Evidence on the cost and cost-effectiveness of palliative care: A literature review

Samantha Smith *Health Research and Information Division, Economic and Social Research Institute, Trinity College, Dublin, Ireland*

Aoife Brick *Health Research and Information Division, Economic and Social Research Institute, Trinity College, Dublin, Ireland*

Sinéad O'Hara *Health Research and Information Division, Economic and Social Research Institute, Trinity College, Dublin, Ireland*

Charles Normand *The Centre of Health Policy and Management, Trinity College Dublin, Dublin, Ireland*

Abstract

Background: In the context of limited resources, evidence on costs and cost-effectiveness of alternative methods of delivering health-care services is increasingly important to facilitate appropriate resource allocation. Palliative care services have been expanding worldwide with the aim of improving the experience of patients with terminal illness at the end of life through better symptom control, coordination of care and improved communication between professionals and the patient and family.

Aim: To present results from a comprehensive literature review of available international evidence on the costs and cost-effectiveness of palliative care interventions in any setting (e.g. hospital-based, home-based and hospice care) over the period 2002–2011.

Design: Key bibliographic and review databases were searched. Quality of retrieved papers was assessed against a set of 31 indicators developed for this review.

Data Sources: PubMed, EURONHEED, the Applied Social Sciences Index and the Cochrane library of databases.

Results: A total of 46 papers met the criteria for inclusion in the review, examining the cost and/or utilisation implications of a palliative care intervention with some form of comparator. The main focus of these studies was on direct costs with little focus on informal care or out-of-pocket costs. The overall quality of the studies is mixed, although a number of cohort studies do undertake multivariate regression analysis.

Conclusion: Despite wide variation in study type, characteristic and study quality, there are consistent patterns in the results. Palliative care is most frequently found to be less costly relative to comparator groups, and in most cases, the difference in cost is statistically significant.

Keywords

Costs, cost-effectiveness, palliative care, review literature

Introduction

In the context of limited resources, evidence on costs and cost-effectiveness of alternative methods of delivering health-care services is increasingly important to facilitate appropriate resource allocation decisions. Care at the end of life is known to account for a large proportion of health-care resources. Estimates from the United States indicate that 25% of health-care expenditure is related to patients in their last year of life.[1] In the United Kingdom, it is estimated that approximately 20% of hospital bed days are taken up by end-of-life care.[2] Palliative care services have been expanding worldwide with the aim of improving the experience of patients with terminal illness at the end of life through better symptom control, coordination of care and improved communication between professionals and the patient and family.[3,4]

However, the application of economic evaluation to palliative care has been slow to develop, and the evidence base remains small. While available studies indicate that

Corresponding author:
Samantha Smith, Economic and Social Research Institute, Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland.
Email: samantha.smith@esri.ie

palliative care is cost-saving, the results should be treated with caution (e.g. heterogeneous methods, poor quality of evaluation[5]). There are challenges in applying standard economic evaluation techniques to palliative care, some of which relate to difficulties in capturing all relevant data (e.g. informal care costs), while others refer to conceptual issues of valuing benefits. There are concerns that the full impacts of the interventions are not being captured. For example, the appropriateness of applying standard economic evaluation techniques (e.g. the Quality Adjusted Life Year (QALY)) to measuring outcomes in palliative care has been questioned.[5] The duration of effect is inevitably limited in many palliative interventions, but a short good experience may be given a high value and this is not captured in the standard approach of adding up QALYs.[4,6]

Thus, there are reasons why studies in this area do not undertake formal cost-effectiveness analyses, but rather assess implications of palliative care interventions on costs separately from outcomes. As a result, methodological approaches are varied and often rely on relatively small observational studies.[3] It is important to keep these challenges in mind when reviewing economic studies in this field, looking for consistent patterns across study results rather than undertaking formal meta-analyses. Existing systematic reviews have assessed some of the evidence on costs and cost-effectiveness of palliative care,[3,4,7] but the focus and the extent to which the quality of the cost analyses is assessed has varied.

This article presents results from a comprehensive literature review of available international evidence on the costs and cost-effectiveness of palliative care interventions in any setting (e.g. hospital-based, home-based (see the 'Methods' section for discussion of terminology)) over the period 2002–2011. Given the linkages between health-care utilisation and costs, evidence on service utilisation is also assessed. While we follow standard methods for conducting a systematic review and assess the quality of the evidence against a set of criteria drawn from the evaluation literature, we take a deliberately inclusive approach and no study is omitted from the summary findings on the basis of poor quality. This reflects our focus on identifying consistent patterns in results within a small field of evidence.

The 'Methods' section outlines the research question for the review and presents the methods. Quality assessment and key findings of the included studies are presented and discussed in the 'Results for literature review (2002–2011)' section, while the 'Conclusion' section concludes the article.

Methods

Terminology and objectives

The terms 'palliative' and 'hospice' have not been used consistently in the literature. Given the aim to capture a comprehensive review of studies in this area, this review avoids making strict delineations between hospice and palliative care. In outlining key findings, we adopt the same terminology as applied in the source literature. The general term 'palliative care intervention' used in this article is intended to cover interventions that specify a palliative care focus and/or hospice-related care. The term 'end-of-life' was kept deliberately vague so as to include as many studies as possible, for example, studies that focus on the last 7 days, last month, last 3 months and so on.

The specific objectives of the review were to

- Identify studies that investigate the cost or resource use implications of a 'palliative care intervention' relative to some type of comparator or control.
- Identify studies that investigate the cost-effectiveness of a 'palliative care intervention' relative to some type of comparator or control.

Search strategy

Key bibliographic and review databases were searched including PubMed (including MEDLINE), EURONHEED, the Applied Social Sciences Index (ASSIA) and the Cochrane library of databases (including the National Health Service Economic Evaluation Database, the Database of Systematic Reviews, the Health Technology Assessment Database and others).

The search strategy was initially limited to articles written in the English language, published in the period 1980–2011 and involving human subjects. The search was kept as broad as possible as there can be quite a lot of overlap between the palliative care and 'end-of-life' literatures. The strategy employed a list of terms grouped under three main headings intended to identify all publications relevant to the review question: life stage (e.g. end of life, last year of life, life-threatening and so on) OR type/location of care (e.g. palliative, hospice and so on) AND costs/cost-effectiveness (e.g. cost, economic, price and so on). The full list of search terms is available on request from the authors.

Applying these search criteria to the databases provided a list for title screening. Titles were excluded on the basis of six criteria: an exclusively non-Western focus, a pharmacological focus, editorials or other descriptive (e.g. historical discussion), literature reviews (systematic or otherwise), no specific focus on palliative or hospice care, or no specific focus on costs or health-care utilisation. Any citations that were ambiguous with regard to the exclusion criteria were retained for the next stage. Duplicates were identified and removed. Abstracts from the retained titles were reviewed and included for full text review unless any of the above exclusion criteria applied. If there were any ambiguity following the abstract review, the article moved to the next stage. The full text for those articles found to be potentially relevant from the abstract screening were reviewed in detail. Only those that met the criteria of examining the cost and/or utilisation implications of a palliative care interven-

tion with some form of comparator were included in the final literature review. References of the retrieved articles were also hand-searched for further relevant studies. Data were extracted (onto an MS Access database) from the selected papers to record key study characteristics and to facilitate quality assessment.

Quality assessment

There is no single approach to assessing quality for a systematic review, and different elements of quality need to be considered for different study designs.[8,9] For the purpose of this review, it was difficult to find an existing single set of criteria that could be applied given the diversity in the types of studies included and given the specific focus on cost analysis. Thus, this review compiled a set of 31 indicators suitable for evaluating a diverse set of papers, drawing on existing evaluation criteria (see Table 1).[4,8,10–13] As a general guide, quality assessment of any study should consider risk of bias, statistical issues, quality of reporting and generalisability.[9] These factors informed the selection of indicators.

The 31 indicators cover six core issues:

1. Study description (e.g. details on objectives, importance of the research question outlined, clear description of the alternatives being compared)
2. Sample selection and size (e.g. details on how the sample was selected, adequate sample size)
3. Measurement (e.g. clear description of outcome measures, viewpoint of analysis clearly stated)
4. Reporting (e.g. details on baseline demographic and outcome measures, details of currency and adjustments for inflation)
5. Analysis (e.g. clear description of statistical analytic methods, adequate controls for variations in individual characteristics and self-selection and other sources of bias)
6. Conclusions (e.g. statements of study limitations)

The quality of the papers was judged by a panel of three reviewers to ensure consistency. The reviewers discussed and agreed on a final mark for each indicator. Each indicator was allocated one of three possible marks: 0 (poor), 2 (incomplete or not clear) or 4 (good). In some cases, the indicator was not applicable for the paper and was marked as such. An overall mark, ranging from 0 (lowest quality) to 1 (highest quality), was then calculated for each of the six core issues (i.e. study description, sample selection and size, measurement and so on). For example, 'study description' covers three indicators. If a particular paper scored 4, 2 and 0 for indicators one, two and three respectively, the numerator for 'study description' would be 6 and the denominator would be 12 (4 being the maximum mark for each indicator), giving an overall score of 0.5. Where a particular indicator was not applicable, it was excluded from the calculation.

However, while quality scales and summary scores have been used in a number of palliative care reviews,[3,4] it is important to note that their limitations and their use in general have been questioned.[9] As shown in the 'Results for literature review (2002–2011)' section, an overall score for each paper can be useful to classify papers into broad quality groupings, but this is more informative when combined with other factors, such as an assessment of the type of analytical methods employed by each paper. As in other literature reviews of palliative care,[3,4] it was not possible to undertake formal meta-analysis of the cost findings, given the heterogeneity of the methods in the studies included in this review. As an alternative, the study findings are discussed broadly in order of general assessment of quality, drawing on the formal assessment ratings and also taking into account the sophistication of the statistical analysis undertaken.

Results for literature review (2002–2011)

Study selection

A total of 54,268 papers were returned from the initial bibliographic and review database search (Figure 1). Following the title screening, 53,041 papers were omitted as they clearly met the exclusion criteria. Of the 1227 papers that moved on to the abstract screening stage, 100 duplicates were omitted and 640 met the exclusion criteria. The full texts of the remaining 487 papers were retrieved. Focusing on the period 2002–2011, 285 papers were reviewed for potential inclusion in the literature review, of which 46 papers met the criteria of examining the cost and/or utilisation implications of a palliative care intervention with some form of comparator.

Study characteristics

Table 2 outlines the key characteristics of the 46 papers selected for inclusion in the review. Drawing on classifications outlined in the literature,[9] the papers fall into six main categories. There are 5 randomised controlled trials (RCTs), 2 non-RCTs, 34 cohort studies, 2 case studies, 2 before-and-after studies and 1 'other' study.

The included papers cover a range of different palliative care interventions including hospice care, hospital-based palliative care programmes, home-based palliative care programmes and others. As noted earlier, the definitions of palliative care interventions vary across studies, and in a number of cases, adequate descriptions of the intervention being studied were relatively limited, making international comparisons more difficult. Most of the papers analysed the impact of one specific palliative care intervention relative to a control, while three focused on comparisons across different types of palliative care or on palliative care in different locations.

Table 1. Quality indicators criteria.

No.	Indicator	Applicable to	Comparator groups	No comparator groups
(A)	Study description			
1.	Specific objectives	All	4: It is clear what the research question is 2: The research question is not clearly stated 0: The research question is not stated at all	
2.	The importance of the research question is stated	All	4: Justification/rationale is provided for the focus of the study 2: Not clear what the rationale behind the specific research question is 0: No introduction justification/rationale is provided	
3.	The alternatives being compared are clearly described	All	4: Each alternative is clearly described 2: Only one alternative is described (and the other not at all), or only one is clearly described (and the other only vaguely), or none of the alternatives are clearly described (all only vaguely) 0: The alternatives are not described at all	4: The programme or intervention is clearly described 2: The programme or intervention is not clearly described 0: The programme or intervention is not described at all
(B)	Sample selection and size			
4.	Clear description of inclusion and exclusion criteria	All	4: The inclusion and exclusion criteria are clearly described 2: The inclusion/exclusion criteria are not clearly described 0: The inclusion/exclusion criteria are not described at all	
5.	Comprehensive strategy for identification of potential cases	All	4: The study has taken a comprehensive approach to identifying all potential participants for the study 2: It is not clear whether a comprehensive approach has been taken, or the approach could be more comprehensive 0: A comprehensive approach has not been taken	
6.	Patient recruitment rate > 70%	Prospective	4: Of all potential patients to be recruited to the study, more than 70% have been recruited 2: The recruitment rate is not clear 0: The recruitment rate is lower than 70% Not appropriate: retrospective study	
7.	Evaluation of non-participants to judge generalisability	All	4: Patients excluded from analysis are evaluated 2: It is not clear whether patients excluded from analysis have been evaluated, or only limited evaluation has been undertaken 0: Evaluation of patients excluded from analysis is not reported Not appropriate: if there are no exclusions	
8.	How sample size was determined	Prospective	4: Is the method for calculating sample size reported 2: The method for calculating sample size is not clear 0: The method for calculating sample size is not reported Not appropriate: retrospective study	
9.	Adequate sample size for each comparator group	All	4: Sample size for each comparator group $\geq$ 30 2: Sample size for each comparator group not clear 0: Sample size for one/more comparator groups < 30	4: Sample size $\geq$ 30 2: Sample size not clear 0: Sample size < 30
(C)	Measurement			
10.	Clearly defined primary and secondary outcome measure(s)	All	4: All specified outcome measures are clearly described 2: The description of one/more outcome measures is not clear; the descriptions for some outcomes are clear but not clear/not included for others 0: None of the specified outcome measures are described	

Table 1. (Continued)

| No.	Indicator	Applicable to	Comparator groups	No comparator groups
11.	Use of validated subjective outcome measures	All	4: Measurement of subjective outcomes is undertaken using recognised, validated measures 2: Measures used for subjective outcomes are not clear; recognised validated measures are used for some but not all of the subjective outcomes 0: None of the subjective outcomes are measured using recognised, validated measures	
12.	The viewpoint(s) of the analysis are clearly stated	Cost	4: The perspective for the cost analysis is clear 2: The perspective for the cost analysis is not clear 0: The perspective for the cost analysis not stated at all	
13.	Quantities of resources are reported	All	4: Quantities of resource use clearly presented 2: Quantities of resource use presented but not clearly 0: Quantities of resource use not presented Not appropriate: quantities of resource use not collected in the study	
14.	Unit costs are reported	Cost	4: Unit costs are clearly presented 2: Unit costs are presented but not clearly or not for all relevant costs 0: Unit costs are collected but not presented Not appropriate: unit costs are not collected in the study	
15.	Methods for the estimation of quantities and unit costs are described	All	4: Methods for calculating resource use and/or costs are described 2: Methods for calculating resource use and/or costs are not clearly described or are only described from some 0: Methods for calculating resource use and/or costs are not described for any	
16.	Time horizon of costs and benefits is stated	All	4: It is clear what time period the data refer to 2: It is not clear what time period the data refer to 0: No reference at all to the time period	
(D)	Reporting			
17.	Baseline demographics and clinical characteristics of each group	All	4: Demographic and clinical characteristics are reported for each comparison group 2: Demographic and clinical characteristics are reported for only one group, not clearly presented 0: Demographic and clinical characteristics are not presented	4: Demographic and clinical characteristics are reported for the study group 2: Demographic and clinical characteristics are incomplete/not clearly presented 0: Demographic and clinical characteristics are not presented
18.	Baseline outcome measures of each group prior to the intervention	All	4: Outcome measures at baseline, prior to intervention, are reported for each comparison group 2: Outcome measures at baseline, prior to intervention, are reported for one group only, or not clearly presented for one/either group 0: Outcome measures at baseline, prior to intervention, are not reported	4: Outcome measures at baseline, prior to intervention, are reported for the study group 2: Outcome measures at baseline, prior to intervention, are not clearly presented for the study group 0: Outcome measures at baseline, prior to intervention, are not reported
19.	No significant differences present across study groups	All	4: There are no statistically significant differences in demographic or clinical characteristics among the comparison groups in the study 2: It is not clear whether there are statistically significant differences in demographic or clinical characteristics among the comparison groups in the study 0: There are statistically significant differences in demographic or clinical characteristics among the comparison groups in the study	Not appropriate

(Continued)

Table 1. (Continued)

No.	Indicator	Applicable to	Comparator groups	No comparator groups
20.	Currency and price date are recorded	Cost	4: Both currency and price date are specifically reported 2: Only one of currency or price date are specifically reported 0: Neither currency nor price date are specifically reported	
21.	Details of currency of price adjustments for inflation or currency conversion are given	Cost	4: Details of adjustments for inflation or currency conversion are clearly presented, or the currency and price date are indicated and the data were collected within one calendar year 2: Details on adjustments for inflation/currency are not clear 0: No details are given on adjustments for inflation/currency	
(E)	Analysis			
22.	*Details of any statistical methods used are given (univariate)*	All	4: Statistical methods for univariate analysis are reported 2: Statistical methods are not clear 0: Statistical methods not reported Not appropriate: univariate analysis not undertaken	
23.	For each primary and secondary outcome, a summary of results for each group and estimated effect size and precision	All	4: For each outcome, results from univariate analysis are presented for each comparison group, including effect size and precision 2: Presentation of results of univariate analysis is unclear 0: Results from univariate analysis not presented Not appropriate: univariate analysis not undertaken	
24.	Details of any model used are given *(multivariate)*	All	4: Details of any regression analysis are reported 2: Regression analysis is not clear 0: Regression analysis is not reported Not appropriate: multivariate analysis not undertaken	
25.	The choice of model used *is appropriate*	All	4: The model is appropriate for the dependent variable, the full list of covariates is included 2: The model is appropriate for the dependent variable but the full list of covariates is not included, or it is not clear what model has been used 0: The model is not appropriate for the dependent variable Not appropriate: multivariate analysis not undertaken	
26.	A summary of results for each model including coefficients/odds ratios/ marginal effects and precision	All	4: The regression results are clearly presented for each model including coefficients/odds ratios/marginal effects and precision 2: The regression results are incomplete, or are not clearly presented 0: The regression results are not presented Not appropriate: multivariate analysis not undertaken	
27.	The statistical methods/ model adequately control for variation across the comparison groups	All	4: The type of statistical analysis undertaken controlled well for variation across the groups when comparing the outcomes of interest 2: The details of the statistical analyses are unclear so it is not clear whether there was sufficient control of variation across the groups 0: More statistical analysis could have been undertaken to control for variation across the groups	Not appropriate
(F)	Conclusions			
28.	Major outcomes are presented in a disaggregated as well as aggregated form	All	4: Details of major outcomes presented for itemised costs/services as well as aggregated values 2: Unclear presentation of major outcomes 0: Only aggregated values presented Not appropriate: only aggregated values estimated	
29.	The answer to the study question is given	All	4: The discussion or conclusions refer to the initial study objectives and outline the answers 2: It is not clear that the analysis has directly addressed the study question 0: No summary statements included	

Table 1. (Continued)

No.	Indicator	Applicable to	Comparator groups	No comparator groups
30.	Conclusions follow from the data reported	All	4: The text in results/discussion/conclusions follows the data presented 2: The text in results/discussion/conclusions does not clearly follow the data presented 0: No discussion of the data presented or the discussion does not correspond to the data presented	
31.	Conclusions are accompanied by the appropriate limitations/caveats	All	4: The study outlines key limitations and should refer at least to issues of generalisability, uncontrolled variation across comparison groups 2: Some limitations are listed but without consideration of one of generalisability or uncontrolled variation 0: No limitations are listed, or no reference to generalisability and uncontrolled variation	4: The study outlines key limitations and should refer at least to the issue of generalisability 2: Some limitations are listed but without consideration of generalisability 0: No limitations are listed

Source: Adapted from existing evaluation criteria.[4,8,10–13]
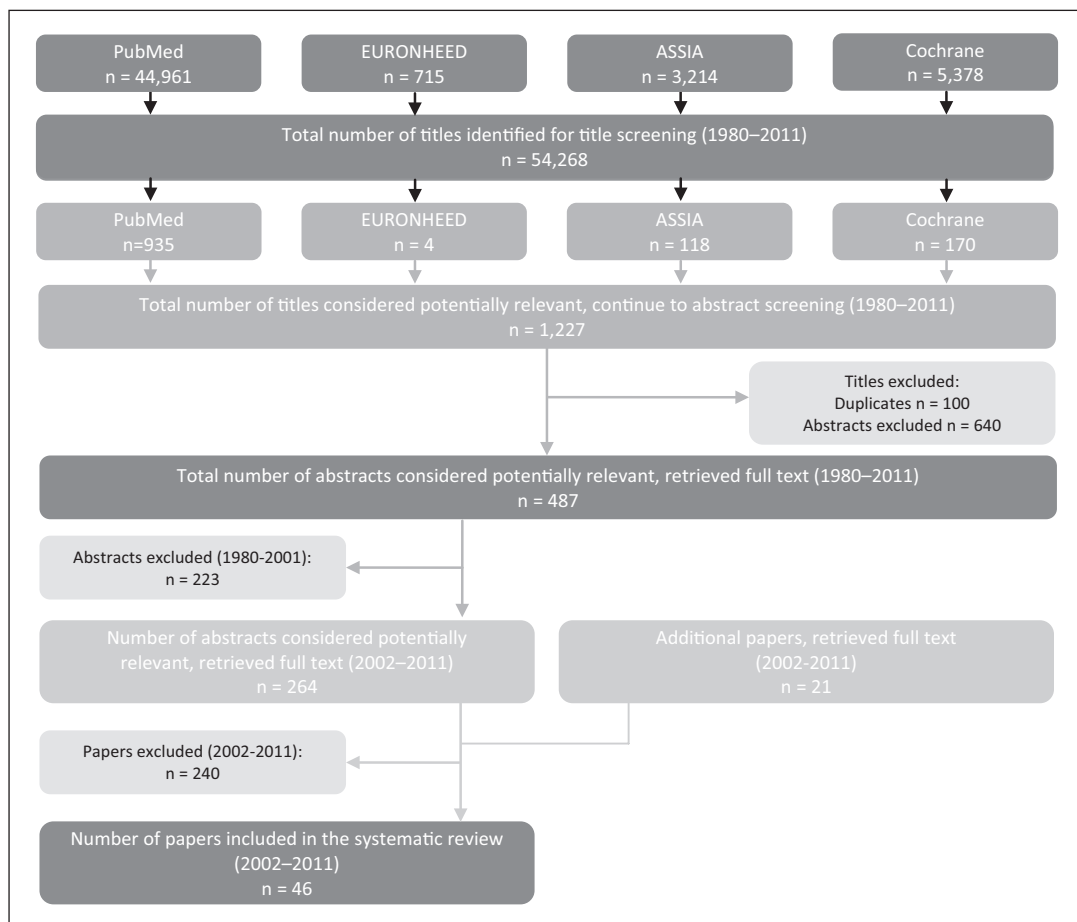
Figure 1. Flow Diagram of Study Selection Process[1]
Additional papers include papers added from ongoing search alerts (PubMed) and references from retrieved papers.

Table 2. Literature review paper characteristics (n = 46).[a]

Study	Country	Study type	Prognosis	No. of patients		Control	Cost/utilisation	Key results
				Intervention				
Bakitas et al.[19]	United States	Randomised controlled trial	Approximately 1 year	161 palliative care		161 usual care	Utilisation	No differences between PC and control group in number of days in hospital (p = 0.14), number of days in ICU (p > 0.99) or number of ED visits (p = 0.53)
Back et al.[57]	United States	Cohort study	≤3 months	82 hospital palliative care case management		183 usual hospital-based care	Utilisation	PC patients enrolled >113 days less likely than control to have acute care care admission in last 60 days of life: OR = 0.306, 95% CI = 0.117–0.802 ALOS per acute care admission sig. shorter for PC patients relative to control (p < 0.05) Results on number of acute care days <60 days of life depended on the length of PC enrolment
Bendaly et al.[28]	United States	Cohort study	—	61 hospital-based palliative care		55 usual hospital-based care	Cost and utilisation	PC consultation associated with sig. lower hospital charges relative to control (p < 0.001) No sig. difference in ALOS during final hospital admission between PC and control (p = 0.65)
Brumley et al.[20]	United States	Non-randomised controlled study	≤1 year (Intervention); ≤2 years (Control)	161 home-based palliative care		139 usual (Medicare guideline) home care	Cost and utilisation	Mean cost of care for PC group US$6580 (1999 prices) lower than for control (p values not reported) Sig. lower use of ED, acute inpatient services in PC relative to control group (p < 0.001) Lower use of physician office visits (p < 0.001) and skilled nursing services (p = 0.005) for PC versus control PC group had sig. more home visits relative to control (p < 0.001)
Brumley et al.[18]	United States	Randomised controlled trial	—	145 in-home palliative care		152 usual home care	Cost and utilisation	Total costs US$7552 (2002 prices) lower for PC group over study period: 95% CI = −US$12,730 to −US$2374, t = −3.63, p < 0.001 Average cost of care per day US$95.30 for PC group compared with US$212.80 for the control: t = −2.417, p = 0.02 Sig. lower levels of use of ED (p = 0.01), acute inpatient services (p < 0.001) by the PC group relative to control
Campbell et al.[31]	United States	Cohort study	≤1 year	44,165 Medicare hospice enrolees		201,199 usual Medicare	Cost	Mean Medicare expenditures in LYOL lower/not sig. different for hospice enrolees relative to non-hospice controls Except for patients aged >85 years where expenditures were sig. higher for hospice group: p < 0.05 Non-cancer patients: mean Medicare expenditures in LYOL sig. higher for hospice enrolees relative to non-hospice controls: p < 0.05
Cassel et al.[48]	United States	Cohort study	—	91 palliative care (of which 15 used for comparison with control)		20 usual hospital-based care	Cost and utilisation	Hospital charges fell from US$1468 to US$1524 (2008 prices) per day prior to PC to US$1050–US$1180 per day following PC consultation Compared with a non-PC group with similar age and LOS in hospital, the latter patients did not experience the same decline in costs per day For PC patients who spent at least 1 night in ICU prior to PC consultation, the PC consultation appeared to facilitate a transfer to PC suite/other medical–surgical room

Table 2. (Continued)

Study	Country	Study type	Prognosis	No. of patients		Cost/ utilisation	Key results
				Intervention	Control		
Ciemins et al.[30]	United States	Cohort	–	282 palliative care (27 used for comparison with control)	128 usual care	Cost and utilisation	Mean daily costs fell by 33% following PC consultation ($p < 0.01$) Mean daily costs for patients following PC consultation were 14.5% lower than matched usual care cohort ($p < 0.01$) Mean total costs per admission were 19.2% lower for PC group compared with non-PC group ($p < 0.001$) No sig. difference in ALOS between PC and non-PC groups
Costantini et al.[58]	Italy	Cohort	≤6 months	189 palliative home-care team	378 usual care	Utilisation	The percentage of days spent in hospital was sig. lower for patients receiving care from Palliative Care Home Team (19%; 95% CI = 15–23) compared with usual care group (30.3%; 95% CI = 26–34)
Cowan[39]	United States	Cohort study	–	164 hospital inpatient palliative care	152 usual hospital-based care	Cost and utilisation	Mean daily charges for PC patients sig. lower than non-PC group: $p = 0.006$ Mean total charges per PC patient higher than for non-PC group (longer LOS for PC group)
Davis et al.[56]	United States	Other	–	–	–	Cost and utilisation	Average total charges in PC unit 9% higher than national average charge Laboratory and pharmacy charges 33% lower in PC unit relative to national average Longer LOS in PC unit relative to national average (8.7 vs 7.1 days)
Douglas et al.[59]	United Kingdom	Cohort	–	101 palliative day care	44 usual care	Utilisation	Indicative patterns: palliative day care substitutes for community care for patients who live >100 days after attendance Indicative patterns: patients attending palliative day care for >100 days have fewer home-care interventions, more access to specialist doctors relative to control group
Emanuel et al.[45]	United States	Cohort study	≤1 year	3754 hospice care – Massachusetts; 2860 hospice care – California	30,377 no hospice care – Massachusetts; 16,204 no hospice care – California	Cost	Medicare expenditures over the LYOL for cancer patients 13% 20% lower for hospice relative to non-hospice patients Patients with other diseases who used a hospice tended to have higher expenditures
Engelhardt et al.[16]	United States	Randomised controlled trial	–	93 participants in advanced illness care coordination and support programme (cost analysis)	76 usual care (cost analysis)	Cost	Total inpatient, outpatient and other costs were not sig. different for patients receiving advanced illness coordinated care programme (US$12,123) compared with usual care (US$16,295) at 6 months post enrolment, year not stated
Enguidanos et al.[23]	United States	Cohort study	≤1 year	159 home-based palliative care	139 usual care	Cost	Cancer patients enrolled in PC group spent US$5936 (1999 prices) less on average compared to usual care ($p = 0.001$) over LYOL

(Continued)

Table 2. (Continued)

Study	Country	Study type	Prognosis	No. of patients		Cost/utilisation	Key results
				Intervention	Control		
Fassbender et al.[46]	Canada	Cohort study	≤1 year	16,282 patients who died of cancer 1993–2000		Cost and utilisation	Total costs per patient over LYOL lower in 1999/2000 relative to 1993/1994. Referrals to any type of PC service increased over time. Proportion of individuals admitted to a hospital declined over the period from 95% to 83%. ALOS decreased at first and then increased after 1996/1997
Gade et al.[17]	United States	Randomised controlled trial	–	275 hospital-based palliative care	237 usual hospital-based care	Cost and utilisation	Total mean health costs per PC patient sig. lower relative to control: US$14,486 versus US$21,252, $p = 0.001$, year not stated. No sig. differences between the PC and control in LOS. No difference between the groups in the number of hospital readmissions. PC group had sig. fewer ICU stays on readmission relative to control: 12 versus 21, $p = 0.04$
Gomez-Batiste et al.[38]	Spain	Cohort study	≤6 weeks	100 patients in 2001	100 patients in 1992	Cost and utilisation	Total cost per PC patient in 2001 over the last 6 weeks of life €1963 compared with €5068 in 1992. Sig. fewer hospitalisations in 2001 relative to the historical period when PC services were in their infancy: 57.8% vs 72%, $p < 0.001$. Mean hospital stay per patient over the last 6 weeks of life sig. lower for PC patients in 2001 relative to 1992: 19.9 days vs 25.5 days, $p = 0.002$
Gozalo et al.[32]	United States	Cohort study	≤1 month	1308 Medicare hospice enrolees	4466 usual Medicare	Cost	Hospice enrolment sig. associated with lower Medicare and Medicaid expenditure in last month of life for short-stay nursing home, non-cancer patients ($p < 0.001$). Short-stay nursing home cancer patients: hospice enrolment had non-sig. downward effect on government expenditure. Long-stay nursing home, non-cancer hospice patients: higher expenditure relative to non-hospice residents (not sig. for patients with dementia). Long-stay nursing home cancer hospice residents: lower expenditure relative to non-hospice residents (not sig.)
Hanson et al.[42]	United States	Cohort study	–	104 hospital-based palliative care	1813 usual hospital-based care	Cost and utilisation	No sig. differences in total variable costs between PC patients and controls over entire hospital admission ($p = 0.78$). Average daily variable costs sig. lower for PC relative to control cases: US$897 vs US$1004, $p = 0.03$, 2004 prices. No sig. difference between PC and control groups in ALOS
Higginson et al.[14]	United Kingdom	Randomised controlled trial	–	25 fast track palliative care	21 later palliative care	Cost and utilisation	Total costs of care £1789 (2005 prices) lower for PC group over 12-week period: bootstrapped 95% CI = −£5224 to £1902

Table 2. (Continued)

Study	Country	Study type	Prognosis	No. of patients Intervention	No. of patients Control	Cost/ utilisation	Key results
							Excluding acute inpatient and informal care, mean service costs £1195 lower for PC group: bootstrapped 95% CI = −£2916 to £178 Control group more likely to be in contact with GPs, receive help from family/friends, admitted or seen in hospital relative to PC group Cost-effectiveness: point estimates indicate that the intervention is cost-saving with equivalent outcomes on the POS-8 scale and improved outcomes on the ZBI
Lewin et al.[35]	United States	Cohort	≤2 month	17 hospice care	67 usual care	Cost and utilisation	Mean total cost per hospice patient over last 60 days of life sig. lower for hospice group (US$15,164) compared with non-hospice group (US$59,319, $p = 0.0001$), year not stated Mean total cost per day US$333 in hospice group compared with US$969 for non-hospice group ($p = 0.0011$) ALOS in hospital over last 60 days of life sig. lower for hospice group (3.6 days) than for non-hospice group (11.2 days, $p = 0.005$) No sig. differences in outpatient visits ($p = 0.513$)
Lo[22]	Taiwan	Cohort study	≤1 week	912 hospital-based hospice; 353 home-care hospice	25,544 conventional care	Cost	Hospice has a negative impact on total expenditure in the last week of life relative to conventional care ($p < 0.01$) Home-based hospice expenditures not sig. different from hospital-based expenditures
Miccinesi et al.[33]	Italy	Cohort study	≤3 months	299 home-based palliative care	2564 no home-based palliative care	Cost and utilisation	Average acute inpatient costs in last 3 months of life €2388 (€year not stated) for PC group compared with €3336 for control ($p < 0.001$) No sig. differences in the average day hospital costs across the two groups ($p = 0.934$) PC associated with reduction in relative risk of having inpatient admission during the last 3 months of life: relative risk 0.75, 95% CI = 0.66–0.86 PC associated with reduction in relative risk of proportion of days spent in hospital: relative risk 0.51, 95% CI = 0.48–0.53
Miller et al.[40,b]	United States	Cohort study	–	1308 nursing home hospice	4466 nursing home non-hospice	Cost and utilisation	Mean total Medicare and Medicaid expenditures in last month of life sig. lower for hospice relative to non-hospice residents ($p < 0.001$). Similar pattern observed for short-stay nursing home residents. Long-stay nursing home residents: no sig. differences found Different patterns observed for mean total government expenditures in last 6 months of life: sig. higher for hospice vs non-hospice residents ($p < 0.01$) but with differences according to nursing home LOS. For short-stay nursing home residents, expenditures sig. lower for hospice users ($p < 0.01$), while opposite was found for long-stay nursing home residents ($p < 0.01$)

(Continued)

Table 2. (Continued)

Study	Country	Study type	Prognosis	No. of patients		Cost/ utilisation	Key results
				Intervention	Control		
Morrison et al.[27]	United States	Cohort study	–	2630 hospital-based palliative care	18,427 usual hospital-based care	Cost	Direct costs for PC group on average US$1696 (2004 prices) lower per admission relative to control group (p = 0.004, or US$174 lower per day, p < 0.001) For decedents, PC consultation associated with mean savings of US$4908 in direct costs per admission relative to control group (p = 0.003, or savings of US$374 per day, p < 0.001)
Morrison, Dietrich[37]	United States	Cohort study	–	290 hospital-based palliative care (discharged alive); 185 hospital-based palliative care (died)	1427 usual hospital-based care (discharged alive); 149 usual hospital-based care (died)	Cost and utilisation	PC patients discharged alive had adjusted average total Medicaid expenditures of US$32,643 (2007 prices) compared with US$36,741 for control group (p < 0.05) For average total daily costs, PC costs US$490 lower per day over entire admission relative to control group (p < 0.0001) No sig. difference between the PC and control groups in ALOS
O'Mahony et al.[52]	United States	Before-and-after study	–	77 hospital-based palliative care	77 pre-intervention usual care	Cost and utilisation	Focus on results from comparison for patients in 90-day period prior to and post PC intervention: Sig. reductions in charges for ancillary tests and ventilator-related charges for PC patients (p < 0.0001) No sig. reductions in utilisation of ED following PC consultation (20.8%–9.1%, p = 0.43) or in hospitalisation rates (42.9%–35.1%, p = 0.06)
Pascuet et al.[55]	Canada	Before-and-after study	–	66 hospice-based paediatric respite care	–	Cost and utilisation	Median LOS for hospice patients sig. reduced (p < 0.05) Mean monthly hospital inpatient days fell by 2.9 days in the period after patients' first respite visit (95% CI = −4.5 to −1.3, p = 0.001) Mean monthly hospital outpatient days fell by 0.5 (95% CI = −1.0 to −0.05, p = 0.029) Mean decrease in monthly cost of inpatient care of US$4252 (2007 prices) (95% CI = US$953–US$7551, p = 0.12)
Penrod et al.[24]	United States	Cohort study	–	82 hospital-based palliative care	232 usual hospital-based care	Cost and utilisation	Total inpatient direct costs per day for terminal hospitalisation were US$239 (year not stated) lower for PC relative to control group: 95% CI = US$387–US$122 PC patients sig. less likely to be admitted to ICU during hospitalisation relative to control group
Penrod et al.[29]	United States	Cohort study	–	606 hospital-based palliative care	2715 usual hospital-based care	Cost and utilisation	Daily hospital costs sig. lower for PC patients relative to control Daily hospital direct costs US$464 lower for PC group relative to control: 95% CI = US$515–US$413, year not stated PC patients sig. less likely to be admitted to ICU during hospitalisation relative to control group

Table 2. (Continued)

Study	Country	Study type	Prognosis	No. of patients		Cost/ utilisation	Key results
				Intervention	Control		
Pyenson et al.[41]	United States	Cohort study	—	1843 Medicare hospice enrolees	2199 usual Medicare	Cost	Mean Medicare expenditure per patient during terminal phase of care sig. lower for hospice enrolees diagnosed with congestive heart failure, liver cancer and pancreatic cancer ($p < 0.05$). Not sig. in the case of prostate cancer and stroke (sig. higher for stroke, $p < 0.05$)
Rabow et al.[21]	United States	Non-randomised controlled study	—	50 outpatient palliative care	40 usual primary care	Cost and utilisation	Mean charge for PC patients US$47,211 (year not stated) compared with US$43,338 for control group ($p = 0.8$). PC group sig. fewer visits to primary care physician ($p = 0.03$), fewer urgent care clinic visits ($p = 0.03$). No sig. differences in specialty clinic visits ($p = 0.25$), ED visits ($p = 0.81$), acute inpatient care
Raphael et al.[53]	France	Case series	—	33 home-based palliative care	34 home-based chemotherapy; 15 home-based other treatment	Cost	Average cost per PC patient at hospital-at-home over 2-week observation period was €1201.7 (2001 €s) compared with estimated cost of inpatient hospital care of €3489.7 ($p < 0.0001$)
Seow et al.[54]	Canada	Case series	—	—	—	Utilisation	Patients admitted to home care earlier than 4 weeks before death sig. less likely to be hospitalised, visit an ED or die in hospital
Shnoor et al.[26]	Israel	Cohort study	≤2 months	73 home hospice care	73 usual care	Cost	Cost of care in intervention group sig. lower than in the control group: $p < 0.01$
Simoens et al.[43]	Belgium	Cohort study	≤1 month	88 hospital-based palliative care	53 usual hospital-based care	Cost	Mean costs per patient per day sig. higher for PC group relative to control group ($p = 0.002$). In an acute ward, mean costs per patient per day were sig. lower for PC patients relative to control ($p = 0.025$)
Smith et al.[34]	United States	Cohort study	—	38 died in hospital palliative care unit	38 died in hospital usual care	Cost	Total hospitalisation costs sig. lower for PC group relative to control for terminal hospitalisation: US$2538 ± US$2918 for control versus US$1095 ± US$1153, $p = 0.0009$, 2000 prices
Stevenson et al.[50]	United States	Cohort study	—	5622 home hospice	1665 institution hospice	Utilisation	Institutional hospice users sig. more likely to receive physician services (OR = 2.55, 95% CI = 1.68–3.87), prescription medicines (OR = 1.6, 95% CI = 1.16–2.2) and others. Average length of enrolment sig. shorter for institutional hospice users than for home hospice users ($p < 0.001$)
Tamir et al.[36]	Israel	Cohort study	≤1 year	120 home-specialised palliative care services	515 home non-specialised palliative care services	Cost	Mean health services cost per person in PC group over LYOL 31% lower than in control group ($p < 0.005$)

(Continued)

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Table 2. (Continued)

Study	Country	Study type	Prognosis	No. of patients		Cost/ utilisation	Key results
				Intervention	Control		
Taylor et al.[25]	United States	Cohort study	≤1 year	1819 Medicare hospice enrolees	3638 usual Medicare	Cost	Hospice use reduced Medicare expenditures by an average of US$2309 (2003 prices) in the time between initiation of hospice care and death relative to the same period for the matched control group (p < 0.001)
Taylor[15]	United States	Cohort study	≤1 year	1819 Medicare hospice enrolees	3638 usual Medicare	Cost	No sig. differences observed between hospice and non-hospice patients in out-of-pocket expenses over study period. Family members of decedents who used hospice before death had sig. higher informal care costs relative to control group. In last 30 days of life, informal care costs for hospice group were US$540 (2001 prices) compared to US$255 for control group (p = 0.01)
Tibi-Levy et al.[51]	France	Cohort study	–	60 rehabilitation palliative care units	59 acute palliative care units	Cost and utilisation	Cost per patient per day sig. lower in hospitals focused on extended care and rehabilitation (p < 0.05). No sig. difference observed in ALOS in hospital for PC patients across the two different types of hospital
Tzala et al.[44,b]	Greece	Cohort study	–	27 home-based palliative care for haematological cancer patients who required monitoring and regular blood transfusions	25 hospital-based usual care	Cost and utilisation	Average cost per patient in home-care scheme was €958.05 (€/year not stated) compared to €436.34 for conventional hospital care. Incremental cost difference: €521.69, 95% CI = €515.8–€527.41. Sig. greater number of blood tests performed under home-care scheme (p < 0.001)
Ward-Smith et al.[49]	United States	Cohort study	≤6 months	9 hospital-based palliative care	9 usual hospital-based care	Cost and utilisation	Total hospital costs for PC patients over last 6 months of life: US$33,283–US$783,953, mean US$231,900 (year not stated). Hospital charges for control group: US$28,970–US$803,657, mean US$228,199. For children who underwent surgery in the last 6 months of life, PC patients had same mean LOS as control group
White et al.[47]	United States	Cohort study	≤20 days	1774 hospital-based palliative care	520 non-PC	Cost	Average direct cost per day in PC unit lower relative to costs in ICU and all other units in the hospital. Subset of patients treated on another unit and transferred to PC unit: average direct costs decreased for all patients when transferred to PC unit

PC: palliative care (non-specific use in this table to refer to the intervention being studied); ALOS: average length of stay; ED: emergency department; LYOL: last year of life; CI: confidence interval; LOS: length of stay; ICU: intensive care unit; sig.: significant (refers to statistical significance).
aSome of the studies undertake additional analysis that is outside the focus of the central research question for the review. The results presented and discussed in sections 'Results for literature review (2002–2011)' and 'Conclusion' focus only on the analysis relevant to this review.
bFocus on cost results only.

The papers were also categorised according to whether they focused on costs, utilisation or both. Most of the studies focus on costs either with or without separate analysis of health-care utilisation. Of the five RCTs, 3 are 'both cost and utilisation studies', 1 is 'cost only' and 1 is 'utilisation only'. The non-randomised controlled studies are all 'both cost and utilisation papers'. The cohort studies comprise 15 'cost' studies, 15 'both cost and utilisation' studies and 4 'utilisation only' studies. The before-and-after studies and one other study are 'both cost and utilisation' papers. Of the two case series papers, 1 is 'cost only' and 1 is 'utilisation only'. Just one out of the 46 studies reports cost-effectiveness analysis,[14] illustrating the scarcity of this type of analysis in the palliative care field. Almost all of the cost studies focus on directly observable costs. Informal care costs are included in two studies,[14,15] and out-of-pocket costs are the focus of one study,[15] although in some cases it is not clear whether out-of-pocket copayments have been included. As noted in other reviews,[7] there is variation in the cost data used with some studies relying on charges, others on observed expenditures and the remaining on detailed bottom-up estimates based on actual resource use.

In all, 31 of the papers are based on data from the United States and this is important when considering the generalisability of the findings to other health-care systems. The remaining studies are based on data from Belgium (1), Canada (2), France (2), Greece (1), Israel (2), Italy (2), Spain (1), Taiwan (1) and the United Kingdom (2).

Study quality

Figure 2 gives a graphical summary of the quality score results. The RCTs and non-RCTs perform well for all indicators with the exception of 'reporting' where there is some variation. The quality of the cohort studies (*n* = 34) varies across the indicators. Most perform well on study description, measurement and conclusions, but results are mixed for sample selection and size, reporting and analysis. The case studies perform well for all indicators. The quality score results for the remaining studies were mixed.

It is useful to discuss the findings of the papers in some order of priority based on the quality assessment. Notwithstanding the caveats in generating summary quality scores for papers, there is scope for combining information on the scores with other factors to generate broad quality rankings. This review assigns papers into groups based on a joint assessment of the total quality scores and the type of analysis undertaken in each study.

RCTs are typically considered to be the gold standard for evaluating the effects of an intervention. An appropriately designed and implemented RCT allocates participants to the intervention and control groups using randomisation and concealment, which should ensure that the groups being compared are 'similar in all respects other than the intervention' (p. 34).[9] RCTs are typically assessed for risk

of bias along key dimensions including sequence generation, allocation concealment, blinding (of participants and outcome assessors), outcome data, outcome reporting and other sources of bias.[8] Based on a brief assessment, the five RCTs[14,16–19] perform relatively well along these dimensions although there is some lack of clarity in terms of blinding and allocation concealment. As noted, these studies perform well on the quality criteria compiled for this review and rank among papers of highest quality.

In non-RCTs, participants are allocated to the intervention and control groups using methods other than randomisation.[9] This increases the risk of selection bias, whereby individuals can be deliberately selected (or self-select) to the intervention or control group meaning that the results of the trial may be influenced by systematic differences between the study groups in terms of participant behaviours/prognosis. The two non-RCTs performed well against the quality criteria for this review.[20,21] The first of these studies controlled for variations in individual characteristics across the groups using appropriate multivariate statistical techniques.[20] In the second study, although patients were not individually randomised to the intervention group, there was some randomisation at a higher level (i.e. two general medical practices operating alongside each other and a coin flip determined, which would form the intervention group and form the control).[21]

Grouping the cohort studies according to whether multivariate[i] or univariate[ii] analysis was undertaken, the average total quality score is higher for the group of multivariate analysis studies (0.82 versus 0.68). Subdividing the 'univariate' group into studies that undertook formal statistical analysis and those that did not (e.g. no *t*-tests, chi-square tests and so on), there are differences in the average total quality score (0.70 versus 0.63). The variation in average quality among these three groups is even more distinct in terms of the average scores on the analytic dimension of quality: 0.85 for multivariate studies, 0.64 for univariate studies with formal statistical tests and 0.11 for studies with no formal statistical analysis.

Study findings on costs

In two out of six RCTs/non-RCTs that include cost data, the costs of the palliative care intervention were significantly

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i   Multivariate analysis involves analysing the impact of a particular variable on an outcome of interest, while taking into account (i.e. controlling for) the effects of all other variables that may influence the outcome of interest (e.g. regression analysis).

ii Univariate analysis examines the association between a particular variable and an outcome of interest, without controlling for any other factors that may influence the outcome of interest. The association can be tested for statistical significance using a range of statistical tests (e.g. t-tests, chi-square tests) depending on the type of variables involved (continuous, categorical).
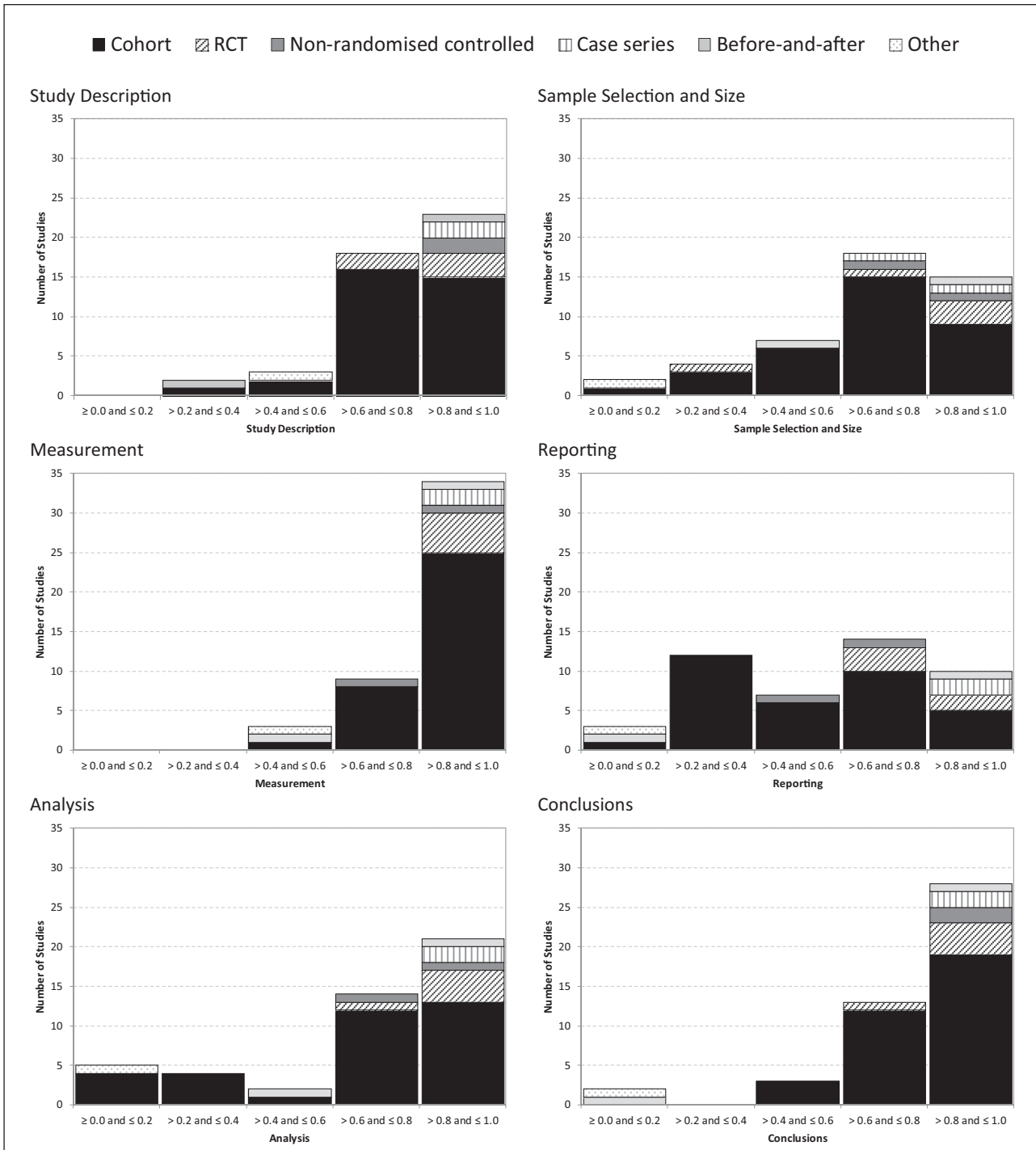
Figure 2. Study quality (*n* = 46).

lower than the costs for the control group.[17,18] In three further studies, the costs were lower for the palliative care intervention although not significantly different,[14,16] or no report of statistical significance.[20] In the remaining studies, costs were higher, but not significantly different, in the intervention group relative to the control group.[21] Throughout this review, the term 'significant' refers to

statistical significance and the level of statistical significance (i.e. *p* value) is indicated where available.

Four of the RCTs included data on costs. One US study focused on a hospital-based palliative care programme.[17] Costs were computed for all health services used within 6 months following index hospitalisation discharge (e.g. hospital outpatient, home health visits, hospital readmissions

and skilled nursing facility admissions). Univariate analysis found that total mean health costs per patient for the palliative care intervention group were significantly lower than the usual care control group (US$14,486 versus US$21,252, $p = 0.001$, year not stated although data were collected between 2002 and 2003). Cost savings were largely driven by a significant difference in hospital readmission costs (US$6421 per palliative care patient versus US$13,275 per usual care patient, $p = 0.009$). A second US study focused on an in-home palliative care programme and observed significantly lower costs for the palliative care group relative to the usual care control group.[18] Costs included acute inpatient, ambulatory, home health and palliative care costs. Total costs were on average US$7552 (at 2002 prices) lower for the in-home palliative care group over the study period (95% confidence interval (CI) = −US$12,730 to −US$2374, $t = −3.63$, $p < 0.001$), even after adjusting for a shorter survival period (i.e. from study enrolment to death) for the intervention group (196 days vs 242 days for the control group). The average cost of care per day was US$95.30 for the intervention group compared to US$212.80 for the control group, a significant difference ($t = −2.417$, $p = 0.02$).

The third RCT is a UK cost-effectiveness study of a new palliative care service for people with multiple sclerosis. The study found that total costs of care, including acute inpatient, ambulatory, other social/community care and informal care costs were £1789 (2005 prices) lower for the palliative care intervention group over a 12-week follow-up period (bootstrapped 95% CI = −£5224 to £1902). Excluding acute inpatient and informal care, mean service costs were £1195 lower for the intervention group (bootstrapped 95% CI = −£2916 to £178).[14]

The fourth RCT is a US-based study of an advanced illness coordinated care programme designed to improve the care of people with serious illness to help them cope with advanced illness and with making end-of-life decisions. The study examined inpatient, outpatient, nursing home, inpatient hospice and other costs (e.g. diagnostic services) for participants and non-participants from 6 months prior to enrolment in the programme to 6 months post enrolment. Results found that total costs of care were lower for patients participating in the programme (US$12,123 per patient, year not stated, paper published in 2006) than for non-participants (US$16,295 per patient) at 6 months post enrolment. This difference in costs was not statistically significant ($p = 0.18$).[16]

Two US studies undertook non-RCTs of palliative care.[20,21] One focused on comparing an outpatient palliative medicine consultation intervention with usual primary care. Costs included physician office visits, emergency department visits and acute inpatient care. Results found that the mean charge for the palliative care patients over the study period was US$47,211 (year not stated, paper accepted for publication in 2003) compared

with US$43,338 for the control group, and this difference was not statistically significant ($p = 0.8$).[21] The second study focused on a home-based palliative care programme, comparing this with standard home health services. Costs analysed referred to staffing costs only. Results found that the mean cost of care for the palliative care group was US$6580 (1999 prices) lower than the mean cost for the control group, after controlling for variation in the number of days receiving the service, severity of illness and having a congestive heart failure diagnosis (p values not reported).[20]

In the cohort studies that undertook multivariate analysis of costs, 9 out of 11 studies found evidence of significantly lower costs in the palliative care intervention relative to the control group.[22–30] The remaining two studies, both based in the United States, identified a more complex picture when disaggregating by age, cancer and length of nursing home enrolment.[31,32]

Five studies analysed the impact of hospice care on health-care expenditure. Three of these were US studies that investigated the impact of hospice care on Medicare (and in one case Medicaid also) expenditure during the last year of life. One study[25] used propensity score matching to control for variation in demographic and clinical characteristics of individuals across the hospice and non-hospice control groups. Results showed that hospice use reduced Medicare expenditures by an average of US$2309 (2003 prices) in the time period between initiation of hospice care and death relative to the same period for the matched control group ($p < 0.001$). The impact of hospice use on government expenditures was found by the other two studies to vary according to age, patient diagnosis and/or nursing home status.[31,32] One study based in Taiwan[22] also undertook multivariate regression analysis, controlling for self-selection, demographic and clinical factors, examining the impact of hospital-based and home-based hospice on health-care expenditures per patient in the week before death. Results indicate that hospice has a negative impact on total expenditure in the last week of life relative to conventional care ($p < 0.01$), controlling for other factors. A study in Israel focused on the impact of home hospice on health-care expenditures in the last 2 months of life relative to conventional care.[26] Multivariate regression analysis found that controlling for gender, age and the number of treatment items per patient, the cost of care in the intervention group was significantly lower than in the control group ($p < 0.01$).

Five US studies examined the impact of hospital-based palliative care on health-care expenditure.[24,27–30] Results were consistent across these studies, each finding palliative care to be associated with significantly lower inpatient costs. Three of these studies used propensity score matching to control for variation in demographic and clinical characteristics of individuals across the palliative care intervention and usual care groups.[24,27,29] For example, in one study, for patients discharged alive from hospital, direct

costs for the palliative care group were on average US$1696 (2004 prices) lower per admission relative to the control group ($p = 0.004$, or US$174 lower per day, $p < 0.001$). For patients who died in hospital, palliative care consultation was associated with mean savings of US$4908 in direct costs per admission relative to the control group ($p = 0.003$, or savings of US$374 per day, $p < 0.001$).[27]

One US study undertook multivariate analysis of the impact of a palliative care home-based programme on staff costs relative to usual home health care.[23] Results showed that cancer patients enrolled in the palliative care group spent US$5936 (1999 prices) less on average compared to those in usual care ($p = 0.001$) over the last year of life, controlling for severity of illness and the number of days on service.

In the cohort studies that undertook univariate statistical analysis, 5 out of 13 studies found evidence of significantly lower costs in the palliative care intervention group compared with the control group,[33–37] and a sixth study found evidence of lower costs without reporting statistical significance.[38] Five others found some evidence for significantly lower costs in the palliative care intervention group, but not consistently so, and variations were observed over a number of different factors including diagnosis, nursing home length of stay, daily cost versus total admission cost, type of ward on which palliative care was provided and time period studied.[39–43] One study found evidence of significantly higher costs in a home-care scheme relative to conventional hospital care, although these results require careful interpretation because of the additional number of blood tests intentionally provided under the home-care scheme.[44] One study focusing on out-of-pocket expenses found no significant differences between the intervention and control groups, while finding informal care costs significantly higher in the intervention group,[15] underlining the importance of paying more attention to the indirect cost in palliative care.

The five cohort studies that did not undertake formal statistical analysis observed patterns of lower expenditures related to palliative care[45–48] or no difference in costs between palliative care and non-palliative-care patients.[49]

Three cohort studies compared palliative care costs across different types of palliative care.[22,50,51] A study based in Taiwan observed no significant differences between home-based and hospital-based hospice expenditures per patient in the week before death, controlling for other factors.[22] One US study examined utilisation differences in hospice care between the institutional and home setting.[50] Multivariate analysis of utilisation over a 30-day period, adjusting for patient characteristics and length of enrolment, found institutional hospice users were significantly more likely to receive several types of services including physician services (odds ratio (OR) = 2.55, 95% CI = 1.68–3.87), prescription medicines (OR = 1.6, 95% CI = 1.16–2.2) and others. Average length of enrolment was significantly shorter for institutional hospice users than for home hospice users ($p < 0.001$). A study based in France examined variations in hospital-based palliative care costs across different types of hospitals (hospitals providing medical, surgical and obstetric care versus hospitals offering extended care and rehabilitation).[51] Univariate analysis found that the cost per patient per day was significantly lower in the hospitals focused on extended care and rehabilitation ($p < 0.05$), driven by differences in personnel and medications costs.

Case studies, before-and-after, other studies

Of the five studies that investigated the impact of palliative care on health-care costs using alternative methods to including a formal comparison group, four found evidence of significantly lower costs related to the palliative care intervention.[52–55] The fifth found evidence of higher charges for palliative care relative to a national average charge.[56] For example, one of the case studies, based in France, compared the cost of hospital at home services with the estimated cost of treating the same patients in a standard hospital setting.[53] Univariate analysis found that for patients considered to be at the palliative care stage, the average cost per patient of hospital-at-home over a 2-week observation period was €1202 (2001 prices) compared with the estimated cost of inpatient hospital care of €3490, a significant difference ($p < 0.0001$).

Study findings on health-care utilisation

In general, the impact of palliative care on resource utilisation is mixed as illustrated by one of the highest quality ranking cohort studies, which focused solely on the use of services (i.e. no cost data[57]). This US study used multivariate analysis to compare resource use by cancer decedents who received hospital-based palliative care with those who received usual care. Results indicated that patients in the palliative care group who were enrolled for longer than 113 days were less likely than the control group to have an acute care admission during the last 60 days of life (OR = 0.306, 95% CI = 0.117–0.802). The average length of stay per acute care admission was significantly shorter for palliative care patients relative to the control group ($p < 0.05$). Results on the total number of acute care days within the last 60 days of life depended on the length of palliative care enrolment. Palliative care patients who were enrolled in palliative care for less than 60 days were more likely to have a greater number of total acute care bed days relative to the control group ($p < 0.05$). Palliative care patients who were enrolled for more than 60 days were more likely to have a smaller number of total acute care bed days relative to the control group ($p < 0.05$).

The mixed results apply to all of the study categories included in the review. Of the six RCTs/non-RCTs with utilisation data, three studies found evidence of lower use of some hospital services,[17,18,20] while three found no significant differences in others.[17,19,21] Of the cohort studies that report specific results on health-care utilisation, the same mixed pattern is observed,[24,28–30,33,35,37–39,42,44,46,48,49,58,59] while detailed analysis by two studies[33,57] illustrate the

varied impacts of palliative care on utilisation (e.g. depending on time period studied, length of enrolment).

Study findings on cost-effectiveness

Only one of the studies met the criteria for a cost-effectiveness study.[14] Patient outcomes were measured on the Palliative Care Outcome Scale (POS-8)[iii] and caregivers' burden was measured using the Zarit Carer Burden Inventory (ZBI). There was no significant difference in the POS-8 measure over the trial, while ZBI scores improved for the intervention group and worsened for the control group. The point estimates indicate that the intervention is cost-saving with equivalent outcomes on the POS-8 scale and improved outcomes on the ZBI. Sensitivity analysis examined uncertainty around those point estimates. For the POS-8 measure, the cost-effectiveness plane shows the intervention group had lower costs and better outcomes than the control group 33.8% of the time, and lower costs and worse outcomes 54.9% of the time. When the cost-effectiveness analysis is based on the ZBI measure, the intervention group shows lower costs and better outcomes 47.3% of the time, and higher costs and better outcomes 48% of the time.

Conclusion

Overall, the review presents an up-to-date picture of the most recent analysis being undertaken on the cost (and resource use) implications of palliative care interventions over the period 2002–2011. The main focus of these studies is on direct costs, from the provider or third-party payer perspective, with little focus on informal care or out-of-pocket costs. While a small number of studies follow an RCT or non-RCT format, the majority of studies are described as cohort studies and therefore need measures to control for confounding factors and selection bias in the analysis. The overall quality of the studies is mixed, although a number of cohort studies do undertake multivariate regression analysis and include measures to control for selection bias.

The evaluation criteria, combined with information on the type of statistical analysis undertaken, have provided a useful overview of the overall quality of the papers. The absence of randomisation in most of the studies highlights the importance of controlling for confounding factors and selection bias when analysing the impact of a palliative care intervention on the outcome of interest. A number of the cohort studies have undertaken multivariate regression analysis, and many of these have also used propensity score matching techniques to control for selection into the intervention and control groups. In general, the RCT papers, the non-RCTs and the cohort and case studies that undertook multivariate analysis are at the higher end of the quality scale.

In terms of generalisability, a couple of points should be considered. The models of care and reimbursement for palliative care pursued across different countries can vary widely, which is particularly relevant here as a large proportion of the 46 studies examined here are based on United States. In addition, while the included studies focus on both malignant and non-malignant conditions, it is recognised that conditions may follow different trajectories.

However, despite the wide variation in study type, characteristic and study quality, there are consistent patterns in the results. Palliative care is most frequently found to be less costly relative to comparator groups, and in most cases, the difference in cost is statistically significant. It is also worth noting that there may be complex interactions between costs of care and diagnosis (e.g. cancer/non-cancer distinctions), age groups and other factors (e.g. length of nursing home enrolment in US studies) that require further investigation and in particular the role played by informal care needs to be analysed in more detail.

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