

1 **Training persons with early-stage Alzheimer’s disease how to use**
2 **an electronic medication management device: Development of an**
3 **intervention protocol**

4 ABSTRACT

5 *Background/objectives:* Medication management is challenging for persons with
6 Alzheimer's disease (AD) and their caregivers. Electronic medication management
7 devices (eMMDs) are specifically designed to support this task. However, theory-driven
8 interventions for eMMD training with this population are rarely described. This study
9 aimed to develop and assess the appropriateness of an intervention protocol to train
10 persons with early-stage AD how to use an eMMD.

11 *Methods:* Interviews with three categories of participants [persons with early-stage AD
12 ($n=3$), caregivers ($n=3$) and clinicians ($n=3$)] were conducted to understand medication
13 management needs, perceived usefulness of an eMMD, and to explore training strategies.
14 Subsequently, this knowledge was integrated in an intervention protocol which was
15 validated with the three clinicians. A content analysis led to iterative modifications to
16 maximize the acceptability and coherence of the intervention protocol in a homecare
17 context.

18 *Results:* The final intervention protocol specifies the expertise required to provide the
19 training intervention and the target population, followed by an extensive presentation of
20 eMMD features. Specific learning strategies tailored to the cognitive profile of persons
21 with AD with step-by-step instructions for clinicians are included. Finally, it presents
22 theoretical information on cognitive impairment in AD and how eMMDs can support
23 them.

24 *Conclusions:* This intervention protocol with its theoretical and pragmatic foundation is
25 an important starting point to enable persons with early-stage AD to become active users
26 of eMMDs. Next steps should evaluate the immediate and long-term impacts of its
27 implementation on medication management in the daily lives of persons with AD and
28 their caregivers.

29 **KEY WORDS**

30 Self care, rehabilitation, information technology, medication therapy management,
31 Alzheimer disease

32 **INTRODUCTION**

33 Alzheimer's disease (AD) is characterized by progressive impairment of memory and
34 other mental functions affecting the execution of activities of daily living (McKhann et
35 al., 1984; Weintraub et al, 2012). Difficulties experienced by persons with AD include
36 medication management, which is also one of the main domains of care supported by
37 family caregivers in the home environment (Brodaty & Green, 2002; Fortinsky, 2001;
38 Gillespie et al., 2014; While et al., 2013). More than 54% of caregivers of people with
39 dementia support medication management (Gillespie et al., 2014). Managing medication
40 is complex and involves several tasks, such as handling and differentiating between
41 multiple pills, following specific schedules, identifying side effects, and managing
42 prescriptions. This role is crucial considering that medication non-adherence can have
43 serious consequences, including poor health outcomes, unnecessary diagnostic and
44 therapeutic measures, hospitalizations, and admission to a nursing home (Col et al., 1990;
45 Kuzuya et al., 2008). Unlike health professionals, caregivers have no training and face

46 many challenges that make their role difficult (Gillespie et al., 2014). Caregivers need to
47 manage a high and varying number of daily medication intakes and prescription duration
48 (Smith et al., 2003; While et al., 2013). They also have to develop their own strategies to
49 remember when to give a specific medication with limited indications on the pill bottles
50 and not a lot more from the prescriber (Gillespie et al., 2014). The lack of support and the
51 complexity of the task may easily lead to burden for family caregivers (Poland et al.,
52 2014).

53

54 People with dementia have a strong desire to maintain independence in their daily
55 activities in order to stay at home as long as possible (Roger, 2008). Technologies, in
56 particular eMMDs, have the potential to increase the independence of individuals with
57 cognitive impairments and reduce the assistance needed from caregivers. Indeed, eMMDs
58 are designed to support basic operations such as classifying pills, issuing reminders when
59 to take the medication, providing cues to select the right medication in the pill box, and
60 remotely tracking medication adherence (Paterson et al., 2017). Despite their relevance,
61 the use of eMMDs by individuals with cognitive impairments and their family caregivers
62 has not received much attention in the literature.

63

64 Several studies suggest that individuals in the early stages of AD can learn/relearn various
65 daily life activities if appropriate methods are used (Clare & Jones, 2008; de Werd et al.,
66 2013; Thivierge et al., 2008; Wilson et al., 1994). Errorless learning methods are
67 particularly useful in facilitating learning for persons with AD because they avoid
68 exposing the person to wrong answers. There are three specific subtypes of errorless
69 learning methods, the errorless learning method (named after the general method)

70 (Baddeley & Wilson, 1994), spaced retrieval (Camp, 1989; Camp et al., 1996) and
71 vanishing cues (Glisky et al., 1986). Errorless learning consists of exposing the person
72 exclusively to the correct answer to avoid eliciting impaired episodic memory. With
73 spaced retrieval, information is provided to the person who is asked to repeat it
74 immediately, then again at gradually increasing intervals. Finally, with vanishing cues
75 method, the assistance offered is gradually reduced by giving less and less informative
76 cues until the person is completely independent. A common feature of these methods is
77 that the correct information can be given verbally or the person is guided physically with
78 tactile prompts to execute each action in learning a skill (Haskins et al., 2012).

79

80 Various studies have used one or many of these errorless learning methods with persons
81 with AD to optimize the use of external aids, such as calendars, to-do lists, mobile phones,
82 electronic organizers, pen-and-paper organizers, radio tapes, and voice messaging
83 technologies (Bier et al., 2008; Camp et al., 1996; Imbeault et al., 2013; Lekeu et al.,
84 2002; Quittre et al., 2009; Rouleau et al., 2006; Thivierge et al., 2008). These studies
85 showed that persons with AD can learn how to use external aids to access specific
86 information. However, none of them examined how technologies can support daily life
87 activities involving several procedural steps such as medication management.

88

89 Implementing assistive technologies in a person's home environment is complex (Molin
90 et al., 2007; Robinson et al., 2007; Starkhammar & Nygård, 2008), and most studies
91 involved caregivers as primary users of technologies (Bartfai & Boman, 2014; Rosenberg
92 et al., 2012). Currently, there are few studies looking at assistive technologies used by
93 persons with AD and the interventions used are not detailed. In addition, no studies have
94 focused specifically on the use of eMMDs by persons with AD. To date, the main gaps

95 to be addressed are to detail interventions adapted to the cognitive capacities of persons
96 with AD, and to understand how they can be used to train them in using technologies such
97 as eMMDs to support their daily life.

98 The overall objective of this study was thus to develop and assess the appropriateness of
99 an intervention protocol, incorporating specific learning strategies that engage persons
100 with early-stage AD and their caregivers in managing medication at home with an
101 eMMD. In our study, appropriateness refers to the characteristics of the intervention
102 perceived as being suitable, useful and relevant prior to adoption (Proctor et al., 2011).

103 **METHOD**

104 **Study Design**

105 This user-centered development study was informed by a purposive sample representing
106 the intervention's potential end users (Dabbs et al., 2009), that is, persons with early-stage
107 AD, family caregivers and clinicians. The study was carried out in three steps. Step 1
108 involved all end users and aimed at understanding their needs. Using interviews, it
109 explored medication management challenges, perceived usefulness of the eMMD, and
110 perceived usefulness of the errorless training strategies. In Step 2, the eMMD intervention
111 protocol was developed by our team, based on key considerations evidenced by Step 1
112 and international standards for reporting interventions (Hoffmann et al., 2014). Step 3
113 involved the same clinicians as in Step 1 to evaluate the appropriateness of the eMMD
114 intervention protocol for clinical use. This study was approved by the Ethics Committee
115 of the *Institut universitaire de Gériatrie de Montréal*.

116

117 **Participants**

118 Three participants from each category of end users were recruited, that is, three dyads of
119 persons with AD and their family caregiver, and three clinicians. The persons with AD
120 had to be at least 65 years of age, have a problem with medication management and have
121 been diagnosed with probable early-stage AD. Exclusion criteria were to have another
122 type of dementia or non-compensated hearing/vision problems or to be known for
123 problems with drug or alcohol use which can affect mental functions such as memory.
124 Family caregivers had to provide persons with AD at least four hours of assistance per
125 week, be directly involved in medication management and not have cognitive disorders
126 themselves. Persons with AD and their family caregivers were recruited at the cognition
127 outpatient clinic of the *Institut universitaire de gériatrie de Montréal*. Clinicians were
128 occupational therapists with at least 10 years of experience, not related to the persons with
129 AD and their caregivers. Training on activities of daily living falls within the area of
130 expertise of these professionals (de Werd et al., 2013; Laver et al., 2017). They were
131 recruited at three centres providing in-home rehabilitation services for individuals with
132 cognitive disorders. The participants included two men and one woman (78, 80 and 85
133 years) who had been diagnosed with early-stage AD, their family caregivers (two women
134 and one man of respectively 74, 75 and 78 years) and three occupational therapists
135 (women with 23, 18 and 13 years of practice).

136

137 **eMMD description**

138 eMMDs are electronic medication dispensers with a reminder system. The model
139 presented to the participants included a 28-compartment dispenser (9"x9") covered by a
140 membrane equipped with sensors that recorded the time each compartment was opened.

141 Visual cues and audio alarms alert the person when it is time to take the medication and
142 identify from which compartment it must be taken. All data are uploadable to a secure
143 Internet server and the system can calculate an adherence ratio (number of pills
144 taken/number of pills prescribed). In normal use, the pharmacist is responsible for
145 programming the device and preparing the medication as prescribed by the primary care
146 physician. Data pertaining to medication management (time of opening, number of
147 reminders, errors and omissions) can be sent by email or text message to a person
148 designated by the user (caregiver and/or clinician).

149

150 **Development and Assessment of the Intervention Protocol**

151 *Understanding end users' needs (Step 1)*

152 Procedure

153 The first step involved all end users and aimed to understand their needs and challenges
154 related to medication management and to explore the appropriateness of the eMMD to
155 address them. Individual semi-structured interviews were held with persons with AD
156 separate from their caregivers. Participants saw a videoclip of the features described later
157 in this section, followed by an offline manipulation of the device. Interviews started with
158 open-ended general questions about medication management challenges. Then
159 participants watched a first videoclip showing use of the electronic pill dispenser. They
160 were invited to handle it and were then asked how the eMMD could help them with
161 medication management. The last part of the meeting explored their perception of the
162 errorless training methods with a second videoclip showing a person participating in an
163 intervention using these training methods. After watching the videoclip, a series of

164 questions explored the participants' willingness to be involved in such training strategies.
165 Table 1 shows the interview structure and topics covered, with samples of questions asked
166 during the interviews.

167

168 Analysis

169 All interviews were audiotaped and transcribed verbatim followed by a content analysis
170 (Cavanagh, 1997). Answers to the questions were grouped by interview section and
171 category of participants (persons with AD, family caregivers and clinicians) by the first
172 author. Mains ideas were discussed with the co-authors and a summary was written. It
173 was used as a guide for the development of the intervention protocol.

174

175 (Table 1 here)

176

177 *Development of the intervention protocol (Step 2)*

178 The intervention protocol was first structured according to the Template for Intervention
179 Description and Replication (TIDieR) Checklist and Guide (Hoffmann et al., 2014), to
180 ensure that all relevant elements were covered. The TIDieR is a 12-item tool for reporting
181 interventions that can be reliably replicated in clinical practice and assessed in research
182 trials. Our study used nine of the items, i.e. brief name, why, what (materials), what
183 (procedures), who provided, how, where, when and how much, and tailoring. Three items
184 relevant for reporting intervention in studies were not applicable (modifications, how well
185 the intervention was planned, and how well the intervention was delivered).

186

187 Second, the protocol integrated the evidence gathered at Step 1 as well as theoretical
188 sources. To support the sequence of steps, the intervention was anchored to the three-

189 stage behavioral approach for individuals with cognitive impairment described by
190 Sohlberg and Mateer (1989). The description of the intervention procedures to obtain the
191 desired behavioural change also integrated errorless learning methods (Baddeley &
192 Wilson, 1994; Camp et al., 2000; Fontaine, 1996). The number and intensity of
193 intervention sessions were estimated by reviewing existing practices using the same
194 approach with similar populations (Haskins et al., 2012). Specifications concerning the
195 expertise required to deliver the intervention and disciplinary background were based on
196 a critical examination of existing interventions conducted with individuals with dementia
197 (Imbeault et al., 2013; Lancioni et al., 2009; Lekeu et al., 2002; O'Neill et al., 2011;
198 Oriani et al., 2003; Perilli et al., 2013). This step resulted in the construction of a prototype
199 of the protocol based on intervention strategies tailored to the cognitive abilities of
200 persons with AD.

201

202 *Perceived appropriateness of the intervention protocol (Step 3)*

203 Procedure

204 This step of the study involved the three clinicians and used an iterative process. The
205 clinicians received the experimental version of the intervention protocol by email and
206 were asked to review it for content and structure and to evaluate how it could be used in
207 their daily practice based on the demonstrations in the videoclips. They were encouraged
208 to test it with colleagues or clients without further training. A month later, the clinicians
209 were asked for their suggestions and questions in a semi-structured interview.

210 Analysis

211 The first author produced a synthesis of each interview to capture the main ideas related
212 to the intervention protocol's content and structure. The modifications requested by the
213 clinicians were identified and used to build the second version of the intervention
214 protocol. The second version of the protocol was then resubmitted to the clinicians by
215 email to ensure that the changes made reflected the desired modifications. The clinicians
216 were then asked to send their written comments and suggestions, which were also
217 discussed on the phone to make sure their meaning was understood. A second series of
218 modifications was made to produce the final version of the intervention protocol, which
219 was unanimously approved after the clinicians read it for the third time with no other
220 suggestions from the clinicians.

221 **RESULTS**

222 **Understanding end users' needs**

223 Understanding end users' needs involved exploring how the tasks were currently
224 performed, perceptions about the new technology and, by extension, perceptions related
225 to learning how to use the new technology (Dabbs et al., 2009). A variety of medication
226 management challenges and compensatory strategies were mentioned as we explored how
227 the tasks were currently performed. Three medication management challenges were
228 consistently named by clinicians and caregivers: difficulty remembering "when", "which
229 medication" to take, and "whether or not" it had actually been taken. Persons with AD,
230 on the other hand, reported that apart from some rare omissions, taking their medication
231 was not challenging. This was well illustrated by the first person with AD interviewed:
232 "Hmmm... my husband is annoying, he's always checking up on me for no reason,
233 because I rarely forget". Strategies used by caregivers to compensate for difficulties

234 included verbal reminders and standard pill dispensers. Additional strategies described
235 by clinicians were task adaptation (establishing regular routines) and provision of external
236 support (calendars, written reminders, and repetition of information by caregivers).

237

238 When we explored the participants' perceptions of the eMMD, a number of advantages
239 and disadvantages were raised. Both clinicians and family caregivers said the eMMD had
240 interesting potential to compensate for difficulties with managing medication. Among its
241 functionalities, the alarm was identified as the main advantage since it reminds persons
242 with AD to take their medication, a responsibility normally assumed by family caregivers.
243 The caregivers realized that the alarm would allow them to go out more since the reminder
244 would go off in their absence. The second caregiver said: "when I go to my woodlot, I'm
245 always limited in time, with this device, I could leave for a lot longer." Clinicians viewed
246 the alarm as a way to relieve family caregivers of some of the stress related to medication
247 management since they could leave to the pill dispenser the task of reminding the person.
248 The second clinician mentioned: "This alarm is even better than human memory!" In
249 addition, the green light was considered a convenient way to identify which compartment
250 to open.

251

252 Clinicians and family caregivers both liked the option of receiving data remotely because
253 of the freedom it could give these caregivers. For their part, persons with AD identified
254 some options as convenient without further elaboration. However, all the participants
255 thought the size of the technology was a weakness since no one could imagine taking a
256 device of that size outside the home. Furthermore, all the clinicians wondered about the
257 utility of the eMMD for pharmaceutical forms other than tablets, since patches are

258 commonly prescribed for persons with AD. In short, the various alerts were appreciated
259 while the size and limited pharmaceutical forms were disadvantages.

260

261 There was a lot of interest in learning how to use this new technology, particularly the
262 errorless training methods shown in the videoclips. Family caregivers were relieved to
263 learn that, by using the right strategies, individuals with AD could still learn. They
264 envisioned some long-term benefits, making it easier not only to take medication, but also
265 to learn other routine tasks. This idea was well illustrated by the third caregiver: “It’s
266 really encouraging to know that he can still learn, I could probably use it to help with
267 other everyday things”. Being involved full-time with persons with AD, they found the
268 training provided by a clinician reassuring in helping them with this learning. As for the
269 three persons with AD, they said they were impressed to know that they could still learn.
270 One of their reasons for getting involved in this process was the idea of having a weekly
271 visit. One participant mentioned: “For sure I would love it, having visitors is a welcomed
272 distraction”. Furthermore, all the clinicians knew that learning was possible despite the
273 presence of cognitive disorders. However, two of the clinicians had never used errorless
274 methods since they did not have enough practical knowledge. One concern common to
275 all three clinicians was the time spent on training. As the second clinicians said: “It’s
276 really interesting, but I don’t know how feasible it is, because there is never have enough
277 time to do everything!” In the end, training was viewed favorably by the family
278 caregivers, persons with AD and clinicians, but obstacles raised included the lack of
279 know-how and time required.

280

281 **Perceived appropriateness of the intervention protocol**

282

283 The intervention protocol developed at step 2 that was presented to the three clinicians
284 was divided into two main sections. In the first section, information about AD and its
285 cognitive impacts, as well as how the disease affects medication management were
286 presented. The electronic pill dispenser and how it works was also described. In the
287 second section, the basic principles of errorless learning methods were introduced,
288 followed by the detailed description of the procedures. The clinicians commented on the
289 structure and content of this version of the intervention protocol.

290 *Structure*

291 Regarding the structure of the intervention protocol, the clinicians' wanted to be driven
292 right into the procedures and have access to the theoretical details at the end of the
293 intervention protocol as they would only read it as needed. Therefore, they suggested to
294 move the first section on AD and how it affects medication management to the end. They
295 also suggested subdividing the content differently with two additional sections. One
296 focusing specifically on the cognitive profile of individuals with mild AD that could
297 benefit from this intervention, and the other one describing the eMMD.

298

299 *Content*

300 After reading the first version of the intervention protocol, all the clinicians were
301 delighted with this new intervention protocol but emphasized the need for a more detailed
302 step-by-step description of the intervention. Indeed, they all considered the description of
303 the intervention to be crucial. Clinicians were also concerned about the time needed to
304 assimilate the intervention and be able to integrate it into their practice. A detailed
305 description would reduce the time and effort needed. They requested more information
306 about how to obtain the eMMD, how to establish communications with drugstores and

307 how to install the eMMD. They also felt that a synthesis at the end of each section would
308 be useful. In the theoretical concepts section, they mentioned that having concrete
309 examples would help them understand complex concepts. All these suggestions were
310 included in the final version.

311

312 The final intervention protocol version was divided into four main sections. The first
313 section describes the skills required by health professionals to provide the intervention
314 and the cognitive, physical, sensory and mental characteristics of clients who can benefit
315 from it. In the second section, the technology features of the eMMD are fully described
316 along with the complete operating instructions and how to obtain the device. The third
317 section provides the detailed step-by-step instructions, including decision trees to support
318 clinicians throughout the training. Finally, the last section provides key concepts about
319 AD, its cognitive impacts, and how it affects medication management. It demystifies
320 cognitive impairments of persons with AD and how the functionalities of the eMMD can
321 support these impairments. Table 2 presents in detail the content and rationale of the final
322 version of the intervention protocol in relation with each item of the TIDieR.

323

324 (table 2 here)

325

326 **DISCUSSION**

327 The overall objective of this study was to understand end users' needs in order to develop
328 and validate a detailed intervention protocol incorporating specific learning strategies to
329 teach persons with early-stage AD how to use an eMMD. The study resulted in the
330 creation of a detailed intervention protocol adapted to the clinical reality, thus filling a

331 gap reported in the rehabilitation research literature concerning the lack of specifications
332 related to interventions (Dijkers et al., 2014; Fuhrer, 2003; Lenker & Paquet, 2004).

333 *Understanding end users' needs*

334 Three groups of participants were directly involved in the study. Their perceptions about
335 medication management and technology varied with the aspects addressed. For example,
336 clinicians and family caregivers identified the same issues experienced by persons with
337 AD with respect to remembering and identifying which medication to take. However, the
338 group of persons with AD did not feel concerned about these aspects. This could be
339 because denial is a typical symptom found in early-stage AD (Kaasalainen et al., 2011;
340 Mokhtari et al., 2012). On the other hand, there was a consensus regarding the
341 functionalities of the eMMD. This result is in line with the study of Cahill et al. (2007),
342 where the use of the technology was seen as fostering the functional autonomy of the
343 person with AD and enhancing the family caregiver's quality of life. Finally, the training
344 methods for using the eMMD were perceived positively by all three groups of
345 participants, although they differed with regard to the perceived time to invest in training.
346 These results diverge from what Thivierge and her team (Thivierge et al., 2014) reported
347 on a program aimed at relearning instrumental activities of daily living with people with
348 mild AD. While in our study, persons with AD and their family caregivers did not see
349 any disadvantage related to investing the time required to do the training, Thivierge
350 (2014) found that some eligible candidates rejected the program because of the high
351 number of assessments and training sessions or because of the length of their study. On
352 the other hand, the clinicians in our study viewed the time required by the training as a
353 major barrier, which is consistent with a study by de Werd et al. (2015). In their

354 nationwide survey, 45 health professionals from various disciplines were questioned
355 about their interest in and the feasibility of using errorless methods with individuals with
356 dementia; 67% considered these methods too time-consuming (de Werd et al., 2015). The
357 time that needs to be invested in the intervention to allow persons with AD learn to use
358 an eMMD will have to be clarified by future studies by examining the number of training
359 sessions required. Moreover, it would be interesting to explore if the intervention could
360 be managed by a variety of health care professionals and thus better accommodate to the
361 reality of professionals' schedules. By applying the intervention by different
362 professionals, the time to be spent by each might more realistic fit into their overloaded
363 schedules. For instance, it would be useful to consider how the intervention could be
364 integrated in a multidisciplinary intervention plan.

365 *Development of the intervention protocol*

366 The method used to develop the intervention protocol should foster adoption by
367 clinicians. First, development of the intervention used evidence-based knowledge
368 mobilization principles. The development of the protocol was discussed in a two-way
369 process with clinicians, who had a direct impact on its content and structure in order to
370 transform the first theoretical version into a protocol adapted to their clinical reality.
371 According to Chagnon and Gervais (2011), this iterative process enhances relevance,
372 applicability and appropriate presentation of the knowledge generated (Chagnon &
373 Gervais, 2011) and also facilitates management (Proctor et al., 2013). Involving end users
374 from the start of knowledge conception maximizes the likelihood of success over the
375 longer term when implementing the intervention in health professionals' practice (Dabbs
376 et al., 2009).

377

378 Next, using the TIDiER ensured that the description of the intervention was detailed
379 enough to be able to replicate it in clinical practice and to compare across studies
380 (Hoffmann et al., 2014). This directly meets the need identified by de Werd et al. (2013)
381 to have access in geriatric practice to studies specifically describing the methods used,
382 the intensity and duration of training, clients' pathology, and other factors that could
383 affect learning. Also, adherence to a detailed intervention protocol is known to improve
384 the quality and consistency of care (Hubbard et al., 2012). Laver et al. (2017) also noted
385 that the characteristics of the most effective interventions in dementia care include
386 symptom- specific training, a client-centered approach and communication strategies
387 directed at patients and family caregivers. All these elements are covered by TIDieR
388 criteria. At this time, studies examining the effectiveness of interventions involving the
389 use of technology by persons with AD have shown variable results (Imbeault et al., 2013;
390 Lancioni et al., 2009; Lekeu et al., 2002; O'Neill et al., 2011; Oriani et al., 2003; Perilli
391 et al., 2013). These results can hardly be compared since little detail on the intervention
392 protocols are provided. A deliverable of our study is a detailed intervention that can be
393 replicated in clinical practice and thus will allow to compare results from one study to
394 another.

395 STRENGTHS AND LIMITATIONS

396 This study has various strengths. The development of the intervention protocol was based
397 not only on theoretical concepts, such as learning methods tailored to the cognitive profile
398 of individuals with cognitive disorders, but also on the perception of various stakeholders
399 concerning medication management, technology and learning methods. With our

400 methodological approach, we were able to incorporate practical elements to provide
401 clinicians with a tailored tool and present the theory in a way that made it meaningful and
402 was adapted to their clinical reality. In addition, the involvement of persons with AD, as
403 a group of participants, is innovative. To our knowledge, no previous study directly
404 involved individuals with dementia at such an early stage in the development of an
405 intervention.

406

407 As for limitations, the three groups of participants were exposed to simulations with the
408 eMMD to capture user needs and appropriateness of the intervention protocol. The actual
409 application of the intervention protocol, in controlled conditions and later on in the in the
410 real life context of persons with AD are needed to reach a high level of evidence (Schulz
411 et al., 2015). This will give persons with AD a more concrete view of the usefulness of
412 the technology in their daily lives and enable them to make a fairer assessment. Finally,
413 a small number of participants were involved in this first development stage and they
414 were all from the same area. Nevertheless, answers within the three groups of participants
415 were generally along the same lines. For future development stages, larger scale studies
416 with more participants will be needed.

417 **CONCLUSION**

418 eMMDs could potentially address difficulties encountered by persons with AD in
419 medication management. However, this technology must be associated with training
420 tailored to their cognitive capacities so they can learn how to use it and incorporate it in
421 their routine. This study resulted in the development of a structured training intervention
422 protocol, incorporating evidence-based data concerning the best methods for persons with

423 AD to learn how to use technology. It established strong foundations to understand how
424 persons with AD can incorporate eMMDs in their daily lives. In the next development
425 stage, future studies will need to use this intervention in a real home rehabilitation context.
426 Among other things, this will clarify the final elements of the TIDieR related to evaluation
427 of adherence and fidelity; modifications, how well the intervention was planned, and how
428 well the intervention was delivered.

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433

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437

438 **Conflict Of Interest**

439 Myriam Tellier has no conflicts of interest to disclose. Claudine Auger has no conflicts
440 of interest to disclose. Louise Demers has no conflicts of interest to disclose.

441

442 **Ethical Standards**

443 The authors assert that all procedures contributing to this work comply with the ethical
444 standards of the relevant national and institutional committees on human
445 experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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