

Self-management in older adults: how to delineate self-management ability, self-management behavior, and self-management support?

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2 behavior, and self-management support?

3

4 **Abstract**

5 **Background:** Self-management is a key element in person-centered and integrated care. It involves
6 several related concepts, such as self-management ability, behavior, and support. These concepts are
7 poorly delineated. The aim of this study was to examine hypothesized associations between self-
8 management ability, behavior, and support in older adults (taking their frailty and complexity of care
9 needs into account) and to examine underlying aspects of these concepts, if these hypotheses lack
10 support.

11 **Methods:** Cross-sectional data from the Embrace study, a stratified randomized controlled trial,
12 evaluating person-centered and integrated care in Dutch community-living older adults, were used.
13 Participants (n=537) were aged 75 and older, assigned to health-related risk profiles based on self-
14 reported frailty and complexity of care needs. Ability was assessed with the Self-Management Ability
15 Scale, behavior with the Partner in Health Scale for Older Adults, and support with the Patient
16 Assessment of Integrated Elderly Care.

17 **Results:** Ability and behavior were positively associated for participants with the risk profiles
18 “Robust” and “Complex care needs” (betas are 0.38 and 0.46). Coping (an aspect of behavior) turned
19 out to be a key element for participants with risk profiles “Robust” and “Complex care needs” (betas
20 ranging from 0.13 to 0.45). Support was associated with aspects of behavior, varying per risk profile.

21 **Conclusion:** We found no associations for self-management on the conceptual level, but the aspect
22 coping did appear to play a major role. Improving coping strategies of older adults may be a
23 promising way of enhancing self-management ability, and of reducing the need for self-management
24 support.

25

- 26 **Keywords:** Self-management ability, self-management behavior, self-management support,
27 older adults, person-centered care, integrated care.

28 **BACKGROUND**

29 Self-management, a concept frequently used by policymakers and researchers, is a key element in
30 person-centered and integrated care [1,2]. Enhancing self-management may be a relatively low-cost
31 way of improving health outcomes in older adults and in patients with chronic conditions [3]. “Self-
32 management” is a term that is often used in connection with an individual’s level of health (which
33 has been shown to be associated with their level of self-management) [5–8]. However, self-
34 management is also essential for maintaining the well-being of older adults, regardless of their health
35 status. This is in line with the theory of self-management of well-being [4]. The theory states that
36 successful aging can only be achieved through sustainable well-being, which is based on the use of
37 self-management abilities.

38 Self-management involves concepts such as self-management ability (i.e. the ability to manage
39 one’s internal and external key resources), self-management behavior (i.e. applying self-
40 management abilities), and self-management support (i.e. the care and education provided to
41 improve an individual’s skills and boost their confidence). As things stand, these concepts are poorly
42 delineated and are often used interchangeably [9,10]. This makes it difficult to compare studies,
43 which undermines attempts to improve our understanding of this complex concept [9–11].

44 We hypothesize that self-management ability is associated with self-management behavior, as
45 ability is a necessary precondition for displaying behavior [12]. Furthermore, we hypothesize that
46 self-management support will impact the association between self-management ability and self-
47 management behavior. More specifically, this implies that the effect of self-management support will
48 be stronger for older adults with lower levels of self-management ability [2,13]. The aim of this study
49 is to test these hypotheses regarding associations between self-management ability, self-
50 management behavior, and self-management support in community-living older adults, taking these
51 individuals’ risk profiles (i.e. an indicator of their level of frailty and complexity of care needs) into
52 account. If there is insufficient evidence to support our hypothesized model, we will proceed to

53 examine the underlying aspects of self-management ability, self-management behavior, and self-
54 management support.

55

56 **METHODS**

57 *Study sample*

58 We used data from a sample of 537 older adults, aged 75 and older, who participated (for a
59 period of one year) in the intervention group of the Embrace study. The latter study is a stratified
60 randomized controlled trial with Dutch participants, the aim of which is to examine the effectiveness
61 of a person-centered and integrated care model for community-living older adults (Netherlands
62 National Trial Register: NTR3039). The Medical Ethics Committee of the University Medical Center
63 Groningen assessed the study protocol and concluded that approval was not required (Reference
64 METc2011.108).

65 Older adults were recruited for the Embrace study by means of a two-step process. Firstly, all
66 general practitioners (GPs) in three municipalities in the province of Groningen, the Netherlands,
67 were asked to participate in the study. These municipalities exhibit differing degrees of urbanization
68 (“rural”, “urbanized rural”, and “industrial”). Secondly, older adults from participating GP-practices
69 who were eligible for inclusion in the Embrace study (criteria: age 75 and older and living at home or
70 in a home for the elderly) were invited to participate. The exclusion criteria at baseline were long-
71 term residence in a nursing home, receiving an alternative type of integrated care, or participation in
72 another study. Eligible older adults received a letter from their GP describing the intervention and
73 the study being performed by the university of Groningen. The participants filled in questionnaires at
74 baseline, and after a period of one year. A more detailed description of the Embrace study’s design,
75 samples, and procedures has been published elsewhere [14]. The participants all provided written
76 informed consent.

77 At baseline, the participants were classified into three risk profiles, according to their level of
78 complexity of care needs, as measured with the INTERMED for the Elderly Self-Assessment

79 (INTERMED-E-SA) [15] and their frailty, as measured with the Groningen Frailty Indicator (GFI) [16].
80 The risk profile “Robust” (scores of <16 on INTERMED-E-SA and of <5 on GFI) comprised participants
81 without complex care needs and with relatively low levels of frailty. These older adults were largely
82 unaffected by aging and have an active social life. The risk profile “Frail” (scores of <16 on
83 INTERMED-E-SA and of ≥ 5 on GFI) comprised participants who were at risk of developing complex
84 care needs and higher levels of frailty. These older adults increasingly suffered from the effects of
85 aging and experienced growing dependency on others. At the same time, their social networks was
86 shrinking. The risk profile “Complex care needs” (score of ≥ 16 on INTERMED-E-SA, and any GFI score)
87 comprised participants with complex care needs. These older adults were dependent on professional
88 support for several underlying aspects associated with the consequences of aging. They may also be
89 referred to a hospital or nursing home.

90 The present study used cross-sectional data (obtained at the one-year follow-up) from
91 participants who received person-centered and integrated care, including self-management support
92 (i.e. they participated in the intervention group of the Embrace study). The participants’ care
93 intensity levels during the intervention depended on their risk profile at baseline, and ranged from
94 group support with a focus on prevention to individual support from a case manager. Participants
95 with a “Robust” profile were offered a “self-management and prevention program” that focused on
96 staying healthy and independent, and which included regular community meetings. In the event of
97 any changes to their health or living conditions, the participants were encouraged to contact an
98 Elderly Care Team, consisting of a GP, an elderly care physician, and two case managers (district
99 nurse and social worker). Participants within the “Frail” and “Complex care needs” profiles were also
100 given an opportunity to follow the self-management and prevention program, while they also
101 received individual support from a case manager. This individual support involved frequent home
102 visits, the assessment and monitoring of their health and living situation, as well as the development
103 and implementation of a care and support plan. Each month, the Elderly Care Team discussed the
104 study participants’ health and living situations.

105 Community-living older adults in the Netherlands are usually under the care of a GP who acts as
106 a gatekeeper for specialized medical care. Older adults can also receive home care and social care
107 from community-based organizations, e.g. nursing care at home, pre-processed meals delivered to
108 their home, adaptations of their home to compensate for physical limitations, and supervised
109 transportation.

110

111 *Measurement instruments*

112 *Self-management ability* (hereafter: “ability”) was assessed with the 30-item Self-Management
113 Ability Scale (SMAS-30) [17], which contains six subscales: “Initiative”, “Self-Efficacy”, “Investment
114 behavior”, “Positive frame of mind”, “Multifunctionality of resources”, and “Variety of resources”
115 (See Table 1). Each subscale consists of five items, each of which was scored on a 5- or 6-point Likert
116 scale. Scores were transformed into index scores ranging from 0 to 100, where higher scores
117 indicated higher levels of ability. A total score was calculated by taking the mean score of the six
118 subscales. The total scale and subscales in this part of the study were found to have good internal
119 consistency (i.e. Cronbach’s alphas ranged from 0.71 to 0.84).

120 *Self-management behavior and knowledge* (hereafter: “behavior”) was assessed with the
121 Partners in Health Scale for Older Adults (PIH-OA) [18]. The subscales “Knowledge” and
122 “Management” each contain two items, and the subscale “Coping” four items (See Table 1). Index
123 scores were calculated and scale scores ranged from 0-100, with higher scores indicating higher
124 levels of behavior. A total score was calculated by taking the mean score of the three subscales. The
125 total scale and subscales in this part of the study were found to have good internal consistency (i.e.
126 Cronbach’s alphas ranged from 0.78 to 0.82).

127 *Self-management support* (hereafter: “support”) was assessed with the Patient Assessment of
128 Integrated Elderly Care (PAIEC) [19]. The subscale “Patient activation and contextual information”
129 (hereafter: “Patient activation”) contains seven items, as does the subscale “Goal-setting and
130 problem-solving” (hereafter: “Goal-setting”). The subscale “Coordination and follow-up” (hereafter:

131 “Coordination”) contains six items (See Table 1). Scale scores ranged from 0-10, with higher scores
132 indicating that a higher level of support was provided. A total score was calculated by taking the
133 mean score of the three subscales. The total scale and subscales in this part of the study were found
134 to have good internal consistency (i.e. Cronbach’s alphas ranged from 0.85 to 0.90). The PAIEC
135 validation study showed that the distribution of PAIEC scores was right-skewed. This was normalized
136 by a squared root transformation [19].

137 A questionnaire was used to obtain details of the participants’ demographic and background
138 characteristics (i.e. age, gender, educational level, marital status, number of chronic conditions, and
139 number of medications).

140

141 *Data analyses*

142 Firstly, we assessed the participants’ demographic and background characteristics using descriptive
143 statistics. To test differences between the risk profiles, chi-square tests were performed for
144 categorical variables (i.e. gender, educational level, marital status, number of chronic conditions and
145 number of medications), and one-way ANOVA analyses for continuous variables (i.e. age, ability,
146 behavior, and support). Differences between all three risk profiles were assessed, as were
147 differences between the risk profile “Robust” and the risk profiles “Frail” and “Complex care needs”.

148 Secondly, for each risk profile, we used linear regression analyses to examine any
149 associations between the concepts of ability, behavior, and support. We calculated crude
150 associations to assess the association between ability and behavior. To assess the possibility that self-
151 management support might have a moderating effect on the association between ability and
152 behavior, we added the interaction term ability*support to the model.

153 Thirdly, for each risk profile, we repeated the analyses for all aspects (i.e. subscales) of these
154 concepts, using multivariate linear regression analyses. In these analyses, individual aspects were
155 included both as dependent and independent variables. Due to the large number of analyses
156 involved, the figures only show statistically significant associations.

157 All of the analyses involved complete cases. They were adjusted by gender, age, educational
158 level, and marital status, and were repeated for each risk profile. SPSS (IBM SPSS Statistics for
159 Windows, Version 23.0. Armonk, NY: IBM Corp.) and Stata (Version 13, StataCorp LP) were used for
160 this purpose.

161

162 **RESULTS**

163 *Characteristics of the sample*

164 The total sample consisted of 537 older adults with a mean age of 81.5 years (SD=4.4). The female
165 subjects (56.1%) outnumbered the male subjects, and almost half of the participants had a low
166 educational level (48.6%). Table 2 shows the characteristics of the sample as a whole and per risk
167 profile. Significant differences between the three risk profiles were found for gender, age,
168 educational level, marital status, number of chronic conditions, and number of medications. This
169 underscored the expected and distinctive differences between these risk profiles. We also found
170 significant differences for all scales of ability, total score, and coping scale of behavior, as well as for
171 all scales of support.

172

173 *Associations between concepts of self-management (i.e. ability, behavior, and support)*

174 In older adults within the “Robust” and “Complex care needs” profiles, we found a positive
175 association between ability and behavior, indicating that a higher level of ability was associated with
176 a higher level of behavior ($\beta = 0.38$, $p = 0.001$ and $\beta = 0.46$, $p = 0.003$, respectively). We found no
177 evidence to suggest that support might have a moderating effect on the association between ability
178 and behavior in these profiles (data not shown). In older adults within the “Frail” profile, we found
179 no significant associations between ability, behavior, and support (data not shown).

180

181 *Associations between various aspects of the aspects of ability, behavior, and support*

182 In older adults within the “Robust” profile, we found that the “Variety of resources” aspect of ability
183 was associated with all aspects of behavior (Figure 1, betas ranging from 0.14 to 0.26). This indicates
184 that robust older adults, who were able to maintain a lively social network, showed higher levels of
185 self-management behavior. We also found that the “Coping” aspect of behavior was associated with
186 all aspects of ability (positive associations, betas ranging from 0.13 to 0.35) and support (negative
187 associations, betas ranging from -0.13 to -0.22). This indicates that robust older adults who showed
188 higher levels of coping also showed higher levels of self-management ability, and reported that they
189 were receiving less support in terms of improving their skills and confidence.

190 In older adults within the “Frail” profile, we found that the “Variety of resources” aspect of
191 ability was associated with all aspects of behavior (Figure 2, betas ranging from 0.26 to 0.33). We also
192 found that the “Management” aspect of behavior was associated with two aspects of support. The
193 first was that patient activation had a positive impact on the behavior of these frail older adults, in
194 terms of their management behavior (beta = 0.35), and the second that support in goal setting (beta
195 = -0.37) had a negative impact on such behavior.

196 In older adults within the “Complex care needs” profile, we found that the “Coping” aspect of
197 behavior was positively associated with all aspects of ability (Figure 3, betas ranging from 0.29 to
198 0.45). This indicates that older adults who were better able to adjust and respond – in a healthy way
199 – to the consequences of aging were better able to manage their key resources. We also found that
200 the “Knowledge” aspect of behavior was positively associated with all aspects of support (betas
201 ranging from 0.20 to 0.34). This indicates that older adults within the “Complex care needs” profile
202 who were more knowledgeable about the consequences of aging have greater need for support, in
203 terms of improving their skills and confidence.

204

205 **DISCUSSION**

206 The aim of this study was to examine associations between the concepts of self-management ability,
207 self-management behavior, and self-management support in older adults, while taking their health-

208 related risk profile into account. We found no evidence to suggest that support might have a
209 moderating effect on the association between ability and behavior. At a more detailed level, coping
210 (an aspect of behavior) turned out to be a key element in older adults within the risk profiles
211 “Robust” and “Complex care needs.” Furthermore, we found that support was associated with
212 aspects of behavior, while associations varied from one risk profile to another.

213 We found no evidence to suggest that support might have a moderating effect on the
214 association between the concepts of ability and behavior. As a result, we were unable to confirm our
215 hypothesized associations for any of the risk profiles used in this study. This was unexpected,
216 especially in older adults within the “Frail” and “Complex care needs” profiles that received the
217 highest levels of support. It might be that the duration of the support provided (i.e. one year) was
218 too short to measure its full effect. Furthermore, there may be a lack of statistical power, due to the
219 limited number of participants in each risk profile. However, a recent review of self-management
220 support and activities in daily living showed that support programs improved the level of activities in
221 daily living, regardless of the length of the program and sample size [20]. A second explanation is that
222 the role of support does indeed differ from the one that we hypothesized, and that associations only
223 involve aspects. Previous studies have shown that support programs can improve various aspects of
224 ability and behavior (e.g., self-efficacy and activities of daily living [20-22]), but none of these studies
225 examined associations at the conceptual level of self-management.

226 We found that the associations between self-management concepts (i.e. ability, behavior, and
227 support) varied from one risk profile to another. More specifically, the results highlighted several
228 significant associations between ability and behavior in older adults within the “Robust” and
229 “Complex care needs” profiles, but very few for those in the “Frail” profile. “Frail” older adults might
230 be in a transitional phase, in terms of their physical, mental, and social functional status. As a result,
231 they might not yet have become accustomed – and adapted – to their changing health and living
232 situation [23]. Successful adaptation could result in higher levels of self-management behavior,
233 leading to higher levels of self-management ability.

234 Associations between aspects of support (i.e. Patient-Activation, Goal-Setting, and
235 Coordination) and aspects of behavior (i.e. knowledge, management, and coping) also differed from
236 one risk profile to another. This may be due to the distinctions involved in the Embrace study, i.e. the
237 intensity of support provided depended on the participants' risk profile. For "Robust" older adults,
238 we found that a higher level of coping was associated with a lower level of support. This finding
239 suggests that relatively healthy older adults who are better able to adapt to the consequences of
240 aging [22] and who are, therefore, in less need of support, will probably not be dependent on
241 professional care and support. In older adults within the "Frail" profile, we found that support was
242 associated with management. Greater patient activation was associated with higher levels of
243 management, whereas more goal-setting was associated with lower levels of management. As these
244 older adults might be in a transitional phase, they may be uncertain about their future. Given their
245 changing circumstances, setting goals may just be too difficult. In older adults within the "Complex
246 care needs" profile, we found that a higher level of knowledge was associated with higher levels of
247 support, indicating that more knowledge generated a greater demand for support, in terms of
248 improving confidence and skills [20].

249 We also found that support is associated with aspects of behavior, and not directly with
250 aspects of ability. Support – as measured with the PAIEC – is related to behavioral outcomes (i.e. it
251 concerns the encouragement and support involved in care, in setting goals, and in participating in
252 health-related activities). Health professionals may find it easier to focus on behavior than on ability,
253 as behavior is more visible and more tangible. For example, it may be easier for health professionals
254 to explain the effects of medication to older adults (thus improving their knowledge) than to change
255 their frame of mind or improve their resources. The differentiated picture of associations between
256 aspects of support and aspects of behavior highlights the importance of the person-centered support
257 offered in Embrace. It also shows that this has a positive impact on decision-making and participation
258 in older adults. This study's findings also indicate that, in person-centered and integrated care
259 models, older adults' demands vary from one risk profile to another. No previous studies into aspects

260 of self-management have taken the risk profile of older adults into account, which makes it difficult
261 to draw comparisons with the present study.

262 In older adults within the “Robust” and “Complex care needs” profiles, coping played a major
263 part in the association between behavior, ability, and support. This confirms the findings of Thoolen
264 et al. [25], who found that proactive coping strategies (i.e. strategies for anticipating potential
265 stressors) in diabetes patients (mean age 61.0) predicted self-management behavior and behavioral
266 change. During the process of aging, the use of effective coping strategies becomes increasingly
267 important in terms of adapting successfully to changing circumstances and conditions, as individuals
268 experience further declines in their health, functioning, and social contacts [26]. At the same time,
269 resources are needed to limit the impact of this deteriorating picture [27]. The relatively limited role
270 of the coping strategies exercised by older adults in the “Frail” profile underlines the fact that this
271 group may potentially find it difficult to adapt to the process of aging [24].

272 This study has several major strengths. Firstly, it was carried out in a general population of
273 community-living older adults receiving self-management support. Secondly, we included both
274 healthy and unhealthy participants, and stratified the analyses by risk profile. To date, most studies
275 into self-management have involved older adults with a chronic disorder or some other health
276 condition [6–8]. Thirdly, the concepts of ability [17], behavior [18], and support [19] were assessed
277 using comprehensive and psychometrically sound measurement instruments.

278 When interpreting the results of this study, various limitations should be kept in mind. Due to
279 the cross-sectional design of this study, no final causal inferences can be made. Another limitation
280 concerns the techniques used to measure the concepts of ability, behavior, and support. While we
281 used the best available questionnaires, even these may not measure the concept completely [17-19].

282 Our findings concerning the associations between concepts and aspects of self-management
283 may have important implications for everyday practice and research. For instance, they show that
284 care providers should be aware of the importance of coping. Older adults with higher levels of coping

285 are better able to deal with stressful events and circumstances, and therefore require lower levels of
286 support [25,27]. Boosting people’s coping levels will also increase their self-management behavior.

287 Furthermore, our findings suggest that the level of support provided should be tailored to the
288 older adult’s levels of knowledge, management, and coping. Any planned interventions should take
289 variation in these levels into account. Use should also be made of risk-profiles based on self-reported
290 levels of frailty and complexity of care needs, as a starting point for person-centered care. Our
291 findings underline the opportunities provided by addressing self-management (or aspects thereof) in
292 person-centered care, an approach that emphasizes the active involvement of individuals in their
293 own health-related care and support [1].

294 To the best of our knowledge, this is the first study that has attempted to delineate concepts
295 of self-management. Further research is needed to confirm our findings. We found that the concepts
296 of ability, behavior, and support have only weak and partial associations. This indicates that the
297 distinction between the three concepts needs further assessment, especially regarding the role
298 played by coping. Further research is needed into the contents of the main concepts and their
299 aspects in the three measurement instruments, to specify these concepts in greater detail.

300 In summary, we found that the concept of support did not moderate the association between
301 the concepts of ability and behavior, but that it was partially associated with aspects of behavior. The
302 associations between aspects of ability, behavior, and support differed from one risk profile to
303 another. In general, however, coping appears to be a key component, in terms of self-management
304 ability, self-management behavior, and self-management support. Healthcare professionals could
305 benefit by managing older adults in ways that improve their coping strategies, as this seems to be a
306 promising route in terms of enhancing self-management ability and of reducing people’s needs for
307 self-management support.

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309

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382 **LIST OF ABBREVIATIONS**

383 **GP** General Practitioner

384 **GFI** Groningen Frailty Indicator

385 **INTERMED-E-SA** INTERMED for the Elderly for Self-Assessment

386 **PAIEC** Patient Assessment of Integrated Elderly Care

387 **PIH-OA** Partners in Health scale for Older Adults

388 **SMAS-30** 30-item Self-Management Ability Scale

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391 **DECLARATIONS**

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393 **Ethical approval and consent to participate**

394 The Medical Ethics Committee of the University Medical Center Groningen assessed the study
395 protocol and concluded that approval was not required (Reference METc2011.108).

396 All the participants had provided written informed consent, including their consent to publish
397 individual data.

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399 **Consent for publication**

400 All the participants had provided written informed consent including their consent to publish
401 individual data.

402

403 **Availability of data**

404 The datasets used and analyzed in the current study are available from the corresponding author on
405 reasonable request.

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407 **Competing interests**

408 None of the authors have any competing interests

409

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412 (ZonMw; file number 314010201) and the Dutch Healthcare Authority (NZA; file number 300-1021).

413

414 **Author Contributions**

415 KW: Conception and design of the study and manuscript, data collection, review of statistical

416 procedures and results, critical feedback on the manuscript

417 KV: Conception and design of the manuscript, data analysis, manuscript preparation

418 MMHL: Critical feedback on the manuscript

419 SLWS: Conception and design of the study, data collection, critical feedback on the manuscript

420 SAR: Conception and design of the study and manuscript, review of statistical procedures and results,

421 critical feedback on the manuscript

422

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424 We would like to thank the participating older adults and healthcare professionals from the 15

425 GP- practices, healthcare organization Zorggroep Meander and welfare organization Tinten

426 welzijnsgroep, without whose assistance this study would not have been possible.

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431 Table 1. Definitions of concepts and aspects of self-management.

| Concept (Measure) | Self-management ability (SMAS-30) | Self-management behavior (PIH-OA) | Self-management support (PAIEC) |
|--------------------------|--|--|--|
| Defined as | The ability to manage one's internal and external key resources | The application of self-management abilities | The support offered to improve someone's skills and confidence |
| Aspect | <i>Taking initiative</i> | <i>Knowledge</i> | <i>Patient activation and contextual information</i> |
| Defined as | The ability to be instrumental or self-motivating in taking the initiative | Being aware of the consequences of aging | Encouraging involvement in care and support and providing information about care and support |
| Aspect | <i>Self-efficacy</i> | <i>Management</i> | <i>Goal-setting and problem solving</i> |
| Defined as | The ability to develop and maintain a belief in personal competence | Active monitoring of – and acting in response to – signals of the personal consequences of aging | Encouragement and support in setting goals and overcoming problems |
| Aspect | <i>Investment behavior</i> | <i>Coping</i> | <i>Coordination and follow-up</i> |
| Defined as | The ability to invest in resources (e.g. social and human capital) for long-term benefits | Adjusting and acting in a healthy way to the consequences of aging | Encouragement and support for participation in health-related activities |
| Aspect | <i>Positive frame of mind</i> | | |
| Defined as | The ability to maintain a positive frame of mind regarding the future, rather than focusing on loss | | |
| Aspect | <i>Multifunctionality of resources</i> | | |
| Defined as | The ability to acquire and maintain resources (e.g. social and human capital) or activities serving dimensions of well-being at the same time, in a mutually reinforcing way | | |
| Aspect | <i>Variety of resources</i> | | |
| Defined as | The ability to gain and maintain a variety in resources (e.g. social and human capital) | | |

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434 Table 2. Participant characteristics (at baseline) and levels of self-management ability, behavior, and
 435 support for the total group and per risk profile (at follow-up) (n=537).

| | Total group | Risk profile | | | p-value | |
|---|-------------|--------------|-------------|--------------------|-----------------|--------------------|
| | | Robust | Frail | Complex care needs | 3 risk profiles | 2 risk profiles*** |
| Gender, n (%) | | | | | 0.003 | 0.04 |
| - Male | 236 (43.9) | 169 (51.5) | 27 (30.7) | 40 (33.1) | | |
| - Female | 301 (56.1) | 159 (48.5) | 61 (69.3) | 81 (66.9) | | |
| Age, mean (SD) | 81.5 (4.4) | 80.9 (3.9) | 82.4 (5.0) | 82.6 (4.6) | <0.001 | 0.63 |
| Educational level, n (%) | | | | | 0.03 | 0.89 |
| - Low | 259 (48.6) | 144 (44.3) | 48 (54.5) | 67 (55.8) | | |
| - Medium/High | 274 (51.4) | 181 (55.7) | 40 (45.5) | 53 (44.2) | | |
| Marital status, n (%) | | | | | 0.01 | 0.10 |
| - Married or in a long-term relationship | 313 (58.3) | 209 (63.7) | 38 (43.2) | 66 (54.5) | | |
| - Divorced, widowed or single | 224 (41.7) | 119 (36.3) | 50 (56.8) | 55 (45.5) | | |
| Number of chronic conditions | | | | | <0.001 | 0.08 |
| ≤ 3 | 424 (79.1) | 295 (92.5) | 57 (66.3) | 69 (54.3) | | |
| ≥ 4 | 112 (20.9) | 24 (7.5) | 29 (33.7) | 58 (45.7) | | |
| Number of medications | | | | | <0.001 | 0.80 |
| ≤ 3 | 240 (44.7) | 185 (57.8) | 21 (24.4) | 33 (26.0) | | |
| ≥ 4 | 297 (55.3) | 135 (44.2) | 65 (75.5) | 94 (74.0) | | |
| Self-management ability*, mean (SD) | | | | | | |
| - Total score | 57.6 (13.2) | 61.6 (11.1) | 54.7 (11.3) | 48.9 (14.8) | <0.001 | 0.001 |
| - Taking initiative | 55.3 (16.1) | 59.1 (14.3) | 51.9 (13.7) | 47.6 (18.9) | <0.001 | 0.08 |
| - Self-efficacy | 74.6 (13.1) | 77.9 (11.6) | 71.7 (10.4) | 68.2 (15.6) | <0.001 | 0.01 |
| - Investment behavior | 61.7 (16.9) | 66.0 (15.0) | 58.5 (15.2) | 52.3 (18.6) | <0.001 | 0.001 |
| - Positive frame of mind | 62.9 (15.5) | 67.3 (13.3) | 59.2 (15.5) | 53.8 (16.4) | <0.001 | 0.002 |
| - Multifunctionality of resources | 40.8 (19.5) | 45.3 (18.3) | 38.5 (19.2) | 30.2 (18.7) | <0.001 | 0.03 |
| - Variety of resources | 50.2 (17.6) | 54.0 (16.3) | 48.5 (15.5) | 41.3 (19.0) | <0.001 | 0.01 |
| Self-management behavior*, mean (SD) | | | | | | |
| - Total score | 72.6 (15.7) | 75.7 (14.5) | 71.1 (13.8) | 65.5 (17.5) | <0.001 | 0.004 |
| - Knowledge | 64.6 (24.7) | 65.1 (24.8) | 65.9 (22.4) | 62.5 (25.9) | 0.23 | 0.06 |
| - Management | 76.2 (24.2) | 77.4 (24.1) | 74.4 (25.2) | 74.2 (23.6) | 0.31 | 0.36 |
| - Coping | 74.8 (18.1) | 80.1 (15.6) | 72.0 (14.0) | 62.6 (20.7) | <0.001 | 0.001 |
| Self-management support**, mean (SD) | | | | | | |
| - Total score | 2.58 (2.11) | 1.85 (1.52) | 3.64 (2.42) | 3.81 (2.35) | <0.001 | 0.24 |
| - Patient activation and contextual information | 2.71 (2.37) | 1.96 (1.78) | 3.74 (2.69) | 4.01 (2.68) | <0.001 | 0.44 |
| - Goal-setting and problem solving | 2.32 (2.19) | 1.67 (1.58) | 3.14 (2.64) | 3.48 (2.58) | <0.001 | 0.09 |
| - Coordination and follow-up | 2.34 (2.14) | 1.62 (1.45) | 3.56 (2.61) | 3.41 (2.47) | <0.001 | 0.34 |

436 * range = 0-100 | ** range = 0-10.

437 *** P-value for difference between the "Frail" and "Complex" risk profiles.

438

439 **Figure titles and legends**

440

441 **Figure 1.** Significant associations between aspects of self-management ability, self-management
442 behavior, and self-management support in “Robust” older adults (n=328)

443

444 Legend:

445 **The figure only shows significant results.**

446 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$;

447 R^2 ranged from 0.05 to 0.21;

448 I and II refer to the direction of the association: I = from Ability to Behavior, from Support to

449 Behavior, or Ability to Support; II = from Behavior to Ability or Support, or from Support to Ability;

450 The results have been adjusted for gender, age, educational level, and marital status.

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452

453 **Figure 2.** Significant associations between aspects of self-management ability, self-management
454 behavior, and self-management support in “Frail” older adults (n=88).

455

456 Legend:

457 The figure only shows significant results;

458 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$;

459 R^2 ranged from 0.06 to 0.23;

460 I and II refer to the direction of the association: I = from Ability to Behavior, from Support to

461 Behavior, or Ability to Support; II = from Behavior to Ability or Support, or from Support to Ability;

462 The results have been adjusted for gender, age, educational level, and marital status.

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464

465 **Figure 3.** Significant associations between aspects of self-management ability, self-management
466 behavior, and self-management support in older adults with “Complex care needs” (n=121).

467

468 Legend:

469 **The figure only shows significant results.**

470 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$;

471 R^2 ranged from 0.12 to 0.34;

472 I and II refer to the direction of the association: I = from Ability to Behavior, from Support to

473 Behavior, or Ability to Support; II = from Behavior to Ability or Support, or from Support to Ability;

474 The results have been adjusted for gender, age, educational level, and marital status.

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Figures

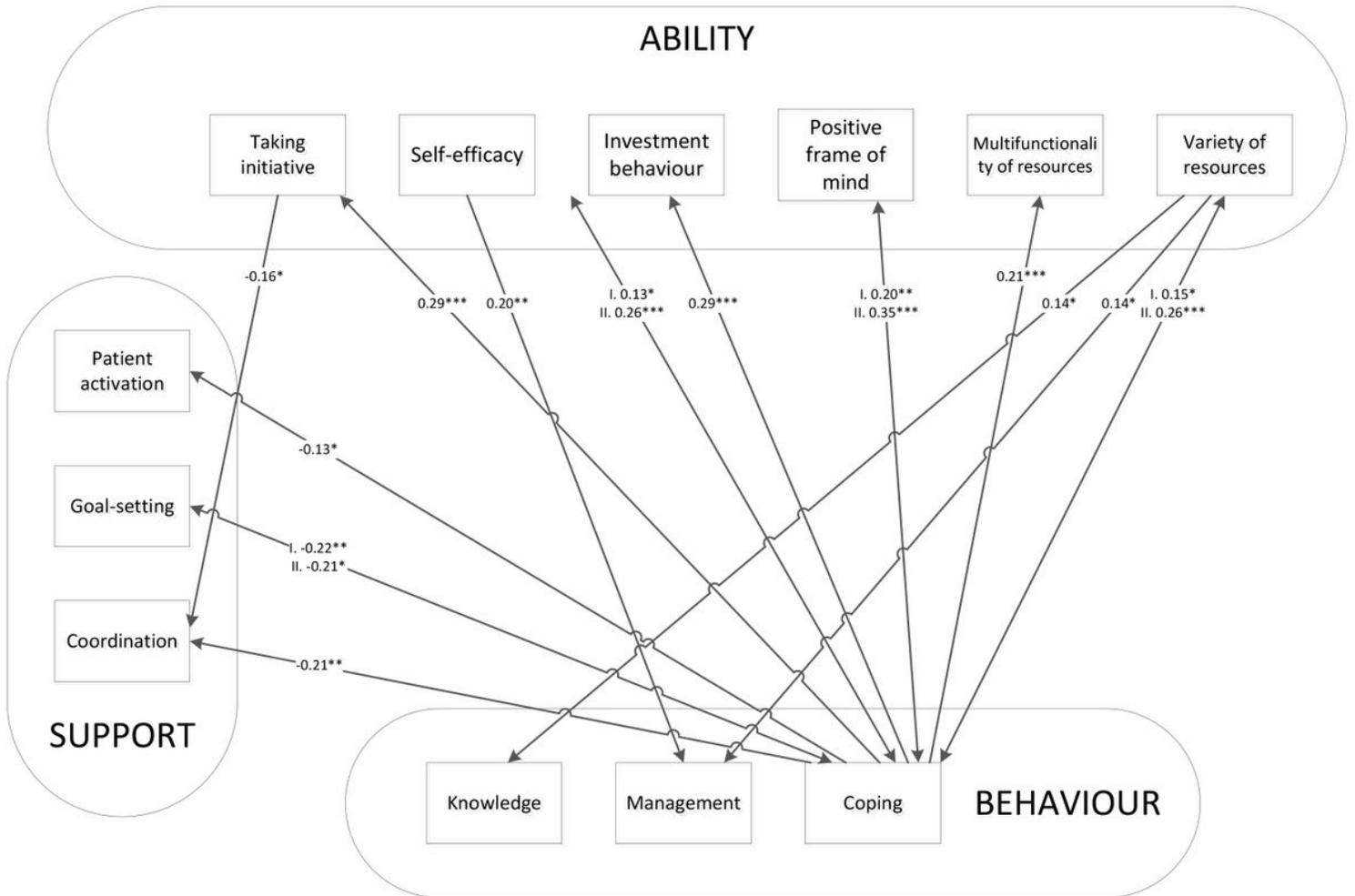


Figure 1

Significant associations between aspects of self-management ability, self-management behavior, and self-management support in “Robust” older adults (n=328). Legend: The figure only shows significant results. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; R2 ranged from 0.05 to 0.21; I and II refer to the direction of the association: I = from Ability to Behavior, from Support to Behavior, or Ability to Support; II = from Behavior to Ability or Support, or from Support to Ability; The results have been adjusted for gender, age, educational level, and marital status.

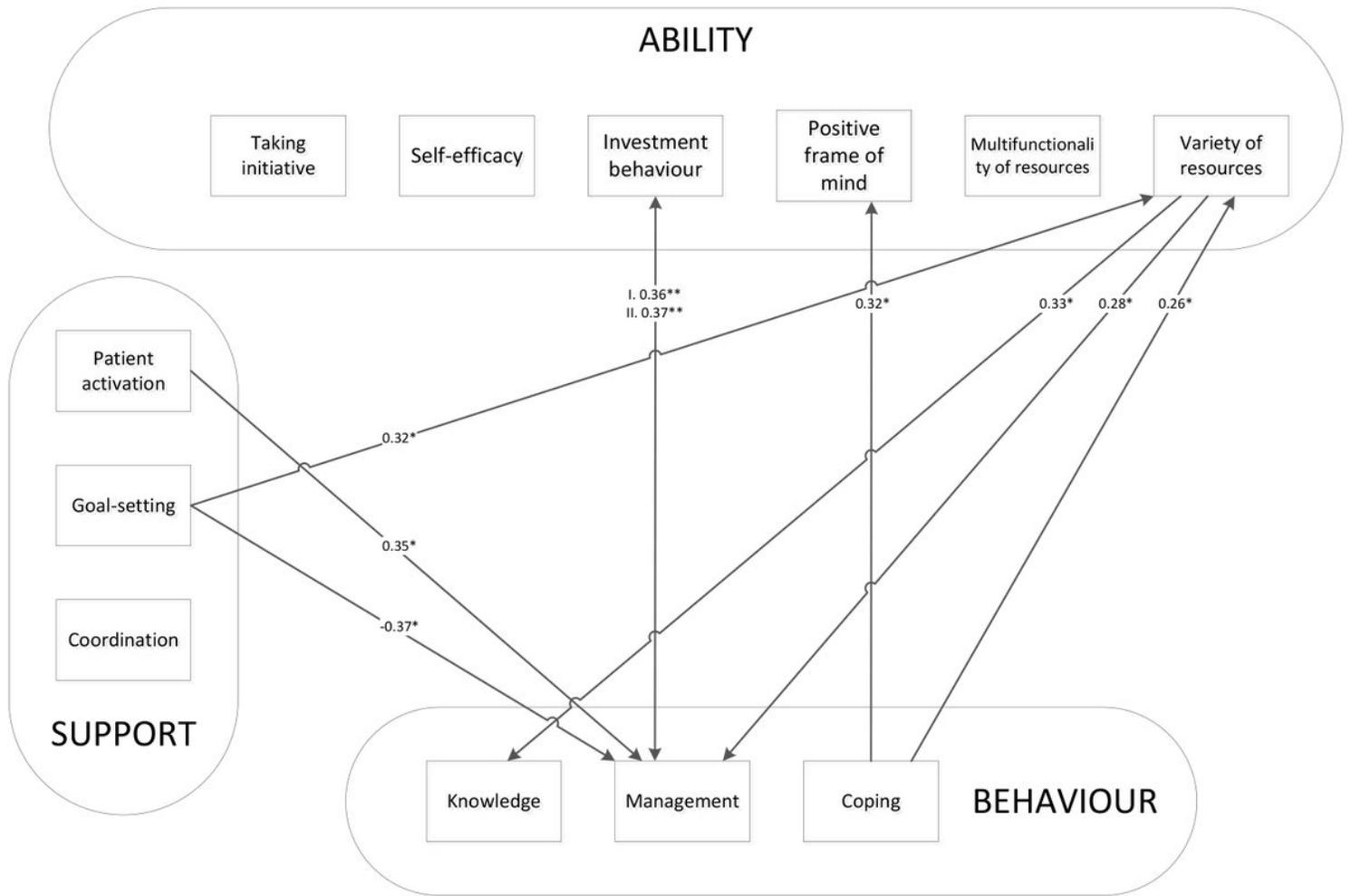


Figure 2

Significant associations between aspects of self-management ability, self-management behavior, and self-management support in “Frail” older adults (n=88). Legend: The figure only shows significant results; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; R2 ranged from 0.06 to 0.23; I and II refer to the direction of the association: I = from Ability to Behavior, from Support to Behavior, or Ability to Support; II = from Behavior to Ability or Support, or from Support to Ability; The results have been adjusted for gender, age, educational level, and marital status.

