

BMJ Open Advance care planning for frail elderly: are we missing a golden opportunity? A mixed-method systematic review and meta-analysis

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ABSTRACT

Objective The aim is to integrate quantitative and qualitative evidence to understand the effectiveness and experience of advance care planning (ACP) for frail elderly.

Design A mixed-methods systematic review and meta-analysis was conducted. Quality evaluation was conducted using critical appraisal tools from the Joanna Briggs Institute. Data were synthesised and pooled for meta-analysis or meta-aggregation as needed.

Data sources An electronic search of MEDLINE, CINAHL, Embase, PubMed, PsycINFO, and Cochrane Library databases from January 2003 to April 2022.

Eligibility criteria for selecting studies We included experimental and mixed-methods studies. The quantitative component attempts to incorporate a broader study design. The qualitative component aids in comprehending the participant's experience with ACP and its efficacy.

Data extraction and synthesis Two independent reviewers undertook screening, data extraction and quality assessment. The quantitative and qualitative data were synthesised and integrated using a convergent segregated approach.

Results There were 12 158 articles found, and 17 matched the inclusion criteria. The quality of the quantitative component of most included studies (6/10) was rated as low, and the qualitative component of half included studies (4/8) was rated as moderate. The meta-analysis showed that the intervention of ACP for frail elderly effectively increases readiness, knowledge and process of ACP behaviours. The meta-aggregation showed that the participants hold a positive attitude towards ACP and think it facilitates expressing their preferences for the medical decision.

Conclusion ACP is an effective and feasible strategy to facilitate frail elderly to express their healthcare wishes timely and improve their outcomes. This study could provide proof for a better understanding of the subject and help direct future clinical practice. More well-designed randomised controlled trials evaluating the most effective ACP interventions and tools are needed for the frail elderly population.

PROSPERO registration number CRD42022329615.

INTRODUCTION

As the world's ageing population is coming, traditional healthcare systems are under

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ To our knowledge, this study is the first to use mixed-methods systematic review to synthesise quantitative and qualitative evidence to illustrate the role and experience of advance care planning in frail elderly people.
- ⇒ In the preliminary review process, no potential studies were discovered that identified patients using objective measures of frailty, so we based previous systematic reviews on designing the inclusion criteria for frail older adults.
- ⇒ We defined 'the frail elderly' as the elderly who do not live in the stage of a terminal condition or dementia; thus, the applicability of findings to patients with significant medical issues is unclear.

more strain with the increasing prevalence of chronic and aging-related disorders in elderly persons who commonly require continuous monitoring and long-term care.¹⁻⁴ According to previous research, ageing is also related to frailty,⁵ which may make the elderly more susceptible to negative impacts.⁶⁻¹¹ Frailty has consequently caused a significant worldwide health burden and effects on clinical practice and public health.²

Frailty is a clinical condition in which an individual's exposure to stressors increases their vulnerability and thus their risk of adverse health outcomes, such as falls, an unexpected disability, hospitalisation and mortality.^{5 12} It is a dynamic process that increases with age and often spirals downward, increasing the likelihood of adverse outcomes.^{5 13 14} A recent meta-analysis of the prevalence of frailty in 62 countries around the world showed a prevalence of 31% in Oceania, 25% in Asia, 23% in the Americas, 22% in Africa and 8% in Europe.¹⁵ Two studies found that frail elderly were more likely to desire comfort care when they approached the end of their lives, but these demands were not accurately recorded,

resulting in receiving treatment or care against their preferences.^{16 17}

Advance care planning (ACP) is planning to help patients receive medical care aligned with their preferences, especially in severe illness or as the end-of-life approaches.¹⁸ It involves various activities, including appointing surrogate decisions, completing or reviewing advance directives (ADs), and discussing end-of-life wishes with family members or healthcare professionals.¹⁹ ACP has been demonstrated to enhance patient quality of life, family communication and care satisfaction, significantly relieving the burden on patients and families.^{20–24} Recent systematic reviews have investigated how ACP affects senior citizens in certain facilities like hospitals²⁵ and nursing homes.²⁶ Others have studied older people's perceptions and experiences with ACP using qualitative evidence-synthesised techniques.²⁷ Others have investigated the efficiency of various interventions in promoting ACP, but it is unclear which strategy is most beneficial.²⁸ However, there are still challenges in implementing ACP for people's low awareness of ACP and cultural conflicts.^{29–31} The absence of opportunity for conversation on end-of-life desires to elicit their reflection is a major contributing factor to this dilemma.³² Frailty is a common clinical symptom in older adults,^{33 34} who commonly have lower AD completion rates.^{2 5} Therefore, ACP may provide an opportunity for it to express its preference.

Despite the availability of studies on ACP for frail elderly, there is a scarcity of literature to synthesise quantitative and qualitative evidence to investigate this topic.

Consequently, this study aims to use a mixed-methods systematic review (MMSR) to integrate the quantitative and qualitative evidence to answer the question 'What is the effectiveness and experience of ACP for frail elderly?', which can provide up-to-date evidence for the dissemination of ACP and the promulgation of relevant policies.³⁵ The quantitative component attempts to incorporate a broader study design. The qualitative component aids in comprehending the participant's experience with ACP and its efficacy. A final synthesis of quantitative and qualitative evidence will be produced to support the implementation and promotion of ACP.

METHODS

This review was performed following the Joanna Briggs Institute (JBI) methodology for MMSRs to address the review question, data synthesis and integration.^{35 36} The review was registered on PROSPERO (CRD42022329615).

Search strategy

Six databases, including MEDLINE, CINAHL, Embase, PubMed, PsycINFO and Cochrane Library, were searched from January 2003 to April 2022. Because the term 'advance care planning' was first used in 2003, this cut-off period was chosen. The search terms include appropriate subject headings and wildcards of 'advance care planning', 'end of life', 'advance directive' and 'frail elderly' or 'pre-frailty'. The completed search techniques are presented in online supplemental appendix 1.

Table 1 Eligibility criteria of studies

	Inclusion	Exclusion
	Quantitative component	Qualitative component
Types of participants	Health status is focused on prefrailty or frailness. Adult (≥50 years old) regardless of gender and geographical location.	Quantitative and qualitative components
Types of interventions	Interventions that adopted any tools or methods to promote ACP or communication of AD. Any comparator or no comparator.	Interventions to help develop resuscitation-assisted euthanasia or suicide.
Outcomes/phenomena of interest	ACP outcomes <ul style="list-style-type: none"> ▶ ACP process outcomes, such as knowledge, and readiness, quality of life ▶ Action outcomes, such as ACP engagement, completion of ACP ▶ Care Outcomes, such as mood or healthcare expenditures 	Experiences with the interventions.
Context	The community, hospital settings, clinics, nursing homes or homes.	Intensive care unit
Types of studies	1. Various types of experimental studies, such as RCTs, non-RCTs, and observational analysis/descriptive studies (prospective and retrospective cohort studies and cross-sectional studies). 2. Mixed-methods studies are only considered when data and findings for quantitative components are reported and can be extracted.	1. Various types of experimental qualitative studies 2. Mixed-methods studies are only considered when data and findings for qualitative components are reported and can be extracted.
		Opinion pieces, guidelines, individual case reports, study proposals/protocols, conference abstracts, PhD theses, grey literature and non-peer-reviewed journals.

ACP, advance care planning; AD, advance directive; RCT, randomised controlled trial.

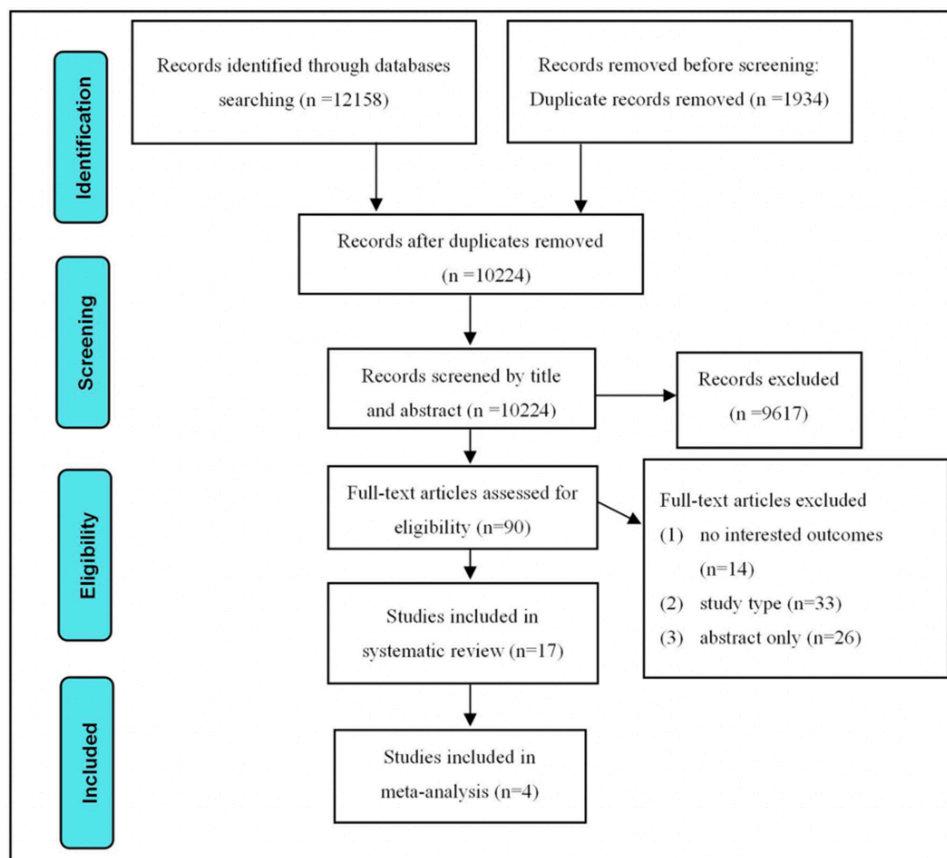


Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram of the study selection process.

Study selection

Based on the initial scoping review, no potential studies were discovered that identified patients using objective measures of frailty. Given this, this study designs inclusion and exclusion criteria that use an operational definition of frailty³⁷ and draw from previous systematic reviews²⁵ to capture frail patients in a diverse population. A mean age criterion of 50 years was chosen because frailty is a geriatric syndrome associated with ageing (prior studies indicate that it may manifest before age 65),¹⁵ and this was combined with the absence of focus on a disease-specific terminal condition or dementia. Research of interventions focusing on developing resuscitation-assisted euthanasia or suicide was excluded, but studies of interventions promoting the ACP or communicating AD were included. ACP is considered an interactive process, so the relevant results (such as ACP process outcomes, action outcomes and care outcomes) should be included in the standard.³⁸ Intensive care unit patients were not included because they could not make plans for the future in most cases.³⁹ Because there were insufficient resources for translation, articles in non-English languages were deleted. [Table 1](#) lists the inclusion and exclusion standards in detail. After searching for and removing duplicate entries, all records were sent to reference manager software (Zotero). Two reviewers independently evaluated titles and abstracts to out irrelevant research and kept papers that met the inclusion criteria. Abstracts and titles will be classified as

‘certainly not relevant’ or ‘possibly relevant’. Take note of the reason for exclusion. If there was any uncertainty or dispute, it was resolved with the assistance of a third review author.

Data extraction

One reviewer used standardised JBI data extraction methods to extract quantitative and qualitative data from the included papers and discussed those findings with the second reviewer.⁴⁰ The quantitative information extracted was the authors, year, participant, setting, design, intervention, result and outcome. The retrieved qualitative information encompassed the population, method, setting, cultural knowledge, study objectives-related data analysis and specifics regarding the phenomena of interest. The author’s interpretations of the qualitative data analysis, which included topics and subtopics, were also obtained. Two reviewers independently evaluated these extractions’ level of ‘confidence’ (defined as clear, believable and unsupported) using illustrations (ie, direct citation of participant voices, field observation records or other data).⁴⁰

Quality appraisal

Two independent reviewers used the JBI Critical Appraisal tools,⁴⁰ comprising checklists for randomised controlled trial (RCT), quasi-experimental study, non-randomised controlled trial (NRCT) and qualitative research to

Table 2 Summary of characteristics of quantitative results of included studies

Author, year	Participants, setting	Design	Intervention	Results	Outcome measures
Sudore <i>et al</i> ⁴⁴ (2018)	Volunteers (n=986) Primary care clinic	RCT	Online PREPARE Programme plus AD, 15 months	ACP Behaviour Change and Action scores increased significantly (p<0.001).	ACP engagement
Overbeek <i>et al</i> ⁴³ (2018)	Volunteers (n=201) Care home and community	RCT	Adjusted Respecting Choices ACP programme, 12 months	There were no statistically significant differences between the intervention and control group in change scores. Of intervention group participants, 93% completed an AD, and 94% appointed a decision-maker. Of control participants, 34% completed an AD, and 67% appointed a decision-maker (p<0.001).	Change in quality of life AD completion Surrogate decision-maker appointment
Sung <i>et al</i> ⁴⁷ (2019)	Older residents (n=57) Care institution	Experimental design	Group patient education, (duration 30 min), 6 months	At post-test, the experimental group had greater knowledge (p=0.014), as well as more positive attitudes overall (p=0.025).	Knowledge and attitude scales
Chan and Yu ⁴⁸ (2021)	Volunteers (n=304) Residential care home	Experimental design	Six sessions per week (6–8 participants/group; mean duration 90 min), 21 months	No significant improvement in QOLC-E subscores following the ACP intervention (p>0.05). No significant difference was found in other outcomes. AD-related outcomes: the ACP group enhanced participants' awareness of AD and more willing to complete AD, and more participants communicated with family members about AD.	QOLC Preferences for EOL care AD-related outcomes
Lin <i>et al</i> ⁴⁵ (2021)	Patients (n=82) Medical centre	RCT	2-Week video-supported nurse-led (5 min), 6 days	ACP knowledge and behavioural intentions: the intervention group showed a significantly higher ACP knowledge score (p=0.01). The rate of AD signing was 33.3% in the intervention group and 9.3% in the control group (p=0.01).	The signing of AD forms Knowledge of ACP Behavioural intention
Lum <i>et al</i> ⁴⁶ (2020)	Patients (n=110) Seniors Clinic	RCT	Talks group visits, 2 sessions (8–10 participants/group; mean duration 120 min), 6 months	At 6 months, 71% of ENACT participants had an ACP document in the EHR compared with 45% of control arm participants (p<0.001), which is a 26% difference. ENACT participants tended toward higher readiness to engage in ACP compared with control at 6 months.	ACP documents Readiness
Deng <i>et al</i> ⁴⁹ (2020)	Older adults (n=74) Nursing homes	Experimental design	Two sessions per month (duration 60 min), 2 months	There was a significant difference in the care and support subscale (p=0.016) and the value of life subscale of mQOLC-E (p=0.012). There were no differences in the use of healthcare services and preference for EOL care between the two groups (p>0.05).	Preferences for EOL care QOLC Healthcare utilisation Certainty of EOL care
Litzelman <i>et al</i> ⁵¹ (2017)	Patients (n=117) Hospital	Mixed method	ACP educational intervention, 1 year	Those who started goal setting had decreased risk of an inpatient stay compared with those with no goal setting.	Healthcare utilisation
Okada <i>et al</i> ²⁴ (2022)	Older adults (n=200) Hospital	NRCT	One-on-one meetings for ACP discussions (60 min), 6 months	There was only a small change in knowledge scores before and after the intervention, with no significant difference between the two groups. ACP engagement and readiness was significantly higher in the intervention group than in the control group at 6 months (p<0.05). Comprehensive QOL was significantly higher in the intervention group than in the control group (p<0.001).	Knowledge QOLC Readiness
Chan and Pang ⁵⁰ (2007)	Older residents (n=287) Long-term care homes	A cross-sectional survey	NG	The mean QOLC-E score of the vulnerable group was significantly lower than the non-vulnerable group (p<0.001). Considerable numbers were uncertain about their end-of-life care preferences and they preferred their physician to be their surrogate.	QOLC Preferences for EOL care

ACP, advance care planning; AD, advance directive; ENACT, Engaging in Advance Care Planning Talks; EOL, end-of-life; mQOLC-E, Quality-of-life Concerns in the End of Life Questionnaire; NRCT, non-randomised controlled trial; QOLC, quality of life concerns; RCT, randomised controlled trial.

evaluate the quality of the included papers. The checklist only accepts answers in the form of 'Yes', 'No' or 'Unclear'. All 'Yes' responses indicate high quality, one or two 'Unclear' or 'No' responses indicate moderate quality, and more than two 'Unclear' or 'No' responses indicate low quality. This method rates the literature as low, moderate and high quality. Any disagreements in the research were discussed until an agreement was reached.

Data synthesis and integration

This study used a convergent segregated approach to synthesise and integrate quantitative and qualitative data because the review examined different dimensions of a phenomenon of interest.^{41 42} A statistical meta-analysis of quantitative data was performed using the Cochrane Collaboration's Review Manager V.5.4 programme to obtain a summary estimate of the effect. Using I-square statistic and χ^2 test to evaluate heterogeneity. The results were presented in narrative summaries when it could not do statistical pooling. Qualitative research findings were gathered using the meta-aggregation approach based on the JBI methodology.⁴⁰ The extract findings (Level 1) were compiled into statements. Then, these findings with similar meaning (at least two findings per category) are combined to create the categorisation (Level 2). Finally, a comprehensive set of synthesised findings for evidence-based practice was developed by synthesising these categories (at least two for each synthesised finding) (Level 3).⁴⁰

Patient and public involvement

Patients and the public were not involved in the development of this study.

RESULT

Study selection

A total of 12 158 articles were retrieved. There were 1934 duplicate articles removed, and 9617 papers were deleted based on title and abstract. The full text of the 90 articles screened was reviewed, and 17 were finally included (figure 1).

Methodological quality

The methodological quality evaluation of the included studies is shown in online supplemental appendix 2. Only five were rated moderate quality for the included quantitative studies (n=10), while the others were rated low quality. There were four RCTs, all of which lacked information on participant blinding⁴³⁻⁴⁶ and three on treatment assignment blinding.⁴⁴⁻⁴⁶ The remaining six studies were categorised into three quasi-experimental studies, one mixed study, one NRCT and one cross-section survey. Four studies were unclear whether participants received similar treatment or care besides the exposure or intervention of interest.⁴⁷⁻⁵⁰ Two studies lack information regarding study methodologies, control groups and multiple outcome measurements.^{24 51} Four studies

were rated as moderate quality and others as low quality for the qualitative component of the included studies (n=8). Those studies were rated as moderate quality because the researcher's theoretical and cultural orientations and potential influence are not mentioned in the research.^{31 51-53} Other studies were rated low-quality because they lacked study objectives, clearly stated data collection and analysis procedures, and participant ethical review guidelines.^{29 30 54 55}

Study characteristics

Tables 2 and 3 summarise the characteristics of the included studies. Seventeen articles published between 2007 and 2022 were included for review. The study design included two-arm RCT (n=4),⁴³⁻⁴⁶ two-arm NRCT (n=1),²⁴ two-arm quantitative quasi-experimental study (n=3),⁴⁷⁻⁴⁹ mixed-method design with a single group pretest-post-test design and a qualitative component (n=1),⁵¹ a cross-sectional study (n=1)⁵⁰ and a qualitative study (n=7).^{28-30 51-55} There were 3312 participants in this study whose mean age ranged from 63 to 88 years. Sample sizes ranged from 10 to 986 from nursing homes, communities, hospitals, clinics, and senior centres.

Synthesis of quantitative evidence

A meta-analysis was performed to examine the effect of interventions on ACP completion, as several studies were available for statistical pooling.^{44-46 48} The forest graph is shown in figure 2. Other outcomes, including quality of life concerns, ACP engagement, surrogate decision-maker appointment, knowledge, healthcare utilisation, behavioural intention, readiness, preferences for end-of-life care, the certainty of end-of-life care and AD-relative outcomes, are not available for statistical aggregation and are therefore presented through narrative synthesis.

ACP completion

A pooled analysis of these four studies showed that the intervention significantly improved ACP document completion (MD: 1.49, 95% CI: 1.17 to 1.91, p=0.33, I²=12%).^{44-46 48}

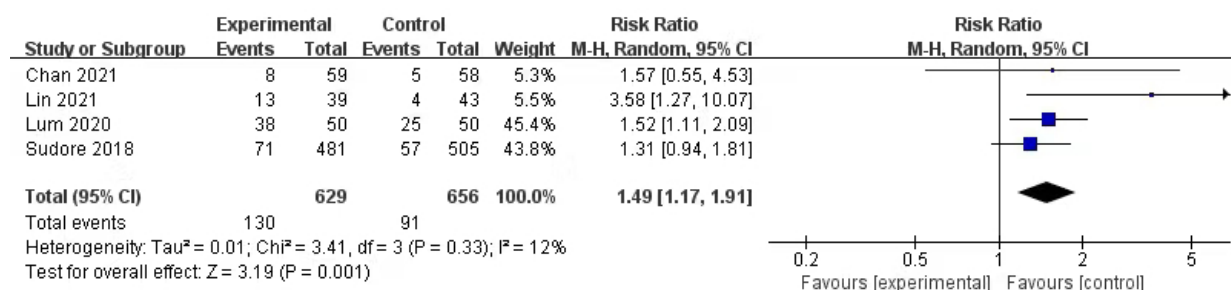
Quality of life concerns

Three studies used End-of-Life Questionnaire (QOLC-E) to measure participants' quality of life concerns.⁴⁸⁻⁵⁰ One result exhibited no statistically significant improvement in the QOLC-E subscores (p>0.05) after the ACP intervention⁴⁸; but another demonstrated significant differences in the care and support subscale (p=0.016) and the value of life subscale of mQOLC-E (p=0.012).⁴⁹ In addition, the average score of frail group is significantly lower than that of the non-frail group (p<0.001), and all groups agree that existential distress, food-related concerns and value of life are the most undesirable subscales.⁵⁰ One using the 12-item Short-Form Health Survey (SF-12) found no significant distinction in participants' quality of life scores (p>0.05)⁴³; however, another using the Comprehensive Quality of Life Outcome scale found a

Table 3 Summary of characteristics of qualitative results of included studies

Author, year	Participants, setting	Methodology/methods	Phenomenon of interest	Theme
Ingravallo <i>et al</i> ²⁹ (2018)	Older adults (n=30) and 10 family members Nursing homes	Qualitative, face-to-face interviews	This study explored the attitudes of NH residents and family members toward ACP and their opinions as to the right time to broach the subject, how it should be approached, and the content of ACP.	Three themes: (1) life in the NH; (2) plans and attitudes towards ACP; (3) contents and manner of ACP
Fan <i>et al</i> ⁶³ (2019)	Older adults (n=28) A long-term care institution	Thematic analysis, in person-to-person interviews, using an ACP booklet	To explore the experiences and processes of ACP discussions in older residents of a long-term care institution.	Three themes: (1) a way to gain a good death; (2) uncertainty in decision-making; (3) the role of families in the ACP decisions
Combes <i>et al</i> ⁶² (2021)	Frail elders (n=10) and eight family members Community	Thematic analysis, in-depth interviews	To explore the barriers and enablers to ACP engagement with frail elders.	Four themes: (1) ACP is unclear; (2) lack of relevance; (3) importance of family, relationships and home; (4) engagement strategies
Bernard <i>et al</i> ⁶⁴ (2020)	Volunteers (n=439) Group clinics	Thematic analysis, questionnaire	This study aimed to better understand the barriers faced by older patients regarding talking to their family members and family physicians about ACP.	Eight themes: (1) they were too young for ACP; (2) the topic is too emotional; (3) ACP is the MD's responsibility; (4) fear of negative impact on the relationship with MD; (5) not enough time in appointments; (6) concern about family dynamics; (7) it is not a priority; (8) a lack of knowledge about ACP
Yap <i>et al</i> ⁶⁰ (2018)	Older adults (n=30) Community	Thematic analysis, semistructured interview	The purpose of this study was to identify factors that influence the engagement of Chinese Australians with ACP.	Three themes: (1) knowledge; (2) attitudes; (3) needs
Yonashiro-Cho <i>et al</i> ⁶¹ (2016)	Older adults (n=34) A large urban area	Grounded theory, three focus groups	The purpose of this study is to explore the knowledge, attitudes and preferences of older Chinese Americans towards ACP.	Three themes: (1) knowledge of advance directives; (2) health as a factor in end-of-life decision-making and communication; (3) communication of end-of-life care preferences
Glaudemans <i>et al</i> ⁶⁵ (2020)	Older adults (n=22) and eight family members Nursing homes	Grounded theory, semistructured interview	To explore older people's and their families' experiences with ACP in primary care.	Three themes: (1) openness and trust; (2) timing and topics; (3) roles of family
Litzelman <i>et al</i> ⁶¹ (2017)	Patients (n=86) Hospital	Thematic analysis, semistructured interview	The purpose of these interviews was to explore patient experiences with an emphasis on the discussions patients may have had with CCAs that were focused on ACP and the designation of healthcare representatives.	Three themes: (1) the importance of ACP conversations and how their CCA facilitated these conversations; (2) the usability of the GW cards; (3) their feelings towards their CCA

ACP, advance care planning; GW cards, Go Wish card; CCAs, care coordinator assistants; MD, The Medical Doctor; NH, nursing home.

**Figure 2** Forest plot of pooled results for advance care planning completion.

statistically significant association between the change in comprehensive QOL and the presence of ACP discussions ($p=0.01$).²⁴

ACP Engagement

One study used a validated ACP Engagement Survey to measure engagement in the ACP process.⁴⁴ This study revealed that ACP Behaviour Change and Action scores increased significantly ($p<0.001$), and 98.1% of experiment participant groups reported that ACP participation (behaviour change or action) scores increased over time, compared with 89.5% in the control group only.⁴⁴

Surrogate decision-maker appointment

One study that used oral counselling to investigate patient surrogate decision-maker appointments discovered that the intervention group (94%) appointed more surrogate decision-makers than the control group (67%) ($p<0.001$).⁴³

Knowledge

One study used a standardised scale of palliative care knowledge and attitudes to measure palliative care knowledge and attitudes in participants and found that the experimental group had a higher level of knowledge ($p=0.014$) after an intervention.⁴⁷ Of the two studies that used a self-developed instrument to assess participants' knowledge scores about ACP, one study observed no significant association between the change in knowledge score and the presence of ACP discussion ($p>0.01$)²⁴; while in another study, the intervention group was much more likely to correctly answer six of the eight knowledge items, suggesting the intervention group scored significantly higher than the control group ($p=0.01$).⁴⁵

Healthcare utilization

One study found a significant difference ($p=0.026$) between the level of goal setting and the time to a first inpatient stay.⁵⁰ Specifically, those who began goal setting had a lower risk of an inpatient stay than those who did not start goal setting, while there was no difference between those who completed goal setting and those who did not begin goal setting.⁵⁰ Another study discovered that current ACP interventions did not reduce the use of healthcare ($p>0.05$).⁴⁹ The participants in the experimental group reported that 91.2% had visited the emergency department, 93.0% had been hospitalised and 84.2% had visited the outpatient department.⁴⁹

Behavioural intention

A study using a self-developed behavioural intention scale to assess patients' behavioural changes in ACP.⁴⁵ This research found that the intervention group had a significantly higher behavioural intention in three out of the four behavioural intention items, suggesting that the intervention group showed substantially higher ACP behavioural intention scores than the control group.⁴⁵

Readiness

Two studies using a validated tool to examine participants' ACP readiness discovered that the intervention group's readiness has improved.^{24 46} One study reported that the readiness score was significantly associated with ACP discussions ($p=0.01$).²⁴ Another study found that the increase in readiness over time was significantly different between the two groups ($p=0.0056$).⁴⁶

Preferences for end-of-life care

Two studies used a self-developed questionnaire to assess patients' preference for end-of-life care and found no statistically significant difference between the two groups for life-sustaining treatment outcomes ($p>0.05$),^{49 50} while the frail group was more willing to involve their physicians and families in hospice preferences.⁵⁰ However, other studies indicated that experimental group more wished to receive cardiopulmonary resuscitation, mechanical ventilation and artificial feeding items at the end of life because they hope for recovery through medical treatments.⁴⁸

Certainty of end-of-life care

One study used the SURE test (Sure of myself; Understand information; Risk–benefit ratio; Encouragement) to measure the certainty of participants' end-of-life care and found that all scores in the experimental group were much higher than the control group.⁴⁹

AD-related outcomes

A study using a self-developed questionnaire to examine AD-related outcomes (awareness of AD, willingness to complete AD and communication with family members about AD) found that after the intervention, the experimental group was more likely to be aware of AD ($p<0.001$), and the number of people willing to complete AD increased from 46.2% to 78.6%, and the communication with family members on AD increased from 21% to 41%.⁴⁸

Synthesis of qualitative evidence

Three themes emerged from qualitative evidence through a meta-aggregation process: positive impact, low engagement and high acceptance. Gain advantages and raising consciousness are the two identified subthemes within the issue of positive impact. Barriers to ACP and awareness of ACP are the two identified subthemes within the issue of low engagement. Roles of families and engagement strategies are two subthemes in the high acceptance (table 4).

Gain advantages

Participants thought the ACP could supply an open channel for discussing end-of-life issues, allowing them to express their dying wishes and provide guidance.^{29 31 53 55} Some participants claimed that using ACP not only helped them undergo death more comfortably and with less pain but also significantly reduced unnecessary healthcare costs, which benefited them and their families.^{30 53 55}

Table 4 Meta-aggregation of qualitative findings

Findings (Level 1)	Categories (Level 2)	Synthesised findings (Level 3)
Residents are willing to talk about the ACP because it allows them to express their opinions (U) ²⁹ Think that ACP can help with a comfortable death and lessen the pain (U) ⁵⁴ They were comfortable with discussions about ACP and could see the benefit of planning and documenting their wishes (U) ⁵⁴ To complete ACP was because they wanted to reduce the burden on their family and suffering for themselves (U) ³⁰ Sharing information on end-of-life preferences will promote their autonomy at the end of life (U) ³¹ Engaging in ACP appeared to increase trust (U) ⁵⁵ ACP can prevent sudden situations in the future (U) ⁵⁵ They were positive about the attention they received during these conversations, felt heard and more at ease and felt they could trust their GP or nurse more after the ACP discussion (U) ⁵⁵ ACP can reduce the burden on your family and your pain(U) ³⁰	Gain advantages	Positive impact
Think it is important to do ACP at the right time (C) ²⁹ Believed that the appointment of a proxy was a good idea (U) ²⁹ Most participants reported positive attitudes towards ACP (U) ³⁰ Respondents were satisfied with the timing of ACP (U) ⁵⁵ Respondents have a positive attitude towards the topic discussed (U) ⁵⁵ These conversations stimulated systematic thinking about various issues about end-of-life care, death, and issues beyond death(U) ⁵⁵ They were comfortable with discussions about ACP and could see the benefit of planning and documenting their wishes(C) ³⁰	Raise consciousness	
Participant cognitive impairment or low education is a major obstacle to ACP (U) ²⁹ Uncertainty and lack of information created difficult barriers (U) ⁵⁴ Death is a taboo topic difficult to discuss with family (C) ^{30 31 52} Participants described feeling too young or too healthy to be thinking about ACP (U) ⁵³ The topic is too emotional for discussions (U) ⁵³ Believing that ACP is the medical doctor's responsibility (U) ⁵³ Participants were concerned that having an ACP discussion might adversely affect the relationship with the doctor (U) ⁵³ Insufficient time in appointments with family physicians emerged as a barrier to ACP discussions (U) ⁵³ The language was identified as the largest barrier to overcome to increase ACP awareness (C) ³⁰	Barriers to ACP	Low engagement
There was low awareness of ACP among the participants and some confusion regarding the concept (U) ³⁰ I don't know enough about ACP (U) ⁵³	Awareness of ACP	
Participants expressed concern about how an ACP discussion may affect family dynamics (U) ⁵³ Family relationships played an important role in the ACP decisions (C) ⁵⁴ Relationships were important to frail elders and impacted decision-making (U) ⁵² The quality of ACP appeared to improve if the family was involved in ACP (U) ⁵⁵	Roles of family	High acceptance
The quality and accessibility of ACP may improve if GPs and nurses include family members in discussions about ACP (U) ⁵⁵ Participants believed the best way to engage frail elders with ACP was by using the right approach and preparing individuals for ACP conversations (U) ⁵² In-language materials and key support networks including GPs, family and Chinese community groups were identified as ideal forums for the promotion of ACP (C) ³⁰ These networks were also important in helping participants who spoke little or no English cope with the language barrier when accessing healthcare (U) ³⁰ Health as a factor in the timing of ACP and communication (U) ³¹ Quality of ACP seemed to improve if respondents' views on their current life and future, a few specific future care scenarios and expectations and responsibilities regarding ACP were discussed (U) ⁵⁵	Engagement strategies	
ACP is unclear, some confusion remained (U) ⁵² Lack of understanding and clarity about advance directives (C) ³¹	Unclear questions	
U and C represent the levels of credibility for the findings: U represents 'unequivocal' evidence, C represents 'credible' evidence and N represents 'not supported' evidence. ACP, advance care planning; GPs, general practitioners.		

Raise consciousness

Some participants stated that joining the ACP at the right time was tremendously useful because it allowed them to act appropriately.^{29 30 55} Additionally, some participants expressed a positive attitude toward the ACP; on the one hand, it allowed them to choose they want surrogate decision-maker; on the other hand, it inspired them to

use comprehensive contemplation regarding hospice care.^{29 30 55}

Barriers to ACP

Participants often do not have the chance to begin discussions about ACP or end-of-life care due to a lack of relevant information and comprehension, particularly when

they think they are too young or in good health.^{29 53 54} Others were concerned that discussing or disputing end-of-life options with a family doctor would harm their benefit, and many also claimed that owing to cultural differences, they could not discuss death with their families.^{30 31 52 54} Only one study claims that language is the most significant barrier to increasing awareness of ACP.³⁰

Awareness of ACP

Some participants showed low ACP awareness because they frequently confused it with other ideas, like wills and euthanasia, and some even claimed they were unaware of it, arguing that family members should make end-of-life decisions rather than themselves.^{30 54}

Roles of family

Participants were concerned that their ACP conversations would impact the relationship between families, which could affect how the ACP functions and even makes decisions.^{52 53} Family relationships were meaningful when making ACP decisions, according to some participants, and it was even possible that family involvement could have a positive effect and enhance the quality of ACP.^{54 55}

Engagement strategies

Participants believed the best way to engage frail elders with ACP was by using the right approach and preparing individuals for ACP conversations.^{52 55} Therefore, in addition to general practitioners (GPs), nurses and family, the Chinese community and networking can be included to enhance the quality and accessibility of the ACP, as some participants felt this could help overcome current language barriers.^{30 55} A minor participant believed that communication time for ACP was related to health because they thought they did not require it when they were healthy.³¹

Unclear questions

There was still some uncertainty during the process when interviewees were unclear about the meaning of ACP.^{31 52} They point out that ambiguous documentation, terminology and professional language may undermine the motivation of frail elderly to engage in ACP and their trust in professionals while enhancing the ambiguity of ACP language.^{31 52}

Integration of quantitative and qualitative evidence

The quantitative and qualitative evidence synthesis results were generally consistent, and the three pieces of evidence aggregated are detailed below (table 5). Participants' positive perceptions of ACP in qualitative evidence help explain the significant improvement in various outcomes of ACP reported in quantitative evidence.

Sense of control

Quantitative and qualitative research has consistently demonstrated that appropriate interventions promote ACP behaviour readiness. Quantitative results show that interventions significantly increase participants'

knowledge of ACP and end-of-life issues while also enhancing their engagement in ACP,^{24 43–48} which may enhance participants' quality of life at the end of their lives. Because after the intervention, a significant proportion of individuals were willing to discuss hospice care preferences with family members or clinicians and complete AD.^{43 45 46 48–50} Qualitative research suggests that ACP can allow people to systematically think about their hospice preference, voice their opinions about death and ensure they pass away comfortably,^{29 31 51 53 55} relieving the strain on their loved ones and their suffering.^{29 31 55} In addition, a positive attitude towards the issue of palliative care may empower them to make behavioural changes.

Obstacles and facilitators

Qualitative data highlighted facilitators and barriers in the process of ACP engagement.^{29–31 52–55} The primary obstacles to ACP awareness improvement were cognitive impairment, educational attainment²⁹ and language communication³⁰; participants also mentioned that discussing death with family members was taboo due to cultural differences.^{30 31 52–54} The optimal way to involve frail elderly in ACP is through the appropriate strategy and preparation of individuals for ACP discussions.³² Additionally, using the web as a medium while engaging GPs, nurses and families in ACP discussions may increase the quality of ACP.^{30 31 55} However, the quantitative research did not examine how facilitators and obstacles affected the results.

Impact of intervention

Quantitative and qualitative studies show that family relationships influence participants' ACP decisions.^{48 52–55} Qualitative findings also revealed that some participants' awareness of the definition of ACP is still unclear.^{30 54} Quantitative data mean that participants' awareness of ACP improved after the intervention, improving patients' quality of life in the dying.^{49 50} Although the qualitative data revealed that some questions were confusing to the participants,^{31 52} it was not reflected in the quantitative data. The differences underscore the need to ascertain the clarity of the ACP to the participants.

DISCUSSION

Main findings

To answer the research question, we integrate quantitative and qualitative evidence by JBI's MMSR guidance to comprehensively understand ACP's effectiveness and the frail elderly' opinions of ACP.⁴¹ The quality of the qualitative studies existential discrepancy because these reviews supplied insufficient methodological information. The quality of the quantitative studies was generally fair because most studies have control groups.

The meta-analysis showed that the intervention of ACP for frail elderly effectively increases readiness, knowledge and process of ACP behaviours, thus promoting AD completion. The meta-aggregation demonstrates that participants

Table 5 Integration of quantitative evidence and qualitative evidence

Quantitative results	Qualitative finding (categories)	Aggregation
ACP completion In intervention group participants, 93% completed AD ⁴³ The intervention resulted in a higher rate of ACP documentation ⁴⁵ Slight increase in AD completions ⁴⁸ The rate of AD signing was 33.3% in the intervention group ⁴⁶ The number of new ACP documents at 6 months was significantly different ⁴⁴ Quality of life concerns Quality of life scores did not change significantly before and after the intervention ⁴³ There was no statistically significant improvement in QOL-E subscores following the ACP intervention ⁴⁸ Regarding QOLC, the ACP intervention interviews had a positive effect on physical discomfort and food-related concerns and a short-term effect on decreasing existential distress ⁴⁷ Comprehensive QOL was significantly higher in the intervention group than in the control group ²⁴ The mean QOLC-E score of the frail group was significantly lower than that of the non-frail group ⁵⁰ Surrogate decision-maker appointment 94% appointed a decision-maker ⁴³ Behavioural intention Significantly higher ACP behavioural intention scores ⁴⁶ The AD sign-up rate was 33.3% ⁴⁶ AD-related outcomes Willingness to complete AD increased from 46.2% to 78.6% ⁴⁸ ACP engagement The intervention resulted in higher self-reported increased ACP engagement scores ⁴⁵ The ACP engagement score increased significantly from baseline to 6-month follow-up, with a 22.5% increase in score ⁴⁴ The scores tended to be higher in the intervention group than in the control group ²⁴ Healthcare utilisation The current ACP intervention did not decrease healthcare utilisation ⁴⁷ ACP had a reduced risk of hospitalisation ⁵⁰ Readiness The increase in readiness over time was significantly different ⁴⁴ Knowledge Significant positive effects of the ACP programme on knowledge ⁴⁷ The intervention group had significantly higher scores in knowledge ⁴⁶ There was only a small change in knowledge scores ²⁴	Gain advantages Raise consciousness	Sense of control
/	Engagement strategies Barriers to ACP	Obstacles and facilitators
Preferences for end-of-life care There was no statistically significant difference in preference for end-of-life care between the two groups ⁴⁸ Respondents in the vulnerable group were more willing to involve their physicians and families in end-of-life care preferences ⁵⁰ AD-related outcomes All scores in the experimental group were much higher than those in the control group ⁴⁷ Awareness of AD increased from 23.6% to 76% ⁴⁸ Communicated with family members about AD increase from 21% to 41% ⁴⁸	Roles of family Awareness of ACP Unclear questions	Impact of intervention

ACP, advance care planning; AD, advance directive; QOL, quality of life; QOLC, quality of life concerns.

generally have a positive attitude towards ACP, believe that it helps them express their preferences for the healthcare decision, and explain the variables that influence their participation in ACP. The aggregated findings from configurative analysis demonstrate that the quantitative and qualitative synthesis were complementary and coherent to support ACP as an effective and feasible strategy to facilitate frail elderly to express their healthcare wishes timely. In addition, participants generally believe that ACP provides a communication channel for frail elderly patients to frankly discuss hospice issues, understand relevant knowledge and share views during participation. These aggregations are consistent with the main elements of the theory of planned behaviour in the behavioural change model of healthy behaviour, where attitude, subjective norm and perceived behaviour control three elements that shape an individual's behaviour intention and actual behaviour.⁵⁶ Thus, these aggregates help to explain

that behaviours that improve ACP practice can promote engagement and completion of ACP and thus improve end-of-life care quality.

Strengths and limitations

The advantage of this study is that using MMSR to give a comprehensive and in-depth analysis of the quantitative and qualitative data already available to explain the effects and experiences of ACP. Given the insufficiency of research in this field, all identified studies were included in this review. The aggregation of the quantitative and qualitative evidence reached a coherent consensus that enhanced the credibility of the findings on the effectiveness and acceptance of ACP.

We are aware of the limitations of this review. First, even though we thoroughly searched the current literature, it is possible to miss relevant studies because we only included English language papers, and a grey literature search was not

undertaken. Second, few studies have explicitly looked at ACP with frail elderly who are cognitively normal and do not have a specific terminal condition, nor have any studies that have used an operational measure of frailty. Therefore, the prevalence and degree of frailty in the research included in this systematic review are unknown; nonetheless, the results can be applied to the elderly without significant medical issues in the community or institutional settings. Third, because most of the studies included in this analysis were not blinded, people who received ACP were likelier to accept participating in ACP-related investigations, potentially risking participation bias. However, most studies had a reasonable response rate, which is beneficial for reducing this risk.

Policy and practice recommendations

There is an obvious need to strengthen and coordinate activities to encourage the involvement of frail old persons and their families in the ACP process. As the research results show, there are contributing factors and obstacles to the participation of frail older adults in the ACP.^{29–31 52–55} Therefore, when drafting relevant policies, such patients' actual constraints should be considered. For example, ACP's language and professional terms are improved according to local cultural characteristics, and new processes have been added to overcome cultural differences in different regions. Moreover, the results of the findings show that the ACP is an effective way to provoke discussion about death and hospice decision-making and promote AD completion.^{29 31 51 53 55} The meta-analysis of four studies showed that the completion rate of ACP improved after the intervention despite heterogeneity in the data.^{44–46 48} Therefore, to target the inclusion of this group of people in the ACP in the primary health-care system, more in-depth conversation and assessment are required while also considering the variations in the complex legal frameworks among countries.

In clinical practice, because frailty is a dynamic process and difficult to define, frail elderly patients often lack the information and awareness to plan their future medical plans. Moreover, the research results show that there is still a need to provide special ACP tools suitable for the frail elderly, which can be used for people of different education in various settings. Therefore, to encourage patients to learn the pertinent information about ACP and increase their readiness, for instance, we can use movies or video games to facilitate the process of ACP and make the ACP knowledge easier to understand.

CONCLUSION

Synthesising the information from quantitative and qualitative research demonstrates that ACP is an effective and feasible strategy to facilitate frail elderly to express their healthcare wishes timely and improve their outcomes. Because the frail elderly usually lacks the opportunity to start ACP discussions, they will miss a golden opportunity to discuss it. Consequently, more extensive and rigorous research is required to improve the quality of research,

especially RCTs to support the reported results, to ascertain the most effective and beneficial ACP interventions and tools for the frail elderly population.

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Provenance and peer review Not commissioned; externally peer reviewed.

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Appendix 1**Search date: 20/04/2022****[Search strategy for MEDLINE / EMBASE / PsycINFO/ CINAHL via OvidSP]**

1. exp Frailty/
2. frailty.mp.
3. exp Frail Elderly/
4. Frail Elderly.sh,kf.
5. Frail Older People.mp.
6. Frailty syndrome.mp.
7. (Frailty adj2 syndrome).mp.
8. (Frail* or geriatric syndrome* or geriatric disorder*).ti,ab.
9. ((elder* or old* or senior* or geriatric*) adj4 function* adj4 (declin* or impair*)).af.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. exp Advance Care Planning/
12. (advance* care adj plan*).tw.
13. (advance* adj (medical plan* or statement*)).tw.
14. acp.tw.
15. Statement of wishes.tw.
16. Terminal Care/
17. terminal care.tw.
18. ((end of life or EOL) adj5 (care or discuss* or decision* or plan* or preference*)).tw.
19. Living Wills/
20. living will*.tw.
21. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20
22. 10 and 21
23. limit 22 to (english language and yr="2003 - 2022" and "all aged (50 and over)")

PubMed

((Frail Elderly[MeSH Terms]) OR (Elderly, Frail[Title/Abstract] OR Frail Elders[Title/Abstract] OR Elder, Frail[Title/Abstract] OR Elders, Frail[Title/Abstract] OR Frail Elder[Title/Abstract] OR Functionally-Impaired Elderly[Title/Abstract] OR Elderly, Functionally-Impaired[Title/Abstract] OR Functionally Impaired Elderly[Title/Abstract] OR Frail Older Adults[Title/Abstract] OR Adult, Frail Older[Title/Abstract] OR Adults, Frail Older[Title/Abstract] OR Frail Older Adult[Title/Abstract] OR Older Adult, Frail[Title/Abstract] OR Older Adults, Frail[Title/Abstract])) AND (Advance Care Planning[MeSH Terms]) OR (Advance Health Care Planning[Title/Abstract] OR Advance Medical Planning[Title/Abstract] OR Medical Planning, Advance[Title/Abstract] OR Planning, Advance Medical[Title/Abstract] OR Advance Directives[Title/Abstract] OR Living Wills[Title/Abstract] OR Terminal Care[Title/Abstract]) AND ((aged[Filter]) AND (2003:2022[pdat]))

Cochrane library

- #1 (advance care planning):ti,ab,kw OR (Advance Directive):ti,ab,kw OR (Living will):ti,ab,kw OR (advance* NEAR/3 plan*):ti,ab,kw OR (future care planning):ti,ab,kw
- #2 (Anticipatory care plan*):ti,ab,kw OR (end of life NEXT (discuss* or conversation* or decision* or plan* or preference*)):ti,ab,kw OR (Medical treatment order):ti,ab,kw OR (Statement of wishes):ti,ab,kw OR (Medical directive):ti,ab,kw
- #3 (advance* NEXT (medical plan* or statement*)):ti,ab,kw
- #4 advance care planning
- #5 Advance Directive
- #6 Living will
- #7 (Frail Elderly):ti,ab,kw OR (Frail):ti,ab,kw OR (Elderly):ti,ab,kw OR (Frailty syndrome):ti,ab,kw
- #8 #1 or #2 or #3 or #4 or #5 or #6

#9 #8 and #7

CINAHL complete

S1 "advance* care plan*"
S2 "Anticipatory care plan*"
S3 "future care planning"
S4 (MH "Advance Care Planning")
S5 "Advance Care Planning"
S6 "Living Wills"
S7 (MH "Advance Directives+") OR (MH "Living Wills")
S8 "Advance Directives"
S9 "Resuscitation Orders"
S10 "Medical treatment order"
S11 "Statement of wishes"
S12 "Medical directive"
S13 "end of life discuss*"
S14 "end of life conversation*"
S15 "end of life decision*"
S16 "end of life plan*"
S17 "end of life preference*"
S18 "advance* medical plan*"
S19 "advance* statement*"
S20 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR
S14 OR S15 OR S16 OR S17 OR S18 OR S19
S21 (MH "Frailty") OR (MH "Frail Elderly")
S22 " frailty"
S23 "Frailty syndrome"
S24 "Frail Older People"
S25 S21 OR S22 OR S23 OR S24
S26 S20 AND S25
S27 (AG "50 and over") AND (DT "2003 - 2022") AND (ZL "English")
S28 S26 AND S27

Appendix 2

Table 2a. Methodological quality of included randomized controlled trial

	Rebecca L et al, 2018	Anouk Overbeek et al, 2019	Li-Hwa Lin et al, 2021	Hillary D. Lum et al, 2020
1. Was true randomization used for assignment of participants to treatment groups?	Yes	Yes	Yes	Yes
2. Was allocation to treatment groups concealed?	Yes	No	Unclear	Unclear
3. Were treatment groups similar at the baseline?	Yes	Yes	Yes	Yes
4. Were participants blind to treatment assignment?	No	No	Unclear	No
5. Were those delivering treatment blind to treatment assignment?	Yes	No	Unclear	No
6. Were outcomes assessors blind to treatment assignment?	Yes	No	Unclear	No
7. Were treatment groups treated identically other than the intervention of interest?	Yes	Yes	Yes	Yes
8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Yes	Yes	Yes	Yes
9. Were participants analyzed in the groups to which they were randomized?	Yes	Yes	Yes	Yes
10. Were outcomes measured in the same way for treatment groups?	Yes	Yes	Yes	Yes
11. Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes
12. Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	Yes	Yes	Yes	Yes
Overall quality	Moderate	Low	Low	Low

Table 2b. Critical appraisal results for included quasi-experimental studies or mixed methods studies or no randomized controlled trial

	Huei-Chuan Sung et al, 2019	Wallace Chi Ho Chan et al, 2021	Renli Deng et al, 2020	Debra K.Litzelman et al, 2017	Hiroko Okada et al, 2022
1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes
2. Were the participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	No	No	No	No	No
4. Was there a control group?	Yes	Yes	Yes	No	No
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	Yes	Yes	Yes	No	No

6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Yes	Yes	No	Unclear	Yes
7. Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes
8. Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes
9. Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes
Overall quality	Moderate	Moderate	Moderate	Low	Low

Table 2c. Critical appraisal results for included qualitative studies

	Francesca Ingravallo et al, 2018	Sheng - Yu Fan et al, 2019	Sarah Combes et al, 2021	Carrie Bernard et al, 2020	Sok Shin Yap et al, 2021	Jeanine Yonashiro-Cho et al, 2016	Jolien J. Glaudemans et al, 2020	Debra K.Litzelman et al, 2017
1. Is there congruity between the stated philosophical perspective and the research methodology?	Unclear	Unclear	Yes	No	Unclear	Yes	Yes	Yes
2. Is there congruity between the research methodology and the research question or objectives?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Is there congruity between the research methodology and the methods used to collect data?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
4. Is there congruity between the research methodology and the representation and analysis of data?	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes
5. Is there congruity between the research methodology and the interpretation of results?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Is there a statement locating the researcher culturally or theoretically?	No	No	No	Unclear	No	No	No	No
7. Is the influence of the researcher on the research, and vice- versa, addressed?	Unclear	Yes	Yes	Unclear	Unclear	Unclear	Unclear	Unclear
8. Are participants, and their voices, adequately represented?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	Yes	Yes	Yes	Yes	No	Yes	No	Yes
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall quality	Low	Moderate	Moderate	Low	Low	Moderate	Low	Moderate

Table 2d. Critical appraisal results for included cross sectional studies

	Helen YL Chan et al, 2007
1. Were the criteria for inclusion in the sample clearly defined?	Yes
2. Were the study subjects and the setting described in detail?	Yes
3. Was the exposure measured in a valid and reliable way?	Yes
4. Were objective, standard criteria used for measurement of the condition?	Yes
5. Were confounding factors identified?	Unclear
6. Were strategies to deal with confounding factors stated?	No
7. Were the outcomes measured in a valid and reliable way?	Yes
8. Was appropriate statistical analysis used?	Yes
Overall quality	Moderate