

Heart

CLINICIAN TARGETED INTERVENTIONS TO IMPROVE ADVANCE CARE PLANNING IN HEART FAILURE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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TITLE PAGE

Clinician-targeted Interventions to Improve Advance Care Planning in Heart Failure: A Systematic Review and Meta-Analysis

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ABSTRACT

Objective: Advance care planning (ACP) is widely advocated to contribute to better outcomes for patients suffering from heart failure. But clinicians appear hesitant to engage with ACP. Our aim was to identify interventions with the greatest potential to engage clinicians with ACP in heart failure.

Methods: A systematic review and meta-analysis. We searched CINAHL, Cochrane Central Register of Controlled Trials, Database of Systematic Reviews, Embase, ERIC, Ovid MEDLINE, Science Citation Index, PsycINFO for randomised controlled trials (RCTs) from inception to January 2018. Three reviewers independently extracted data, assessed risk of bias (Cochrane risk of bias tool), the quality of evidence (GRADE) and intervention synergy according to Template for Intervention Description and Replication (TIDieR). Odds ratios (ORs) were calculated for pooled effects.

Results: Of 14175 articles screened, we assessed the full text of 131 studies. 13 RCTs including 3709 participants met all of the inclusion criteria. The intervention categories of patient-mediated interventions (OR, 5.23; 95% CI [2.36 – 11.61]), reminder systems (OR 3.65; 95% CI [1.47 – 9.04]), and educational meetings (OR, 2.35; 95% CI [1.29 - 4.26]) demonstrated a favourable effect to engage clinicians with the completion of ACP.

Conclusion: The review provides evidence from 13 published RCTs and suggests that interventions that involve patients to change clinical practice, reminder systems and educational meetings have the greatest effect in improving the implementation of ACP in heart failure.

KEY WORDS

Heart failure, meta-analysis, systematic review, ACP, clinicians, complex interventions

What is already known about the topic

- ACP is widely advocated to provide better care at the end-of-life for patients suffering from heart failure.
- However, clinicians appear hesitant to engage with ACP.
- Interventions to better engage patients with ACP have been evaluated. But a systematic review and meta-analysis of clinician-targeted interventions is missing.

What this paper adds

- Clinician-targeted interventions can help healthcare professionals to engage with ACP for patients suffering from heart failure.
- Interventions that involve patients to change clinicians' practice, reminder systems and educational meetings seem to be among the most effective approaches to facilitate ACP.
- This effect was observed especially when the intervention simultaneously enabled both clinicians and patients to engage with ACP.

How might this impact on clinical practice

- Interventions that enable clinicians to engage with ACP in heart failure need to be developed.
- Given the constraints of clinical practice, barriers and facilitators for a such a complex intervention need to be identified
- Patients with heart failure hold a key to change clinical practice and need to be enabled to engage clinicians with ACP.

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CLINICIAN-TARGETED INTERVENTIONS TO IMPROVE ADVANCE CARE PLANNING IN HEART FAILURE: A SYSTEMATIC REVIEW AND META-ANALYSIS

INTRODUCTION

The proportion of patients suffering from treatment refractory, end stage heart failure is growing¹. These patients have significant palliative care needs². Advance care planning (ACP) is widely advocated as a way of addressing these needs and facilitating better end-of-life care³⁻⁵. But studies show that clinicians often do not engage with ACP⁶⁻⁸ and patient care is affected. Patients might be motivated to discuss their care preferences and engage with future care planning, yet they require the cooperation of their clinicians^{9, 10}. Interventions have been used in the past to change clinicians’ practice pattern¹¹. While the effect of interventions to engage *patients* with ACP has been systematically evaluated in systematic reviews^{12, 13}, a rigorous assessment of the effect of interventions targeting *clinicians* is missing.

Furthermore, no past review considered a detailed analysis of different intervention approaches according to the Template of Intervention Description and Replication (TIDieR) in supporting clinicians in the delivery of ACP¹⁴. TIDieR has been used to explain intervention content and how their components might change clinicians’ behaviour¹⁵. Not investigating and understanding how interventions might work, can hinder efforts to intervention design, replication and efficiency¹⁶. The aim of this review was to synthesise the evidence for interventions with the greatest potential to engage clinicians with ACP in heart failure. The objectives were:

- To determine the effectiveness of interventions targeting clinicians to engage with ACP in heart failure
- To examine which intervention components might be associated with intervention synergy and which might be not

METHODS

This review was conducted according to the Preferred Reporting Items for systematic reviews and meta-analysis (PRISMA-P)¹⁷, the Cochrane Collaboration reporting items for systematic reviews and meta-analysis¹⁸, the Grading of Recommendation Assessment, Development, and Evaluation (GRADE) for the quality of evidence in selected trials¹⁹. The description intervention content followed TIDieR and intervention effect was reported based on CONSORT guidelines²⁰. **Supplementary File 1** shows the review protocol.

Eligibility criteria

We included only randomised controlled trials (RCTs) and cluster randomised controlled trials (cRCTs) of clinician-targeted interventions compared with standard professional development. We excluded studies that did not explicitly include patients suffering from heart failure or only dealt with the effect of the intervention on the implementation of ACP in paediatric but not in adult end-of-life care.

Studies were required to have a sufficiently detailed description of intervention components. Where this was not the case, we used the following approach: If the study identified that the intervention was a defined strategy, we searched online for details of the strategy and used these to classify the study components. Where insufficient details were available online, we contacted the authors directly, asking for a response by a given date. If the study seemed of interest but did not contain identifiable intervention components, we contacted the study authors with a template email asking them to provide any details they might have on the intervention.

Types of participants

We included studies of clinicians who worked in either primary or secondary care, the community or hospice setting and looked after patients suffering from heart failure. A clinician was defined as a person whose prime function was to manage a sick person with the purpose of alleviating most effectively the total impact of the illness upon that person²¹.

Types of interventions

Clinician-targeted interventions were defined as interventions designed to bring about changes in the behaviour of healthcare professionals according to the Cochrane Effective Practice and Organisation of Care Group (EPOC) Taxonomy²² (**Supplementary file 2**). EPOC provides a common language to categorise intervention components targeting clinicians. There was no limitation in terms of theory informing the intervention, the person delivering the intervention (e.g. research staff, trained clinician, social worker, counsellor, religious representative) or the health care setting. We included interventions that promoted the implementation of any type of ACP like advance directives, future care plans, durable power of health care attorney, living wills or health care proxies and interventions aimed at influencing professional practice by using patients as the agent for changing a clinician's behaviour. ACP was defined as a co-ordinated and comprehensive approach of care for patients early, during or towards the end of suffering from a terminal illness⁶. Authors had to explicitly state ACP intentions or this had to be evident in the composition of their study. Interventions that only looked at do-not-attempt-cardio-pulmonary-resuscitation orders were excluded from the review because they on their own did not represent the complexity of ACP²³. Furthermore, interventions that were solely aimed at changing the behaviour of patients without affecting clinicians were not within the scope of this review.

Type of outcome

We selected a priori as our primary outcome the completion of an ACP document to determine whether a clinician engaged with the process of ACP as a result of the intervention. ACP completion rates related to any outcome that described data on the

completion, recording or modification of any part of an ACP document. This outcome tended to indicate significant progress with discussing and deciding on various aspects of end-of-life care between clinicians and patients.

Search strategy

We searched the following data bases from their inception until January 2018: CINAHL, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Embase, ERIC, Ovid MEDLINE(SP), Other Non-Indexed Citations and Ovid MEDLINE(R), Science Citation Index, Social Science Citation Index & Conference Proceedings and PsycINFO. Together with a specialist health science librarian (NR), we used filters to reliably identify RCTs. A MEDLINE search strategy is presented in **Supplementary file 3**. We checked the reference lists of 15 relevant reviews and all potential cross references and records (**Supplementary file 4**). We contacted authors of main trials and experts in the field who were known to conduct research for additional papers or to provide missing or unpublished study data.

Selection of studies, data extraction and management

Titles and abstracts were independently screened against inclusion criteria by three reviewers (MS, IO, SC). Disagreements were resolved by discussion or referred for arbitration to a fourth author (BW). Full texts of screened papers were assessed for inclusion criteria and study quality. We pilot tested eligibility criteria and included a flow diagram of study selection and reasons for exclusion to conform to the PRIMSA statement. We kept a list of excluded trials and documented reasons for exclusion in the ‘Characteristics of Excluded Studies’ (**Supplementary file 5**).

We assessed the overall quality of the trials’ methods by using the GRADE system Version 3.6.1²⁴. A GRADE profile was created for each pooled estimate. Two authors (MS, IO) independently extracted data from papers and documented findings on a data extraction form. Two reviewers (SC, MS) independently coded interventions in each trial using the EPOC taxonomy²². **Supplementary File 1** describes the intervention scoring and coding procedures.

Data analysis

We performed quantitative meta-analysis with RevMan 5.3.5²⁵ using random effects models and assessed publication bias by performing Egger’s Test²⁶ with STATA version 14²⁷. For individual studies with dichotomous data, we calculated odds ratios (ORs) with 95% confidence intervals (CI) between the intervention and control group as recommend by Cochrane¹⁸. We calculated effect sizes for each EPOC category. Significance was set at $p < 0.05$. We conducted sensitivity analyses to explore the effect of trial quality on the primary outcome, to investigate reasons for heterogeneity, and to assess the effect of outliers on the outcome data. We did not adjust sample sizes to account for clustering in the included cRCT²⁸ as this study reported adjusted effect estimates, which took the intra-class coefficient found into consideration. We used a generic inverse variance approach and random effects meta-analysis to include the estimate into the meta-analysis. When multiple time points were reported, we used the one closest to three months post-intervention based on research practice in palliative care²⁹ and the premise that it would require a reasonable length of time for ACP

to take effect. We analysed the content, timing, frequency and synergy of clinician-targeted interventions that resulted in high and low effect sizes according to TIDieR¹⁴.

We assessed heterogeneity using the I^2 statistic stating the percentage of variability in effect estimates that is due to heterogeneity rather than to chance³⁰. Thresholds for the interpretation of heterogeneity were based on Cochrane guidance¹⁸ as follows: 0% to 40%: might not be important; 30% to 60%: moderate heterogeneity; 50% to 90%: substantial heterogeneity; 75% to 100%: considerable heterogeneity. Two reviewers (MS, IO) independently assessed the risk of bias using the Cochrane Collaboration's tool for risk of bias domains³¹.

RESULTS

Of 14175 articles screened, we reviewed the full text of 131 papers. Thirteen RCTs including one cRCTs representing 3709 participants met all the inclusion criteria (**Figure 1**. PRISMA Flow Diagram). We excluded 102 studies with reasons provided in the "Characteristics of Excluded Studies" (**Supplementary file 5**). A detailed description for each trial is presented in **Table 1**.

[Figure 1. PRISMA flow diagram]

Study (year)	Setting/ Country	Unit of Randomisation	Description of Healthcare Professionals	HCPs undergoing Randomisation & Completed (No.)	Description of Patients	Patients undergoing Randomisation & Completed (No.)	Female Patients (no/%) & Mean age (Years)	Follow-up (weeks)	Type(s) of ACP outcome
Aiken ³² (2006)	Community, USA	Patient	Hospice nurse and case manager	N/a	CHF and COPD patients	192/191	123/64 65.5	12	ACP Doc
Detering ³³ (2010)	Hospital, Australia	Patient	Internal & pulmonary physicians, cardiologists	N/a	CHF patients >80 years of age	309/305	162/52.5 84.5	12	ACP Doc
Dexter ³⁴ (1998)	Community, USA	Primary Care Physician	Primary Care physicians, residents, fellows and faculty	147/147	>75 years of age or > 50 years of age with terminal illness and CHF	1009/814	665/66 65.1	20	ACP Doc
Doorenbos ³⁵ (2016)	Hospital, USA	Patient	Cardiology staff	N/a	CHF patients	80/73	19/23.7 58.1	8	ACP Doc
Engelhardt ³⁶ (2006)	Hospital and community, USA	Patient	Primary and secondary care physicians	N/a	Patients with chronic HF or terminal illnesses	275/186	118/82.6 Not reported	12	ACP Doc
Gade ³⁷ (2008)	Hospital USA	Patient	Internal physicians	N/a	Terminally ill and CHF patients	517/512	162/59 73.3	24	ACP Doc
Heffner ³⁸ (2001)	Hospital, USA	Patients	Cardio-vascular healthcare professionals	N/a	Cardio-vascular rehabilitation patients	415/284	77/27.1 65.3	24	ACP Doc
Heiman ^{28*} (2004)	Community, USA	Primary Care Clinic	Primary care faculty physicians	48/48	>70 years of age or > 50 years of age with CHF and terminal illness	1079/895	740/68.3 71.1	28	ACP Doc
Metzger ³⁹ (2016)	Hospital, USA	Patient	Cardiology staff	N/a	CHF patients	29/29	9/ 31.0 62.4	2	ACP Doc
Nicolasora ⁴⁰ (2006)	Hospital, USA	Patient	Internal medical physicians	N/a	Patients admitted to medical ward incld. CHF	297/294	150/50.5 67.0	1	ACP Doc
Reilly ⁴¹ (1995)	Hospital, USA	Patient	Internal medical physicians	100/74	Patients from acute admissions incld. CHF	162/162	86/53 63.6	12	ACP Doc
Rubin ⁴² (1994)	Hospital, USA	Patient	Patients' health care provider	Not reported	>65 years of age, discharged from hospital	1101/1101	517/47 Not reported	20	ACP Doc
Sidebottom ⁴³ (2015)	Hospital, USA	Patient	Cardiology staff	N/a	CHF patients	232/ 167	110/ 7.4 73.4	12	ACP Doc
Abbreviations	ACP Doc: Completion of an ACP document; CHF: congestive heart failure; * = cRCT;								

Table 1. Characteristics of included studies

Characteristics of included studies

Twelve of the 13 studies were conducted in the USA, and one in Australia³³. Nine trials were performed in a hospital setting, three studies in the community and one study involved hospital and community settings³⁶. All thirteen included studies using a randomized controlled trial design. The one cRCTs reported baseline cluster sizes at the practice level²⁸. The median sample size was 411 participants. The smallest number of participants randomized at baseline was $n=29$ ³⁹. The largest sample size was $n=1101$ ⁴². The median follow-up period was 14.38 weeks (range from one week to 28 weeks).

Comparators to the intervention was standard professional development like chronic disease management for heart failure patients. If clinicians were the target of the intervention, the control group was not included in the intervention training or exposed to any form of the intervention.

Risk of bias assessment

Key descriptors for the risk of bias assessment of the 13 RCTs are summarised in the risk of bias graph (**Figure 2**) and presented for each study in **Supplementary file 6**.

[Figure 2]

No trial reported inadequate methods of random sequence generation. Allocation concealment was unclear in six included trials as authors did not describe methods. Blinding of participants seemed not possible in a four trials because of the nature of the interventions used resulting in a high risk of performance bias. Outcome assessors were likely to be aware of the allocation of participants to control or intervention groups in one trial³⁶. Incomplete outcome data (attrition bias) and selective reporting was adequately addressed in all studies. Eight patients from the control group of Sidebottom et al.'s study received the intervention indicating issues with contamination.

Egger's test and the inspection of funnel plot symmetry showed no evidence of a small study effect or publication bias for studies ($n = 4$) including only heart failure patients ($p=0.117$). Mixed study populations ($n=13$) demonstrated a small study effect ($p=0.006$) (**Supplementary file 7**).

Quality of evidence

The mean score for the overall quality of evidence across all studies was moderate after rating all GRADE criteria because many participants could not be blinded to the nature of the intervention. We identified four EPOC intervention categories targeting clinicians:

Patient-mediated interventions used patients to change clinicians' behaviour had the greatest effect (OR, 5.23; 95% CI [2.36 – 11.61], $p < 0.0001$) on the implementation of ACP in heart failure (**Figure 3**) followed by reminder systems (3.65; 95% CI [1.47 – 9.04], $p = 0.005$)

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(**Figure 4**), educational meetings (OR, 2.35 [1.29 - 4.26], $p = 0.005$) (**Figure 5**), and academic detailing (OR, 1.66; 95% CI [1.09 – 2.52], $p = 0.02$).
[**Figure 3**]

[**Figure 4**]

[**Figure 5**]

Synergy of intervention components

Based on the effect sizes of included studies, **Table 2** provides a summary according to TIDieR of the most effective and the least effective interventions found in the review. The column labelled ‘Synergy’ considers how intervention components might have interacted with each other to determine higher or lower effect sizes. Interventions with the highest effect sizes included components that targeted clinicians and patients simultaneously to engage with ACP. The timing of the most effective interventions of engaging clinicians was nearly always during significant milestones in a patient’s disease trajectory. Typically, this took place before or after a hospital admission, before or after a change in the patient’s health status or in the context of a scheduled appointment.

Study OR [95% CI]	Content of the <u>most</u> effective interventions Description according to EPOC	Timing of the intervention	Synergy
Rubin ⁴² 61.58 [15.11 - 250.96]	Physicians received a patient visit and were prompted (patient-mediated) by the patient to talk about End-of-life issues. The provision of and completion of a durable power of attorney form was prompted by the patient visit. Patients were educated in how to prompt clinicians to engage with ACP and complete a durable power of attorney. They were offered telephone support throughout the study. Patients were sent a cover letter, an educational brochure with treatment options and a durable power of attorney form.	Patients were educated in ACP <i>after a recent hospitalisation</i> at a time when their medical condition was stable.	Physicians responded to educated patients who had the motivation and skills to initiate discussions about their ACP preferences. Additionally, patients were given the opportunity and time to clarify their wishes before the completion of an ACP document.
Nicolasora ⁴⁰ 18.55 [2.38 - 144.37]	Physicians were trained in using a script (training) from which to read detailed information about ACP (education). Patients prompted (patient-mediated) clinicians to talk about ACP. Patients were educated in the purpose of ACP and trained how to communicate their EOLC preferences with their clinician. They could reflect on how the information about ACP applied to their own values.	<i>At the point of admission to hospital</i> , patients were asked by the admitting staff about their EOL wishes and the completion of an ACP document.	The concurrent arrangement of targeting physicians and patients may have increased physician-patient dialogue, a clarification of EOL preferences and a greater proportion of completed ACPs. The training of patients and clinicians in the intervention group may have increased levels of motivation and skills to address ACP.
Detering ³³ 14.84 [3.89-56.70]	Physicians received a patient visit (patient-mediated) who prompted an ACP conversation. Patients received education from an ACP facilitator using the Respecting Patient Choices model about the purpose of ACP. They were educated on how to identify a surrogate decision maker, and how to identify EOLC choices. Typically, the facilitator met with patients and family members on three occasions before discharge to achieve an ACP.	<i>Before hospital discharge</i> , patients and family members were asked by a trained facilitator (nurse or allied health professional) whether they would like to engage with ACP.	Both, patients and facilitators, were trained in identifying and communicating End-of-life issues and ACP preferences. Patients and families were given the time and the opportunity to think about their choices leading to better shared decision making and ACP completion.
Heiman ²⁸ 5.90 [1.58 – 22.00]	Physicians received computer generated reminders including an ACP template (reminder system), training in how to use the ACP template (educational meeting), and education on the purpose of ACP. Patients received educational brochures on ACP, a set of ACP forms. They were encouraged to ask their clinician about ACP.	Physicians received ACP computer reminders one day prior to the patient visit. Patients received ACP education six weeks prior to their scheduled routine appointment.	Physician-patient interaction and ACP completion may have been improved by <i>simultaneously</i> targeting physicians and patients with reminders and training in communicating EOL/ ACP issues. The content and electronic format of the ACP reminder made it easy for the clinician to identify relevant issues that needed to be covered.

Study OR [95% CI]	Content of the <u>least</u> effective interventions Description according to EPOC and BCTTv1	Timing of the intervention	Synergy
Gade ³⁷ 1.66 [1.09 - 2.52]	Physicians received support from an interdisciplinary palliative care consultative service (IPCS) in the management of HF patients. Patients were only the passive recipients of information. While members of the IPCS team met with patients and family members on an as required basis, patients were not educated in identifying their EOLC preferences or trained in how to talk to their clinicians about ACP.	After admission to hospital, patients were approached to document their EOLC preferences.	A lack of interaction between physicians and patients was in part due to the omission of training and supporting patients to pro-actively talk to their clinicians about ACP. The comparatively small effect size of this rather costly intervention involving many clinicians was remarkable.
Heffner ³⁸ 1.56 [0.95 - 2.56]	Physicians were prompted by their patients to discuss ACP. Clinicians did not receive any training or support in how to address End-of-life issues. Patients received only printed material on the purposes of ACP and were encouraged to talk to their clinicians about it. Patients did not receive any training in how to talk to their clinicians. Only 2% of patients in the intervention group and 12% in the control group suffered from CHF NYHA Class III and IV.	The majority of patients was at an early stage in their HF disease trajectory. The intervention was delivered in the context of a cardiovascular rehabilitation programme.	Only the minority of patients suffered from end-stage CHF. These patients might have been less motivated to talk to their clinician about ACP since the relevance seemed less obvious. Additionally, neither patients nor physicians received any training in talking about or completing an ACP.
Reilly ⁴¹ 1.19 [0.46 - 3.04]	Physicians received only printed material in form of a cover letter, a brochure explaining an advance directive and the New York State healthcare proxy form. No additional support was offered. Patients received the same printed material about advance directives. The cover letter encouraged patients to complete the form before meeting their clinician. Patients did not receive any further education, training or support in filling in the form or identifying their care preferences.	Patients who were recently discharged from hospital were sent the educational material and a healthcare proxy form.	Patients were expected to complete the form on their own before attending their next outpatient appointment with their clinician. Physicians lacked any training in engaging with ACP. A lack of support for both, physicians and patients, may have resulted in a low level of doctor-patient interaction and ACP completion.

Table 2. Intervention synergy

Sensitivity analyses

Several sensitivity analyses including studies restricted to only heart failure patients^{35, 38, 39, 43} (OR 1.95, 95% CI [1.30 - 2.91], $p < 0.001$, $I^2 = 0\%$), trials at low risk of bias^{32, 33, 38, 39, 41} (OR 3.17, 95% CI [1.30 - 7.76], $p = 0.01$, $I^2 = 70\%$), and the exclusion of the three highest^{33, 40, 42} and lowest outliers^{37, 38, 41} (OR 2.99 [1.97 - 4.51], $p < 0.00001$, $I^2 = 0\%$) confirmed the consistency of the results of the primary analyses (**Supplementary file 8**).

DISCUSSION

Previously, there was no firm evidence for the effect of clinician-targeted interventions to engage healthcare professionals with ACP in heart failure. This literature review and meta-analyses investigated 13 RCTs including 3709 participants and demonstrated that patient-mediated interventions (OR, 5.23; 95% CI [2.36 - 11.61]), reminder systems (3.65; 95% CI [1.47 - 9.04]), and educational meetings (OR, 2.35 [1.29 - 4.26]) were the most effective intervention components. Academic detailing demonstrated only small effects (OR 1.66, 95% CI [1.09 - 2.52]). Several sensitivity analyses confirmed the consistency of the results of the primary analyses.

Relation to other studies

This review is the first to analyze the effect of interventions targeting healthcare professionals on the delivery of ACP in heart failure in a meta-analysis. A number of reviews had investigated the effectiveness of interventions to implement ACP^{13, 44, 45, 12, 46-48} but none focused on healthcare professionals or interventions with the greatest potential in changing clinicians' behavior in heart failure. For example, the review by Houben et al.¹² only presented data on the efficacy of interventions targeting patients to improve the implementation of ACP but did not analyze which intervention components made a difference to clinical practice.

Our results concurred with findings from a number of Cochrane reviews on the effectiveness of interventions targeting clinicians. For example, we found that educational meetings were often combined with other interventions to maximize their impact. This finding agrees with a review by Forsetlund et al.⁴⁹. They demonstrated that training clinicians was rarely used as a stand-alone tool and was nearly always combined with other techniques. A number of other Cochrane reviews had investigated the evidence base for the effect of reminder systems and academic detailing^{11, 34}. Again, authors concluded that these interventions appeared effective in improving clinical behavior across a number of settings preferably when combined with other methods. Their findings largely concurred with our results: reminder system were always combined with other intervention categories. The strong effect sizes for and frequency of patient-mediated interventions was a surprise. Published data on the effect of patient-mediated interventions to improve professional practice was sparse⁵⁰.

Strengths and limitations of the study

The strength of this review and meta-analyses consisted of the use of a robust search strategy, assessing the quality of the evidence with the GRADE system, rating risks of biases, pooling data across studies for each intervention category, exploring intervention synergy according

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2 to TIDieR, and performing sensitivity analyses. The overall quality of evidence was moderate
3 to low mainly due to a high risk of performance and detection bias. Egger’s test for the heart
4 failure-only studies did not show any publication bias; the bias for mixed population studies
5 was significant. This may have introduced a beneficial effect of the interventions compared
6 to standard training. Almost all studies were based in the USA. This has implications of the
7 generalizability of the results to other countries where different definitions and legal
8 frameworks exist.
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11 Using the EPOC taxonomy was an important first step towards providing a common
12 language to describe intervention categories and attempt an analysis of intervention
13 effectiveness. Amongst a number of categories, EPOC highlighted the importance of patient-
14 mediated interventions, reminders and educational meetings to change clinicians’ practice.
15 However, EPOC provided only a superficial level of detail in describing intervention content
16 and application. This made their replication very difficult. TIDieR addressed that limitation
17 to some extent by a more detailed consideration of the content, timing, frequency and
18 synergy of interventions components. The content of the most effective interventions
19 included multiple components that *simultaneously* targeted clinicians and patients to talk
20 about ACP.
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24 The right timing for a clinician to engage with and deliver ACP was often associated with
25 significant milestones in a patient’s disease trajectory. For example, before patients had a
26 scheduled appointment with their clinician²⁸, at the point of admission to a medical ward⁴⁰ or
27 after a recent hospitalisation⁴². The involvement of patients as part of a strategy to change
28 clinicians’ behaviour seemed even more important. This included interventions that provided
29 support for patients and their families by enabling them to ask their clinicians questions about
30 their care preferences and start the process of completing an ACP document^{40, 42}. A lack of
31 support of patients seemed predictably associated with lower effect sizes in the completion of
32 ACP^{37, 41}. A comparison between the studies of Rubin et al.⁴² and Reilly et al.⁴¹ highlights
33 that fact. Rubin et al.’s intervention might appear similar to Reilly’s components. But there
34 were two significant differences: Rubin et al.’s⁴² study included telephone support for
35 patients for the duration of the study in case patients had any questions about their healthcare
36 proxy form. Patients and family members could discuss their care preferences with their
37 clinician *before* they completed the form in Rubin’s study. Reilly et al.’s intervention did
38 provide either of these.
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42 Based on findings from the literature review, **Table 3** summarizes intervention components
43 with the greatest potential to change clinical practice according to TIDieR. These
44 components, their content, timing and format might inform policy and be useful when
45 considering the engagement of clinicians with ACP in routine clinical practice.
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Intervention Component	Content	Timing	Provider	Format	Delivery
Patient-mediated interventions	A list with questions that clarify patients' end of life care preferences, ACP treatment options, tips in talking to a clinician	When heart failure patients are stable, after or before significant changes in their status of health	Research Team or Clinicians	ACP document, Question Prompt List, Shared decision-making tool for heart failure	Education of patients and information provision by research team or clinicians
Education and Training	Training clinicians in how to communicate end-of-life issues and ACP to patients, case scenarios	Ongoing, as part of clinicians' CPD	Research Team or Senior clinicians	Workshop or Conference	Education, persuasive communication, model behaviour to clinicians by facilitators
Reminder systems or Prompts	Electronic or paper reminders on core aspects of ACP and CHF, links to resources on heart failure and end-of-life care	Ongoing, as part of the professional work/ IT environment	Research Team	As part of the local IT system or the patient's paper medical records	Restructure the physical environment and provide opportunities for clinicians to engage with ACP
Abbreviations	ACP: advance care plan; CPD: continuous professional development; CHF: congestive heart failure; EOL: end-of-life				

Table 3. Clinician-targeted interventions

CONCLUSIONS

The review provides evidence from 13 published RCTs and suggests that interventions that involve patients to change clinicians' behaviour, reminder systems and educational meetings have the greatest effect in improving the implementation of ACP in heart failure. Almost all studies were based in the USA affecting the generalizability of the results. However, findings may have the potential to be highly useful for services to consider how best to introduce ACP amongst healthcare professionals.

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Declaration of competing interests

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Research ethics and patient consent

This systematic review and meta-analysis did not require ethics approval.

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MS had the idea for the review, wrote the protocol, extracted, evaluated and analysed the data, wrote, critically revised and submitted the entire manuscript. BW critically supervised the conduct of the review and revised the entire manuscript. RP critically revised the study protocol, the statistical meta-analyses and publication bias sections as well as the TIDieR analysis of intervention characteristics. IO independently screened papers, extracted data and evaluated risk of bias and study quality according to GRADE and the Cochrane risk of bias assessment tool. Charlotte Albury independently identified and coded and synthesised intervention evidence for the intervention synergy analysis. Sarah Collins independently identified and coded

Cochrane EPOC intervention components and synthesised the evidence for the intervention synergy analysis. All co-authors approved the version to be published.

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PRISMA 2009 Checklist

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Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	5
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	7
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	7
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6,7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	7
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7,8



PRISMA 2009 Checklist

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Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	8
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	8
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	8
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	9
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	10
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	11-12
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	11
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	10
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	13-15
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	15
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	16
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	17
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	19

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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Figure 1. PRISMA flow diagram

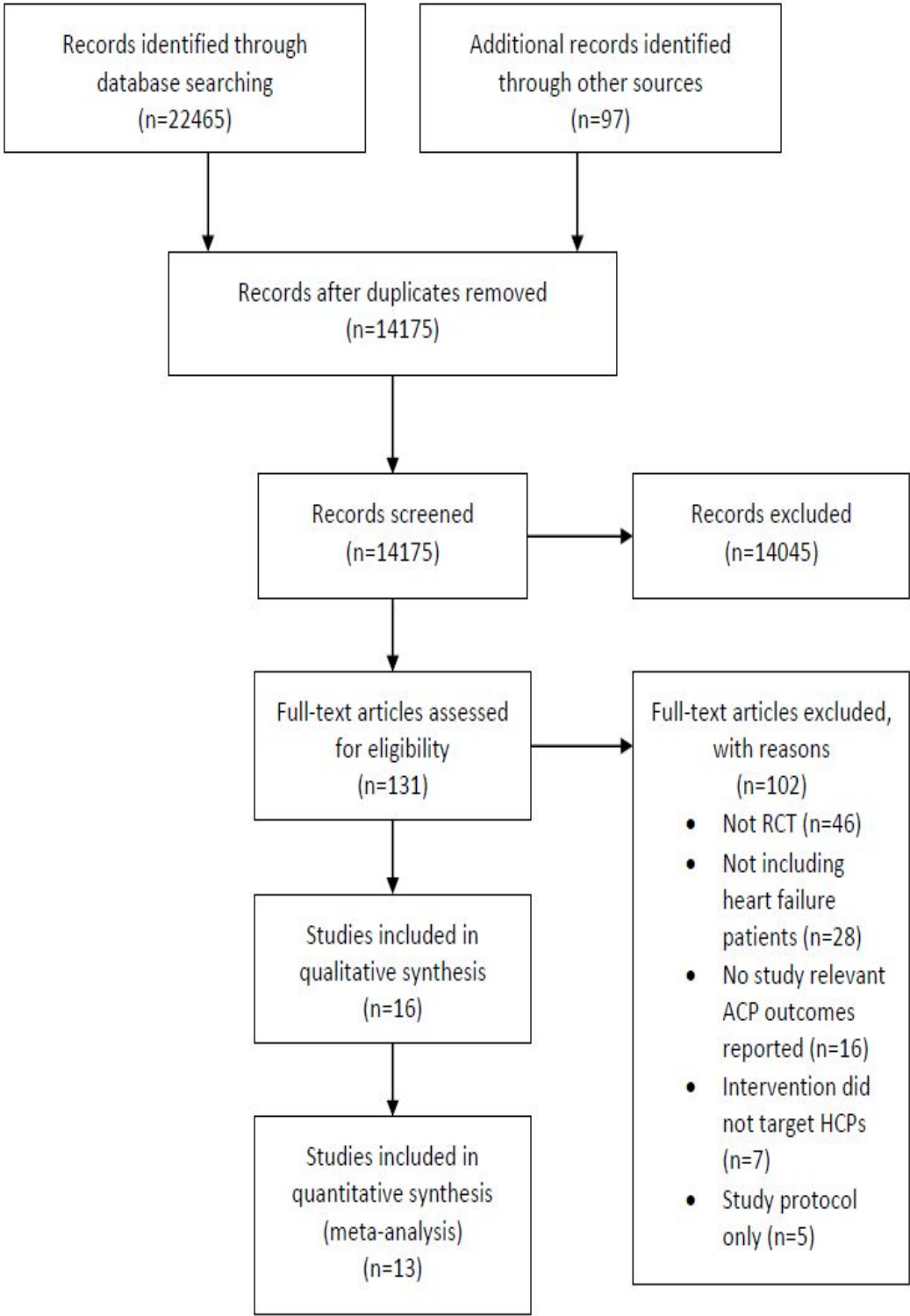


Figure 2. Risk of bias graph

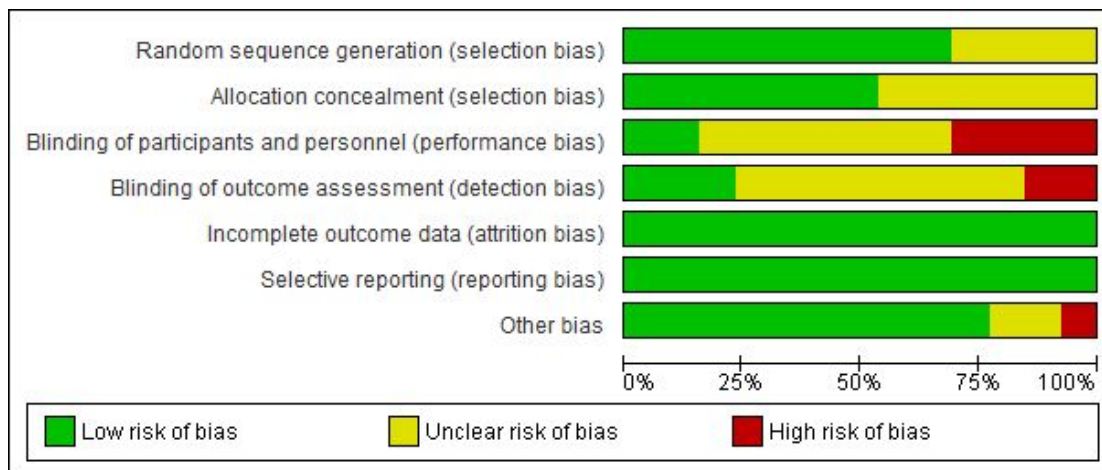


Figure 3. Patient mediated interventions

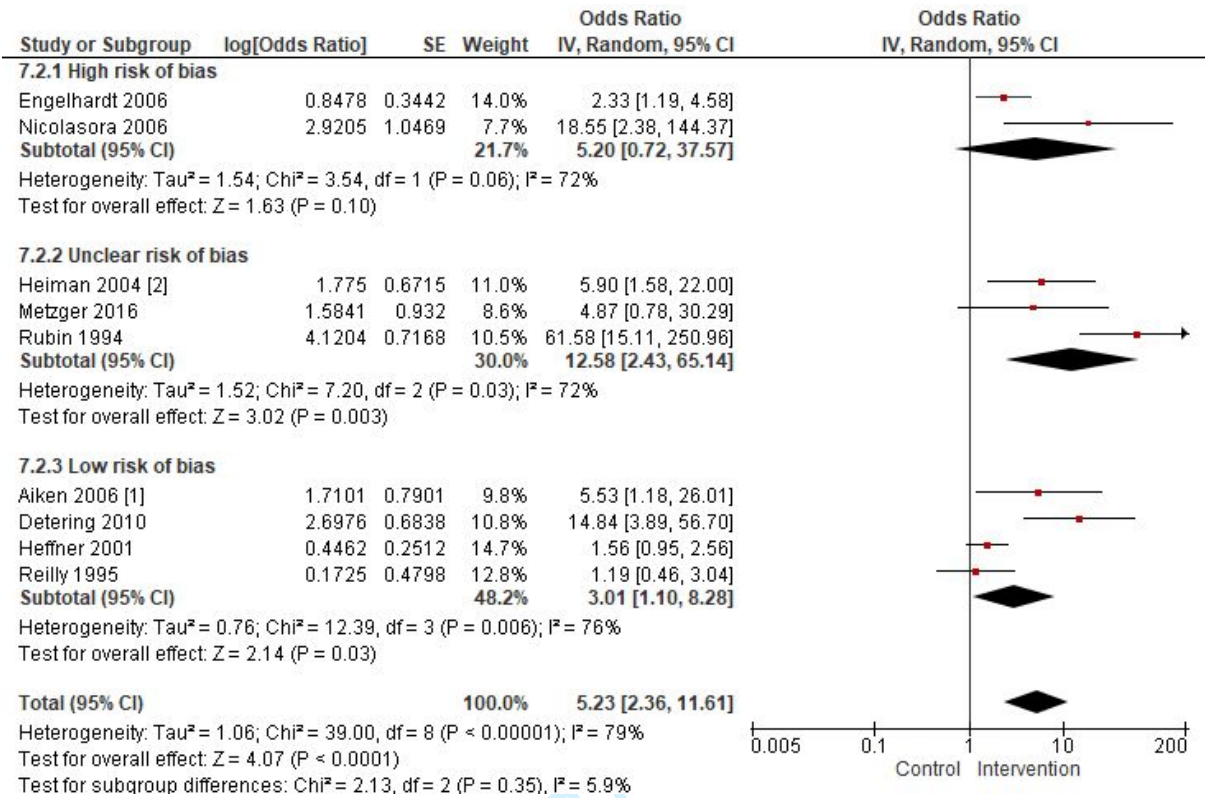


Figure 4. Reminder systems

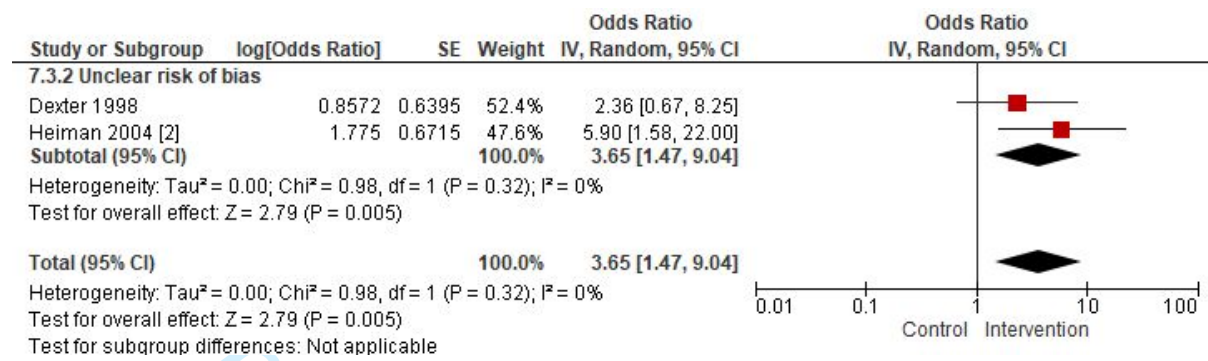
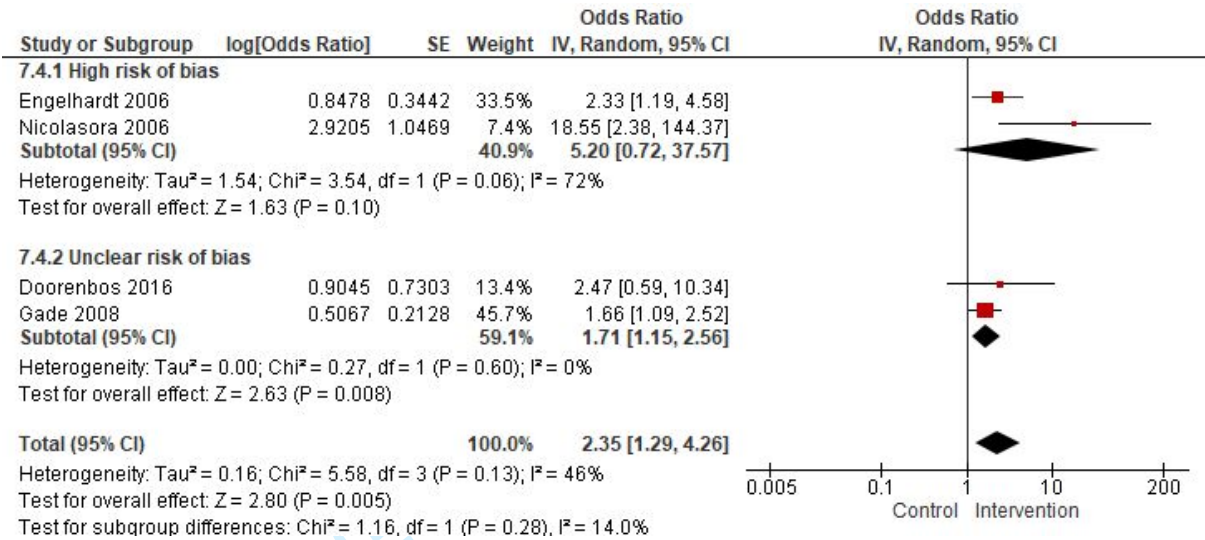


Figure 5. Educational meetings



SUPPLEMENTARY FILES

SF1. PROTOCOL FOR A SYSTEMATIC REVIEW AND META-ANALYSIS on clinician-targeted interventions to improve advance care planning in heart failure

BACKGROUND

While the effects of interventions to optimise the implementation of advance care planning among patients and carers have been systematically evaluated in a number of reviews, a rigorous assessment of the effect of interventions on *clinicians* is missing. Patients might be motivated to discuss their care preferences, engage with future care planning and explore decisions about treatment options. For a number of reasons, clinicians hesitate to have these conversations. Furthermore, no past review considered a detailed analysis of different intervention approaches according to the Cochrane Effective Practice Organisation of Care (EPOC) and behaviour change techniques in supporting clinicians in the delivery of ACP. Behaviour Change Techniques and Behaviour Change Taxonomies have been used to explain intervention content and why and how their components might change clinicians' behaviour. Not investigating and understanding why and how interventions might work, can hinder efforts to intervention design, replication and efficiency.

Relationships to other relevant reviews

A number of other reviews on the effects of interventions to improve the delivery of ACP have been identified. However, these reviews predominantly focus on interventions targeting patients in order to improve engagement with ACP but not clinicians. A precise estimate of intervention effect targeting clinicians based on a meta-analysis of available trial data is missing. Furthermore, none of these reviews consider a detailed analysis of the different interventions according to behaviour change techniques (BCTs) in supporting clinicians in the delivery of ACP. Behaviour change techniques and the Behaviour Change Techniques Taxonomy Version 1 (BCTTv1) have been used to explain intervention content and why and how their components might change clinicians' behaviour. Not investigating and understanding why and how interventions might work, hinders efforts to intervention design, replication and efficiency.

The aim of this review is to synthesise the evidence for behavioural interventions with the greatest potential to engage clinicians with ACP in heart failure. The objectives are:

- To determine the effectiveness of interventions targeting clinicians to engage with ACP in heart failure
- To identify which behavioural change techniques are associated with clinicians' behaviour change

- To examine which intervention components might be associated with intervention synergy and which might be not

METHODS

This review follows the Preferred Reporting Items for systematic reviews and meta-analysis (PRISMA-P)¹⁴³ statement, the Grading of Recommendation Assessment, Development, and Evaluation (GRADE)¹⁴⁴. The TIDieR¹⁰³, the Behaviour Change Techniques Taxonomy, and the Effective Practice Organisation of Care Taxonomy.

Types of Studies

We include randomised controlled trials (RCTs) together with cluster randomised controlled trials (cRCTs). Studies are required to have a sufficiently detailed description of intervention components. Where this is not the case, we use the following approach:

- If the study identified that the intervention is a defined strategy, we search online for details of the strategy and used these to classify the study components. Where insufficient details are available online, we contact the authors directly, asking for a response by a given date.
- If the study seems of interest but does not contain identifiable intervention components, we contact the study authors with a template email asking them to provide any details they might have on the intervention.
- Where authors do not respond by a date specified, provide insufficient information, or where we can not find a current e-mail address, the study is excluded, with the reason for exclusion clearly identified (for example, “unclear on reminder activity”).

Types of Participants

We include studies of clinicians who work in either a primary, secondary care or the independent healthcare sector and look after patients suffering from heart failure. A clinician is defined as a person whose prime function is to manage a sick person with the purpose of alleviating most effectively the total impact of the illness upon that person. This includes General Practitioners, cardiologists, palliative care clinicians, nurses in primary or secondary care and allied healthcare professionals like physiotherapists or occupational therapists. We exclude studies that do not mention the inclusion of patients suffering from heart failure.

Types of Interventions

We use the taxonomy of the Effective Practice Organisation of Care Group which defines clinician targeted interventions. Using the Taxonomy is a first important step to categorize intervention content. There are no restrictions in terms of theory informing the intervention, the person delivering the intervention (e.g. research staff,

trained clinician, social worker, counsellor, religious representative) or the healthcare setting in which the intervention is delivered (e.g., primary care, secondary care, independent or private healthcare sector or online). Interventions could be delivered using any design and by any type of media. We include interventions that promote the implementation of any type of advance care planning like advance directives, future care plans, durable power of healthcare attorney, living wills or healthcare proxies, and interventions aimed at influencing professional practice by using patients as the agent for changing a clinician's behaviour. However, interventions that are solely aimed at changing the behaviour of patients or consumers, such as lifestyle counselling, are generally not within the scope of this review. The exception is when professional and patient behaviour are affected by the intervention.

Exclusion Criteria

We exclude studies where the intervention solely targets patients but is not intended to change clinicians' behaviour. We exclude studies that focus exclusively on the choice of resuscitation preferences as the primary outcome measure of the intervention and do not consider the complexity of advance care planning. Conversely, we include studies which both support the use of advance care planning and include information on resuscitation preferences. We exclude studies that do not report the components of the intervention, studies that do not explicitly include patients suffering from heart failure and studies that only deal with the effect of the intervention on the implementation of advance care planning in paediatric but not in adult end-of-life care.

Types of Outcome

The selection of outcomes for this review focuses on whether the intervention is effective in engaging clinicians with the delivery of advance care planning. Therefore, we select a priori as our primary outcome the completion of an advance care planning document to determine whether a clinician engaged with the process of advance care planning as a result of the intervention. ACP completion rates relate to any outcome that described data on the completion, recording or modification of any part of an ACP document. We elect the completion of an ACP document as our primary outcome because it tends to indicate significant progress with discussing and deciding on various aspects of end-of-life care between clinicians and patients. As such, this outcome seems further "downstream" in the pathway of care compared to the occurrence of an ACP conversation. The completion of an ACP document can, for example, include outcomes on recording end-of-life care preferences, values and choices of patients, family members or healthcare proxies. If more than one outcome follow-up is reported, we use the frequency of ACP completion rates at any time closest to three months post-intervention based on the premise that it will require a reasonable length of time for clinicians and patients to complete an ACP document after they were exposed to the intervention.

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3
4 **Search Strategy**
5

6 Together with a specialist health science librarian (NR), we will design, test and
7 conduct the literature searches. We will search the following data bases from their
8 inception: CINAHL, Cochrane Central Register of Controlled Trials, Cochrane
9 Database of Systematic Reviews, Database of Abstracts of Reviews of Effects,
10 Embase, ERIC, Ovid MEDLINE(SP), Other Non-Indexed Citations and Ovid
11 MEDLINE(R), Science Citation Index, Social Science Citation Index & Conference
12 Proceedings and PsycINFO. We use filters to reliably identify RCTs. We check the
13 reference lists of relevant reviews and all potential cross references and records.
14 Additionally, we contact authors of main trials and experts in the field who are known
15 to conduct research for additional papers or to provide missing or unpublished study
16 data.
17
18

19
20 **Selection of Studies, Data Extraction and Management**
21

22 Three authors (MS, IO, SC) independently assess titles and abstracts against inclusion
23 criteria to identify potentially relevant studies using EndNote X8¹⁵⁷. Those studies
24 that are thought to be relevant are obtained as full text papers. Differences between
25 authors during the selection process are discussed. The opinion of a fourth author will
26 be sought (RP) where relevant. Finally, two reviewers (MS and IO) independently
27 evaluate whether these studies should be included using the pre-specified data
28 extraction form. We keep a list of excluded trials and document reasons for exclusion
29 in the ‘Characteristics of Excluded Studies.’
30
31

32 We assess the overall quality of the trials’ methods by using the GRADE system
33 Version 3.6.1⁴¹. A GRADE profile will be created for each pooled estimate. Two
34 authors (MS, IO) independently extracted data from papers and documented findings
35 on a data extraction form.
36
37

38
39 **Intervention Coding**
40

41 Two reviewers (SC, MS) will independently code interventions in each trial initially
42 using the Effective Practice Organisation of Care Taxonomy. Using the Effective
43 Practice Organisation of Care Taxonomy is a first step and will help to address the
44 lack of precision in intervention reporting. The Cochrane Effective Practice
45 Organisation of Care Group provides a taxonomy for interventions targeting
46 *healthcare professionals* which includes a category called “patient-mediated
47 interventions” describing intervention components where the patient acts as the agent
48 of change of the clinician behaviour. By starting the intervention component analysis
49 with the Effective Practice Organisation of Care Taxonomy, that important set of
50 interventions should be identified.
51
52

53 Each intervention reviewed will receive the following score, reflecting the degree of
54 certainty that the intervention domain is used in the trial:
55

- 56 ▪ yes = 1
- 57 ▪ unclear = 0.5
- 58 ▪ no = 0
- 59
- 60

The 'unclear' code will be applied where an intervention is not explicitly stated, but reviewers agree that elements of the intervention description imply that it is used in the study. A score of >1.5 (max. 2.0) confirms the use of the intervention in the trial. Discrepancies in coding are resolved by discussion. We may develop a number of our own coding rules for heart failure, palliative care, and clinicians since the focus of EPOC does not yet exist for heart failure. We will document the rationale of our coding decisions in a coding book. Finally, we will record the frequency of use of each behaviour change techniques targeting healthcare professionals and patients and conduct random effects meta-analyses to estimate the impact of the change on clinicians' behaviour.

Statistical Analysis and Quality of Evidence Assessment

We will perform quantitative meta-analysis with RevMan 5.3.5 using random effects models. For individual studies with dichotomous data, we calculate odds ratios (ORs) with 95% confidence intervals (CI) between the intervention and control group as recommend by Cochrane. We will not adjust sample sizes to account for clustering in cluster RCTs if these studies report adjusted effect estimates, which take the inter-class coefficient into consideration. We will use a generic inverse variance approach to include these estimates into the meta-analysis. We conduct meta-analyses for the primary outcome and calculate effect sizes for each Effective Practice Organization of Care Group and behaviour change techniques intervention category.

We conduct sensitivity analyses to explore the effect of trial quality on the outcome and to investigate reasons for heterogeneity. Issues surrounding heterogeneity included subgroup analyses for patient populations, trials at low risk of bias, outliers and characteristics of the most and the least effective clinician targeted interventions.

Managing units of analysis issues and missing data, assessing risk of bias and the quality of evidence follows Cochrane principles as stated in the Cochrane Handbook.

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SF 2.The Effective Practice and Organisation of Care (EPOC) Taxonomy



EPOC Category	Definition
Audit and feedback	A summary of a health workers performance over a specific period of time, given to them in a written, verbal or electronic format
Educational materials	Distribution to individuals, or groups, of educational materials to support clinical care, i.e., any intervention in which knowledge is distributed. For example this may be facilitated by the internet, learning critical appraisal skills
Educational meetings	Courses, workshops, conferences or other educational meetings
Educational outreach visits or academic detailing	Personal visits by a trained person to health workers in their own settings, to provide information with the aim of changing practice
Inter-professional education	Continuing education for health professionals that involves more than one profession in joint, interactive learning including information and communication technology
Patient-mediated interventions	Intervention aimed at changing the performance of healthcare professionals through interaction with patients, or information provided by or to patients
Reminders	Manual or computerised interventions that prompt health workers to perform an action during a consultation with a patient, for example computer decision support systems
Routine patient-reported outcome measures	Routine administration and reporting of patient-reported outcome measures to providers and/or patients
Tailored interventions	Interventions to change practice that are selected based on an assessment of barriers to change, for example through interviews or surveys
Local opinion leaders	The identification and use of identifiable local opinion leaders to promote good clinical practice

SF 3. Medline search strategy

# ▼	Searches	Results
1	exp Advance Care Planning/	7552
2	(advance* adj2 (care plan* or directive* or statement*)).ti,ab.	4028
3	living will*.ti,ab.	1141
4	"do not resuscitate".ti,ab.	1568
5	"right to die".ti,ab.	931
6	(resuscitation adj3 (order* or wish*)).ti,ab.	285
7	((write or written or writing or make? or made or making) adj3 will?).ti,ab.	9402
8	((write or written or writing or make? or made or making) adj3 care plan*).ti,ab.	229
9	("end-of-life" adj3 plan*).ti,ab.	372
10	("end-of-life" adj3 place*).ti,ab.	49
11	("end-of-life" adj3 (rite? or wish or wishes)).ti,ab.	125
12	("end-of-life" adj3 (home* or hospital* or hospice*)).ti,ab.	486
13	((palliative care or palliative therap* or palliative treat*) adj3 plan*).ti,ab.	152
14	((palliative care or palliative therap* or palliative treat*) adj3 (wish or wishes)).ti,ab.	13
15	((death or dying) adj3 plan*).ti,ab.	1045
16	((death or dying or die?) adj3 place*).ti,ab.	2798
17	((death or dying or final) adj2 (rite? or wish or wishes)).ti,ab.	178
18	((death or dying or die?) adj3 (home* or hospital* or hospice*)).ti,ab.	18226
19	euthanasia.ti,ab.	8336
20	(assisted adj2 (death or dying)).ti,ab.	682
21	"Tissue and Organ Procurement"/	14206
22	(organ adj3 (donor* or donation)).ti,ab.	9387
23	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22	70141
24	exp Health Personnel/	385677
25	(physician? or doctor? or cardiologist? or general practitioner? or gp or gps or clinician? or medical staff* or clinical staff* or specialist?).ti,ab.	612032
26	nurse?.ti,ab.	197243
27	((care or health or healthcare) adj2 (personnel or staff* or assistant?)).ti,ab.	15866
28	((palliative care or "end-of-life" or terminal*) adj2 (personnel or staff* or assistant?)).ti,ab.	124
29	24 or 25 or 26 or 27 or 28	1021566
30	23 and 2912901	
31	Employee Incentive Plans/	1636
32	Physician Incentive Plans/	2081
33	reimbursement mechanisms/ or reimbursement, incentive/	14427
34	persuasive communication/	3107
35	Motivation/	54169
36	Coercion/	4412
37	(pay* adj3 (perform* or result* or penalt* or improv* or chang*)).ti,ab.	3840
38	(incentive? or reward? or bonus or bonuses or compensat* or imbus* or reimburs* or reimburs* or disbus*).ti,ab.	187616
39	(promot* or encourag* or enabl* or motivat* or facilitat* or persuad* or persuasive or persuasion).ti,ab.	1359553
40	(coerc* or challeng* or barrier* or threat*).ti,ab.	742276
41	exp Inservice Training/	24719
42	education/ or exp education, professional/ or teaching/	285257
43	Mentors/	7883
44	exp Professional Competence/	88324
45	Physician's Practice Patterns/	43836
46	(educat* or training or ((staff or professional or practice) adj2 develop*)).ti,ab.	622149
47	((professional or clinical) adj5 (competenc* or capacit* or capabilit* or skill*)).ti,ab.	15902
48	((professional or clinical) adj5 (intervention? or initiative? or scheme? or program*)).ti,ab.	32770
49	((competenc* or capacit* or capabilit* or skill*) adj5 (intervention? or initiative? or scheme? or program*)).ti,ab.	11267
50	(mentor* or academic detail* or ((opinion or academic or practice) adj2 leader*)).ti,ab.	10704
51	((physician? or doctor? or cardiologist? or general practitioner? or gp or gps or clinician? or professional? or staff* or specialist? or nurse?) adj5 (leader* or influen* or motivat* or champion?)).ti,ab.	19809
52	(peer* adj5 (group? or led* or educat* or support or intervention* or program*)).ti,ab.	9745
53	(behavio?r* adj3 (chang* or intervention? or initiative? or program*)).ti,ab.	54499
54	interpersonal relations/ or exp professional-patient relations/	179875

55 communication barriers/ 5007
 56 ((communicat* or (decision* adj3 mak*) or discuss*) adj5 (intervention? or initiative? or scheme? or
 57 program*)),ti,ab. 20485
 58 ((communicat* or (decision* adj3 mak*) or discuss*) adj5 (competenc* or capac* or capabilit* or
 59 skill*)),ti,ab. 15464
 60 (communicat* or (decision* adj3 mak*) or discuss*),ti. 93172
 61 exp Clinical Audit/ 19493
 62 Benchmarking/ 10598
 63 benchmark*.ti,ab. 19728
 64 audit*.ti,ab. 110534
 65 capacity building/ 861
 66 social control, formal/ or government regulation/ or exp social control policies/ 147959
 67 (policy or policies or regulat*).ti. 414369
 68 (governance or governing).ti,ab. 29078
 69 (organi?ation* adj5 (intervention? or initiative? or program* or scheme* or infrastructure? or structure?
 70 or innovation? or influen*)),ti,ab. 20295
 71 (organi?ation* adj5 (policy or policies or regulat*)),ti,ab. 7302
 72 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or
 73 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 67 or
 74 68 3674496
 75 30 and 696773
 76 exp Health Personnel/ed 48546
 77 23 and 71366
 78 70 or 72 6834
 79 limit 73 to "reviews (maximizes specificity)" 94
 80 randomized controlled trial.pt. 399441
 81 controlled clinical trial.pt. 90638
 82 randomized.ab. 318743
 83 placebo.ab. 163621
 84 drug therapy.fs. 1782347
 85 randomly.ab. 228453
 86 trial.ab. 332417
 87 groups.ab. 1436405
 88 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 3524893
 89 exp animals/ not humans.sh. 4090273
 90 (rat or rats or rodent? or mice or mouse or cow or cows or cattle or calf or calves or ewe? or sheep or
 91 goat or ruminant? or pig or pigs or minipig? or chicken? or horse or horses or murine or bovine or ovine
 92 or porcine or animal?).ti. 1687213
 93 83 not (84 or 85) 2987800
 94 73 and 86915
 95 multicenter study.pt. 188007
 96 pragmatic clinical trial.pt. 82
 97 (randomis* or randomiz*).ti,ab. 416348
 (trial or multicenter or multi center or multicentre or multi centre).ti. 162049
 (intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5
 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or
 evaluat* or time series or time point? or repeated measur*).ti,ab. 6825650
 88 or 89 or 90 or 91 or 92 6988406
 93 73 and 932278
 94 94 not (84 or 85) 2266
 95 73 not (84 or 85) 6809
 96 96 not (94 or 87 or 74) 4129

Selection of terms for search strategy

Behavioural intervention, Behavioural medicine, Behavioural strategies, Advance care planning, End-of-life Care, conversation, Advance directive, Future care, Palliative Care, Training, Clinician, Education, Heart Failure, Cardiovascular disease

SF 4. References of relevant reviews

- Barclay S, Momen N, Case-Upton S, Kuhn I, Smith E. End-of-life care conversations with heart failure patients: a systematic literature review and narrative synthesis. *The British Journal of General Practice* 2011; **61**(582): e49-e62. doi: 10.3399/bjgp11X549018
- Hancock K, Clayton JM, Parker SM, Wal der S, Butow PN, Carrick S *et al.* Truth-telling in discussing prognosis in advanced life-limiting illnesses: a systematic review. *Palliative medicine* 2007; **21**(6): 507-517. e-pub ahead of print 2007/09/12; doi: 10.1177/0269216307080823
- Durbin CR, Fish AF, Bachman JA, Smith KV. Systematic Review of Educational Interventions for Improving Advance Directive Completion. *Journal of Nursing Scholarship* 2010; **42**(3): 234-241. doi: 10.1111/j.1547-5069.2010.01357.
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- Bravo G, Dubois M-F, Wagneur B. Assessing the effectiveness of interventions to promote advance directives among older adults: A systematic review and multi-level analysis. *Social Science & Medicine* 2008; **67**(7): 1122-1132. doi: <http://dx.doi.org/10.1016/j.socscimed.2008.06.006>
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- Jezewski MA, Meeker MA, Sessanna L, Finnell DS. The effectiveness of interventions to increase advance directive completion rates. *Journal of aging and health* 2007; **19**(3): 519-536. e-pub ahead of print 2007/05/15; doi: 10.1177/0898264307300198
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- Ramsaroop SD, Reid MC, Adelman RD. Completing an advance directive in the primary care setting: what do we need for success? *J Am Geriatr Soc* 2007; **55**(2): 277-283. e-pub ahead of print 2007/02/17; doi: 10.1111/j.1532-5415.2007.01065.x
- Tamayo-Velazquez MI, Simon-Lorda P, Villegas-Portero R, Higuera-Callejon C, Garcia-Gutierrez JF, Martinez-Pecino F *et al.* Interventions to promote the use of advance directives: an overview of systematic reviews. *Patient Educ Couns* 2010; **80**(1): 10-20. e-pub ahead of print 2009/11/03; doi: 10.1016/j.pec.2009.09.027
- Hanson LC, Tulskey JA, Danis M. Can clinical interventions change care at the end-of-life? *Ann Intern Med* 1997; **126**(5): 381-388. e-pub ahead of print 1997/03/01;
- Houben CH, Spruit MA, Groenen MT, Wouters EF, Janssen DJ. Efficacy of advance care planning: a systematic review and meta-analysis. *Journal of the American Medical Directors Association* 2014; **15**(7): 477-489. e-pub ahead of print 2014/03/07; doi: 10.1016/j.jamda.2014.01.008
- Patel RV, Sinuff T, Cook DJ. Influencing advance directive completion rates in non-terminally ill patients: a systematic review. *Journal of critical care* 2004; **19**(1): 1-9. e-pub ahead of print 2004/04/22;
- Gaertner J, Siemens W, Meerpohl JJ, Antes G, Meffert C, Xander C *et al.* Effect of specialist palliative care services on quality of life in adults with advanced incurable illness in hospital, hospice, or community settings: systematic review and meta-analysis. *BMJ* 2017; 357. doi: 10.1136/bmj.j2925

SF 5. Characteristics of excluded studies

Characteristics of excluded studies [ordered by study ID]		
Study	Reason for exclusion	
1. Allen 2012	Consultation process only; no advance care plan (ACP) outcomes reported	
2. Allen 2008	Not a randomised controlled trial	
3. Bailey 2014	No advance care plan outcomes reported; no control group;	
4. Betz-Brown 1999	No heart failure patients	
5. Blue 2001	No advance care planning outcomes reported	
6. Bocchi 2008	No advance care planning outcomes reported	
7. Briggs 2006	Unit randomisation was patient/ surrogate dyad; trained facilitators delivered ACP interview; patient not encouraged to see clinician	
8. Brown 2001	No advance care planning outcomes reported	
9. Butow 1994	No advance care planning outcomes reported	
10. Casper 2008	No heart failure patients	
11. Cintron 2006	No heart failure patients	
12. Clayton 2007	No heart failure patients	
13. Coleman 1996	Not a randomised controlled trial	
14. Connors 1995	No advance care planning outcomes reported, only single care choice preferences, nurse delivered discussion with patients but no intervention involved to train her	
15. Cugliari 1995	No heart failure patients	
16. Curtis 2011	No advance care planning outcomes reported	
17. Denvir 2014	Consultation process only – no advance care planning outcomes reported	
18. Der Schmitt 2014	Sample not randomly allocated	
19. Dipko 2003	Samples not randomised;	
20. Ditto 2001	No project relevant ACP outcomes reported, only effects of ACP on	
21. Doughty 2002	No advance care planning outcomes reported	
22. El-Jawahri 2010	No project relevant advance care planning outcomes reported	
23. Epstein 2013	No heart failure patients	
24. Fisher 2015	No heart failure patients	
25. Green 2011	Unit of randomisation was medical students, not health care professionals	
26. Greenberg 1993	Unit of randomisation was medical students, not health care professionals	
27. Griffiths 1995	No ACP outcomes reported; only CPR preferences of patients	
28. Grimaldo 2001	No heart failure patients	
29. Grubaugh 1998	Not a randomised controlled trial	
30. Guo 2010	Not a randomised controlled trial: retrospective medical records review	
31. Gutheil 2005	No ACP outcomes reported	
32. Hamel 2002	Not a randomised controlled trial	
33. Hammes 1998	Not a randomised controlled trial	
34. Happ 2002	Not a randomised controlled trial	
35. Hare 1991	No heart failure patients	
36. High 1993	No heart failure patients	
37. Hill 2015	Not a randomised controlled trial	
38. Ho 2000	Not a randomised controlled trial but a prospective cohort study	
39. Holloran 1995	Not a randomised controlled trial	
40. Houben 2014	Consultation process and study protocol only	
41. Jacobsen 2011	No heart failure patients	
42. Johnson 2006	Not a randomised controlled trial	
43. Jones 2011	Using trained mediators to carry out ACP; clinician behavior was not meant to be changed by the intervention	
44. Kim 2007	Not a randomized controlled trial, a qualitative study	
45. Kinley 2014	No heart failure patients	
46. Kirchhoff 2012	No project relevant ACP outcomes reported	
47. Kularik 2002	No heart failure patients	
48. Landry 1997	No heart failure patients	
49. Lautrette 2007	No project relevant ACP outcomes reported	
50. Lemont 2011	Not a randomised controlled trial	
51. Lindner 2007	No control group; sample not randomly allocated;	
52. Livingston 2013	Sample not randomly allocated, no control group	
53. Lundstrom 2005	Sample not randomly allocated	
54. Luptak 1994	Not a randomised controlled trial	
55. Marbella 1998	No project relevant ACP outcomes reported	
56. Markson 1994	No control group, sample not randomly allocated;	
57. Medvene 2002	Not a randomised controlled trial	

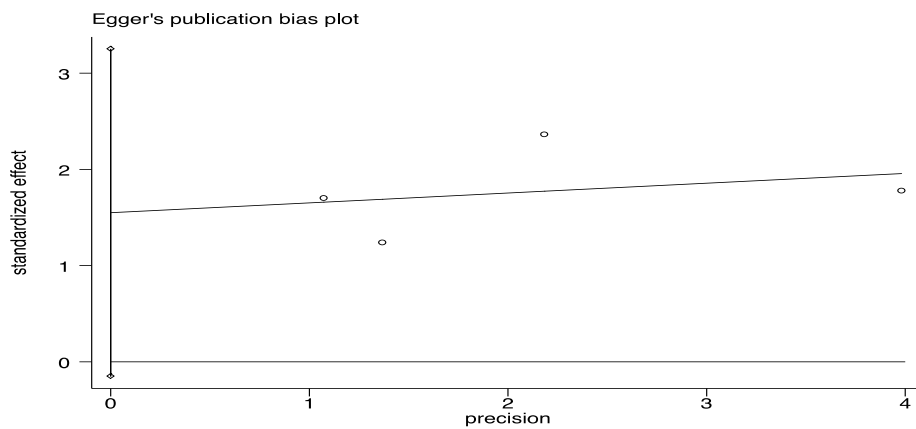
58.	Medvene 2003	Longitudinal study, not a randomised controlled trial
59.	Meier Fuss 1996	No involvement of health care professionals
60.	Meier Gold 1996	Not a randomised controlled trial
61.	Molloy 2000	No heart failure patients
62.	Momen 2011	Not a randomised controlled trial
63.	Moore 1994	no advance care planning outcomes reported; describes only emotional impact of ACP
64.	Morrison 2005	No heart failure patients
65.	Murray 2008	Consultation process only – no advance care planning outcomes reported;
66.	Murray 2010	No project relevant advance care planning outcomes reported
67.	Pearlman 2005	No heart failure patients
68.	Perry 2005	No heart failure patients
69.	Ponikowski 2014	Not a randomised controlled trial
70.	Reilly 1995	3 years time series intervention trial: samples were not randomly allocated; no control group for the “intervention” or “education” phase of the study;
71.	Resnick 2002	Descriptive study only
72.	Richter 1995	No heart failure patients
73.	Sachs 1992	No heart failure patients
74.	Sampson 2011	Researchers carrying out ACP; patients with severe dementia, unit of analysis were patient and carer dyads; carers were not encouraged to discuss ACP with clinician, clinician behavior was not intended to be changed by intervention
75.	Sampson 2008	Consultation process only, no advance care planning outcomes reported
76.	Schellinger 2011	Not a randomised controlled trial
77.	Schirm 1996	Not a randomised controlled trial
78.	Schmitt 2014	Not a randomised trial
79.	Schneiderman 1992	Reports impact of ACP but not effectiveness of interventions to promote ACP; no project relevant ACP outcomes reported
80.	Schwartz 2002	No project relevant ACP outcomes reported
81.	Sidebottom 2015	Unit of randomisation was patients; using trained facilitators to carry out ACP a process independent from clinicians. Clinician behavior was not intended to be affected by the intervention.
82.	Siebert 1996	No project relevant ACP outcomes were reported
83.	Sinclair 2017	No heart failure patients
84.	Singer 1995	Intervention was not intended to change clinician behaviour
85.	Singer 1997	No project relevant ACP outcomes reported
86.	Smucker 1993	No project relevant ACP outcomes reported
87.	Song 2005	No project relevant ACP outcomes were reported; unit of randomisation and analysis was patients
88.	Song 2009	No project relevant ACP outcomes were reported; unit of randomisation and analysis was patients
89.	Song 2010	Unit of randomisation was patients i.e. homeless persons not health care providers, counsellors just delivered the intervention; clinician behaviour was not intended to be changed by the intervention
90.	Sulmasy 1996	No heart failure patients
91.	SUPPORT 1995	No project relevant ACP outcomes reported
92.	Swanson 2006	No heart failure patients
93.	Thoinsen 2011	Consultation process only, no advance care planning outcomes reported
94.	Teno 1997	Unit of randomisation was patients not health care providers; nurse delivered ACP; no project relevant ACP outcomes reported, only impact of ACP on hospital resources
95.	Tolle 1998	Not a randomised controlled trial
96.	Walczak 2014	Consultation process only, unit of randomisation was patients and care giver dyads
97.	Walker 1999	No heart failure patients; not a RCT
98.	White 2012	Samples not randomly allocated; intervention targeted at surrogate decision makers
99.	Wissow 2004	Quasi experimental trial, samples not randomly allocated; no control group;
100.	Volandes 2009a (JAMDA)	No project relevant ACP outcomes reported
101.	Volandes 2009b (BMJ)	No project relevant ACP outcomes reported
102.	Yamada 1999	No heart failure patients

SF 6. Risk of bias graph for each study

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Aiken 2006 [1]	+	+	?	?	+	+	+
Detering 2010	+	+	?	+	+	+	+
Dexter 1998	+	+	-	+	+	+	+
Doorenbos 2016	?	?	?	?	+	+	?
Engelhardt 2006	+	?	-	-	+	+	+
Gade 2008	+	?	-	?	+	+	+
Heffner 2001	+	+	?	?	+	+	+
Heiman 2004 [2]	+	+	+	-	+	+	+
Metzger 2016	+	+	?	?	+	+	+
Nicolasora 2006	+	?	-	?	+	+	+
Reilly 1995	?	+	+	+	+	+	+
Rubin 1994	?	?	?	?	+	+	?
Sidebottom 2014	?	?	?	?	+	+	-

SF 7. Egger's test and Funnel Plot Symmetry

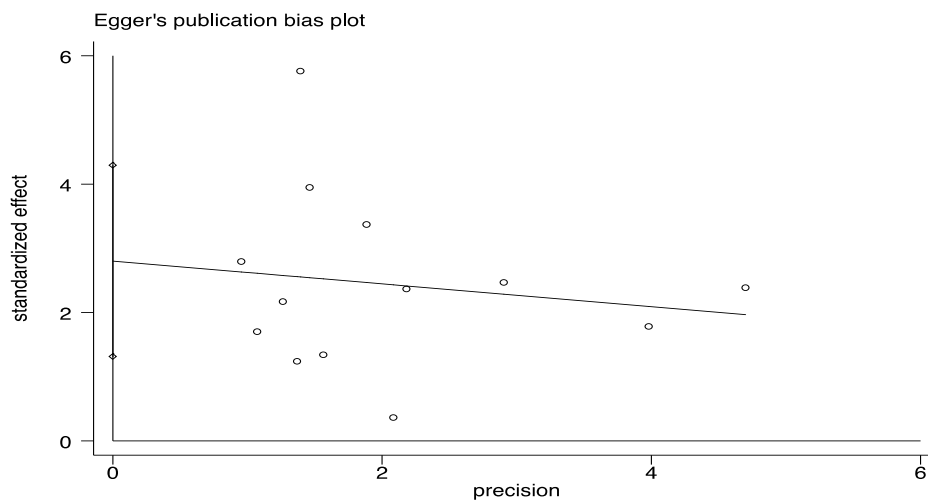
• Heart Failure Patients only



Egger's test (n=4)

	Std_Eff	Coef.	Std. Err.	P> t	[90% Conf. Interval]	
slope	.1020839	.2393979	0.43	0.711	-.5969544	.8011222
bias	1.550026	.5821463	2.66	0.117	-.1498331	3.249885

• Heart Failure and other EOLC Patients

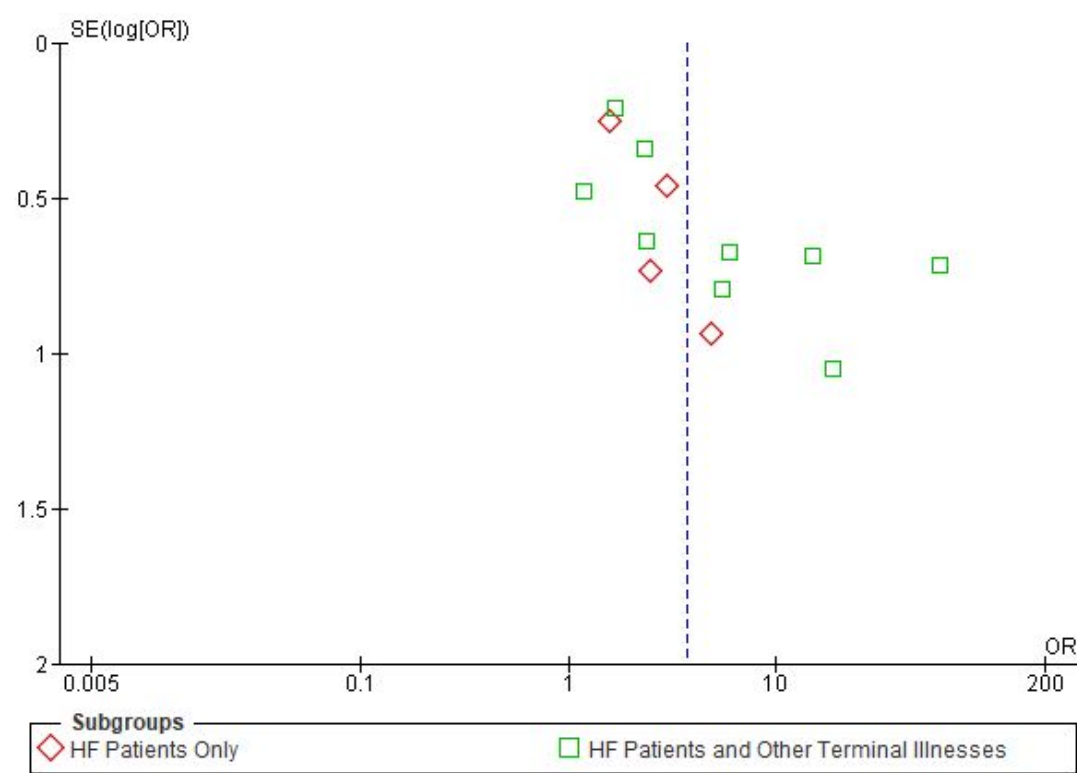


Egger's test (n=13)

	Std_Eff	Coef.	Std. Err.	P> t	[90% Conf. Interval]	
slope	-.1773835	.3546158	-0.50	0.627	-.8142326	.4594656
bias	2.800633	.8294832	3.38	0.006	1.310977	4.290289

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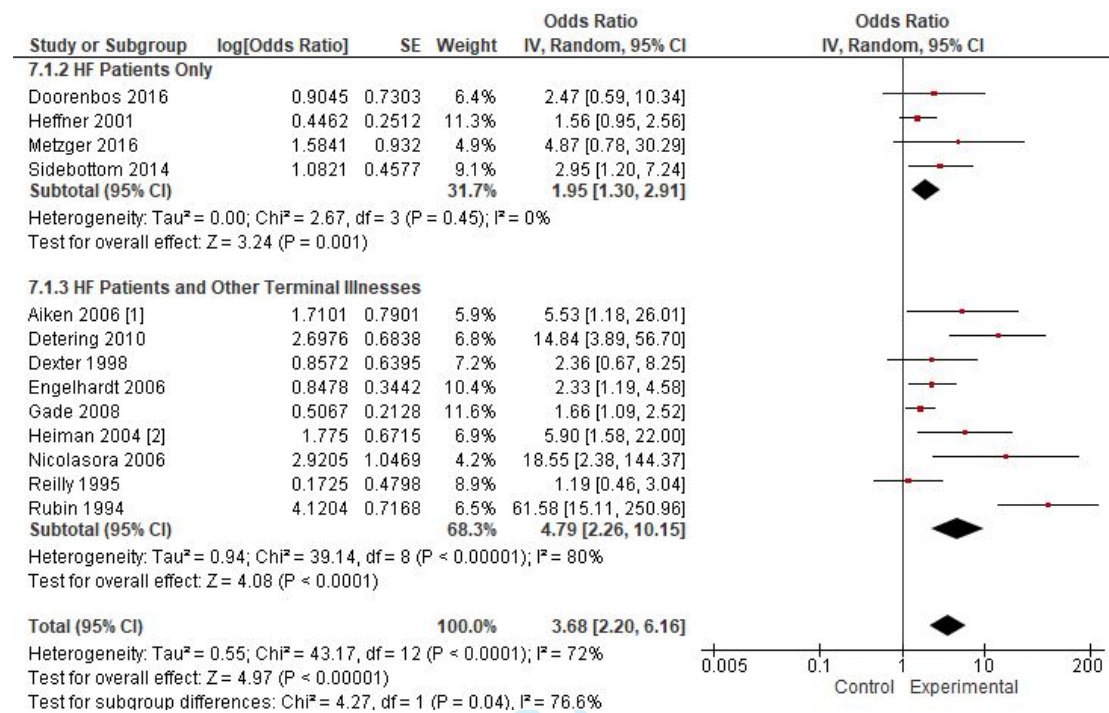
• **Funnel Plot**



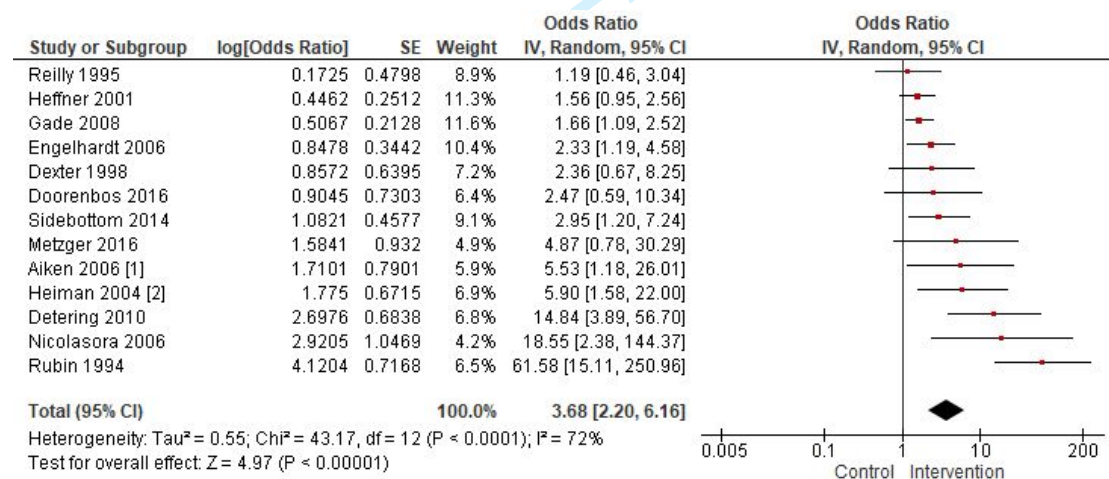
For Review Only

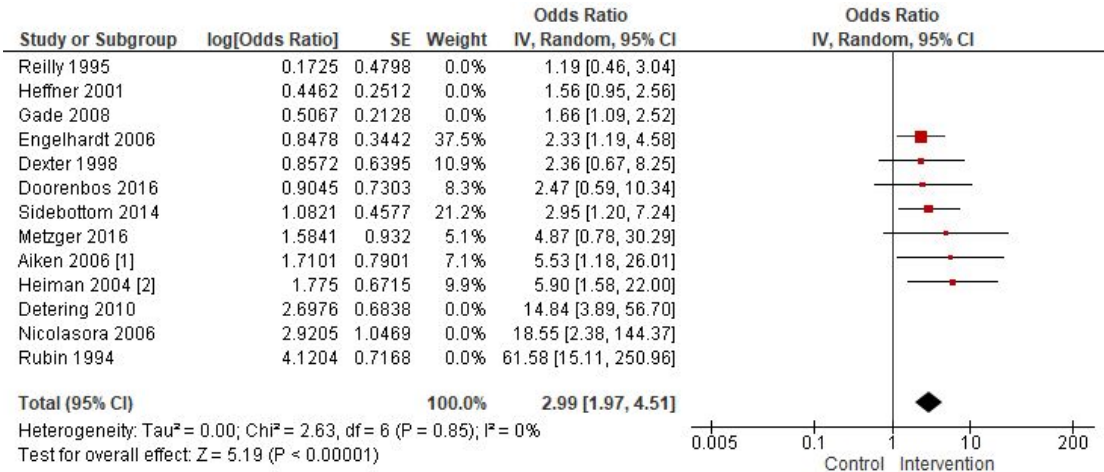
SF 8. Sensitivity analyses

• Patient population



• Outliers





• Risk of bias

