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End-Of-Life Care : A Randomized Controlled Trial

Lamppu, Pauli J.

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Title: Effects of staff training on nursing home residents' end-of-life care – a randomized controlled trial

1 Abstract

Objectives: This trial examines the effects of end-of-life training on long-term care facility (LTCF) residents' health-related quality of life (HRQoL) and use and costs of hospital services.

Design: A single-blind, cluster randomized (at facility level) controlled trial (RCT). Our training intervention included four small-group four-hour educational sessions on the principles of palliative and end-of-life care (advance care planning, adverse effects of hospitalizations, symptom management, communication, supporting proxies, challenging situations). Training was provided to all members of staff. Education was based on constructive learning methods and included resident cases, role plays, and small-group discussions.

Setting and participants: We recruited 324 residents with possible need for end-of-life care due to advanced illness from 20 LTCF wards in Helsinki.

Methods: Primary outcome measures were HRQoL and hospital inpatient days per person-year during a two-year follow-up. Secondary outcomes were number of emergency department visits and cost of all hospital services.

Results: HRQoL according to the 15D instrument declined in both groups, and no difference was present in the changes between the groups (p for group 0.75, adjusted for age, sex, do-not-resuscitate orders, need for help, and clustering). Neither the number of hospital inpatient days (1.87 vs. 0.81 per person-year) nor the number of emergency department visits differed significantly between intervention and control groups (p for group 0.41). The total hospital costs were similar in the intervention and control groups.

23   **Conclusions and Implications:** Our rigorous RCT on end-of-life care training intervention

24   demonstrated no effects on residents' HRQoL or their use of hospitals. Unsupported training

25   interventions alone might be insufficient to produce meaningful care quality improvements.

Introduction

Older people in long-term care facilities (LTCFs) are living the last years of their lives.[1] Staff in nursing homes (NHs) and assisted living facilities (ALFs) therefore have a prominent role in older people's palliative and end-of-life care.[2] LTCF staff with a lower educational level and high turn-over often have a need for training, which has been recognized in various development projects.[3–5]

Staff in LTCFs are required to master many competencies and practical skills to deliver good-quality end-of-life care. These include advance care planning (ACP), communication skills with residents and their proxies, and adequate symptom care. Staff should also be aware of the adverse effects of hospitalizations and have the necessary skills and resources to treat certain acute scenarios without hospitalization.[6,7] Admissions to hospitals may lead to functional decline, falls, use of restraints, delirium, infections, pressure ulcers, and decreased comfort without any survival benefit.[8,9] Furthermore, previous studies have shown that care transitions and hospitalizations towards the end of life are very common among residents and pose a major challenge for continuity and quality of care in LTCFs.[10]

Promoting ACP seems to decrease the need for hospital care and is associated with a reduction in emotional symptoms related to dying.[11] However, few studies have been conducted in LTCFs.[3] In some studies, educational interventions focusing on end-of-life care and ACP targeted at LTCF staff may enhance the completion of advance directives and discussions on end-of life care. However, most studies have reported on surrogate outcomes, such as improved staff knowledge, rather than resident-related outcomes.[12]

In recent years, several trials have explored the effects of staff training on residents' burdensome hospitalizations, showing no significant impact.[7,13–15] In addition, some trials

49   have reported no significant effects on residents' quality of life (QoL),[14,16,17] whereas others

50   have found minor effects.[18] The mentioned trials include staff training as part of a

51   multicomponent intervention but the role and type of training are mostly poorly

52   characterized. To our knowledge, there have been no trials using constructivist learning

53   theory and modern learner-centered training approaches to improve end-of-life care. Modern

54   adult-learning theory considers active learning environments, where learners regulate their

55   goals and set aims for development, to be critical to motivation and long-term learning.[19] This

56   kind of self-regulation and competency development is unlikely if the goals of learning –

57   adopting new care processes in the facilities – are predetermined by the research team.

58

59   We performed a cluster randomized controlled trial in LTCFs and investigated whether a

60   learner-centered staff training in palliative and end-of-life care would benefit residents'

61   health-related quality of life (HRQoL) or reduce their hospital days in a two-year follow-up.

62   In addition, we counted and compared the emergency department visits and costs of all

63   hospital use in both arms.

Methods

64

65   The Ethics Committee of Helsinki University Central Hospital approved the trial.

66   Participating residents and their closest proxies gave their informed consent. In cases of

67   moderate to severe dementia, a proxy gave consent on behalf of the resident. We registered

68   the trial in the Australian New Zealand Clinical Trials Registry: ACTRN12617001040358.

69   *Study design and participants*

70   The design, recruitment of participants, intervention, outcome measures, and baseline

71   findings have been presented in detail previously.[20] Briefly, this is a single-blinded cluster

72   randomized trial in which LTCFs in Helsinki were randomized into two groups; the staff in

73   the intervention group received training in palliative and end-of-life care over four

74   afternoons, whereas for the staff in the control wards the same training was provided after the

75   trial.

76   ALFs in Finland are similar in their case-mix to NHs. Both LTCFs provide round-the-clock

77   care with a registered nurse being in charge of the ward. Most direct care work in the

78   facilities is carried out by licensed practical nurses (2-3 years of nursing education) and

79   registered nurses (3-4 years nursing education). Physicians mainly act in a consulting role.

80   ALFs are more home-like and often provide service for people with dementia needing more

81   assistance in ADL. [21] Both settings typically take care of their residents until death. Both

82   ALFs and NHs can utilize local hospital-at-home type services for more intensive care needs.

83   *Randomization*

84   NH and ALF wards were assessed using RAI (Resident Assessment Instrument)

85   measurement data from MDS (Minimum Data Set). The RAI is an internationally widely

86   used assessment tool. It is mandatory to be completed at regular intervals for all residents in

87   our settings .[22] The following items from MDS data were used for pair-matching of wards:

88   sex, age, any degenerative brain disease, cancer, CPS = 5-6 (poor cognition), ADLh = 5-6

89   (major difficulties in Activities of Daily Living), CHESS > 0 (instability of health

90   indicators), proportion of hospitalized and with emergency department visits without

91   hospitalization within three months. Entire facilities with wards of a similar case-mix were

92   paired and then one was randomly assigned to the intervention group and the other to the

93 control group. One pair was formed of two smaller NHs against one large NH. We used

94 computer-generated randomization numbers received by telephone from a randomization

95 center.

96 *Participants*

97 We aimed to include residents with poor prognosis most likely to benefit from avoidance of

98 hospitalizations. Inclusion criteria for participation were as follows:

99 1) Being a permanent resident in a LTCF managed by the City of Helsinki.

100 2) Having a severe disease or condition that was likely to have a prognosis of less than 12

101 months (severe dementia, cancer, heart failure, COPD, renal failure, severe disability, or

102 other terminal disease).

103 3) Being Finnish-speaking.

104 *Intervention*

105 The intervention training was designed and modified according to a training-needs survey

106 from intervention wards. In line with adult learning theories, we assumed that the participants

107 would be best motivated if they felt that the topics were relevant to them and were based on

108 their experiences.[23,24] Registered nurses, licensed practical nurses, and physicians in the

109 intervention group took part in four afternoon training sessions in small groups. The session

110 topics covered the basics of good palliative care, advance care planning and discussing these

111 issues with residents and their relatives, good symptom management, adverse effects of

112 hospitalizations, communication skills, tailoring end-of-life care, supporting relatives, and

113 confronting challenging situations in end-of-life care.[25,26] The sessions included plenty of

114 learners' own cases and problems related to care. Training applied learning methodology

115 from constructive learning theory, learner-centered learning and reflective learning,[27]

116 particularly resident cases, role plays, reflections, and small-group discussions.[24] The

117   constructivist learning theory states that groups of learners should face complex, ill-defined

118   questions and set their own aims and goals for building knowledge and skills.[19] We aimed to

119   provide learners with new competencies rather than mere knowledge.[28] Thus, unlike most

120   previous interventions, our training did not define precise new practices or tools to be

121   implemented in the facilities, although many possible tools, practices, and attitudes were

122   handled in the sessions. A geriatrician (KP, ML, JL, or HF) with long experience working

123   and conducting research in both LTCFs and palliative care led each session.

124   *Measures*

125   Trained research nurses were responsible for all assessments. They were blind to the group

126   allocation.

127   Demographic data (age, sex, and education), diagnoses, and medication use were retrieved

128   from medical records. Charlson comorbidity index was computed from active diagnoses as

129   described elsewhere.[29] The number of regularly used medications was counted and

130   medications used for pain (opioids (ATC:N02A), paracetamol (N02BE01), selective and

131   nonselective nonsteroidal anti-inflammatory drugs (M01A)) were registered.[30] The probable

132   prognosis for the residents was assessed according to the diagnoses, malnutrition, and

133   disability. We evaluated the most severe terminal condition for each participating resident.

134   Severe dementia was determined as a score of 3 in the Clinical Dementia Rating (CDR) scale

135   [31] and a score of <11 points in the Mini-Mental State Examination (MMSE)[32]. Nutritional

136   status was assessed with the Mini Nutritional Assessment (MNA), with <17 points indicating

137   malnutrition, 17-23.5 points at-risk of malnutrition, and >23.5 points well-nourished.[33]

138   Needing assistance in activities of daily living was defined as CDR scale 'personal care'

139   score ≥2. Advance directives (ADs), such as "Do-not-resuscitate" (DNR) orders, and

140 documented ACP discussions were retrieved from medical records at baseline and at follow-

141 up assessments.

142 We used the 15D instrument to measure health-related quality of life (HRQoL).[34] It evaluates

143 15 different dimensions of HRQoL to construct an index between 0 and 1, with larger values

144 representing better HRQoL. The dimensions include mobility, sight, hearing, breathing,

145 sleeping, eating, excretion, usual activities, mental function, discomfort and symptoms,

146 anxiety, depression, vitality, and sexual activity. The dimension sexual activity had numerous

147 missing values. Therefore, we imputed all of them by the lowest value. 15D can be used both

148 as a profile measure and as a single index.[31] It has a good discriminatory validity and

149 excellent reliability. It also correlates well with other HRQoL instruments such as SF-36, EQ-

150 5, and HUI. It has also shown good sensitivity to change in response to interventions in older

151 populations.[1] 15D can be either reported by the resident or completed by proxy.[34] Since most

152 of our residents suffered from moderate-severe dementia, about four in five 15Ds were

153 completed by proxy. The instrument is sensitive to change in NH settings.[1] The follow-up

154 assessments for 15D were performed at 6, 12, and 24 months from the intervention.

155 Participants were followed up prospectively for two years or until death regarding emergency

156 department (ED) visits, hospital inpatient days, and hospital-at-home service use. Service use

157 was retrieved from medical records. Service costs were determined at their mean unit costs

158 according to the national cost registers from 2011,[35] with an appropriate correction for

159 inflation rate. All costs were calculated in Euros (€) and transformed to 2020 rates.

160 *Primary and secondary outcome measures*

161 The primary outcome measures were change in HRQoL according to the 15D instrument and

162 the number of hospital days during 24 months from baseline or until participant's death.

163 Secondary outcome measures included the number of ED admissions and total hospital costs

164   during the 24-month follow-up. We also report how the number of residents with documented

165   DNR orders and ACP discussions changed during the follow-up.

166   *Statistical analysis*

167   The power calculation was based on the 15D measure (HRQoL). The sample size was

168   calculated with the assumption of detecting a clinically significant difference of 0.04 in 15D

169   scores between the intervention and control groups. With an estimated standard deviation of

170   0.01, a type I error of 0.05, and power of 80%, 120 residents were needed in each group. Our

171   power calculation hypothesized a 20% drop-out, and therefore, we aimed to recruit at least

172   150 participants in each group.

173   We used the t-test, Chi-square test, or Fischer exact test to make statistical comparisons

174   between the groups. In cases of violation of the assumptions (e.g. non-normality), we used a

175   bootstrap-type test. Repeated measures of the changes in primary outcomes were compared

176   between the intervention and control groups with multilevel mixed-effects generalized linear

177   models with appropriate distribution and link function, assuming data were missing at

178   random. Fixed effects included the group, time and group x time interactions.

179   Because cost and hospital days data were skewed, we used a bootstrap-type method (10 000

180   replications) to estimate standard error; confidence intervals (CIs) were obtained by bias-

181   corrected bootstrapping. The models accounted for clustered data by random effect modeling

182   with an unstructured covariance pattern. Secondary outcome measures included the number

183   of emergency department admissions analyzed by using Poisson's model with cluster-robust

184   standard errors. Cost analyses were performed using a generalized linear regression model

185   with log link and gamma variance functions. The variance function was selected based on the

186   Park test and Akaike's information criterion. Survival in the groups was computed using the

187   Kaplan-Meier method and compared using the log-rank test. Normal distributions were

188   evaluated graphically and with the Shapiro–Wilk W-test. All analyses were performed with

189   Stata 16.1 (StataCorp LP; College Station, TX, USA).

Results

190

191   There were 494 residents in all LTCFs at the start of the recruitment process on 1 September

192   2017. Baseline information for both study groups, altogether 340 potential participants, was

193   assessed in fall 2018. After randomization, our intervention group consisted of 159 residents

194   and the control group 181 residents living in 20 NHs and ALF wards. Altogether 16 residents

195   were deceased before completion of the intervention on 15 November 2018 in NH wards and

196   on 15 January 2019 in ALF wards and were therefore excluded from analyses. More details

197   are provided in *Appendix 1*.

198   *Baseline findings*

199   The mean age of residents was 84 years and 75% were women. There were no significant

200   differences between the two groups in educational background, burden of comorbidities,

201   proportions of inclusion criteria terminal conditions, mean number of medications, use of

202   pain medications, MMSE scores, CDR or MNA. However, at baseline there were more

203   residents with a DNR order in their medical charts in the control group than in the

204   intervention group (95% vs. 68%, $p<0.001$). Furthermore, those in the control group were

205   slightly more dependent in their ADL functioning ("need for help") than those in the

206   intervention group, see *Table 1*.

207   *Intervention effects*

208   HRQoL measured by the 15D instrument declined in both groups and no intervention effects

209   were observed between the groups during the 24 months (p for time <0.001, group 0.42,

210   interaction 0.41; adjusted for age, sex, DNR order, need for help, and clustering) (*Figure 1*).

211   Hospital inpatient days did not differ between the groups. Intervention group mean was 1.87

212   days/person/year (SE 0.09) vs. control group mean 0.81 days/person/year (SE 0.06), resulting

213   in an incidence rate ratio (IRR) of 2.01 (95% CI 0.75 to 5.44, adjusted for age, sex, DNR

214   order, need for help, and clustering). There was no difference in the mean number of ED

215   visits: intervention group 0.72 visits/person/year (SE 0.06) and control group 0.56

216   visits/person/year (SE 0.05), IRR 1.27 (95% CI 0.39 to 4.14, adjusted for age, sex, DNR

217   order, need for help, and clustering). See *Table 2*.

218   The mean total service costs in the intervention group (including specialized hospital days,

219   rehabilitation hospital days, ambulatory visits to hospitals, and ED visits) were 1748

220   €/person/year compared with 941€/person/year in the control group (ratio 1.74; 95% CI 0.86

221   to 3.15, adjusted for age, sex, DNR order, need for help, and clustering). The costs of

222   hospital-at-home were 314.7€ (SE 89.6) in the intervention group and 129.1€ (SE 38.4) in the

223   control group (mean ratio 3.83; 95% CI 0.88 to 8.30, adjusted for age, sex, DNR order, need

224   for help, and clustering).

225   Of intervention participants, 72% had undergone ACP discussions at baseline, whereas the

226   corresponding figure for the control participants was 78%. At 12 months, 99% of the

227   intervention participants and 92 % of controls had had an ACP discussion. The proportion of

228   residents with DNR orders in the control group was already very high (95%) at baseline and

229   it increased to 100% at 12 months. The corresponding figures for the intervention group were

230   68% and 94%.

231   No difference in mortality existed between the groups. Of the intervention participants, 48%

232   were alive at two years compared with 53% in the control group (p=0.23, log rank test).

233   Since there was a trend that the intervention arm had more use of hospital services and higher

234   costs, we further explored the hospital costs across different sites. One intervention site

235   differed significantly in hospital use from other sites (*Figure 2*).

Discussion

237 Our intervention showed no effects on HRQoL in the intervention group compared with the

238 control group. Nor were differences present in hospital days or emergency department visits

239 between the intervention and control arms. The total hospital costs were also similar in the

240 intervention and control arms. One study site in the intervention arm had higher costs than the

241 others.

242 Our study has several strengths. It was a rigorous, single-blind randomized controlled trial

243 with a typical LTCF population and a long-term follow-up. Education concerning palliative

244 and end-of-life care issues is urgently needed in LTCFs. However, few previous educational

245 trials report resident-related outcomes. Furthermore, economic analyses are rare in these

246 trials. Our outcomes are valid and the collection of hospital-related outcomes was 100%

247 complete. The intervention was clear, well described,[20] and based on modern and theoretical

248 learning methods.[24] To our knowledge, this is the first educational trial consciously using

249 constructive learning theory and adult education theory to improve end-of-life care in this

250 setting. This approach, including learner-centered training, activating learning methods and

251 reflection, has been shown to result in effective learning in adult education in the medical

252 field.[1,24] Lack of specified implementation aims allowed the staff members to set their own

253 learning aims for quality improvement and care process change, enabling better motivation

254 and deeper learning. We managed to train 74% of the staff and all physicians in our

255 intervention wards. Most participated in all sessions. The training raised enthusiasm and

256 awareness among the trainees.[20] Decision-making in NHs on end-of-life care has been shown

257 to be based only to some extent on factual knowledge and to be strongly based on the

258 attitudes and the culture of the working environment.[36–38] Therefore, the trial included

259 emotion-evoking components and participants' reflection in the training. To prevent

260   contamination of the intervention, we randomized the participants in facility clusters. This

261   design allowed us to pair-match the wards according to case-mix. Two thoroughly trained

262   and experienced research nurses blinded to the group assignment gathered the data to ensure

263   reliability.

264   Some limitations also warrant mention. The number of clusters in our trial was small. Even

265   though we pair-matched all wards, there were differences between the intervention and

266   control groups. We adjusted for these in our analyses. An increase has occurred in

267   development projects in palliative care and advance care planning in Finnish LTCFs. At least

268   one ALF in the control arm had been involved in another palliative care project with goals

269   similar to ours. This may have diluted the effect of our intervention and caused some of the

270   unbalanced baseline findings. Thus, the difference in DNR orders between the intervention

271   and control groups could well reflect previous educational interventions. High staff turnover

272   likely had a diluting effect on our intervention. It is possible that the chosen learner-centered

273   approach was too demanding in this short intervention. While we allowed freedom for

274   learners to choose the care process changes, implementing these changes might have

275   benefitted from re-enforcement during follow-up. Furthermore, we emphasized measuring

276   resident-related outcomes. However, a qualitative study examining the changes in staff's

277   attitudes and competencies might have given more insight into the learning processes and

278   attitude changes.

279   Another limitation is that the intervention did not provide the facilities with any additional

280   resources. We wanted the intervention to be feasible and transferable into practice in real-life

281   settings. However, this might have compromised its effectiveness. Interventionists were not

282   present in the wards after the initial training. Thus, the trial did not include possibilities to re-

283   train the staff or to support cultural changes that might have had an impact on resident

284   outcomes. All intervention sessions included non-formal audits by a second study team

285   member to assess fidelity to the learner-centered approach. We observed occasional

286   difficulties in assuring all participants' active participation in the discussions and some need

287   for additional facilitation through role-plays to overcome initial resistance. It is not possible

288   to clarify whether inadequacies in training contents, the chosen learner-centered approach,

289   lack of support for implementation or the exclusion of other important intervention

290   components are the reason for the lack of effect. Finally, participants in trials tend to have

291   better functioning and prognosis than real-life populations,[14,39] and it is also likely that

292   residents and families with difficult relationships with the staff in LTCFs were more prone to

293   decline participation.

294   Apparently, the caring culture and attitudes of staff are very difficult to change.[40] This was

295   also seen in our trial, where one ALF was many times more likely to admit residents to

296   hospitals. The resident characteristics at baseline according to MDS were similar with respect

297   to hospitalizations, but we were not prepared for the fact that the caring culture differed

298   between the facilities. We noted in our training sessions that the staff in this particular ALF

299   was reluctant to care for acute situations. In their small-group discussions, it was stated that

300   the staff cannot take responsibility for a resident dying in the ALF, whereas most staff

301   members in other study sites viewed death as a natural part of residents' life course. In the

302   limited scope of these training sessions, these beliefs and attitudes could not be sufficiently

303   challenged. Previous research suggest that staff are more likely to favor hospitalization if

304   there is inadequate possibilities for physician consultation or when fear of legal consequences

305   drives actions.[37]

306   Our findings are in line with previous trials.[41] According to many educational intervention

307   trials, it is difficult to affect quality of life,[14,16] change the practice of admitting long-term

308 residents to the emergency department[7,13,15,42] or reduce hospital inpatient days.[43]

309 Summarizing earlier evidence[20], there might be two promising ways to reduce burdensome

310 hospitalizations: promoting ACP[44,45] and providing specialist palliative care support to

311 facilities[46]. Successful ACP promotion has been achieved by employing a nurse especially for

312 this purpose[45] or with the help of a ACP video decision-aide together with formalized

313 conversion instructions to staff[44]. ACP discussion activity was high in both our intervention

314 and control arms, and it markedly increased during the follow-up year. However, this did not

315 have an impact on hospital use. External palliative specialist nurse consulting on selected

316 residents might reduce hospitalizations and improve quality of dying.[46] Therefore, future

317 training interventions should provide also residents and families with information about ACP

318 and equip facilities with the possibility for palliative care specialist consultation.[18,44,46]

319 Our trial, although not attaining its original goals, suggests some considerations for future

320 interventions. Firstly, if only the residents with the shortest prognosis and greatest needs for

321 EOL care are targeted, the inclusion criteria should be developed further. The mean length of

322 stay before death among residents in these settings was known to be only two years, and the

323 inclusion criteria in our study were set such that only those with the poorest prognosis were

324 included. Unexpectedly, only one in four residents died during the first follow-up year. Other

325 trials have had similar surprises.[14] Furthermore, the training should note the different learning

326 needs of different occupational groups such as physicians who have an important role in

327 decisions about hospitalization and symptom management. The intervention could benefit

328 from emphasizing components with the strongest evidence e.g. promoting ACP discussions

329 and involving residents and families in shared decision-making.[41,44,45] Concepts such as "end-

330 of-life" should be discussed thoroughly with the staff to reach a consensus on their meanings.

331 Finally, the choice of QoL measure should be suited to this frail population. While the 15D

332 has shown sensitivity to change in response to interventions in previous studies,[1] it might not

333   be suitable for this very frail, cognitively impaired population. Moreover, such dimensions as

334   mobility, speech, vision, or hearing are not likely to be modified by any kind of EOL care

335   intervention. The use of dementia-specific QoL indicators or palliative care quality measures

336   should be considered in future studies.

337   Many LTCFs suffer from high staff and management turnover rates, hindering long-term

338   development efforts. There are competing practical and economic interests in developing care

339   quality. Low organizational support, high training attrition rates, and poor resources to

340   organize care were often seen in larger high-quality trials.[7,17] Alongside skills training and

341   quality initiatives, more political will to ensure proper financial and staff resources is

342   paramount in achieving quality care for LTCF residents. Thus, education is important but not

343   in itself sufficient to change care practices.

344   Conclusions and Implications

345   An intervention based on constructive learner-centered methods, adult education, and

346   reflective learning did not produce significant changes in practice in LTCFs. HRQoL,

347   hospital days, emergency department visits, and costs of hospital care did not differ between

348   the intervention and control wards. Educational interventions in end-of-life care are important

349   in LTCFs but unsupported might be insufficient to produce clinically meaningful changes in

350   care practices.

References

1. Pitkala KH, Juola AL, Kautiainen H, et al. Education to reduce potentially harmful medication use among residents of assisted living facilities: a randomized controlled trial. *Journal of the American Medical Directors Association*. 2014;15(12):892-898. doi:10.1016/j.jamda.2014.04.002 [doi]

2. Froggatt KA, Moore DC, Van den Block L, et al. Palliative Care Implementation in Long-Term Care Facilities: European Association for Palliative Care White Paper. *Journal of the American Medical Directors Association*. 2020;21(8):1051-1057. doi:10.1016/j.jamda.2020.01.009

3. Flo E, Husebo BS, Bruusgaard P, et al. A review of the implementation and research strategies of advance care planning in nursing homes. *BMC geriatrics*. 2016;16:4. doi:10.1186/s12877-016-0179-4 [doi]

4. Gonella S, Basso I, Dimonte V, et al. Association Between End-of-Life Conversations in Nursing Homes and End-of-Life Care Outcomes: A Systematic Review and Meta-analysis. *Journal of the American Medical Directors Association*. 2019;20(3):249-261. doi:10.1016/j.jamda.2018.10.001

5. Rolland Y, Aquino J-P, Andrieu S, et al. IAGG Workshop: Identification of the main domains for quality of care and clinical research in nursing homes. *J Nutr Health Aging*. 2011;15(5):410-424. doi:10.1007/s12603-011-0091-8

6. Ouslander JG, Perloe M, Givens JH, Kluge L, Rutland T, Lamb G. Reducing Potentially Avoidable Hospitalizations of Nursing Home Residents: Results of a Pilot Quality Improvement Project. *Journal of the American Medical Directors Association*. 2009;10(9):644-652. doi:10.1016/j.jamda.2009.07.001

7. Kane RL, Huckfeldt P, Tappen R, et al. Effects of an Intervention to Reduce Hospitalizations From Nursing Homes. *JAMA Internal Medicine*. 2017;177(9):1257. doi:10.1001/jamainternmed.2017.2657

8. Gozalo P, Teno JM, Mitchell SL, et al. End-of-life transitions among nursing home residents with cognitive issues. *New England Journal of Medicine*. 2011;365(13):1212-1221. doi://dx.doi.org/10.1056/NEJMsa1100347

9. Dwyer R, Gabbe B, Stoelwinder JU, Lowthian J. A systematic review of outcomes following emergency transfer to hospital for residents of aged care facilities. *Age and Ageing*. 2014;43(6):759-766. doi:10.1093/ageing/afu117

10. Aaltonen M, Raitanen J, Forma L, Pulkki J, Rissanen P, Jylha M. Burdensome transitions at the end of life among long-term care residents with dementia. *Journal of the American Medical Directors Association*. 2014;15(9):643-648. doi:10.1016/j.jamda.2014.04.018 [doi]

11. Vandervoort A, Houttekier D, Stichele RV, Steen JT van der, Block LV den. Quality of Dying in Nursing Home Residents Dying with Dementia: Does Advanced Care Planning Matter? A Nationwide Postmortem Study. *PLOS ONE*. 2014;9(3):e91130. doi:10.1371/journal.pone.0091130

12. Anstey S, Powell T, Coles B, Hale R, Gould D. Education and training to enhance end-of-life care for nursing home staff: a systematic literature review. *BMJ Supportive & Palliative Care*. 2016;6(3):353-361. doi:10.1136/bmjspcare-2015-000956

13. Connolly MJ, Boyd MNP, Broad JBBA, et al. The Aged Residential Care Healthcare Utilization Study (ARCHUS): A Multidisciplinary, Cluster Randomized Controlled Trial Designed to Reduce Acute Avoidable Hospitalizations From Long-Term Care Facilities.

Journal of the American Medical Directors Association. 2015;16(1):49-55. doi:10.1016/j.jamda.2014.07.008

14. Agar M, Luckett T, Luscombe G, et al. Effects of facilitated family case conferencing for advanced dementia: A cluster randomised clinical trial. *PLOS ONE*. 2017;12(8):e0181020. doi:10.1371/journal.pone.0181020

15. Arendts G, Deans P, O'Brien K, et al. A clinical trial of nurse practitioner care in residential aged care facilities. *Archives of Gerontology and Geriatrics*. 2018;77:129-132. doi:10.1016/j.archger.2018.05.001

16. Husebø BS, Ballard C, Aarsland D, et al. The Effect of a Multicomponent Intervention on Quality of Life in Residents of Nursing Homes: A Randomized Controlled Trial (COSMOS). *Journal of the American Medical Directors Association*. 2019;20(3):330-339. doi:10.1016/j.jamda.2018.11.006

17. Van den Block L, Honinx E, Pivodic L, et al. Evaluation of a Palliative Care Program for Nursing Homes in 7 Countries: The PACE Cluster-Randomized Clinical Trial. *JAMA Intern Med*. Published online November 11, 2019:1-10. doi:10.1001/jamainternmed.2019.5349

18. Liu W, Koerner J, Lam L, et al. Improved Quality of Death and Dying in Care Homes: A Palliative Care Stepped Wedge Randomized Control Trial in Australia. *J Am Geriatr Soc*. Published online November 4, 2019:jgs.16192. doi:10.1111/jgs.16192

19. Loyens SMM, Gijbels D. Understanding the effects of constructivist learning environments: introducing a multi-directional approach. *Instr Sci*. 2008;36(5):351-357. doi:10.1007/s11251-008-9059-4

20. Lamppu PJ, Laurila J, Finne-Soveri H, Laakkonen M-L, Kautiainen H, Pitkälä KH. Training nursing home staff to improve residents' end-of-life care: design and baseline findings from a randomized controlled trial. *Eur Geriatr Med*. 2019;10(4):649-657. doi:10.1007/s41999-019-00200-5

21. Roitto H-M, Kautiainen H, Aalto UL, Öhman H, Laurila J, Pitkälä KH. Fourteen-Year Trends in the Use of Psychotropic Medications, Opioids, and Other Sedatives Among Institutionalized Older People in Helsinki, Finland. *Journal of the American Medical Directors Association*. 2019;20(3):305-311. doi:10.1016/j.jamda.2018.12.022

22. Morris JN, Hawes C, Fries BE, et al. Designing the national resident assessment instrument for nursing homes. *Gerontologist*. 1990;30(3):293-307.

23. Knowles MS. *The Modern Practice of Adult Education : From Pedagogy to Andragogy*. Association Press; 1980.

24. Spencer JA, Jordan RK. Learner centred approaches in medical education. *BMJ*. 1999;318(7193):1280-1283. doi:10.1136/bmj.318.7193.1280

25. Gamondi C, Larkin P, Payne S. Core competencies in palliative care: an EAPC white paper on palliative care education: part 2. Published online 2013. http://hdl.handle.net/10147/325630

26. van der Steen JT, Radbruch L, Hertogh CM, et al. White paper defining optimal palliative care in older people with dementia: a Delphi study and recommendations from the European Association for Palliative Care. *Palliative medicine*. 2014;28(3):197-209. doi:10.1177/0269216313493685 [doi]

27. Kolb DA. *Experiential Learning : Experience as the Source of Learning and Development*. Prentice-Hall; 1984.

28. Frank JR, Snell LS, Cate OT, et al. Competency-based medical education: theory to practice. *Medical Teacher*. 2010;32(8):638-645. doi:10.3109/0142159X.2010.501190

29. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of chronic diseases*. 1987;40(5):373-383.

30. WHO Collaborating Centre for Drug Statistics Methodology. *Anatomical Therapeutic Chemical Classification System. ATC/DDD Index 2018*. Vol 2018.; 2018. Accessed November 1, 2018. https://www.whocc.no/atc_ddd_index/

31. Hughes CP, Berg L, Danziger WL, Coben LA, Martin RL. A new clinical scale for the staging of dementia. *The British journal of psychiatry : the journal of mental science*. 1982;140:566-572.

32. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*. 1975;12(3):189-198. doi:10.1016/0022-3956(75)90026-6

33. Guigoz Y, Lauque S, Vellas BJ. Identifying the elderly at risk for malnutrition. The Mini Nutritional Assessment. *Clinics in geriatric medicine*. 2002;18(4):737-757. doi:S0749-0690(02)00059-9 [pii]

34. Sintonen H. The 15D instrument of health-related quality of life: properties and applications. *Annals of Medicine*. 2001;33(5):328-336. doi:10.3109/07853890109002086

35. Kapiainen S, Väisänen A, Haula T. *The unit costs of health and social care in Finland in 2011. In Finnish.* THL; 2014. Accessed September 16, 2020. http://www.julkari.fi/handle/10024/114683

36. Lopez RP. Decision-making for acutely ill nursing home residents: Nurses in the middle. *Journal of Advanced Nursing*. 2009;65(5):1001-1009. doi:10.1111/j.1365-2648.2008.04958.x

37. Laging B, Ford R, Bauer M, Nay R. A meta-synthesis of factors influencing nursing home staff decisions to transfer residents to hospital. *Journal of advanced nursing*. 2015;71(10):2224-2236. doi:10.1111/jan.12652 [doi]

38. Abrahamson K, Mueller C, Davila HW, Arling G. Nurses as boundary-spanners in reducing avoidable hospitalizations among nursing home residents. *Research in gerontological nursing*. 2014;7(5):235-243. doi:10.3928/19404921-20140519-01 [doi]

39. Strandberg TE, Pitkala KH, Berglind S, Nieminen MS, Tilvis RS. Multifactorial intervention to prevent recurrent cardiovascular events in patients 75 years or older: The Drugs and Evidence-Based Medicine in the Elderly (DEBATE) study: A randomized, controlled trial. *American Heart Journal*. 2006;152(3):585-592. doi:10.1016/j.ahj.2006.02.006

40. Ouslander JG, Naharci I, Engstrom G, et al. Root Cause Analyses of Transfers of Skilled Nursing Facility Patients to Acute Hospitals: Lessons Learned for Reducing Unnecessary Hospitalizations. *Journal of the American Medical Directors Association*. 2016;17(3):256-262. doi:10.1016/j.jamda.2015.11.018

41. Lamppu PJ, Pitkala KH. Staff Training Interventions to Improve End-of-Life Care of Nursing Home Residents: A Systematic Review. *J Am Med Dir Assoc*. 2021;22(2):268-278. doi:10.1016/j.jamda.2020.09.011

42. Saevareid TJL, Thoresen L, Gjerberg E, Lillemoen L, Pedersen R. Improved patient participation through advance care planning in nursing homes-A cluster randomized clinical trial. *Patient Education & Counseling*. 2019;102(12):2183-2191. doi:10.1016/j.pec.2019.06.001

43. Temkin-Greener H, Mukamel DB, Ladd H, et al. Impact of Nursing Home Palliative Care Teams on End-of-Life Outcomes. *Medical care*. 2018;56(1):11-18. doi:10.1097/MLR.0000000000000835

44. Hanson LC, Zimmerman S, Song M-K, et al. Effect of the Goals of Care Intervention for Advanced Dementia. *JAMA Intern Med*. 2017;177(1):24-31. doi:10.1001/jamainternmed.2016.7031

45. Molloy DW, Guyatt GH, Russo R, et al. Systematic Implementation of an Advance Directive Program in Nursing Homes: A Randomized Controlled Trial. *JAMA*. 2000;283(11):1437-1444. doi:10.1001/jama.283.11.1437

46. Forbat L, Liu W-M, Koerner J, et al. Reducing time in acute hospitals: A stepped-wedge randomised control trial of a specialist palliative care intervention in residential care homes. *Palliat Med*. Published online January 2, 2020:0269216319891077. doi:10.1177/0269216319891077

Table 1. Residents' characteristics at baseline.

Baseline characteristic	Control (N=173)	Intervention (N=151)	P-value
Mean age, (SD)	84 (8)	83 (8)	0.15
Women, n (%)	130 (75)	115 (76)	0.87
Education <8 years, n (%)	91 (53)	73 (49)	0.52
Main terminal condition, n (%)			0.96
Severe dementia	112 (65)	91 (60)	
Cancer	10 (6)	11 (7)	
Heart failure	19 (11)	21 (14)	
COPD	1 (1)	0 (0)	
Renal failure	2 (1)	2 (1)	
Severe disability	23 (13)	21 (14)	
Other terminal condition	6 (3)	5 (3)	
Charlson comorbidity index[29], mean (SD)	2.7 (1.8)	2.9 (1.5)	0.47
CDR, n (%)			0.57
0.5-1	35 (20)	38 (25)	
2	44 (25)	33 (22)	
3	94 (54)	80 (53)	
MMSE, mean (SD), [0 – 30]	8.5 (9.0)	10.2 (9.5)	0.10
Number of medications, mean (SD)	9.2 (3.7)	9.9 (3.9)	0.073
Pain medications[*], n (%)	118 (68)	97 (64)	0.45
MNA, n (%)			0.58
Malnourished <17	31 (18)	22 (15)	
At risk of malnutrition 17-23.5	119 (69)	109 (72)	
Well-nourished >23.5	23 (13)	20 (13)	
Need for help[†], n (%)	157 (91)	125 (83)	0.033
Do-not-resuscitate order in medical records, n (%)	164 (95)	102 (68)	<0.001
ACP discussion[‡], n (%)	135 (78)	109 (72)	0.22
15D, mean (SD), [0 – 1]	0.577 (0.103)	0.600 (0.097)	0.043

[*] = Including opioids N02A, paracetamol (N02BE01) selective and nonselective nonsteroidal anti-inflammatory drugs (M01A)[30]; [†] = "Personal care" ≥2 points in CDR; [‡] Documentation of ACP discussion in medical records

15D = 15-dimensional health-related quality-of-life instrument[34], ACP=Advance care planning, CDR = Clinical Dementia Rating[31], COPD = Chronic obstructive pulmonary disease, MMSE = Mini-Mental State Examination[32], MNA = Mini Nutritional Assessment[33], SD = standard deviation

Table 2. Participants' hospital service use and costs of these services.

	Visits or days/person/year			Cost estimate €/person/year		
	Control (N=173), mean (SE)	Intervention (N=151), mean (SE)	IRR (95% CI)	Control (N=173), mean (SE)	Intervention (N=151), mean (SE)	RATIO (95% CI)
Emergency department visits	0.56 (0.08)	0.72 (0.10)	1.28 (0.37 - 4.41)	254.2 (61.7)	336.0 (58.6)	
Specialized hospital days	0.22 (0.06)	0.67 (0.19)	2.03 (0.67 - 6.15)	415.3 (180.8)	783.8 (223.7)	
Subacute / rehabilitation hospital days	0.59 (0.17)	1.20 (0.31)	2.12 (0.65 - 6.92)	151.7 (42.6)	532.3 (184.2)	
Ambulatory hospital visits	0.35 (0.06)	0.35 (0.06)	0.85 (0.29 - 2.53)	119.3 (39.1)	95.9 (17.7)	
TOTAL				941 (248)	1748 (334)	1.74 (0.86 - 3.15)

All results adjusted for sex, age, DNR, need for help, and clustering

95% CI = 95% confidence interval, IRR = Incidence rate ratio, SE = standard error

Appendix 1

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┌─────────────────────────────────────────────────────────┐
│            Nursing homes: 32 wards                        │
│      Assisted living facilities: 62 wards                 │
└─────────────────────────────────────────────────────────┘
                          ⇩
┌─────────────────────────────────────────────────────────┐
│    Chosen according to Minimum Data Set casemix:          │
│  Five nursing homes: 6 intervention vs. 7 control wards   │
│                    (n=288)                                │
│  Two assisted living facilities: 4 intervention vs. 3     │
│             control wards (n=206)                         │
└─────────────────────────────────────────────────────────┘
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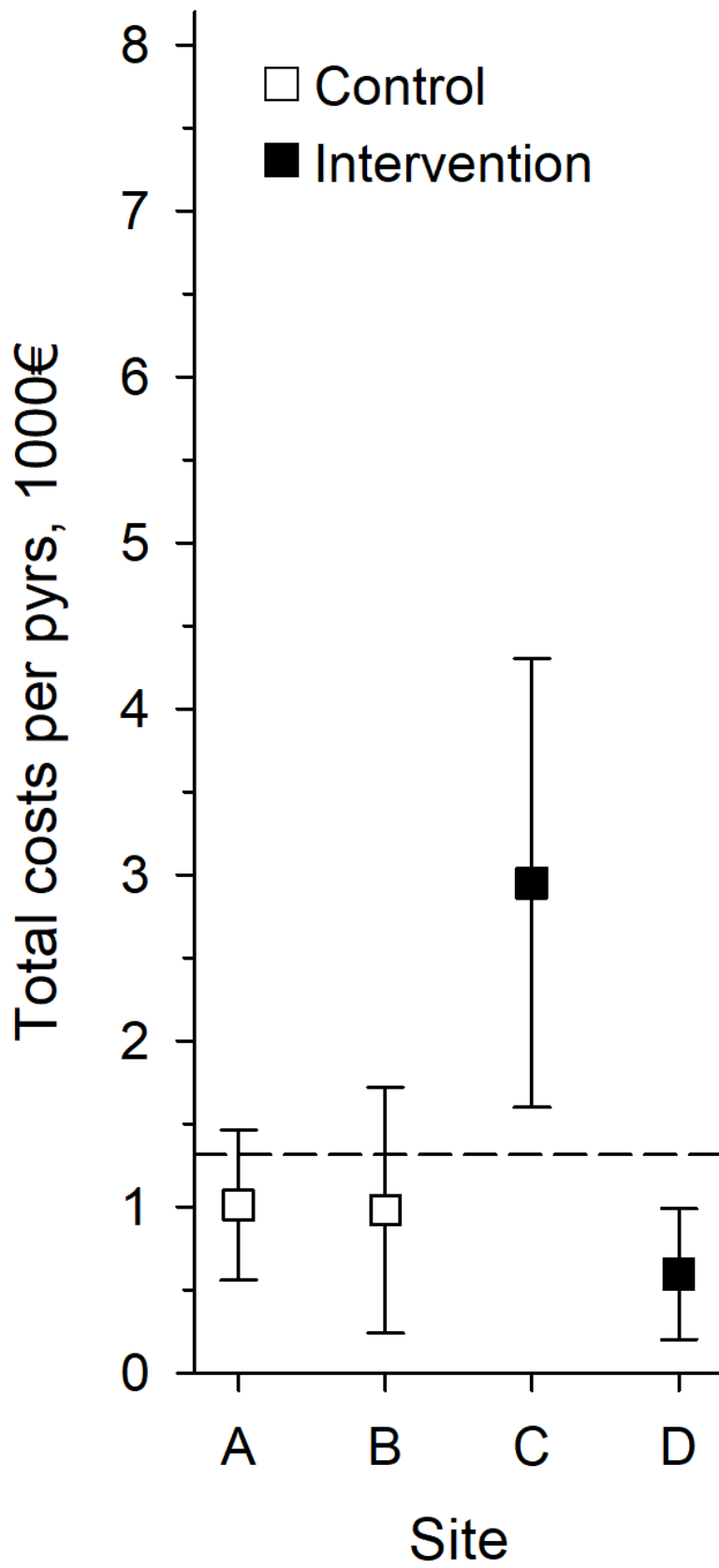
Proxy could not be reached n=31
Refused n=63
Deceased before assessment n=20
Moved or hospitalized n=20
Not fulfilling inclusion criteria n=19
Not included total n=154

Baseline assessments n=340

Randomization

| Intervention group n=159 | Control group n=181 |

Intervention

Deceased before intervention was completed n=16

| Intervention group n=151 | Control group n=173 |

Intervention group n=132	Control group n=159
Deceased n=18	Deceased n=14
Moved n=1	

6-month assessments

| Intervention group n=107 | Control group n=142 |
| Deceased n=25 | Deceased n=17 |

12-month assessments

| Intervention group n=71 | Control group n=92 |
| Deceased n=36 | Deceased n=50 |

24-month assessments

| Intervention group n=151 | Control group n=173 |

Use and costs of hospital services during 24 months

Legends for figures

Figure 1. Change in health-related quality of life according to 15D in the intervention and control groups during the 24-month follow-up.

Figure 2. Residents' costs of hospital services according to clusters.
A and C represent assisted living facilities, B and D nursing homes.