

# Effects of a theory-based advance care planning intervention for nursing homes: a cluster randomized controlled trial

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## **Abstract**

**Background:** Uptake of advance care planning in routine nursing home care is low. Through extensive literature review, theoretical development, and stakeholder involvement, we developed the ACP+ intervention.

**Aims:** To evaluate the effects of ACP+ on the knowledge and self-efficacy (confidence in own skills) of nursing home care staff concerning advance care planning.

**Design:** Cluster randomized controlled trial, conducted between February 2018 and January 2019 (NCT03521206, clinicaltrials.gov). ACP+ is a multicomponent intervention aimed at training and supporting nursing home staff and management in implementing advance care planning in nursing home practice through a train-the-trainer approach over eight months. Fourteen nursing homes were randomized using a matched-pairing strategy, seven received ACP+, seven followed usual practice. Analyses (intention-to-treat) involved linear mixed models.

**Setting/participants:** Nursing homes in Flanders (Belgium).

**Results:** 694 of 1017 care staff (68% response rate) at baseline and 491 of 989 care staff (50%) post-intervention (8 months) returned questionnaires. Post-intervention, care staff's self-efficacy concerning advance care planning was significantly higher in the intervention than in the control group (baseline-adjusted mean difference 0.57; 95%CI 0.20 to 0.94;  $p=0.003$ ; Cohen's  $d=0.30$ ). Advance care planning knowledge (95%CI 0.95 to 1.15;  $p=0.339$ ; ratio: 1.04) did not differ significantly between groups.

**Conclusions:** The ACP+ intervention for nursing homes improved care staff's self-efficacy but not their knowledge concerning advance care planning. Considering the comprehensive and multi-component approach used, these effects were smaller than expected. Reasons for this may be related to the chosen follow-up period, outcomes and measurements, or to the intervention itself and its implementation.

## Key statement

### What is already known about the topic

- Timely advance care planning is recognized as an important part of routine nursing home care, but its uptake is low.
- Interventions aiming to improve advance care planning in nursing homes have led to inconsistent findings.

### What this paper adds

- The ACP+ intervention improved nursing home care staff's self-efficacy (confidence in own skills) in performing advance care planning, albeit with an effect size that can be considered small to medium.
- The intervention did not improve care staff's knowledge concerning advance care planning.

### Implications for practice, theory or policy

- An intensive program such as the ACP+ intervention can positively impact nursing home care staff's confidence in discussing residents' preferences for care and aligning care with their preferences.
- Considering the comprehensive and multi-component intervention approach used, the intervention effects were smaller than expected.
- The absence of stronger intervention effects may be related to shortcomings in the intervention design and implementation problems, a too short follow-up period, or outcomes and measurement instruments not being optimal to measure the effects of this intervention.

## Introduction

A growing number of older adults spend the last years or months of their life in nursing homes. In several high-income countries, up to one-third of people die there(1,2). Timely advance care planning is therefore advocated as an important part of routine nursing home care(3). Advance care planning is defined as a process that supports adults at any age or stage of health in understanding and sharing their personal values, life goals and preferences regarding future medical, including end-of-life, care.(4) If a person wishes, the contents of such conversations can be documented in the form of an advance directive. (4,5) While critical voices have recently questioned whether advance care planning is suitable for people to achieve goal-concordant care,(6) others have strongly advocated for it as a communication process concerning people's hopes, preferences, values and potential care goals.(7,8) It should be initiated early in a person's illness trajectory with the aim to develop a shared narrative among residents, family and staff concerning end-of-life values to inform patient care.(7) However, the uptake of advance care planning is generally low, with older nursing home residents reporting little experience with advance care planning(9) and research in different countries showing that one-third to two-thirds of residents do not have written advance directives.(10,11)

Several studies have taken on the difficult task of testing interventions to improve advance care planning in nursing homes.(12) While they indicated several elements that could support advance care planning, overall they have resulted in mixed findings, which led some authors to conclude that no firm conclusions can be drawn concerning the effectiveness of advance care planning interventions. The inconsistency in findings is to a large part due to differences in the types of interventions tested and outcomes measured and the fact that few studies employed methods that can be judged as high quality.(12–15) The perhaps strongest evidence of the effectiveness of advance care planning is provided by trials that showed increased patient/surrogate satisfaction with communication and care, and decreased surrogate/clinician distress.(16)

We have developed a multi-component advance care planning intervention targeting multiple levels of the nursing home (i.e. management, care staff, support staff, residents and family), that aims to integrate advance care planning in regular nursing home practice using a train-the-trainer approach. The ACP+ intervention was developed by integrating a theory of change approach within the steps of the UK Medical Research Council (MRC) framework for developing and evaluating complex interventions(17–21). The theory of change is based on an extensive literature review, theoretical development and intensive stakeholder involvement(18)

and postulates that nursing home care staff need to have sufficient knowledge of advance care planning and confidence in their own advance care planning skills to be able to increase the uptake of advance care planning in the nursing home context.

To evaluate this theory-based ACP+ intervention, we addressed the following research question: Does the ACP+ intervention improve nursing home care staff's knowledge and self-efficacy concerning advance care planning (primary outcomes) and their self-reported engagement in advance care planning communication and documentation (secondary outcome)?

## Methods

### Trial design

From February 2018 (start of recruitment) until January 2019 (end of data collection) we conducted a multi-facility cluster-randomized controlled trial in Belgium (Flanders, the Dutch-speaking part of Belgium) to compare the ACP+ intervention with usual care (control). The trial is registered at [clinicaltrials.gov](https://clinicaltrials.gov) (NCT03521206). Ethics approval was granted by the ethics committee of Brussels University Hospital (2017/31, B.U.N. 143,201,732,133). We followed CONSORT guidelines to report study results(22). The trial protocol has been published(17).

### Participating nursing homes

Nursing homes in Belgium are care facilities where continuous (24/7) nursing care is available on-site, and residents receive medical care from their general practitioner (GP). Nursing homes whose management expressed interest in participating were added on a first come first serve basis to a list stratified by region, number of beds and facility type (non-profit and for-profit public/private). We then contacted the nursing homes consecutively, starting with the first per stratum, until the target number of clusters was recruited. Inclusion and exclusion criteria are presented in Table 1. Nursing home managers who agreed to participate were asked to sign an informed consent form.

### Randomization and blinding

A blinded statistician, not affiliated with this study, randomized the nursing homes using a matched-pairing strategy. All included nursing homes were ordered based on their facility type and, within each type, based on their geographic location. Each consecutive pair of nursing

homes was then allocated randomly to either the intervention or control group, using a computer-generated random sequence. Owing to the nature of the study, allocation concealment (blinding) was not possible for participants or researchers.

### The ACP+ intervention

The ACP+ intervention is a multicomponent intervention aimed at training and supporting nursing home staff and management with the implementation of advance care planning in routine nursing home practice through a train-the-trainer approach.(20) It combines ten intervention components and permits tailoring of several components to the existing nursing home context. Table 3 provides a structured description of the intervention based on the TIDieR checklist.(23) Components were implemented step-wise, over a period of eight months, with the help of two external advance care planning trainers: a GP specialized in nursing home care and a nursing home nurse specialized in palliative care and dementia (assigned to 4 and 3 nursing homes in the intervention group, respectively). The advance care planning trainers' support was more intensive at the start of the intervention and progressively decreased.(20)

The ACP+ intervention defines several roles, assigned to nursing home care staff (henceforth termed 'care staff'; i.e nurses, care assistants, allied health staff (e.g. psychologists, physiotherapists, occupational therapists, social workers, animators, pastoral or spiritual caregivers, and moral consultants)) and support staff (i.e. staff working in the nursing home but without a role in care such as cleaning, administrative, technical/logistical or kitchen staff):

- Advance care planning reference persons, who are trained specifically in advance care planning and subsequently train other staff and champion the implementation of advance care planning in their nursing home (at least two 0.10 FTE per 30 to 40 beds);
- Advance care planning conversation facilitators, who plan and conduct advance care planning conversations with residents and family (number determined by the nursing home); and
- Advance care planning antennas, whose task is to recognize and signal 'triggers' that indicate a resident's readiness or need for advance care planning (all others).

In-depth descriptions of the development and feasibility-testing of the ACP+ intervention have been published.(18,20,21).

## Outcomes

### Primary outcomes

Primary outcomes were: 1) care staff's knowledge concerning advance care planning and 2) care staff's self-efficacy concerning advance care planning (confidence in own advance care planning skills). We measured these outcomes at baseline (T0; prior to randomization) and post-intervention, i.e. after eight months (T1).

### Secondary outcome

The secondary outcome was care staff's self-reported engagement in advance care planning communication and documentation, measured at baseline and post-intervention. We had initially specified a further secondary outcome, i.e. care staff's attitudes towards advance care planning. Due to the scale's poor internal consistency at baseline, we did not include it in further analyses. This was decided after trial commencement but before the start of trial analysis.

### Additional measurements

We collected data on the following care staff characteristics: age, gender, job experience in years, occupation, highest level of education, number of hours working in the nursing home per week, whether or not they received training in palliative care or advance care planning, and the mean number of residents for which they care on a regular working day. We also collected data on nursing home characteristics, i.e. facility type; location (region); availability of guidelines and documents concerning palliative care and advance care planning, number of staff and number of beds per nursing home.

To evaluate the overall implementation of the ACP+ intervention, we asked the advance care planning trainers to rate how well the intervention was implemented on a scale from 1 to 10, with 1 indicating 'not at all implemented as intended' and 10 indicating 'entirely implemented as intended'.

### Measurement instruments

When this study was designed, there were no validated measures available assessing advance care planning knowledge, self-efficacy and engagement in communication/documentation among care staff. We therefore developed new measures, based on adaptations of existing questionnaires(17). We tested internal consistency and face validity through cognitive testing with several care professionals(17). Cronbach's alpha for the scales measuring advance care planning knowledge, self-efficacy and communication/documentation was 0.72, 0.97, and 0.81, respectively.

Advance care planning knowledge was measured through 11 statements (e.g. concerning applicability of advance directives) with response options 'true', 'false' and 'I don't know'. The responses were scored as 0 ('incorrect'; 'I don't know') and 1 ('correct'). The advance care planning self-efficacy scale measured confidence in own advance care planning skills (e.g. initiating an advance care planning conversation) with 12 items, rated on a 10-point Likert-type scale ranging from 'not at all confident' (scored as 0) to 'very confident' (scored as 10) or 'not applicable' (coded as missing). The scale measuring self-reported engagement in advance care planning communication/documentation assessed whether staff were engaged in six practices over the past six months (e.g. initiating an advance care planning conversation). Responses were scored as 0 ('not performed') or 1 ('performed').

### Data collection, procedures and respondents

In each nursing home, a contact person (i.e. head nurse, administrator or manager) was designated to identify all eligible care staff. We included care staff if they understood and spoke Dutch and were aged 18 years or over. Students and interns were excluded. Data were collected at month 0 (prior to randomization) and post-intervention (month 8). We collected nursing home characteristics through a questionnaire distributed among contact persons at baseline and post-intervention.

The return of a completed questionnaire was taken as consent to participate. Questionnaires were coded by the researchers to ensure pseudonymization and distributed accompanied by an information leaflet and return envelope. Staff returned questionnaires to a locked mailbox in the nursing home accessible to the researchers only. Reminders were distributed twice (after two and four weeks).

### Statistical analysis

We had estimated that a sample of 161 care staff for each study arm (approximately 30 to 35 per nursing home) would achieve at least 80% power to detect an effect size of 0,5 with an intra-cluster correlation coefficient (ICC) of 0,036, at significance level of 2,5%. To allow for 30% non-response as well as 10% staff turn-over(17), we recruited 7 nursing homes per arm.

Advance care planning knowledge was treated as a rate of correct statements relative to the total number of statements responded to. For advance care planning self-efficacy, the mean



score of all items was used. Advance care planning communication/documentation was considered as a dichotomous variable (at least one activity performed versus none). Outcomes were set as missing if a respondent had not answered more than 25% of statements or items.

We fitted generalized linear mixed models to take the two levels of clustering in the data into account, i.e. care staff within nursing homes; measurements (baseline and post-intervention) within care staff. All final models included two random intercepts (one for nursing homes, one for care staff) and were fitted using the restricted maximum likelihood approach (REML). No random slope was used.

For advance care planning knowledge, a negative binomial mixed model was fitted. For advance care planning self-efficacy (mean score and scores on the individual items), linear mixed models were fitted. For advance care planning communication/documentation, a binary logistic mixed model was fitted. For the individual items of advance care planning knowledge and advance care planning communication/documentation, binary logistic mixed models were fitted.

In two sets of exploratory subgroup analyses for the primary and secondary outcomes, we 1) compared intervention nursing homes with a high implementation score ( $\geq 7$ ) with the control group, and 2) tested whether the intervention effects of the intervention differed between staff with higher (i.e. nurses and allied health staff) versus lower (i.e. care assistants) educational levels.

All final models included the matching variables (i.e. facility type and location) timepoint (post-intervention vs. baseline), study arm (intervention vs. control) and the two-way interaction between timepoint and study arm. The ACP+ effect is reflected in the interaction between study arm and time point. Corresponding 95% confidence intervals (CIs) are reported. P-values for the two primary outcomes were considered statistically significant when  $< 0,025$  (Bonferroni correction for multiple testing). P-values for the secondary outcome were considered statistically significant when  $< 0,05$ . All hypothesis testing was 2-sided. All analyses were on an intention-to-treat basis. We assumed missing outcome data was missing at random.

All presented intra-class correlation coefficients correspond to the proportion of variance in the respective outcome at baseline that can be explained at the level of the nursing home (i.e. null-model with one random intercept). We determined the Cohen's d effect size for advance care planning self-efficacy by calculating the standard deviation using the same null-model.

All analyses were performed using IBM SPSS Statistics Version 25 for Macintosh, except for the graphs, which were created using R version 3.6.1(24).

## Results

Of 37 clusters assessed for eligibility, 14 were included and randomized to intervention or control after baseline data collection (Figure 1). All clusters received the intended intervention, none were lost to follow up, and all were included in all analyses, and analysed according to their originally assigned group. Out of 17 activities that were part of the ACP+ intervention, the intervention group nursing homes implemented between 13 and 16. Over a total of 23 weeks, the trainers visited each nursing home between 7 and 17 times. In all intervention nursing homes, 100% of advance care planning reference persons were trained. Nursing home characteristics are presented in Appendix 1-e.

### Clusters and participants

Both study arms taken together, we received questionnaires from 694 of 1017 care staff (68% response rate) at baseline and 491 of 989 care staff (50% response rate) post-intervention. Characteristics of respondents are presented in Table 2. The proportion of nurses in the different groups and timepoints ranged from 27% to 31%, and from 42% to 48% for care assistants.

### Outcomes

Post-intervention, care staff's mean advance care planning knowledge did not differ significantly between groups (ratio 1.04; 95%CI, 0.95 to 1.15;  $p=0.339$ ). Care staff's mean self-efficacy in advance care planning was significantly higher in the intervention group than in the control group (baseline-adjusted mean difference, 0.57; 95%CI, 0.20 to 0.94;  $p=0.003$ ; effect size (Cohen's  $d$ ) = 0.3) (Table 4, Figure 2). The advance care planning self-efficacy items that had significantly higher means in the intervention than in the control group were: discussing wishes and preferences for future care; explaining the role of a representative to residents/family, responding to residents'/family's questions regarding advance directives; aligning care with a resident's written wishes; knowing legislation regarding advance directives (Appendix, Table 5-e). The items of advance care planning knowledge and advance care planning communication/documentation are reported in the appendix (Table 4-e, 6-e).

We found no difference between the intervention and control group for staff's engagement in advance care planning communication/documentation (ratio 1.47; 95%CI 0.88 to 2.46;

p=0.145) (Table 4). This measure should be interpreted as the number of clinicians that do advance care planning conversations, rather than the number of advance care planning conversations at patient level.

The results of the subgroup analysis regarding implementation score were similar to those of the main analyses in terms of statistical significance of baseline-adjusted differences between groups post-intervention, for occupational level no significant differences were found (Appendix, Table 2-e, 3-e).

## Discussion

### Main findings

In this cluster RCT, the ACP+ intervention in nursing homes led to a statistically significant improvement on care staff's self-efficacy in advance care planning after 8 months, but did not improve their advance care planning knowledge. We did not detect any negative effects of the intervention. Although statistically significant, the effects on self-efficacy were smaller than expected.

### Strengths and limitations of the study

This is the first cluster RCT testing the outcomes of an advance care planning intervention developed through in-depth theoretical modeling and targeting multiple stakeholders in the nursing home.(17,18,20) Strengths include the trial's pragmatic nature permitting tailoring of several intervention components, absence of cluster drop-outs, and the focus on staff-level outcomes. While staff education has been the chief implementation strategy in advance care planning interventions in nursing homes, and staff outcomes were found to be important preconditions for changes related to residents,(25) no previous trials have evaluated the effect of these interventions on staff outcomes. This is an important research gap given that staff training interventions to improve nursing home residents' end-of-life outcomes (i.e. quality of life, quality of dying, hospital admissions) have largely led to 'negative' findings, despite relatively high study quality.(26) It is therefore necessary to take a 'step back' in the theoretical causal pathway to change and examine which interventions can actually achieve changes relating to staff. This strategy is consistent with systematic review findings showing that studies that did not change the targeted staff behavior tended to also not improve resident outcomes.(27) While constructs on the resident level (e.g. completion of advance directives or the time residents spent in advance care planning conversations or their quality) could have been considered as secondary outcomes in this study, it is highly debated whether they are

suitable outcomes to evaluate advance care planning interventions.(7) While all nursing home residents should be *offered the possibility* to participate in advance care planning conversations and complete written advance care plans, not all may wish to do so. Some may participate in one or several conversations without wanting to complete written plans. Furthermore, time spent in advance care planning conversations is arguably not a clear indicator of successful advance care planning without knowing the content of these conversations and the functional status of patients (some may not be able to conduct long conversations, and some may prefer short ones if they have, for instance, discussed advance care planning with family or their GP). That said, we acknowledge the limitation that we did not measure these resident-level constructs as process outcomes of this intervention. Further limitations of this cluster RCT include that care staff could not be blinded due to the nature of the intervention. The response rate among care staff was only satisfactory and declined post-intervention. We could not assess potential non-response bias as we did not assess non-responder characteristics.

#### What this study adds

This study showed that we partially succeeded in reaching the aim of the ACP+ intervention, as care staff's self-efficacy increased, but not their knowledge of advance care planning. This implies that an intensive intervention such as ACP+ can positively impact staff's confidence in discussing residents' preferences for care and aligning care with preferences. However, we expected the effects to be larger (i.e. effect size for self-efficacy was small to medium-sized only and knowledge did not change), especially considering the comprehensive and multi-component intervention. While the medium range baseline scores for both primary and secondary outcomes might be part of the explanation, as improving a low baseline might be easier, we believe that there are additional possible reasons.

First, the chosen primary and secondary outcomes and measurement instruments might not have been optimal to detect improvements caused by the intervention(28). A published organizing framework of advance care planning domains,(29) and additional more recent literature,(30) identified knowledge of advance care planning and self-efficacy about engaging in it as important process or mediator outcomes in the advance care planning process. This central mediating role of staff outcomes was also confirmed by our theory of change of the ACP+ intervention.(18) However, particularly for advance care planning knowledge, there may have been a poor match between the contents of the intervention (i.e. focusing on communication and organizational embedment of advance care planning) and the constructs measured (i.e.

knowledge of the legal framework concerning advance care planning). The intervention may have had a greater effect on constructs that we did not measure. We also needed to use newly developed scales, tested for face validity but not yet for content or construct validity. Although we determined internal consistency, the measure was not tested for sensitivity to change. Furthermore, there is no consensus on what is a clinically meaningful change in the tested outcomes.(31)

Second, our follow-up period may have left too little time for the intervention to develop an impact on the outcomes. An additional consolidation phase following the implementation period – as was suggested in a recent White Paper on guiding implementation of palliative care improvements in nursing homes – may have allowed advance care planning self-efficacy to grow further and engagement in advance care planning communication/documentation to increase.(32,33) We structured the ACP+ intervention in a way that would allow four months to practice planned advance care planning conversations and documentation (i.e. in the follow-up phase). Staff had possibly needed more time to consolidate and practice the knowledge and skills taught in the training phase (i.e. the first four months) of the intervention. In addition, advance care planning knowledge and self-efficacy are preconditions for engaging in advance care planning conversations and documentation. Failure to achieve large effects in the former may also explain the absence of effects on staff-reported involvement in advance care planning conversations and documentation.

Third, we evaluated our outcomes across all groups of care staff (care assistants, allied health staff and nurses) while our intervention differentiated between several roles in terms of responsibilities within advance care planning. The effect on the outcomes may have been greatest among the advance care planning reference persons, as they acted as champions of the intervention in their nursing homes and were responsible for training other staff. However, the analyses did not allow identification of these roles and the trial lacked power to perform sub-analyses per role.

Finally, next to these methodological aspects, factors related to the intervention itself may have contributed to the absence of larger intervention effects. While our theoretical work and stakeholder involvement indicated that staff training by external experts is a key component to include in the ACP+ intervention, the intervention might not have been designed well enough to support implementation. In fact, three of seven intervention nursing homes did not receive a high implementation score from the external trainers. Although we considered contextual

barriers in the theory of change, risks for suboptimal implementation remain in such a complex context.(21,34–38) This includes the possibility that management of the participating nursing homes did not give staff sufficient time to engage with and implement the intervention, although they in principle agreed to this upon inclusion. Nevertheless, implementation problems alone cannot explain the absence of larger intervention effects seeing as our subgroup-analysis in nursing homes with high implementation scores led to similar findings as the main analysis. It is possible that despite thorough and evidence-based theoretical modeling and stakeholder involvement, critical intervention activities were missing. This might concern additional group or one-on-one training or additional intervention activities to encourage the transition from training to adoption in practice. Practice of a new skill is of great importance for improving one's confidence therein, and our intervention may have been more effective in improving staff outcomes had it ensured more time and additional suitable strategies to encourage the different staff members to engage in ACP conversations and document them. The separately published process evaluation of this trial will shed further light on this.

A further potential flaw in the ACP+ intervention design is that the ACP+ intervention may have targeted too many different care practices at once (e.g. training reference persons, conversation facilitators and all other staff as antennas, multidisciplinary meetings, planned ACP conversations). A large systematic review showed that interventions in nursing homes that target specific care practices may be more able to demonstrate effectiveness on carefully selected (matched) outcomes, than interventions requiring more global practice changes or aiming at coordinated changes between staff across multiple care practices.(27) But the same work also concluded that, to be successful, interventions need to consider implementation barriers using program theory. This means that interventions to change staff care practices in nursing homes need to keep a delicate balance between including the necessary complexity and being very specific and limited in the targeted care practices. Future research has the important task to determine how this can be achieved for advance care planning, given that it necessarily involves multiple care practices. In this context, we may need to consider alternative methods and research designs to capture the effects of such complex interventions, alongside 'traditional' randomized controlled trials, for instance pragmatic trial designs.(14)

The fact that we can identify multiple possible reasons for the failure of the ACP+ intervention to produce larger effects on staff advance care planning outcomes – both related to the intervention design itself, measured outcomes, and trial methods – attests to the complexity of advance care planning and its evaluation. This study's findings, along with

ongoing discussions in our field,(7,8,39,40) stress the need for investing resources in researching and understanding more fully the complexity of advance care planning in nursing homes; its components, processes and necessary contextual conditions. This is needed to develop interventions that stand a chance at being effective in achieving change for residents, family and staff. Our Theory of Change-based approach was very important to better understand all preconditions necessary for implementing ACP, but it may not have been sufficient to navigate its full complexity. Approaches from psychology, implementation science, and complexity science in public health hold promise when combined with Theory of Change. A recent review has highlighted the key role of co-production for successful implementation of interventions in nursing homes.(38) Furthermore, we require further resources to determine what are and should be reasonable aims of advance care planning. Deeper insights on this question will help uncover suitable outcomes to evaluate the effects of advance care planning. This work should consider not only outcomes that relate to desired ‘results’ of advance care planning (e.g. advance directives, concordance between wishes and care received) but also its process (e.g. feeling of involvement and trust). Ideally, the scientific community will be able to reach agreement on a core outcome set for studies that evaluate interventions.(41,42)

## Conclusions

The ACP+ intervention improved care staff’s self-efficacy regarding advance care planning after eight months, albeit to a relatively limited extent. It did not improve care staff’s advance care planning knowledge. The smaller than expected effects could be related to the intervention design, its implementation or the chosen outcomes or measurements. Future research on advance care planning in nursing homes should prioritize the further development of interventions that can address its complex nature and effect sustainable change. There is also an urgent need for a consensus-based and resident- and family-centred core set of outcomes that can detect relevant effects of advance care planning interventions. This necessitates a clear and common understanding of what advance care planning in nursing homes should entail and what it should strive to achieve.

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**Data availability:** Data will be made available for non-commercial research purposes upon reasonable request to the authors (LP, LVdB).



## References

1. Pivodic L, Pardon K, Morin L, Addington-Hall J, Miccinesi G, Cardenas-Turan M, et al. Place of death in the population dying from diseases indicative of palliative care need: A cross-national population-level study in 14 countries. *J Epidemiol Community Health*. 2015;70(1).
2. Broad JB, Gott M, Kim H, Boyd M, Chen H, Connolly MJ. Where do people die? An international comparison of the percentage of deaths occurring in hospital and residential aged care settings in 45 populations, using published and available statistics. *Int J Public Health*. 2013 Apr;58(2):257–67.
3. MacLeod RD, Van den Block L. *Textbook of Palliative Care*. Springer Nature; 2019.
4. Sudore RL, Lum HD, You JJ, Hanson LC, Meier DE, Pantilat SZ, et al. Defining Advance Care Planning for Adults: A Consensus Definition From a Multidisciplinary Delphi Panel. *J Pain Symptom Manage*. 2017;53(5):821-832.e1.
5. Rietjens JAC, Sudore RL, Connolly M, van Delden JJ, Drickamer MA, Droger M, et al. Definition and recommendations for advance care planning: an international consensus supported by the European Association for Palliative Care. *Lancet Oncol*. 2017;18(9):e543–51.
6. Sean Morrison R. Advance Directives/Care Planning: Clear, Simple, and Wrong. *J Palliat Med*. 2020;23(7):878–9.
7. Tishelman C, Enesl  t M, Menkin ES, Van Den Block L. Tishelman et al’s Response to Morrison: Advance Directives/Care Planning: Clear, Simple, and Wrong (DOI: 10.1089/jpm.2020.0272). *J Palliat Med*. 2021;24(1):16–7.
8. Curtis JR. Three Stories About the Value of Advance Care Planning. *JAMA*. 2021 Dec 7;326(21):2133–4.
9. Mignani V, Ingravallo F, Mariani E, Chattat R. Perspectives of older people living in long-term care facilities and of their family members toward advance care planning discussions: A systematic review and thematic synthesis. *Clin Interv Aging*. 2017;12:475–84.
10. Andreasen P, Finne-Soveri UH, Deliens L, Van Den Block L, Payne S, Gambassi G, et al. Advance directives in European long-term care facilities: A cross-sectional survey. *BMJ Support Palliat Care*. 2019;(2017):1–10.
11. Jones AL, Moss AJ, Harris-Kojetin LD. Use of advance directives in long-term care populations. *NCHS Data Brief*. 2011;(54):1–8.
12. Martin RS, Hayes B, Gregorevic K, Lim WK. The Effects of Advance Care Planning

- Interventions on Nursing Home Residents: A Systematic Review. *J Am Med Dir Assoc.* 2016;17(4):284–93.
13. Sævareid 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 Educ Couns.* 2019;102(12):2183–91.
  14. Mitchell SL, Volandes AE, Gutman R, Gozalo PL, Ogarek JA, Loomer L, et al. Advance Care Planning Video Intervention Among Long-Stay Nursing Home Residents A Pragmatic Cluster Randomized Clinical Trial. 2020;02131:1–9.
  15. Jimenez G, Tan WS, Virk AK, Low CK, Car J, Ho AHY. Overview of systematic reviews of advance care planning: summary of evidence and global lessons. *J Pain Symptom Manage.* 2018;56(3):436-459.e25.
  16. McMahan RD, Tellez I, Sudore RL. Deconstructing the Complexities of Advance Care Planning Outcomes: What Do We Know and Where Do We Go? A Scoping Review. *J Am Geriatr Soc.* 2021 Jan 1;69(1):234–44.
  17. Gilissen J, Pivodic L, Wendrich-Van Dael A, Gastmans C, Vander Stichele R, Engels Y, et al. Implementing the theory-based advance care planning ACP+ programme for nursing homes: Study protocol for a cluster randomised controlled trial and process evaluation. *BMC Palliat Care.* 2020;19(1):1–18.
  18. Gilissen J, Pivodic L, Gastmans C, Vander Stichele R, Deliëns L, Breuer E, et al. How to achieve the desired outcomes of advance care planning in nursing homes: A theory of change. *BMC Geriatr.* 2018 Feb 14;18(1).
  19. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: new guidance. London: Medical Research Council; 2008.
  20. Gilissen J, Pivodic L, Dael AW van, Gastmans C, Stichele R Vander, van Humbeeck L, et al. Implementing advance care planning in routine nursing home care: The development of the theory-based ACP+ program. *PLoS One.* 2019;14(10).
  21. Gilissen J, Pivodic L, Smets T, Gastmans C, Vander Stichele R, Deliëns L, et al. Preconditions for successful advance care planning in nursing homes: A systematic review. Vol. 66, *International Journal of Nursing Studies.* Elsevier Ltd; 2017. p. 47–59.
  22. Campbell MK, Piaggio G, Elbourne DR, Altman DG. Consort 2010 statement: Extension to cluster randomised trials. *BMJ.* 2012;345(7881):1–21.
  23. Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, et al. Better reporting of interventions: Template for intervention description and replication

- (TIDieR) checklist and guide. *BMJ*. 2014;348(March):1–12.
24. R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. 2019.
  25. Flo E, Husebo BS, Bruusgaard P, Gjerberg E, Thoresen L, Lillemoen L, et al. A review of the implementation and research strategies of advance care planning in nursing homes. *BMC Geriatr*. 2016;16(1).
  26. 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):268–78.
  27. Low L-F, Fletcher J, Goodenough B, Jeon Y-H, Etherton-Beer C, MacAndrew M, et al. A Systematic Review of Interventions to Change Staff Care Practices in Order to Improve Resident Outcomes in Nursing Homes. Quinn TJ, editor. *PLoS One*. 2015 Nov 11;10(11):e0140711.
  28. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quinonez HR, Young, Sera L. Best practices for developing and validating scales for health, social, and behavioral research: a primer. *Front Public Heal*. 2018;6(149).
  29. Sudore RL, Heyland DK, Lum HD, Rietjens JAC, Korfage IJ, Ritchie CS, et al. Outcomes That Define Successful Advance Care Planning: A Delphi Panel Consensus. *Journal of Pain and Symptom Management*. 2018;
  30. Fleuren N, Depla MFIA, Janssen DJA, Huisman M, Hertogh CMPM. Underlying goals of advance care planning (ACP): A qualitative analysis of the literature. *BMC Palliat Care*. 2020 Mar 6;19(1):27.
  31. Baughman KR, Ludwick R, Fischbein R, McCormick K, Meeker J, Hewit M, et al. Development of a Scale to Assess Physician Advance Care Planning Self-Efficacy. *Am J Hosp Palliat Med*. 2017;34(5):435–41.
  32. Van den Block L, Honinx E, Pivodic L, Miranda R, Onwuteaka-Philipsen BD, van Hout H, et al. Evaluation of a Palliative Care Program for Nursing Homes in 7 Countries: The PACE Cluster-Randomized Clinical Trial. *JAMA Intern Med*. 2019 Nov 11;1–10.
  33. Froggatt KA, Moore DC, Van den Block L, Ling J, Payne SA, Arrue B, et al. Palliative Care Implementation in Long-Term Care Facilities: European Association for Palliative Care White Paper. *J Am Med Dir Assoc*. 2020;1–8.
  34. Aasmul I, Husebo BS, Sampson EL, Flo E. Advance care planning in nursing homes - Improving the communication among patient, family, and staff: Results from a cluster

- randomized controlled trial (COSMOS). *Front Psychol.* 2018;9(DEC):1–10.
35. Lund S, Richardson A, May C. Barriers to advance care planning at the end of life: An explanatory systematic review of implementation studies. *PLoS One.* 2015;10(2):1–15.
  36. Oosterveld-Vlug M, Onwuteaka-Philipsen B, Ten Koppel M, Van Hout H, Smets T, Pivodic L, et al. Evaluating the implementation of the PACE Steps to Success Programme in long-term care facilities in seven countries according to the RE-AIM framework. *Implement Sci.* 2019 Dec 19;14(1).
  37. Van Den Block L, Honinx E, Pivodic L, Miranda R, Onwuteaka-Philipsen BD, Van Hout H, et al. Evaluation of a Palliative Care Program for Nursing Homes in 7 Countries: The PACE Cluster-Randomized Clinical Trial. *JAMA Intern Med.* 2020;180(2):233–42.
  38. Peryer G, Kelly S, Blake J, Burton JK, Irvine L, Cowan A, et al. Contextual factors influencing complex intervention research processes in care homes: a systematic review and framework synthesis. *Age Ageing.* 2022;51:1–16.
  39. Morrison RS, Meier DE, Arnold RM. What’s Wrong With Advance Care Planning? *JAMA.* 2021 Oct 26;326(16):1575–6.
  40. Teno JM. Promoting Multifaceted Interventions for Care of the Seriously Ill and Dying. *JAMA Heal Forum.* 2022 Apr 7;3(4):e221113.
  41. Williamson PR, Altman DG, Blazeby JM, Clarke M, Devane D, Gargon E, et al. Developing core outcome sets for clinical trials: Issues to consider. *Trials.* 2012 Aug 6;13(1):132.
  42. Gilissen J, Van Den Block L, Pivodic L. Complexities and Outcomes of Advance Care Planning. Vol. 181, *JAMA Internal Medicine.* American Medical Association; 2021. p. 143.
  43. Wendrich-Van Dael A, Gilissen J, Humbeeck L Van, Deliëns L, Stichele R Vander, Gastmans C, et al. Advance care planning in nursing homes: new conversation and documentation tools. *BMJ Support Palliat Care.* 2021;0:1–6.

Table 1. Inclusion and exclusion criteria for participating nursing homes

Inclusion criteria:	
–	have at least 100 beds
–	nursing homes management expresses explicit motivation to participate in the study and agrees to allocate 0.10 FTE per week for at least two staff members per 30 to 40 nursing home beds to act as ‘ACP Reference Person(s)’.
Exclusion criteria:	
–	have taken or are taking part in another research study that is evaluating palliative care or advance care planning programs or communication strategies, currently or in the past four years
–	have developed - or are planning to develop during the foreseen trial period - an extensive ACP policy, meaning that (i) all nursing home residents, or their families, regularly receive ACP conversations (two or more conversations per year) or (ii) the nursing home is judged by the researchers as having explicit and detailed ACP guidelines available (corresponding to high-quality ACP procedures and practices)
–	planned or ongoing major organisational or physical changes to the facility (e.g. building activities or staff re-organisation) during the study period
–	was involved in the development or pre-testing of the ACP+ intervention and materials(20)

Abbreviation: ACP, advance care planning

Table 2. Characteristics of care staff included in the ACP+ trial, by group and time point<sup>a</sup>

	Baseline (T0) (N=694)				Post-intervention (T1) (N=491)			
	Control (N=355)		Intervention (N=339)		Control (N=254)		Intervention (N=237)	
Age, mean (SD)	39,8	(11,2)	40,4	(12,0)	40,1	(11,8)	41,6	(12,3)
Female gender, n (%)	323	(92,0)	298	(89,8)	229	(92,3)	204	(89,1)
Job experience in years, mean (SD)	13,9	(10,6)	15,4	(11,6)	14,0	(11,1)	16,5	(11,7)
Occupation, n (%)								
Nurse	95	(27,0)	101	(30,5)	75	(30,5)	68	(29,7)
Care assistant	159	(45,0)	160	(48,3)	104	(42,3)	102	(44,5)
Allied health staff	99	(28,0)	70	(21,1)	67	(27,2)	59	(25,8)
Highest level of education, n (%)								
Primary education	0	(0,0)	4	(1,2)	2	(0,8)	1	(0,4)
Secondary education	184	(52,6)	157	(48,0)	119	(48,4)	107	(46,5)
Higher college education	118	(33,7)	121	(37,0)	85	(34,6)	88	(38,3)
Graduate education (university)	48	(13,7)	45	(13,8)	40	(16,3)	34	(14,8)
Received training in palliative care, n(%)	256	(72,5)	235	(72,1)	193	(78,5)	172	(74,5)
Received training in ACP <sup>b</sup> , n (%)	100	(29,0)	72	(22,2)	78	(31,7)	102	(45,7)
Hours/week working in the nursing home, n (%)	29,1	(8,3)	30,6	(8,8)	29,5	(9,1)	30,7	(8,9)
Mean number of residents cared for per day, n (%)	26,1	(27,3)	23,8	(23,0)	26,0	(25,9)	19,2	(19,2)

Abbreviations: SD, Standard Deviation; ACP, Advance Care Planning

<sup>a</sup> Missing data did not exceed 6%, except for ‘number of residents cared for’ at T1:14,6%.

<sup>b</sup> Prior to intervention (at T0) or in the previous 6 months (at T1).

Table 3. ACP+ intervention description according to TIDieR checklist

Item	Description
<i>Brief name</i>	ACP+ intervention
<i>Why</i>	To improve knowledge and self-efficacy of nursing home care staff concerning advance care planning
<i>What</i>	The ACP+ intervention comprises ten intervention components (ACP+ Trainer; buy-in and engagement of management; tailoring; ACP+ Reference persons; information sessions; in-house training; planned advance care planning conversations; information transfer; coaching; audit) and 17 supporting materials (e.g., conversation manuals, booklets, etc.). They are split over a preparation and training phase (months 1-4) and a follow-up phase (months 5-8). The former focuses on training, while the latter focuses on consolidating the new knowledge through practice of planned ACP conversations, multidisciplinary meetings, one-on-one coaching, and additional specialized training.
<i>Who provided</i>	The ACP+ intervention defines several roles: ACP Reference persons, ACP Conversation facilitators, and ACP Antennas (includes all nursing home staff). Two External ACP Trainers delivered the training sessions and were available for guidance throughout the intervention period. Their support was more intensive at the start of the intervention and progressively decreased
<i>How</i>	All training and information sessions, management and multidisciplinary meetings were held face-to-face, one-on-one or in a group (depending on the intervention activity). External trainers were additionally available for advice via telephone and e-mail. A common (across nursing homes) two-day interactive training was held at the start of the intervention and a common come-back seminar halfway through the intervention. All other training and information sessions were organized in-house for each nursing home separately. The intervention protocol foresaw the planned ACP conversations to be conducted face-to-face, in a private room in the nursing home.
<i>Where</i>	Nursing homes in Flanders (Belgium)
<i>When and how much</i>	<ul style="list-style-type: none"> <li>- The ACP+ intervention was implemented stepwise over eight months. Two-day interactive training, and one-day come-back seminar for ACP Reference Persons, provided by the ACP Trainer</li> <li>- Two In-house 4-hour training sessions (session 1 and session 2) to train nurses (and other interested staff, such as clerical workers, moral consultants, social workers, etc.) in conducting advance care planning conversations (i.e. to become ACP Conversation Facilitators)</li> <li>- In-house 2-hour training session to train non-nursing staff (care assistants, hairdressers, cleaning staff, administrative staff, etc.) and volunteers to recognize ACP triggers in residents and family (i.e. to become ACP Antennas)</li> <li>- Regular reflective debriefing sessions throughout the implementation period and individual coaching were offered to all staff by the ACP Trainers</li> <li>- Two specialization sessions (on 'dementia' and on 'communication with other healthcare professionals') for ACP Reference Persons and other interested staff</li> <li>- The intervention protocol foresaw monthly multidisciplinary meetings or in the frequency in which they were usually organized in the nursing home</li> </ul>

	<ul style="list-style-type: none"> <li>- Nursing homes were encouraged to start organizing and planning structured ACP conversations with residents and/or family from month 4, according to the ACP+ conversation tools (published separately(43)).</li> <li>- Audit meetings were to be arranged yearly, and once within the timeframe of the implementation period, in month 8 (last month of implementation)</li> </ul>
<i>Tailoring</i>	At the start of the intervention, at least one tailoring meeting between ACP reference persons, management, and other leading staff (e.g., head nurse) and the ACP trainer was planned to discuss how to implement the ACP+ intervention in routine care. A 'Tailoring checklist' specifying a minimum of elements that should remain unchanged and elements that could be adapted was provided as one of the intervention materials
<i>Modifications</i>	During the implementation of the intervention, 13 adaptations (component added, deleted, or adapted) were made across nursing homes: 1) extra meetings between staff and management were organized; 2) an ACP working group was set up; 3) a new role (i.e. ACP coordinator) was introduced to arrange practicalities around training sessions; 4) development of an internal ACP nursing home policy; 5) new ACP Reference Person assigned due to staff turnover; 6) adaptations in the duration and planning of training sessions (e.g. integrated into existing staff meeting structures; more but shorter training sessions); 7) addition of an information session for GPs; 8) multidisciplinary meetings replaced by internal team meetings; 9) separate information sessions for residents with cognitive capacity and family of residents who have dementia; 10) content of specialization sessions was integrated into other training sessions; 11) one-on-one coaching replaced by group coaching; 12) ACP+ document to register care goals were deemed superfluous in addition to own (electronic) documentation systems and hence not used.
<i>Fidelity</i>	Fidelity in the trial was rated by the researchers based on the analysis of post-intervention interviews with ACP Trainers and ACP Reference Persons. Fidelity was defined as the number of foreseen intervention activities that were delivered as intended. At least 13 of 17 intervention components were implemented as intended in each nursing home.

Table 4. Cluster-adjusted mean scores and differences for the primary and secondary outcomes (T0: N=694, T1: N=491)

	Baseline (T0)		Post-intervention (T1)		Baseline adjusted mean difference or ratio and 95% CI	ICC	Effect size: Cohen's d/ratio <sup>d</sup>	p-value <sup>e</sup>
	Control	Intervention	Control	Intervention				
	EMM (95% CI)	EMM (95% CI)	EMM (95% CI)	EMM (95% CI)				
Primary outcomes								
ACP Knowledge (rate) <sup>a</sup>	0,52 (0,48 to 0,56)	0,52 (0,48 to 0,56)	0,53 (0,49 to 0,58)	0,55 (0,51 to 0,60)	1,04 (0,95 to 1,15)	0,025	1,041	0,399
ACP Self-efficacy (mean score) <sup>b</sup>	5,99 (5,60 to 6,38)	5,76 (5,40 to 6,11)	5,89 (5,50 to 6,29)	6,23 (5,86 to 6,60)	0,57 (0,20 to 0,94)	0,015	0,301	<b>0,003</b>
Secondary outcome								
Staff-reported involvement in ACP communication and documentation (proportion) <sup>c</sup>	EP (95% CI)	EP (95% CI)	EP (95% CI)	EP (95% CI)				
						0,007	1,467	0,145
	0,40 (0,33 to 0,48)	0,39 (0,32 to 0,47)	0,36 (0,28 to 0,44)	0,44 (0,35 to 0,53)	1,47 (0,88 to 2,46)			

Abbreviations: ACP, Advance care planning; CI; confidence interval, EMM; estimated marginal mean, EP; estimated proportions, ICC; intra-class correlation coefficient. Across scales: If more than 25% of items were not answered (missing or not applicable), the summary score was defined as missing. Excluded records in the models used: knowledge n=30 (2,5%); self-efficacy n=270 (22,8%)(approximately 16,3% of staff answered 'not applicable', range over all self-efficacy questions 12,1%-21,6%), ACP communication and documentation n=16 (1,4%).

<sup>a</sup> negative binomial mixed model for rate, random intercepts for clustering within nursing home and staff member, adjusted for nursing home type and location. Range 0-1, higher scores indicate more knowledge.

<sup>b</sup> linear mixed model, random intercept for clustering within nursing home, compound symmetry covariance matrix for clustering within staff member, adjusted for nursing home type and location. Range 0-10, higher scores indicate more self-efficacy.

<sup>c</sup> binary logistic mixed model, random intercepts for clustering within nursing home and staff member, adjusted for nursing home type and location. Proportion (%) of staff engaging in at least one ACP communication and documentation activity, higher scores indicate more staff.

<sup>d</sup> Ratio was calculated for negative binomial mixed model and binary logistic mixed model, Cohen's d for linear mixed model.

<sup>e</sup> Interaction effect of group (intervention vs. control) and timepoint (post-intervention vs. baseline).



