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45

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54 recruiting participants.

55

56 **ABSTRACT**

57 **Objectives:** To investigate the effects of a 12-month home-based exercise program on functioning
58 and falls among persons with signs of frailty.

59

60 **Design:** A randomized controlled trial with a 1:1 allocation

61

62 **Setting:** Home-based

63

64 **Participants:** Home-dwelling persons aged ≥ 65 years meeting at least one frailty phenotype
65 criteria (n=300).

66

67 **Intervention:** 12-month, individually tailored, progressive and physiotherapist-supervised, physical
68 exercise twice a week (n=150) vs. usual care (n=149).

69

70 **Main outcome Measures:** Functional Independence Measure (FIM), Short Physical Performance
71 Battery (SPPB), handgrip strength, instrumental activities of daily living (IADL), and self-reported
72 falls and physical activity (other than intervention). Assessed four times at home over 12 months.

73

74 **Results:** The mean age of the participants was 82.2 (SD 6.3), 75% were women, 61% met 1–2
75 frailty criteria and 39% ≥ 3 criteria. FIM deteriorated in both groups over 12 months, -4.1 points
76 (95% CI: -5.6 to -2.5) in the exercise group and -6.9 (-8.4 to -2.3) in the usual care group (group
77 $p=0.014$, time $p<0.001$, interaction $p=0.56$). The mean improvement in SPPB was significantly
78 greater in the exercise group [1.6 (1.3 to 2.0)] than in the usual care group [0.01 (-0.3 to 0.3)]
79 (group $p<0.001$, time $p=0.11$, interaction $p=0.027$). The exercise group reported significantly fewer
80 falls per person-year compared to the usual care group (incidence rate ratio, IRR 0.47 [95% CI 0.40
81 to 0.55]; $p<0.001$). There was no significant difference between the groups over 12 months in
82 terms of handgrip strength, IADL function or self-reported physical activity.

83

84 **Conclusions:** One year of physical exercise improved physical performance and decreased the
85 number of falls among people with signs of frailty. FIM differed between the groups at 12 months,
86 but exercise did not prevent deterioration of FIM, IADL or handgrip strength.

87

88 **Keywords:** physical therapy, physical functional performance, functional status, falls, aging

89

90 **List of abbreviations:** CI Confidence Interval, FDR False Discovery Rate, FIM Functional

91 Independence Measure, FRAIL Fatigue, Resistance, Ambulation, Illnesses, Loss of weight, IADL

92 Instrumental Activities of Daily Living, IQR Inter-Quartile Range, IRR Incidence Rate Ratio, MMSE

93 Mini-mental State Examination, NYHA New York Heart Association, RCT Randomized Controlled

94 Trial, SPPB Short Physical Performance Battery

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96

97 Frailty is a syndrome which occurs especially in older adults¹ and is often associated with
98 sarcopenia². People with frailty often suffer from impaired functioning, and diminished muscle
99 strength and endurance^{3,4} and frailty increase the risk of disability and falls.⁵ Physical frailty can be
100 defined via five phenotypic criteria: weight loss, weakness, slowness, low physical activity, and
101 exhaustion.⁶

102

103 Physical exercise is a promising treatment option for frailty.^{3,7,8} Group-based exercise training for
104 frail older adults has shown positive effects on physical performance^{9,10} and physical activity can
105 postpone harmful consequences⁸ such as disabilities, falls and mortality.^{3,4,6} The strongest
106 evidence comes from multicomponent training programs with resistance training as the central
107 component, accompanied by aerobic, balance and flexibility exercises.^{8,11}

108

109 Even though physical exercise is a treatment option for frailty, persons with signs of frailty may
110 think that they lack the capacity to be physically active.¹² The barrier to participate in physical
111 activities may be lowered by providing opportunities to instructed exercise near their own
112 homes.¹² Supervised home-based training might be a valuable option for frail older adults but
113 evidence on its effectiveness is still scarce. Previous home-based exercise trials targeting frail older
114 adults have consisted of interventions of a maximum of six months with limited supervision from
115 professionals and inconclusive results.¹³

116

117 The aim of this randomized trial was to investigate the effects of a 12-month physiotherapist-
118 supervised, home-based exercise program on functioning and falls among people with signs of
119 frailty, in comparison with usual care.

120

121

122 METHODS

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124

125 Study design

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127

128 This article reports secondary outcomes of our trial which was registered to ClinicalTrials.gov
129 (NCT02305433) prior to recruitment. The study protocol has been published,¹⁴ and the primary
130 outcome, days lived at home, has been reported earlier.¹⁵ In short, we performed a parallel,
131 randomized clinical trial, with a 1:1 allocation ratio. After the baseline assessments, the research
132 personnel randomized participants into two groups, using a computer-generated random
133 sequence allocation program with randomly varying block sizes from 2 to 10, without
134 stratification. A statistician, who had no role in the trial, created the randomization program. One
135 person in the research group used the randomization program and informed the participants of
136 their allocation by phone. The allocation groups were a physiotherapist-supervised physical
137 exercise group (n=150) and a usual care-group (n=150).

138

139

140 Participants

141

142

143 Home-dwelling individuals aged ≥ 65 years were recruited between December 2014 and August
144 2016, via advertisements in newspapers and with the help of the home healthcare personnel of

145 the social and health care district. To be eligible, the individuals needed to pass through a two-
146 phase recruitment process and had to fulfill at least one phenotype criterium of frailty. First, they
147 were evaluated using the FRAIL questionnaire.^{16,17} FRAIL has five domains with one point each:
148 Fatigue (feeling tired all the time or most of the time), Resistance (unable to climb 1 flight of
149 stairs), Ambulation (unable to walk 1 block), Illnesses (more than 5), Loss of weight (>5% during
150 the previous years). If a person scored at least one point in FRAIL they advanced to the second
151 phase, where the research nurse checked their eligibility criteria and verified their frailty status
152 using Fried et al.'s phenotype criteria⁶ with slight modifications. The criteria used were: weight
153 loss $\geq 5\%$ during the preceding year⁶, physical activity under 30 minutes/week¹⁸, a feeling of "not
154 getting going" or "everything is an effort" for most or all of the time⁶, handgrip strength under cut-
155 off values based on BMI and gender⁶, and walking speed under 0.46 m/s (walking length either 4
156 or 2.44 m)¹⁹.

157
158 Other eligibility criteria were residing at home, ability to walk indoors with or without mobility
159 aids, scoring ≥ 17 in Mini-Mental State Examination (MMSE) test,²⁰ and the ability to communicate
160 in Finnish. Individuals were excluded if they were living in an institutional care facility or nursing
161 home, or had alcohol or drug abuse problems, severe problems with hearing or eyesight, terminal
162 illnesses (e.g., cancers), or other severe illnesses (e.g., a cardiovascular disease with New York
163 Heart Association Functional Classification class III or IV, severe pulmonary disease or a stroke)
164 that was contraindication to physical exercise. The study received ethics approval on November
165 12, 2014 from the Coordinating Ethics Committee and was conducted in accordance with the
166 standards of the Helsinki declaration. All the participants were volunteers and signed a written
167 informed consent document prior to the baseline assessments.

168

169 **Outcomes**

170

171

172 Here we report the secondary outcomes of our trial. A research physiotherapist/nurse, not blinded
173 to the allocation, performed assessments at the participant's home using interviews,
174 questionnaires, and measurements at baseline, and at three, six, and twelve months. If necessary,
175 details of demographic characteristics and illnesses were complemented with electronic medical
176 records of the social and health care district. The assessors did not participate in the
177 implementation of the intervention.

178

179 Functioning was assessed using several measurements. The Functional Independence Measure
180 (FIM)²¹ evaluates the participant's ability to perform 13 motor and five cognition tasks and was
181 performed via an interview. Each task was graded on a scale of seven (fully independent) to one
182 (needs assistance from two people). Maximum points were 126; 91 for motor and 35 for
183 cognition. Instrumental activities of daily living (IADL) were assessed via Lawton's eight-item
184 questionnaire,²² using polytomous item scoring (1–3, 1–4 or 1–5) with higher scores indicating
185 better functioning and an item sum ranging from 8–31.²³ Physical performance was assessed using
186 the Short Physical Performance Battery (SPPB),¹⁹ which has three parts (balance, walking and the
187 chair rise test) and a maximum summary score of 12 points. Handgrip strength was measured in
188 seated position, three times from both hands using a handheld dynamometer^a, the elbow
189 unsupported in a 90-degree angle, placed next to the body, and the wrist in a neutral position.²⁴
190 The mean of the best values of both hands was used in the analyses to eliminate possible joint
191 conditions in one hand that would hinder the maximal performance. Frequency of physical activity
192 (intervention physical exercise not included) was assessed by two structured questions²⁵ during

193 the interviews: 1) How often did you have a walk outdoors at least 30 minutes at a time in the
194 previous month, and 2) how often did you perform physical activities other than walking at least
195 30 minutes at a time in the previous month. Physical activity was reported as weekly sessions,
196 which was calculated by summing up the number of sessions from both questions.

197

198 Falls were queried during the assessment visits as participants reported the number of all falls
199 during the previous three or six months.

200

201

202 **Physical exercise intervention**

203

204

205 The 12-month exercise program comprised physiotherapist-supervised, one-hour sessions twice a
206 week at the participant's home. The research group trained the physiotherapists to conduct a
207 structured, periodical, progressive, and multicomponent physical exercise program, which
208 included strength, balance, mobility, and functional exercises (Table 1).¹⁴ The physiotherapists
209 modified the sessions to suit the participants' current health status. The physiotherapists were
210 instructed to periodically perform multiple-repetition maximum-tests for lower extremities with
211 ankle weights (0.5 to 10 kg) to ensure progression and define suitable training resistance. At the
212 end of each session, its intensity was evaluated with Borg's Ratings of Perceived Exertion (RPE)
213 scale²⁶, with the targeted range from moderate (12) to vigorous (17), and the intensity of the
214 following session was modified accordingly. The physiotherapist also gave brief counseling on
215 nutrition and encouraged the participant to be physically active outside the supervised exercise
216 sessions as well. The physiotherapists reported contents of all the exercise sessions and adverse

217 effects monthly. In addition, the participants could receive any social and health care (including
218 rehabilitation) services they needed during the trial.

219

220 **Usual care**

221

222

223 In the usual care group, the participants continued to live their lives “as usual”. They received any
224 health care or social services they needed during the study period, including home care and
225 rehabilitation delivered according to the social and health care district’s normal policies.

226

227

228 **Statistical analysis**

229

230

231 The sample sizes were calculated in proportion to the primary outcome, which was number of
232 days living at home over 24 months. In brief, to detect a difference (α (significance level) 0.05, β
233 (power) 80%) of the hypothesized 180 (SD 431) days between the physical exercise and usual care
234 groups, a sample size of 91 persons in each group would have been needed (simulation-based
235 effect size was 0.40). To allow for discontinuation (estimated as 15%) and death (20%) of
236 participants, our targeted sample size was 300 participants. More detailed description of power
237 calculations is reported elsewhere.^{14,15}

238

239 All analyses were performed based on the intention-to-treat principle. The characteristics of the
240 participants are reported as means with standard deviations (SD), as medians with inter-quartile

241 ranges (IQR) or as counts with percentages. Repeated measurements taken at different
242 assessment points, were analyzed using mixed-effects models with an unstructured covariance
243 structure (Kenward-Roger method to calculate the degrees of freedom). The fixed effects were
244 group, time, and group-time interaction. Mixed models allowed analyses of unbalanced datasets
245 without imputation; therefore, all available data were analyzed with the full analysis set. The
246 Benjamin-Hochberg step-up FDR²⁷ (false discovery rate) was applied to correct the levels of
247 significance for multiple testing in the single FIM items. Poisson regression was used to calculate
248 the incidence rate ratio (IRR) for falls. The Poisson regression model was tested using the
249 goodness-of-fit test of the model, and the assumptions of over dispersion in the Poisson model
250 were tested using the Lagrange multiplier test, and over dispersion was not detected. Normal
251 distributions were evaluated graphically and using the Shapiro–Wilk W test. Stata 16.1^b was used
252 for the analyses.

253

254

255 **RESULTS**

256

257

258 At baseline, the mean age was 82.2 (SD 6.3) years in the exercise group and 82.7 (SD 6.3) in the
259 usual care group. Most of the participants were female (75%), and 61% met 1–2 frailty criteria and
260 39% three or more, 80% of the participants used walking aid (Table 2). Soon after randomization,
261 one participant withdrew and refused use of their data, decreasing the number of participants in
262 the usual care group to 149. One hundred thirty-three participants in the exercise and 127 in the
263 usual care group participated in the assessments at 12 months (Figure 1).

264

265 In the exercise group, attendance of the home-based exercise sessions ranged from three to 104
266 with a median of 96 (IQR 87 to 99). Participation rate over 75% was achieved by 128 participants
267 (85%). The median of other rehabilitation sessions (e.g., physiotherapy, occupational therapy)
268 received from the social and health care district during the intervention year was 0 (IQR 0 to 2) in
269 the exercise group and 1 (0 to 8) in the usual care group.

270

271 In both groups, the mean FIM score deteriorated over the 12 months (group $p=0.014$, time
272 $p<0.001$, interaction $p=0.56$; Figure 2). Overall, in the exercise group, the mean FIM score changed
273 by -4.1 points (95% CI: -5.6 to -2.5) and in the usual care group by -6.9 points (-8.4 to -2.3). When
274 compared with the 12-month change in single FIM motor items (Figure 3), the exercise group
275 performed better in transferring to the bath/shower ($p=0.037$) and walking on stairs ($p=0.036$)
276 than the usual care group, after correcting the levels of significance for multiple testing.

277 In IADL the baseline mean scores were 23 (SD 5) in the exercise and 23 (6) in the usual care group.
278 Over 12 months IADL functions deteriorated in both groups, the mean change was -1.4 points
279 (95% CI: -1.9 to -0.9) in the exercise and -2.1 (-2.6 to -1.6) in the usual care group (group $p=0.095$,
280 time $p<0.001$, interaction $p=0.92$).

281

282 In the SPPB, the mean improvement over 12 months was 1.6 (95% CI: 1.3 to 2.0) points in the
283 exercise group, and 0.01 (-0.3 to 0.3) points, in the usual care group ($p<0.001$) (Figure 2). The mean
284 change in handgrip strength was -0.5 kg (-1.0 to 0.1) in the exercise group and -1.2 kg (-1.7 to -0.6)
285 in the usual care (group $p=0.26$, time $p<0.001$, interaction $p=0.29$).

286

287 At baseline, the participants in the exercise group reported on average 2.2 (95% CI: 1.8 to 2.7) and
288 in the usual care group 2.2 (1.8 to 2.6) weekly physical activity sessions lasting for at least 30
289 minutes at a time. At six months, the exercise group had increased the number of weekly sessions
290 to 3.3 (2.7 to 4.0) and the usual care group to 2.7 (2.2 to 3.2). At 12 months, the number of weekly
291 sessions declined close to baseline level, to 2.5 (1.9 to 3.0) and 2.1 (1.7 to 2.5), respectively (group
292 $p=0.26$, time $p<0.001$, interaction $p=0.32$) (Figure 2).

293

294 During the intervention year, the participants in the exercise group had 1.4 (95% CI: 1.2 to 1.6) and
295 in the usual care group 3.1 (2.8 to 3.4) falls per person-year. The difference between the groups
296 was significant (IRR 0.47 (95% CI: 0.40 to 0.55; $p<0.001$).

297

298

299 **DISCUSSION**

300

301

302 Persons with signs of frailty who participated in a yearlong home-based physical exercise program
303 improved their SPPB more, and they experienced fewer falls than those who received usual care.

304 In both groups, FIM declined over 12 months. However, at 12 months, the physical exercise group
305 had a significantly better FIM score than the usual care group, whereas there was no difference

306 between the groups in handgrip strength or IADL functions. The frequency of self-reported

307 physical activity sessions during leisure time increased in both groups until six months but

308 reverted to baseline level at 12 months, with no significant difference between the groups.

309

310 Over 12 months, all motor and cognitive components of FIM deteriorated in both of our groups.
311 The FIM evaluates a person's need for care in everyday tasks and has mainly been used in
312 inpatient rehabilitation.²¹ We assessed FIM by an interview at the person's home. Only a few
313 other studies have used FIM in outpatient settings among older adults. In two Finnish studies, FIM
314 was used to measure the change over 12 months among older people at risk of
315 institutionalization, (AGE study),²⁸ and people with Alzheimer's disease, (FINALEX study).²⁹ In both
316 studies, FIM deteriorated in the intervention and usual care groups, like in our study, and among
317 the people in the intervention groups, deterioration was slower. The AGE²⁸ and FINALEX²⁹
318 participants were on average a few years younger than those in our sample, and the FINALEX
319 study used a home-based intervention²⁹ similar to ours. Some of our participants might have been
320 unable to improve their FIM scores because of the aids they used at home (e.g., dentures, walking
321 aids, shower handles, raised beds, use of a banister) and which they were unwilling or unable to
322 discard.

323

324 Because SPPB predicts nursing home admissions¹⁹ and all-cause mortality,³⁰ and is a fast and easy
325 way to measure physical performance, it is widely used in clinical practices. In our trial, SPPB
326 improved in the exercise group by 1.6 points over 12 months, which can be considered clinically
327 important. In previous studies a substantially clinical meaningful change in SPPB has been
328 estimated to range from 0.4 to 1.5 points,³¹ and from 0.5 to 1.3 points.³² In community-living older
329 adults with frailty, group-based supervised exercise training of 24 weeks improved their SPPB
330 score by 0.9 points, whereas that of the usual care group deteriorated by 1.5 points.¹⁰ In all these
331 studies^{10,31-33} the participants had better baseline SPPB scores than ours. Among frail nursing
332 home residents³⁴ with a similar SPPB baseline level to ours, a six-month progressive

333 multicomponent group-based exercise intervention improved the mean SPPB score by 1.8 points,
334 whereas the mean score in the control group declined by 0.9 points.

335

336 Another important gain was the smaller number of falls in our exercise group than in the usual
337 care group. We based our intervention on the exercises from the OTAGO exercise program, which
338 effectively reduced the number of falls among community-dwelling older adults.³⁵ An Italian cross-
339 sectional study on older outpatients in a geriatric clinic³⁶ found an association between lower SPPB
340 scores and history of falls. In our trial, no severe complications occurred; only one injurious fall
341 during exercise session needed medical care.

342

343 Our physical exercise intervention included brief counselling on physical activity as
344 physiotherapists encouraged the participants to be active outside the supervised sessions. Even
345 though the usual care group received no counseling, both groups increased their number of
346 physical activity sessions per week in the first half of the trial. However, both groups decreased
347 back to baseline level in the later half.

348

349 Training with the physiotherapists at home enabled people also in rural areas to participate in our
350 study. Adherence to home-based programs has been better than in center-based programs,³⁷ as
351 older adults prefer activities close to home.¹² Furthermore, the effects of supervised home-based
352 training on strength and functional ability have been greater,^{38,39} and the intensity of the sessions
353 can be higher⁴⁰ than in training without supervision. In our trial, supervision meant higher
354 intervention expenses, but in the subgroup of frail participants, there was a decrease in total costs
355 of social and health care services over 24 months compared to the frail participants in the usual
356 care.¹⁵

357

358 As a strength, our study was a rigorously performed RCT with good compliance. Furthermore, our
359 sample was identified as frail or pre-frail at baseline⁴¹ based on two validated frailty
360 assessments.^{6,16} We also used validated measurements to assess functioning and physical
361 performance, and the proportion of missing measurements during the intervention year was very
362 low (13% at 12 months).

363

364

365 **Study limitations**

366

367 Falls and physical activity were self-reported, which is more unreliable than diaries⁴² and objective
368 measurements.⁴³ Our validated questions²⁴ included only frequencies of physical activities lasting
369 over 30 minutes but neither intensity nor exact duration. Therefore, our findings regarding falls
370 and physical activity are only indicative and need to be interpreted with caution. In addition, the
371 assessors were not blinded to the allocation status of the participants.

372

373

374 **CONCLUSION**

375

376

377 In conclusion, among people with signs of frailty, 12-month supervised, home-based exercise
378 improved SPPB and decreased the number of falls. At 12 months, the physical exercise group had
379 a better FIM than the usual care group, but there was no difference in IADL or handgrip strength
380 between the groups. Supervised exercise did not enhance physical activity during leisure time.

381 **SUPPLIERS**382 ^aSaehan, model Sh5001, South Korea383 ^b Stata 16.1, StataCorp LP, College Station, TX, USA

384

385

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509

510 **Figures and tables**

511

512

513 **Figure 1.** Flowchart of participants in randomized clinical trial. Numbers of participants.

514

515 **Figure 2.** Mean changes in Functional Independence Measure (FIM) (A), and in Short Physical
516 Performance Battery (SPPB) (B), and mean weekly frequency of physical activity sessions (C) in
517 physical exercise and usual care groups over 12 months. Whiskers denote 95% confidence
518 intervals.

519

520 **Figure 3.** Mean changes in FIM items in the physical exercise and usual care groups from 0 to 12
521 months. Whiskers denote 95% confidence intervals. Benjamin-Hochberg step-up false discovery
522 rate was applied to correct levels of significance for multiple testing in single FIM items.

523

524 **Table 1.** Contents of one 60-minute physical exercise session, supervised by physiotherapist.

525

526 **Table 2.** Baseline characteristics of participants in physical exercise and usual care groups. Means
527 (SD) and frequencies (%).

528 **Table 1.** Contents of one 60-minute physical exercise session, supervised by a physiotherapist.

| | Warm-up exercises | Resistance training | Balance training | Flexibility training | Functional exercises | Counseling |
|---------------------------|---|--|--|--|--|--|
| Duration | 5–10 minutes | 30–40 minutes | 5–10 minutes | 5–10 minutes | 5–10 minutes | Individual |
| Main exercises | Walking, chair exercises, stationary cycling | Focus on lower limbs, main exercises based on Otago program. ⁴⁴ Exercises included e.g., knee extension, knee flexion, hip abduction, calf raises, toe raises. Upper limbs: no specific movements assigned. | Static, dynamic, and dual task exercises based on Otago program ⁴⁴ , e.g., tandem stand, squats, walking in various directions. | Stretching, reaching | Tasks of IADL* such as climbing stairs, washing dishes, handling laundry, piling firewood, walking outside, grocery shopping | Nutrition: energy intake, protein intake, meal pattern, fluid intake Physical activity counseling and encouragement |
| Intensity | Low to moderate | Moderate to vigorous | Moderate | Low | Moderate to vigorous | Individual |
| RPE †²⁶ | 10–12 | 12–17 | 12–14 | 10–11 | 12–17 | |
| Progression | Longer distance or more challenging terrain, or e.g., higher resistance in the stationary cycle | Increasing the number of sets, repetitions, and resistance with ankle weights to match the targeted RPE and the phase of the training cycle: 1 st mo. ‡ getting used to exercises; 2 nd to 3 rd mo. strength (sets 2–5, reps [§] . 8–12, 60-80% of maximum muscle strength according to multiple RM-test ⁴⁵); 4 th to 6 th mo. power (sets 3–5, reps 4–10, 20-60%); 7 th to 9 th mo. endurance (sets 2-3, reps. 12-30, 20-60%); 10 th to 12 th mo. strength/power. | More challenging surfaces and tasks to challenge the participant's balance. Starting from static exercises, progressing to dynamic and dual-task exercises | Larger range of motion | Advancing to more challenging tasks and combined with strength and balance training | From broad and general to the more specific |
| Accessories | Walking aid (if needed), fitness equipment e.g., stationary bike | Resistance with ankle weights from 0.5 kg to 10 kg, dumbbells, kettlebells, rubber bands | Balance pads, different types of floor surfaces, outdoor environment | Stick | Natural home environment | Pamphlets and booklets |
| Goal | To warm-up and prepare the body before other exercises | To increase the strength of lower limbs and to enhance physical performance | To challenge individual balance abilities, to prevent falls | To enlarge the range of motion in large joints to maintain ADL | To support individual abilities to live independently at home | To provide knowledge and motivate to follow nutrition and exercise guidelines |

529 *IADL, Activities of Daily Living; † RPE, Ratings of Perceived Exertion²⁶; ‡ mo., month(s); § reps., repetitions; || ADL, Activities of Daily Living

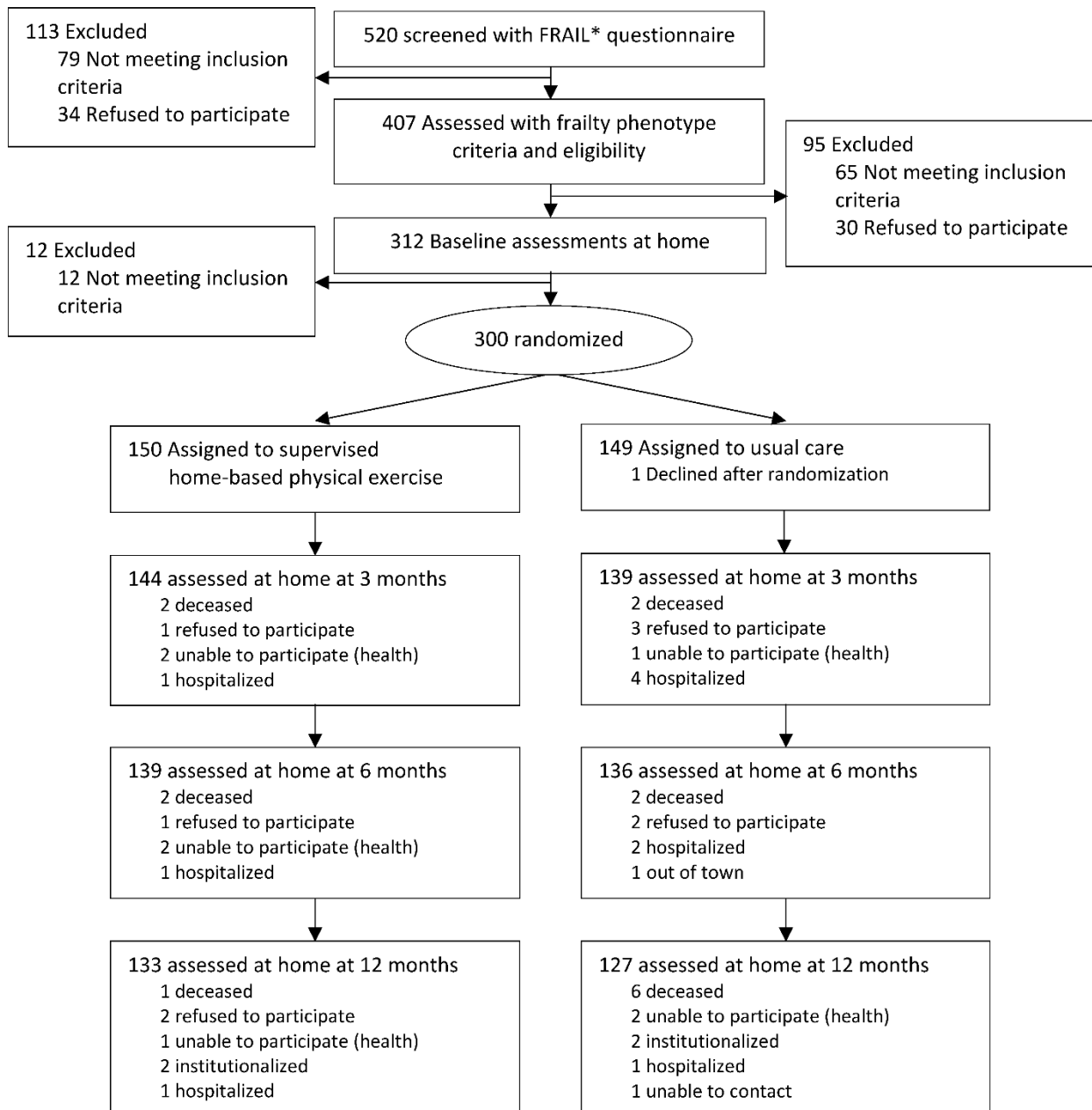
530 **Table 2.** Baseline characteristics of participants in physical exercise and usual care groups. Means
 531 (SD) and frequencies (%).

| Characteristic | Physical exercise (n=150) | | Usual care (n=149) | |
|---|------------------------------|-------|--------------------------|-------|
| Age (years), mean (SD) | 82.2 | (6.3) | 82.7 | (6.3) |
| Women, n (%) | 114 | (76) | 110 | (74) |
| Number of frailty criteria ^a , n (%) | | | | |
| 1 | 44 | (29) | 48 | (32) |
| 2 | 48 | (32) | 44 | (30) |
| 3 | 40 | (27) | 42 | (28) |
| 4 | 13 | (9) | 13 | (9) |
| 5 | 5 | (3) | 2 | (1) |
| Mini-Mental State Examination (MMSE) ^b , mean (SD) | 24.2 | (3.1) | 24.6 | (3.2) |
| Functional Independence Measure (FIM) ^c , mean (SD) | 109 | (10) | 109 | (11) |
| Instrumental Activities of Daily Living (IADL) ^d , mean (SD) | 23 | (5) | 23 | (6) |
| Short Physical Performance Battery (SPPB) ^e , mean (SD) | 6.1 | (2.7) | 6.3 | (2.5) |
| Handgrip strength ^f (kg), mean (SD) | 18.9 | (7.8) | 19.7 | (7.8) |
| Living alone, n (%) | 88 | (59) | 86 | (58) |
| Walking aids, n (%) | 122 | (81) | 117 | (79) |
| Number of regular medications, mean (SD) | 6.7 | (3.2) | 7.0 | (3.1) |

532 **Note.** ^a According to modified Fried et al.'s⁴ phenotype criteria; ^b Points range from 0 to 30, a higher value indicating
 533 better cognition; ^c Points range from 18 to 126, a higher score indicating better functional independence; ^d Reported
 534 as an item sum, (points range from 8 to 31); a higher score indicates better functioning; ^e Scores range from 0 to 12, a
 535 higher score indicates better performance; ^f Mean of best values of both hands.

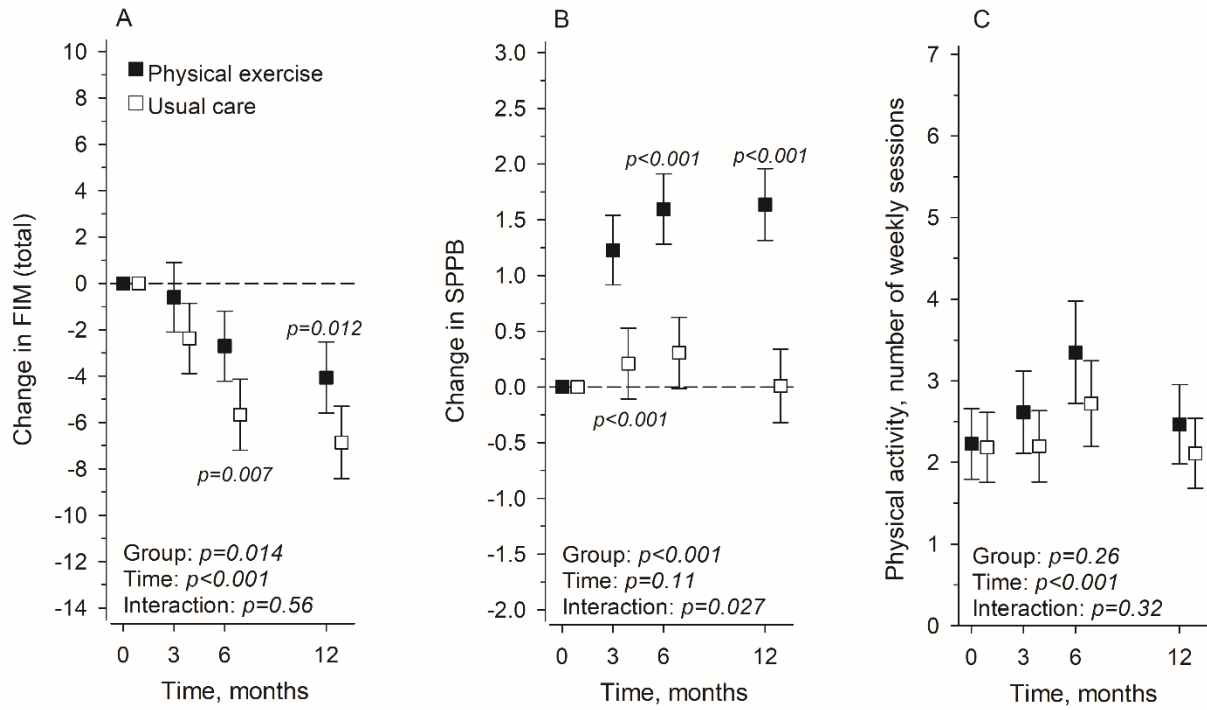
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538 **Figure 1.** Flowchart of participants in randomized clinical trial. Numbers of participants.

* FRAIL Fatigue, Resistance, Ambulation, Illnesses, Loss of weight

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 541 Performance Battery (SPPB) (B), and mean weekly frequency of physical activity sessions (C) in
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546 **Figure 3.** Mean changes in FIM items in the physical exercise and usual care groups from 0 to 12
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