

Using a cognitive orthosis to support older adults during meal preparation: Clinicians' perspective on COOK technology

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Abstract

Introduction: Occupational therapists promote safety and autonomy of older adults with cognitive impairments. A technology, named COOK, offers support on a touch screen installed next to the stove to support task performance while correcting risky behaviors. We aimed to document (1) the functional profiles according the diagnosis (2) the types of interventions used to increase autonomy in the kitchen (3) the facilitators and obstacles to the implementation of COOK with this clientele.

Methods: Four focus groups were conducted with occupational therapists ($n = 24$) and were transcribed and analyzed using thematic analysis, including coding and matrix building.

Results: Occupational therapists identified different (1) functional profiles and (2) interventions for both diagnoses. The use of COOK (3) could be more beneficial in mild cognitive impairment, as many barriers occur for the use in Alzheimer's disease. Some parameters, such as digital control of the stove and complex information management, need to be simplified.

Discussion: According to occupational therapists, this technology is particularly applicable to people with mild cognitive impairment, because this population has better learning abilities.

Conclusion: This study documented the specific needs of older adults with cognitive impairments as well as interventions used by occupational therapists. The perspectives of caregivers should be captured in future research.

Keywords

Dementia, cognition, assistive technology, rehabilitation, daily life

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Introduction

In the world, 9.9 million new cases of dementia are diagnosed each year. Alzheimer's disease is the most common form of dementia, accounting for 70% of this diagnostic group.^{1,2} Alzheimer's disease is a neurodegenerative disease that is accompanied by memory problems and a cognitive decline that gradually evolves towards a loss of autonomy.^{1,2} Mild cognitive impairment is a transient disorder that can progress to dementia.³ It is characterized by problems with memory, language, reasoning, and judgment that are more

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serious than the cognitive impairments associated with normal aging but not yet as severe as that, which occurs in dementia.⁴ In both conditions, the cognitive deficits will impact the person's ability to perform instrumental activities of daily living (IADL), which are complex activities that are central to a person's ability to live independently in the community. IADL include such activities as managing finances, preparing meals, traveling, using the phone, taking medication, and going shopping.⁵⁻⁷ They are opposed to basic ADL, which are day-to-day core survival activities (e.g. eating, dressing, grooming).^{8,9}

Among IADL, maintaining the ability to prepare meals independently is of paramount importance to individuals with cognitive deficits and for their caregivers.¹⁰ Meal preparation meets the need to feed oneself promotes self-esteem and maintains social roles.⁹ However, difficulties in carrying out this task as well as inherent safety problems (burns and fire hazards) are important obstacles to the autonomy of this clientele and for keeping them at home. In fact, according to a Statistics Canada survey, 88% of people living with Alzheimer's disease aged 45 and over require assistance with meal preparation.¹¹ This activity requires complex cognitive capacities (executive functions, working memory, attention, etc.) that can be affected in people with early stage Alzheimer's disease or mild cognitive impairment.¹²

Assistive technology for cognition and home-monitoring technologies have great potential to facilitate efficient task completion and the adoption of safe behaviors while cooking in these clienteles.¹³ Furthermore, simple technology usage in Alzheimer's disease has been shown to increase independence in daily living and postpone institutionalization by up to 8 months.⁹ Assistive technology for cognition is the use of technology to extend human capacities related to mental function.¹⁴ Home-monitoring is the use of sensors, telecommunication technologies, and intelligent algorithms to monitor the human-environment interactions.¹⁵ However, to date, technologies to support cooking in AD have nearly exclusively focused on limiting or prohibiting engagement in meal preparation¹⁶ such as the use of a timer that cuts the power of the stove. Therefore, our team recently developed COOK (Cognitive Orthosis for coOKing), an innovative context aware application for smart tablets that is connected to the stove and designed to optimize the independence of the person with cognitive deficits during meal preparation. This application was initially designed to specifically target impaired cognitive abilities in people with moderate or severe traumatic brain injury.¹⁷

COOK includes two systems: a cognitive assistance system and a security system designed to prevent or

manage potential critical errors made by the person with cognitive deficits, especially when cooking hot meals on a stove. The assistant can support complex meal preparation with explicit guidance, as well as simple and lighter meal preparation without specific guidance. Complementary tools such as meal planning, grocery-list preparation, matching spices to various types of foods, etc. are also provided. Both the cognitive assistance system and the security system are context aware and rely on a sensor infrastructure (motion, contact, electricity, fire, etc.). Most of the sensors are put on or close to the stove. Some are also placed in the apartment, for instance to detect if the person has opened a door and left the apartment. This pervasive sensor infrastructure feeds information to context aware assistance and communication modules. Context awareness is the most highly sophisticated technology currently being developed for individuals with cognitive deficits and the most adapted to cognitive rehabilitation principles.¹⁸

The cognitive assistance system

This system addresses non-emergency situations. This system supports the person in tasks involved in meal preparation (ingredients to prepare, planning, safety rules, etc.). More specifically, a web application on a tablet guides the user along the four steps that compose meal preparation:¹⁹ formulate a goal, plan, carry out the task, and verify the attainment of the goal. Evidence-based interventions in cognitive rehabilitation²⁰ are selected according to the user's cognitive profile and needs. They can be added or removed at any time. The user accesses COOK through a touch screen usually placed besides the stove. For instance, the user interface and wording can be adapted for people having difficulties to read, hear, or understand complex sentences. Our team is currently working on certain aspects of COOK related to customization.

The security system

This system prevents and manages potential critical errors.²¹ The Security System collects information from the sensors, detects critical errors and dangerous situations, and when necessary, turns off the stove and calls for help. Using the sensor infrastructure, the Security System can detect the temperature of the stove top, the presence of the person near the stove, the opening of the oven door, etc. The Security System proposes a default set of safety rules. We are currently working on the possibility to add new rules. For instance, there is a safety rule that specifies when something is cooking on stove top, the user cannot leave it unattended for more than 5 min. Rules are

parameterized, so one can adapt the allowed unattendance time to the person's cognitive capabilities. A video of COOK can be viewed at www.youtube.com/watch?v=o0jkauWLBGo.

This application thus has great potential for persons living with mild cognitive impairment or Alzheimer's disease. However, to be appropriate for them, COOK must be adapted to the specific needs of this clientele. To our knowledge, their specific needs for independence and safety when preparing meals have not been described in sufficient detail in the scientific literature. The potential of using COOK with this clientele as well as the perspective of the clinicians who will recommend or prescribe its use therefore need to be documented.

The general purpose of this study was to conduct a needs assessment of older adults living with mild cognitive impairment or Alzheimer's disease when preparing meals and explore if COOK could be useful with these populations. Specifically, we aimed to document the perspectives of occupational therapists (OTs) because these clinicians are entitled to assess the needs of people living with cognitive impairments to determine the types of interventions that can ensure safety and increase their independence in a specific activity.²² They are also able to anticipate facilitators and obstacles to the implementation of new technologies, such as assistive technologies for cognition.²³ Their perspective was documented regarding: (1) the functional profiles of people living with mild cognitive impairment and/or early stages of Alzheimer's disease when preparing meals; (2) the types of interventions that can be used to increase independence and safety in meal preparation; (3) the perceived facilitators and obstacles to the implementation of COOK with these clienteles.

Materials and methods

The research design

This study is the first phase of a user-centered design, i.e. the needs analysis phase.²⁴ We used a descriptive qualitative research design to address the perceived needs, a design that has been shown to be relevant to obtain a detailed portrait of a phenomenon for which little literature exists²⁵ as well as a valid method for needs analysis in the context of technology research in aging.²⁶ To ensure validity of the data when using this type of design, words and facts must be reported as accurately as possible. Researchers conducting this type of study attempt to stay close to their data, the words used, and events described.²⁷

Participants and recruitment process

E-mail invitations were sent to several OTs working in various clinical settings in specialized psychogeriatrics. Inclusion criterion was that participants have at least 3 years of clinical experience working in a public health system setting. There was no exclusion criterion. Participants were divided into groups of 4–6 to form 4 focus groups, since the guidelines for this method recommend that amount of participants per group.²⁸ The Aging-Neuroimaging Ethical Review Board of the Centre Intégré Universitaire de Santé et Services Sociaux (CIUSSS) of Centre-Sud de l'île de Montréal approved the project. Participants provided their written and informed consents to participate in the study.

Data collection

Each focus group met once for a 1-h period. All sessions were held over a 3 months period. A semi-structured interview guide was used (Table 1). Participants were asked to discuss three topics related to: (1) the participation of older adults with mild cognitive impairment or Alzheimer's disease in meal preparation; (2) the effective interventions and prompts used to support independence and safety of this clientele during meal preparation and (3) their perspectives on the relevance of using COOK with this clientele. A video describing the different features of COOK was presented between topics 2 and 3. A member of the team (M.C.) acted as facilitator and was responsible for asking questions and guiding the discussion. Another member (N.B) acted as observer

Table 1. Questions used to guide focus group discussions.

According to your experience, what are the main difficulties faced by people with a MCI when preparing meals?
– What are their needs in terms of intervention?
– In your practice, what modalities do you use to improve independence in meal preparation with this clientele?
According to your experience, what are the main difficulties faced by people with AD when preparing meals?
– What are their needs in terms of intervention?
– In your practice, what are the means you use to improve independence during meal preparation with this clientele?
Presentation of a short video of the culinary assistant COOK and explanation of the parameters of use available to maximize autonomy and safety during the preparation of meals (e.g. Oven extinguished automatically in case of smoke)
Following the presentation of the culinary assistant COOK, do you think that such a tool can help elderly people with MCI or AD improve their independence when preparing meals?
– What would you change in order to adapt this tool to the needs of your clients?
– Would you use such a tool with your clients?

AD: Alzheimer's disease; MCI: mild cognitive impairment.

and took notes and validated the discussion content with the group at the end of the discussion of each topic. All group interviews were audiotaped with the consent of each participant to facilitate the analysis.

Data analysis

Inductive qualitative analysis was conducted in four stages using Miles et al. thematic analysis approach:²⁹ (1) full transcription of the audio recordings; (2) first-order coding of transcribed data; (3) second-order coding from the first-order code list; (4) data reduction and matrix development. In order to validate data analysis, the lead author, the research assistant and a researcher specialized in qualitative analysis performed the coding until a consensus was reached on an integrated code list. The coding aimed to assign labels (codes) to relevant units of meaning, such as words, sentences, or paragraphs. After first-order coding, second-order codes were used to condense the data in different categories that were then condensed in different major themes (third-order codes). Once the three-step coding was completed, conceptual grouping matrices based on the major themes and the comparison of the two profiles (Alzheimer's disease and mild cognitive impairment) were developed to reduce the set of codes to a format that was more manageable and easier to conceptualize.²⁹

Results

A total of 24 OTs from different clinical settings in psychogeriatric (intensive functional rehabilitation unit, long-term care, day hospital, home support,

and day center) agreed to participate in the study; 13 clinicians had over 10 years' experience and 11 had 3–10 years' experience in geriatrics.

Functional profile and task performance

According to the OTs interviewed in this study, people living with mild cognitive impairment or Alzheimer's disease have different functional profiles related to meal preparation (see Table 2 for more details); people with mild cognitive impairment can complete the task with difficulty, while those with Alzheimer's disease cannot complete this task. In this regard, an occupational therapist stated:

“For my mild cognitive impairment patients, the final result will usually be ok, it will be a meal. It's the process during the task that might be a bit disjointed.”
– Participant 2, FG1

Achieving the task

“They (Alzheimer's disease patients) will try to do something and it will end up half done, so it will not be what was asked (for) at all.” – Participant 3, FG2.

For people living with Alzheimer's disease, one of the most salient obstacles identified by participants is the difficulty performing the operations required for the task. This can result in difficulty evaluating the right amount of ingredients, initiating the task, maintaining focus on the task, following the steps of a recipe and finalizing the task. These difficulties compromise the

Table 2. Functional profile during meal preparation, according to the diagnosis.

Factors that influence task performance			MCI	AD
Facilitators	Achieving the task	Ability to finalize the task using existing procedural knowledge	X	
	Environment's influence on task performance	Familiar and ergonomic environment	X	
		Involvement and proximity of the family	X	
	Personal characteristic's influence on task performance	Recognition of own mistakes and confidence in own abilities	X	
		Prior experience in meal preparation		X
Barriers	Personal characteristic's influence on task performance	Interest in meal preparation task		X
		Presence of behaviors that put safety at risk ^a	X	X
	Achieving the task	Memory loss hindering the task ^a	X	X
		Difficulty orienting oneself in the kitchen		X
		Difficulty changing the way he/she does things		X
		Difficulty performing the operations required for the task		X
	Difficulty managing frustrations		X	

AD: Alzheimer's disease; MCI: mild cognitive impairment.

^aAlthough the factors are similar for both diagnoses, according to participants, the intensity and impact are more important for people with AD.

safety, but also the functioning of the person in the activity. For example, one participant said:

“Following a recipe is difficult for them (...). Often (...) they’re sure to fail” – Participant 4, FG2

Another gave the following example:

“The quantity for example, (...) of oatmeal, someone who has mild cognitive impairment (...) would generally know how to make oatmeal, but sometimes they (patient with Alzheimer’s disease) don’t even know how much oats they have to put... they ask: “did I put enough?” –Participant 3, FG2

Another obstacle to meal preparation for people with Alzheimer’s disease is related to changing their way of doing things. According to OTs, one of the reasons for this is the low learning potential of this clientele, which makes it difficult for them to learn a new strategy or to change a habit. These people have a hard time finding new ways of dealing with problems they encounter during the task. According to the participants, even if they are offered recommendations of strategies to improve their performance, clients often demonstrate resistance to adaptations and changes. In this regard, one participant said:

“In my opinion, it’s sometimes more with these people, let’s say in the early stages of Alzheimer’s disease, that I find that we must negotiate a lot more, and... there is a much greater rigidity then in terms of...changing the way they do things: “Yes, but, at home, it’s like that.” Then they stop there. They are not going to find a solution. “Yes, but my coffee maker is not like that.” It does not matter then, manipulate it, you will figure it out. “No, no, at home it’s not like that.” Then we stop there... Because it’s too complex” – participant 4, FG3.

Environment’s influence on task performance. Being in an ergonomic (e.g. small and organized kitchen) and familiar environment is another facilitator for people living with mild cognitive impairment. Indeed, working in a kitchen, they know well and that is well organized makes it possible for them to preserve previously acquired routines for meal preparation. The steps, like preparing the ingredients, are completed more automatically, which reduces anxiety, makes the person more comfortable, and ultimately optimizes performance. About this, one participant said:

“The cognitive difficulties are less evident when the person prepares a meal at home. Organization and planning is better” – participant 1, FG4.

A small kitchen provides access to counters and the necessary equipment within easy reach, which compensates for physical limitations. An occupational therapist elaborated:

“Avoid having three worktops, pick everything up and put it in one place to avoid having to move from one place to another and thus limit the risk of falling” – participant 5, FG1

Personal characteristic’s influence on task performance. For people with Alzheimer’s disease, the two dimensions related to their personal characteristics that act as the main facilitators for meal preparation are experience and interest. Past experience, according to the study participants, refers to the experience in meal preparation tasks carried out throughout one’s life. The more a person has prepared meals over their lifetime, the more the activity is routine. Interest is what motivates the person to continue to prepare meals or to adapt to be able to continue this activity. One participant said:

“Even in the beginning of dementia, depending on whether the person had prepared a lot of meals before, the patients are still able to do it, because this skill is (...) acquired. The person has done it so often in his life that it is automatic... And it’s something they like to do, or that they liked to do in the past” – Participant 1, FG2.

For people living with mild cognitive impairment, personal characteristics such as self-awareness (i.e. recognition of their own mistakes) and confidence in their own abilities make them able to achieve their task goals. According to OTs, when the person is aware of his or her difficulties, they can take the necessary steps to ensure safety and improve performance during the task. Finally, trust in their own abilities makes the person less worried about the activity and therefore more willing to do it. One participant summarized this by saying:

“They (persons with mild cognitive impairments) are aware of the mistakes they make [...] and they are also less fearful I think when they are asked something [...] (...) they will offer us a tea more spontaneously” – participant 1, FG1.

Obstacles that stand out for the two types of diagnoses related to their personal characteristics are the presence of at-risk behaviors as well as memory impairments that affect task accomplishment. However, at-risk behaviors typical of people living with Alzheimer’s disease are more harmful, as these can lead to fires or acute intoxications. The risks for people living with

mild cognitive impairment are often associated with difficulties managing several steps at once or task disorganization, which sometimes leads to burns. According to OTs, what differentiates the two clienteles at this level is the decreased self-awareness of people living with Alzheimer's disease, which sometimes places them in dangerous situations. For example, one participant said:

"The patient can cause a fire without realizing it!"
 – Participant 1, FG1.

Memory problems affect people with both types of diagnoses, but differently. For people living with mild cognitive impairment, occasional oversight can cause them to move more slowly or omit certain details while engaging in the activity. For people with early-onset Alzheimer's disease, memory problems can cause the person to forget such important components as the purpose of the activity, the steps already taken, the ingredients or the location of the tools. They can also experience difficulty in orienting themselves in the kitchen. Speaking about people with Alzheimer's disease, one participant explained:

"Their mistakes are related to memory problems; the patient begins the task and then she starts looking for something. I showed her where everything was in our kitchen, but now she's looking, it's been 30 seconds, she forgets that the bread is in the freezer even if I told her at the beginning of the evaluation...so memory problems are a lot more apparent" – Participant 2, FG2.

Occupational therapy interventions for meal preparation

According to the participants, the use of a meal preparation activity in occupational therapy can have two aims: task training and/or specific skill development (problem solving, multitasking, organization in the task, etc.) OTs have identified several interventions related to this activity, which vary according to the nature of the pathology (see Figure 1).

Rehabilitation interventions. For people with mild cognitive impairments, the proposed interventions are more diversified. In fact, in addition to those mentioned above, many rehabilitation interventions were proposed in the discussion group. According to the participants, this type of intervention makes it possible to acquire or recover skills and competencies, to facilitate the person's independence during meal preparation. For example, this can involve repeatedly training the person to perform the task or presenting strategies to

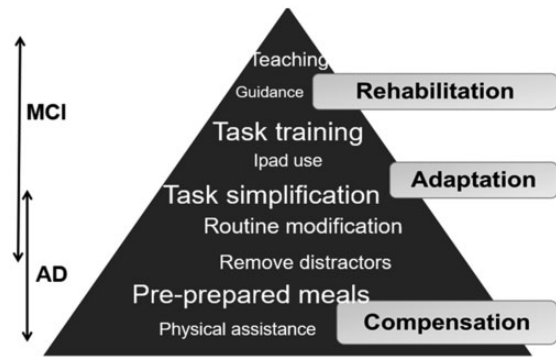


Figure 1. Meal preparation interventions used with older adults with cognitive impairments.

the persons to help them organize themselves better. OTs also identified teaching as an intervention modality to demonstrate ways of doing things that can facilitate accomplishment of the task. One participant explained this as follows:

"We try to teach, to integrate, because we know that if we practice the same task and repeat it, it becomes easier to learn. We teach them, for example, that when they go to the fridge, they should get everything they need at the beginning of the task, which avoids going back and forth, because when you go back and forth, you are less organized" – Participant 3 FG3

Adaptation interventions. For both types of clientele, adaptation interventions are necessary to facilitate meal preparation. Adaptation interventions change the way a task is performed or the environment in which it is carried out (physical or social). These include such measures as reducing environmental distractors, simplifying the task, setting up a routine and using a technology. For example, using an iPad is one intervention used to facilitate activities for people with mild cognitive impairments. According to OTs, for some older people living with mild cognitive impairments, using such technology structures the task by providing the steps to follow, improving organization while planning the ingredients and offering visual and interactive help to guide meal preparation. For people living with Alzheimer's disease, one possible adaptation is to provide assistance from a person standing near by throughout the task to ensure safety to reorient the person towards the goal (modification of the social environment). This adaptation makes it possible to guarantee their safety during the task and reframes the person when he/she deviates from the initial goal. Participants mentioned environmental adaptations as a way of facilitating the meal preparation activity for

people with either diagnosis. For example, about mild cognitive impairment patients, one participant said:

“Avoid distractions, no TV, no radio, let the phone ring, leave it, return the call later, for example” – Participant 3, FG3

Compensation interventions. For an Alzheimer’s clientele, the most successful interventions are more of a compensatory nature. A compensation-type intervention involves removing one or more stages of the task, to enable the person to reach the goal without risk to his or her safety. For example, many OTs choose to suggest that Alzheimer’s clients use prepared or frozen meal delivery services to ensure that they have a meal to eat. In connection with this point, one participant said:

“In our recommendations, we talked often about compensating, but actually it comes down to introducing take-out, frozen meals or caterers, then often we try to convince them . . . to make them realize how much it matters when it’s the home safety component.”
 “– Participant 2 FG1

Facilitators and obstacles for COOK implementation

Overall, OTs perceived COOK as a technological tool with great potential for psychogeriatric clients. They identified a number of facilitators and barriers that influence the implementation of COOK for both client types (mild cognitive impairment and Alzheimer’s disease) (see Table 3).

An important facilitator for both diagnoses is experience with different technologies. This dimension includes having skills to use a computer or electronic tablet. In this regard, one participant said:

“I think it depends on their . . . initial knowledge or skill with using a computer, a tablet. For those who already use the computer, it would not be a problem”
 “– participant 2, FG1

Another point related to this theme is that the next generation of clients may be much more comfortable with these technologies, since more and more seniors are using electronic tablets, which will further facilitate implementation of COOK. In this regard, one participant said:

“I think it’s . . . for the current generation, it’s still a little bit too complex, but I think it’ll come because we’re starting to see patients who have electronic tablets, who are more comfortable with that . . .” – participant 1, FG1

Table 3. Facilitators and barriers for COOK implementation, according to the diagnosis.

Factors that influence COOK implementation		MCI	AD
Facilitators	Learning potential	X	
	Interdisciplinary collaboration and collaboration with the family		X
	Experience with different technologies (tablets and smart phones, computers, etc.)	X	X
	Features of COOK (offers reminders, customizable, etc.)	X	X
Barriers	Complexity of application functions		X
	Difficulty adapting to a new tool		X
	Requires a large amount of resources (time and costs) associated with the use and implementation of COOK	X	X
	Resistance to the use of a technological aid	X	X

AD: Alzheimer’s disease; MCI: mild cognitive impairment.

Another facilitator identified for both groups of clients includes COOK characteristics, whose features make it a more comprehensive tool than other technologies currently available in clinics. For example, OTs mentioned (name of a commercial timer) as a tool to make food preparation safe for this clientele because it allows you to stop the stove after a period of time that must be set beforehand on a timer; this can prevent fires or burns. However, it does not help the person to prepare his/her meal, which COOK can do, by means of the many reminders that it emits to the person before disconnecting the stove. To illustrate this, one participant said:

“[COOK] answers a need that [name of a commercial timer] did not answer [. . .]. It’s much more functional than [name of a commercial timer]. Because the person can use her stove, and then if it’s ok, well it’s okay. If something goes wrong, well it is blocked, the family is warned.” – Participant 6, FG4

For the mild cognitive impairment clientele, the main facilitator of COOK implementation is the presence of residual learning capabilities. Indeed, according to the participants, this clientele could learn and integrate COOK, with some simplification of the features. One participant said:

“With mild disorders, I think there may be the possibility of having a training program to learn COOK as long as it is quite simple.” – Participant 5, FG3

For people with Alzheimer's disease, an interdisciplinary and family collaboration would facilitate the implementation of COOK in the early stages of the disease. The interdisciplinary aspect refers to the fact that when all members of the professional team (physicians, nurse, occupational therapist, speech therapist, and physiotherapist) are on the same page and apply the same recommendations, it facilitates COOK implementation. For example, as stated by the participant, if the doctor, the nurse and the occupational therapist of the team suggest the same thing (the use of COOK at home), the patient is more likely to accept this technology, so it is a facilitator.

For example, having the support of the interdisciplinary team would first convince the person of the relevance of using an assistive technology, such as COOK. In this regard, one participant said:

"We are told to repeat that the doctor told us that [...] the doctor or the nurse is (important for) their age groups"— Participant 5, FG3

Second, family collaboration is a facilitator as discussion with the family appears enhance the acceptance of COOK with this clientele. Indeed, having the support and involvement of the family would also ensure a more optimal use of the recommended tools. According to the OTs surveyed, family involvement is very important, because when it is proactive and framing, it reduces the time needed to teach and train the person to use a tool such as COOK. In this regard, two participants said:

"So the caregiver or the social environment is very important. That's really where we go to get support"— participant 1, FG 3

"Then when the family members are actively involved... We will not need as much time for training"— Participant 2, FG3

One barrier to implementing COOK for both clienteles is the large amount of time that may be required by professionals to teach the use of COOK for meal preparation and the cost associated with its use. Indeed, OTs all described the context of current clinical practice as challenging, in which it is difficult to find time and financial resources for learning new approaches as well as for training clients to use such technologies. In connection with this point, one participant said:

"It's always at the level of...resources. The staff...how much does it cost...when I think of here, for example, in a hospital context...I think there are no resources for

that...everyone is overwhelmed, running in all directions..."— participant 5, FG4

Another obstacle to implementing COOK with both clienteles is the resistance of the elderly to using technological aids. Indeed, OTs generally mention that the elderly have difficulty accepting the need or the relevance of using technology to support their independence. People living with mild cognitive impairment tend to deny and hide their difficulties when offered technological supports. The rigidity of people living with Alzheimer's disease causes resistance to using a technological tool. In this regard, one participant explained:

"They (people with mild cognitive impairment or Alzheimer's disease) have all kinds of ways of showing that everything is fine. They explain, they verbalize, step by step, sometimes before we start cooking, because they absolutely want us to know that they do not need that..."— Participant 5, FG1

OTs did not mention any specific barriers for mild cognitive impairment clients, other than the two mentioned above. However, they mentioned two other obstacles to implementing COOK for the Alzheimer's disease clientele, even at an early stage. First, the person's difficulty adapting to novelty hinders their ability to learn to use the technology. Indeed, they reported that it is very difficult to introduce a new tool or a new way of doing things with this clientele. As one participant said:

"To convince them that it is necessary to change their way of doing things...is difficult...That's also why there is no openness to learning about new equipment."— Participant 3, FG4

The complexity of COOK's functions also represents an obstacle to its implementation. One participant said:

"It's really technical, the people I see, I do not think they are able to...manage that system."— Participant 4, FG3

Finally, OTs see COOK as a more relevant tool for mild cognitive impairment clients than Alzheimer's disease clients, even at an early stage. Indeed, participants perceived COOK to be an interesting, appropriate, and justified tool for the former clientele. In this regard, one participant said:

"I think it would be possible for people with mild cognitive impairment, and I like the fact that there is the

*voice that helps to guide, the colors are also interesting
(...) – Participant 3, FG1.*

Overall, as recommended by OTs, the interface component of the application could be better integrated (digital control of the stove and visual information) and better explained. The participants would like it to be more customizable according to the needs of each patient. Also, one of the main points made by the participants is what refers to the sensory peculiarities of this clientele (sight and hearing). Indeed, participants recommend enlarging the font size, reducing the visual load and simplifying the options available on the tablet. Also, it was asked to keep clear, simple, and direct instructions regarding verbal cues.

Discussion/conclusion

The purpose of this study was to describe OTs' perspectives on the potential of COOK to support performance and ensure safety during meal preparation for people living with mild cognitive impairment or early stages of Alzheimer's disease. The results demonstrate that, according to OTs: (a) older adults have different functional profiles and needs during meal preparation depending on their diagnosis (mild cognitive impairment or early stages of Alzheimer's disease); (b) OTs use different interventions with clients depending on their diagnosis; (c) COOK has greater potential to be implemented with a mild cognitive impairment clientele than with Alzheimer's disease.

The main objective of the study was to document the facilitators and barriers faced by individuals living with mild cognitive impairment or early stage Alzheimer's disease during meal preparation to support technology development from the perspective of OTs. First, our study showed that the two clienteles encounter several difficulties in carrying out the activity, with a higher intensity among Alzheimer's disease clients. These findings are consistent with other studies that showed that mild cognitive impairment and/or Alzheimer's disease affects the performance of complex activities.^{30–32} Also in line with other studies, we found that clinicians perceive differences in the functional profiles of these two clienteles.³³ People living with Alzheimer's disease experience more barriers in meal preparation than those living with mild cognitive impairment, as this clientele has difficulty performing even the simplest tasks, making them non-functional in this activity. Moreover, people living with mild cognitive impairment are able to obtain a final result during the activity, despite the presence of difficulties. These are novel results, because the specific functional profiles of these clienteles in such a specific complex activity such as meal preparation have not been described in the literature to date.⁸ The

findings of this study therefore add to our current understanding of the difficulties related to meal preparation that these clienteles experience and will serve as a basis for the development of better solutions to support their independence.

This study also aimed to identify the interventions used with people living with early-stage of Alzheimer's disease or mild cognitive impairment for meal preparation by OTs, as these strategies have not yet been documented in order to develop technology.¹⁸ Our results show that OTs use more rehabilitation interventions (teaching, coaching, and rehearsals) with mild cognitive impairment clients and that they opt more for compensatory interventions (prepared meals, using the microwave oven, etc.) with an Alzheimer's disease population. In fact, OTs tend to use mostly compensation interventions with Alzheimer's disease clients because of the difficulty of teaching and training them to use different strategies. These results are supported by findings in other study,³⁴ which suggests that using training interventions in Alzheimer's disease does not have significant effects on daily functioning. However, these findings seem to be at odds with studies that have shown that errorless techniques are effective for learning skills required to carry out everyday tasks in this same population.³⁵ The primary aim of this method is to foster the ability to learn a specific useful and meaningful task, and the data show that this approach has considerable potential.³⁵ It would be interesting to document how clinicians make the most of this method in their practice and why OTs in the present study use mostly compensation techniques in Alzheimer's disease.

The final objective of this study was to document the relevance of using COOK with people living with Alzheimer's disease or mild cognitive impairment. As our results show, OTs are open to using COOK. Indeed, our findings further highlight the openness of clinicians to using technologies in their practice as observed in previous studies.³⁶ Malinowsky et al. described a framework for understanding the openness of OTs to using assistive technologies to facilitate the daily lives of people living with dementia. According to this author, one of the most important ways to encourage clinician's openness towards assistive technologies is to enable them to use these tools in assessments or interventions. The OTs who participated in our study were generally open to using assistive technologies such as COOK with their clients but did not have all of the resources needed to teach clients to use such a tool. OTs have the knowledge and skills to assess clients and provide appropriate assistive technology.²³ It would therefore be relevant, in future research, to document the current context of OTs' practice in the field of assistive technologies.

Our results demonstrate considerable potential for implementing COOK with mild cognitive impairment

clientele, mainly because of their ability to learn new tasks. These results complement those obtained in a qualitative study³⁷ on the relationship between technology and older people with mild cognitive impairment. The researchers found that people living with mild cognitive impairment were motivated to use technologies in an innovative way to meet their needs, to reduce their responsibilities and their cognitive load. In addition, according to the OTs, the availability and support of family members was a major facilitator, which is consistent with our findings.

COOK shows an interesting potential for use with older people with cognitive impairments. Our results show that COOK is perceived by OTs as being very useful because it compensates for the limitations of commercial timer systems used to turn off an oven after a predetermined time. OTs emphasized that commercial timers do not encourage clients to accomplish the task or achieve their goal. This corroborates previous research that has demonstrated the limitations of using commercial timers.³⁸ Indeed, a study by Yared et al. demonstrated that timers on the stove can prevent only a single specific risk situation (the stove remains on for too long) and must be programmed by the person—which is a problem when an older person has cognitive impairments. COOK's tele-vigilance safety system-related features were those most cited as favorable and promising. For example, being able to detect the person's absence in the kitchen and turn off the power of the stove turned out to be a central parameter in the participants' interest in COOK. The principal barriers presented by the participants were principally related to the cognitive assistance system and to the electronic tablet application: the application needs to be simplified at all levels according the cognitive and sensory abilities of persons living with cognitive impairments (AD or MCI) and the financial and logistical capabilities of the health institutions. In future research projects, it would therefore be necessary to document the modifications to specific features that would be necessary to the use of COOK to support meal preparation in mild cognitive impairment and Alzheimer's disease by administering usability tests with OTs, older adults living with cognitive impairments and caregivers.

We acknowledge a number of limitations in this study. First, participants came from clinical settings based in a single city, limiting the generalization of results. In addition, consultation times were limited by participant availability. However, our focus groups were consistent, as recommended in the qualitative research guides,²⁸ as all participants were OTs working in psychogeriatric. Nonetheless, the diversity of participants' clinical setting was an asset, as this allowed for in-depth documentation of our

assumptions with the profile of our clientele across the continuum of care. Finally, the saturation of the data was noted as early as the third focus group, which reinforces the credibility of the results obtained for the analysis of the four focus groups.

Conclusion

Our study suggests that, according to OTs, COOK has good potential to support the independence and safety of older adults with cognitive impairments when preparing meals. This technology is particularly applicable to people with mild cognitive impairment, because this population has better learning abilities. Finally, it would be useful to document the perspective of caregivers, as they could contribute relevant input on the daily difficulties experienced by people living with mild cognitive impairment and early-stage Alzheimer's disease in their home environment.

Statement of ethics

Ethical Aging-Neuroimaging Committee of the Centre Intégré Universitaire de la Santé et des Services Sociaux (CIUSSS) of Centre-Sud de l'île de Montréal approved the project. The study had a minimal level of risk. Participants provided their written consent to participate in the study.

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Guarantor

This study is guaranteed by the authors.

Contributorship

Yaddaden conducted the qualitative analyses and wrote the entire paper. Bier, Couture and Gagnon-Roy revised the qualitative analyses and participated in writing the paper. Bier and Couture also conducted the focus groups. Giroux, Pigot, Belchior, Lussier, and Bottari participated in the writing and revision of the paper.

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