Chapter 4
An Introduction to Personalized eHealth

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1 Introduction

In recent years, the field of personalized medicine has greatly expanded and has attracted great interest not only among professionals but also from the general public. The concept of "therapy for a disease" is no longer satisfactory, and the need for a drug that takes into account the individual becomes more and more a necessity (Ginsburg and Willard 2009; Plebani 2016).

However, the paradigm of personalized medicine is not new in the field of care; medicine has always taken into consideration the variability of individuals by treating the patient in relation to his/her differences both in terms of diagnosis and response to treatment; for example, blood typing has long been used to conduct blood transfusions and organ transplants (Collins and Varmus 2015).

Advancements in science and technology have allowed a more in-depth study of human genetic individuality. In particular, the enormous development of genetics, through DNA sequencing, has enabled scientists to manage a large amount of data.

Some examples are the powerful methods to characterize patients (such as different cell dosages, geomorphology, proteomics, metabolomics, and even mobile health technology), the development of large-scale biological databases (such as the human genome sequence), and computational tools for the analysis of large data sets.

All these advances, inseparable from the sociological aspects, have allowed the development of a more objective approach to diagnosis and targeted therapies and

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the ability to predict the response to therapy, avoiding undesirable effects (Collins and Varmus 2015; Offit 2011). The field of oncology has derived the largest benefits from the use of personalized medicine. The application of molecular biology technology has allowed a precise distinction between the different types of cancer, an early diagnosis for some forms of cancer, and a definition of ad hoc therapeutic strategies for the cancer patient.

1.1 What Are the News of Personalized Medicine?

Compared to "traditional" medicine, personalized medicine allows greater precision in predicting risk and responding to therapies (Ginsburg and Willard 2009; Swan 2009; Zhang et al. 2012).

The result is P5 approach, a model of healthcare based on proactive (preventive) planning (cfr. Chap. 3), unlike the traditional model of reactive health (episodic). Indeed, traditional medicine interventions were implemented in acute crisis, i.e., when the disease was already established and sometimes irreversible. Furthermore, disease treatment and prevention strategies are developed for the general population, without distinction. We then move from a one-dimensional clinical approach to one focused on the patient, in order to optimize medical decisions and to apply specific treatments.

1.2 A Brief History

As previously mentioned, personalized medicine is a known field. Since ancient times, doctors were convinced that the onset of diseases had different causes. They believed that subjects with the same disease should be treated differently from one another because of the physical and psychic differences.

Previously, the Egyptians distinguished the endogenous causes (corruption of the intestinal contents due to a "matter pecans"), the exogenous causes (natural calamities, parasites, bites of animals), the hidden causes (revenge of a dead person, wrath of God, hatred of enemies), and finally the psychogenic causes (mood disorders or psychosomatic pathologies).

Subsequently, Hippocrates (480–390 b.c.) began to take care of the ill person and not of the disease (Grmek 1993), considering alimentation, physical activity, lifestyle, and climate. Hippocrates unifies "in a critical analysis the patient, the sickness, the physician and above all proposes the integration of the physical and psychological uniqueness of the subject with the socio-cultural and physical-geographical complexity of his environment" (Zitelli and Palmer 1979). Claudio Galeno introduced the concept of predisposition (129–200 a.c.). Taking up the humoral theory of Hippocrates, he introduced two internal causes beside the body's external causes:

- Causes that predispose a certain individual to certain diseases
- Immediate causes that the doctor can only see when the disease has started

Galeno also expanded this theory to the healing of the patient; he argues that healing from an illness also depends heavily on the patient's life habits (alimentation, rest, sexual activity, emotional state). According to this theory "the patient needs individualized attention, since the preservation of health changes according to the complexions and bodily habitus" (Sotres 1993).

More recently, Sacks dealt with this theme. He showed that patients with the same disease are fundamentally different from each other and that the technical-scientific evaluations were insufficient because they "revealed only the deficits and not the abilities; they provide us only fragmentary data and patterns, while we need to see a music, a story, a series of actions lived" (Sacks 1986). For example, he mentions that patients with Tourette syndrome were never the same.

The development of technologies and the progress of science have today led to the study of interindividual variability through genotypic characteristics. The discovery and study of the human genome has allowed an incredible advancement of personalized medicine. Although personalized medicine is an area that has always been known and it is an intuitive concept, there are different opinions about its definition. In fact, today there is not yet a precise and universally accepted definition of personalized medicine (Table 4.1).

In Table 4.2 instead, we compare the five main definitions of personalized medicine. The first one by Carlson (2008) considers the prevention and treatment of disease based on the patient's genetic profile. Differently, Personalized Medicine Coalition's definition considers prevention as predisposition of patients to particular disease and the management of illness.

The definition from the America Medical Association is only about pharmacological treatment. Finally, the third definition gives information about prevention, treatment, and individuality.

As we can see, psychological aspects are considered by only one definition (Personalized Medicine Coalition's definition). As we saw before, personalized medicine uses the information about patient's life, to create an individualized care and cure (cfr. Chap. 1). It is fundamental to consider that the patient's life is

Table 4.1 Personalized medicine definitions

Definition	Reference
Prevention, diagnosis, and therapy of a specific disease based on the individual genetic profile	Carlson (2008)
Use of new methods of molecular analysis to better manage an illness or the predisposition to pathologies	Personalized Medicine Coalition
Provide the right treatment to the right patient at the right dose	European Union
Medicine based on the clinical, genetic, and environmental information of each person	American Medical Association
Medicine that uses information about genes, proteins, and the person's environment to prevent, diagnose, and treat diseases	National Cancer Institute

Table 4.2 The definition of personalized medicine on comparison

Definition	Prevention	Treatment	Individuality	Psychological aspects
Carlson (2008)	x	x	x	–
Personalized Medicine Coalition	x	–	–	x
European Union	–	x	–	–
American Medical Association	–	–	x	–
National Cancer Institute	x	x	x	–

constituted not only by genomic aspects but also by his social condition, work (activity), family history, etc. (cfr. Chap. 3).

This underlines the confusion surrounding the definition of personalized medicine.

In general, personalized medicine can be defined as the medical approach that uses the specific biological characteristics, environment, needs, and lifestyle of an individual to create ad hoc therapy, including drugs, dosages, and other possible remedies (Swan 2009; Capurso 2018; Jameson and Longo 2015).

2 The Development of Personalized Medicine

The development of personalized medicine and the increased knowledge between genes and external factors have brought some changes in different fields of healthcare:

- Treatments
- Diagnosis and risk prediction
- Doctor-patient communication
- Disease/illness management

Further, we will analyze them one by one to better understand how and what are the changes that personalized medicine has brought in each of these areas.

2.1 Treatments

From the earliest times, it was known that the response to drugs is genetically determined. Over the years, we have seen how, together with its genetic heritage, other factors play a fundamental role, including health status, environmental exposure, nutrition, and age (cfr. Chap. 3).

The introduction of personalized medicine has allowed the extension of the approaches traditionally used for the understanding and treatment of diseases (Vogenberg et al. 2010; Ginsburg and Willard 2009).

Thus, pharmacogenomics was born, a discipline that consists in the study of genomic characteristics that determine individual differences in the response to drugs; it has allowed doctors to select drugs and to create customized intervention protocols on the nature of diseases, diagnosis, responses to treatments, and its individual characteristics (Panahiazar et al. 2014). Pharmacogenomics allows the following:

- The prediction of possible side effects of drugs on specific patients
- The identification of the susceptibility of an individual to certain diseases, allowing doctors to draw up a monitoring and prevention plan
- To define a priori the best treatment and the best drugs for specific patients

Doctors will be able to make more effective clinical decisions for each patient, going beyond the classic "one-size-fits-all" concept.

The personalization of treatments also allows identifying the subpopulations that behave differently toward a given drug, compared to the typical patient. This creates more stringent inclusion/exclusion criteria that make treatment positive in terms of safety and efficacy (Richmond 2008).

2.2 Diagnosis and Risk Prediction

The progress of genomics has allowed, through the execution of genetic tests, the identification of genomic alterations that underlies many genetic diseases. This allows to obtain information on the probability that an individual can develop a disease, especially the most difficult to treat, such as cancer, diabetes, or cardiovascular disorders. In this way, doctors will be able to develop individual interventions to avoid or control the development of the pathology, by implementing, for example, changes in the patient's lifestyle (cfr. Chap. 3) (Steffen and Lenz 2013; Gaitskell 2017).

In this way, we can focus more on prevention rather than on the management of the disease (cfr. Chap. 3). With this aim, we can, in the future, use the collection of genetic information from prenatal tests, to outline possible diseases that can be avoided or adequately controlled.

The use of personalized medicine in the field of prevention, and also in P5 approach, can therefore significantly reduce the incidence of diseases, especially chronic ones. However, the development of biological markers based on primary prevention is still distant, despite the enormous development of research (Panahiazar et al. 2014; Katsios and Roukos 2010).

2.3 Doctor-Patient Communication

With the introduction of personalized medicine, there will be more and more information about the available treatment options, to be understood and discussed by the patient and the doctor. This implies a change in the relationship and, in particular, in the patient-doctor communication. The doctor-patient communication concerns two subjects who are in an unfair and often in a not voluntary position. Both patient and the physician find themselves in difficulty: the patient, following a diagnosis, finds himself in a state of shock and refusal that makes it difficult to process the information that is provided or does not have the necessary knowledge to understand them; on the other hand, the doctor often lacks the confidence and training necessary to provide patients with clear, understandable, and empathetic information and finds himself having to conduct the interview quickly and in an unsuitable place. In this situation very often the patient's expectations or understandings are left in the background, focusing only on the biomedical aspects (Kerr et al. 2003; Ong et al. 1995). The introduction of personalized medicine implies a change in the relationship and, in particular, in the patient-doctor communication. Communication must be characterized by three key elements shared by both parties:

- Information
- Autonomy
- Responsibility

In accordance with P5 approach, this means that the professional will aim to create a more personalized environment that promotes the flow of information; communication will be more informative: the specialist will tend to be more clear, using a colloquial language that is understandable for the patient and will provide such information with empathy, dignity, and respect. In this way, the whole process of diagnosis and treatment is clear and understandable. At the same time, the patient will feel more involved and no longer a passive subject (cfr. Chap. 1); he will be able to express his preferences on treatments, for example, he will be able to have a say in the choice of treatment planning or in the choice of the various exercises proposed, etc.. In this way, the doctor will no longer feel the only responsible for the outcome of the intervention, but a sharing of responsibility is established (Lemay et al. 2017; Cutica et al. 2014).

2.4 Disease/Illness Management

The change in communication between doctor and patient has made healthcare more collaborative, allowing patients to be participants and guides of their path to recovery (Gorini et al. 2018). The involvement of the patient in the decision-making process recognizes the autonomy of the latter, who will be more inclined to accept and follow the treatment leading to the possibility of a better prognosis (Cutica et al.

2014). The patient's knowledge of his condition will lead to more and more experienced and more active patients managing their pathology in the future, which is the purpose of P5 approach.

In the future, the patient-driven medicine could expedite dramatically the clinical trial process. Health social networks can bring standardized digital data and pre-aggregated patient registries to clinical trial conductors. Moreover, a collaboration between health social networks and clinical trial representatives can be created, on their needs for electronic data collection, ensuring that the quantitative information necessary for clinical trials is already available to all participating patients. Clinical trial prescreening survey can be administered easily through health social network websites (Swan 2009).

3 The Role of eHealth (and mHealth Specifically)

Considering the complexity of eHealth resources (cfr. Chap. 1), we will focus on mHealth, which is characterized by technologies particularly useful for the aim of personalization.

When we speak about mHealth, we refer to mobile telecommunication technologies supporting wellness through the delivery of healthcare (Steinhubl et al. 2013; Gorini et al. 2018; Triberti et al. 2019).

The smartphone could become the hub of future medicine, also regarding mental health services (Ben-Zeev et al. 2013). Personalized medicine in P5 approach includes for example the possibility to access *real-time patient self-report data* (cfr. Chap. 3) during the time interval between visits. In other words, eHealth could be a support for patients and caregivers in terms of self-monitoring. Mobile phones and other personal devices indeed can improve the accessibility to these data sets. Indeed, these can be utilized in order to help patients in gathering information about their own diseases so to make them able to manage their own situation more effectively.

Iterative development processes could create applications that will be available on multiple platforms (cfr. Chap 9), used also to improve patients' acceptance of disease in often complicated day-to-day routines (Diamantidis and Becker 2014). Patients could have access to data collection, becoming active managers of their symptoms, potentially leading to more accurate assessment. Berrouiguet et al. (2018) describe an example in which eHealth tools allow an endocrinologist to chart blood glucose levels. In this way, before and after a doctor's appointment, health professionals could observe and control these values with a portable blood glucose meter. At the same time, changes in sleep, appetite, mood, and other behavioral and psychological data could be recorded, which is important both for physical and mental health management. In general, smartphones and portable computers have a pluripotent impact in terms of collection of data about blood pressure, glucose, brain waves, and heart rhythm.

Therefore, we can observe an interesting aspect in P5 approach: patients could update their data in order to *be carried on by medical staff* in each moment of the day; at the same time, the combination of real-time self-monitoring and contextual information could enhance medical decision-making, according to data analysis tools. Data can be collected by patients or caregivers themselves, and they could be reported in a portable device or could be captured through sensors in the patient's living environment. The choice and challenge of using artificial intelligence data-mining techniques give the possibility for improving clinical decision-making and a more personalized treatment (Van der Krieke et al. 2013; Durand et al. 2014; Gorini et al. 2018). In addition, it is possible to *reduce the number of visits to the doctor*. Many measurements will be acquired by oneself; people will collect data also respecting their own convenience, and it is possible to assume that much more information will be acquired than ever before (Van Dyck et al. 2016; Steinberg et al. 2013).

eHealth could become an *instrument of cost reduction and prevention* (cfr. Chap. 1); the idea is that this technology will be developed with the aim of leading a reduction in resource consumption, emergency room use, and number of patients recovering in hospitals. Indeed, the delocalization of therapeutic procedures permitted by the use of mobile-based resources will make possible to reduce the necessity for the patients to reach the hospital for any healthcare need. This would be desirable also in terms of keeping away infections and other problems related to recovery in hospitals (Hayes et al. 2014). For example, the high risk of social isolation caused by recovery could increase delays in patients' discharges from care hospitals (Landeiro et al. 2016). Possibly, hospital recovery will be necessary only in specific conditions; it will be part of an important change; for all other cases, patients will be taken care of at their homes, with the help of mobile healthcare technologies. These instruments can also answer to the emergence of new treatment paradigms able to determine when a disease is a current or a future burden for someone, with the desire to anticipate illness and its consequences (preventive medicine) (Rotily and Roze 2013) (see Fig. 4.1).

It is clear that the importance of safety and regulation of smartphone apps in this advancing field is in continuous growth, aiming to an accurate and meticulous sharing of a person's care (Hayes et al. 2014), which also raises ethical issues such as privacy concerns (cfr. Chap. 10). A future perspective of eHealth-related personalized medicine could include the role of caregivers. Family members and friends are an important form of support for patients (cfr. Chap. 3); in this sense, eHealth could become a key facilitator of medical adherence helping unprepared people for the demand of caring. Technologies indeed could require support and training in the process of caring (Car et al. 2017). In addition, in the future we could assume the ongoing growth of new services based on a user-centered approach and iterative development processes, even evaluating the context of use (Scandurra and Sjölinder 2013) (cfr. Chap. 9).

Another interesting resource for personalization among digital technologies (relating both mobile and non-mobile devices) regards *avatars*. Avatars are digital representations of users within digital environments, ranging from static images (e.g., in social networks) to dynamic figures able to act and move (e.g., in video games). Avatars are often customized by users, and according to literature, such customization

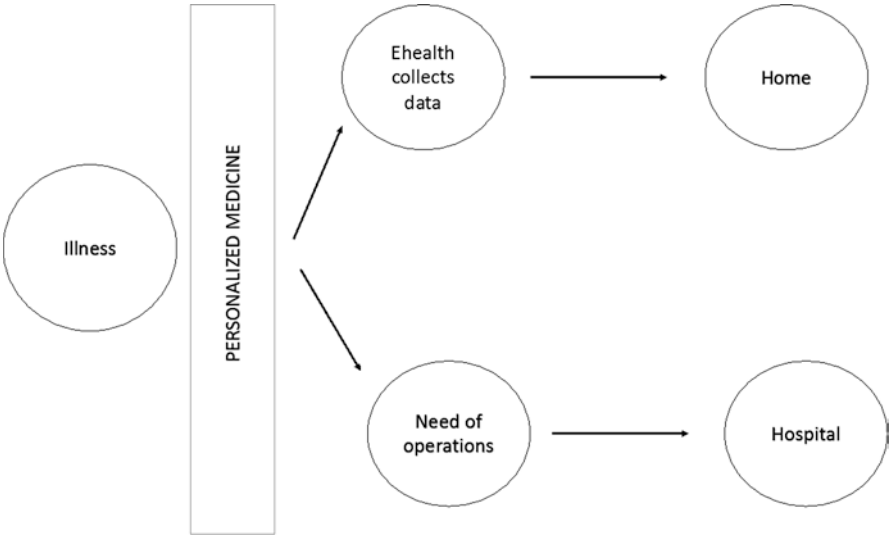

Fig. 4.1 The impact of personalized medicine on hospitalization

process is not random, rather users tend to use avatars to represent aspects of their physical appearance, personality, and even beliefs in a symbolic manner.

In that some eHealth technologies entail social network features or video games/serious games, avatars can appear in this field. An interesting development is to exploit this specific feature beyond its basic representational features; creating dynamical avatars whose appearance changes over time depending on users' behavior (e.g., adherence to therapy and to healthy activities) would create a digital feedback of patients' progress through their own healthcare journey (Triberti and Chirico 2017).

Moreover, recent studies are exploring the idea that digital avatars created by patients could be analyzed such as drawings and personal artifacts, in that they may be characterized by relevant features to be considered for psychological assessment (e.g., patients with low self-esteem and depression symptoms may create less detailed avatars) (Triberti et al. 2017; Villani et al. 2016).

Indeed, giving patients the opportunity to represent themselves is another resource both in terms of engagement and self-expression and also an innovative source of health-related information for health providers and researchers.

4 Liability: The Road Toward Becoming Active Patients

During the specification of technologies referring to P5 approach, we cannot forget an important included aspect: *the sense of liability*. Technologies in general, and also eHealth, should include a reflection on this ethic element because the usage of these instruments has both benefits and limits.

Firstly, a great advantage of eHealth in terms of liability underlines that people can become *healthier* in their lifestyle. Patients indeed can be incentivized to be healthier in all sorts of ways, and the possibility of having one's own data could be a stimulus. This concept is also linked to an idea of prevention; in this case, people ideally prevent the development of a chronic disease, involving an own sense of liability (Hayes et al. 2014). Therefrom, liability is a positive reaction that an individual could improve in front of a possible disease, helped by eHealth. In order to explain how eHealth can help the development of liability, we can consider the use of genomic markers for personalized medicine. Genomic markers should be a great way in order to underline people at high risk of the more common side effects or with a high probability of nonresponse. In this case, eHealth could be an accurate and current helper in order to find alternative strategies: either with other drugs or through preventive means, including diet and physical exercise (Norman et al. 2007).

The overall goal is based on the possibility to have patients even more characterized by an *increase in level of information flow, transparency, and collaboration with personal care as well as quantitative, predictive, and preventive aspects that are basic conditions for taking responsibility* as P5 approach underlines. This idea is sustained by the current and continuous expansion of the healthcare through new services. About this, Swan (2009) underlines that social networks are a potential instrument in the field of health. Through social networks, everyone can share information and knowledge about conditions, symptoms, and treatments, creating a platform for discussion about different issues; if I would have the possibility to know my symptoms, I can prevent chronic disease or monitor a future state of illness (cfr. Chap. 3). In addition, I can read and understand similar experiences of others; patients have to accept a radical change: the repositioning from being a minimally informed advice recipient to become an active manager of their own health.

Everyone has the liability of their health, and evaluating this fundamental role, individuals must become instigating collaborators, peer leaders, and information sharers in participative medicine. In other words, liability through eHealth can bring to a transition from paternalistic healthcare to partnership models (Townsend et al. 2015). In this way, individuals become more and more engaged in the course of their care, for example, by participating in a variety of self-testing and self-management activities and becoming more and more aware of the personal and environmental factors that impact their health (Swan 2009).

Liability should not only increase in patients but also in physicians, which are active protagonists of a care co-building. If patients will be more careful about the management of their symptoms, *physicians should adapt their behavior and workout strategies* to this new shift, starting to become a care consultant and collaborator for patients. This possibility prefigures a collaboration between patients and medical staff (Appelboom et al. 2014).

In summary, eHealth could be a basic condition to supply people with personalized data for better quantification of their wellness by involving a sense of liability; individuals are more likely to have positive behavioral changes, becoming active protagonists of their life and not passive recipients of others' decisions (Flores et al. 2013).

5 Communication Through eHealth

Genetic and genomic technologies were the start for the development of many medical specialties involved in personalized medicine. This is indeed the strategy to reduce disjointed or uncoordinated clinical care, in order to *optimize effective communication*. The overall goal aims at the promotion of patients' understanding and engagement regarding the need, and the consequent use, for these services. An interpersonal approach can also optimize the quality of care starting from the minimization of duplicate testing, providing accurate information to patients and their families and reducing gaps in healthcares. This can be the optimal result to achieve when different medical care roles will collaborate and communicate correctly with each other. This way, healthcare services can work together with patients to address all issues in a cohesive manner (Haga et al. 2015), moving to a co-diagnosis and a co-care model between physicians, patients, and other parties.

We could assist to a *change of mental representation* within the P5 approach; a collaborative communication could start to make physician a colleague and advisor, as one of many sources during a care plan. At the same time, patients could become more and more of an informed participant, an active responsibility taker, and a coordinator of his/her health program and health data (Hood and Friend 2011). Future interactions will be focused on this new way of communication: in this case, patients will call physicians in order to have a consultative co-interpretation of the results, bringing quantitative reports from their self-testing and self-tracking activities hold through eHealth services. Speaking about a change of communication, another option is to assume that could be the emergence of on-demand web-based physician consultation services with video and chat (Swan 2009).

The usage of eHealth has benefits and limitations at the same time. Several advantages of eHealth are evident starting from the high flexibility in its usage regarding *time and place*. Patients could formulate questions and understand responses in each moment through communication with healthcare professionals. We assume that eHealth could potentially contribute to an increased *quality of care* in front of the *new awareness of patients* themselves.

At the same time, if many studies underline the positive attitude of patients toward self-management, others report to patients' *feeling of inability* to judge the seriousness of their side effects and symptoms. A research of Schulman-Green et al. (2011) establishes the necessity of the assessment related to patients' preferences and ability to self-manage over time, putting attention during transitions and its possible changes.

Other limits in the use of eHealth could be patient's *age and different cancer diagnosis*. Regarding the first point, Schulman-Green et al. (2011) underline that higher age is associated with lower eHealth usage. It is also possible that the number of comorbidity conditions in older persons influences self-management ability negatively. Variations toward eHealth among different cancer diagnosis groups are instead examined in depth by Boyes et al. (2012); they report that prostate and testicular cancer survivors had a more positive attitude toward online contact with

healthcare professionals. It's clear the preference to *communicate online intimate symptoms encountered*, such as incontinence, infertility, and reduced sexual functioning. Børøsund et al. (2013) describe different attitudes toward eHealth between breast and prostate cancer patients; *sex* is in fact another important element of discussion. Among women with breast cancer, high use of eHealth is typical of those with depression and low levels of perceived social support; for men with prostate cancer, eHealth's usage is instead linked to symptom distress. In another study (Triberti et al. 2018), males were more likely to use mobile app's notes function to communicate with the health providers, both in terms of medical information and personal confidences, comments, and emotional states.

As a solution, future eHealth and mHealth resources should be designed basing on users' personal characteristics, desires, and contexts, in order to tailor such devices and services on their own predispositions; according to literature, this would augment the probability that such solutions will be accepted and productively used (cfr. Chap 9).

6 Health Social Networks

In this chapter, we have had the occasion to discover how eHealth (mobile technologies and social networks specifically) can support the introduction of personalized medicine in the P5 approach. It is important to focus on social networks in order to provide more details on how this important resource of web-based technologies can be used within a P5 approach to healthcare:

1. Health social networks are primarily directed to patients, but, at the same time, we know that caretakers, families, and other interested parties may be involved (Gage-Bouchard et al. 2017). Sharing information and emotional support is important in order to build networks of relationships, reducing the idea to be lonely during the healthcare process.
2. Several health social networks (e.g., eHealth forum) give the possibility to pose some questions to physicians (Hawn 2009). This transparency changes the image of doctors: it is not a 10-min accessible collaborator in care, but it could become a professional role based on the willingness to interact with patients. Even this basic mechanism of lightweight doctor-patient interaction could change burdens on the healthcare system.
3. eHealth forum could also be used in order to create a community with other patients in which feeling of commonality and mutual comprehension are presented. This eHealth forum offers the sharing of feelings and personal opinions that could be useful for patients lacking social relationships or having the need to speak with other people with their same medical condition (Nabi et al. 2013).
4. Another type of service offered by health social networks is based on quantified self-tracking, that is, an easy-to-use data entry screening for symptoms, treatments, and other biological information (Aral and Nicolaides 2017; Morris and

Aguilera 2012). The use of graphical displays or other strategies could improve patient's ability of understanding treatments, in order to become active protagonists of their cares and, eventually, to be able to call physicians if there is a negative symptom of disease. This object aims at a personalized medicine based on prevention.

5. In addition, regarding the importance of scientific publications, we could assume the possibility to use information for clinical trials. The availability of large searchable online databases in which health history and condition information of patients are included could improve traditional clinical trials, making them more efficient (Groves et al. 2013).

7 Challenges to eHealth Usages and Possible Solutions

New health technologies (eHealth) are recognized as having a major impact on health promotion and management. These tools allow to develop the implementation of integrated, sustainable, and patient-centered services and to promote an effective exchange between patient and doctor, with the patient acquiring an active role in the health process (Barello et al. 2016; Gorini et al. 2018). However, in some cases, eHealth is often unacceptable and/or long term adopted by its users.

There are many factors that can influence the use of eHealth to monitor patient health. Firstly, in some patients the idea of being constantly monitored can create excessive anxiety; in fact, patients with low self-control, through the use of self-monitored technologies, may be afraid of having more problems or treatments for the well-being of patients (Kessel et al. 2017). If the patient is not convinced of the usefulness of these tools for his health management, or if he/she is excessively afraid of the disease, such new commitments could be a source of further stress and negative attitude treatment comparisons. In such situations, patients can not only abandon the eHealth tools but also their trust in healthcare professionals can be reduced with detrimental effects on the effectiveness of the health management process as a whole.

In most cases, considering eHealth not useful for oneself, it is related to the lack of customization of the tools. The functions and contents of eHealth (including required information, patient feedback, etc.) should be adapted to the patient's individual biopsychosocial characteristics to provide more useful, more accepted, and nonredundant information (Gorini et al. 2015; Pravettoni et al. 2016). Furthermore, the personalization factors also refer to the possibility of the patient to express himself within the use of the technology. For example, eHealth functions, as well as automatic communications, will not be generalized to patient populations, but will be based on individual characteristics.

Secondly, some patients were concerned about the implementation of eHealth as a result of the budget cuts being treated. The need for face-to-face contact with professional figures is always a very requested and reassuring aspect for patients

(Mattsson et al. 2017). It is important to explain the reason for using eHealth, which is intended to accompany the work of physician and not to replace it.

In conclusion, the goal of personalized medicine, and the specific approach of P5, is to highlight the importance of a personalized technology for each type of patient.

8 Conclusion

In recent years, personalized medicine has attracted great interest and has expanded more and more, involving different areas of healthcare. In particular, it allowed changes in the choice of treatment through pharmacogenomics. Through this discipline, it has indeed been possible to predict the possible side effects of drugs on individual patients, define a priori the best treatment and the best drugs that fit the specific patient, and identify the susceptibility of an individual to certain diseases, favoring the identification of a preventive treatment plan.

All these aspects have favored the shift of attention more on prevention than the treatment of diseases. The use of personalized medicine in the field of prevention can significantly reduce the incidence of diseases, especially chronic ones.

Another aspect that has been involved since the advent of personalized medicine is the communication between doctor and patient. The doctor is more attentive to the needs of the patient, providing clear information about diagnosis and treatment. At the same time, the patient has a voice in relation to the decisions that determine their state of health and their care.

The patient is no longer a passive subject, but becomes an active one, both in decision-making and in the management of his illness. This aspect is favored by technology that through different devices has made it easier to monitor your health and communication.

eHealth, for example, could be a useful instrument for helping monitoring and managing diseases. eHealth, indeed, makes it possible for patients to be carried by medical staff in each moment of day through the combination of real-time self-monitoring with many contextual information. The result of this health strategy can enhance medical decision-making, in combination to data analysis tools. This not only brings to a reduction of the number of times patients have to visit the doctor but also is a means of reducing costs and healthcare service prevention. At the same time, as well as known, putting patients at the center of their medical care is essential for their sense of participation. It could be interesting also for increasing the sense of liability of patients through a new awareness. A collaborative communication could start to make the physician a colleague and advisor, one of many sources during a care plan. In conclusion, personalized medicine as aspect of the P5 approach is a great strategy of intervention for increasing personal skills of illness management.

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