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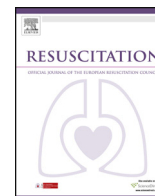
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Review article

Systematic review of interventions to improve appropriate use and outcomes associated with do-not-attempt-cardiopulmonary-resuscitation decisions[☆]



Richard A. Field^{a,b}, Zoë Fritz^{b,c}, Annalie Baker^a, Amy Grove^b, Gavin D. Perkins^{a,b,*}

^a Heart of England NHS Foundation Trust, Bordesley Green East, Birmingham B9 5SS, United Kingdom

^b University of Warwick, Gibbett Hill, Coventry CV4 7AL, United Kingdom

^c Department of Acute Medicine, Cambridge University Hospitals, United Kingdom

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ABSTRACT

Background: The treatment for a cardiac arrest, cardiopulmonary resuscitation (CPR), may be lifesaving following an acute, potentially reversible illness. Yet this treatment is unlikely to be effective if cardiac arrest occurs as part of the dying process towards the end of a person's natural life. Do not attempt CPR (DNACPR) decisions allow resuscitation to be withheld when it has little chance of success, or where the patient, or those close to the patient, indicate the burdens of CPR outweigh the benefits. This review sought to identify evidence for systems that improve the appropriate use of DNACPR decisions.

Methods: Electronic databases were searched (Medline, CINAHL and Embase) for English language articles from 2001 to 2014.

Results: 4090 citations were identified of which 37 studies were relevant. The overall quality of evidence was moderate to poor. Thematic synthesis identified key interventions which may improve DNACPR decision making. The most promising interventions involved structured discussion at the time of acute admission to hospital and review by specialist teams at the point of an acute deterioration. Linking DNACPR decisions to discussions about overall treatment plans provided greater clarity about goals of care, aided communication between clinicians and reduced harms. Standardised documentation proved helpful for improving the frequency and quality of recording DNACPR decisions. Patient and clinician education in isolation were associated with limited or no effects.

Conclusion: Relatively simple process changes may enhance the appropriate use of and outcomes associated with DNACPR decisions.

Systematic review registration number: PROSPERO2012:CRD42012002669.

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1. Introduction

Cardiopulmonary resuscitation (CPR) can be lifesaving when there is a reversible cause of the cardiac arrest. However for many patients outcomes are poor. Survival to hospital discharge rates are less than 20% for in-hospital arrests and less than 10% for out of hospital cardiac arrest.^{1,2} It is important to differentiate between patients for whom CPR may be beneficial (those who were in previous good health and sustain a sudden and witnessed cardiac arrest)

and patients whose hearts stop beating as part of the natural dying process.³ Performing an invasive and unsuccessful resuscitation procedure towards the end of a person's natural life can lead to a loss of dignity and potentially prolong suffering.

A do-not-attempt-resuscitation (DNAR) order or as it has more latterly been known a do-not-attempt-cardiopulmonary-resuscitation (DNACPR) decision provides a mechanism for making a decision to withhold CPR prior to a cardiac arrest occurring. DNACPR decisions have been recorded in medical records since the early 1970s.⁴ Despite the existence of processes to record resuscitation decisions for almost 40 years their application is variable. A multi-centre cohort study conducted in the UK examined the case records of over 500 patients that sustained an in-hospital cardiac arrest during a 2-week period in November 2011.^{5,6} Reviewers found that a quarter of patients who received CPR had substantial functional limitations and two-thirds had an underlying fatal

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* Corresponding author at: University of Warwick, Gibbett Hill, Coventry CV4 7AL, United Kingdom.

E-mail address: g.d.perkins@warwick.ac.uk (G.D. Perkins).

disease.⁵ The independent reviewers suggested that a DNACPR decision could have been made prior to cardiac arrest in 85% of cases.⁵ There were also 52 cases where despite a DNACPR decision being in place CPR was commenced.⁵ Other research has demonstrated deficiencies in several aspects surrounding DNACPR decisions. These include: a failure to recognise patients in whom resuscitation is not appropriate and make a timely DNACPR decision^{7,8}; unclear communication of the decision both within the healthcare team as well as to patients/surrogates^{7–9}; suboptimal documentation and misunderstandings of the scope of the decision.^{7,8,10} This highlights a major gap in current approaches to making and applying DNACPR decisions. There are significant regional and international variations in how DNACPR decisions are approached with many institutions initiating changes to improve DNACPR practice.^{11,12} DNACPR decisions are broadly based around three categories: perceived futility of CPR (CPR is unlikely to restore spontaneous circulation); refusal of CPR by the patient with capacity or through an advanced decision for the refusal of treatment; and when the burdens of the resuscitation attempt are thought to outweigh the benefits. In some countries patients are not always informed of DNACPR decisions, in some (including the UK, following the recent Tracey Judgement)¹³ it is illegal to make DNACPR decisions without informing the patient, while in other countries patient consent is required. Irrespective of international differences in decision-making DNACPR decisions form part of an essential framework to enable a dignified death, uninterrupted by a futile resuscitation attempt.

The purpose of the review was to identify recent studies examining interventions designed to improve the application of DNACPR policy into practice.

2. Methods

A systematic review of the literature was conducted in accordance with a pre-defined protocol (unpublished). The review was registered on PROSPERO (2012:CRD42012002669).

2.1. Eligibility

Studies were eligible for inclusion if they were (1) randomised control trials, before-and-after studies and observational studies with a control group (2) involved DNACPR decisions on adults in hospitals, nursing homes or the community (3) tested an intervention designed to improve the application of DNACPR policy into practice.

2.2. Search strategy

The search of electronic databases was conducted using the Ovid SP platform for Medline and Embase databases and the EBSCOhost platform for the CINAHL database and covered papers published between 2001 and February 2014. This date range was chosen as a scoping study was initially conducted in 2011 spanning the previous 10 years. A search strategy was developed which included the MeSH heading Resuscitation Orders (encompassing: Do-Not-Resuscitate Orders; Resuscitation Decisions; Resuscitation Policies; Withholding Resuscitation) and the following text words: do not resuscitate, do not attempt resuscitation, not for resuscitation, allow natural death, DNR, DNAR, NFR and DNACPR. The search terms were combined with the Boolean operator “OR”. Search results were limited to articles published in English.

The search was first conducted using the Medline database and then searches of Embase and CINAHL were performed with the removal of duplicates. The article selection process is summarised in Fig. 1.

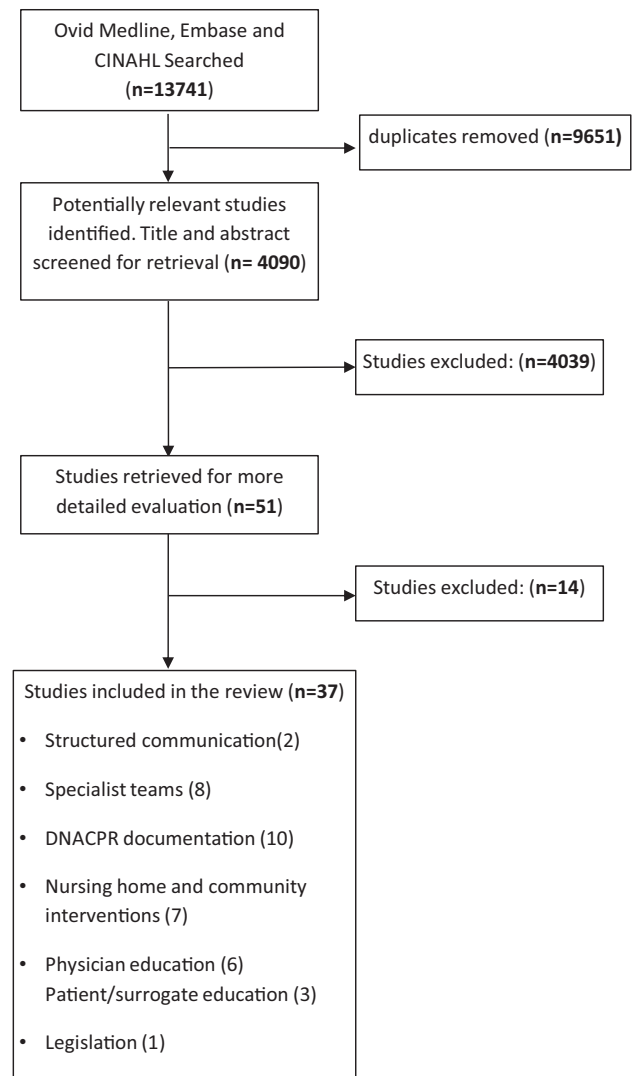


Fig. 1. Flow diagram of study selection.

2.3. Study selection

The search results were initially screened for relevance by reviewing the title and abstracts. The full text of eligible and potentially eligible articles were retrieved and reviewed during a second phase of study selection. Screening and study selection was undertaken independently by two reviewers. Any disagreements between reviewers were resolved by discussion.

2.4. Data collection process

A bespoke data extraction form was developed, refined and then tested on four randomly selected studies (see supplementary material). Information was extracted on (1) country/countries of origin, (2) study design, (3) population studied including number in each group, (4) the type of intervention used, (5) details on the control group, (6) outcome measure used, (7) the effect of the intervention. The assumption was made that all participants were adults unless otherwise stated. Data extraction was undertaken by one review author and checked by a second reviewer. Any disagreements were resolved through discussion.

Supplementary material related to this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.resuscitation.2014.08.024>.

Table 1
Structured communication.

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Nicolasora et al. (2006) ¹² (USA)	Prospective randomised trial	297 patients admitted to the department of medicine	Scripted intervention detailing life sustaining interventions and advance directives (3 months). <i>n</i> = 136	Routine clerking (3 months). <i>n</i> = 161	Number of patients who welcomed the intervention, number who made a decision regarding resuscitation	98% in the intervention group willingly discussed CPR, 8 patients requested DNACPR orders. Resuscitation status was documented by discharge in 61 (38%) patients (control) vs. 125 (92%) patients (intervention).	Moderate
Stein et al. (2013) ¹³ (Australia)	Prospective randomised trial	Patients with advanced metastatic cancer with no further curative treatment based in two hospitals over a 17 month period. <i>n</i> = 120	A patient information leaflet on "living with Advanced Cancer" and a discussion with a psychologist used a shared decision making model including a question about resuscitation wishes. <i>n</i> = 55	Standard care. <i>n</i> = 65	DNACPR order in place at time of death Median time between documented DNACPR decision and death	DNACPR order at time of death control = 44/58 (76%) vs. 26/38 (68%) intervention (<i>p</i> = 0.4) Medium time DNACPR order placed before death control = 12.5 days vs. 27 days intervention group (<i>p</i> = 0.03)	Moderate

2.5. Risk of bias and quality of evidence

The studies were assessed for risk of bias using the criteria given by Thomas.¹⁴ This tool assesses selection bias, study design, confounders, blinding, data collection methods and withdrawals and drop-outs. Each element was rated as strong, moderate or weak to give an overall global rating. All studies were rated for quality independently by two reviewers and any discrepancies were settled by consensus.

2.6. Evidence synthesis

Studies were assessed for heterogeneity of setting, participant, intervention and outcome with the intent of undertaking meta-analysis if possible; findings were summarised thematically for descriptive analysis.

3. Results

The search identified 4090 unique studies. Following review of titles and abstracts 51 were selected for full text review from which 14 articles were excluded leaving 37 articles for data extraction (see Fig. 1).

3.1. Setting

More than half (20/37) of the studies were conducted in the USA with nine studies from the UK, two from Australia and a single study from each of the following countries; Germany, Belgium, Switzerland, the Netherlands, Singapore and Saudi Arabia.

3.2. Quality of evidence

Of the 37 studies 8 were randomised controlled trials, 27 before and after studies and 2 cluster controlled studies. The overall quality assessment of evidence was strong (*n* = 2), moderate (*n* = 12) and weak (*n* = 23).

3.3. Synthesis of findings

The settings and outcomes were too heterogeneous to allow meta-analysis. Studies were therefore grouped into four themes: (1) structured communication and specialist teams (2) DNACPR documentation (3) nursing home and community interventions (4) education (physician and patient). One paper, investigating a change in legislation, did not fall into these themes. The characteristics and results from each study are in Tables 1–7, and reported below under the relevant headings.

3.3.1. Structured communication (Table 1)

In a prospective randomised trial, general medical patients were randomised to a scripted intervention (involving talking about what resuscitation involves and asking the patients preferences with regard to resuscitation status) or standard clerking. There was significant improvement in documentation in the intervention arm. Patients (98%) in the intervention group reported being happy to take part in a discussion about resuscitation.¹⁵ In the second study patients with advanced cancer were randomised to a combination of a patient information leaflet and a resuscitation discussion with a psychologist compared to standard care. DNACPR decisions were placed earlier in the intervention group, but the overall frequency of decisions was the same.¹⁶

3.3.2. Introducing specialist teams (Table 2)

Medical emergency teams (MET) have been introduced to respond to acute deterioration in patients admitted to hospital. Four studies investigated the relationship between MET and DNACPR decisions. Chen et al. assessed the role of the MET on the issuing of DNACPR orders as part of the MERIT cluster randomised study involving 23 hospitals in Australia.^{17,18} Issuing a DNACPR order at time of appropriate call-out was ten times higher per 1000 admissions in hospitals with a MET, although this only represented 5% of total DNACPR activity. Two retrospective audits of the impact of the MET on the number of patients dying with DNACPR decisions in place had conflicting results: Smith et al.

Table 2
Introducing specialist teams.

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Chen et al. (2008) ¹⁴ (Australia)	Cluster randomised controlled trial	6780 patients who required an emergency team response at 23 hospitals	Medical emergency team (MET) (6 months). <i>n</i> = 4161	Non-MET hospitals (6 months). <i>n</i> = 2619	Difference in issuing DNACPR orders between MET and non-MET emergency teams	For adverse event free calls the proportion of DNACPRs made at the call (3.05% non-MET vs. 7.96% MET (<i>p</i> = 0.048)). DNACPR issued 1 in every 33 calls non-MET vs. 1 in every 12 MET hospitals (however this subset only represented 5% of all DNACPR activity. Per hospital admission METs were 10 times more likely to issue a DNACPR	Strong
Kenward et al. (2004) ¹⁷ (UK)	Before and after comparison	Patients in a 700 bed District General hospital with approximately 53,500 admissions per year	Introduction of a medical emergency team (MET)	Audit data for 1 year prior to the introduction of the MET	Percentage of deaths with a DNACPR order	Deaths with a DNACPR order 87.1% (pre) vs. 87.6% post-intervention. No significant difference (24.6% (32/130) of patients seen by the MET were made DNACPR within 24 h of review).	Weak
Al-Qahtani et al. (2013) ¹⁸ (Saudi Arabia)	Before and after comparison	256,195 patients admitted to a tertiary care academic hospital	Introduction of an intensivist led rapid response team (RRT). <i>n</i> = 157,804	Data obtained over a 2 year period pre RRT implementation. <i>n</i> = 98,391	Incidence of ward based DNACPR orders initiated by the intensive care team	Pre intervention DNACPR incidence was 0.7 per 1000 admissions vs. 1.7 per 1000 admissions post intervention (<i>p</i> < 0.0001)	Weak
Smith et al. (2013) ¹⁶ (USA)	Before and after comparison	Patients in tertiary referral centre over a 13 year period	Introduction of a medical emergency team (MET). Data were collected from a 5 year period	Retrospective audit data for 8 years prior to introduction of the MET	Ratio of number of new DNACPR orders placed to the number of in-hospital deaths (DNR/death ratio)	The DNR/Death ratio was 0.53–0.58 pre intervention this increased by 0.10 over the intervention period (<i>p</i> < 0.001)	Weak
Wald et al. (2011) ²¹ (USA)	Quasi-randomised controlled trial	Medical inpatients aged ≥70 years admitted to a 425-bed tertiary care hospital. <i>n</i> = 217	An hospitalist-run acute care for the elderly (ACE) service an interdisciplinary team approach to identify and address geriatric syndromes in patients aged ≥70 years. <i>n</i> = 122	Patients randomised to usual care on the general medical services. <i>n</i> = 95	Percentage of patients with DNACPR orders	26.3% of control patients had a DNACPR order vs. 39.3% of intervention patients (<i>p</i> = 0.04)	Moderate
Lustbader et al. (2011) ¹⁹ (USA)	Before and after comparison	Patients who died following admission to the medical ICU. <i>n</i> = 1208	A palliative care consultation with the palliative care team and the patient and/or legal surrogate. Treatment preferences and goals of care were discussed (42 months). <i>n</i> = 693	Control data from patients who died prior to the introduction of the palliative care team (18 months). <i>n</i> = 515	Percentage of patients with DNACPR orders at time of death.	The intervention group contained a significantly higher percentage of patients with a DNR designation at death than did the control group (86% vs. 68%, χ^2 test, <i>p</i> < 0.0001). 68% of patients in the control group had DNACPR orders at time of death vs. 86% of patients post intervention (<i>p</i> < 0.0001)	Weak

Table 2 (Continued)

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Shuman et al. (2013) ²⁰ (USA)	Before and after comparison	Patients with head and neck cancer receiving ethics consultations between 2007 and 2011. <i>n</i> = 14	Ethics consultation which are designed to enable to patient to make informed choices about their medical care including resuscitation status	Percentage with DNACPR orders before consultation	Change in number of patients with DNACPR orders	Percentage of patients with DNACPR orders 21% (3/14) pre vs. 79% (11/14) post consultation.	Moderate
Wilson et al. (2013) ²² (USA)	Before and after comparison	Patients dying on the medical intensive care unit over two 6 month periods. <i>n</i> = 150	24 h on-site intensivist cover. <i>n</i> = 65	Intensivist on call from home 7 pm to 7 am with residents on-site. <i>n</i> = 85	Time from admission to document DNACPR status CPR performed within 24 h of death	Pre-intervention median (IQR) time to document DNACPR status 3 (1–8) days vs. 1 (0–6) days post-intervention (<i>p</i> = 0.03) CPR was performed within 24 h of death in 22/85 (26%) pre vs. 15/65 (23%) cases post-intervention (<i>p</i> = 0.69)	Weak

found there to be a significant increase,¹⁹ while Kenward et al. found no significant differences between the two periods.²⁰ They did, however observe that 24% of patients (not in cardiac arrest at time of call) seen by the MET received DNACPR decisions within 24 h of review.²⁰ Finally, Al-Qahtani et al. found the introduction of an intensivist led rapid response team significantly increased the number of ward based DNACPR decisions initiated by the intensive care team.²¹

Three studies (2 cohort and one quasi randomised) demonstrated that specialist teams such as palliative care, acute care for the elderly and ethics were associated with an increased proportion of patients with documented resuscitation decisions.^{22–24} A further cohort study evaluated the effect of 24hr intensivist cover on DNACPR processes: there was an improvement in the time taken to document DNACPR decisions but no significant differences in the number of patients receiving CPR within 24 h prior to death.²⁵

3.3.3. DNACPR documentation (Table 3)

Two prospective chart audits and three retrospective chart audits evaluated the introduction of pre-printed DNACPR forms compared to hand-written notes in the medical records.^{26–30} Butler et al. found significant improvement in recording a valid reason, consultant authorisation, consultant review and patient involvement.²⁶ There were also increases in surrogate involvement and documentation in nursing notes.²⁶ By contrast Lewis et al. found no difference in the number of resuscitation attempts, demographics and survival to discharge.²⁷ In retrospective studies Castle et al. found improvements in clarity of decision, date, clinician name and signature and reason for decision.²⁸ No significant improvement in patient or surrogate involvement was observed.²⁸ Diggory found the introduction of a clerking proforma to record patients' resuscitation status on admission was associated with an increased documentation of decisions.²⁹ Tan et al. showed the introduction of a physician order form for DNACPR decisions was associated with fewer patients receiving CPR within the 24 h prior to death and more patients dying with a DNACPR decision in place.³⁰

Five studies examined modifications to existing DNACPR forms. Diggory's team continued the audit cycles from their 2003 study and found that removing the statement indicating that all DNACPR decisions should be discussed with the patient increased the recording of resuscitation status and the number of DNACPR decisions issued.³¹ Piers et al. updated the DNACPR form to emphasise the reason for the DNACPR decision and involvement of others

(surrogates, nurses) in the decision-making process.³² In addition they provided a 45-min briefing on patient rights.³² There was improved completion of reason for decision, nurse involvement and surrogate involvement.³² However there was no improvement in number of deaths occurring with DNACPR decisions.³²

Reducing complexity of the DNACPR form from a seven-page to one-page document increased junior doctors confidence, reduced stress and improved the number of DNACPR decisions per 100 admissions.³³ Changing to a form (the Universal Form of Treatment Options or 'UFTO') which contextualises the DNACPR decision within overall treatment plans was associated with a reduction in harms per 100 admissions as well as a reduction in the harms contributing to patient death.³⁴ Thematic interviews were suggestive of increased clarity of goals of care, better communication between clinicians and earlier decision making with the UFTO compared to the standard DNACPR form.³⁴

Finally, linkage between the electronic patient record and printing of DNACPR wristbands reduced the number of discrepancies between patients' documented wishes and resuscitation status wristband.³⁵

3.3.4. Nursing home and community interventions (Table 4)

Six studies identified interventions which increase the proportion of nursing home residents with DNACPR decisions. Interventions included introduction of a palliative care team end-of-life care pathways and staff training/education.^{36–41} The introduction of structured advanced care planning in the community moved preferences towards less invasive levels of care at life's end, and increased compliance with participants' wishes and deaths at home (including DNACPR).⁴²

3.3.5. Legislation (see Table 5)

Evaluation of the American 1991 Patient Self Determination Act (PSDA) on the number of early and late DNACPR decisions for six medical conditions one year either side of the PSDA.⁴³ There were increases in the percentage of early DNACPR decisions for four of the six conditions, while patients with COPD showed a significant increase in late DNACPR decisions; overall there was little change in the use of DNACPR decisions.⁴³

3.3.6. Physician education (Table 6)

Six studies assessed educational interventions.^{44–49} Study participants included 44 medical students and 269 junior doctors.^{44–49}

Table 3
DNACPR forms.

Author	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Lewis et al. (2009) ²⁴ (UK)	Before and after comparison	280 adults sustaining an in-hospital cardiac arrest	Introduction of standard DNACPR forms (workshops and discussions on DNACPR in training courses) (2 years). <i>n</i> = 147	Pre-interventional data (no form) (2 years). <i>n</i> = 133	Primary: Number of CPR attempts. Secondary: patient demographics, survival to discharge (STD)	No difference in the number of CPR attempts, or demographics and STD. However ROSC decreased 42.9% pre vs. 30.6% post-intervention (<i>p</i> = 0.033)	Weak
Castle et al. (2003) ²⁵ (UK)	Before and after comparison	37 adult in-patients who had died without undergoing resuscitation in a large district general hospital	Introduction of a pre-printed DNACPR form which included briefing on the new form as part of the junior doctors induction (1 week). <i>n</i> = 20	Audit pre-introduction of the form (1 week). <i>n</i> = 17	Clear documentation in notes; decision, date, signed, clinician name, reason, patient involvement	Clarity of decision 65% pre vs. 100% post (<i>p</i> = 0.05). Date 71% pre vs. 100% post (<i>p</i> = 0.014). Signed 53% pre vs. 100% post (<i>p</i> = 0.001). Clinician name 29% pre vs. 100% post (<i>p</i> ≤ 0.001). Reason 18% pre vs. 90% post (<i>p</i> ≤ 0.001). Patient involvement 6% pre vs. 20% post (not significant <i>p</i> = 0.348). No change in surrogate involvement (24% vs. 25%).	Weak
Butler et al. (2003) ²³ (UK)	Before and after comparison	All patients who died at the hospital pre-intervention and patients with a DNACPR in the post intervention period	Introduction of a standardised DNACPR form (4 months). <i>n</i> = 62	Audit pre-introduction of the form (DNACPR order written in patients notes (8 months). <i>n</i> = 94	Deaths with a DNACPR order. Improved documentation and decision making, reason, consultant authorisation and review.	Deaths which had a DNACPR 94/193 (48.7%) pre vs. 37/65 (59.6%) post-intervention. Valid reason for DNACPR 81 (86.1%) pre vs. 61 (98.4%) post (<i>p</i> > 0.01). Consultant authorised 35 (37.2%) pre vs. 56 (90.3%) post. Decision reviewed 35 (37.2%) pre vs. 50 (80.6%) (<i>p</i> < 0.001). Patient involvement 1.1% pre vs. 14.5% post (<i>p</i> < 0.001) Relatives involved 69 (74%) vs. 52 83.9% post. Documentation in nursing notes 64 (68.1%) pre vs. 58 (93.5%) post.	Weak
Diggory et al. (2003) ²⁶ (UK)	Before and after comparison	184 patients admitted and clerked on an elderly care unit.	Audit 2 proforma to record resuscitation status decision (1 month). <i>n</i> = 109	Audit 1 pre-introduction of proforma (1 month). <i>n</i> = 75	Increased documentation of resuscitation status decision	Documentation increased from 36% pre vs. 94% post-intervention	Moderate
Tan et al. (2014) ²⁷ (Singapore)	Before and after comparison	1397 adult deaths on the general wards of a large tertiary hospital	Introduction of a physician order form, staff education and a palliative consult period (1 year). <i>n</i> = 714	Pre-interventional audit data (1 year). <i>n</i> = 683	Deaths with DNACPR order. CPR attempt in the last 24 h of life	Deaths with a DNACPR decision 452/683 (66%) pre vs. 571/714 (80%) post (<i>p</i> < 0.001) CPR in last 24 h of life 64/683 (9.4%) pre vs. 37/714 (5.2%) post (<i>p</i> = 0.003)	Moderate

Table 3 (Continued)

Author	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Piers et al. (2011) ²⁹ (Belgium)	Before and after comparison and cross sectional	228 consecutive deaths in a tertiary hospital and a cross sectional study carried out on a single day in the pre- and post-intervention period.	Staff education and new DNACPR form (16 weeks). <i>n</i> = 113	Pre interventional data (12 weeks). <i>n</i> = 115	Documented surrogate involvement; nurse involvement; reason for DNACPR; deaths without a DNACPR form. No. of DNACPRs on a single day	Surrogate involved 34/78 (44%) pre vs. 46/73 (63%) post (<i>p</i> = 0.022) Nurses involved 11/78 (14%) pre vs. 20/73 (27%) post (<i>p</i> = 0.047) Documented reason 25/78 (32%) pre vs. 43/73 (59%) post (<i>p</i> = 0.001) Deaths without a DNACPR 7/89 (8%) pre vs. 11/88 (13%) post (<i>p</i> = 0.332) Patients with DNACPR 117/676 (17%) pre vs. 75/624 (12%) post-intervention (<i>p</i> = 0.008)	Moderate
Diggory et al. (2004) ²⁸ (UK)	Before and after comparison	259 patients admitted and clerked on an elderly care unit.	Audit 6 removal of the mandatory patient/relative discussion from the DNACPR policy (1 month). <i>n</i> = 119	Audit 5 (1 month). <i>n</i> = 140	Increased documentation of resuscitation status decision and DNACPR rate	Resuscitation status documented 96 (81%) pre vs. 148 (94%). Amount of patients with DNACPR orders 25 (45%) pre vs. 73 (68%) post	Moderate
Sulmasy et al. 2006 ³⁰ (USA)	Before and after comparison with a comparison site	Patients/Surrogates approached for consent for DNACPR orders	Change in DNACPR policy in which a single sided consent form was used instead of 7 separate forms	A control site in which no intervention was given	% of House officers lacking confidence in consenting; DNACPR orders per hospital admission; Surrogate stress (Horowitz impact of event scale)	Percentage of house officers who lacked confidence 24% pre vs. 7% post intervention site (<i>p</i> = 0.002). Control site 20% pre vs. 15% post (<i>p</i> = 0.45). Incidence of DNACPR orders 4.53 per 100 admissions pre vs. 7.22 per 100 admissions post (<i>p</i> < 0.001) intervention site. Control site incidence 3.85 per 100 pre vs. 1.95 per 100 admissions post (<i>p</i> < 0.001) Surrogate stress 23.6 ± 10.1 pre vs. 17.3 ± 15.9 post (<i>p</i> = 0.02) intervention site.	Weak
Fritz et al. (2013) ³¹ (UK)	A prospective mixed-methods before-and-after study with contemporaneous case controls	Adult patients admitted to 2 wards of a 480 bed acute hospital in two 3 month periods. <i>n</i> = 1090	Introduction of a Universal Form of Treatment Options (UFTO) which includes a resuscitation status decision. The UFTO was to be completed for all admissions. Patients who had a not for attempted CPR decision were included. <i>n</i> = 118	Pre intervention data. Patient's with a standard DNACPR order. <i>n</i> = 103	Harm rate using the Global Trigger Tool. Results of thematic interviews with clinicians	Harm rate per 100 admissions pre (DNACPR group) 68.9 vs. 37.3 post intervention (UFTO) <i>p</i> = 0.001 Harms contributing to patient death pre (DNACPR group) 66/71 (93%) vs. 4/44 (9.1%) post intervention (UFTO) <i>p</i> = 0.006 Key findings from interviews suggested there was increased clarity of goals of care, better communication between clinicians and earlier decision making with the UFTO compared to the standard DNACPR form.	Strong

Table 3 (Continued)

Author	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Schiebel et al. (2013) ³² (USA)	Before and after comparison	Patients with DNACPR status in 2059 bedded academic tertiary care hospital over a 3 year period. <i>n</i> = 299	Implementation of an electronic DNACPR system which clearly displayed active DNACPR orders on the patient's electronic medical record. The system was linked to the automated printing of a newly designed DNACPR wristband. <i>n</i> = 103	Audit of patients medical records pre-intervention to look for discrepancies between patient wishes and electronic medical record. <i>n</i> = 196	Primary: discrepancies between documented patient wishes and resuscitation status wristband. Secondary clear identification of current resuscitation status in the electronic record. Recognition of DNACPR wristband by resuscitation team.	Pre-intervention 37/196 (19%) patients vs. 2/103 (2%) post-intervention had discrepancies between wristband and documented wishes (<i>p</i> < 0.001). In simulated scenarios correct identification of wristband occurred 12/36 (33%) vs. 14/24 (58%) with new wristband (<i>p</i> = 0.056). Pre-intervention multiple resuscitation statuses were present in 8% of electronic patient records, following intervention no patients had multiple resuscitation orders.	Weak

Studies typically used multi-faceted interventions including role play (*n* = 3), provision of information (*n* = 2), reflective practice (*n* = 3) and case based discussions (*n* = 2).

Two linked studies randomised first year post-graduate residents to a multimodal educational intervention to improve code status discussions.^{48,49} The multi-modal package included a 2-h teaching with deliberate practice of communication skills, online modules, self-reflection in addition to assigned clinical rotations. Control group residents completed clinical rotations alone. Residents' performance was rated using an 18-point behavioural checklist during a standardised patient encounter with an actor.^{48,49} Residents randomised to the educational intervention had significantly higher scores in the simulated discussion with a standardised patient both at two months and at one year than those who received routine education alone.^{48,49} Residents rated the education programme positively.^{48,49}

Two studies assessed self-reported changes in comfort and/or confidence in discussing CPR decisions; Seoane et al. found house officers rated their self confidence in this area more highly at the end of a rotation which involved a specialised teaching component,⁴⁷ while Kahn et al. found that participants reported significantly improved understanding of the legality of DNACPR decisions (but not in comfort of discussing them) after attending a workshop with simulated patients centred on end-of-life discussion skills.⁴⁶

Two studies assessed changes in patients' outcomes/experiences after training.^{44,45} Furman et al. found no change in the number of resuscitation discussions with patients on admission following a half-day training session (including role-playing exercises) for medical residents.⁴⁴ Perron Junod et al. trained nine junior doctors on the meaning of and ethics surrounding DNACPR decisions in parallel with introducing a new DNACPR policy and form.⁴⁵ The doctors self-reported performance in DNACPR decision making. The doctors reported better patient involvement and improved understanding of the scope of the DNACPR decisions post intervention.⁴⁵

3.3.7. Patient/surrogate education (Table 6)

Five studies were identified.^{10,15,16,50,51} Three studies addressed patient/surrogate education whilst two studies evaluated

structured communication with patients. The overall quality assessment was weak for one study and moderate for four.

In a large (*n* = 2517) before-and-after study, introduction of a patient information leaflet and provision of written information for doctors in a tertiary hospital in the Netherlands had no effect on the frequency of DNACPR documentation.¹⁰ Showing a short video of CPR to relatives of patients in intensive care improved their knowledge about resuscitation but did not influence their preference about DNACPR decisions.⁵⁰ Finally, in a randomised controlled cross over trial, cancer patient's choice about whether they preferred to be asked about their opinion or informed of a DNACPR decision was unchanged after watching two short videos.⁵¹

4. Discussion

The main findings of this review were that although interest and research into DNACPR decisions has been increasing the overall quality of published studies was generally poor. Thematic synthesis identified key interventions which may improve DNACPR decision making. The most promising interventions provided some structure to the decision making process, by contextualising the resuscitation decision alongside overall treatment objectives. The deterioration of a patient or the need to talk about other treatments with them is often the trigger for discussions about CPR. This was evidenced by a recent systematic review of medical emergency team (MET) activations which reported that between 1.7% and 30.8% of MET calls resulted in initiation of discussions about limitations of medical therapy.⁵² Standardised documentation proved helpful for improving the frequency and quality of recording DNACPR decisions. Patient and clinician education in isolation were associated with limited or no effects. A single before and after study found mixed effects following the introducing legislation providing greater patient self-determination.⁴³

One of the early benefits seen with the introduction of medical emergency teams was a reduction in the frequency of cardiac arrest.⁵³ Whilst this has been attributed in part by prompting early recognition of deterioration and cardiac arrest prevention, the initiation of a DNACPR decision prior to cardiac arrest will also lower the un-expected cardiac arrest rate.²¹ Intensive care teams are becoming increasingly involved in end of life care decisions

Table 4
Nursing home and community interventions.

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Hanson et al. (2005) ³³ (USA)	Before and after comparison	458 nursing home residents in 8 nursing homes	Introduction of palliative care leadership teams into 6 nursing homes. <i>n</i> = 346	Pre-intervention baseline data. <i>n</i> = 345	Percentage of residents with a DNACPR order and percentage of residents with a DNACPR order flag on their chart	DNACPR orders 58% (pre) vs. 65% (post) $p \leq 0.05$, DNACPR chart indicators 45% (pre) vs. 60% (post) ($p \leq 0.05$)	Weak
Hockley et al. (2010) ³⁴ (UK)	Before and after comparison	Residents in 7 nursing homes. <i>n</i> = 228	Introduction of two end-of-life care tools (Gold Standards Framework for Care Homes (GSFCH) and adapted Liverpool Care Pathway for Care Homes (LCP). <i>n</i> = 133	Pre-intervention data. <i>n</i> = 95	Increase in percentage of residents with a DNACPR order in their notes	14/95 (15%) residents had a DNACPR order pre vs. 96/133 (72%) post-intervention ($p < 0.001$)	Weak
Morrison et al. (2005) ³⁶ (USA)	Randomised controlled clinical trial	Adults admitted to a long term bed in a 514 bed nursing home. <i>n</i> = 139	Training of nursing home social workers in advanced care planning; structured advance care planning discussions with residents and completion of a care plan with regular review. <i>n</i> = 43	Training of nursing home social workers in legal aspects of advance directives only. <i>n</i> = 96	Documentation of CPR preference	CPR preference recorded 20% (control) vs. 40% (intervention) ($p = 0.05$)	Weak
Livingston et al. (2013) ³⁵ (UK)	Before and after comparison	Adults with dementia who died in a 120 bed Jewish nursing home. <i>n</i> = 98	A 10 session interactive staff educational training programme on end of life care including advance care planning and communication about end of life. Managers also underwent training in the gold standards framework. post intervention (12 months). <i>n</i> = 42	Pre intervention review of records (12 months). <i>n</i> = 56	Number of residents who died with a DNACPR order in place. Number of residents whose advanced care wishes (DNACPR and/or hospitalisation) were met.	Residents with dementia dying with a documented DNACPR decision pre = 4/28 (14%) vs. 16/22 (73%) post intervention ($p < 0.001$) Residents without dementia dying with a documented DNACPR decision pre = 2/20 (10%) vs. 6/7 (86%) post intervention ($p < 0.001$) Residents whose advanced care wishes were met pre = 5/7 (71%) vs. 13/13 (100%) post intervention $p = 0.04$	Weak
Wenger et al. (2013) ³⁸ (USA)	Cluster controlled trial	Nursing homes in coalition and non-coalition areas. <i>n</i> = 555	The formation of community coalitions which were to provide grassroots, education and training to nursing homes in order to improve implementation of POLST (physician orders for life sustaining treatment). Nursing homes in coalition areas. <i>n</i> = 143	Nursing homes in non-coalition areas. <i>n</i> = 140	Percentage of residents with a POLST. POLST completed with resident. Staff education Structural implementation of POLST Difficulties in implementation	Percentage of residents with a POLST were 59.8% in coalition areas vs. 48.0% non-coalition areas ($p = 0.02$) Percentage of POLST forms completed with resident were 92.1% in coalition areas vs. 76.5% non-coalition areas ($p = 0.015$) Use of case discussions and role play in staff education was 53% in coalition areas vs. 36% in non-coalition areas ($p = 0.01$) other educational measures were none significant. No significant difference in percentage of nursing homes reporting difficulties in POLST use or in structural factors.	Weak

Table 4 (Continued)

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Schmitt et al. (2014) ³⁷ (Germany)	Prospective cluster controlled trial	Nursing home residents in 9 nursing homes in one German state. <i>n</i> = 1582	The establishment of regional advanced care planning programme in 4 nursing homes consisting of. 20 h training of non-physician facilitators. 4 h training of primary medical care physicians and 4 h staff education of other key medical/nursing staff. <i>n</i> = 136	5 control nursing homes. <i>n</i> = 439	Number of new advance directives (AD) over the 16.5 month period. Number of AD stating current resuscitation status and if a prominent note for DNACPR was on their file. Total number of AD at the end of the study period. Total number of AD stating resuscitation status at the end of the study period.	Number of new AD were 49/136 (36%) intervention vs. 18/439 (4.1%) control (<i>p</i> < 0.001) Number of new AD stating current resuscitation status 47/49 (95.9%) intervention vs. 7/18 (38.9%) control (<i>p</i> = 0.001) Prominent DNACPR note of file 40/49 (81.6%) intervention vs. 0/18 control (<i>p</i> = 0.001) Total number of AD at end of study 71/136 (52.2%) intervention vs. 109/439 (24.8%) control (<i>p</i> < 0.001) Total AD with current resuscitation decision 51/71 (71.8%) intervention vs. 11/98 (11.2%) control (<i>p</i> < 0.001)	Weak
Schamp et al. (2006) ³⁹ (USA)	Before and after comparison	Adults enrolled in a urban community outpatient programme for All-inclusive Care of the elderly (PACE) site (aged at least 55 years and frail enough to qualify for a nursing home placement). <i>n</i> = 160	Enrolment in PACE which involved confirmation of current healthcare wishes and advance directive	Documented health care wishes prior to enrolment on the PACE programme	Change in present DNACPR documentation	77 (48%) of patients had DNACPR orders pre-intervention vs. 61 (38%) post-intervention (<i>p</i> < 0.05)	Weak

Table 5
Legislation.

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Baker et al. (2003) ⁴⁰ (USA)	Before and after comparison	Medicare patients admitted to 29 non-federal hospitals between 1991 and 1997 with myocardial infarction (MI), heart failure (HF), gastrointestinal haemorrhage (GIH), chronic obstructive pulmonary disease (COPD), pneumonia (PNU), or stroke (STR). <i>n</i> = 91,539	Passage of the Patient self-determination Act (PSDA) in Dec 1991 (requiring hospitals to develop policies on advance directives, ask new patients if they had an advance directive, provide patients with information on advance directives and educate the staff on advance directives)	Chart data of patients before the PSDA (1991 data)	Percentage of early DNACPR orders (1 st or 2nd day of hospital stay) and percentage of late DNACPR orders (day 3 or later)	MI early DNACPR orders 10.4% (1991) vs. 13.1% (1992) <i>p</i> = 0.02, HF early DNACPR orders 8.6% (1991) vs. 13.0% (1992) <i>p</i> = 0.03, GIH early DNACPR orders 8.9% (1991) vs. 11.8% (1992) <i>p</i> = 0.02, COPD early DNACPR orders 6.9% (1991) vs. 9.7% (1992) <i>p</i> = 0.05. There were no significant changes for patients with PNU or STR. No significant changes in late DNACPR orders except for COPD; COPD late orders 4.3% (1991) vs. 6.4% (1992) <i>p</i> = 0.01	Weak

Table 6
Physician education.

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Furman et al. (2006) ⁴¹ (USA)	Before and after comparison	8 medicine residents serving 79 patients on at internal medicine unit	Medical residents received a half day training session intervention involving didactic training and a role play exercise (5 days). <i>n</i> = 35	Pre-intervention documentation of a resuscitation discussion (10 days). <i>n</i> = 44	Increased documentation of a resuscitation status discussion	Pre-intervention 44 (32%) patients had discussions. Post-intervention 35 (34%) patients had discussions. No significant difference.	Weak
Junod Perron et al. (2002) ⁴² (Switzerland)	Before and after comparison	9 junior doctors serving 255 patients with a DNACPR order on an internal medicine unit	Information given to the doctors about DNACPR meaning, ethics, patients rights and futility (5 months). <i>n</i> = 115	Pre-intervention data (5 months). <i>n</i> = 140	Accurate understanding, interpretation and use of DNR orders (survey attached to DNACPR form). Patient involvement in the decision	Pre-intervention correct physician understanding 62/140 (44%) vs. 107/115 (93%) post (<i>p</i> < 0.001). Patient involvement 17.1% pre vs. 47.8% post (<i>p</i> < 0.01). Nurse and surrogate involvement non-significant.	Weak
Kahn et al. (2001) ⁴³ (USA)	Before and after comparison	44 third year medical students	A half day workshop using standardised simulated patients with 2 end of life scenarios. <i>n</i> = 44	Pre-test of self efficacy to deal with end of life issues using a 5 point Likert scale. <i>n</i> = 44	Improvement in pre- and post-test scores on being comfortable discussing DNACPR orders and understanding the legal issues surrounding DNACPR orders	More students felt comfortable discussing DNACPR orders mean Likert score 2.5/5 (pre) vs. 2.7/5 (post) (<i>p</i> = 0.54). Improved understanding of legal issues 2.6/5 (pre) vs. 3.6/5 (post) (<i>p</i> < 0.01)	Weak
Seoane et al., 2012 ⁴⁴ (USA)	Before and after comparison	214 medical intensive care unit house officers	Teaching throughout a one month rotation involving role modelling, tutorials and case-based discussions	Pre-rotation survey using a 4 point Likert scale to rate confidence in 9 aspects of palliative care including discussion DNACPR orders	Improvement in pre- and post-test scores on being comfortable discussing DNACPR orders	Mean confidence was 3.1(0.9)/4 pre and 3.6(0.6)/4 post intervention (<i>p</i> < 0.001)	Weak
Szmulowicz et al. (2012) ⁴⁵ (USA)	Prospective randomised controlled trial	38 post-grad year 1 medical residents at a large academic medical centre. <i>n</i> = 38	Extra multimodal educational intervention consisting of seminars, self directed learning, e-learning modules, reflective practice and a booster session at 4 months. <i>n</i> = 19	Residents undergoing the 6 month rotation without any of the extra educational interventions. <i>n</i> = 19	Score of a resuscitation status decision with a simulated patient after 2 months after the booster session.	Mean resuscitation status discussion scores were 53.2 ± 16.2% for control group vs. 75.1 ± 8.9% for intervention group (<i>p</i> < 0.001)	Moderate
Wayne et al. (2012) ⁴⁶ (USA)	As above	As above	As above	As above	Score of resuscitation status decision with a simulated patient 12 months after 1st simulated discussion test	Mean resuscitation status discussion scores were 54.7 ± 17.1% for control group vs. 71.9 ± 16.0% for intervention group (<i>p</i> < 0.001)	Moderate

including DNACPR decisions. Appropriate recognition of patients approaching the end of their natural lives allows a dignified death, un-interrupted by a failed resuscitation attempt. Through providing a mechanism to engage patients in discussion about their overall treatment goals, it allows scarce intensive care resources to be used more efficiently.^{54–56}

There are several points in the patient's journey where consideration of resuscitation status seems logical. Acute admission to hospital indicates a change in patient status and could prompt a useful time to review choices about resuscitation. A structured intervention designed to explore the benefits and burdens of a

resuscitation attempt at the time of hospital admission improved documentation of DNACPR decisions.¹⁵ Furthermore this review suggests that if acute deterioration occurs following hospital admission, review by a medical emergency or intensive care team can serve as a useful trigger to review the appropriateness of resuscitation.^{17,20,21}

Pre-printed forms compared to handwritten notes improve accurate recording and adherence to policy. The forms most likely act as a checklist to ensure key elements such as consultant name and date of decision are clearly recorded.⁵⁷ However whilst they show benefits in improving documentation only Tan's study,

Table 7
Patient/surrogate education.

Author and country	Study type	Population (patient) <i>n</i>	Intervention	Control	Outcome (tool used)	Effect	Study quality
Meilink et al. (2006) ⁴⁷ (Netherlands)	Before and after comparison	2517 admission notes on all clinical admissions to a tertiary referral hospital	Introduction of a DNACPR patient information sheet and informing (in writing) consultants and residents about the DNACPR order documentation (1 month). <i>n</i> = 1281	Pre-intervention audit data (1 month). <i>n</i> = 1237	Documentation of resuscitation status decision in the medical record.	Pre-intervention 132 (10.7%) patients had a resuscitation decision. Post-intervention 119 (9.3%) had a decision. No improvement.	Moderate
McCannon et al. (2012) ⁴⁸ (USA)	Before and after comparison	Surrogate decision makers of medical intensive care unit patients. <i>n</i> = 50	A 3-min video depicting a simulated CPR attempt followed by a 4 question CPR knowledge assessment. <i>n</i> = 27	A 4 question CPR knowledge assessment without the video. <i>n</i> = 23	Primary: Score on CPR knowledge Secondary: percentage of surrogates making a DNACPR decision for patients	Pre-intervention average surrogate score was 2.0 ± 1.2 vs. 2.9 ± 1.2 out of 4 post-intervention ($p = 0.008$). Pre-intervention 22% of surrogates chose DNACPR status vs. 59% post intervention ($p = 0.23$)	Weak
Rhondali et al. (2013) ⁴⁹ (USA)	Randomised controlled crossover trial	Patients with advanced cancer attending a supportive care clinic. <i>n</i> = 80	Patients watched two similar videos showing a simulated resuscitation status discussion. Video 1 ended the discussion with a question asking the patient their preference for resuscitation. Video 2 ended the discussion with a recommendation of DNACPR from the doctor. <i>n</i> = 80	The patients were split into two groups. The first group watched video 1 followed by video 2. The second group watched video 2 followed by video 1 in order to minimise bias. <i>n</i> = 80	Patients were asked at the end of each video what resuscitation status they would choose for the patient (CPR or DNACPR)	There was no difference in patients choosing DNACPR between the question (video 1) and the recommendation (video 2). 58/80 patients chose DNACPR for the video patient. After watching the first video DNACPR was chosen 34/58 (59%) for video 1 (question) vs. 24/58 (41%) for video 2 recommendation ($p = 0.49$). Overall patients choosing DNACPR for the video patient was 74% for question (video 1) vs. 73% recommendation (video 2)	Moderate

which combined new forms with staff education showed any clinical impact, with an increased proportion of patients dying with DNACPR decisions in place.³⁰ Forms alone are unlikely to improve recognition of patients for whom resuscitation is not appropriate. Nevertheless, forms can act to 'nudge' certain positive behaviours, or eliminate negative ones.⁵⁸ The Diggory study showed that removing a statement implying a mandatory discussion with patient/surrogate is required increased the number of DNACPR decisions made.³¹ Piers et al. instituted a different change, and found the number of conversations with patients or surrogates increased.³² Sulmasy's changes were associated with an improvement in house officer confidence and reduced surrogate stress when consenting for DNACPR decisions.³³ One study assessed changing the form from a traditional DNACPR order to a treatment option form (UFTO) which focussed on treatments to be given rather than ones to be withheld.³⁴ The introduction of the UFTO was associated with reduced patient harms as well as improving communication and user friendliness.

Education has been proposed as a solution to poor DNACPR decision-making.⁵⁹ Research addressing this question was generally low quality and often limited to knowledge and clinician satisfaction outcomes. The most promising interventions were multi-modal training for clinicians which combined role play, self-reflection and case base discussion.^{48,49} However a recent large randomised trial found a failure of translation of communication skills from simulator to bedside.⁶⁰ Whether such interventions translate to improve patient and relative focused outcomes should be tested in robust trials. Education in the form of providing passive information to patients (and relatives) in the form of an information leaflet or short video had limited effects.^{45,50}

5. Limitations

While there were many different methodologies and desired outcomes, the one which was most commonly aspired to was an increase in the proportion of patients with DNACPR

decisions^{10,15,16,19–24,26,29–33,36–40,42,50} reflecting a concern that patients have inappropriate attempts at resuscitation performed on them, at a personal and financial cost.^{61,62} Only six of these studies had additional outcome measures to assess clinical impact and patient/relative satisfaction.^{15,16,26,30,32,33}

Most of the studies identified for review were observational studies and therefore were of low quality evidence. Only seven studies were randomised controlled trials of moderate-strong quality evidence.^{15–17,24,48,49,51}

The studies were conducted in range of countries, which have differences in the way DNACPR decision-making occurs. For example in the USA the decision advocates a patient-centred decision respecting autonomy. In the UK many DNACPR decisions, particularly where the grounds for the decision are that CPR would be futile (that CPR will not restart the heart/breathing for sustained period) are initiated by the medical teams.^{3,63} Many other European countries have no formal policy for recording DNAR decisions and the practice of consulting patients about the decision is variable.^{64,65} In some countries, withholding CPR is considered a criminal offence.^{64,65} This geographical variation in national approaches to DNACPR decision making means that a system that may work effectively in one country may not be immediately extendable in another country.

6. Conclusions

This review suggests that structured discussions at the time of admission to hospital and review by specialist teams at the point of an acute deterioration served as useful triggers to review DNACPR decisions. Linking DNACPR decisions to discussions about overall treatment plans provided greater clarity about goals of care, aided communication between clinicians and reduced harms. Standardised documentation proved helpful for improving the frequency and quality of recording DNACPR decisions. Patient and clinician education in isolation were associated with limited or no effects.

Conflict of interest statement

RAF – none declared. ZF – Zoe Fritz has been involved in the development and evaluation of the Universal Form of Treatment options, and was co-author on three papers listed on the systematic reviews. She was not involved in assessing these papers, and all were assessed by two independent reviewers. AB – none declared. AG – none declared. GDP – none declared.

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