 Viewcrest, CA, 954766028

### **Transoma**

The united States based Transoma Medical had raised 30 million Euro in 20 € in 2007 and went public in 2007, according to the Wall Street journal in 2009 the company that once stirred high hope among investors run out of funds. This happened despite the fact that its main product a wireless implantable cardiac monitor has acquired FDA approval. It was been capable of communication with a personal device carried in a pocket or purse, the transmitted data was analysed to dispatch an alarm to the patient's physician if an abnormal rhythm is detected. According to an angel investor the accompanying analytical division has been profitable.

The company's Web site is no longer active [47]

### **Tunstall Healthcare**

Since its establishment in the United Kingdom in 1957 Tunstall has become one of the world's largest providers of telecare<sup>30</sup> and RMT solutions. According to their website the company serves more than 2,5 million people in over 30 countries, this includes 1 million in the UK. While part of the equipment provided by Tunstall ha been traditionally been used in institutional settings, the company also enables telecare and RMT services for social and health care within the home of the users. The company has gained popularity for its fall detection monitors. Among its products relevant for SIMPHS2 is Tunstall's Genesis, a telehealth monitor which allows patients to monitor their vital signs at home. The monitor can be connected to a wider range of medical devices to monitor blood pressure, heart rate, weight and other parameters; it has additional capabilities to record blood glucose levels, PT/INR measurements and ECG. Tunstall offers the Central Triage Station software application to remotely collect the data from Genesis monitors and transfer it to medical professionals for review. Tunstall's MetrikLink is a universal connectivity tool that enables patients to upload self-testing data from over 20 personal health monitoring devices using just a standard telephone line or an Internet-enabled PC connection. Tunstall's MediCompass Web-based

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<sup>30</sup> The company initially provided first generation telecare and bedside alarms and subsequently developed second and third generation devices. For a distinction see *O 3.2 Different generations.*

solutions receive information from patients provided with MetrikLink enabling information to be viewed over a secure Web page. Tunstall has acquired the telecare operations of the Attendo Group, which is a Nordic market leader in the operation of elderly care homes and services. It was a main competitor in the UK for telecare services. In 2008, the Tunstall Healthcare Group also acquired the Danish company RTX Healthcare, to strengthen its position in the field of RMT and wireless applications to telehealth as well as to support its strategic transition to tele healthcare. Through these acquisitions Tunstall strives to strengthen its position in the emerging telehealth market in Continental Europe and North America. [4, 29, 50].

Address: Whitley Lodge, Whitley Bridge, Yorkshire, DN14 0HR, UK

Website: [www.tunstall.co.uk](http://www.tunstall.co.uk)

### **Tynetec**

The British company Tynetec has been providing telecare and alarm systems since 1979. The company designs the hardware and software in-house but manufactures the components in the UK. Its market includes British local authorities and housing associations across the UK. After the installation the company remains responsible for the maintenance of the equipment and organises if necessary the supporting care services in cooperation with local health and social care. The company provides warden and social alarm systems, remote door entry concierge services, and sensors for telecare. Its second and third generation telecare equipment includes blood pressure monitors, pulse oximeter sensors, precision weight scales and a health hub which collects data and can dispatch an alarm if necessary. The company offers carer givers and care facilities a software package for the analysis of the equipment Tynetec has installed.

Address: Tynetec Ltd, Cowley Road, Blyth Riverside Business Park, Blyth, Northumberland, NE24 5TF, UK

Website: [www.tynetec.co.uk](http://www.tynetec.co.uk)

### **Virgin Health Miles**

As part of the Virgin group, Virgin Health miles offers a web-based motivation program similar to frequent travellers schemes offered by airlines, including the one belonging to the group. It is based on the assumption that physical activity and behavioural change can prevent diseases. A motion detector or pedometer continuously collects the movements a person is doing during a day, including workouts in the fitness chain belonging to the Virgin group. The collected HealthMiles translate into so called "HealthCash " vouchers, which can be used to acquire health related services and products or can be redeemed as gift cards at participating United States based retail stores. The health offers include light food, fruits, or even a visit in a spa. Virgin Health Miles targets corporations and companies keen on finding ways to keep their employees fit and motivated, improve their satisfaction and reduce absenteeism and related medical costs. The company claims that a large number of companies and organisations participate, representing more than 500,000 employees. According to their own website, over 40% of these users participate actively.

Address: Virgin HealthMiles 139 Newbury Street, Framingham, MA 01701

Website: <https://www.virginhealthmiles.com/>

### **Vitalograph**

The United States based Vitalograph produces and markets easy to use lung function test equipment, used in primary care, occupational health, sports medicine, asthma management in hospitals and at home. Its products include motivational tools for smoking cessation. Its home asthma monitors are of particular interest for the SIMPHS project: they can store the results of each reading, their aerosol Inhalation monitor supports users in their training to administer their prescribed medication more effectively and they give the carer and the patient an instant and objective appraisal of the patients' technique.

Address: 13310 W 99th St. Lenexa, KS 66215

Website: [www.vitalograph.com](http://www.vitalograph.com)

## **Vitaphone GmbH**

Vitaphone offers integrated telemedicine services and patient care solutions to care suppliers and healthcare insurers. It provides integrated applications for capturing and transferring physiological data. It operates its own telemedicine service centre in Chemnitz, Sachsen.

The Vitaphone Tele-Care-Monitor acts as a central gateway for collection of data from peripheral monitoring devices (blood pressure, weight, glucose, ECG) and automatic transmission to the telehealth service centre. Remote configuration allows interactive communication with patients such as reminder function and individual questioning, such as questions regarding clinical symptoms, current medication or quality of life. The telecare call centre is used to provide alarms and more advanced telecare services, including a simple to use mobile phone with an alarm and a location system. According to the alarm different emergency chains can be activated from an ambulance, janitors, lock and key services and informal care provided by relatives.

The medical *dispenser pico* aims at controlling the adherence of patients to their prescribed medication; it has a reminder function and pot alarms the care givers and patients if complications may arise.

Vitaphone has released a programme including motion tracker called "vita motion sun", which connects in a similar way, targeting patients with cardiovascular diseases and worried well customers as a way to stay active and engage in more physical activity. The goal is sustained behavioural change, the business model is based on non-automatic renewed subscription for a certain period; tracked data on the level of physical activity is used to provide immediate feedback by a practitioner or trainer.

The company participate furthermore in a research project called Motivotion60+ to track training of elderly and motivate them through feedback. Motion sensor collected data on training efforts and vital parameters for cardio and endurance training as well as co-ordination and strengthening exercises. Exercise and training can take place either outdoors, in a central training facility or at home, feedback is provided by the centralised telemedical service centre. Through a setup box connected with a TV set a software tracks the movements and analysis them. Corrections for the movements are offered. The project so far remains a pilot, but it is

Address: Markircher Straße 22, 68229 Mannheim, Germany

Website: [www.vitaphone.de](http://www.vitaphone.de)

Website [www.vitamotionsun.de](http://www.vitamotionsun.de)

Website: [www.vitaphone.de/en/products/medication-adherence/pico-dispenser.html](http://www.vitaphone.de/en/products/medication-adherence/pico-dispenser.html)

Website: [www.motivotion.org/](http://www.motivotion.org/)

## **Viterion TeleHealthcare**

The US based Viterion TeleHealthcare LLC is a joint venture between Bayer HealthCare LLC's Diagnostics Division and Matsushita Electric Industrial Co. Ltd. Viterion products include monitors, easily accessed medical information and services to support the delivery of telecare by specialists. The Viterion 100 and 500 Telehealth monitors incorporate an array of features that include store-and-forward technology for the transmission of vital sign measurements, personalised questions and the possibility to schedule appointments. The display can be adjusted to the needs and capacities of the patients by the healthcare provider. The devices can track blood pressure, blood oxygen, blood sugar, weight, record temperature and record peak flow, record stethoscope sounds and take ECGs. They comprise personalisable patient communications features, customizable question/answer interaction, allowing personalised advice messages for patient, flexible scheduling capabilities for measurements, questions, medications and simply—reminders, important schedule and advice alerts and alarms, digital photography capabilities, Web access, real-time video conferencing, digital photography capabilities etc. The technology is also applied in a kiosk for health care institutions to guide the patients to the adequate carer. The ViterionNET TeleHealthCare Network enables healthcare providers to monitor and communicate with their patients through a simple connection. The company claims that it is structured in an easy way for both the healthcare

provider and patient, without the need for additional expensive hardware so users do not have to install any expensive technology. The corresponding network is managed by Viterion and the company claims a high level of security to protect sensitive patient data. The company offers a simpler Telehealth system as well capable of sending patient's biometric results to their healthcare provider over an analogue telephone line with a simple to use design that does not require using a computer. [46]

Address: 555 White Plains Road, Tarrytown, NY 10591 USA. Website: [www.viterion.com/](http://www.viterion.com/)

### **Vodafone**

The UK-based telecommunication company Vodafone provides digital wireless voice and data services and has over 300 million customers in 30 countries. Since 2003 the company has been catering for the needs of the health care sector by using the company's mobile networks to notify patients' appointments, facilitate the digitalisation of X-rays, and the organisation of drug logistics in emerging markets. In 2009 the company Vodafone identified the health care market and in particular mHealth as an important area to focus on. Vodafone Ventures invested in T+ Medical, a UK-based company that offers disease-management and remote-monitoring services via mobile devices. Vodafone offers a specialist service using radio pads transmitting data over its core network and radio network. Vodafone Care in Germany launched a service hotline staffed with a qualified team of doctors and assistants operated through Vitaphone, a German E-Health service provider featured in this report as well.

The Vodafone Foundation has partnered with the United Nations Foundation and The Rockefeller Foundation to create the Mobile Health Alliance at the February 2009 GSM Mobile World Congress. The mHealth Alliance will provide a platform to bring the technology and health sectors together to maximize the impact of the mobile technology in improving health across the world.[30, 33]

The United States based company WellDoc produces modular platforms that can be configured to support health environments ranging from medication adherence to complex multi-disease management.

Website: [www.vodafone.com](http://www.vodafone.com)

### **Welch Allyn**

The United States based Welch Allyn manufactures medical diagnostic devices, patient monitoring systems, and connected solutions in the health care field for the United States based market and internationally. Their products include general medical equipment, electronic, cardiology, physical diagnosis, general exam, and disposable stethoscopes; blood pressure management products, including sphygmomanometers, home blood pressure management, reusable and disposable blood pressure cuffs, and bladders/bulbs/valves. While their main markets are in situ of health care institution from a SIMPHS perspective are the application of their products at home for chronic ill patients.

Address: 4341 State Street Road Skaneateles Falls, NY 13153-0220, USA

Website: [www.welchallyn.com](http://www.welchallyn.com)

### **Withings**

The France based start up Withings designs, develops, and industrializes connected objects for the internet of things, including a body scales with wifi and internet connectivity, marketed under its own name and for other companies. They connect automatically to the Microsofts HealthVault and Google Health. Its products include a blood pressure monitor with connects over the Apples smart phones and tablet computers. The device measures blood pressure and exchange the data with an online already existing EHR or the a special application. The product uses a distinct design and can be used by several users. The company claims that through the applications part of the more functions of a medical professional can be conducted by a layman. The company offers as well a baby monitor which connects over the internet with smart phones and measures ambient

parameters and allows to communicate with the child remotely and chose a lullaby. The company is backed by a the French Venture Capital Company Ventech.

Website: <http://www.withings.com>

Address: Rue du Général Leclerc, 92130 Issy les Moulineaux

### **ZEO**

The United States based Start-up ZEO inc, produces a personal Personal Sleep Coach which measures at home next to the bed the quality of the sleep and tracks the sleep phases. The company claims that using the monitor reveals insight in the users own sleep circles and promotes thus better sleeping habits promises. By wearing a headband all phases are collected and can be uploaded to a sleep journal to spot trends one is unaware of.

Website: <http://www.myzeo.com/>

Address: 320 Nevada Street, Floor 4, Newton, MA 02460 United States

### **Other**

#### **FALCOM**

The medium-sized German enterprise FALCOM develops and manufactures wireless communications market and tracing systems as well as sensors. They are involved in an Ambient Assistant Living project *Weitblick* involving the German Workers Welfare and the system provider Kirchhoff Datensysteme. Its tracing devices are based on GPS and target rescue personal, children and elderly citizens; in the pilot *Weitblick* they include social alarms connecting informal caregivers and telecare.

Adresse: Gewerbering 6 98704 Langewiesen Germany. Website: [www.falcom.de](http://www.falcom.de)

#### **MHealth Alliance**

The mHealth Alliance has been set up as a non profit organisation bringing together policy research, advocacy, and support for the development of interoperable solutions and sustainable deployment models regarding mHealth. The idea for the mHealth Alliance emanated from a July 2008 conference in Bellagio, Italy on the future of mHealth, during which participants committed to forming a non-profit mHealth Alliance to maximize the impact of mobile health. It was founded at the GSM Mobile World Congress in February 2009. Its founding members are the UN Foundation, the Rockefeller Foundation, and The Vodafone Foundation. Soon after its launch, the mHealth Alliance welcomed GSMA and the U.S. Presidents Emergency Plan for AIDS Relief (PEPFAR) as Founding Partners. During the 2010 mHealth Summit, HP announced its commitment to the mHealth Alliance and was added as a Founding Partner.

As an umbrella organization it strives to complement, bring together and expand upon the mHealth initiatives of organizations around the world. Its mission is to "cultivate cross-sector, public and private collaboration in support of innovation and projects that address global health needs".

The mHealth Alliance recognises that mobile devices are already active in the provision of health services particularly in the collection of health data, the support of diagnosis and treatment, and in the advancing education and research. These can be used to reach the UN's Millennium Development Goals to reduce child and maternal mortality worldwide. Finally, the mHealth Alliance will facilitate regional partnerships and initiatives that improve healthcare in developing countries.

Address: 1800 Massachusetts Avenue NW, Suite 400, Washington, DC 20036, USA

Website: [www.mHealthalliance.org](http://www.mHealthalliance.org)

#### **European Connected Health Alliance (EChAlliance)**

The European Connected Health Alliance is the result of the merger in January 2012 of the MHealth Alliance (EuMHA) and EChCampus. Originally the EuMHA had been established through its enabling sponsors of the Kuopio Wellbeing Cluster of Eastern Finland and Oske, a programme for the

Ministry of the Economy and Employment of the Finnish Government along with the support of the European Connected Health Campus and the University of Manchester.

ECHAlliance supports both the private and public sectors working together through collaboration to develop the mHealth market. The structure of the organisation has been designed to provide the flexibility to accommodate the needs of a wide range of companies and organisations, that are already working within this new and exciting area or are new entrants. This flexibility provides a framework where organisations and individuals can work together through collaborative networks to develop innovation and promote this industry. Website: <http://www.echalliance.com/index.phpz>

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#### Abstract

This report aims to provide an overview of market developments in RMT and in the new areas of telecare, mobile health, wellness, fitness and independent living, based on the review of market reports acquired from market research companies and other sources like industry newsletters.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.