

# A MARKET STUDY INVOLVING THE EMPLOYMENT OF ASSISTIVE TECHNOLOGIES IN THE CASE OF ELDERLY USERS WITH PHYSICAL IMPAIRMENTS

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**Abstract.** The emphasis in designing modern assistive systems is focused on the ability of the devices to provide a greater independence for the users. In parallel, the transition to a greater social inclusion for people with mobility impairments changed the meaning of the term disability, as it now underlines the user's capacity to interact with the working environment. Thus, not only the improvement of assistive devices are considered, but also the development of working or living spaces that are suitable to the needs of people with physical disabilities, as well as to elderly users. Several changes occur as a result of the aging process, either in sensory processes, affecting the ability of individuals to receive information about the external environment, or in terms of the central nervous system, by slowing the reaction time. Given the increased life expectancy there raises the need for assistive devices adapted to elderly users with specific mobility impairments. Thus, taking into consideration all the above, the paper presents the need for the development of assistive technologies. A market research is also considered in order to obtain more information about users' opinion on their current mobility aids and if there are certain features of the devices that they would improve or adapt to their disability.

**Keywords:** elderly users, assistive technologies

## 1. Introduction

There are several changes that occur as a result of aging, starting with the consequences of chronic diseases and ending with individual behaviour or even social adversity. It is thus difficult to determine whether aging or disease itself produces certain changes (for example, cardiopulmonary diseases cause symptoms that also occur with advanced age). Aging produces changes in muscles and joints, particularly muscle atrophy of the limbs and torso, changes in flexibility, strength as well as posture and gait (osteoporosis and its corresponding medication, for example, can lead to postural instability). In the same manner, medications used to treat Parkinson's or hypertension may increase susceptibility to failure due to orthostatic hypotension [1, 2].

Changes in sensory processes that appear with aging (most often around the age of 65) may affect the ability to receive external information, influencing the way a person is interacting with the working environment [3].

Regarding the central nervous system, the main change is the loss of cells, which can be responsible for a slow reaction time. In general, the information stored is maintained, but the ability to form new concepts may decrease [3] and the time of reaction may be rigid. Therefore, elderly people need a constant, secure environment to develop their activities, as new environments can lead to confusion and slow adaptation.

## 2. Assistive technologies

Considering the structure proposed by the World Health Organization concerning the classification of Functionality, Disability and Health, disability results from the interaction between the user, technology and environment. The participation of an individual in certain activities may be restricted when the environmental requirements exceed his or hers mobility capacity. In this sense, technology can facilitate individual interaction with the environment, improving mobility, either indirectly (through treatment or therapy), or directly (through physical assistance) (Figure 1) [4].

Given the rapid aging of the population, leading to reduced mobility and various physical constraints, there emerges a need to develop new products or to implement various changes in the configuration of existing solutions, adapting them to new the physical abilities.

Indirect technological solutions improve mobility by reducing deficiencies in the body's functions or by supporting the rehabilitation of the affected area (Figure 1, black arrows). Robotic therapy devices are an example of indirect approach because they allow improving deficiencies in training with repetitive movements. Therapeutic technologies typically require clinical supervision as they are considered a mean in a comprehensive rehabilitation plan, and are not usually designed to perform everyday activities outside a clinic [4].

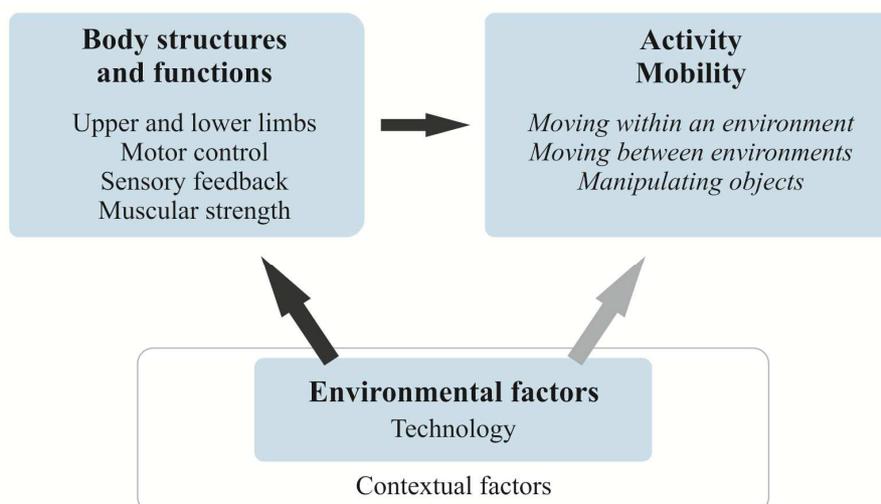


Figure 1. Indirect therapeutic ways (black arrows) and direct ways (gray arrow) that technological solutions lead to improved mobility [4]

Regarding direct assistive technologies, their employment helps improve mobility without altering the structure or function of the impaired body function (Figure 1, gray arrow). An example, the wheelchairs or walking frames increase mobility, but do not affect the physical impairment leading to the mobility loss. Assistive technologies can support users in reducing structural weaknesses of the body, as walking sticks or frames, or even substitute a lacking member, as in the case of prostheses. Unlike therapeutic technologies, assistive technologies are operated by the user and are designed to be easily used at home and in the community [4].

In this sense, assistive technologies is a term that refers to products and services that can compensate for functional limitations, facilitate independent living and enable disabled people to achieve their potential. Even though a lot of products fit this definition, it is generally accepted that “assistive technology refers to products and services to those needs that are specific to three groups: people with disabilities, the elderly and chronically ill people, allowing these individuals to participate more fully in daily life and supporting their independent life” [5]. In this sense, the role of assistive technology becomes extremely important, these include a wide range of products, starting with ramps or support bars and ending with sophisticated devices present in smart homes [6].

Considering their key attributes, Noble categorizes assistive technologies as follows [7]:

- Active: devices that require direct operation from the user, e.g. pressing a button to open a door.
- Passive: in contrast with the active assistive

devices, passive devices work without user intervention, as he is either not aware of the existence of the device or the device does not require the direct involvement of that user, operating automatically, in response to an outside influence, e.g. a triggered smoke alarm can stop the power supply to other devices.

- Portable: devices that are worn by the user, improve the mobility of its members, being included among typical exoskeleton devices.
- Supportive: peripheral structures are used for load-supporting; force transfer from the body to a distal plan, which is exerted force (e.g. crutches, walking frames) [7].

Martins et al. [8] further categorizes assistive technologies as alternative – in the case of the user’s total physical incapacity, referring to wheelchairs – and augmentative – as in the case of partial physical incapacity, consisting in rehabilitation training devices, as well as functional compensation devices, such as canes or walkers.

After studying various types of existing walking frames, both classic and smart / robotic [8, 9, 10, 11, 12], there was observed a tendency to discontinue their use, in the group of older users, due either to lack of physical capacity to control the walker, the reluctance to new technology, or because of difficult manoeuvrability of the device in tight spaces. At the same time, the prohibitive costs and the lack of information on different types of devices lead to low employment rate of the assistive technologies in elderly care centres. Thus, it raises the need for a user-friendly solution in the case of elderly users with mobility impairments, either living independently or in care centres.

### 3. Market study

#### 3.1. Procedure

In order to obtain information regarding the use of assistive devices, but also to find out users' opinion about the employment of such devices, a market research was conducted among residents in elderly care centres. As a tool in the conducted market research, a questionnaire was considered, consisting of 11 questions that was sent to a total of 26 care centres. A logic scheme of the questionnaire is presented in Figure 2.

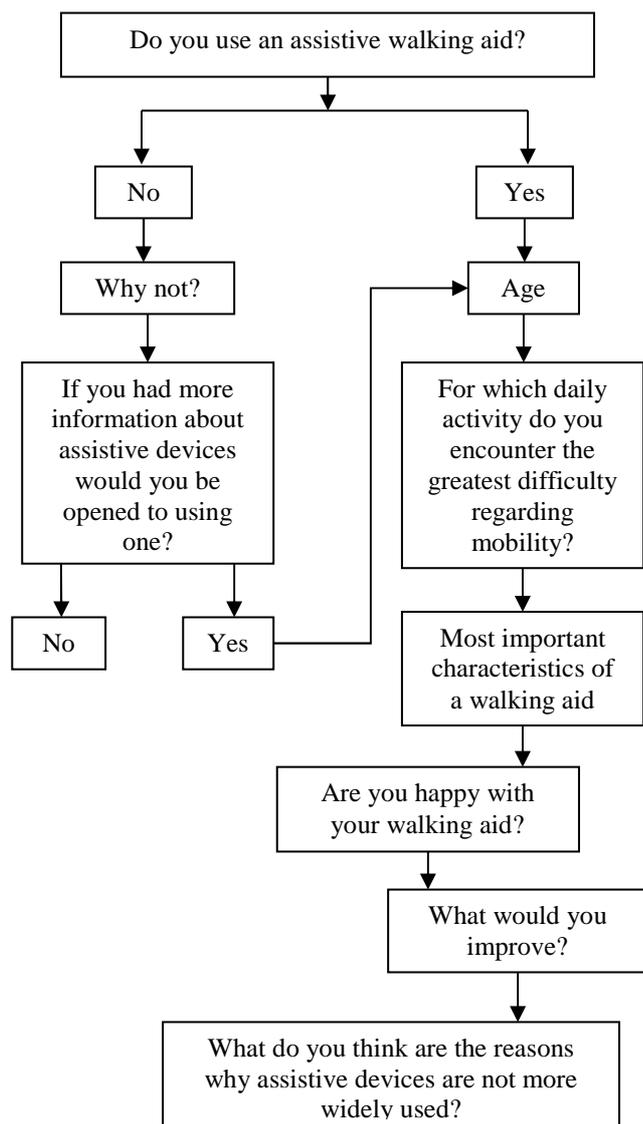


Figure 2. Logic scheme of the questionnaire

#### 3.2. Results of the market study

According to responses received after completing the questionnaire were obtained the following results (Figures 3-7) proving the need to develop a system to assist older people with physical limitations.

It was observed that most respondents fit into the over 60 age group and that the two usual daily activities that meet the greatest difficulties are walking and standing up from a chair or the bed.

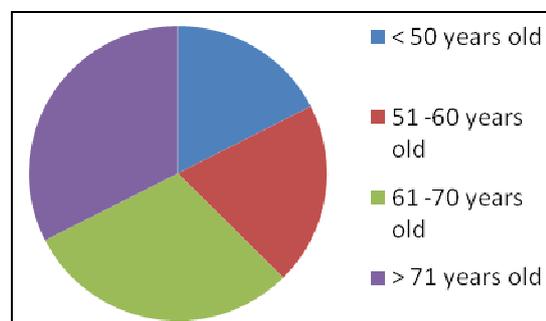


Figure 3. Distribution of respondents by age

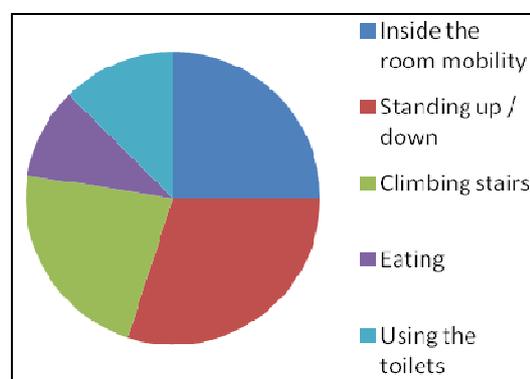


Figure 4. Daily activities for which the greatest physical difficulties are encountered

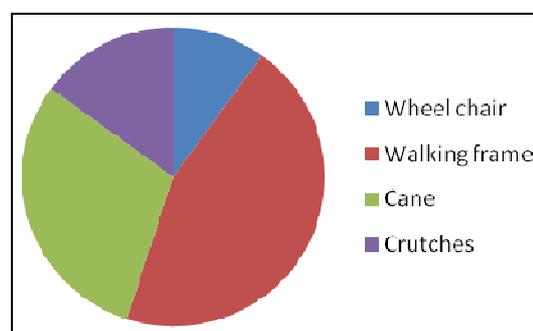


Figure 5. Assistive devices used by respondents

It was also observed that a large number of respondents were already using an assistive device, mainly walking frames, or would be interested in using such a device (Figure 5), while stability and safety / usability of the device are considered it's most important features (Figure 6).

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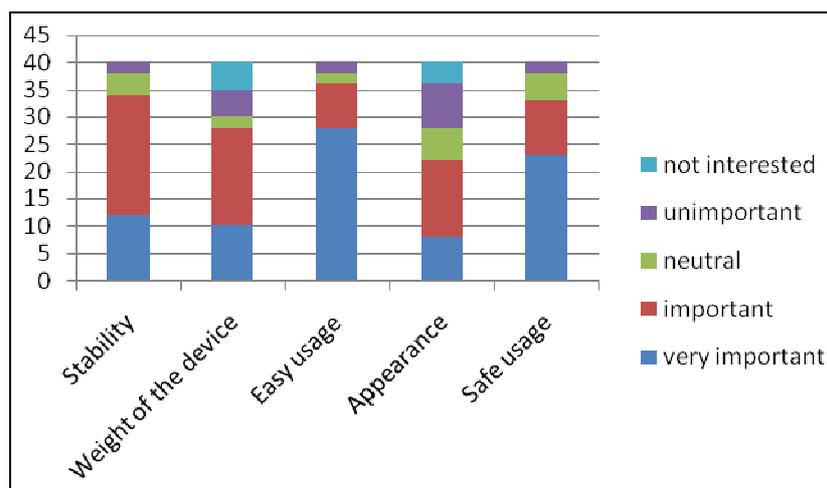


Figure 6. The importance of various characteristics of an assistive device

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The last question, considering the reasons why assistive devices are not more widely used, showed that, even though users would benefit from the devices, the lack of information, as well as the fear of new technologies and social exclusion play an important role in preventing the acceptance of assistive technologies (Figure 7).

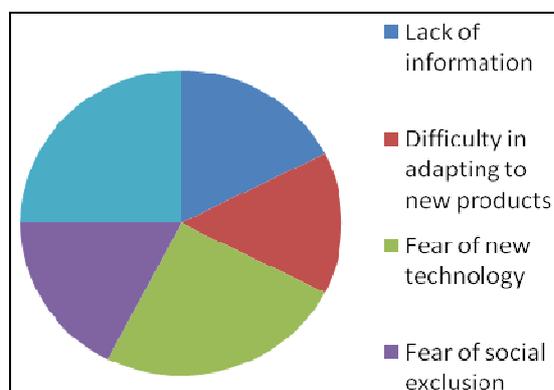


Figure 7. Reasons why assistive devices are not widely used

#### 4. Conclusion

This paper considered the need for the development and employment of a new assistive walking device. In this sense, a market research was performed and by the means of a questionnaire a group of elderly care centres residents were asked to state their opinion on their current mobility aids and also, more importantly, what other features they consider would better serve their disability. The

obtained results point out that the currently used assistive devices – mostly walking frames – show a large degree of generality and, thus, it raises the need for a more appropriate solution, designed to adapt to the more specific needs of the considered group.

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