

CONSIDERATIONS ON INTEGRATING ARTIFICIAL INTELLIGENCE IN ELDERLY CARE CENTERS

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ABSTRACT: *at present, awareness of progress in the field of artificial intelligence is driving new research directions on the effective integration of related tools across various spheres of activity. Although still in an initial phase of exploration, the adoption of ai adjacent instruments within elderly care centers may represent a primary focus among the interested parties. In this context, it becomes necessary to understand the needs of the integration process itself. Thus, the purpose of the current research is to outline, using the results of existing studies as a starting point, a preliminary ai adoption model for elderly care centers. Additionally, possible factors regarding the readiness for ai adoption in elderly care centers will be explored. The perspectives presented in this paper can aid in the development of effective strategies for integrating ai into senior care centers, while also laying the groundwork for future studies.*

Key words: *artificial intelligence (ai); elderly; care centers; technology; ai integration;*

1. Introduction

Actors of the modern world recognize adaptation as a key factor in streamlining activities and achieving objectives at both the micro and macro level. In the current context, referring to adaptation in relation to technological progress becomes imperative. At the individual level, this may involve adjusting behaviors, skills and attitudes to cope with the rapid and constant changes brought about by new technologies. Undoubtedly, the process itself is essential for the individual to benefit from the opportunities offered by technology and to minimize any negative effects.

On the other hand, once the main factor that underlies the organizations' activities, namely the individual, recognizes and applies the adaptation to technological progress, the shift in organizations activities in relation to digitalization is crucial to remain competitive and relevant on the market. This involves changing organizational structures, processes and culture to effectively integrate new technologies and capitalize on their advantages.

The efficiency of activities in care centers for the elderly is a current and particularly important topic in the context of the aging of the population at the global level. Therefore, the use of advanced technologies in this field promises not only to improve the quality of life of residents, but also to

optimize the processes of care and resource management.

In recent years, the rapid development of artificial intelligence (AI) technologies has opened new horizons in various fields, including the elderly care sector. Elderly care centers face major challenges, such as financial constraints, the lack of professionalism, collaboration and supports, or the ability to ensure a high level of quality of the services provided [Akil, Abdullah, & Sipon, 2014; Li, Goh, Jhanjhi, Isa, & Balakrishnan, 2021]. Moreover, recent studies highlight the fact that creating sustainable and equitable long-term care systems for elderly and dependent people is one of the major challenges of social policy in developed countries [Díaz Díaz, García-Ramos, López Gutiérrez, & Pérez, 2023].

Under the previously mentioned circumstances, the integration of modern technologies, such as AI-based solutions, can bring significant benefits, helping to improve the care and quality of life of the elderly. However, this is an issue that should be primarily addressed from an organizational perspective, as the implementation of artificial intelligence in elderly care centers may require significant changes in the structure and internal processes of these institutions.

Thus, the purpose of this research consists in sketching a preliminary model for the adoption of

artificial intelligence in elderly care centers, by focusing on the organization, having as a starting point the results of existing studies. Possible factors influencing AI adoption readiness in these centers will, therefore, be analyzed. The insights presented in this paper can contribute to the development of effective strategies for integrating AI into senior care, while also laying the groundwork for further research.

From a methodological point of view, the present research is predominantly focused on external scientific sources, being oriented towards the analysis of the specialized literature available on the studied topic. This approach allows an exploration of the main concepts and theories of interest, providing a preliminary frame of reference for interpreting and evaluating the data.

2. Elderly Care Centers as Organizations

Care is recognized as an interactive process characterized by observation, help and communication, like two wheels connected to the same axis, preceded by individuality and followed by well-being [Hwang, 2017]. Expanding the concept in question, the World Health Organization (WHO), as cited by Díaz Díaz et al. [Díaz Díaz, García-Ramos, López Gutiérrez, & Pérez, 2023] defined long-term care as “the activities undertaken by others to ensure that people with, or at risk of, a significant ongoing loss of intrinsic capacity can maintain a level of functional ability consistent with their basic rights, fundamental freedoms and human dignity”. Under these premises, elderly care can be characterized as a range of services designed to support the physical, emotional and social needs of seniors.

Although the aging of the population has been a point of interest since ancient times, starting from the 20th century, attention has turned to social and medical care for the elderly, a fact promoted, without a doubt, by their growing number [Denham, 2016]. According to Li et al. [Li, Luo, & Dong, 2024], as individuals age in their own homes, their needs for health and/or social care, and physical assistance increase, due to physical and cognitive decline. Under these conditions, caring for the elderly in an organized setting, such as specialized centers, can become a necessity.

According to the definition provided by Aschbacher et al. [Aschbacher, et al., 2016], long-term care facilities can include chronic

long-term care hospitals, nursing homes, and inpatient behavioral health facilities that involve various types of care for the elderly. Exposing a similar view, the National Institute of Aging, division of the U.S. National Institutes of Health, describes residential (living) facilities such as a nursing home, continuing care retirement community, or assisted living facility, where aging adults may move [The NIH National Institute on Aging (NIA), 2023]. In order to improve the understanding, residential care can be characterized as the care given to the elderly in a residential setting intended for seniors who live in accommodation spaces with permanent care staff [Spasova, Baeten, Coster, & Ghailani, 2018].

Considering the organization form, although, as has been observed, the specific names are vary, the care centers for the elderly are mainly identified as non-profit organizations and government agencies. The mission of non-profit organizations is usually focused on supporting communities and vulnerable groups, rather than making a profit, as they play an essential role in providing care services for the elderly. On the other hand, the importance of government agencies involved in the care of the elderly cannot be disputed, as they often provide financial support or other resources to ensure access to quality care, especially for those with low incomes or those in need. In addition, these agencies could finance and regulate various forms of care, including assisted living centers or home care. Private care centers also exist, but they tend to have a different, for-profit approach.

Regardless of the form of organization, a care center for the elderly certainly has policies and operating rules, qualified human resources and predetermined processes. Thus, the adoption of new technologies to streamline the activities of a senior care center can only be achieved through a preliminary analysis of the factors of interest.

3. Key existing views on AI for elderly

Although recent scientific studies intensively deal with both the integration of AI technologies and the aging of the population, the nexus between the two phenomena is often concretized in the body of specialized literature without directly referring to specialized centers for the care of the elderly. However, some key perspectives can be mentioned in this regard.

As stated by Rubeis [Rubeis, 2020], the use of AI in senior care promises to be personalized, participatory, predictive and preventive. Especially in the context of care for the elderly, the uniqueness of each individual's needs makes the development of user-adaptive assistance systems in dynamic environments a difficult process, but cyber-physical assistance systems powered by artificial intelligence facilitate adaptive, flexible and personalized assistance through data analysis from the physical environment [Sahlab & Jazdi, 2020]. This reflects the importance of personalization in aged care, showing that despite the difficulties, the integration of advanced technologies can transform the care experience, making it more relevant and effective for each individual.

Among the advantages observed in the use of AI for older adults, it was also demonstrated that artificial intelligence benefits from great potential in terms of advancing the diagnosis and treatment of patients with neurocognitive disorders, while the data obtained can contribute to the personalization and prediction of learning algorithms automatic in the field of health [Graham, et al., 2020].

As per Lee et al. [Lee, Wang, Fan, Li, & Chen, 2023] the fact that multiple areas of healthcare for the elderly have already developed and implemented AI-enabled systems and scenarios was demonstrated, the study also revealing the increased positive impact of the technology in question.

The results of the relatively recent study conducted by Ma et al. [Ma, et al., 2023] highlight that AI technologies have a promising impact on healthcare for the elderly, being able to address the unmet care needs of older adults and showing great potential for further development in this sector.

These suggest that there are significant opportunities to improve the quality of life of seniors through innovations and strategies tailored to their specific needs.

For example, in the daily activities of the elderly, artificial intelligence (AI) and the Internet of Things (IoT) can offer promising solutions for fall prediction and prevention, both in assisted living and healthcare monitoring, by comparing past and current data to generate predictions future [Mohan, et al., 2024].

At the same time, it has been demonstrated that AI can improve remote monitoring of elderly

patients, providing real-time data analysis, as well as increased support for clinical trials and more uniform results [Park, Mirian, & McKeown, 2024]. This remote monitoring capability not only enhances patient safety, but also facilitates faster and more informed medical interventions, thereby contributing to an overall improvement in the quality of care.

Despite the fact that specialized literature often refers to the potentially beneficial influences of the use of AI technologies by or for the elderly, there are also frequently discussed barriers in adoption or threats to be considered. Modern AI solutions can be a real challenge for some groups of people, especially the elderly [Wolniak & Stecula, 2024].

At a general level, attitudinal and cognitive barriers, age-related changes that affect the use of technology [for example, the visual acuity] and privacy concerns were early recognized among the challenges regarding the acceptance of technology as a whole by the elderly [Charness & Boot, 2009]. In addition, the lack of adequate technical support and the complexity of interfaces may further discourage the use of technology among older people.

Regarding the general adoption of AI at the individual level, among the influential factors recognized were those related to security, trust, security, cost, utilitarian benefit, intrinsic motivation and social influence, while at the organizational level, technical skills, top support management, strategies for AI adoption and the digital maturity of the organization are discussed as potential barriers [Radhakrishnan & Chattopadhyay, 2020].

Undoubtedly, the previously mentioned challenges are even more accentuated among elderly people who have not benefited from technological training and familiarization throughout their lives. We are thus discussing issues related to familiarity with technological tools, including AI technology and, moreover, the ability to use it by the elderly.

The previously considered aspects, although limited to the reviewed literature, provide an overall picture of some potential benefits and challenges of the artificial intelligence adoption by/for the elderly.

The advantages of this technology are promising in order to improve the quality of life of seniors, but the barriers and threats must be made aware.

4. Preliminary AI Adoption Model for Elderly Care Centers

Sketching a valid general model regarding the adoption of artificial intelligence represents an almost impossible task. Every decision to integrate the technology in question, whether at the individual level or at the organizational level, must take into account factors of influence specific to the subject.

The specialized literature brings, however, to the attention of the audience, directions of interest that can be a good starting point in the adoption of AI by organizations. In this sense, the current research focused on the method proposed by Bettoni et al. [Bettoni, Matteri, Montini, Gładysz, & Carpanzano, 2021], which suggests a model designed to measure the degree of artificial intelligence (AI) readiness and promote its adoption in SMEs. The original model focuses on areas in the organization that must be developed for the adoption of AI, being structured on the following five pillars: digital and smart factory, data strategy, human resources, organizational structure and organization's culture. Thus, in the following, the present research aims to adapt the previously mentioned model in order to focus on elderly care centers.

For a feasible adaptation, the five existing pillars will be kept as such in the outline of the model for the integration of AI in elderly care centers, and, with the aim of a better understanding, they can be described as follows [Bettoni, Matteri, Montini, Gładysz, & Carpanzano, 2021]:

- **Digital and Smart Factory:** At the term level, Digital and Smart Factory represents an industrial concept that combines advanced technologies of automation, digitalization and data analysis to optimize the production process. According to Bettoni et al., the Digital Factory has the role of collecting data in order to provide a unique and updated representation in real time, while the Smart Factory has the responsibility of implementing decisions and making optimizations defined by decision makers, including artificial intelligence. Also, the ICT infrastructure could be mentioned as an important aspect directly linked to the Digital and Smart Factory pillar.
- **Data Strategy:** Refers to the organization readiness for AI solutions that take data as

input and extract useful information, with the aim of optimizing operations or even supporting decision-making processes.

- **Human Resources:** Regarding human resources, reference is made mainly to its abilities in terms of the use of AI, the author also suggesting the need for the support offered by the company in order to develop these skills.
- **Organizational Structure:** The pillar in question focuses on the organization's ability to reorganize from "left to right" the development of operations and all adjacent activities, in order to ensure the transition to an organization based on artificial intelligence.
- **Organization's Culture:** A good approach to adopting AI technology is represented by the ability to change the organization's culture to one that promotes innovation and experimentation, including changing the mindset of employees, if necessary.

To evaluate the previously described pillars, the model involves the use of a questionnaire divided into three sections, including a set of predefined questions. According to the authors [Bettoni, Matteri, Montini, Gładysz, & Carpanzano, 2021], each of the predefined questions focuses on a certain pillar, having a specific weight $[W_i]$. The answers recorded after the distribution of the questionnaire contribute with various scores $[S_{i,j}]$, determined on the basis of the best practices related to the subject analyzed in the question. Subsequently, the calculated weighted scores contribute to the calculation of the so-called maturity score for each pillar $[Sp]$. To calculate the score related to each pillar, a specific formula is indicated.

However, in the present research it is not aimed at adapting the calculation method, but at sketching an extended model, by supplementing the main pillars. As for the pillars proposed in the original model, it can be considered that they can also be successfully used in elderly care centers without encountering major difficulties. Even if the model was originally developed for small and medium-sized enterprises, the fundamentals on which each pillar is based are universally applicable and can be adjusted to reflect the specificities of care centers.

The addition of pillars from the basic model can be considered necessary in the context of the analysis at the level of care centers for the elderly,

as they present unique particularities. In this type of institutions, the interaction with the beneficiaries, namely the elderly, is fundamentally different from that in a regular enterprise, requiring a personalized approach that takes into account the needs, perceptions and comfort level of the elderly with technology. Despite the fact that these aspects can be included, to some extent, as part of the organizational culture of a center for the elderly care, an additional pillar can lead to obtaining a greater degree of relevance regarding the readiness of the analyzed center for the adoption of AI. Undeniably, the patients of an elderly center can change, but most of them intend to benefit from the center's services until the end of their lives, given the possibility of evaluating such a pillar at a certain point in time.

In this context, the suggested additional pillar refers to the beneficiaries and focuses on the level of familiarity and knowledge of the elderly related to AI, considering that the success of the implementation of this type of technology in care centers also depends on the degree of acceptance and comfort of the patients - in this case, the elderly. This pillar aims to assess and improve the level of awareness, confidence and familiarity of the seniors regarding the use of AI-based technologies in care facilities, with the following suggested, but not limited to, key components:

- **Technology Literacy Level of the Elderly:** Analysis of basic knowledge related to technology and AI. It crucial for seniors to understand how AI can help them, whether in health monitoring, safety or emotional support.
- **Acceptance and attitude towards AI:** Assessing the perception and attitude of the elderly towards AI, including the level of confidence and comfort in using the technologies.
- **Hands-on experience using AI technologies:** Creating opportunities for seniors to interact directly with AI solutions, such as social bots, smart devices or assistive applications. Familiarity with these technologies can increase confidence and reduce fear of the unknown.
- **Adapting AI technologies to the specific needs and limitations of the elderly:** Technologies should be easy to use, intuitive and adapted to the needs of the elderly, including in terms of physical or cognitive limitations they may have.

The inclusion of this pillar, called Beneficiaries, reflects a patient-centered approach to aged care facilities, and could ensure that AI solutions are not only functional, but also humanely and socially acceptable. Unlike other organizations, in the case of centers for the elderly, the beneficiaries cannot be recognized only as clients, especially if the institution in question is not for profit. Therefore, an extended model such as the one proposed, though not restricted to, could help to make better decisions regarding the degree of maturity in order to adopt AI technologies in elderly care centers.

5. Conclusions

The reality of the last decades has demonstrated the need to adapt to the existing technological changes, both at the individual level, as well as what concerns the organizations. Recent developments and implementations include, among others, AI solutions, representing a real point of interest in specialized literature and beyond.

Observing the potentially beneficial effects that AI technologies can have, organizations from all over the world are trying to integrate them into their activities. However, the AI adoption process cannot be carried out without a detailed analysis of the organization's readiness in this regard. Although existing methods for analyzing the maturity of organizations for the adoption of AI have already been tested, when we refer to care centers such as those intended for the elderly, they can have different specificities.

The present research led to the identification of some existing considerations regarding AI for the elderly and to the subsequent sketching of a model for evaluating the degree of readiness in order to adopt AI by elderly care centers. Thus, starting from the original model proposed by Bettoni et al. [Bettoni, Matteri, Montini, Gładysz, & Carpanzano, 2021], the research suggests the inclusion of the Beneficiaries additional pillar, with the aim of addressing their special needs.

The recognition of the fact that the proposal in question was not tested directly led to the characterization of the resulting model, including six pillars instead of five, as preliminary. This aspect, along with the fact that the chosen pillar might not be the only relevant one, represents the limitations of the present research.

Thus, the future directions of research should be focused on the application of several methods of analysis, the definition of questions related to

the questionnaire for the suggested pillar and the subsequent practice of first-hand research through direct testing in the case of some centers for the elderly.

References

1. Akil, S. M., Abdullah, S., & Sipon, S. (2014). *Challenges in managing elderly care centres in Malaysia*. International Journal of Arts & Sciences, 129-139.
2. Aschbacher, R., Pagani, E., Confalonieri, M., Farina, C., Fazii, P., Luzzaro, F., . . . Pagani, L. (2016). *Review on colonization of residents and staff in Italian long-term care facilities by multidrug-resistant bacteria compared with other European countries*. Antimicrob Resist Infect Control, 1-9. doi:10.1186/s13756-016-0136-1.
3. Bettoni, A., Matteri, D., Montini, E., Gładysz, B., & Carpanzano, E. (2021). *An AI adoption model for SMEs: a conceptual framework*. IFAC-PapersOnLine, 54(1), 702-708. doi:10.1016/j.ifacol.2021.08.082.
4. Charness, N., & Boot, W. R. (2009). *Aging and information technology use: Potential and barriers*. Current directions in psychological science, 253-258. doi:10.1111/j.1467-8721.2009.0164.
5. Denham, M. (2016). *A Brief History of the Care of the Elderly*. History of Geriatric Medicine.
6. Díaz Díaz, B., García-Ramos, R., López Gutiérrez, C., & Pérez, A. (2023). *Dependency and Elderly Care: The Cost of the Long-Term Care System in the Context of the SDGs*. Sustainability, 15(21). doi:10.3390/su152115674.
7. Graham, S., Lee, E., Jeste, D., Van Patten, R., Twamley, E., Nebeker, C., . . . Depp, C. (2020). *Artificial intelligence approaches to predicting and detecting cognitive decline in older adults: A conceptual review*. Psychiatry Research. doi:10.1016/j.psychres.2019.112732.
8. Hwang, H. I. (2017). *Caring for Residents of Eldercare Facilities: A Concept Analysis*. International Journal of Nursing Knowledge, 37-43. doi:10.1111/2047-3095.12103.
9. Lee, C., Wang, C., Fan, X., Li, F., & Chen, C. (2023). *Artificial intelligence-enabled digital transformation in elderly healthcare field: scoping review*. Advanced Engineering Informatic, 101874. doi:10.1016/j.aei.2023.101874.
10. Li, J., Goh, W., Jhanjhi, N. Z., Isa, F., & Balakrishnan, S. (2021). *An empirical study on challenges faced by the elderly in care centres*. EAI Endorsed Transactions on Pervasive Health and Technology, 7(28), 1-11.
11. Li, Y., Luo, L., & Dong, H. (2024). *Delivering Integrated Community Care for the Elderly: A Qualitative Case Study in Southern China*. Public Health. doi:10.3390/ijerph21060680.
12. Ma, B., Yang, J., Wong, F., Wong, A., Ma, T., Meng, J., . . . Lu, Q. (2023). *Artificial intelligence in elderly healthcare: A scoping review*. Ageing Research Reviews, 101808. doi:10.1016/j.arr.2022.101808.
13. Mohan, D., Al-Hamid, D. Z., Chong, P. H., Sudheera, K. L., Gutierrez, J., Chan, H. C., & Li, H. (2024). *Artificial Intelligence and IoT in Elderly Fall Prevention: A Review*. IEEE Sensors Journal, 4181-4198. doi:10.1109/JSEN.2023.3344605.
14. Park, K. W., Mirian, M. S., & McKeown, M. J. (2024). *Artificial intelligence-based video monitoring of movement disorders in the elderly: a review on current and future landscapes*. Singapore Medical Journal, 141-149. doi:10.4103/singaporemedj.SMJ-2023-189.
15. Radhakrishnan, J., & Chattopadhyay, M. (2020). *Determinants and Barriers of Artificial Intelligence Adoption – A Literature Review*. Re-imagining Diffusion and Adoption of Information Technology and Systems: A Continuing Conversation: IFIP WG 8.6 International Conference on Transfer and Diffusion of IT, 89-99.
16. Rubeis, G. (2020). *The disruptive power of Artificial Intelligence. Ethical aspects of gerontechnology in elderly care*. Archives of gerontology and geriatrics, 104186. doi:10.1016/j.archger.2020.104186.

17. Sahlab, N., & Jazdi, N. (2020). *AI-Based elderly assistance systems*. IOS Press, 163-169.
18. Spasova, S., Baeten, R., Coster, S., & Ghailani, D. (2018). *Challenges in long-term care in Europe. Brussels: Directorate-General for Employment, Social Affairs and Inclusion*.
19. The NIH National Institute on Aging (NIA). (2023, October 12). *Long-Term Care Facilities: Assisted Living, Nursing Homes, and Other Residential Care*. Retrieved from National Institute of Aging: <https://www.nia.nih.gov/health/assisted-living-and-nursing-homes/long-term-care-facilities-assisted-living-nursing-homes>.
20. Wolniak, R., & Stecula, K. (2024). *Artificial Intelligence in Smart Cities-Applications, Barriers, and Future Directions: A Review*. Smart Cities, 1346-1389. doi:10.3390/smartcities7030057.