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SOCIAL TELEREHABILITATION

What is social telerehabilitation?

In a relatively short time, information and communication technologies (ICT) have spread worldwide, from defense and space exploration to large industrial applications, and to the worlds of commerce, education, and entertainment. ICT is changing people's daily lives, the way they work, buy, sell, and learn, and also the way that services are run in the healthcare sector.

Consequently, *e-health*, *telehealth*, and *telemedicine* are now terms that are commonly used in this sphere, encompassing three main computer-assisted areas in healthcare, namely: clinical assessment, diagnosis, and therapy. E-health comprises the monitoring of patients' health, the promotion of good practices, and the prevention and treatment of health conditions by electronic means, as well as the provision of online access to literature and medical knowledge.

One of the first reviews of telehealth is that provided by Winters (2002), who identified two major subsets of telehealth: telemedicine (i.e., delivery of clinical services) and telehealthcare (i.e., management of disability and health).

Nowadays, there is a progressive specialization within the field of e-health, and the specificity of the different branches appears to be increasingly sharp.

The term"telerehabilitation" is a relatively new one, although it has been observed that the first experimentwith remote medical interventions dates back tothe 1880s, following the invention of the telephone (Scalvini, Vitacca, Paletta, Giordano & Balbi, 2004).

Until a few years ago, telerehabilitation applications were considered within the wider field of e-health, and only recently telerehabilitationhas been assumed to have an autonomous, separate, and parallel identity under the telehealthumbrella, alongside both telehealthcare and telemedicine (Schmeler, Schein, McCue & Betz, 2009).

Social telerehabilitation,which focuses on solving limitations and social issues associated with health conditions, represents a further specialization in telerehabilitation.

This results from a change in the concept of rehabilitation, which has seen a shift in view point away from a predominantly medical one, towards an increasingly complex one in which psychological and socio-cultural aspects are deemed to be of equal importance (Brown & Hughson, 1993; Wade & de Jong, 2000; Altman, Swick, Parrot & Malec, 2010; Karkou, Martinsone, Nazarova & Vaverniece, 2011).

Both telerehabilitation and social telerehabilitation are grounded in the delivery of rehabilitation services through telecommunication networks, especially by means of the Internet. Essentially, telerehabilitation comprises methods of delivering rehabilitation services using ICT to minimize the barriers of distance, time, and cost, and, more specifically, has been defined "as the application of telecommunication, remote sensing and operation technologies, and computing

technologies to assist with the provision of medical rehabilitation services at a distance'' (Cooper *et al.*, 2001).

Likewise, one can define social telerehabilitation as being the application of ICT to provide equitable access to social rehabilitation services, at a distance, to individuals who are geographically remote, and to those who are physically and economically   disadvantaged.

In general, rehabilitation encompasses any services or providers that are directed to the reduction of impairments, activity limitations, or social participation restrictions experienced by an individual. The World Health Organization describes rehabilitation for people with disabilities as being a process aimed at enabling them to reach and maintain their optimal physical, sensory, intellectual, psychological,   and   social   functional   levels[1].

The scope of social telerehabilitation is vast, since it faces challenges related to both medical and community care settings (Hill, 2010). Recently, an emerging crucial issue is that of helping people regain their psycho-physical functions and improving their daily quality of life through the use of ICT and mobile technologies (Markovitch, Lauznis, Balodis, Katashev & Markovitcha, 2013; Reeder, Chung & Stevens-Lapsley, 2016; Kamwesiga, Tham & Guidetti, 2016). In this regard, research has underlined the potential for social media, mobile phones, and   the   Internet   in   general,   to   improve   rehabilitation   processes.

Generally,   two   different   forms   of   rehabilitation   can   be   distinguished: *medical* and *social*, or, in the latter case, also referred to as*vocational*.Both forms are aimed at developing the functional and psychological abilities of the individual and, if necessary, his/her compensatory mechanisms, in order to enable him/her to attain self-dependence and lead an active life. The main difference between them is that medical rehabilitation is more restricted to curative medicine, and involves intensively trained clinicians and different health professionals, especially physiotherapists, whilst social rehabilitation focuses more on the individuals' social sphere, and includes services such as rehabilitative nursing, occupational

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[1] http://www.who.int/topics/rehabilitation/en/; last accessed 7.06.2016;

therapy, speech and language therapy, audiology, dietetics, prosthetics and orthotics, podiatry, art therapy, music therapy, and social work. However, although social rehabilitation is directed, for example, at overcoming barriers for people to access, maintain, or return to employment or other useful occupations (ILO, 2008; Kuoppala & Lamminpää, 2008), it substantially differs from strategies and policies aimed at promoting and developing the inclusion of people with disabilities in the work place.

Offender rehabilitation (Robinson & Crow, 2009) and addict rehabilitation (Wilson *et al.*, 2012), for example,are considered to be forms of social rehabilitation that focus on the development of practices and programs for helping individuals   to   retake   their   place   in   society.

Many social scientists and policy makers share the opinion that community-based rehabilitation practices are a part of general medical care (Haig, 2013).As a consequence of this, it is not always possible to trace a line of demarcation between clinical and social rehabilitation,and sometimes there is an overlapping relation between these two forms of rehabilitation.

A case in point is the *Report on Disability* (WRD) of June 9th 2011, published by the World Health Organization (WHO) and World Bank (WB),whichoutlined concrete actions that befit both medical and social rehabilitation.

Such concrete actions intended to help overcome barriers to the provision of rehabilitation services (WHO & WB, 2011) include:

- increasing human resources for rehabilitation (training, retaining, and retention of rehabilitation personnel);
- expanding and decentralizing service delivery;
- increasing the use and affordability of technology and assistive devices.

It has been observed that the WRD reports presents a challenge to medical rehabilitation(Bethge, von Groote, Giustini & Gutenbrunner, 2014) and, although it doesn't provide a fixed definition of rehabilitation, its description of the concept represents a valuable frame of reference that can help to foster a common

understanding of the rehabilitation scope and rehabilitation services (Meyer, Gutenbrunner, Bickenbach, Cieza, Melvin & Stucki, 2011).

In fact, many authors cite in their works the WRD definition of rehabilitation, that being:"a set of measures that assist individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning in interaction with their environments" (Kho *et al.*, 2012; Meyer *et al.*, 2014; Lynggaard, May, Beauchamp, Nielsen & Wittrup, 2014; Gibson, 2016).

It is important to note that the WRD definition recalls that of Article 26, entitled *Habilitation and Rehabilitation*, of the United Nations Convention on the Rights of Persons with Disabilities (CRPD, 2006):[…] appropriate measures, including through peer support, to enable persons with disabilities to attain and maintain their maximum independence, full physical, mental, social and vocational ability, and full inclusion and participation in all aspects of life[2].

The above definitions fit well with both medical and social rehabilitation, as well as with telerehabilitation and social telerehabilitation.

Expanding and decentralizing service delivery

Telerehabilitation and social telerehabilitation share the same goal: to expand and decentralize rehabilitation service delivery.

In fact, rehabilitation services are generally located in urban centers and heath care structures, and this hinders theiraccess by people with disabilities or those living in rural areas. In many cases, the burden of transportation, as well as the mobility assistance for persons with temporary or chronic deceases, represents a serious barrier that limits the advantages of rehabilitation services. Parking, distance, or transportation difficulties can significantly interfere with the receiving of treatments. In fact, the more frequent the treatments are, the more the mobility burden increases.

Furthermore, in the majority of cases, rehabilitation involves multidisciplinary professional competence and expertise (Neumann *et al.*, 2010; Stanos, 2012;

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[2] http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf; lasr accessed 06.06.2016.

Malladi, 2015). This means that the planning activity and the actual treatments involve teams of professionals (physiotherapists, psychologists, social educators, etc.) who must work together in order to achieve common and complementary goals. Their activity is directed to resolving the patient problems, following an iterative, active, educational, and problem-solving process that focuses on the patient's behavior and adapts to it(Marzano, Lubkina &Rizakova, 2015). The most common goals of the rehabilitation process are:

- Maximizing the participation of the patient in his/her social setting;

- Minimizing the pain and distress experienced by the patient;

- Minimizing the distress of, and the stress on, the patient's family and caregivers.

The coordination of rehabilitation service delivery requires the improvement and expansion of the availability of coordinated multidisciplinary rehabilitation in an effective care framework. Telerehabilitation services are generally provided on an outpatient basis, usually at home and under the supervision of at-a-distance professionals. Experts check patient evolution through regular online meetings or by analyzing data from sensors and equipment.Depending on the telerehabilitation programs, there are many kinds of assistive devices whose cost is lowered by mass production, e.g. there are many very affordable teleconference systems, and mobile phones are used for remote data collection,control of equipment, and telemonitoring. Supervisors can help the patient to perform exercises during the day-to-day rehabilitation sessions, suggesting the correct execution.

In the last few years, many researchers and practitioners have argued the importance of social telerehabilitation services for patients, caregivers, and public institutions, for instance in regard to services for children suffering from physical handicaps and emotional disturbances (Nilsson & Nilsson, 2011a; Nilsson & Nilsson, 2011b), alcoholics (Simpson, T. L., Kivlahan, Bush & McFall, 2005; Rose, Skelly, Badger, Naylor & Helzer, 2012), and for patients with affectivedisorders, such as depression and manic-depression or bipolar disorder (Sachpazidis & Sakas, 2008; Acampora, Cook, Rashidi & Vasilakos, 2013).

Research has underlined the potential for social media, mobile phones, and the internet in general, to improve mental and physical health, treat addictions, and also to help individuals experiencing homelessness (Quan, Joseph, Keller & Arch,

2011; McInnes, Fix, Solomon Petrakis, Sawh & Smelson, 2015). Artificial Intelligence solutions could discover new opportunities to overcome the limitations of the computational approach (Pravettoni, Folgieri& Lucchiari, 2015).

The scope of social telerehabilitation services is vast: it faces challenges that set it apart from the broader telemedicine and telehealth arenas.

It has been observed that one such challenge is that rehabilitation is often provided across both medical and community settings, often with different funding structures and rehabilitation protocols in place
(Scaffa & Reitz, 2013; Camicia, Black, Farrell, Waites, Wirt & Lutz, 2014).

Application of social telerehabilitation

The idea of exploiting ICT in psychosocial care is not a novelty. Eliza, the computer program created by Weizenbaum between 1964 and 1966 (Weizenbaum, 1966), can be considered to have been a primitive attempt at social telerehabilitation. It was a tongue-in-cheek application, which emulated the responses of a Rogerian non-directional psychotherapist during an initial psychiatric interview.Since then, much progress has been made to the point that social telerehabilitation now represents a topical field of research.

Thanks to the investigations that have started in the last fifteen years on different forms and roles of affection in virtual agents and robots (Scheutz, 2011), some researchers are now considering the employment of robots in social rehabilitation services (Tickle-Degnen, Scheutz & Arkin, 2014). The new robots could provide moral functionalities that enable them to establish therapeutic human relationships, for example in the context of occupational therapy and Parkinson's or Alzheimer's disease (Salichs, Encinar, Salichs, Castro-González & Malfaz, 2015). At the simplest level, a robot could ensure basic functional elements of interpersonal communication. On a more sophisticated level, they could act as *observers* that accurately detect and prioritize people, objectives, and context attributes relevant to reasoned and ethical therapeutic interaction (Arkin, Scheutz & Tickle-Degnen, 2014).

The application of wearable technology to monitor older adults and subjects with chronic conditions at home and in community settings are multiplying, while the integration of wearable and ambient sensors has made relevant progress (Patel, Park, Bonato, Chan & Rodgers, 2012).

Almost 50 years have passed between the creation of the Eliza Weizenbaum program and the appearance of the new robots designed for rehabilitation services. The difference between the two is that Eliza was one of the first experimental programs in the field of natural language processing, whilst the new robots are able to utilize the achievements made in natural language processing for communicating with patients.

The focus is now on programming machines for empathy emulation and ethical therapeutic activities. However, a lot of time will pass before the research findings can provide robotic caregivers for social rehabilitation purposes.

From the analysis of the literature, three principal areas of interest emergein terms of the development of social telerehabilitation services:

1. the psycho-physical area;

2. the social-communication area;

3. the behavioral area (e.g. behavioral addictions).

Applications are available for health education and counseling programs, many of them offered to myocardial infarction patients during and after hospitalization. During hospitalization, the interventions consist of individual counseling sessions and group health education sessions focusing on medication, healthy habits, and anxiety and depression. After discharge from hospital,patients are checked at home by telephone or via the internet, and are encouraged to perform exercises and physical activity.

Telerehabilitation programs demonstrate their effectiveness in the areas of decreasing unhealthy eating habits, cessation of smoking, and treating anxiety and depression of patients following a stroke

(Beatty, Fukuoka & Whooley, 2013; Varnfield *et al.*, 2014).

A typical telerehabilitation service for patients who need physical exercises

To better understand how telerehabilitation processes operate, we can illustrate a typical example of a telerehabilitation service that concerns physical exercises.

The first step is the identification of needs and the recognition of related problems: the rehabilitators' team performs the evaluation of the patient conditions in order to verify his/her capability to benefit from the service. Professionals engaged in the rehabilitation program use teleconference and/or phone communication to discuss the case and define the rehabilitation program, and to generate its electronic workflow. Following this, the trainer demonstrates exercises to the patient, and answers his/her queries and clears his/her doubts. This step can be performed either at a distance or face-to-face. The trainer then conducts videoconferencing sessions for the progression of exercises, supervision of program completion, additional demonstrations, and consultations. As may be the case, exercises might include flexibility, strength, endurance, and other types of active motion activities. For videoconferencing, a professional video camera and Skype software with a broadband internet facility can be used. The patient is regularly engaged in exercises and followed by the same trainer, who will give him/her instructions, e. g. in order to adjust the video camera for each exercise, number of repetitions, etc.

Online delivery of social rehabilitation services encourages the rethinking, reorganization, optimization, and extension of the current social rehabilitation services that fall under face-to-face treatments and protocols.

This can require the retraining of rehabilitators.

In general, a telerehabilitation system should provide patients and caregivers suitable mechanisms to interact with each other as if they were meeting face-to-face. Furthermore, patients should have at their disposal all the information about the schedule of the rehabilitation plan, a full description of the rehabilitation activities, and real-time feedback about their performance. For rehabilitators, the system should gather information about the fulfillment of the program, and the correctness of the patients' performance.

This will allow a quick and ubiquitous assessment of the patients' evolution, and an adjustment of their rehabilitation program if necessary.

A telerehabilitation system includes:

- Computers and other general-purpose devices (i.e. tablets, laptops, videocameras, and so on), for both patients and rehabilitators, which are used to run the applications.

- Different types of sensors used to monitor the patient's performance; the simplest of them being low-cost wearable motion capture devices (e.g. accelerometers that gather values of linear acceleration along three perpendicular axes (x, y, z).

Conclusion

The use of computers to deliver traditional social rehabilitation services cannot be a sufficient condition for transforming them into effective social telerehabilitation services: to make these services really effective, it is often necessary to both rethink them in the light of the opportunities offered by the new technologies and, at the same time, to carefully analyze the impact that they have on the persons involved in the process. In many cases it is worthwhile to verify the impact on the organization which delivers telerehabilitation, e.g. considering the requalification of personnel, the reliability of the computing services, the costs, and so on.

Internet-based applications can be realized not only for follow-up communications between caregiver-doctor-patient after a therapy, which is the most common use of ICT in the rehabilitation process, but also for improving the quality of the traditional rehabilitation therapies, or for realizing services that are entirely new.

The aim of developing new types of services is shared by social innovation. Another common point between social innovation and telerehabilitation is that both entail cutting across organizational, sectoral, or disciplinary boundaries of expertise. Furthermore, social innovation looks towards technology as a means to create new social relationships between previously separate individuals and groups.

Social innovation and social economy are closely related: both pursue the same goal of creating solutions that can generate a positive impact, not only on the economic but also on the social development of people and their communities.

The basis of social economy is the creation of services that focus on specific target groups who need to be sustained and assisted (e.g. services that complement core hospital staff, employment counseling, vocational training, education/rehabilitation for addict/misfit people, and so on), or that satisfy a general public need (e.g. nurseries, care services for the elderly, shelters for the homeless, integration for the disabled, and so on).

Social telerehabilitation can primarily be useful in the above-mentioned sectors, especially in the scope of social rehabilitation applications related to the labor sector. In this case, social telerehabilitation needs to be underpinned by an integrated approach and by a strong collaboration among different subjects, namely: rehabilitation structures, employers, and workers. Education institutions play a crucial role in the implementation of social telerehabilitation services since the different subjects involved in them need to be educated.

More generally, though, telerehabilitation and social innovation necessitate training and retraining activities for both the providers and users of services.

However, we are left with some as yet unresolved questions concerning social telerehabilitation:

1. To what measure can social telerehabilitationreplace traditional face-to-face social rehabilitation therapies?

2. Which are the priority sectors for intervention?

3. Is social telerehabilitation in these sectors really economical?

4. What is the educational effort and cost that would be required to diffuse knowledge about social telerehabilitation practices?

A broad, coordinated, *research effort is required to provide answers to* the above questions.

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