Article

Medical and Para-Medical Personnel' Perspectives on Home Health Care Technology

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Abstract: User-based research is strongly recommended in design for older adults. The aim of this paper is to focus the attention on the poorly explored role of medical and para-medical personnel's perspective on home health care technologies using data that have been gained during the "Active Ageing At Home" (AA@H) project. A focus group was organized at the National Institute of Health & Science on Ageing (INRCA) in Italy. Results demonstrate that several challenges deserve a stronger effort by the whole research sector on ageing and technology: (1) a leading role of the participatory design process; (2) the assessment of the added value of health technologies through robust methods; (3) the definition of an unique identity and well established practices among disciplines; (4) the creation of favorable prerequisites and conditions to the technology uptake.

Keywords: home health care technology; active ageing; user perspective analysis

1. Introduction

Population ageing is a long-term trend in Europe and this trend requires immediate actions to cope with people' needs who live longer, remaining more active and staying in their home longer than before. In the attempt to address age-related problems, the application of health information technologies in geriatrics and gerontology may be particularly helpful. For example, the connected health sector is providing cost-effective solutions to remotely manage and monitor patients' data [1]. Another well-known example comes from the market of Ambient Assisted Living (AAL) that includes technologies that can be used by seniors, formal and informal caregivers, health care providers and aging services providers (as first, secondary and tertiary end-users), to improve the quality of care, enhance the care's experience, efficiency and cost-effectiveness. However, many barriers stand in the way to successful innovation actions to meet market demand, especially when the target is an inhomogeneous group, as older people, that differs by age, sex, degree of impairment, biography, income, education, religion, culture and, especially, technology experience.

Several studies report older adults and caregivers' perceptions and expectations towards features of home health care technologies and their active role in the users driven design approach [2–4]. It is evident to the scientific community that the majority of those aged 65 and more prefer to live independently and find their own ways to satisfy their principal needs of safety, independence, health, wellness, mobility as well as social inclusion. Furthermore, caregivers, especially those involved in informal care that live in stressful contingences with serious physical and mental health consequences, need solutions to cope with their care assistance and to catch up with their leisure time, social lives, and family harmony. These macro-level needs are strictly connected to the AAL market demand and open the way for the deployment of technology-related aids that provide new ways for helping older citizens and their caregivers to live independently.

Even if the majority of these studies have been performed with small samples, in uncontrolled settings or focusing on specific devices [5] and little is still known about positive impacts on patients' health, productivity, efficiency and cost as well as clinicians or patients' satisfaction and empowerment [6], a large literature on older adults and caregivers perspectives on innovation technology is available. On the contrary, few studies reported clinicians' views about home health care technology or their direct engagement into the design and development process of such artifacts [7]. Although important findings may arise from them to better address future implementation of home health care technologies, medical care providers are seldom contacted by design teams.

Further efforts are broadly requested by the whole scientific community to point out how health information technology can really reach positive outcomes in terms of care and cure in the clinical process. A pivotal starting point in this sense might be the analysis of medical and para-medical personnel's perspectives on such technologies since the almost absence of this data in literature [7]. With this starting point in mind, this paper aims to contribute to the understanding of these perspectives examining feedback of front-line clinicians enrolled during the "Active Ageing At Home" (AA@H) project.

2. Materials and Methods

2.1. The AA@H Project

This study was part of the User Centered Design process for the development of the "Active Ageing@home" project (acronym AA@H), co-financed by the Ministry of Education, aggregating public/private partnership set up by a network of companies, National Centres of Research and the Universities of Ancona, Trento and Lecce.

The project aims at realizing services to improve quality of life for older adults by means of ICT solutions based on Ambient Intelligence paradigms. The AA@H project meant to realize an innovative and integrated ICT system to help improve the quality of life of the elderly, fostering their autonomy to live in their homes, and to provide and manage for themselves to keep good health. In particular, an intelligent environment was devised to:

- monitor indicators for health status, physical and intellectual well-being of the individual;
- act as personal guidance, evaluate the individual's evolution in time and promote correct life styles and behaviors;
- prevent and detect critical situations or risk (e.g., smoke in the room or fall), avoiding false alarms but promptly intervening in case of need;
- promote adequate physical activity;
- epromote active socialization and participation in community life.

The AA@H system: (a) allows individuals to have an active role in managing their own health and in maintaining good health conditions by the creation of a Personal Guidance system to the person, based on the senior's specificity; (b) provides personalized indications by interacting with the individual to make her/him more conscious of unhealthy behaviors and advise on improving habits toward better behaviors, to prevent diseases or reduce worsening of physical and mind state.

From a technical point of view, the system is based on a cloud infrastructure that organizes collected data in a remote system, thus assuring reliability, scalability, security, performance and independence from the device or application used to access to the data (Figure 1). In this cloud, a Virtual Model module conveys data from field sensors and applications, applies correlations and ontologies to track user behaviors, then compares them with historical baseline and user's personal goals, in order to stimulate and promote more healthy habits. The Virtual Model compares eight different indicators from the daily lifestyle of the subjects: nutrition, weight, stress, mobility, socialization, sleep-wake cycle, posture, cardiac and physiological parameters. These come from data collected by the elements at the base of the system architecture, let them be wearable or contactless sensors, specially-developed apps or home environment technologies.
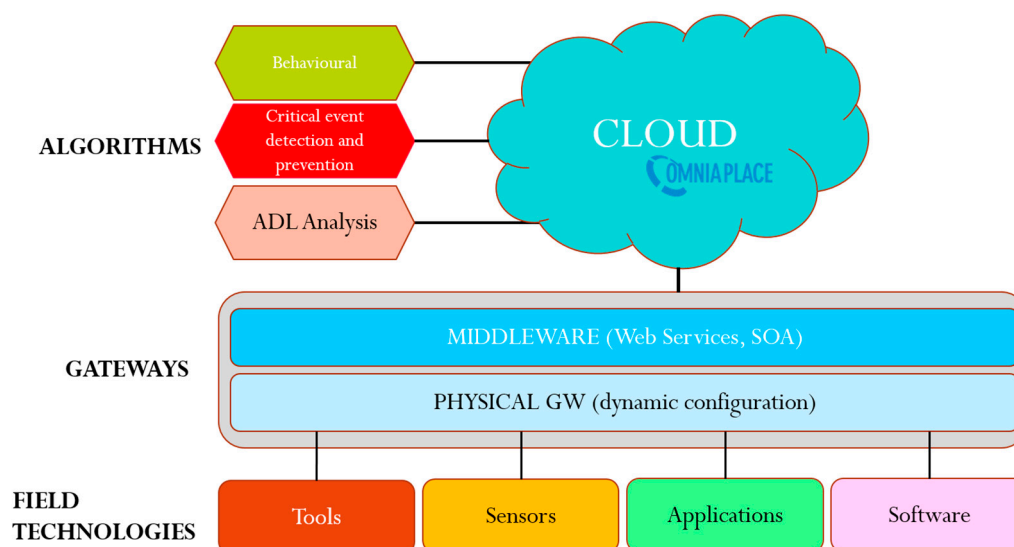
Figure 1. The AA@H Logical System Architecture.

A user-driven design was employed by a multidisciplinary team during the project lifetime, in order to guarantee the centrality of needs, capability and behaviours of the AA@H target.

2.2. Participants

This study recruited medical and paramedical personnel in a focus group. The inclusion criteria for participants to be enrolled were their previous experience in the home health care technology sector as users, researchers, project manager or advisors and the voluntary participation to share their own knowledge on this topic. Written informed consent and non-disclosure agreement were required for participation to the focus group. The research institute that held the organization of this activity did not require any other ethical requirement. The focus group was moderated and facilitated by the project coordinator and senior project staff, whereas other trained researchers participated as observers and note takers. It took approximately 120 min; discussions were audiotaped and transcribed, with the support of field notes.

2.3. The Focus Group

The focus group was organized at the National Institute of Health & Science on Ageing (INRCA) in Italy. The original aim of the focus was to collect information for the technical partners on possible weaknesses and strengths in the development of the Virtual Model Module. Such partners urged for an evaluation of their assumptions by competent clinical professionals, to make sure the design they had carried out was suitable to the user requirements set out in the early phases of the project. Requirements called for the creation of visual dashboards to show indicators of physiological and physical condition of the senior, based on measurements collected by field technologies.

The focus group setting included: a brief explanation of the AA@H concepts, the discussion of two different scenarios (Table 1), the use of three open-ended questions for the participants in order to detect positive and negative perspectives toward the benefits of using smart home technologies for ageing: (1) whether the AA@H concepts may support ageing at home; (2) whether the indicators used by the Virtual Model Module to stimulate and promote more healthy habits may be coherent with clinical findings; (3) what enablers and barriers could hinder the use of this kind of technology for ageing well among older adults, their caregivers and clinicians.

In order to explore these questions the following two hypothetical scenarios were proposed to ease and stimulate the discussion.

Table 1. Hypothetical scenarios proposed during the Focus Group.

N. Scenario	Description of Characters	Indicators of AA@H System	Outcomes of AA@H System
First Scenario	Pino is 68 and lives with his wife, Lucia. Since 5 years he suffers from diabetes and high blood pressure. The medical prescription is to follow a specific diet and make physical activity every day in order to reduce glycaemia and the onset of possible complications	nutrition, weight, mobility, cardiac and physiological parameters	Health prevention Active Ageing
Second Scenario	Gina is 76 and live alone since eight years ago her husband passed away. She is in good health apart from a slight overweight, hypertions and some initial cognitive decline	nutrition, weight, stress, mobility, socialization, sleep-wake cycle, cardiac and physiological parameters	Health prevention Active Ageing

The two scenarios described how population ageing increases the need for technological solutions that enable individuals to stay active longer, remain socially connected and live independently into old age. The use of fictitious characters such as Pino and Lucia provided an explicit concrete vision of how some health need could be supported by the AA@H technology and remotely monitored by clinicians.

At the end of the focus group, a summary of the highlighted issues was reported to the participants to collect their agreement.

2.4. Data Analysis

Transcriptions and field notes were used for a conventional content analysis [8], performed independently by two researchers who subsequently achieved an agreement to produce themes and subthemes of the transcriptions.

3. Results

Six clinicians participated to the session. Participants were well balanced in respect to gender, age, profession and years of job experience (Table 2).

Table 2. Participants characteristics.

Socio-Demographics Characteristics	
Age (mean ± SD)	43.2 ± 9.4
Range	29–60
Gender (M/F)	4/6
Profession	3 Geriatricians, 1 Practitioners 2 Nurse
Job experience (years)	Mean: 10 ± 2 Range: 1–30
Work setting	INRCA Hospital

Through the coding process, the primary study results were grouped in the following categories based on the three open-ended questions asked to participants. When citations by the participants interviews are reported, we indicate whether the participant was a geriatrician ("G"), a practitioner ("P") or a nurse ("N") and a two-digit number to unique identify him/her (that is, G03 is the participant identified as 03 who belongs to the group of geriatricians).

3.1. Technologies for Ageing in Place

[G02] "Recent systematic review reported that the use of technologies for ageing in place to support home monitoring is particularly promising in some specific clinical domains such as diabetes, congestive heart failure, chronic obstructive pulmonary disease and hypertension".

All clinicians stated that innovative approaches to the challenges of care and cure of the aging population are promising. Despite this positive perspective, they manifested a great criticism on the definition of technology focus.

[P01] "For my experience it is important to clarify the purpose of technology. Is it intended for monitoring of the health status or for promoting of active ageing? From my point of view in the specific case of this project, the technology approaches the monitoring goal since after 1 month of running pilot I will only be able to track the subject's compliance to my prescription. I have no data to evaluate variables of health change, for example in terms of health improvement or deterioration and I'm not in the right condition to act accordingly. This is because the technology used continuously for just one month can only give me data on adherence to therapy and not on active ageing".

Several devices aim both at monitoring health and promoting active ageing. Yet, realistically, the majority of these technologies can be mainly used for verifying the patient condition on a short-term base. On the other hand, promoting a sense of well being in the process of ageing is a broader scope than merely monitoring and it requires a long-term observation of the users' day-to-day rituals and habits. How technology can match this requirement is still an open issue due to the complexity of ageing in itself.

3.2. Clinical Outcomes

Participants agreed that the AA@H indicators were potentially in line with their clinical assessment tools for measuring health status of older adults. However, highlighting the disadvantage of the marginal role assigned to them by developers in design, implementation and evaluation of systems, they mostly pointed out criticism on the evaluation phase.

[G01] "Studies suggest positive effects of home monitoring, but evidence provided for the real benefit of home monitoring in some aspects was not totally convincing. Further research, including large scale RCT trials with consistent primary and secondary outcomes, and robust analysis about long-term sustainability, is required to allow the full incorporation of home monitoring in the clinical practice".

[G02] "I agree, a single piece of data is not significant, we need data collected over several days to make comparisons and understand if there is something abnormal."

Only long pilot studies or multi-site randomized clinical trials can offer the possibility to collect significant data on patients' long-term status. Without a long running evaluation approach and the use of rigorous methods, health technology can only measure the adherence to therapy but remains quite far from achieving the promised cost-effectiveness and quality of health service outcomes.

3.3. Enablers and Barriers

The medical and para-medical personnel in the focus group manifested the strong certainty that technology is well accepted by older adults when it is easy to use, matches a perceived need and it is not imposed by family members. People aged 65 are unfamiliar with modern devices and more usually fear of a lack of security and to be exposed to potential harms. Moreover, a sense of minor control in their environment and in their private life generates significant concerns.

[P01] "It is important to understand in depth how people approach and experience technology".

[N02] " In my opinion, we must also spend thought on the negative side of control. Older adults do not want to feel under control, lose their freedom to do or not to do something. A system that forces duties cannot be accepted positively. For example, many older people do not want caregivers because they are afraid to lose control over themselves. You need to be very careful about this negative twist of technology".

Great efforts should be done to not modify or erode this sense of identity, respect perception and attitude to privacy and private lives in order to avoid the sense of stigmatization or refusal in adopting such technologies.

The following two subthemes emerged from the content analysis.

3.4. Personalized Approach

[N02] "Personalization is crucial because each person owns peculiarities that cannot be generalized to others".

[G02] "A more targeted approach will be necessary, from my point of view. If older adults report frustration in their interaction with technologies this is because the system may not have been designed to accommodate older adult's limitation and capabilities".

Participants agreed that older adults represent a user group who could benefit from home health care solutions to maintain and increase home independence and quality of life. However, this target of population experiences the same age-related changes in chronological, biological, physiological and social dimensions but they do not represent a homogeneous group since the decay in all five senses occurs at different times and rates among persons. This phenomenon poses the great challenge of personalization in the development of ICT whereas developing successful artifacts is strictly related to an explicit deep understanding of users, their health needs, limitations and expectations.

3.5. Accuracy of Measurements

[P] "Let me make this example: we collect heart rate and ECG . . . but these kind of data need to be associated with what the person is really doing in terms of physical activity, I mean..is the individual really doing an activity that justifies the detected cardiac data?".

[N01] "Measurements should always be related to the context and what the subject is really doing. I suggest to ask the person to fill in a daily diary to compare data declared and those detected by technology".

Participants highlighted the importance to assess the accuracy of technology against a self-filled activity diary. This strategy can enable medical personnel to figure out the correlation between physiological data gathered by technology, activities performed by users during measurements and its significance in terms of health status. Otherwise, data coming from sensors and actuators would be only an amount of data without clinical positive or negative meaning.

4. Discussion

A positive perspective toward innovation technology to enhance active ageing is clearly shown by the participants in this study. This primary finding is in accordance with some other studies which consider health care professionals' experience when using innovative technology [9–11]. Despite the critical role that this perspective may play in the uptake of ambient assisted living technologies, user-based researches still show a gap especially in the involvement of primary care clinicians, geriatricians and medical and para-medical personnel engaged in the care and cure of older adults. If the applied research on older adults and their formal/informal caregivers has begun in the last ten years [12–14], the involvement of the so called "tertiary end users" [15], is in its infancy and very few studies are reported in literature [7]. This gap poses four important interconnected challenges to overcome.

The first challenge is to open the healthcare technologies development to a broader spectrum of professionals that must be involved in a participatory design process in which all the human, technical and medical components are represented and mutually accounted in defining the focus of a specific artifact. Since older adults often show substantially different requirements than any other users, due to ergonomic, cognitive and usability needs, the personalization issue could be easily approached by a multidisciplinary team engaged in the definition of the target.

In the specific case of technologies for ageing well, the participatory design may start creating the theoretical foundation for the design, evaluation and implementation of the whole development cycle in which special attention is posed on a rigorous evaluation strategy. This point leads to the second challenge that is connected to health-related outcomes.

Since only telehealth seems to have obtained significant outcomes [16], robust methods are required to assess the added value of health technologies in the care process management to understand what differences, why or why not health technologies can impact outcome variables such as costs, patient health condition, adherence to technology and interventions [16]. As underlined by participants of the focus group, large scale RCT trials with consistent primary and secondary outcomes, and robust analysis about long-term sustainability are requested from the clinical sector. As a matter of fact,

a need for geriatric medicine researchers to be actively involved in research projects emerges, for identifying those significant clinical outcomes and cost-effectiveness of long-term care in different living settings [17]. Developers and designers should not wait until the completion of a product to bring in experienced advisory staff, who might add invaluable counsel. This strategy would enrich the probability to reach the market successfully as well as the possibility to match technologies with the complexity of health care and the habits of primary, secondary and tertiary users. Furthermore, it is well reported that physicians are important enablers to the adoption of new technology: if physicians recommend a technology tool, there is a significantly higher chance that patients will use in the context of a comprehensive treatment plan [15].

The third challenge is to build a common foundation in the fragmentary field of research on aging and technology. Effectively, even though its early work since 1980 [18], this sector is still far from defining a unique identity and well established practices. Thus, the obvious consequence is a lack of agreed proof of concepts among the diverse scientific approaches that creates diverse fragmentary concepts on aging and technology. This issue could in part explain the misleading use of concepts, labels and definitions to categorize technologies (for example in this focus group, the use of term "technology to promote active ageing" against the use of "technology for monitoring") that do not facilitate communication among researchers, clinicians and other stakeholders.

The last challenge concerns the effective integration of home health care technologies in the daily practice of medical and para-medical personnel, that might be the normal endpoint of a home health care technology, as although it is as challenging as developing the technology itself [14]. Despite numerous research projects in this field, industrialization of such tools and services is rare and only few prototypes achieve the higher technology maturity level for market penetration and adoption by the health care providers. The matter of costs-benefits seems to cause this failure: technologies in home care setting is still expensive and no active policies help the sustainability of expenditure. The challenge in this specific case is to act for changing political, organizational and operational levels of society and creating prerequisites and conditions favorable to the technology uptake [19], since this is not to be considered as a catalyst for innovation [2–15].

Authors are aware that the use of only one focus group with 6 participants provides insufficient data to reliably count on the results, but despite the findings from this study are not generalized to larger groups, they contribute to focus the attention on the poorly explored role of medical and para-medical personnel' perspectives on home health care technologies and demonstrates that several challenges deserve the profound effort of the whole research sector on ageing and technology.

This investigation contributes to show the potential role of clinicians in the design of home health care technologies for older adults: participants in this study reported willingness for a more rigorous practice to approach studies in the field of gerontechnology. They manifested interested and knowledge to put in place actions for participatory design approach. This interest might potentially build on an emerging body of research aimed to overcome barriers and gaps cited.

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