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Association of advance care planning with hospital use and costs at the end of life: a population-based retrospective cohort study

Ian Scott ,[1,2] Liz Reymond,[3,4] Xanthe Sansome,[5] Hannah Carter [6]

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For numbered affiliations see end of article.

Correspondence to
Professor Ian Scott;
ian.scott@health.qld.gov.au

ABSTRACT

Objective To investigate associations between the availability and timing of digitally available advance care planning (ACP) documents and hospital use and costs during the last 6 months of life.

Design Retrospective population-based cohort study using data linkage.

Setting 11 public hospitals in Queensland, Australia.

Participants 5586 decedents with ACP documents were directly matched 1:2 to 11 172 control decedents based on age category, sex, location, year of death and principal diagnosis code for the last-known hospital admission.

Exposure ACP discussions with documents uploaded to a widely accessible statewide digital platform. Directly matched subgroup analyses investigated differences between decedents with ACP documents available at three different times prior to death: ≥6 months, between 1 and 6 months, and <1 month.

Main outcomes and measures Emergency department (ED) presentations, hospital and intensive care unit (ICU) admissions, and in-hospital deaths, expressed as adjusted OR (aOR). Secondary outcomes were hospital bed-days and costs.

Results ACP decedents with documents uploaded ≥6 months prior to death, compared with controls, had fewer ED presentations (aOR 0.90, 95% CI 0.81 to 1.00), hospitalisations (aOR 0.83, 95% CI 0.74 to 0.92), ICU admissions (aOR 0.23, 95% CI 0.10 to 0.48), and in-hospital deaths (aOR 0.56, 95% CI 0.51 to 0.63), and lower adjusted mean hospital costs per person over the last 6 months of life ($A2290 less (95% CI –$4116 to –$463)). Conversely, decedents with ACP documents uploaded less than 6 months prior to death showed higher rates of ED presentations and hospital admissions and greater hospital costs relative to controls.

Conclusion The association between digitally available ACP documents and health service use and cost differed based on the timing of ACP upload, with documents available ≥6 months prior to death being associated with less hospital use and costs.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Large multisite longitudinal analysis of standardised, patient-linked data on consecutive episodes of hospital care for almost 17 000 decedents, providing generalisable estimates of advance care planning (ACP) effects on hospital utilisation, costs and place of death.
⇒ Use of a matched cohort design compensated for the logistical difficulties of performing large randomised controlled trials, and where assigning patients to a no-ACP arm may be deemed unethical.
⇒ Observational design precludes confirmation of causal relationships between ACP and measured outcomes.
⇒ Inability to access data to control for potentially important but unmeasured confounders such as clinical status and disease severity, frailty, comorbidity burden and levels of psychosocial support.
⇒ Analyses were hospital focussed such that utilisation and costs of non-hospital care were not ascertained.

INTRODUCTION

Advance care planning (ACP) is the iterative process of defining and documenting a person's values and preferences to guide future healthcare delivery.[1] Evidence shows ACP decreases anxiety, grief, decisional conflict and burden for surviving relatives and surrogates,[2–4] enhances clinician adherence to patient preferences, increases use of palliative care, improves patient and family satisfaction with care and avoids unwanted cardiopulmonary resuscitation (CPR) and life-support treatments.[5–7] Considerable expenditure on end-of-life care[8 9] may not improve care quality,[10] and aggressive treatment may violate patient preferences[11] or prove non-beneficial.[12 13]

Whether ACP reduces healthcare use and cost is unclear,[14 15] especially when ACP uptake occurs in less than 50% of eligible patients[16] and multiple implementation barriers exist,[17] including inaccessibility of ACP documentation when needed, and up to 75% of ACP documents being of poor quality.[18] The findings of economic evaluations of ACP vary according to their definitions of how and who provides ACP

(influencing costs) and who the beneficiaries are (influencing outcomes).[19 20] Studies of the association between ACP and healthcare use have yielded conflicting results depending on the level and fidelity of ACP uptake and documentation, characteristics of the population studied and the choice of utilisation measures.[21 22] Such ambiguity has led some to question the desirability of investing more resources towards large-scale adoption of ACP,[23] while others assert existing research is methodologically limited and does not adequately account for the nuances and complexity of ACP.[24 25]

There is increasing recognition of the need for ACP to be conducted proactively, iteratively and with longer lead time prior to death.[26 27] Advocates have called for system-wide changes to how ACP is conceptualised, moving beyond the one-off completion of advance health directives to an ongoing process to support individuals to better prepare for future decision making,[24 28] including enhancing their understanding of their illness, identifying proxies and having values-based conversations.[28] The earlier these ACP processes are initiated prior to death, the greater the potential impact on individual treatment choices and care provided during the end-of-life phase. However, the relationship between the timing of ACP and healthcare resource use and cost remains unclear.

The aim of this study was to investigate the association between the time prior to death at which standardised ACP documents became available on an accessible statewide digital platform and hospital use and costs over the last 6 months of life among a large population of decedents.

METHODS

Study design

This was a retrospective, longitudinal, population-based, matched cohort study comparing public hospital use and costs, in-hospital deaths and terminal admission (ie, admissions where death occurs in hospital) outcomes over the last 6 months of life between a cohort of decedents with a digitally uploaded ACP document (ACP cohort) and a control cohort with no uploaded ACP documents.

Setting and population

Eligible decedents were those over 18 years whose deaths were officially registered between 1 August 2015 and 31 October 2019, and who had resided in one of five health service regions in South East Queensland, Australia (Gold Coast, Brisbane North, Brisbane South, Sunshine Coast, West Moreton), serviced by 11 public hospitals. Decedents whose terminal hospital admission and/or registered cause of death was due to acute trauma were excluded, as ACP was aimed at those likely to die an expected death from chronic diseases within 12 months. Due to unavailability of cost data, people dying after 30 June 2019, were excluded from hospital cost analyses.

Within Queensland, hospitals within a defined geographical catchment area are centrally managed by a local hospital and health service which enables an overarching regional approach to care. All hospitals across the five health services included in this study had equivalent clinical service capabilities in regards to emergency departments, intensive care units, palliative care services and general medical and surgical inpatient care. All study hospitals also operated under a consistent ACP funding and policy framework. Hence, patients presenting to different hospitals within the same health service would experience similar approaches to ACP.

The ACP cohort comprised decedents with a complete, valid ACP document uploaded to a statewide digital platform before death. Decedents with only an enduring power of attorney (EPOA) document were excluded as completion of this document may not have involved ACP discussions. All other decedents, with no uploaded document, were eligible to be randomly selected and matched as controls.

Exposure to Advance Care Planning

The Queensland Health (QH) Statewide Office of Advance Care Planning (SOACP) is responsible for supporting a coordinated approach to ACP across all care settings.[29] It provides standardised education for dedicated ACP facilitators who then upskill and assist local clinicians to invite eligible individuals to partake in ACP conversations, having been identified using the 'surprise question': would I be surprised if this person died in the next 12 months?[30] 12 full-time facilitators are funded and distributed equitably across the five health services according to relative catchment populations and who worked within hospitals, primary care practices and residential aged care facilities (RACFs). The SOACP has developed a values-based, standardised statement of choices (SoC) form[31] available as a user-friendly, non-legally binding, easily modified form detailing patients' goals of care and preferences for CPR, life-support interventions and other supportive care (online supplemental eAppendix 1). A legally binding advance health directive (AHD) is also available and considered an appropriate ACP document. In addition, during the study period, QH incentivised ACP uptake by providing a one-off payment to hospitals of between $A100 and $A200 for each ACP invitation administered.

Copies of ACP documents are sent, via fax, mail or e-mail, to the SOACP where they are audited for legibility and completeness before being uploaded to the person's hospital electronic medical record via an app, 'The ACP Tracker', located within a secure statewide digital platform accessible to all QH clinical staff (online supplemental eAppendix 2). Forms with incomplete mandatory fields, including missing signatures, are not uploaded until corrected. Queensland Ambulance Service paramedics and authorised primary care practitioners, community nurses and RACF nursing staff also have read-only access

to the app through a Health Provider Portal (online supplemental eAppendix 3).

Variables, data sources and matching process

Data on patient characteristics, episodes of care and outcomes were collected and linked by the QH Statistical Services Branch (SSB) across five datasets: deaths from the Queensland Registry of Births, Deaths and Marriages; International Classification of Disease V.10, Australian modification (ICD-10-AM) coded cause of death from the Australian Bureau of Statistics; data on emergency department (ED) presentations from the statewide Emergency Department Information System; data on hospital and intensive care unit (ICU) admissions, including ICD-10-AM primary diagnosis codes, from the Queensland Hospital Admitted Patient Data Collection; and hospital admission costs (combined direct and overhead costs) from the National Hospital Cost Data Collection. A full list of extracted data items is provided in online supplemental eAppendix 4. Consecutive hospital presentations and admissions at the patient level were linked by QH SSB using deterministic and probabilistic linkage algorithms (online supplemental eAppendix 5) resulting in 99.7% linkage of available records. All costs are reported in 2021 Australian dollars with costs collected in financial years 2015/2016 to 2018/2019 indexed to the most recent reference year using the Australian consumer price.[32]

All ACP decedents were randomly matched in a 1:2 ratio with control decedents based on age (with 5-year age brackets applied when direct matches could not be identified), sex, year of death, health service region and ICD-10-AM code for the primary diagnosis of the last-known hospital admission prior to death in the community or in hospital or of the terminal admission (ie, admission in which the person died in hospital) if no prior admission was recorded. The choice to match on diagnosis of the last-known hospital admission, rather than on admissions within a specific time period prior to death, reflected our hypothesis that earlier completion of ACP documentation may alter treatment choices which could in turn reduce the likelihood of future admissions. The 1:2 ratio was selected to increase precision and decrease bias in effect estimates while ensuring feasibility of exact matching within the available data.[33]

Outcome measures

Primary outcome measures were differences between ACP and control cohorts in the odds of decedents, over the last 6 months of life: having one or more presentations to ED, hospital admissions and ICU admissions; or dying in hospital. Secondary outcome measures were differences between the cohorts in hospital bed-days, ED costs, hospital admission costs and total hospital costs over the 6-month period. We also assessed associations of an uploaded document prior to a terminal hospital admission (an admission in which the person died in hospital) with ICU admissions, palliative care classifications (ie, admission classified as palliative care if an end-of-life care pathway was initiated and comfort care only was provided), length of stay and cost of that admission.

We followed the Strengthening the Reporting of Observational Studies in Epidemiology guideline in reporting clinical outcomes[34] and the Consolidated Health Economic Evaluation Reporting Standards checklist in reporting cost outcomes.[35]

Statistical analyses

Adequacy of matching

In addition to comparing cohorts using the matching variables, we also compared both cohorts for ICD-10-AM coded cause of death, this data becoming available after matching had been completed. For decedents with at least one hospital admission during the 6 months prior to death (admitted patient cohorts), we also compared these cohorts for variables unavailable for all decedents. These variables comprised preferred language, marital status, hospital insurance, indigenous status, residence locality (according to Accessibility/Remoteness Index of Australia (ARIA))[36] and socioeconomic status (according to Socio-Economic Indexes for Areas (SEIFA) quintiles).[37] For both total and admitted patient cohorts, we calculated standardised mean differences (SMDs) for each variable as a measure of balanced distribution between ACP and control cohorts, with cohorts considered acceptably matched if SMDs were <0.20.[38 39]

Outcome analyses

The main outcome analysis compared primary and secondary outcomes between the subgroup of ACP decedents who had an ACP document uploaded for 6 months or more prior to death compared with controls directly matched over the same period. Separate prespecified subgroup analyses compared ACP decedents who had an ACP document uploaded between 1 and 6 months, and less than 1 month, prior to death, with correspondingly matched controls. These subgroup analyses tested our hypothesis that the earlier completed ACP documents became available, the more likely these documents would guide a more person-centred conservative approach to subsequent end-of-life care over a longer period prior to death, resulting in less hospital use and costs and fewer in-hospital deaths. Post hoc, exploratory analyses assessed differences in hospital costs between ACP subgroups according to the timing of ACP upload. Additional matched subgroup analyses were conducted to test the robustness of results within the two largest cause of death categories: cancer (33% of deaths) and diseases of the circulatory system (25% of deaths).

Regression Modelling

Logistic regression models were used in analysing primary outcomes, and linear regression models in analysing secondary outcomes. All regression models adjusted for registered ICD-10 coded underlying cause of death which became known after matching, with effect estimates expressed as an adjusted OR (aOR).[40] Residual

plots of all models were assessed to confirm assumptions of constant variance and normally distributed error terms were met. Due to the zero-inflated, non-normal distribution of length of stay and costing data, bootstrap resampling was used to produce 10 000 simulated regression models from which adjusted means were derived and the percentile method used to estimate 95% CIs.[41] All analyses were performed using R (V.4.0.3) and two-sided $p<0.05$ denoted statistical significance.

Ethics approval

Ethics approval for this multisite study was granted by Metro South Human Research Ethics Committee (ref: HREC/17/QPAH/36) with administrative ethics approval from Queensland University of Technology Human Research Ethics Committee (approval number: 2000000611) and approval under the Public Health Act to access de-identified decedent data from the Office of the Director General of QH (QH-SSB request ID32140).

Patient and public involvement

No patients or members of the public were involved in the design or conduct of this study.

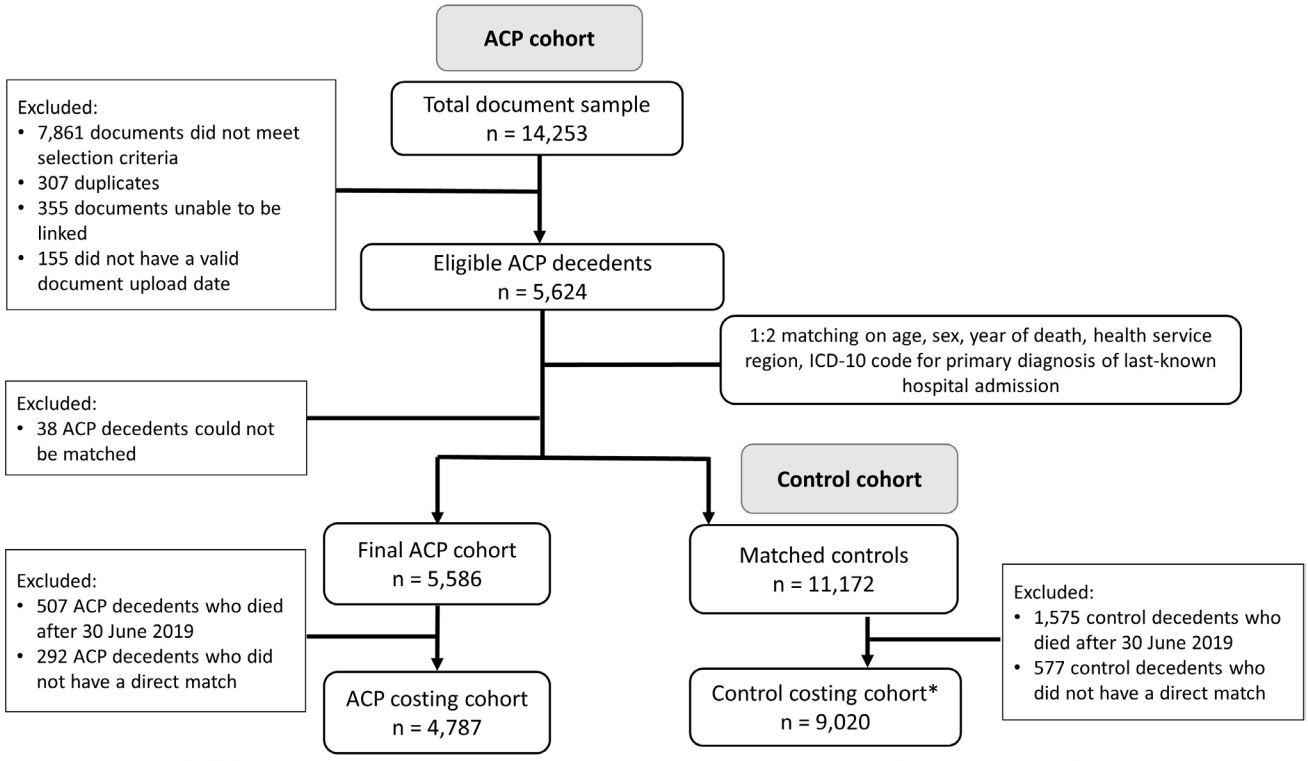
RESULTS

From the initial sample of 14 253 uploaded documents, after excluding those failing participant selection criteria, were duplicates, comprised only EPOA documents or had an invalid upload date, 5624 decedents with at least one uploaded ACP document (SoC or AHD) were subject to matching (figure 1). Of these, 38 could not be directly matched as they had no hospital admission in the preceding 5 years, leaving 5586 in the total ACP cohort matched with 11 172 controls. The admitted patient cohort comprised 4018 (71.9%) ACP and 7857 (70.3%) control decedents. For hospital costing analyses, after removing deaths occurring after 30 June 2019, and decedents unable to be directly matched, 4787 (85.7%) and 9020 (80.7%) decedents comprised ACP and control cost cohorts respectively.

Participant characteristics

Clinical and demographic characteristics of ACP and control decedents in the total and admitted patient cohorts are listed in table 1, along with SMDs for matching and comparison variables, all of which were <0.16, indicating the cohorts were acceptably matched. Corresponding data for each of the ACP subgroups and the costing cohorts are included in online supplemental eAppendix 6. Mean (SD) age for both cohorts was 81 (±12) years, 51.7% were females, and among ACP decedents, 5312 (95.1%) had an SoC form, 391 (7.0%) had an AHD, and 117 (2.1%) had both.

Within the ACP cohort, 2507 (45%) had ACP documents uploaded 6 months or more before death, 1223 (22%) between 1 month and less than 6 months and 1856 (33%) less than a month before death (online supplemental figure 1 **in Supplement**).



*1:2 matching ratio does not hold for the costing cohort, as matching occurred based on calendar year and therefore some ACP decedents had only one direct match remaining after excluding deaths after June 2019

Figure 1 Patient flow diagram.

Table 1 Participant characteristics*

	ACP	Control	SMD	P value
Full cohort	**n**=5586	**n**=11 172		
Age at death: mean (SD) years	80.9 (12.0)	80.8 (11.9)	0.006	0.714
Female sex	2888 (51.7)	5776 (51.7)	0.002	0.932
Health service regions: no. (%)			0.085	<0.001
Gold Coast	385 (6.9)	883 (7.9)		
Metro North (Brisbane)	888 (15.9)	1977 (17.7)		
Metro South (Brisbane)	3419 (61.2)	6524 (58.4)		
Sunshine Coast	318 (5.7)	749 (6.7)		
West Moreton	575 (10.3)	1039 (9.3)		
Year of death: no. (%)			<0.001	1.000
2015	117 (2.1)	235 (2.1)		
2016	609 (10.9)	1218 (10.9)		
2017	1369 (24.5)	2737 (24.5)		
2018	1916 (34.3)	3832 (34.3)		
2019	1570 (28.1)	3139 (28.1)		
Underlying cause of death: no (%)†			0.156	<0.001
Neoplasms	1799 (32.2)	3747 (33.5)		
Diseases of the circulatory system	1398 (25.0)	2875 (25.7)		
Diseases of the respiratory system	574 (10.3)	1121 (10.0)		
Mental, behavioural, neurodevelopmental disorders	513 (9.2)	859 (7.7)		
Diseases of the nervous system	446 (8.0)	623 (5.6)		
Endocrine, nutritional metabolic diseases	240 (4.3)	418 (3.7)		
Other	184 (3.3)	420 (3.8)		
Diseases of the digestive system	149 (2.7)	392 (3.5)		
Diseases of the genitourinary system	137 (2.5)	254 (2.5)		
Other	140 (2.5)	444 (4.0)		
Missing	6 (0.1)	19 (0.2)		
Documents available prior to death: no (%)				
SoC only	5195 (93.0)	–		
AHD only	274 (4.9)	–		
SoC and AHD	117 (2.1)	–		
Admitted patient cohort‡	**n**=4018	**n**=7857		
Preferred language			0.152	<0.001
English	3845 (95.7)	7315 (93.1)		
Non-English	157 (3.9)	503 (6.4)		
Not stated/unknown	16 (0.4)	39 (0.5)		
Marital Status			0.069	0.054
Divorced	414 (10.3)	739 (9.4)		
Married (registered and de facto)	1921 (47.8)	3803 (48.4)		
Never married	309 (7.7)	668 (8.5)		
Not stated/unknown	125 (3.1)	306 (3.9)		
Separated	112 (2.8)	188 (2.4)		
Widowed	1137 (28.3)	2153 (27.4)		
Hospital insurance status			0.105	<0.001
Hospital insurance	498 (12.4)	1194 (15.2)		

Continued

Table 1 Continued

	ACP	Control	SMD	P value
Not insured	3504 (87.2)	6592 (83.9)		
Not stated/unknown	16 (0.4)	71 (0.9)		
Indigenous status			0.010	0.875
Indigenous	56 (1.4)	110 (1.4)		
Non-indigenous	3946 (98.2)	7716 (98.2)		
Not stated/unknown	16 (0.4)	31 (0.4)		
ARIA classification			0.068	0.014
Inner regional Australia	362 (9.0)	849 (10.8)		
Major cities of Australia	3608 (89.8)	6922 (88.1)		
Outer regional Australia	48 (1.2)	86 (1.1)		
SEIFA quintile			0.136	<0.001
1 (lowest socioeconomic quintile)	908 (22.6)	1829 (23.3)		
2	746 (18.6)	1586 (20.2)		
3	778 (19.4)	1632 (20.8)		
4	864 (21.5)	1522 (19.4)		
5 (highest socioeconomic quintile)	722 (18.0)	1288 (16.4)		
Proportion of admitted cohort records in full cohort	71.9%	70.3%		
Proportion of cost cohort records in full cohort	85.7%	80.7%		

*Number and percentages are provided unless otherwise indicated.
†Queensland Health (QH) Statistical Services Branch (SSB) undertook the matching process on all decedents using age, sex, year of death, health service region and ICD-10-AM code for primary diagnosis of the last-known hospital admission. Data for the latter variable obtained from the Queensland Hospital Admitted Patient Data Collection were not able to be provided to the authors by QH SSB as a request for this data was not included in the original ethics approval. Subsequent to the matching process, ICD-10-AM coded cause of death data for all decedents were obtained from QH SSB and are included here as a further measure of balance between ACP and control cohorts.
‡Additional characteristics are available for the cohort that was admitted to the hospital within the last 6 months of life. These characteristics were not included in the matching process and are presented here as descriptive analyses only.
ACP, advance care planning; SMD, standardised mean difference; SoC, statement of choices; AHD, advance health directive; ARIA, Accessibility/Remoteness Index of Australia; SEIFA, Socio-Economic Indexes for Areas.

Hospital use

ACP decedents with documents uploaded ≥6 months prior to death, compared with matched control decedents, demonstrated significantly lower odds of ED presentations (aOR 0.90, 95% CI 0.81 to 1.00; 65.0% vs 68.5%), hospital admissions (aOR 0.83, 95% CI 0.74 to 0.92; 61.9% vs 67.6%), ICU admissions (aOR 0.23, 95% CI 0.10 to 0.48; 0.3% vs 1.3%) and in-hospital deaths (aOR 0.56, 95% CI 0.51 to 0.63; 38.4% vs 53.1%).

For ACP decedents with documents uploaded between 1 and 6 months, or less than 1 month, prior to death, similar reductions were seen in ICU admissions (aOR 0.39; 95% CI 0.20 to 0.71 and aOR 0.46; 95% CI 0.17 to 1.04 respectively) and in-hospital deaths (0.58; 95% CI 0.51 to 0.65 and 0.71; 95% CI 0.61 to 0.82) compared with controls, although the odds of ED presentations (1.41; 95% CI 1.23 to 1.61 and 1.74; 95% CI 1.47 to 2.06) and hospital admissions (1.57; 95% CI 1.36 to 1.81 and 1.74; 95% CI 1.47 to 2.08) were higher (table 2).

Hospital bed-days and costs

ACP decedents with a document uploaded ≥6 months prior to death demonstrated an adjusted mean reduction of $2337 (95% CI −$4222 to −$452) in total hospital costs with no difference in bed-days compared with matched controls (table 3). Decedents with an ACP uploaded between 1 and 6 months prior to death, relative to controls, incurred more bed-days (8.9; 95% CI 7.6 to 10.2) and total hospital costs (+$11 282; 95% CI 8770 to 13 793) than ACP decedents with uploads less than 1 month prior to death relative to controls (4.5; 95% CI 3.2 to 5.9 and +$5628; 95% CI 2700 to 8557 respectively).

Terminal admission outcomes

ACP decedents with documents uploaded prior to the terminal admission had significantly lower odds of ICU admission relative to controls during that admission (aOR 0.13, 95% CI 0.06 to 0.23; 0.7% vs 4.7%), and higher odds of the admission being classified as palliative care (aOR 1.98, 95% CI 1.72 to 2.27; 71.6% vs 57.0%, table 4). While there were no significant differences in length of stay, mean hospital costs for the ACP cohort were $3966 less (95% CI −$5487 to −$2444) than for controls.

Table 2 Hospital use outcomes

Outcomes	Proportion in ACP cohort (%)	Proportion in control cohort (%)	Unadjusted OR	Adjusted OR (95% CI)
ACP document uploaded ≥6 months prior to death (ACP=2507; Control=5014)				
ED presentation	65.0	68.5	0.85	0.90 (0.81 to 1.00)
Admitted to hospital	61.9	67.6	0.78	0.83 (0.74 to 0.92)
Admitted to ICU	0.3	1.3	0.21	0.23 (0.10 to 0.48)
Death in hospital	38.4	53.1	0.55	0.56 (0.51 to 0.63)
ACP document uploaded between 1 and <6 months prior to death (ACP=1792, Control=3584)				
ED presentation	76.3	70.2	2.35	1.41 (1.23 to 1.61)
Admitted to hospital	79.4	72.3	1.47	1.57 (1.36 to 1.81)
Admitted to ICU	0.7	1.8	0.37	0.39 (0.20 to 0.71)
Death in hospital	46.0	58.3	0.61	0.58 (0.51 to 0.65)
ACP document uploaded <1 month prior to death (ACP=1287, Control=2574)				
ED presentation	80.7	71.6	1.65	1.74 (1.47 to 2.06)
Admitted to hospital	81.2	72.9	1.61	1.74 (1.47 to 2.08)
Admitted to ICU	0.5	1.3	0.01	0.46 (0.17 to 1.04)
Death in hospital	52.1	71.6	0.72	0.71 (0.61 to 0.82)

ACP, advance care planning; aOR, adjusted OR; ED, emergency department; ICU, intensive care unit; LOS, length of stay.

Post-hoc analyses

Hospital outcomes within the subgroup of matched deaths from cancer, as well as the subgroup of matched deaths from diseases of the circulatory system, were consistent with the overall study findings. A full set of outcomes for these two subgroups is presented in eAppendix 7 in Supplement. ACP decedents with documents uploaded ≥6 months prior to death incurred $10 575 (95% CI −$12 458 to −$8691) less total hospital costs than ACP decedents with documents uploaded in the last month of life, but there was no significant difference in costs compared with ACP decedents with documents uploaded between 1 and 6 months. Notably, monthly costs continued to reduce numerically in the months immediately after ACP document upload (online supplemental figure 2 **in Supplement**).

DISCUSSION

Summary of findings

To our knowledge, this is the first population-level cohort study of the association between audited, standardised and digitally accessible ACP documents uploaded at varying time intervals prior to death and hospital use and costs over the last 6 months of life. Having an ACP document available 6 months or more prior to death was associated with fewer ED presentations, admissions to hospital or ICU, and in-hospital deaths, and lower hospital costs compared with having no ACP document available for the same period. In contrast, decedents with an ACP document uploaded <6 months prior to death demonstrated higher rates of hospital use and higher costs than controls, although ICU admissions and in-hospital deaths continued to be lower. While this observational study is unable to demonstrate causality, our findings suggest that more patient benefit and less hospital use and costs may accrue if ACP documents are completed proactively, with

Table 3 Hospital bed-day and cost outcomes

Outcomes	Mean ACP	Mean control	Adjusted mean difference (95% CI)
ACP document uploaded ≥6 months prior to death (ACP=1906, Control=3513)			
Hospital bed-days	13.4	10.9	−0.3 (−1.2 to 0.60)
ED cost ($)	1649	1565	115 (14 to 217)
Admissions cost ($)	16062	19203	−2405 (−4188 to −622)
Total costs ($)	17711	20768	−2290 (−4116 to −463)
ACP document uploaded between 1 and <6 months prior to death (ACP=1643, Control=3123)			
Hospital bed-days	21.86	13.06	8.9 (7.6 to 10.2)
ED cost ($)	2224	1687	549 (428 to 671)
Admissions cost ($)	35311	24380	11282 (8770 to 13 793)
Total costs ($)	37535	26067	11831 (9272 to 14 391)
ACP document uploaded less than 1 month prior to death (ACP=1238, Control=2384)			
Hospital bed-days	18.05	13.75	4.5 (3.2 to 5.9)
ED cost ($)	2079	1637	420 (292 to 548)
Admissions cost ($)	30798	26331	5208 (2331 to 8085)
Total costs ($)	32877	28010	5628 (2700 to 8557)

All costs in 2021 Australian dollars.
ACP, advance care planning; ED, emergency department.;

long lead times prior to death rather than reactively in response to more imminent death.

Comparisons with other studies

Our findings of less hospital use and fewer in-hospital deaths in patients undertaking ACP more than 6 months prior to death have been replicated in a US study of 650 patients with 1:1 matching and using adjusted differences-in-differences analyses over 12-month periods before ACP (with a matched control corresponding to the same period) and before death. Patients undergoing ACP compared with controls had fewer admissions (−0.37 per person), inpatient days (−3.66 days) and less Medicare costs (−$US9500), driven primarily by less inpatient utilisation.[42] In another US study of 237989 decedent Medicare beneficiaries subject to multivariable adjustment, patients with at least one billed ACP visit (6.3%, 14 986) which on average occurred 7 months before death experienced fewer hospitalisations (OR 0.77), ED visits (OR 0.77) or ICU stay (OR 0.78) within a month of death, and fewer died in hospital (OR 0.79), although mean expenditures were unchanged.[43] In contrast, a propensity score matched US study of 18484 seriously ill Medicare patients revealed a billed ACP encounter for 864 (4.7%) patients was associated with a higher likelihood of hospitalisation (incidence rate ratio (IRR) 1.37) and ICU admission (IRR 1.25) over the subsequent 6 months, and total medical costs were higher (per patient per month difference $US1,635), largely driven by hospital costs.[22] In another US study of 2394 selected decedents aged over 65 years, Medicare expenditures in the last 6 months of life had no association with ACP.[44] These discrepancies may relate to variability across jurisdictions in the frequency, intensity and processes of ACP, target populations, availability and cost of non-hospital care, and organisational and public attitudes towards ACP.

Table 4 Terminal admission outcomes*

	Proportion in ACP cohort (%)	Proportion in control cohort (%)	Unadjusted OR	Adjusted OR (95% CI)
Admitted to ICU	0.7	4.7	0.150	0.129 (0.065 to 0.231)
Palliative care admission	71.6	57.0	1.904	1.979 (1.725 to 2.274)
	Mean ACP	**Mean control**	**Unadjusted mean difference**	**Adjusted mean difference (95% CI)**
Hospital bed-days	6.20	6.51	−0.316	−0.383 (−0.999 to 0.233)
Admissions cost	9821	13572	−3751	−3966 (−5487 to −2444)

All costs in 2021 Australian dollars.
*ACP cohort (n=1509) vs control cohort (n=3823).
ACP, advance care planning; ICU, intensive care unit.

Our findings of increased hospital use and costs in patients undergoing ACP less than 6 months prior to death compared with controls are surprising, and not seen in other studies, although the exact timing of ACP prior to death was not reported. In a study in Hong Kong, 69 ACP patients with advanced cancer or end-stage organ failure, compared with 174 matched controls, had significantly fewer acute hospital admissions (0.78 vs 1.2 per person) and shorter length of stay (4.6 vs 7.5 days) over the last 3 months of life.[45] In a US population study involving 27711 patients with one or more chronic diseases, regression analyses showed patients undergoing ACP >30 days before death, except those with primarily renal disease, had significantly lower odds of hospitalisation and ICU admission in the last month of life.[22] We hypothesise that patients undergoing ACP might have become more aware of their likely clinical trajectory such that, when confronted by symptomatic deterioration or complications, more likely resorted to hospital care than less informed controls who were less sensitised to changes in their health status and who sought less hospital care. Also, patients and treating clinicians motivated to undergo ACP, compared with controls, may have stronger therapeutic relationships and be more aware of care options mutually perceived as being more reliably and quickly accessed by going to hospital.

Implications for clinical practice

Critics of ACP note that randomised trials of ACP have not reported reduced healthcare utilisation,[23] but these trials were methodologically limited because of recruitment bias,[46] small samples with inadequate power,[47] very low uptake and fidelity of ACP interventions,[48] fixed default care options in AHDs,[49] and primary outcome measures which did not include healthcare use.[50]

In our study, several system-level factors specific to the QH setting may explain the observed positive impacts of ACP on hospital use not seen in the randomised trials. First, the use of ACP in hospital practice and primary care was supported by whole of community education campaigns, use of skilled ACP facilitators, clinician access to ACP resources and templates, provision of patient information brochures, and embedment of end-of-life care frameworks that clearly defined clinician roles and responsibilities for ACP discussions.[29 51 52] Second, early patient engagement in ACP discussions was encouraged[53] by proactive identification of ACP-eligible patients using the 'Surprise' question[30] rather than waiting for patients to enter terminal phases. As a primary intent of ACP, this allowed time for iterative refinement of ACP documents which ensured ongoing ACP discussions remained relevant to patient needs and cognisant of important interpersonal relationships.[54] Third, within hospitals, ACP facilitators helped to initiate and progress early discussions with ACP-eligible patients and advised attending clinicians of ACP status and the need to finalise ACP discussions and review, complete and sign documentation. Fourth, a centralised process was in place to ensure valid, high-quality ACP documents were widely accessible when needed.[55 56] Finally, we ensured clinical care and patient wishes were aligned in confirming ACP as a high value activity[57] by auditing in-hospital care provided to patients with an uploaded SoC. One audit of 600 decedents demonstrated high concordance between preferred and actual place of death (79%) and between practice and preferences for CPR (100%) and life-prolonging treatments (99%) over the last 6 months of life.[58] Another showed similar concordance in care (79%, 100%, 97% respectively) for 198 patients over a 12-month period following SoC completion.[59]

Most studies of ACP analyse processes at the level of individual patient-clinician interactions. We could find only one other study featuring a standardised, proactive approach to ACP at the system level similar to ours: an 11-hospital US healthcare system which, from late 2019,

upgraded system-level capabilities and resources in ACP, revamped inpatient workflows for ACP, engaged outpatients in ACP, used ACP prompts and document uploads embedded in EMR and employed ACP facilitators.[60] Unfortunately, the COVID-19 pandemic disrupted the programme and no conclusive before-after results are available.

Strengths and Limitations

Study strengths include longitudinal analysis of standardised, patient-linked data on consecutive episodes of hospital care for almost 17 000 decedents. This large multisite study provides generalisable estimates of ACP effects on hospital utilisation, costs and place of death using a matched cohort design which compensates for the logistical difficulties of performing large randomised controlled trials, and where assigning patients to a no-ACP arm may be deemed unethical. Analysis of standardised hospital costing data afforded assessment of ACP-mediated hospital cost minimisation. Our SoC form satisfied all relevant documentation quality and accessibility criteria[61] and we described ACP processes and outcomes often missing in evaluation studies.[62]

There are also several limitations, in addition to the previously noted inability to establish causality between ACP and hospital use, cost and place of death. While we minimised selection bias by matching ACP and control decedents on available demographic and clinical variables, we could not access data to control for potentially important but unmeasured confounders such as clinical status and disease severity, frailty, comorbidity burden, and levels of psychosocial support. In addition, underlying differences in individual values and preferences may have influenced decisions by those in the control cohort to elect not to participate in ACP. Data on private hospital presentations were not available, although we suspect very little leakage of patients from the public hospital system. As our analyses were hospital focussed, utilisation and costs of non-hospital care were not ascertained, but other studies suggest hospital costs account for most expenditure.[7 22 42] Finally, some control decedents may have undergone ACP discussions and even completed ACP documents which were not uploaded electronically but which may still have informed care decisions.

In conclusion, we provide observational evidence that digitally accessible, standardised ACP documentation available prior to death is associated with reduced ICU admissions and in-hospital deaths over the last 6 months of life. Additional reductions in health service use and cost were associated with documents being available 6 months or more prior to death. Large-scale pragmatic randomised controlled trials are warranted to confirm causality of these associations.

Author affiliations
[1]School of Clinical Medicine, University of Queensland, Brisbane, Queensland, Australia
[2]Department of Internal Medicine and Clinical Epidemiology, Princess Alexandra Hospital, Brisbane, Queensland, Australia
[3]Statewide Office of Advance Care Planning, Metro South Hospital and Health Service, Woolloongabba, Queensland, Australia
[4]School of Medicine, Griffith University, Nathan, Queensland, Australia
[5]Queensland University of Technology, Brisbane, Queensland, Australia
[6]Australian Centre for Health Services Innovation, Queensland University of Technology Faculty of Health, Brisbane, Queensland, Australia

X Hannah Carter @Hannah_E_Carter

Contributors Concept and design: IS, LR, XS and HC. Acquisition, analysis or interpretation of data: LR, IS, XS and HC. Drafting of the manuscript: IS and HC. Critical revision of the manuscript for important intellectual content: LR, IS, XS and HC. Statistical analysis: HC and XS. Administrative, technical or material support: LR and IS. Supervision: IS and LR. HC is guarantor for this article, had access to all data and approved decision to publish.

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ORCID iDs
Ian Scott http://orcid.org/0000-0002-7596-0837
Hannah Carter http://orcid.org/0000-0002-0046-4126

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