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Original Article

Building care gerontotechnologies in the context of elderly person with Alzheimer's disease

Construção de gerontotecnologias de cuidado no contexto da pessoa idosa com doença de Alzheimer

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ABSTRACT
Objective: to build care gerontotechnologies to help family caregivers with the difficulties experienced in the context of elderly people with Alzheimer's disease. **Methods:** strategic action research carried out with seven family caregivers of elderly people with Alzheimer's disease and 12 health academics from a university. Data was gathered from the family caregivers using a semi-structured interview. Three focus groups were held with the academics. The data was submitted to the discursive textual analysis technique. **Results:** eight difficulties experienced by family caregivers emerged, corresponding to cognitive aspects, Activities of Daily Living and issues relating to family care. It was possible to construct 14 care gerontotechnologies in product form. **Conclusion:** gerontotechnologies were built to help family caregivers with the difficulties experienced by elderly people living with Alzheimer's disease. **Contributions to practice:** the gerontotechnologies developed have the potential to contribute to the care process, since they can be used by family caregivers on a daily basic and can be adapted to each reality, based on the unique needs of each elderly person.
Descriptors: Aged; Family Relations; Geriatrics; Alzheimer Disease; Technology.

RESUMO
Objetivo: construir gerontotecnologias de cuidado para auxiliar familiares cuidadores nas dificuldades vivenciadas no contexto das pessoas idosas com doença de Alzheimer. **Métodos:** pesquisa-ação estratégica, realizada com sete familiares cuidadores de idosos com doença de Alzheimer e 12 acadêmicos da saúde de uma universidade. Os dados foram coletados com os familiares cuidadores, por meio de entrevista semiestruturada. Com os acadêmicos, realizou-se três grupos focais. Os dados foram submetidos à técnica de análise textual discursiva. **Resultados:** emergiram oito dificuldades vivenciadas pelos familiares cuidadores correspondentes aos aspectos cognitivos, as Atividades de Vida Diária e as questões relativas à família no cuidado. Foi possível construir 14 gerontotecnologias de cuidado na forma de produto. **Conclusão:** foram construídas gerontotecnologias para auxiliar familiares cuidadores nas dificuldades vivenciadas junto às pessoas idosas que vivem com doença de Alzheimer. **Contribuições para a prática:** as gerontotecnologias construídas possuem potencial de contribuir com o processo de cuidado, uma vez que podem ser utilizadas por familiares cuidadores no cotidiano e serem adaptando para cada realidade, a partir da necessidade singular de cada pessoa idosa.
Descritores: Idoso; Relações Familiares; Geriatria; Doença de Alzheimer; Tecnologia.

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Introduction

Recently, there has been a sharp rise in the number of elderly people worldwide. It is estimated that in 2021 this number was 212.7 million, and that by 2050 it will reach the proportion of two elderly people for every one under five[1]. Regarding Brazil, it is expected that by 2025 the country will be the sixth largest in terms of concentration of people over 60[2]. The aging process poses several challenges for the health system and the elderly, since as people get older, they are more susceptible to developing chronic diseases of various kinds, including neurodegenerative diseases. Among these is Alzheimer's disease (AD), characterized as one of the types of dementia that most affects the elderly[3].

Looking at the world picture, it is estimated that there are approximately 55.2 million people affected by dementia and international statistics warn that by the year 2050, this figure will be 139 million[3]. In Brazil, around 1.2 million people are affected by AD, which has a degenerative, progressive, and irreversible nature that affects cognition and functionality and is usually characterized by three stages: initial, intermediate, and terminal[4]. In the initial period of the condition, there is a progressive reduction in recent memory; in the intermediate stage, memory capacity is lost, and physical-motor, language and reasoning limitations begin; while the terminal stage is characterized by intense muscle rigidity, fragility, a vegetative state and, in this case, the person regresses to the fetal position[4].

Due to its neurodegenerative characteristics, as the disease progresses, the elderly person's performance of activities of daily living (ADLs) becomes impaired, leading to the need for care, most of which is carried out by family members in the home environment[5]. Thus, AD imposes specific challenges on the elderly, including the complexity of care and the impact on the family, which are proportional to the stage of the disease and, consequently, the level of impairment presented by the elderly person in the development of Basic Activities of Daily Living (BADL), represented by everyday tasks such as feeding and dressing. Also, Instrumental Activities of Daily Living (IADL), which include community tasks such as preparing meals and managing money, and Advanced Activities of Daily Living (AADL), which are more complex and subdivided into physical, leisure, social and productive aspects, which are influenced by the motivational and cultural patterns of each person[5].

Faced with this reality, there is a need for innovative approaches that meet the needs of each person. To this end, professionals need to be aware of the main difficulties experienced by family caregivers, as well as being able to identify tools to help them in the day-to-day care of elderly people with AD[6]. In this sense, there is a growing use of technologies in the provision of care, which can be used to support, facilitate, and create new possibilities in the care of elderly people with dementia[7]. Complex care-educational gerontotechnologies have emerged in the form of products, such as equipment, machines, support bars and non-slip mats. In addition, there are also gerontotechnologies in the form of process/knowledge/strategy, which are characterized as the various non-materialized tools used for care, for example, support groups, strategies to calm, distract and actively involve the elderly person[8].

In this way, gerontotechnologies can potentially contribute to improving the quality of life of elderly people with AD and their families. However, although there is research on the subject[9-10], there are gaps in the development of low-cost care gerontotechnologies for the context of AD. Thus, there is a need for personalized approaches that can be reproduced and used by family caregivers without burdening them financially, a fact that justifies the relevance of this research. In addition, the World Health Organization has prioritized dementia as a global public health concern and recommended that research be carried out to inform support interventions for people living with dementia and their families[11]. This issue was reaffirmed by Brazil when it included issues related to the care of

the elderly and their families on the agenda of research priorities[12].

Considering the above, the question arises: what gerontotechnologies can be developed to help with the main difficulties experienced by family caregivers of elderly people with Alzheimer's disease? In an attempt to answer this question, this research aimed to build care gerontotechnologies to help family caregivers with the difficulties experienced in the context of elderly people with Alzheimer's disease.

Methods

Strategic action research. The recommendations of the Consolidated Criteria for Reporting Qualitative Research (COREQ) were followed.

Data collection took place in the homes of family caregivers of elderly people with AD, and in an extension, project developed in the form of a support group, linked to a private university in Rio Grande do Sul, Brazil. Data were collected from two groups: the first, with family caregivers of elderly people with AD; the second, with health academics.

The selection criteria for family caregivers were being or having been a family caregiver of elderly people with AD and being registered with the project. Exclusion criteria were not being in a cognitive condition to answer the questions, according to the Mini-Mental State Examination (MMSE). For the academics, the selection criteria were to be an academic on one of the health courses, to have been taking part in the project for at least six months, a sufficient period for them to have already experienced the situations presented to the group by the family caregivers. Students who had a doctor's certificate or were away from the group for various reasons were excluded.

At the time of the research, the project had 20 registered family caregivers and 40 undergraduates enrolled in nursing, pharmacy, physiotherapy, speech therapy, nutrition, dentistry, psychology, and occupational therapy, making up an eligible population of 60 participants. However, seven family caregivers and 12 academics met the criteria and agreed to take part in the study, giving an undetermined total of 19 participants.

Data were collected in two stages: initially, in August 2020, family caregivers were invited individually by telephone to take part in the research. Once they had accepted, home visits were made in September 2020, during which time the first stage of data collection took place, using a semi-structured interview specifically designed for this research, which was carried out in a single session with each participant. The interview script consisted of two parts, the first describing the participants and the second with the following open questions: what was/is it like for you to be a family caregiver for an elderly person with AD? What were/are the main difficulties that you and/or the family experienced or are experiencing in the day-to-day care of the elderly person with AD? The interviews were conducted by a single researcher with a PhD in nursing and experience in qualitative research and gerontotechnology. They were audio-recorded using an MP3 device and then transcribed in full into Word documents.

After the initial stage, the researchers invited the health academics who were part of the project to take part in the research by telephone. Data collection, moment two, took place from September to November 2020, through a focus group, a technique that enabled dialog about the topic, which was experienced and shared through common experiences. This involved the participation of a coordinator and a scientific initiation scholarship holder, who took part as a group observer and had the role of helping to collect and record the data and take notes. Three focus groups were held, each lasting approximately 120 minutes, which took place in the room where the support group, linked to the extension project at the University, takes place. It should be noted that all the recommendations for protection and prevention of COVID-19 were followed.

The first group aimed to understand academics' perceptions of gerontotechnologies for caring

for the elderly/families. At the start of the activity, the moderator gave each participant a sheet of paper so that they could record their understanding of gerontotechnologies. After completing this activity, the participants presented and explained their records to the others, identifying the similarities and differences that led to a wide-ranging discussion on the subject. Next, the moderator presented the group with some concepts and images of gerontotechnologies and a new sheet of paper was given to the participants so that they could record the topic again. Finally, there was a collective summary of what had been developed.

In the second meeting, with the aim of deepening and broadening the perception of the subject, some of the points highlighted in the summary of the previous meeting were taken up again. The moderator then presented a summary of the main difficulties identified in the interviews with family caregivers, proposing that the participants think of strategies for each difficulty raised. They were given approximately 15 minutes to think about possible gerontotechnologies of care. They were then invited to present their suggestions to the large group, which made it possible to discuss, expand and adapt them.

In the third meeting, the students built the gerontotechnologies according to the suggestions from the previous meeting. Materials such as boxes, sheets of paper, cardboard, scissors, colored pens, rulers, glue and other materials were made available for making them. Once they had been made, the gerontotechnologies were photographed and explanatory material was created, containing their application and the purpose of this production.

The data produced in the interviews and focus groups was submitted to the discursive textual analysis technique, organized into three components: unitarization, establishment of relationships and communication[13]. Regarding the data from the interviews with family caregivers, the researchers initially examined the texts in depth, forming three basic units: cognition and memory; activities of daily living; and family in care.

The reports included in the base units were then read again and separated into different units by textual approximation, giving rise to the categories. The process of communication between the different difficulties was then carried out, resulting in meta-texts describing and interpreting the phenomena investigated, the last stage of the analysis method[13]. The same stages of analysis were carried out for the data from the groups with the academics, producing 14 gerontotechnologies of care.

Participation in the research took place after signing the Free and Informed Consent Form, and the participants were assured of the anonymity and confidentiality of the information. Participants remained anonymous and were identified by the letters F (family member) and A (academic) followed by a number (F1, F2... F7; A1, A2... A12). The ethical precepts involving research with human beings, set out in Resolution 466/2012 of the National Health Council, were respected. The project was approved by the Research Ethics Committee of the Franciscan University with opinion number 3,920,648/2020 and Certificate of Submission for Ethical Appreciation number 29816420.8.0000.5306.

Results

Seven family caregivers took part in this study, six female and one male, aged between 33 and 68; three were children; three were caregivers; one was a spouse; four lived at the same address as the elderly person. The time spent working as a caregiver ranged from two to 17 years, and all the participants were the main caregivers of the elderly person with AD. Twelve health academics also took part, one of which was studying nursing; two, speech therapy; two, physiotherapy; one, nutrition; three, dentistry; and three, occupational therapy. They were all female, aged be-

tween 19 and 43, and studying between their fourth and 10th semesters.

The data analyzed resulted in the identification of eight difficulties experienced in the daily care of elderly people with AD. Based on the difficulties identified and the suggestions, 14 gerontotechnologies were built/materialized by the students, which aim to help with cognitive and memory alterations in the elderly with AD; gerontotechnologies for caring for the Activities of Daily Living of the elderly with AD; and gerontotechnologies related to the family in the context of caring for the elderly with AD. Figure 1 summarizes the data.

Basic units	Difficulties experienced	Family identification
Cognition and Memory	Forgetfulness for the elderly person about activities that have already been carried out or need to be carried out	*F1; F2; F5
	Forgetting places, routes and destinations	F1; F2
	The elderly loses track of money	F2; F4
Activities of Daily Living	Bathing and oral hygiene by the elderly	F2; F5
	Difficulty feeding the elderly person	F1; F3; F6
	Difficulty with the elderly person's medication	F2; F6; F7
Family in care	Family member/caregiver overload	F3; F4
	Lack of knowledge about the disease	F3; F4

*F: Familiar

Figure 1 – Base units, difficulties experienced in the daily care of elderly people with Alzheimer's disease. Santa Maria, RS, Brazil, 2020

Gerontotechnologies to help cognition and memory disorders in the elderly with Alzheimer's disease

As difficulties experienced by family members, the following were identified: forgetting activities that have already been carried out or that need to be carried out by the elderly person; forgetting the way home, which means that the elderly person is unable to return home after leaving alone; and losing track of the value of money. For these situations, low-cost gerontotechnologies have been built in product form (Figure 2).

Figure 2 – Gerontotechnologies in the form of products for cognition and memory. Santa Maria, RS, Brazil, 2020

Gerontotechnology 1 (value vs. product) can be useful in situations where the elderly person has difficulties with the value of money when buying utensils. We have therefore created material for the elderly person to consult quickly on the value of each product. It should be updated with the items most consumed by the elderly person daily: *This material we have built, with the values of each product, can be used or even built by the family carers themselves, including the main items consumed by the elderly daily* (A1).

In situations where the elderly person has completely lost track of the value of money, a wallet with fictitious money can be used: *We build a wallet with fictitious money, so that the elderly person can go to the stores and buy whatever they want, without the risk of carrying real money and losing it or giving it to someone else. Then we need to make arrangements with the shops closest to the elderly person's home so that they can deliver the product they want and receive this "money", and instruct the store owner to inform the family member when this happens so that they can exchange it for real notes* (A3).

The ID badge should be used to help in situations where the elderly person forgets their places, routes, and destinations. This way, if they leave home and forget the way back, people will be able to identify that they are a person with AD and get in touch with the relative, as the badge provides this information: *The ID badge is a very important piece of technology because we know that it's common for elderly people with Alzheimer's to forget where they're going, get lost and not know how to get home. The badge should include the name and address of the elderly person and the telephone number of the family caregiver so that anyone can contact their family member if they notice that the elderly person is lost* (A6). *The badge can be adapted, it doesn't necessarily have to be a physical badge, it can even be embroidered on the elderly person's main clothing* (A9). *That's right, I think the badge can be embroidered or sewn onto the clothes because sometimes the elderly person find it strange and doesn't want to wear it hanging from their clothes, but if it's sewn on or embroidered, they won't mind* (A11).

The simple-to-understand cards were built by the students as a model to help the elderly person remember the activities they have already done or need to do. They should be updated with the main activities carried out by the elderly person daily: *We have constructed examples of cards that can be used as reminders for the elderly person daily. They are very simple and can be adapted, in other words family caregivers can build them with various activities that the elderly person usually does daily* (A1). *Using these cards will help the elderly person with Alzheimer's to remember the main activities they need to do daily, such as making lunch, collecting their clothes, and taking their medication* (A4).

Gerontotechnologies for caring for the Activities of Daily Living of the elderly person with Alzheimer's disease

Other difficulties presented by family caregivers in this study relate to BADLs, particularly situations in which the elderly person forgets to perform bodily hygiene or refuses to do so, saying that they have already done so. Forgetting or duplicating meals and medication intake were also difficulties identified. In addition, situations related to opening the oral cavity to sanitize it and limitations in holding cutlery were other difficulties experienced by family caregivers. Figure 3 shows the gerontotechnologies suggested/constructed to help family caregivers with these difficulties.

Figure 3 – Gerontotechnologies in the form of products for Activities of Daily Living. Santa Maria, RS, Brazil, 2020

To help with BADLs, a planner was built with daily activities to be carried out by the elderly person, from the moment they wake up from their night's sleep: *We built this planner with the elderly person's daily activities, inserting in it the activities that, we believe, are important* (A1). *It's important to note that the activities should be consistent with what the elderly person does in their routine so that the planner is more assertive. It should be displayed in a visible place, and it should be explained to the elderly person how it works, in other words, that it contains the activities to be carried out from the time the elderly person wakes up until bedtime* (A6).

For situations in which the elderly person refuses to perform their bodily hygiene, the use of the bathing doll was suggested as a gerontotechnology: *The logic of the doll is to guide the elderly person to bathe themselves so that they can get into the shower together and, while "sanitizing" the doll, the family caregiver helps them with their bodily hygiene* (A9).

The mouth retractors were designed to help with the oral hygiene of elderly people with AD in more advanced stages who, due to the nature of the disease, can no longer perform their BADLs independently: *I built some adapted mouth retractors. Their potential lies in keeping the elderly person's jaw open so that the family member can insert the toothbrush or other oral hygiene tool* (A6). *In dentistry, we realize how much these mouth guards can contribute to people's oral hygiene, especially elderly people with advanced Alzheimer's disease* (A2).

The food diary is a gerontotechnology with the potential to help in situations where the elderly person forgets or eats too many meals, as it is a tool for recording all the food eaten: *We developed the food diary as a gerontotechnology, a book or notebook in which all the food eaten by the elderly person over a 24-hour period should be recorded. Its potential lies in helping the elderly person and family caregivers to control their daily food intake, avoiding forgetfulness or double meals (A4). Filling in the food diary should preferably be done by the elderly person themselves, if they have preserved capacity; if they can't, it should be done by the family caregiver* (A12).

The adaptations to the cutlery with a fixing bracket were gerontotechnologies built/suggested to help in situations where it was difficult for the elderly person to hold the cutlery when eating: *We made these adaptations to the cutlery for when the elderly person found it difficult to hold the cutlery. It's very simple to do, and it helps a lot because the hand is inserted into the adaptation support and holds the cutlery, allowing the person to maintain their independence to eat, even partially* (A2).

The organizer box and jars are useful gerontotechnologies for minimizing situations in which the elderly person forgets their medication intake: *The organizer box is divided into three compartments, for morning, afternoon, and evening medication, where the medication cards to be taken during each shift should be inserted* (A10). *Like the box, we built these organizer jars. Their logic is to insert all the day's medication in the morning, afternoon, and evening. The difference between the jars and the organizer box is that in the jars you only insert the pills, and, in the box, you insert the medicine packs. Both are good because they help the elderly person or family caregiver to control the correct intake of medication each shift, avoiding forgetfulness* (A4).

Gerontotechnologies to integrate the family in the care of elderly people with Alzheimer's disease

Family/caregiver overload and lack of knowledge about AD were difficulties reported by family caregivers, which implies that the family is (not) integrated into the process of caring for the elderly person. Three gerontotechnologies were built to help in this process, as shown in Figure 4.

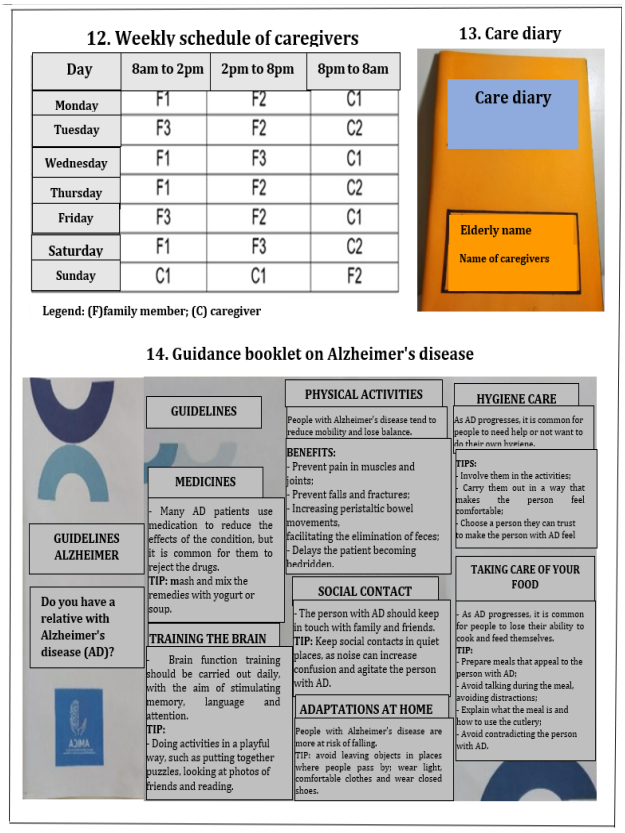

Figure 4 – Gerontotechnologies in the form of products for integrating the family into the care process. Santa Maria, RS, Brazil, 2020

To help reduce the burden of care and improve the elderly person's safety, an example of a caregiver schedule and care diary has been drawn up*: It is important for caregivers to take turns, as it is exhausting when only one person is responsible for care. So, we've put together an example of a schedule that can be used by family caregivers. Of course, it should be adapted according to each family's routine, as well as the possibility of having hired caregivers if family members are unable or refuse to share the care* (A2). *The care diary was drawn up with the aim of the family caregiver describing all the care that was carried out with the elderly person while they were with them. This way, everyone involved in caring for the elderly person can access the diary and confirm what care has been carried out and what still needs to be done* (A5).

To help with the lack of knowledge about AD, the students created a gerontotechnology booklet that presents guidelines in simple, objective, and easy-to--understand language: *The AD guidelines booklet clearly and objectively presents some care related to medication, exercises for brain plasticity, the need for physical activity, social contact, the adaptations that may be needed at home, as well as hygiene and food care for the elderly person with Alzheimer's* (A7). *This booklet is very interesting because we know that there is still a lack of knowledge about Alzheimer's disease and the main types of care. So, this booklet, which was written in simple, objective language, can help with this issue, which will also have an impact on the care of elderly people with Alzheimer's* (A5).

Discussion

Regarding everyday difficulties related to the cognition and memory of the elderly, gerontotechnologies called "value vs product" and "wallet with fictitious money" were suggested and built by the academics. These are intended to help in situations where the elderly person loses track of the value of the money but retains the memory of its purpose. A study carried out in a psychosocial rehabilitation unit showed that the use of fictitious money notes allowed participants to recognize the notes as money, being able to report their function, as well as their use in everyday life as a personal resource, which stimulated their autonomy[14]. Thus, the use of these gerontotechnologies provide helps in the care process, making it possible to help in the day-to-day lives of elderly people[9].

To help elderly people forget places, routes and destinations, an identification badge was built, a gerontotechnology like that found in another study[10]. Also, in relation to the difficulty of forgetting things daily, the use of cards with reminders about the main activities to be carried out was suggested. In this sense, the use of a badge with the contact details of the family members of the elderly person with AD, as well as the use of identification cards and reminders were strategies that helped in this situation[10].

Regarding difficulties related to ADLs, such as the elderly person's body and oral hygiene, the students built gerontotechnologies 5 (planner with daily activities to be carried out by the elderly person) 6 (bathing doll) and 7 (mouth retractors). These gerontotechnologies are important because researchers have identified that bathing is generally the ADL that causes the most problems in the daily lives of elderly people and their caregivers/family members[15].

The use of dolls as a technology to help care for the elderly was used in another study which demonstrated their potential and can be used to improve the acceptance of bathing by elderly people with AD[10]. Evidence shows the repercussions of the disease and its progression on oral health, highlighting the use of mouth guards to perform oral hygiene properly[16].

Considering the above, it is possible to see the relevance of gerontotechnologies designed to help family members in this sensitive care context, since they have the potential to contribute to health practices in the various contexts involving the elderly[17]. From this perspective, the use of printed technologies, combined with health education, are important strategies for helping family members and caregivers to bathe and hygiene the elderly, as they help them understand the guidelines.

Regarding difficulties in ADLs related to forgetfulness for the elderly person when it comes to eating, the academics created gerontotechnology 8 "food

diary". Its rationale lies in the elderly person or family caregiver recording the food they eat throughout the day. This gerontotechnology is relevant, since food can be considered a health enhancer, as it provides well-being, energy, strength, joy and good humor[18].

Food records and the use of food diaries are advantageous strategies. This is because, as a rule, when they are used, food notes are taken now of consumption, there is no dependence on memory, and it is possible to identify the types of food consumed, the preparations made and their times. Therefore, this gerontotechnology can be adapted and used as a tool in the home environment of elderly people with AD.

Still in relation to food, however, regarding the elderly person's motor difficulties in holding utensils, gerontotechnology 9 was built by adapting cutlery with a fixing bracket. Similar data can be seen in a systematic review, which aimed to investigate and analyze the state of the art regarding the development and evaluation of cutlery adapted to the feeding process. This study indicated that improved cutlery facilitates the feeding process, enables gains in confidence and independence and improves quality of life[19]. The main features used to adapt utensils are an increase in the diameter of the handle to make it easier for the person to hold it[20].

To help elderly people forget their medication, the students built gerontotechnologies 10 (box) and 11 (organizing containers). Gerontotechnologies are especially relevant in the moderate and advanced stages of the disease, when there is a growing loss of memory and the onset of changes in language, reasoning, motor difficulties, worsening to bed restriction, mutism, retention and/or intestinal/urinary incontinence[10].

Regarding the burden on family caregivers in the day-to-day care of the elderly person with AD, gerontotechnology 12 (caregiver scale) was constructed, with an emphasis on the alternation of the person responsible for care. Taking turns providing care is essential, especially in the context of elderly people with this disease. The person responsible for caring for the elderly often restricts their personal and social life to devote themselves exclusively to their family member. In this sense, it can be said that family caregivers of elderly people with AD suffer from care-related overload[21].

In addition, the burden that care generates has negative repercussions on the life of the family caregiver, which need to be monitored to encourage them to accept and understand their condition and that of their elderly family member. In this context, it is necessary to develop strategies to help family caregivers avoid becoming ill due to the high demands of care[21]. It is therefore important to implement actions to support caregivers of elderly people with dementia, to help them cope with the difficulties they experience in the care process, minimizing the burden they experience[22]. In this sense, the relevance of the gerontotechnologies developed in this research is highlighted, as they seek to contribute to this goal.

Gerontotechnology 13, called the care diary, aims to enable family caregivers to record all the activities carried out with the elderly person, ensuring greater safety in care. This gerontotechnology is practical and functional, which characterizes it as a technological tool that can be easily consulted by the family caregiver in situations of doubt related to care. The students built gerontotechnology 14, "AD guidance booklet", to help people understand the disease. Educational materials about caring for the elderly have potential, since they contribute to the quality of care, benefiting the daily lives of those involved and avoiding failures in caring for the elderly[23]. In short, the use of low-cost educational gerontotechnologies is a viable source of health information that can lead to health promotion and disease prevention. It allows the patient/family member to read it and can serve as a guide in cases of doubt and help with day-to-day decision-making[24], as well as making contributions related to stimulating cognition[25].

Study limitations

It is worth mentioning that the fact that the gerontotechnologies presented in this research were developed based on the difficulties experienced by a group of seven family caregivers may be a limitation. This is because the difficulties experienced by other families in their day-to-day care for Alzheimer's disease may not have been explored in this research and, therefore, may not have resulted in the construction of other possible gerontotechnologies.

Contributions to practice

The study's practical relevance stands out, since the results can help to improve care interventions for elderly people with AD. The gerontotechnologies developed can be used by family caregivers in everyday care, adapting them to each reality based on the needs and uniqueness of each elderly person. It is therefore understood that sharing gerontotechnologies can contribute to the care of older people and family caregivers. It can also serve as a basis and influence the future development of technologies in this field.

Conclusion

It was possible to build gerontotechnologies to help family caregivers with the difficulties they experience daily with elderly people with Alzheimer's disease, which were divided into three dimensions according to the difficulties: cognition and memory, activities of daily living and family in the care process. Regarding cognition and memory, the gerontotechnologies were built cards with reminders; identification badge; value vs. products; wallet with fictitious money. For difficulties related to activities of daily living, the following gerontologies were built daily activities' planner; mouth retractors; use of the bath doll; food diary; and adapted cutlery. Regarding the difficulties related to the family in the care process, the gerontotechnologies developed were a weekly schedule for caregivers; a care diary and a booklet providing guidance on the disease.

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Authors' contribution

Conception and design or data analysis and interpretation: Casarin F, Munhoz OL, Ilha S.
Writing of the manuscript or relevant critical revision of the intellectual content and Final approval of the version to be published: Casarin F, Fernandes F, Rangel RF, Gautério-Abreu DP, Munhoz OL, Ilha S.
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