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Socially Assistive Robots (SAR) in In-Patient Care for the Elderly

Johannes KRIEGEL[a,b,1], Victoria GRABNER[c], Linda TUTTLE-WEIDINGER[b] and Irmtraud EHRENMÜLLER[b]
[a]*Institute for Management and Economics in Healthcare, UMIT - University for Health Sciences, Medical Informatics & Technology, 6060 Hall i.T., Austria*
[b]*Department Gesundheits-Sozial- und Public Management, Fachhochschule Oberösterreich, Linz, Austria*
[c]*Alten- und Pflegeheime der Kreuzschwestern GmbH, Sierning, Austria*

Abstract. In-patient care of the elderly is currently being put to the test in all developed industrial nations. The aim is to make the resident-centered and nursing-related care more professional. In addition to the organizational and interdisciplinary orientation, the use of socially assistive robot technologies and artificial intelligence is increasingly coming to the fore. By means of literature research, expert interviews and an online survey of Upper Austrian nursing home directors, current and future challenges and challenges for the use of socially assistive robots (SAR) in in-patient care for the elderly were identified and prioritized. It becomes clear that the technological and application-oriented maturity of SAR as well as the modular adaptation of the hybrid SAR services to the existing structures and processes from the point of view of the nursing home management are in the foreground. In the future, it will be increasingly important to bring the process-related and technological support of human-machine interaction through SAR to a value-adding level.

Keywords. socially assistive robots, in-patient care of the elderly, human-machine interaction, use cases, business model, Austria

1. Introduction

1.1. In-patient care of the elderly

Nursing care for the elderly in Austria is, in addition to the informal care provided by relatives and mobile care for the elderly, characterized by in-patient care in retirement and nursing homes. In-patient care of the elderly includes long-term residency in a nursing home, where people´s needs for care are accommodated by a specialist staff under constant supervision. In in-patient nursing homes, long-term accommodation is usually the case. The prerequisite for this is that out-patient care or other types of care can no longer adequately address a person´s need for care. The range of services in the in-patient care of older people includes not only the provision of hotel services (for example, accommodation and meals) but also nursing, therapeutic and medical services,

[1] Corresponding Author: Johannes Kriegel, University of Applied Sciences Upper Austria, Garnisonstraße 21, 4020 Linz/Austria, E-Mail: johannes.kriegel@fh-linz.at

some of which are self-provided or secured by cooperation partners. In addition, the retirement and nursing home provides social services designed to ensure the desired quality of life and social participation. [1]

Currently, there are about 850 homes in Austria offering nursing and in-patient care with about 75,000 places, and the average length of stay is about 1.5 years. A public or municipal provider runs approximately 400 of the facilities, and about 450 are in private or church hands. In-patient care of the elderly is financed by taxes and private funds, whereby the corresponding daily allowances are regulated by the state. At present, the in-patient care of elderly people in Austria is determined by the increasing needs for care and support of the residents, increasing waiting times for a nursing home space and a lack of qualified caregiving professionals. These developments are being addressed by increased quality assurance and the expansion of cooperation between nursing homes and external partners (such as primary care physicians, hospitals, service providers). The goal here is to organize and link the nursing homes, which have previously been isolated, within the framework of regional care networks, in a centralized, nurturing and interdisciplinary manner [2].

1.2. Residents´ orientation through socially assistive robots

In order to improve the security of supply and the quality of care in the in-patient care of older people, it is necessary to improve the division of labor and fragmented in-patient care for the elderly by means of more comprehensive and resident-centered provision of services. Such optimization is increasingly carried out by technologically supported solutions. In doing so, it increasingly uses socially assisted robotic technologies and artificial intelligence. Socially assistive robots (SAR) are autonomously acting robots that interact and communicate with humans or other autonomous physical agents, following social behavior and defined rules tied to their roles and functions [3,4,5]. A key factor of influence and success is thereby the consideration of user and resident interests. In addition to the resident`s perspective (e.g., wishes and possibilities of the residents), centering on residents also includes the service and process perspective (e.g., comprehensive and barrier-free design of the care processes) [6,7]. Important aspects in this regard are the interlinked service and service design in in-patient care across professions and specialties. Increasingly, supportive and digital technologies are used in the areas of nursing and therapy as well as supporting services. What are the possible applications for the use of socially assistive robots (SAR) to support and optimize the security of supply and quality in in-patient care provided by nursing homes? Furthermore, it is necessary to identify the associated challenges regarding the use of socially assistive robots (SAR) to support and optimize the security and quality of care in in-patient care provided by nursing homes for the elderly.

2. Methods

2.1. Identification of influences and challenges through literature research

The identification of possible influencing factors, requirements and applications of socially assisted robot technologies in the in-patient care of older people as well as the associated challenges was carried out by means of a semi-structured literature search.

For this purpose, relevant national and international databases (e.g., Science Direct College Edtition, Emerald Collections, Pubmed, Cochrane Library, Thieme Connect, SpringerLink) were searched using targeted keywords or keyword combinations (e.g., residential geriatric care, socially assistive robots, use cases, service providers, etc.). The identified articles, studies and reports were reviewed and their contents interpreted in the context of the research question raised. Furthermore, the results of the literature search were incorporated into the development and design of the survey instruments used below (online questionnaire, expert interviews).

2.2. Survey of nursing home director`s perspectives via online survey

In order to identify possible influencing factors, requirements and applications for the use of socially assistive robots to support and optimize the security of supply and quality in in-patient care by nursing homes, a survey of the nursing home directors´ perspectives was carried out by means of an online survey. This focused on the current situation and the future applications of SAR-supported service provision in the in-patient care of older people. A distinction was made between function-related and resident-related use cases. For this purpose, a standardized online questionnaire based on the results of the literature search as well as six expert interviews (one nursing home director, two nurses, three graduate social workers for elderly work, one kitchen manager, one laundry assistant) were compiled. Based on a pre-test (n=5), the number of application options as well as challenges to be selected and the formulation of the questions were adopted. The online survey took place from 12/18/2018 to 1/8/2019 using the Unipark survey tool [8]. To this end, 106 nursing home directors in Upper Austria were invited to participate by e-mail. The return was n=46, resulting in a return rate of 48.76%.

3. Results

3.1. Factors influencing the use of SAR in in-patient care for the elderly

The use of socially assistive robot technologies in in-patient care for the elderly is confronted with a multitude of different influencing factors, ranging from legal regulations and access to utility services to the lack of services and mature technologies in the context of in-patient care for the elderly. In the process of assessing them, a systematic classification of the manifold challenges concerning the external dimensions of environment and society, caregiving system and technological developments as well as the internal dimensions of organization and results, information and communication, and caregiving professionals of in-patient care for the elderly can be made (see Fig. 1).

3.2. Optional use cases for SAR in in-patient care for the elderly

Socially assistive robotics aims to support in-patient care for the elderly through social interaction and human users (such as employees, residents) in order to add value to the care services and associated supportive processes. In addition to the technical, legal and economic aspects, it is also important to consider the psychological, social and ethical

dimensions of robotics technologies. According to the estimates of nursing home directors in Upper Austria, the main use cases for the use of SAR in in-patient care for

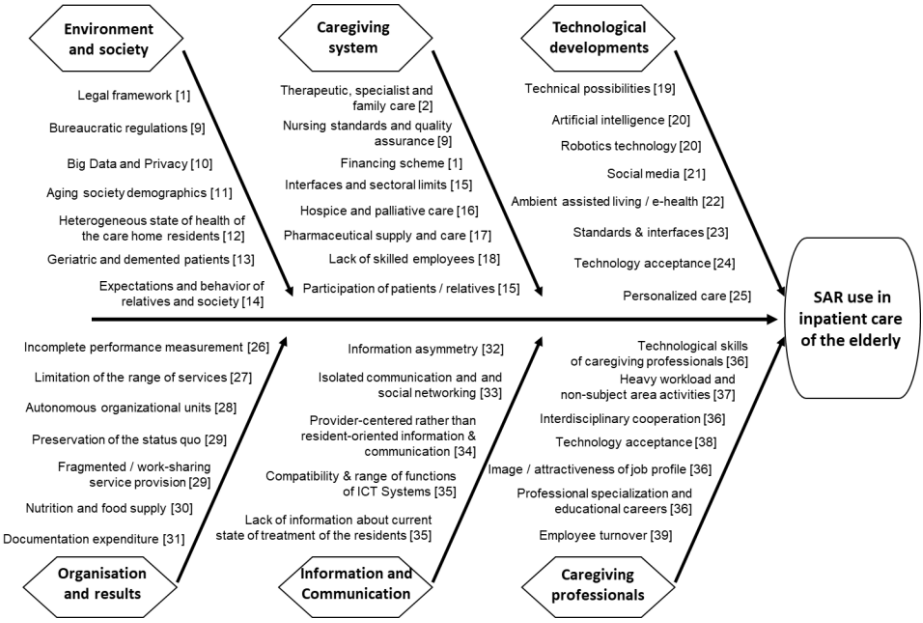

Figure 1. Factors influencing the use of SAR in in-patient care for the elderly

the elderly lie in the function-related support processes (e.g., transport of food, laundry, care supplies) as well as in the resident-related care processes (e.g., communication, entertainment, therapy support) (see Figure 2).

Usefulness of SAR in stationary nursing homes for the elderly			
In the functional areas (very helpful)	% (n=46)	In the resident-related areas (very helpful)	% (n=46)
Transport food carts	41	Read aloud / play music	35
Cleaning	41	Play games	33
Laundry collection and delivery service	33	Alert caregivers in the event of an emergency call	28
Mail delivery	26	In-house security checks at night	28
Transport medicine carts	26	Train cognitive skills	24
Distribute and put away laundry	24	Report missing residents	22
Warehouse logistics (storage, inventory)	20	Entertain residents	20
Hygiene check	13	Serve meals, remove dishes	4
Purchase goods	2	Help with food selection	4
Enhanced feeling of security during night shifts	2	Biography work	2
Create meal plan	0		

Figure 2. Prioritization of possible use cases for SAR in in-patient care for the elderly

3.3. Challenges for the use of SAR in in-patient care for the elderly

Based on the intended usefulness of the use of robotic technologies in the in-patient care of older people with regard to time saving, the focus on the core business, workload management, documentation and cost savings, it is important to establish the deployment of SAR conceptually and in an application-oriented way in the future. In addition to a functioning and solution-oriented robotics technology, this also requires its incorporation into existing or future supply and support processes. Furthermore, it is necessary to provide the appropriate interfaces, standards and necessary infrastructures for embedding SAR in the complex supply system. Another key success factor is the respective acceptance on the part of employees, residents and relatives towards SAR. Finally, a dedicated SAR services provider is required to enable and ensure hybrid SAR services in nursing homes.

From the point of view of the surveyed nursing home directors, the embedding of SAR technologies into the existing infrastructures and service processes as well as the training and involvement of the employees and residents involved are critical to success. The nursing home directors accordingly expect challenges in establishing SAR in the nursing home, especially with regard to the integration and maintenance of existing and required software and information technologies. In addition to the different software requirements, the interface management between the different software programs will be a particular challenge. In addition to the technological realization, according to the nursing home directors, the SAR solutions must be adapted to the respective structural and process-related circumstances and preferences. The nursing home directors consider the publicly debated threats of data abuse, reduced staff and monitoring by SAR and artificial intelligence to be minor challenges.

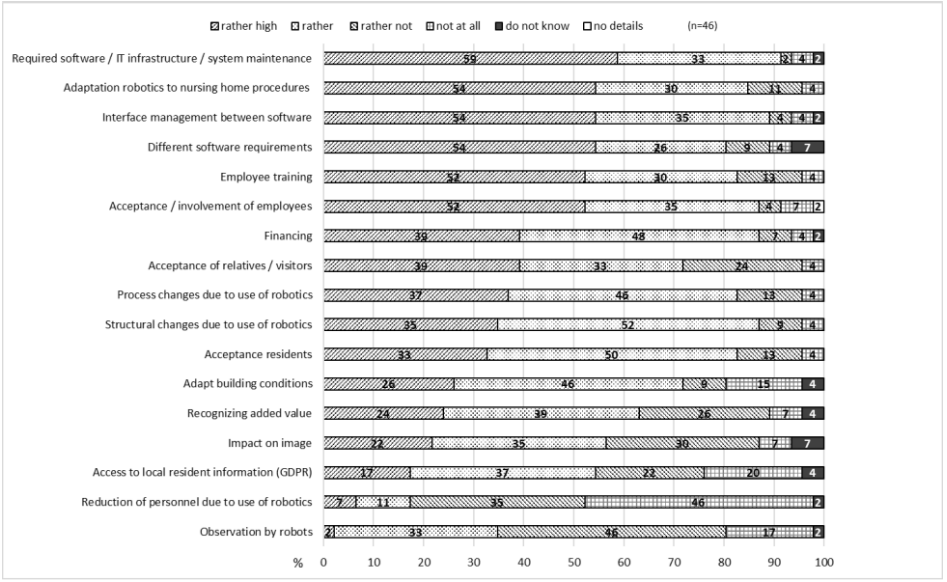

Figure 3. Challenges associated with the use of SAR in in-patient care of the elderly

4. Discussion

4.1. Required business model for modular SAR services in the nursing home

In conjunction with the development of new SAR services and innovative value-added services, customer- and solution-oriented product bundles of services have to be combined and integrated into hardware and software as well as service elements to form an independent new customer-specific business solution [40]. It is also important to involve an active service provider in the development and provision of SAR services. Without a service provider, there will be no SAR services in nursing homes! For this, the development of a SAR business model is recommended, which illustrates the core structure, the internal and external cooperations as well as the financial requirements of the organization [41]. Furthermore, the business model represents the current and future core products or services that the organization offers or wants to offer as well as the associated objectives. In the context of an experimental research and SAR services development, the possible and identified use cases have to be considered in concrete terms of the twelve relevant dimensions of a SAR services business model (customer segments; customer relationships; communication and distribution channels; revenue streams; value propositions; emotions; key activities; key resources; key partnerships; cost structure; ethics; legal regulation) [42].

4.2. Functionality and added value for in-patient care of the elderly

The future use of socially assistive robots in tailored, comprehensive in-patient care for the elderly will be determined on the one hand by user requirements and on the other hand by the associated added value [43]. In the medium term, SAR services will play a major role in support and cooperative performance processes, not only in order to cope with the upcoming shortage of skilled workers, but also to foster qualitative and supportive human-machine interaction. At the same time, the delegation of non-professional, repetitive and stressful activities to SAR gives rise to the possibility of enhancing and expanding social human-human interactions as well as the nursing profession [44]. The use of SAR results in a measurable benefit for the elderly and health care. However, the development of this future scenario must actively involve caregiving professionals and residents with their corresponding requirements, possibilities and fears and integrate the targeted SAR solutions into the actual care processes [45]. This requires appropriately aligned experimental research and development as well as targeted integration and project management.

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