Changes in Healthcare: towards a “patient-centric” approach

Silvio Bonfiglio

FIMI PHILIPS, via S. Banfi 1 – 21047 SARONNO (Italy),
Tel. +39 0296175237, Fax +39 0296175305, e-mail: Silvio.Bonfiglio@philips.com

Abstract

We are facing significant changes in healthcare.
Its role is extending from treatment to prevention and remote patient monitoring and up to health maintenance through fitness, weight management and in general healthier lifestyle.
Healthcare is enlarging its scope beyond the patient domain and is including the support to people with special needs such as elderly and disabled for an independent living. Healthcare is extending its “institutional” role and it is becoming personal, ubiquitous and mobile.
Informal caregivers (patient’s family, friends, volunteers) are complementing the tasks of the medical professionals.
All the citizens are becoming the users of the new healthcare services and will be motivated and empowered to manage their own health.
This transition from a “clinical-centric” to a “patient-centric” approach is attracting the attention of the industry and telemedicine will play an important role in this new scenario.
Unfortunately the implementation of new approaches in healthcare is hampered by various challenges and restraints; they deal with technological issues and lack of standardization but also – and in some case preponderantly – with political, legal and cultural issues.
In this paper we intend to analyse these barriers and suggest some guidelines for a successful introduction of new telemedicine services and for the effective exploitation of personal and at home healthcare solutions.

Keywords

e-Health, Healthcare, Personal Healthcare, Remote Monitoring, Telemedicine
1. Introduction: the need of a change

Healthcare is approaching a very critical situation:

- Healthcare users are continuously growing in number. This is due from one side to the ageing of the population - as effect of the reduced birth rate and of the extended longevity - and from the other side to the healthcare access by emerging and underdeveloped economies. This demographics change is particularly significant in Europe where the population with age over 60 will grow from the 150 million of 2005 to 200 million in 2025 (plus 33%) (see fig. 1). In 2020 30% of the European population will have an age over 60.

- Moreover the ageing of the population is increasing the prevalence of chronic diseases. According to Frost & Sullivan\(^1\), in Europe a total of 50% of the hospital bed occupancy is by patients suffering from chronic illnesses such as diabetes and COPD (chronic obstructive pulmonary disease). This places a huge strain on the healthcare infrastructure.

![Ageing of the European population](image)

- People are becoming more conscious about healthcare and there is a growing demand for better quality of care.
- The overall healthcare costs are exploding: in USA they are already at a level of 15% of the GDP with an increase by 50% in 2006 since 2000. The World Health Organization expects a growth of the worldwide healthcare expenditure from 9% of the GDP (2005) to 11 % in 2015 (see fig.2a).
  The United States have the worldwide leading position with a healthcare expenditure per capita of approx. 6,000 US$ (2003 data) while in Europe France and Italy are the countries with the larger expenditure (3,000 US$) (see fig. 2b).

• The consequence of this growing demand is a shortage of medical professionals and of suitable medical infrastructures.

![Healthcare Expenditures to grow from ~9% of worldwide GDP to ~11% in 2015](image)

Fig. 2a: Worldwide Healthcare expenditure as percentage of the GDP

![Healthcare expenditure per capita, US $](image)

Fig. 2b: Healthcare expenditure per capita

Fig. 2: Healthcare expenditure

According to the Institute for Healthcare Improvement, “many healthcare systems around the world will become unsustainable by 2015. The only way to avoid this critical situation is to implement radical changes”.

2 Healthcare: from a “clinical-centric” towards a “patient-centric” approach

Healthcare needs to move from treatment to prevention; the possibility of monitoring chronically ill patients without having to accommodate them in the hospital is an exiting proposition for the National Healthcare Services in Europe.

Some significant changes are already in progress:

a. Healthcare – traditionally focused on institutional care and on curing diseases (diagnosis, treatment) - since last decade is shifting to monitoring and early detection and management of chronic diseases; the aim is to avoid – at least – the occurrence of complications.

b. The site of care is expanding its boundaries going outside the hospital and the clinical setting and moving towards the patient’s home;

c. Care is enlarging its scope beyond the patient domains and is including also the support to people with special needs such as elderly and disabled for an independent living;
d. Informal caregivers (relatives, friends, volunteers) are playing an important role by complementing the tasks of the medical professionals (formal caregivers).

Currently we are witnessing the last wave of this change: healthcare is pursuing a preventive objective, by focusing on health maintenance through fitness, weight management and in general healthier lifestyle; all the citizens are becoming the users of the healthcare services and are empowered to manage their own health through healthier habits. Healthcare is becoming ubiquitous, personal and mobile. This transition of healthcare from a “clinical-centric” to a “patient-centric” approach is attracting the attention of the industry. We expect an evolution over the next decade towards a continuous and pervasive care at home and away, from an “expert-centric system” to an “user-centric” system (personal healthcare – PHC).

![Fig.3: The expanding world of healthcare](image)

Let’s analyse some of these elements.

### 2.1 The Continuum of Care

The move from a “clinical care” (hospital, ICU, speciality clinic) to a “residential care” (nursery facility, assisted living, etc.) and up to “home care” will result in a reduction of the healthcare costs and – at the same time – in a higher comfort of the patient and enhanced quality of life as clearly indicated in the graph of fig.4 elaborated by the Digital Health Group of Intel.
2.2 From treatment to prevention, from episodic monitoring to long term, multi-parameter monitoring

Remote patient monitoring (RPM) – initially focussed on treatment and limited to a single vital sign and to post-operative situations – is now becoming an effective tool for the prevention of complications in chronic diseases; it is becoming a “continuous monitoring” and its main users are the sub-acute care groups i.e. users needing continuous vital signs monitoring but not continuous nurse care. For them better results are often achieved through the analysis of trends of a variety of parameters (multi-parameter monitoring) (see fig.5).
2.3 Enlargement of the healthcare user groups and of the caregivers

Healthcare is addressing new user groups other than the traditional patients; they are elderly and in general people with special needs such as persons with disabilities. By taking into account the ageing of the population, this new and additional “assistive” role of healthcare is very important. Degenerative episodes will be prevented and the need of frequent hospitalizations reduced by supporting the older people to live independently, to slow down their physical and cognitive decay.

Fortunately the extension of the healthcare user groups is compensated by an equivalent extension of the carers. Informal caregivers (the family, friends, volunteers, ...) are complementing the tasks of the formal caregivers i.e. the medical professionals (physicians, practitioners, nurses, ...).

![Image](Source: Continua Health Alliance)

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2.4 The last wave of the healthcare evolution: disease’s management and health maintenance through fitness and healthier lifestyles

Healthcare is becoming “personal” and is extending its role by including health coach and wellbeing enabling (nutritional advisory, fitness, “worried well” vital sign monitoring such as weight and physical activity) (see fig.7). This represents a paradigm shift and potentially all the citizens will become the users of the healthcare services.
Quality of Life will have a new, extended meaning where physical, psychological and social aspects are taken into account all together and the “way the patient perceives his/her overall health status” will become of paramount importance.

A study conducted in USA concluded that to improve health outcomes, the total healthcare system must focus more on the psychological and social issues attached with living with disease. In this new scenario the patients are aware, motivated and empowered to self-manage their health. Proper treatment of a patient is not just about medicine but includes awareness, education and training.

3 ICT: a challenging and great opportunity in the new healthcare scenario

New technologies and mainly ICT certainly will play an important role and will be determinant for this transition of healthcare from an institutional, “clinical-centered” towards a “patient-centric” approach.

ICT will complete the realization of the “digital hospital” by facilitating and enabling the clinician’s work at the point of care (security, decision support, increased productivity, mobile information access, reduction of errors, reduction of the overall costs).

Moreover ICT will have a challenging and great opportunity in reshaping the healthcare beyond the hospital’s environment by making possible the “home care” and the “personal healthcare”.

Involved technologies will be:
- New user interfaces, beyond the mouse and keyboard paradigm (simple, intuitive and natural interaction approaches between the user and the computer, multimodal and adaptive interfacing, user profiling and personalized user interfaces);
- Wireless & mobility with specific focus on near range communication (body area network and personal area network);
- Sensor technologies (vital sign sensors including biosensors, activity sensors, ambient sensors, tracking and localization systems, medication tracking);
- New Internet technologies for easy collection and ubiquitous access to widespread clinical data, for a powerful deployment of new healthcare services and as an effective inclusion tool for people at risk of exclusion (social networking, Web 2.0);
- Web services (telemonitoring, health coach, diet & fitness services, disease management service, etc.).

3.1 Barriers and drivers in the implementation of a new healthcare approach

3.1.1 Restraints

The journey towards a “patient-centric” healthcare will not be so easy... There are heavy barriers to be removed such as:

a. The lack of awareness at all levels (medical education, lack of motivation and poor adherence to treatments by the patients; lack of a suitable attention by the Institutions and the policy makers);

b. Regulation issues (difficulties linked to the involvement of multiple institutions, lack of development of a global e-health policy, lack of legislations, reimbursement policies, integration of telehealth into the conventional healthcare system);

c. Lack of standardization (inter-operability standards to foster the entrance of new players and the market growth);

d. Poor implementation and lack of effective business models involving all the stakeholders;

e. Insufficient validation of the newly proposed solutions and some resistance in the acceptance by the medical community.

Here below some of these elements will be briefly analysed:

A. Lack of awareness at all levels

There is a lack in understanding the important contribution new technologies such as ICT can give to avoid the “healthcare crisis”.

There is the need of education and awareness campaigns to overcome the poor adherence to treatments and long term therapies (in developed countries the adherence to treatments of chronic diseases averages 50%; in developing countries the rates are even lower).

B. Technical issues

For the effective introduction of e-health and remote patient monitoring ICT infrastructures need to become widely extended.

Fortunately we see a positive trend in this direction. The proliferation of more affordable broadband Internet access, of high quality telephony and videoconferencing throughout Europe is set to
underpin the continued expansion of transmission technologies such as telemedicine. Probably a bigger effort will be needed to speed up the process; a secure medical Intranet could be the next key enabler for Telemedicine.

C. Legislation and political issues

Policy makers and institutions need a better proof of the benefits of telemedicine in terms of return on investment and cost savings. The intervention of the Public Authorities will be needed to sponsor and support high profile projects, trials / specialist applications and to develop private-public partnership schemes.

The development of a global e-health policy is missed; there is the lack of a set of statements, directives, regulations, laws and juridical interpretations that direct and manage the lifecycle of e-health including the reimbursement policy, the integration of telehealth into the conventional healthcare system (the payback is in some cases a long process and most politicians have short planning horizons).

D. Lack of standards

The lack of standards specifically developed for the medical world is another barrier for the introduction of new technologies.

Areas of main interest for standardization are Wireless interoperability in the tele-healthcare domain, Security and privacy, Data exchange and interoperability issues at an application level.

Standardization needs to cover the data interfacing between the sensors and the wireless device at the patient’s site and between this device and the remote server of the Healthcare Center and finally the data transfer and integration into the health electronic record (HER).

Standards are also expected in the areas of user interfaces and reference design.

The goal of standardization is to ensure interoperability among devices, solutions, services provided by different companies; it will allow purchasers to have a greater choice regarding how to assemble their system and will intensify the competitive landscape by limiting the use of proprietary and expensive solutions.

Furthermore the standardization will ensure much more stability to the market.

![Fig. 8: Standardization areas for e-health](image-url)
Several standardization initiatives are in progress in all the relevant areas of the personal tele-health care domain. The following table gives a summary of some of these initiatives.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Notes</th>
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<tbody>
<tr>
<td>IEEE - Personal Health Data (PHD) Working Group</td>
<td></td>
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<tr>
<td>Bluetooth SIG Medical Devices Working Group</td>
<td>Established in May 2006</td>
</tr>
<tr>
<td>ZigBee Application Framework - Personal / Home Health Care Study Group</td>
<td>Development of a new application profile in the area of health monitoring to enable plug-and-play interoperability of wireless ZigBee-enabled medical sensors and devices</td>
</tr>
<tr>
<td>CEN/TC251/PT5-021 Project Team</td>
<td>Standardisation of the representation of digitised biomedical signals, measurements, events and alarms</td>
</tr>
<tr>
<td>IEEE P1073.0.1.1 Working Group</td>
<td>Promotion of the use of off-the-shelf technologies (IEEE 801.11 “WiFi”, IEEE 802.15.1 “Bluetooth” and IEEE 802.15.4/“Zigbee”) in a shared IT infrastructure where multiple devices and systems from diverse vendors can be integrated to provide safe and effective communication of medical data.</td>
</tr>
<tr>
<td>IEEE P1451.5 Project</td>
<td>Definition of wireless communication protocols and data formats for wireless transducers (sensors and actuators) based on the IEEE P1451 family of smart transducer interface standards. The expected standard will adopt the IEEE 802 family of the wireless communication protocols.</td>
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Table 1: Standardization initiatives

To solve the interoperability problem at an application level it is necessary that devices speak a common language by means of a common nomenclature, data types, message syntax and encoding rules. Many national and international organizations are working on standards that enable upper-layer information exchange (HL7, ISO 11073 / IEEE 1073 family of standard). It is important to extend their applicability to a “non-clinical”, “de-institutionalized” context, i.e. to personal healthcare systems, where sensors and battery powered devices demand for very low computational complexity and low power consumption. Other initiatives are expected in the area of integrity and security of data; an example is offered by the USA where guidelines were defined by the HIPAA (Health Insurance Portability and Accountability Act).

E. The lack of reimbursement policies
In the USA the telemedicine services are reimbursed only in few cases; physicians are not rewarded for remote device data analysis and physical presence of the clinician is needed in order to ensure reimbursement of his / her performances (face-to-face medical service delivery). The situation is not different in Europe and in other parts of the world.
Another restraint is the cost of the new solutions; in general there is little empirical evidence of the relative benefit and it refrains the adoption of clear reimbursement policies by the National Health Service and/or by Health Insurance companies.

The dependence of the market on the reimbursement system can be a strong restraint to its growth. The Continua Health Alliance has formed a Working Group (the Reimbursement Strategy Working Group (RSWG)) which is running an analysis on all the tests, trials in Remote Patient Monitoring (RPM) conducted over the last five years in Europe and in the United States. The goal is to prove benefits of RPM and promote reimbursement policies for personal tele-health technologies worldwide.

F. Unclear legal aspects

As a consequence of the shifting of healthcare from a clinical setting towards the patient’s home, the tasks of formal and informal caregivers are changing their contents; for instance they get to do new, additional medical and technical tasks such as the operation and maintenance of home care equipment. In this new tendency the responsibilities and liabilities are very often not clearly defined, both the liability of health professionals and of the other players (health service providers, network providers, device producers).

An appropriate legal framework is still missed. Moreover legislations are different on geographical basis and this variety of legal frameworks represents a further barrier that often refrains the industry to enter in the market of the telemedicine services.

G. Fragmented healthcare structure

The complex and fragmented healthcare structure in Europe and the lack of sufficient alignment of Government initiatives are the key reasons of the delay of Europe in Telemedicine when compared with USA. Standardization and implementation of a common code is a major factor that needs to be sorted out to avoid – at least – a disparity in the stages of growth of the Telemedicine and of the “new healthcare” industry.

3.1.2 Market drivers

In spite of the challenges above described, there are several factors that will foster the evolution of healthcare and will drive the growth of the related market:
- Growing prevalence of chronic diseases mainly due to the ageing of the population,
- Longer life expectancy and population expansion,
- Continuous investments of the industry stimulated by the market potential,
- A never ending demand of enhancement in quality and treatment (increased expectations on the part of the “engaged consumer” and the “future patient” with regard to achieving and regaining optimal health),
- Increased public awareness,
- Technological innovation.

![Key Drivers of Market Development](image)
(Source: Frost & Sullivan, 2006)

**Fig. 9**: Market drivers for e-health and telemedicine

4 Strategies and Recommendations

As highlighted by Dr. Stroetmann of the Institute for Communication and Technology Research in Bonn, “successful results will be achieved only if the interests of the various players involved in healthcare will be taken into account including patients, physicians, policy makers and the overall community”.

Therefore it will be important to identify all the involved stakeholders and address them.

The healthcare process involves not only the medical professionals and the patients but other stakeholders such as the families, the policy makers, the institutions including obviously the National Health System, the industry, the overall community. The move to a “personal healthcare” is changing and widening this stakeholders scenario (see fig.9).

Healthcare will evolve only through the synergic effort of all of them towards a common objective: a better quality of care and a sustainable healthcare system. The interests of all the players have to be considered (see fig. 10).
The reluctance of the medical community to accept the entrance in the medical world of new technologies such as ICT is often a “cultural matter”, a mindset problem.

To avoid this barrier, “telemedicine should definitely be used as a tool by health professionals but it should definitely be at the service of the patients. It should not change the way clinicians practice. It has to fit with the existing framework.” (Dr. Daniel Mart of the Comité Permanent des Médicins Européens / Standard Committee of European Doctors (CPME)). We have to avoid the risk of the dehumanization of healthcare; the use of technology “should be to support medicine not the other way around”.

The graph reported in the following fig. 11 indicates some of the recommended initiatives.
Industrial co-operation and alliance (e.g. licensing by large companies of innovative products developed by smaller companies; common standardization initiatives) are needed. Collaboration is also needed between manufacturers, system integrators and telecom companies; in this regard it will be of high importance to define the role of the telecom companies i.e. their willingness in incorporating remote patient monitoring services in their offer to the market.

5. Conclusions

As evidenced by several analysts the healthcare system is experiencing a critical situation: demand is dramatically growing both in terms of the enlargement of the healthcare users and in terms of higher expectations with regard to the quality of care.

ICT has the great opportunity to foster the transformation of healthcare toward a “patient-centric” focus. Nevertheless several barriers have to be removed and often they are not linked to the shortage of suitable and advanced technologies but – preponderantly – they are related to political, legal and cultural issues.

All the stakeholders (medical professionals, policy makers, institutions, patients and their families, the overall community) need to find the way to cooperate in a common effort. The ultimate goal is a better quality of care for all the citizens and the access to the healthcare services extended to everyone including people with special problems (e.g. elderly and people with disabilities) and people living in underdeveloped or emerging countries.