

Economic Evaluation of the Palliative Care Home Support Packages Program

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Abstract

Background: Economic evidence in palliative care is important for making decisions regarding allocation of resources and support patient preferences for end-of-life (EOL) care. However, there is limited evidence on the cost-effectiveness of palliative and EOL models of care to inform healthcare funding decisions. **Aim:** To evaluate the cost-effectiveness of providing Palliative Care Extended Packages at Home (PEACH) in addition to usual care to support clients in their wish to be cared for, and die at home. **Design:** A modelled cost-effectiveness analysis was conducted from a healthcare provider perspective to estimate the incremental costs, effects and cost effectiveness. **Setting/participants:** De-identified prospective and retrospective data on the resource use, cost and consequences of the PEACH Packages Program (n = 75) and usual care (n = 95) were collected from three participating local health districts (LHD) data information systems. **Results:** Mean costs per patient of providing PEACH (\$3493) in addition to usual care were offset by lower mean inpatient care (\$6392) and emergency department presentation costs (\$139). On average, patients receiving PEACH spent an additional four days at home in the last week of life and more died at home (95% vs 49%). If a daily PEACH cost is applied rather than a per package cost, additional savings of \$52,544 may be realised. Better prognostic tools could also result in further savings. **Conclusions:** PEACH is a cost-effective model of care when added to usual care for people in the last week of life as PEACH plus usual care is more effective and less costly than usual care alone.

Keywords

Cost-Effectiveness, Economic, Home Death, Palliative Care Extended Packages

at Home, Palliative Care, Usual Care

1. Introduction

Provided symptoms can be adequately controlled, up to 90% of people at the end-of-life (EOL) prefer to be cared for and, often, to die at home (Agar et al., 2008). However, inability to rapidly mobilise nursing and social services can cause delays in receiving homebased care (Thomas et al., 2010). Cost-effective models of care that overcome these barriers are required to support patient preferences for EOL care.

Palliative care focuses on the provision of care to a patient with advanced disease or illness for which further treatment is likely to be ineffective or unkind. A good death has been associated with a number of key elements, such as low patient suffering, shared decision-making and preparation for death, carer's emotional support and preparation for death of a loved one, as well as communication with providers about patient wishes, awareness of prognosis and therapeutic alliance (Lee et al., 2018; Meier et al., 2016; Wye et al., 2014; Aoun et al., 2013). Various factors are associated with preference for place of death such as treatment priorities, diagnosis, functional independence, quality of life (QoL) and living with someone (Higginson et al., 2017). Studies have shown that given a choice, most people would prefer to die in the comfort of their own home (Higginson et al., 2017; Foreman et al., 2006). In a South Australian study, 70% would have people preferred to die at home compared to 14% of home deaths between 2000 and 2002 (Foreman et al., 2006). As such, there is more incentive for palliative care services to respond to the needs of a population that wants to be able to choose how they want to spend their last says of life without compromising on quality.

Home-based palliative care programs have been developed overseas to address this need. One example is the Marie Curie Cancer Care programs in England and Scotland, delivered to local communities. This program comprises of nurse educators, coordination centres providing equipment, night staff and personal care staff, and out of hours advice and response line for carers, patients and professionals, and "discharge in reach" nurses identifying and facilitating patients wanting to die in the community (Purdy et al., 2015). Another model of care which uses a whole system approach is the Macmillan Specialist Care at Home service in England to improve Community-based palliative care provision. The programme was piloted and evaluated in Midhurst and later implemented in six further sites across England. Significant outcomes of the evaluation were improved choice in respect to place of death and enhanced psychosocial support, better co-ordination of palliative care through project management, a single referral point and multi-disciplinary teamwork including leadership from consultants in palliative medicine, the role of health care assistants in rapid referral and volunteer support (Johnston et al., 2018). This program has been successful

in achieving high carer satisfaction and fewer hospital admissions.

In Australia, there is no standard model for palliative home care. Government subsidised Commonwealth Home Support Programmes (CHSP) and Home Care Packages (HCP) exist to provide care and independent living support to clients in their home. Although they advertised within a context of dying at home, these are not specific for palliative care (Australian Government, n.d.). To address this gap, in 2012 the NSW Ministry of Health undertook a pilot study for the development of Palliative Care Home Support Packages to address the barriers to prevent clients from dying in their preferred place (Chow et al., 2021).

Despite the increasing imperative to demonstrate the value of palliative care's contribution to health as demands on health and social care systems rise, there is limited evidence on the cost-effectiveness of palliative and EOL models of care to inform healthcare funding decisions (García-Pérez et al., 2009; McCaffrey et al., 2015). Economic evaluations systematically compare the relative costs and benefits of competing options and thus provide information about how best to improve patient and family outcomes within funding constraints (McCaffrey et al., 2015). Costs and outcomes are jointly considered to evaluate how best to achieve value for money from scarce resources.

In 2010, a prospective cost-effective analysis of the Palliative Care Extended Packages at Home (PEACH) pilot randomised controlled trial (RCT) was conducted (McCaffrey et al., 2013). PEACH was an individualised, home-based EOL model of care designed to expedite discharge from hospital and enable patients to remain at home. Based on the results of this small pilot study (N = 32) most of the costs of the intensive, home-based care packages were offset by reduced in-patient stays, while days at home were increased. Overall, the findings suggested there was potential for such packages to be cost-effective but there was high uncertainty within the study due to the small sample size.

In December 2013, implementation of the refreshed PEACH Program began across five local health districts (LHDs) in New South Wales (NSW). The purpose of the updated PEACH "package" is to expedite discharge and enable people to remain at home while maintaining satisfactory symptom control and function through provision of intensive, rapid, flexible, individualised nurse-led care (Chow et al., 2021).

With limited health care resources available, societal decision makers need to consider costs as well as the health and quality of life outcomes associated with providing care when assessing the relative merits of funding alternative models of care. Consequently, information on the joint incremental impacts on costs as well as health outcomes of care along alternative treatment pathways is important to evaluate to allow evidence-based decision making. In light of the initial PEACH pilot cost-effectiveness analysis, a comprehensive economic evaluation of the PEACH Program is needed to compare the relative costs and benefits of this new end-of-life model of care with usual care, including consideration of secondary outcomes such as symptom control and functional status (McCaffrey et al., 2013).

- This study aims to evaluate the incremental resource use, costs and consequences of adding PEACH packages to usual care during the last week of life. This article is organised as follows:
- Background with literature review
- Methodology including study population and setting, model of care structure, data collection and statistical analysis
- Results discussing effects, resources and costs, incremental cost and effects, sensitivity analyses
- Discussion
- Conclusion

2. Methods

2.1. Study Population & Setting

This study was undertaken in three local health districts in New South Wales, South Western Sydney; Sydney; and Illawarra Shoalhaven. These sites were part of the funded project for the implementation of the PEACH program. Ethical approval was granted by the South Western Sydney Local Health District Human Research Ethics Committee (15/322 LNR) on 18 March 2017.

PEACH package: The individual care packages involve rapid response, where services are put into place within 24 hours and a higher intensity of hands-on nursing hours is provided compared with usual care (24 hour nursing for a maximum duration of seven days). The package also includes coordination of allied health input (occupational therapy, physiotherapy, pastoral care) should other services be required and telephone and/or video conference support, including a tablet device. All other care equipment is provided from local LHD loan pools as per usual care.

Usual Care: Usual care includes historical hospital-specific conventional discharge planning with existing available community services based on the intake criteria and waiting times. Patients had access to a 1300 after hours palliative care number, specialist palliative care community services, and equipment from loan pools. Allied health was accessed through existing community services.

Eligible for the study were patients in the last week of life in the terminal or deteriorating phase of illness with an Australia-modified Karnofsky Performance Scale (AKPS) (Abernethy et al., 2005) score ≤ 40 and a preference for home place of care (POC) &/or home place of death (POD) (Table 1). Patients received either a PEACH package plus usual care or usual care alone for seven days. Patients may die at home or during an inpatient admission (hospital, hospice or palliative care unit). Patients may be cared for at home or receive inpatient care during the seven day period. Further, symptom control and functioning levels may vary.

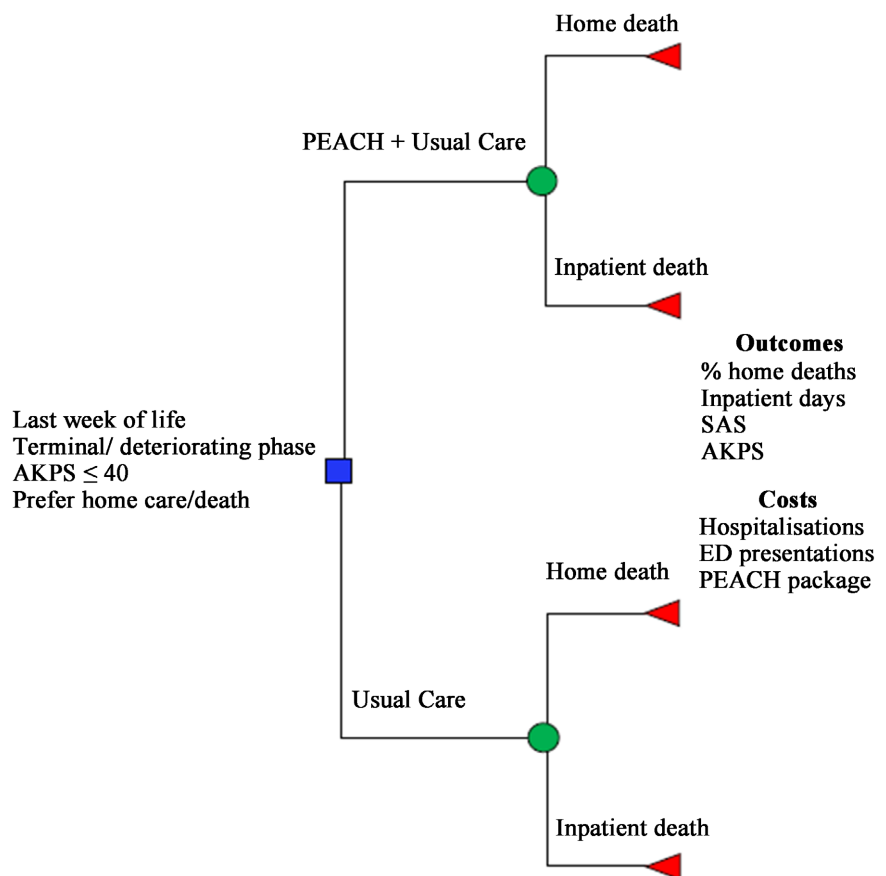
2.2. Model Structure and Inputs

A decision analytic model was developed to evaluate the cost-effectiveness of adding PEACH packages to usual care (Figure 1). The model was designed,

Table 1. Eligibility criteria for referral to the PEACH program.

An individual of any age may be eligible for a referral to the Program. Clients meeting the below criteria may then be considered into the program. Referrals are received through the Triple I (Hub).

- 1) Client is known to the LHD Palliative Care Service and is admitted to a LHD community based nursing service
- 2) Client is assessed by referrer utilising the following validated tools:
 - Phase Assessment
 - Resource Utilisation Groups – Activities of Daily Living (RUG_ADL)
 - The Australia-modified Karnofsky Performance Scale (AKPS)⁸
 - Symptom Assessment Scale (SAS)
 - Palliative Care Problem Severity Score (PCPSS)
 - Waterlow Pressure Ulcer Assessment Tool
- 3) The client must be in the terminal phase of their illness as defined by the clinical assessment with a predicted survival of 7 days or less, Palliative Phase 3 or 4 (deteriorating or terminal) and AKPS ≤ 40.
- 4) The client must, in the opinion of the referrer, be experiencing burdensome symptoms associated with the terminal illness that require increased level of support, increased care needs, and/or additional carer support to enable the client to remain at home; and
- 5) Client must have a carer residing with them
- 6) The client and/or their family have been consulted and are aware of diagnosis and referral.



AKPS = Australian Karnofsky Performance Status; ED = emergency department; SAS = symptom assessment scores.

Figure 1. Model structure.

developed and populated largely based on prospective and retrospective data collected on resource use, cost and consequences of the PEACH Packages. Program (intervention group) and usual care (control group) from the three LHDs' data information systems, clinical notes, the published literature and in accordance with clinical practice.

Table 2 summarises the key model inputs and sources used in the base case analysis. A list of the main assumptions used in the model is provided in **Table 3**.

2.3. Data Collection

PEACH: De-identified data were collected prospectively for a total of 79 consecutive clients who received a PEACH package from across the three LHDs between December 2015 and January 2016. This was the period when all three sites had successfully implemented the PEACH program. Longitudinal data were collected for seven days post-initiation of the PEACH package. The following clinico-demographic characteristics: age, gender, language spoken at home, carer status, relationship to care recipient, living arrangements and primary diagnosis, were also collected to inform external validity of the findings. Data for clients in the last week of life ($n = 39$), i.e. those who died within the seven day period, inform the model.

Usual care: De-identified data were collected from a retrospective audit of the clinical notes and LHD data information systems for a consecutive cohort of 95 people receiving palliative care services who died during July to December 2012, i.e. *before* the PEACH program was available to ensure no contamination bias. Data were extracted for the seven day period prior to death for an approximately equal sample of cases who died at home, in a hospice or palliative care unit and in hospital. Data for clients who had an identified carer ($n = 72$) inform the model to satisfy comparability conditions.

The proportion of people in the last week of life receiving usual care who died at home could not be estimated from the retrospective audit given the method used to identify the usual care cases. Consequently, the proportion is estimated from the literature. A search of the literature was conducted using the PubMed database and Google to identify published and grey literature reporting the proportion of home and inpatient deaths for patients receiving palliative care in Australia. Due to the paucity of information for the palliative care population the search was broadened to include the general population. Summary of the estimates and sources is available in **Table 4**. Conservatively, one of the highest estimates of the proportion of home deaths is used in the model (this approach favours usual care given a home death is considered a desirable outcome for this population). The impact of varying this parameter on the robustness of the cost-effectiveness results is explored in the univariate sensitivity analyses.

2.4. Resource Use & Costs

De-identified data on the number and length of inpatient stays and ED visits

Table 2. Model inputs and sources used in the base case analysis.

| Model input | Value | Data Source |
|--|-----------------------|--|
| PEACH* | | |
| Probability of a home death | 0.9487 | LHDs (Table 3) |
| Probability of an inpatient death | 0.0513 | LHDs (Table 3) |
| People who died at home | | |
| Length of inpatient stay (days), mean | 0 | LHDs (Table 3) |
| Average cost of an inpatient stay | \$0 | LHDs (Table 3) NHCDC Round 18 |
| Average cost of an ED visit | \$0 | LHDs (Table 3) NHCDC Round 18 |
| Proportion with an inpatient stay | 0% | LHDs (Table 3) |
| People who died in hospital | | |
| Length of inpatient stay (days), mean [#] | 5.97 | LHDs (Table 3) |
| Average cost of an inpatient stay [#] | \$9826 | LHDs (Table 3) NHCDC Round 18 |
| Average cost of an ED visit | \$0 | LHDs (Table 3) NHCDC Round 18 |
| Proportion with an inpatient stay | 100% | Assumption |
| Cost of a PEACH package (including administration) | \$3493 | PEACH Program, CIBU |
| Usual care* | | |
| Probability of a home death | 0.49 | AIHW Palliative Care Services in Australia 2014 ⁹ |
| Probability of an inpatient death | 0.51 | AIHW Palliative Care Services in Australia 2014 ⁹ |
| People who died at home | | |
| Length of inpatient stay (days), mean | 6.90 | LHDs (Table 3) |
| Average cost of an inpatient stay | \$12,689 [^] | NHCDC Round 18 |
| Proportion with an inpatient stay | 30% | LHDs (Table 3) |
| Proportion with an ED visit | 3% | LHDs (Table 3) |
| Average cost of an ED visit | \$557 | LHDs (Table 3) NHCDC Round 18 |
| People who died in hospital | | |
| Length of inpatient stay (days), mean | 5.97 | LHDs (Table 3) |
| Average cost of an inpatient stay | \$9826 | LHDs (Table 3) NHCDC Round 18 |
| Proportion with an inpatient stay | 100% | LHDs (Table 3) |
| Proportion with an ED visit | 28% | LHDs (Table 3) |
| Average cost of an ED visit | \$906 | LHDs (Table 3) NHCDC Round 18 |

*All values are calculated for the 7 day period prior to death; [#]Two of the PEACH cases did not have place of death recorded. These cases were conservatively assumed to have an inpatient death with an average length of stay and cost similar to usual care cases that had an inpatient death; [^] hospital coding data were unavailable for the inpatient episodes. Therefore, the average national cost per day for all admissions is applied; AIHW = Australian Institute of Health & Welfare; CIBU = Clinical Innovation and Business Unit, NSW; NHDC 2013-14 = National Hospital Cost Data Collection Australian Public Hospitals Cost Report 2013-14 Round 18; ED = Emergency Department.

Table 3. List of assumptions in the modelled analysis.

| Terms | Assumptions |
|---|--|
| <i>Community specialised palliative care services (SPCS)</i> | The provision of PEACH does not alter community SPCS resource use. |
| <i>Emergency visit presentations</i> | <ul style="list-style-type: none"> • If an ED presentation was recorded without a specific date then the visit was assumed to have occurred within the seven days prior to death. • ED presentations without complete coding data: assumed the lowest cost category based on the data that was provided. |
| <i>Hospital, hospice and palliative care unit inpatient stays</i> | <ul style="list-style-type: none"> • There are no ARDRG coding data for the inpatient stays for UC cases with a carer who died at home to enable costing of the inpatient days. Therefore applied the average national cost per day (2013-14 \$1839). • PEACH cases without place of death data are assumed to experience an inpatient death with an average inpatient stay similar in length and cost to usual care cases that have a carer and an inpatient stay and death. |
| <i>Usual care</i> | It is assumed that the people who die are in the terminal/deteriorating phase and have an AKPS score ≤ 40 and therefore have similar functional status and illness severity to PEACH Program participants. According to the recent National Report on Patient Outcomes in Palliative Care in Australia, ²⁴ 93.7% of inpatients in the terminal phase who were receiving services from palliative care providers died at the end of the phase. Further, the majority of these palliative care patients are assumed to prefer home-based care and a home death. ¹ |

Table 4. Distribution of clinico-demographic characteristics before and after matching

| Variable | Before matching | | After matching |
|-------------------------------------|---------------------|---------------|----------------|
| | PEACH + UC (N = 39) | UC (N = 72) | UC (N = 19) |
| Local Health District, n (%) | | | |
| Illawarra | 17 (43.6) | 20 (27.8) | 4 (21.1) |
| Sydney | 6 (15.4) | 18 (25.0) | 11 (57.9) |
| South West Sydney | 16 (41.0) | 34 (47.2) | 4 (21.1) |
| Age, years (mean, SD) | 72.23 (13.34) | 74.83 (11.04) | 74.11 (10.00) |
| SD difference | NA | -0.21 | -0.16 |
| Gender, female, n (%) | 13 (33.3) | 28 (38.9) | 4 (21.1) |
| SD difference | NA | -0.12 | 0.28 |
| Main language spoken at home, n (%) | 32 (82.1) | 61 (84.7) | 16 (84.2) |
| English | | -0.07 | -0.06 |
| Other | 7 (17.9) | 11 (15.3) | 3 (15.8) |
| Marital status, n (%) | | | |
| Married/De Facto | 24 (61.5) | 46 (63.9) | 18 (94.7) |
| Separated/divorced | 1 (2.6) | 5 (6.9) | 1 (5.3) |

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|---|-----------|-----------|-----------|
| Widowed | 0 | 21 (29.2) | 0 |
| Not reported | 14 (35.9) | 0 | 0 |
| Diagnosis, n (%) | | | |
| Cancer | 32 (82.1) | 56 (77.8) | 16 (84.2) |
| SD difference | NA | 0.11 | -0.06 |
| Breast | 1 (3.1) | 3 (5.4) | 0 |
| CNS | 1 (3.1) | 1 (1.8) | 0 |
| Colorectal | 3 (9.4) | 5 (8.9) | 2 (12.5) |
| Other GIT | 7 (21.9) | 4 (7.1) | 0 |
| Haematological | 2 (6.3) | 6 (10.7) | 3 (18.8) |
| Head & neck | 2 (6.3) | 5 (8.9) | 3 (18.8) |
| Lung | 11 (34.4) | 13 (23.2) | 5 (31.3) |
| Pancreas | 0 | 3 (5.4) | 1 (6.3) |
| Prostate | 1 (3.1) | 6 (10.7) | 2 (12.5) |
| Other urological | 2 (6.3) | 2 (3.6) | 0 |
| Gynaecological | 2 (6.3) | 3 (5.4) | 0 |
| Skin | 0 | 1 (1.8) | 0 |
| Malignant (not further defined) | 0 | 1 (1.8) | 0 |
| Other primary malignancy | 0 | 1 (1.8) | 0 |
| Unknown primary | 2 (6.3) | 2 (3.6) | 0 |
| Non-cancer | 7 (17.9) | 16 (22.2) | 3 (15.8) |
| Alzheimer's dementia | 0 | 2 (12.5) | 0 |
| Cardiovascular | 0 | 2 (12.5) | 0 |
| End-stage kidney failure | 2 (28.6) | 2 (12.5) | 0 |
| End-stage liver | 0 | 1 (6.3) | 0 |
| Other dementia | 0 | 1 (6.3) | 0 |
| Other neurological | 2 (28.6) | 2 (12.5) | 1 (33.3) |
| Respiratory Failure | 3 (42.0) | 6 (37.5) | 2 (66.7) |
| Informal carer identified, n (%) | 39 (100) | 72 (100) | 0 |
| Relationship of informal carer to care recipient, n (%) | | | |
| Spouse/partner | 22 (56.4) | 39 (54.2) | 15 (78.9) |
| Daughter/son | 14 (35.9) | 27 (37.5) | 3 (15.8) |
| Parent | 0 | 1 (1.4) | 1 (5.3) |
| Other family member | 3 (7.7) | 3 (4.2) | 0 |
| Friend | 0 | 1 (1.4) | 0 |

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|---------------------------------|-----------------|-----------------|-----------------|
| Not reported | 0 | 1 (1.4) | 0 |
| Living arrangements, n (%) | | | |
| Spouse/partner | 20 (51.3) | 43 (59.7) | 17 (89.5) |
| Other family relative | 15 (38.5) | 24 (33.3) | 2 (10.5) |
| Carer, other than family | 1 (2.6) | 4 (5.6) | 0 |
| Residential aged care facility | 0 | 1 (1.4) | 0 |
| Not reported | 3 (7.7) | 0 | 0 |
| Preferred place of death, n (%) | | | |
| Home | 38 (97.4) | 35 (48.6) | 10 (52.6) |
| Hospice/palliative care unit | 0 | 7 (9.7) | 0 |
| Hospital | 0 | 0 | 0 |
| Not reported | 1 (2.6) | 30 (41.7) | 9 (47.4) |
| AKPS | n = 37 | n = 28 | n = 19 |
| Mean score (SD) | 27.05 (11.95) | 28.93 (14.49) | 29.47 (13.93) |
| SD difference | NA | -0.14 | -0.19 |
| Median score (range) | 30.00 (10 - 50) | 20.00 (10 - 60) | 30.00 (10 - 60) |

AKPS = Australian-modified Karnofsky Score; CNS = central nervous system; GIT = gastro-intestinal tract; NR = not reported; SD = standard deviation.

were collected prospectively and retrospectively for PEACH and usual care. Community specialised palliative care service (SPCS) provision data was collected retrospectively for people who died at home and received usual care. Adding a PEACH package to usual care was conservatively assumed to have no impact on the utilisation of community SPCS.

Resource use is costed according to the *Australian Manual of Resource Items and their Associated Costs* (Australian Government Department of Health, 2020) and the Australian Medical Services Advisory Committee guidelines (Australian Government Department of Health, 2020) in 2016 Australian dollars. Inpatient stays are costed using case-mix weights for Australian Refined Diagnosis Related Groups (ARDRGs). ED visits are costed using the urgency related group (URG) cost weights from the Independent Hospital Pricing Authority. Specialist palliative care services are estimated using hourly rates of local salaries plus 30% on-costs.

PEACH package costs are estimated based on the annual service agreement and local allocated program management costs, including staff time, overheads, e.g. office space and heating and lighting. Local Health Districts are charged per PEACH package, i.e. for seven days' provision, rather than a daily cost. The impact of using the latter approach on the robustness of the cost-effectiveness results is explored in the univariate sensitivity analyses. Costs and benefits are not discounted as the modelled evaluation lasts no more than a year.

2.5. Statistical Analysis

Clinico-demographic characteristics were summarised using frequency counts and percentages for categorical data and the mean and standard deviation (SD) for continuous variables. Clinical and sociodemographic characteristics were compared between the control and intervention groups using t-test, Mann-Whitney *U* or chi-squared statistical tests as appropriate, to explore any key differences. In order to satisfy comparability conditions, information on the location of death is categorized into “inpatient” (hospital, hospice or palliative care unit) or “home” as the estimate for the proportion of people in the last week of life receiving usual care who die at home informing the model is only available as a binary outcome.

Univariate, deterministic sensitivity analyses explored the robustness of the cost-effectiveness results to changes in the model inputs and assumptions. Propensity score matching, a conventional analytical approach for reducing confounding due to selection bias in observational study designs was used to estimate the effects of adding PEACH to usual care adjusting for any differences in key clinical and sociodemographic characteristics in a sensitivity analysis (D’Agostino et al., 1998; Haukoos et al., 2015). Where appropriate, the mean incremental net monetary benefit (INB) was estimated at potential threshold values for a unit gain in effect. INB represents the monetary value of additional effects of care minus the additional costs of care (Stinnett et al., 1998). Cost effectiveness acceptability curves (CEACs) and net benefit curves were also estimated.

The decision tree model was constructed in Microsoft® Office Excel 2003 and analyses was performed using Microsoft® Office Excel 2003 and SPSS for Windows version 22.0 (SPSS, Inc., Chicago, IL).

3. Results

Data was available for 79 clients who received a PEACH package from across the three LHDs between December 2015 and January 2016 and 95 people receiving palliative care services who died during July to December 2012 (Table 5). More clients were male (PEACH 66.7%, usual care 61.1%). In both groups, lung cancer and respiratory failure were the most common cancer and non-cancer primary diagnoses respectively. There were no differences in key baseline clinical and sociodemographic characteristics between the PEACH and usual care groups except for marital status ($p < 0.01$), possibly due to the large proportion of missing data (35.9%) for PEACH clients (Table 6).

3.1. Effects, Resource Use and Costs

In the base case modelled analysis, participants receiving a PEACH package spent on average 6.69 days at home in the last week of life versus 3.95 days for participants receiving usual care suggesting that PEACH packages enable high care needs patients to go home earlier from hospital, the hospice or palliative

Table 5. Model inputs—Matched dataset.

| Model input | Value | |
|--|---------------------|---------------------|
| | Unmatched | Matched |
| PEACH* | | |
| Probability of a home death | 0.9487 | 0.9487 |
| Probability of an inpatient death | 0.0513 | 0.0513 |
| <i>People experiencing a home death</i> | | |
| Proportion with an inpatient stay | 0% | 0% |
| Length of inpatient stay (days), mean | 0 | 0 |
| Average cost of an inpatient stay | \$0 | \$0 |
| Average cost of an Emergency department visit | \$0 | \$0 |
| Proportion with an Emergency department visit | 0% | 0% |
| Average cost of an Emergency department visit | \$0 | \$0 |
| Average cost of community SPCS | \$546 | \$958 |
| <i>People experiencing an inpatient death</i> | | |
| Proportion with an inpatient stay | 100% | 100% |
| Length of inpatient stay (days), mean# | 5.97 | 5.71 |
| Average cost of an inpatient stay# | \$9,826 | \$8,531 |
| Proportion with an Emergency department visit | 0% | 0% |
| Average cost of an Emergency department visit | \$0 | \$0 |
| Average cost of an Emergency department visit | \$0 | \$0 |
| Cost of a PEACH package (including administration) | \$3493 | \$3493 |
| Usual care* | | |
| Probability of a home death | 0.49 | 0.49 |
| Probability of an inpatient death | 0.51 | 0.51 |
| <i>People experiencing a home death</i> | | |
| Proportion with an inpatient stay | 3% | 10% |
| Length of inpatient stay (days), mean | 0.03 | 0.10 |
| Average cost of an inpatient stay | \$1839 [^] | \$1839 [^] |
| Proportion with an Emergency department visit | 3% | 10% |
| Average cost of an Emergency department visit | \$557 | \$557 |
| Average cost of community SPCS | \$546 | \$958 |
| <i>People experiencing an inpatient death</i> | | |
| Proportion with an inpatient stay | 100% | 100% |
| Length of inpatient stay (days), mean | 5.97 | 5.71 |
| Average cost of an inpatient stay | \$9826 | \$8531 |

Continued

| | | |
|---|-------|-------|
| Proportion with an Emergency department visit | 28% | 14.3% |
| Average cost of an Emergency department visit | \$906 | \$940 |

*All values are calculated for the 7 day period prior to death; #Two of the PEACH cases did not have place of death recorded. These cases were conservatively assumed to have an inpatient death with an average length of stay and cost similar to usual care cases that had an inpatient death; ^hospital coding data were unavailable for the inpatient episode. Therefore, the average national cost per day for all admissions is applied (\$1839); AIHW = Australian Institute of Health & Welfare; CIBU = Clinical Innovation and Business Unit, NSW; NHDC 2013-14 = National Hospital Cost Data Collection Australian Public Hospitals Cost Report 2013-14 Round 18; SPCS = specialised palliative care service

Table 6. Clinico-demographic characteristics of the PEACH and usual care cases informing the model.

| Variable | PEACH + UC (N = 39) | UC (N = 72) |
|-------------------------------------|------------------------|---------------|
| Age, years (mean, SD) | 72.23 (13.34) | 74.83 (11.04) |
| Gender, female, n (%) | 13 (33.3) | 28 (38.9) |
| Main language spoken at home, n (%) | | |
| English | 32 (82.1) | 61 (84.7) |
| Other | 7 (17.9) | 11 (15.3) |
| Marital status, n (%) [*] | | |
| Married/De Facto | 24 (61.5) | 46 (63.9) |
| Separated/divorced | 1 (2.6) | 5 (6.9) |
| Widowed | 0 | 21 (29.2) |
| Not reported | 14 (35.9) | 0 |
| Diagnosis, n (%) | | |
| Cancer | 32 (82.1) | 56 (77.8) |
| Breast | 1 (3.1) | 3 (5.4) |
| CNS | 1 (3.1) | 1 (1.8) |
| Colorectal | 3 (9.4) | 5 (8.9) |
| Other GIT | 7 (21.9) | 4 (7.1) |
| Haematological | 2 (6.3) | 6 (10.7) |
| Head & neck | 2 (6.3) | 5 (8.9) |
| Lung | 11 (34.4) | 13 (23.2) |
| Pancreas | 0 | 3 (5.4) |
| Prostate | 1 (3.1) | 6 (10.7) |
| Other urological | 2 (6.3) | 2 (3.6) |
| Gynaecological | 2 (6.3) | 3 (5.4) |

Continued

| | | |
|---|-----------------|-----------------|
| Skin | 0 | 1 (1.8) |
| Malignant (not further defined) | 0 | 1 (1.8) |
| Other primary malignancy | 0 | 1 (1.8) |
| Unknown primary | 2 (6.3) | 2 (3.6) |
| Non-cancer | 7 (17.9) | 16 (22.2) |
| Alzheimer's dementia | 0 | 2 (12.5) |
| Cardiovascular | 0 | 2 (12.5) |
| End-stage kidney failure | 2 (28.6) | 2 (12.5) |
| End-stage liver | 0 | 1 (6.3) |
| Other dementia | 0 | 1 (6.3) |
| Other neurological | 2 (28.6) | 2 (12.5) |
| Respiratory Failure | 3 (42.0) | 6 (37.5) |
| Informal carer identified, n (%) | 39 (100) | 72 (100) |
| Relationship of informal carer to care recipient, n (%) | | |
| Spouse/partner | 22 (56.4) | 39 (54.2) |
| Daughter/son | 14 (35.9) | 27 (37.5) |
| Parent | 0 | 1 (1.4) |
| Other family member | 3 (7.7) | 3 (4.2) |
| Friend | 0 | 1 (1.4) |
| Not reported | 0 | 1 (1.4) |
| Living arrangements, n (%) | | |
| Spouse/partner | 20 (51.3) | 43 (59.7) |
| Other family relative | 15 (38.5) | 24 (33.3) |
| Carer, other than family | 1 (2.6) | 4 (5.6) |
| Residential aged care facility | 0 | 1 (1.4) |
| Not reported | 3 (7.7) | 0 |
| Preferred place of death, n (%) | | |
| Home | 38 (97.4) | 35 (48.6) |
| Hospice/palliative care unit | 0 | 7 (9.7) |
| Hospital | 0 | 0 |
| Not reported | 1 (2.6) | 30 (41.7) |
| AKPS | n = 37 | n = 28 |
| Mean score (SD) | 27.05 (11.95) | 28.93 (14.49) |
| Median score (range) | 30.00 (10 - 50) | 20.00 (10 - 60) |

AKPS = Australian-modified Karnofsky Score; CNS = central nervous system; GIT = gastro-intestinal tract; NR = not reported; SD = standard deviation.

care unit, or to remain at home. More people died at home when PEACH was added to usual care (95% versus 49%). The mean direct cost associated with provision of a PEACH package, including program administration was \$3493 per participant over 7 days. The resource use and effectiveness data for the PEACH and usual care cases informing the model are summarised in **Table 7**.

Table 8 summarises the number of actual days PEACH was provided in the last week of life. The mean cost of other healthcare provision was \$1022 and \$5444 per participant for PEACH and usual care respectively. This largely reflects lower average costs per PEACH participant for hospital, hospice and palliative care unit costs (\$504 versus \$5038). Descriptive summary statistics for the complete PEACH (N = 79) and usual care (N = 95) datasets are presented in **Table 9**.

Table 7. Resource use and effectiveness data for the PEACH and usual care cases informing the model.

| Variable | PEACH + UC (N = 39) | UC (N = 72) |
|--|------------------------|----------------|
| Outcomes[®] | | |
| Place of death, n (%) [#] | | |
| Home | 37 (94.9) | 33 (45.8) |
| Hospice/palliative care unit | 0 | 18 (25.0) |
| Hospital | 0 | 21 (29.2) |
| Not reported | 2 (5.1) | 0 |
| Inpatient bed-days | | |
| Inpatient stay, yes, n (%) [^] | 0 | 49 (68.1) |
| Home death (n = 33) | 0 | 10 (20.4) |
| Hospice or palliative care unit (n = 18) | 0 | 18 (36.7) |
| Hospital (n = 21) | 0 | 21 (42.9) |
| Number of inpatient admissions, mean (SD) | | |
| Home death (n = 33) | 0 | 0.30 (0.47) |
| Hospice or palliative care unit (n = 18) | 0 | 1.06 (0.24) |
| Hospital (n = 21) | 0 | 1.05 (0.22) |
| Number of bed-days, mean (SD) | | |
| Home death (n = 33) | 0 | 6.90 (0.32) |
| Hospice or palliative care unit (n = 18) | 0 | 5.72 (2.27) |
| Hospital (n = 21) | 0 | 6.21 (1.40) |
| Resource use[®] | | |
| Number of days received PEACH package, mean (SD) | 4.3 (2.0) | NA |
| ED visit, yes, n (%) | 0 | 12 (16.7) |

Continued

| | | |
|--|----|-------------|
| Home death | 0 | 1 (8.3) |
| Hospice or palliative care unit | 0 | 2 (16.7) |
| Hospital | 0 | 9 (75.0) |
| Community specialised palliative care, mean hours (SD) | | |
| Palliative care Clinical Nurse Consultant | NC | 1.48 (1.88) |
| Palliative Care Registered Nurse | NC | 0.56 (1.13) |
| Palliative Care Nurse Specialist | NC | 2.93 (5.40) |
| Palliative Care Staff Specialist (outpatient clinic) | NC | 0.35 (0.78) |
| Community Nurse | NC | 5.36 (8.65) |
| Occupational Therapist | NC | 0.97 (1.56) |
| Social Worker | NC | 0.39 (0.99) |
| Dietician | NC | 0.26 (0.77) |

[@] in the last week of life; [#] A comparative analysis of place of death is not appropriate as usual care data were collected using deliberative sampling based on place of death, i.e. an approximately equal sample of cases who died at home, in a hospice or palliative care unit and in hospital; [^] Inpatient stays include admissions into acute care, hospice and palliative care units; NA = not applicable.

Table 8. The total number of days PEACH provided in the last week of life.

| Total number of days received PEACH package | Frequency, n (%) |
|---|------------------|
| 7 | 9 (23.1) |
| 6 | 5 (12.8) |
| 5 | 4 (10.3) |
| 4 | 5 (12.8) |
| 3 | 6 (15.4) |
| 2 | 10 (25.6) |

Table 9. Clinico-demographic characteristics of the peach and usual care cases (complete dataset).

| Variable | PEACH (N = 79) | UC (N = 95) |
|-------------------------------------|----------------|---------------|
| Local Health District | | |
| Illawarra | 30 (38.0) | 30 (31.6) |
| Sydney | 19 (24.1) | 30 (31.6) |
| South West Sydney | 30 (38.0) | 35 (36.8) |
| Age, years, mean (SD) | 71.27 (15.13) | 74.68 (12.17) |
| Gender, female, n (%) | 30 (38.0) | 36 (37.9) |
| Main language spoken at home, n (%) | | |
| English | 60 (75.9) | 77 (81.1) |

Continued

| | | |
|---|-----------|-----------|
| Other | 19 (24.1) | 18 (18.9) |
| Marital status, n (%) | | |
| Separated/divorced | 2 (2.5) | 10 (10.5) |
| Married/De Facto | 48 (60.8) | 47 (49.5) |
| Widowed | 0 | 32 (33.7) |
| Never married | 1 (1.3) | 5 (5.3) |
| Not reported | 28 (35.4) | 1 (1.1) |
| Diagnosis, n (%) | | |
| Cancer | 67 (84.8) | 70 (73.7) |
| Breast | 5 (7.5) | 3 (4.3) |
| CNS | 3 (4.5) | 2 (2.9) |
| Colorectal | 3 (4.5) | 6 (8.6) |
| Other GIT | 18 (26.9) | 6 (8.6) |
| Haematological | 3 (4.5) | 7 (10.0) |
| Head & neck | 3 (4.5) | 5 (7.1) |
| Lung | 13 (19.4) | 18 (25.7) |
| Pancreas | 3 (4.5) | 3 (4.3) |
| Prostate | 6 (9.0) | 7 (10.0) |
| Other urological | 4 (6.0) | 3 (4.3) |
| Gynaecological | 4 (6.0) | 3 (4.3) |
| Skin | 0 | 1 (1.4) |
| Malignancy, not further defined | 0 | 1 (1.4) |
| Other primary malignancy | 0 | 2 (2.9) |
| Unknown primary | 2 (3.0) | 3 (4.3) |
| Non-cancer | 12 (15.2) | 25 (26.3) |
| Cardiovascular | 1 (8.3) | 5 (20.0) |
| End-stage kidney failure | 4 (33.3) | 2 (8.0) |
| Stroke | 0 | 1 (4.0) |
| Alzheimer's dementia | 0 | 3 (12.0) |
| Other dementia | 0 | 1 (4.0) |
| Other neurological | 2 (16.7) | 3 (12.0) |
| Respiratory Failure | 5 (41.7) | 8 (32.0) |
| End stage liver disease | 0 | 2 (8.0) |
| Informal carer identified, n (%) | 79 (100) | 72 (75.8) |
| Relationship of informal carer to care recipient, n (%) | | |
| Spouse/partner | 39 (49.4) | 39 (54.2) |

Continued

| | | |
|---------------------------------|---------------|---------------|
| Daughter/son | 32 (40.5) | 27 (37.5) |
| Parent | 2 (2.5) | 1 (1.4) |
| Other family member | 6 (7.6) | 3 (4.2) |
| Friend | 0 | 1 (1.4) |
| Not reported | 0 | 1 (1.4) |
| Living arrangements, n (%) | | |
| Spouse/partner | 38 (48.1) | 45 (47.4) |
| Other family relative | 31 (39.2) | 24 (25.3) |
| Carer, other than family | 2 (2.5) | 5 (5.3) |
| Alone | 0 | 13 (13.7) |
| RACF | 0 | 5 (5.3) |
| Not reported | 8 (10.1) | 3 (3.2) |
| Preferred place of death, n (%) | | |
| Home | 68 (86.1) | 35 (36.8) |
| Hospice | 0 | 9 (9.5) |
| Hospital | 5 (6.3) | 1 (1.1) |
| Not reported | 6 (7.6) | 50 (52.6) |
| AKPS | n = 77 | n = 46 |
| Mean score (SD) | 30.27 (12.22) | 30.65 (15.26) |
| Median score (range) | 30 (10-60) | 30 (10-60) |

AKPS = Australian-modified Karnofsky Performance Status; CNS = central nervous system; GIT = gastro-intestinal tract; RACF = residential aged care facility; SD = standard deviation.

3.2. Incremental Costs and Effects

The mean INB over the last week of life for PEACH plus usual care relative to usual care alone is positive for all potential decision maker threshold values when considering either the proportion of home deaths or the number of bed-days. In other words, provided these outcomes have value to the decision-maker, PEACH plus usual care is the preferred model of care versus usual care alone. **Table 10** summarises the difference in costs and benefits between the two models of care.

3.3. Sensitivity Analyses

The dominance of PEACH plus usual care was maintained in all deterministic sensitivity analyses except when the cost per PEACH package nearly doubled from \$3494 to \$7076 to account for all PEACH packages provided irrespective of mortality status at the end of the seven day period. Even in this scenario, the mean incremental cost per extra home death is only \$72. **Table 11** presents the

Table 10. Summary of incremental costs and outcomes for PEACH plus usual care versus usual care alone (base case analysis).

| | PEACH + UC | UC | Increment |
|--|---------------|---------------|----------------|
| Expected outcomes | | | |
| Proportion of home deaths | 94.87% | 49.00% | 45.87% |
| Mean number of bed-days in the last week of life | 0.31 | 4.07 | -3.76 |
| Expected costs, mean cost per patient | | | |
| Inpatient stay | \$504 | \$6895 | -\$6392 |
| ED presentations | \$0 | \$139 | -\$139 |
| Community specialised palliative care services | \$518 | \$267 | \$250 |
| PEACH package & program administration | \$3,493 | \$0 | \$3,493 |
| Total | \$4515 | \$7034 | -\$2787 |
| Incremental cost per additional home death | | Dominates* | |
| Incremental cost per bed-day avoided | | Dominates* | |

*PEACH plus usual care dominates usual care alone, i.e. more effective and less costly; UC = usual care.

Table 11. Univariate sensitivity analyses.

| Assumption | ICER |
|--|-------------------|
| Base case analysis | Dominates |
| Proportion of people in the last week of life receiving usual care who die at home ranges from 6.7% - 51% rather than | Dominates |
| The two PEACH cases with missing place of death data experience a home rather than inpatient death | Dominates |
| Applying an average daily cost for PEACH instead of a complete package cost | Dominates |
| Applying a PEACH package cost accounting for all PEACH packages provided irrespective of mortality status at the end of the seven day period | \$17 [#] |
| Applying a 5% - 20% reduction in community SPCS resource use for PEACH rather than assuming the provision of PEACH has no impact on SPCS. | Dominates |

[#]Incremental cost per additional home death; SPCS = specialised palliative care services

results of the univariate sensitivity analyses.

4. Discussion

Overall, the findings from the economic evaluation of the PEACH Program suggests that adding a PEACH package to usual care for people in the terminal phase of their illness and the last week of life increases the number of palliative care clients succeeding in their wish to die at home, facilitates discharge from acute inpatient facilities and reduces hospital presentations to EDs. Further, the results indicate providing PEACH with usual care for this patient population is

more cost-effective than usual care alone. The average cost per patient was lower for PEACH plus usual care compared to usual care alone, \$4515 and \$5444 respectively, mainly driven by lower inpatient costs.

Additionally, on average, patients receiving PEACH spent an extra three days at home in the last week of life and more died at home (95% vs 49%). Consequently, providing PEACH with usual care is more effective and less costly than usual care alone, i.e. PEACH plus usual care dominates usual care alone. PEACH increases capacity in the health care system by reducing ED visits, hospitalisations and bed-days.

The findings suggest that providing PEACH in addition to usual care in this study may have saved the Australian healthcare system approximately AU\$36,251 and freed up 107 inpatient bed-days over 12 months. If a daily PEACH cost is applied rather than a per package cost, additional savings of \$52,544 may be realised. Better prognostic tools could also result in further savings.

This is the first modelled economic evaluation of a model of care supporting Australian patients who want homebased rather than inpatient EOL care. Findings are consistent with other RCT evidence that suggests homebased palliative care can reduce hospitalisations and associated costs, and extend the results of the PEACH pilot study (García-Pérez et al., 2009; McCaffrey et al., 2013; Singer et al., 2016; Nordly et al., 2016; Goldsnury et al., 2015; Masucci et al., 2013; McCaffrey et al., 2016). The majority of the PEACH packages were initiated from home (71.8%, 28/39), perhaps suggesting PEACH mainly enables people to remain at home. However, PEACH provision did facilitate the discharge of eleven patients from acute inpatient facilities and supported their wish to die at home. Clearly, the PEACH Program also helps meet patient and family preferences for preferred place of death at the EOL as all but two of the PEACH clients died at home without inpatient admissions or ED visits in their last week of life (place of death for the remaining two cases was unknown).

Half of the PEACH clients (49.4%; 39/79) in the original dataset died within seven days of receiving PEACH and just under a third (30.4%; 24/79) received multiple PEACH packages (range 1 - 5). However, of note, adding PEACH to usual care continues to be cost-effective versus usual care alone even when the cost of all the PEACH packages ($N = 79$) is included in the analysis (incremental cost per additional home death \$72). According to the service agreement, LHDs are charged for a complete package (seven days provision) irrespective of the length of time the package is provided in practice. The univariate sensitivity analysis suggests on average, potential cost savings of \$2277 per patient (\$88,796 for 39 patients) if a daily cost is applied.

Limitations

A number of caveats should be considered when interpreting the results. Although the direction of the results was unaffected when PEACH and usual care cases were matched using propensity scores, there may have been important dif-

ferences in unmeasured baseline characteristics strongly associated with a home death or health care resource utilization at the EOL between the intervention arms, e.g. comorbidities (higher comorbidity burden is associated with greater resource use) (Masucci et al., 2013). Further, data for the intervention and control arms were collected from two different years (2015/6 and 2012, respectively) and other factors such as improvements in clinical practice and changes in the provision of SPCS may have influenced the results. As with any retrospective audit of clinical notes and data information systems, only information that has been recorded in the notes can be collected so the usual care cost and effect estimates are reliant upon adequate, relevant documentation (McCaffrey et al., 2016). However, important data variables of interest, such as functional status were missing for some patients during the audit. The estimate for the proportion of home deaths in people receiving usual care in the base case analysis likely includes people who would not be eligible for PEACH. Univariate sensitivity analysis suggests the dominance of PEACH is maintained irrespective of plausible parameter values for this model input. Secondary outcomes such as symptom control and functional status should also be considered to aid evaluation of impact on the quality of care of providing PEACH in addition to usual care (Currow et al., 2008).

Cost estimates did not include claims data for any additional costs of community care, such as general practitioner visits or medications, so the true cost of the models of care in each arm may be underestimated. However, these costs are not expected to differ by arm and are unlikely to influence total incremental costs which are mainly driven by the difference in inpatient costs.

Finally, analyses are deterministic, i.e. based on point estimates (mean) for incremental costs, effects and cost-effectiveness. Probabilistic sensitivity analysis (Briggs, 2005; Briggs et al., 2012) is needed to estimate the joint sampling uncertainty associated with the individual inputs in the modelled economic evaluation, particularly due to small sample sizes informing some of the model inputs and to provide a quantitative estimate of decision uncertainty.

5. Conclusion

Overall, the findings suggest PEACH is a cost-effective model of care when added to usual care for people in the last week of life. Results from this study provide important information on the value for money of the PEACH Program, informing future health service delivery and healthcare funding allocation decisions in NSW, Australia and internationally. This is the first modelled economic evaluation of a model of care supporting Australian patients who want home-based rather than inpatient end-of-life care. PEACH is a cost-effective model of care when added to usual care for people in the last week of life as PEACH plus usual care is more effective and less costly than usual care alone.

Adding a PEACH package to usual care for people in the terminal phase of their illness and the last week of life increases the number of palliative care cli-

ents succeeding in their wish to die at home, facilitates discharge from acute in-patient facilities and reduces hospital presentations to Emergency Departments. Results from this study provide important information on the value for money of the PEACH program, informing future health service delivery and healthcare funding allocation decisions in NSW, Australia and internationally.

Authorship

Chow JSF, Jobburn K, Harlum J & Agar MR, made a substantial contribution to the concept and design of the work. Initial draft: Chow JSF. Final draft was created by Chow JSCF which was reviewed critically by Jobburn K & Agar MR for important intellectual content. All the Authors approved the version to be published.

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Research Ethics and Patient Consent

Ethical approval was granted by the South Western Sydney Local Health District Human Research Ethics Committee (15/322 LNR) on 18 March 2017.

Data Management and Sharing

Data are available upon reasonable request.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Abernethy, A. P., Shelby-James, T., Fazekas, B. S., Woods, D. & Currow, D. C. (2005). The Australia-Modified Karnofsky Performance Status (AKPS) Scale: A Revised Scale for Contemporary Palliative Care Clinical Practice [ISRCTN81117481]. *BMC Palliative Care*, 4, Article No. 7. <https://doi.org/10.1186/1472-684X-4-7>
- Agar, M., Currow, D. C., Shelby-James, T. M., & Abernethy, A. P. (2008). Preference for Place of Care and Place of Death in Palliative Care: Are These Different Questions? *Palliative Medicine*, 22, 787-795. <https://doi.org/10.1177/0269216308092287>
- Aoun, S. M., Wall, D., Kristjanson, L. J., & Shahid, S. (2013). Palliative Care Needs of Terminally Ill People Living Alone: A Service Provider Perspective. *Collegian*, 20, 179-185. <https://doi.org/10.1016/j.colegn.2012.08.001>
- Australian Government (n.d.). *My Aged Care*. <https://www.myagedcare.gov.au/help-at-home/home-care-packages>
- Australian Government Department of Health (2020). *Medical Services Advisory Committee*. <http://www.msac.gov.au/>
- Briggs, A. (2005). Probabilistic Analysis of Cost-Effectiveness Models: Statistical Representation of Parameter Uncertainty. *Value Health*, 8, 1-2. <https://doi.org/10.1111/j.1524-4733.2005.08101.x>
- Briggs, A. H., Weinstein, M. C., Fenwick, E. A., Karnon, J., Sculpher, M. J., Paltiel, A. D. et al. (2012). Model Parameter Estimation and Uncertainty Analysis: A Report of the ISPOR-SMDM Modelling Good Research Practices Task Force Working Group-6. *Medical Decision Making*, 32, 722-732. <https://doi.org/10.1177/0272989X12458348>
- Chow JSF, Barclay, G., Harlum, J., Swierczynski, J., Jobburn, K., & Agar, M. (2021) Palliative Care Home Support Packages (PEACH): A Carer Cross-Sectional Survey. *BMJ Supportive & Palliative Care*, 12, e68-e74. <https://doi.org/10.1136/bmjspcare-2020-002294>
- Currow, D. C., Eagar, K., Aoun, S., Fildes, D., Yates, P., & Kristjanson, L. J. (2008). Is It Feasible and Desirable to Collect Voluntarily Quality and Outcome Data Nationally in Palliative Oncology Care? *Journal of Clinical Oncology*, 26, 3853-3859. <https://doi.org/10.1200/JCO.2008.16.5761>
- D'Agostino Jr., R. B. (1998). Propensity Score Methods for Bias Reduction in the Comparison of a Treatment to a Non-Randomized Control Group. *Statistics in Medicine*,

17, 2265-2281.

[https://doi.org/10.1002/\(SICI\)1097-0258\(19981015\)17:19<2265::AID-SIM918>3.0.CO;2-B](https://doi.org/10.1002/(SICI)1097-0258(19981015)17:19<2265::AID-SIM918>3.0.CO;2-B)

- Foreman, L. M., Hunt, R. W., Luke, C. G., & Roder, D. M. (2006). Factors Predictive of Preferred Place of Death in the General Population of South Australia. *Palliative Medicine*, 20, 447-453. <https://doi.org/10.1191/0269216306pm1149oa>
- García-Pérez, L., Linertová, R., Martín-Olivera, R., Serrano-Aguilar, P., & Benítez-Rosario, M. A. (2009). A Systematic Review of Specialised Palliative Care for Terminal Patients: Which Model Is Better? *Palliative Medicine*, 23, 17-22. <https://doi.org/10.1177/0269216308099957>
- Haukoos, J. S., & Lewis, R. J. (2015). The Propensity Score. *JAMA*, 314, 1637-1638. <https://doi.org/10.1001/jama.2015.13480>
- Higginson, I. J., Daveson, B. A., Morrison, R. S., Yi, D., Meier, D., Smith, M. et al. (2017). Social and Clinical Determinants of Preferences and Their Achievement at the End of Life: Prospective Cohort Study of Older Adults Receiving Palliative Care in Three Countries. *BMC Geriatrics*, 17, Article No. 271. <https://doi.org/10.1186/s12877-017-0648-4>
- Johnston, B., Patterson, A., Bird, L., Wilson, E., Almack, K., Mathews, G. et al. (2018). Impact of the Macmillan Specialist Care at Home Service: A Mixed Methods Evaluation across Six Sites. *BMC Palliative Care*, 17, Article No. 36. <https://doi.org/10.1186/s12904-018-0281-9>
- Lee, M. C., Hinderer, K. A., & Alexander, C. S. (2018). What Matters Most at the End-of-Life for Chinese Americans? *Gerontology and Geriatric Medicine*, 4, 1-7. <https://doi.org/10.1177/2333721418778195>
- Masucci, L., Guerriere, D. N., Zagorski, B., & Coyte, P. C. (2013). Predictors of Health Service Use over the Palliative Care Trajectory. *Journal of Palliative Medicine*, 16, 524-530. <https://doi.org/10.1089/jpm.2012.0199>
- McCaffrey, N., Agar, M., Harlum, J., Karnon, J., Currow, D., & Eckermann, S. (2013). Is Home-Based Palliative Care Cost-Effective? An Economic Evaluation of the Palliative Care Extended Packages at Home (PEACH) Pilot. *BMJ Supportive & Palliative Care*, 3, 431-435. <https://doi.org/10.1136/bmjspcare-2012-000361>
- McCaffrey, N., Cassel, J. B., & Coast, J. (2015) Bringing the Economic Cost of Informal Caregiving into Focus. *Palliative Medicine*, 29, 866-867. <https://doi.org/10.1177/0269216315612653>
- McCaffrey, N., Fazekas, B., Cutri, N., & Currow, D. C. (2016). How Accurately Do Consecutive Cohort Audits Predict Phase III Multisite Clinical Trial Recruitment in Palliative Care? *Journal of Pain and Symptom Management*, 51, 748-755. <https://doi.org/10.1016/j.jpainsymman.2015.11.022>
- Meier, E. A., Gallegos, J. V., Montross Thomas, L. P., Depp, C. A., Irwin, S. A., & Jeste, D. V. (2016). Defining a Good Death (Successful Dying): Literature Review and a Call for Research and Public Dialogue. *The American Journal of Geriatric Psychiatry*, 24, 261-271. <https://doi.org/10.1016/j.jagp.2016.01.135>
- Nordly, M., Vadstrup, E. S., Sjøgren, P., & Kurita, G. (2016). Home-Based Specialized Palliative Care in Patients with Advanced Cancer: A Systematic Review. *Palliative and Supportive Care*, 14, 713-724. <https://doi.org/10.1017/S147895151600050X>
- Purdy, S., Lasseter, G., Griffin, T., & Wye, L. (2015). Impact of the Marie Curie Cancer Care Delivering Choice Programme in Somerset and North Somerset on Place of Death and Hospital Usage: A Retrospective Cohort Study. *BMJ Supportive & Palliative Care*, 5, 34-39. <https://doi.org/10.1136/bmjspcare-2013-000645>

- Singer, A. E., Goebel, J. R., Kim, Y. S., Dy, S. M., Ahluwalia, S. C., Clifford, M. et al. (2016) Populations and Interventions for Palliative and End-of-Life Care: A Systematic Review. *Journal of Palliative Medicine*, *19*, 995-1008.
<https://doi.org/10.1089/jpm.2015.0367>
- Stinnett, A. A., & Mullahy, J. (1998). Net Health Benefits: A New Framework for the Analysis of Uncertainty in Cost-Effectiveness Analysis. *Medical Decision Making*, *18*, S68-S80. <https://doi.org/10.1177/0272989X98018002S09>
- Thomas, C., & Ramcharan, A. (2010). Why Do Patients with Complex Palliative Care Needs Experience Delayed Hospital Discharge? *Nursing Times*, *106*, 15-17.
- Wye, L., Lasseter, G., Percival, J., Duncan, L., Simmonds, B., & Purdy, S. (2014). What Works in 'Real Life' to Facilitate Home Deaths and Fewer Hospital Admissions for Those at End of Life?: Results from A Realist Evaluation of New Palliative Care Services in Two English Counties. *BMC Palliative Care*, *13*, Article No. 37.
<https://doi.org/10.1186/1472-684X-13-37>