Original Research

A quasi-experimental evaluation of an intervention to increase palliative medicine referral in the emergency department

Journal of Health Services Research & Policy
2019, Vol. 24(3) 155–163

DOI: 10.1177/1355819619839087
journals.sagepub.com/home/hsr
SAGE

Eoin Tiernan[1], John Ryan[2], Mary Casey[3], Aine Hale[4], Valerie O'Reilly[5], Millie Devenish[6], Barbara Whyte[6], Siobhan Hollingsworth[6], Olga Price[6], Ian Callanan[7], Declan Walsh[8,9], Charles Normand[10,11] and Peter May[12,13]

Abstract

Objective: To evaluate a new intervention intended to increase referral rates from the emergency department (ED) to the palliative medicine service (PMS) in acute hospitals.

Methods: We conducted a quasi-experimental evaluation in an urban teaching hospital in Dublin, Ireland. Data were collected over two eight-week periods in November/December 2013 and May/June 2015, with the PALliative Medicine in the Emergency Department (PAL.M.ED.™) intervention implemented in the intervening period. All adults who were admitted to the hospital via the ED during the two time periods and who received a palliative care consultation during their hospital stay were included in the study. Our primary analysis evaluated the impact of PAL.M.ED.™ on PMS referral in the ED. Our secondary analysis evaluated the impact of PMS referral in the ED on length of stay (LOS) and utilization, compared to PMS referral later in the admission. We controlled for observed confounding between groups using propensity scores.

Results: PAL.M.ED.™ was associated with an increase in PMS referral in the ED ($p < 0.005$; odds ratio: 10.5 (95%CI: 3.8 to 28.7)). PMS referral in the ED was associated with shorter hospital LOS ($p < 0.005$; −10.9 days (95%CI: −17.7 to −4.1)).

Conclusions: Low PMS referral rates in the ED, and the poor outcomes for patients and hospitals that arise from admissions of those with serious illness, may be mitigated by a proactive intervention to identify appropriate patients at admission.

Keywords

emergency department, length of stay, palliative care

[1]Consultant in Palliative Medicine, Department of Palliative Medicine, St. Vincent's University Hospital, Ireland
[2]Consultant in Emergency Medicine, St. Vincent's University Hospital, Ireland
[3]Research Assistant, SHO in Palliative Medicine, St. Vincent's University Hospital, Ireland
[4]Registrar in Palliative Medicine, St. Vincent's University Hospital, Ireland
[5]Locum Consultant in Palliative Medicine, Milford Hospice, Ireland
[6]Clinical Nurse Specialist in Palliative Care, St. Vincent's University Hospital, Ireland
[7]Clinical Audit Coordinator, St. Vincent's Healthcare Group, Ireland
[8]Chair, Department of Supportive Oncology, Levine Cancer Institute, Carolinas HealthCare System
[9]Professor of Medicine, Carolinas HealthCare System, Director, Center for Supportive Care and Survivorship, USA
[10]Edward Kennedy Professor of Health Policy & Management, Centre for Health Policy & Management, Trinity College Dublin, Ireland
[11]Professor in Health Economics, Cicely Saunders Institute Of Palliative Care, Policy & Rehabilitation, King's College London, UK
[12]Research Assistant Professor, Centre for Health Policy and Management, Trinity College Dublin, Ireland
[13]Visiting Research Fellow, The Irish Longitudinal study on Ageing, Trinity College Dublin, Ireland

Corresponding author:
Eoin Tiernan, Department of Palliative Medicine, St. Vincent's University Hospital, Dublin 4, Ireland.
Email: e.tiernan@svuh.ie

Introduction

Background

Acute hospital admission of people with serious chronic illness, frailty and functional impairment is a well-known international policy concern.[1] This population has frequent inpatient admissions that may be avoidable;[2] these are often associated with poor outcomes for patients and families, high costs, and worse hospital performance;[3] and many such admissions occur through the emergency department (ED),[4] making this a pivotal location for determining care trajectories.[5]

Palliative medicine services (PMS) for hospital inpatients with serious illness are increasingly common in both Europe and the United States,[6,7] and studies show that consultation teams can improve patient and family experiences and shorten length of stay (LOS),[8,9] with the greatest effect occurring if PMS services are made as soon as possible following admission.[10–12]

Despite recent growth in access to PMS, and recognition that the ED is an established first point of admission for many people with serious illness, palliative care integration with the ED is often poor, with significant barriers and challenges.[13–15] One US study at a large urban hospital found that while a majority (51%–62%) of PMS consultations are for patients admitted through the ED, only 3–6% of these consultations are initiated by ED staff, with referrals often coming days later.[16]

Importance

The international evidence base suggests there is scope for significant improvement in quality of care and patient experience, as well as a reduction in the avoidable utilization of hospital services, through improved integration of PMS and ED teams. Given this evidence, as well as low referral rates to palliative medicine in the EDs of Irish hospitals, the PALliative Medicine in the Emergency Department (PAL.M.ED.^{TM}) intervention was developed and implemented at an acute urban hospital in Ireland. The PAL.M.ED.^{TM} intervention, including the P.A.U.S.E.^{TM} tool, was conceived by the first author (ET), prompted by evolving international literature on palliative care in the ED and the impact of earlier referral during a hospital admission. Development of the intervention was also influenced by the model of direct medical specialty referral outlined in Ireland's Report of the National Acute Medicine Programme.[17]

Goals of this investigation

The primary objective of this study was to evaluate the impact of the PAL.M.ED.^{TM} intervention on palliative care referral in the ED, compared to later in the hospital admission, i.e. for a cohort of adults with palliative care needs who presented at the ED, was the intervention associated with any change in the rate of PMS referral in the ED? The secondary objective was to evaluate the association between a PMS referral from the ED and in-hospital utilization, including LOS and specific diagnostic tests, compared to a PMS referral subsequently in the admission.

We hypothesized that the intervention increased the likelihood of palliative care referral in the ED, and that referral from the ED was associated with reduced hospital LOS and ancillary utilization.

Methods

Study design and setting

This is a quasi-experimental before-and-after study design conducted at a single site over two eight-week periods in November/December 2013 and May/June 2015. The PAL.M.ED.^{TM} intervention was implemented between these time periods and the data for November/December 2013 were collected retrospectively.

St Vincent's University Hospital (SVUH) is a large urban academic hospital in south Dublin. Palliative care provision in Ireland is based on a national policy of universal access free at the point of use on the basis of need, including consultant-led services for hospital in-patients.[18] Studies evaluating access to and the impact of Irish palliative care are scant.[19]

The study received approval from the Clinical Audit Committee, St Vincent's Healthcare Group at the study site. The Audit Committee did not identify any ethical issues with the study. The lead author (ET) sent a copy of the study protocol to all the admitting medical and surgical teams in advance of the intervention study period, to make them aware of the study, and to offer them an opportunity to critique or opt out of the process, which no one did. Patients did not provide informed consent; all data were collected as a part of routine clinical practice.

Selection of participants

Patients were included in the study only if they presented in the ED at SVUH and subsequently received a consultation from the PMS during their admission. These eligibility criteria were chosen as all patients had the opportunity to receive our exposure of interest (a PMS consultation in the ED) and were deemed during their hospitalization to have palliative care needs (since all subsequently received a PMS consultation). Data

were recorded routinely and there were no missing data for any eligible person in any field used in this study. Patients admitted via the ED and seen by the PMS more than once over the two study periods were included for their first visit only.

PAL.M.ED.™ intervention

The PAL.M.ED.™ intervention, whose objective was to increase referral rates to the PMS from the ED, had four components:

1. **'Flagging' system**. Patients referred to the PMS during an admission to SVUH in the three years prior to the study period, and then discharged from hospital, had their records in the ED database 'flagged' so that, should they present to the ED at a later date, an alert would appear indicating that they were previously known to palliative care. A prompt encouraged the ED physician then to contact a member of the PMS to discuss the appropriateness of a consultation. A prior Irish hospital study found that only 57% of patients known to community palliative care services were referred to the hospital PMS on admission.[20] This can sometimes lead to patients previously known to the PMS having inappropriate investigations and interventions in the early stages of their admission.[21] Hospital-based palliative medicine consultations are typically initiated over a week into admission, rather than in the critical initial days when goals of care should be established.[16,22]
2. **Checklist.** A checklist 'P.A.U.S.E.'™ was developed to identify patients not previously known to the PMS in SVUH, but potentially appropriate for a referral to the service (see Figure 1). All ED staff were asked to refer to the checklist when admitting a patient. This tool, based on a synthesis of the key items from other tools, as well as the expert opinion of the project group members, was designed to be brief and easy to administer. A number of screening tools have previously been developed,[23] but most, for example SPEED,[24] are for use only with cancer patients. P.A.U.S.E.™ was developed for both cancer and non-malignant conditions.
3. **Proactive PMS engagement.** Each morning, a member of the PMS liaised with the ED team to screen for patients registered at the ED in the previous 24 h who might be appropriate for referral to palliative care. As well as the daily morning visit to the ED, the PMS were available to evaluate patients in the ED weekdays (7.30 a.m. to 5 p.m.) and weekends (9 a.m. to 4 p.m.), and provided telephone consultation outside of those hours. Visibility, ready availability and rapid response by the PMS have previously been identified as key to improving partnership between palliative medicine and ED services.[21]
4. **Education.** Training on palliative care and the PAL.M.ED.™ project, with particular focus on the introduction of the 'flagging' system and the P.A.U.S.E.™, was designed and delivered by the PMS to ED doctors and nurses through a series of interactive multi-disciplinary 1-h workshops. Topics covered included symptom management, communication and ethical challenges in end-of-life decision-making.

A PMS consultation consists of a multidisciplinary team led by a specialist consultant; the team typically integrates with existing management of patients with a life-limiting illness, providing expert guidance on pain and symptom management as well as engaging the patient and their families in goals-of-care discussions.[25]

Measurements

Data collected and data sources

Sociodemographic and clinical baseline data, and subsequent in-hospital utilization data, were collected on all patients in the study through a combination of chart review and database extraction:

- **Sociodemographics**: Age (years), gender, nationality (Irish/non-Irish), marital status (yes/no), living situation (alone/with another/in a nursing home), residence (Dublin city, Dublin county, other county), private insurance (yes/no), medical card to access hospital care and other health services free of charge (yes/no);
- **Clinical baseline data**: reason for ED admission (stratified into five categories by two palliative care consultants [ET & DW] following data collection), triage status (priority attributed by admitting staff in the ED on a scale of 1–4 where 1 designated low- and 4 designated high-priority), admitting specialty, primary diagnosis (record via patient notes and categorized by ET & DW), comorbidities (extracted from hospital database as ICD-10 codes, converted to the Charlson index[26] using Charlson command in Stata 12[27]), and whether the patient was previously known to palliative care services either in the community or at SVUH (yes/no);
- **Utilization data**: location of PMS consult (ED or elsewhere), hospital LOS, and numbers of computed tomography (CT) scans, magnetic resonance imaging (MRI) scans, ultrasounds, haematology

Table 1. Baseline variables by group following propensity score matching ($N = 141$).

		Primary analysis					Secondary analysis				
		Pre-intervention (n=57)		Post-intervention (n=84)		Absolute standardized difference (%)	Consult in ED (n=39)		Consult post-ED (n=92)		Absolute standardized difference (%)
		Mean	St. Dev	Mean	St. Dev		Mean	St. Dev	Mean	St. Dev	
Age	*Years*	72.4	20.0	71.7	15.4	4	69.4	19.7	69.3	15.3	1
Gender	*Female*	54%		57%		6	65%		63%		3
Married	*Yes*	46%		46%		0	46%		49%		6
Private insurance	*Yes*	31%		30%		2	34%		35%		1
Medical card	*Yes*	81%		81%		0	81%		82%		3
Reason for ED admission	*Cardiorespiratory*	28%		25%		6	22%		20%		3
	Neurocognitive	20%		20%		2	22%		22%		0
	Gastrointestinal	29%		32%		6	31%		35%		8
	Sepsis	18%		18%		0	18%		16%		6
	Musculoskeletal	6%		5%		3	6%		6%		1
Triage status	*1 to 4*	3.5	0.7	3.5	0.7	2	3.4	0.6	3.4	0.6	10
Primary diagnosis	*Cancer*	54%		54%		1	60%		63%		6
	Circulatory	11%		10%		6	12%		10%		4
	Respiratory	16%		18%		6	13%		12%		4
	Neurological	9%		11%		6	8%		8%		1
	Other	10%		8%		6	6%		6%		0
Comorbidities	*Charlson index*	4.4	3.5	4.3	3.4	4	4.3	3.2	4.5	3.6	6
Previously received PC	*Yes*	32%		31%		2	40%		45%		9

Medical cards provide free access to a General Practitioner, community health services, dental services, prescription medicine costs, hospital care and other benefits; access is provided on the basis of means and age; 38% of the population have a medical card including 89% of people over 70 years.[28]
St. Dev: standard deviation; ED: emergency department.

Table 2. Utilization measures for whole sample ($N = 141$).

	Mean	Median (25th–75th percentile)
LOS (days)	17.6	12 (6–22)
CT scans (#)	0.9	1 (0–1)
MRI scans (#)(#)	0.1	0 (0–0)
Ultrasounds	0.3	0 (0–0)
Haematology tests (#)	15.5	10 (4–18)
Biochemistry tests (#)	40.6	25 (9–51)
Microbiology tests (#)	4.4	2 (1–5)

LOS: length of stay.

tests, biochemistry tests and microbiology tests during admission.

Dependent and independent variables in analysis

In the primary analysis, the dependent variable is a binary variable: did the patient receive a PMS consultation in the ED compared to later in the admission? The main independent (exposure) variable is also binary: during which phase of data collection did the patient enter the hospital (pre-intervention or post-intervention)? Additional independent variables are all those in Table 1.

In the secondary analyses, the groups from pre- and post-intervention are pooled. The dependent variables are continuous utilization variables listed in Table 2: LOS, and numbers of specific investigative scans and tests. The main independent (exposure) variable is binary: did the patient receive a PMS consultation in the ED? Additional independent variables are all those in Table 1.

Analysis

Bias

In both primary and secondary analysis, the groups were balanced for observed confounders using propensity score weights.[29]All variables included in the propensity scores are listed in Table 1. These variables were chosen because they were hypothesized to be associated with outcome of interest, or both treatment and outcome.[30] The balance of the samples after propensity score weighting was evaluated using absolute standardized difference, where 10% is the rule of thumb for acceptable standardized difference,[31] as illustrated in

Table 3. Primary analysis: Estimated odds ratio of receiving a PC consult in the ED post-intervention (versus pre-intervention).

Outcome	Exposure	OR	*p* value	95% CI	
PMS in the ED	Post-intervention	10.5	<0.005	3.8	28.7

ED: emergency department; PMS: palliative medicine service.

Table 1. Additionally, propensity scores were evaluated for balance across the distribution of fitted values.

Statistical methods

For the primary analysis, we performed a multivariate logistic regression to estimate an odds ratio (OR) using 'location of first palliative care consultation' as the dependent variable and 'phase' as the primary independent variable (the first phase being prior to implementation of PAL.M.ED.^{TM}, and the second phase post-implementation). Additionally, we controlled for all baseline covariates in Table 1 and applied the weights.

Secondary analysis is concerned with evaluation of utilization outcomes. These outcomes for the whole sample are summarized in Table 2, using medians and interquartile ranges given skew typical to healthcare utilization data. Taking into account distribution characteristics of each outcome variable,[32] we evaluate exposure impact on outcome using a generalized linear model (gamma, log) for the LOS and tests, and a simple *t*-test for scans and ultrasounds.

Results

Characteristics of study patients

The final analytic sample size is 141 patients (Table 1), reflecting all eligible adults admitted during the designated study periods but excluding seven readmissions for patients already included in the study.

In the primary analysis, the intervention group comprised patients admitted in May/June 2015 (i.e. following the intervention, $n = 84$) and the comparison group comprised patients admitted in November/December 2013 (before the intervention, $n = 57$). These groups were balanced using propensity score weights and a comparison made of referral rates in the ED: for a cohort of patients who presented at the ED with palliative care needs, did the intervention increase the likelihood of a PMS referral in the ED?

In the secondary analysis, the sample ($N = 141$) was cross-tabulated so that the intervention group comprised patients who received the palliative care consult in the ED ($n = 49$) and the comparison group comprised patients who received their consultation subsequently ($n = 92$). These groups were balanced using propensity score weights and a comparison made of utilization during the admission: for a cohort of adults admitted through the ED with palliative care needs, did receipt of a palliative care consult in the ED impact LOS or ancillary utilization?

Outcome data

Summary statistics of utilization among the sample are provided in Table 2. Participants stayed on average 17.6 days in hospital.

Main results

The primary research question of this project is: what was the association between the intervention and rate of palliative care consultation initiated in the SVUH ED?

In the pre-intervention phase, 6 patients out of 57 (11%) received their first PMS consultation in the ED; in the post-intervention phase, this was 43 patients out of 84 (51%). The OR result is given in Table 3: patients admitted to SVUH through the ED who subsequently received a palliative care consultation during their hospitalization were 10.5 (95% CI: 4–29) times more likely to receive the first consult in the ED after the intervention than beforehand.

Secondary results

Results of the secondary analyses are presented in Table 4. These find that a PMS consult initiated in the ED (versus later in the hospital stay) is significantly associated with reduced LOS ($p < 0.005$; −10.9 days (95%CI: −17.7 to −4.1)), fewer haematology tests ($p < 0.005$; −9.8 (95%CI: −15.6 to −4.0)), fewer biochemical tests ($p < 0.005$; −30.0 (95%CI: −50.5 to −9.6)), fewer microbiology tests ($p < 0.005$; −3.2 (95%CI: −5.0 to −1.4)) and fewer CT scans ($p = 0.03$; −0.4 (95%CI: −0.7 to 0)). There is no statistically significant association with number of MRI scans or ultrasounds.

Sensitivity analyses

Estimates of associations with in-hospital utilization using observational data are vulnerable to a number of potential biases. Results may be sensitive to right-hand skew and outliers,[32] use of propensity scores,[33]

Table 4. Secondary analyses: Estimated mean effect on utilization of a PMS consult in the ED (vs. PMS consult later).

Utilisation outcome	Treatment effect	*p* value	95% CI	
LOS (days)	−10.9	<0.005	−17.7	−4.1
CT scans (#)	−0.4	0.03	−0.7	0.0
MRI scans (#)(#)	−0.1	0.06	−0.3	0.0
Ultrasounds	−0.1	0.29	−0.3	0.1
Haematology tests (#)	−9.8	<0.005	−15.6	−4.0
Biochemistry tests (#)	−30.0	<0.005	−50.5	−9.6
Microbiology tests (#)	−3.2	<0.005	−5.0	−1.4

ED: emergency department; PMS: palliative medicine service; LOS: length of stay.

and choice of modelling approach.[34] To assess the robustness of our results in Table 4, we re-ran the analyses with the sample trimmed at 95% on the LOS distribution, propensity score weights omitted and alternate modelling approach. Results for LOS and tests did not change substantively; the estimate for CT scans was not statistically significant in any sensitivity analysis. See Appendix 1 (online supplement) for details.

Discussion

Key results

The introduction of a four-part intervention, PAL.M.ED.™, was associated with a significant increase in early referral to a hospital PMS from within the ED. An ED referral was also found to be associated with significantly lower in-hospital utilization, including reduced LOS, compared to subsequent referral.

These results highlight the scope to improve relatively simply the integration between ED and PMS in acute hospitals, as well as some of the benefits of improved integration. International evidence suggests that such improvements are widely needed. The ED is the gateway and point of entry for triage for the majority of patients admitted to acute hospitals, and many patients with serious and life-limiting illness attend the ED because of worsening symptoms that have been inadequately addressed in an outpatient setting.[16] However, palliative care referral rates in the ED remain low and if referral does not occur in the ED, it may be delayed until days into the admission.[5,10,13–16,28,35] Palliative medicine review in the ED offers an opportunity to redirect the focus of care and re-evaluate goals of care, when appropriate.[35] In addition to the impact on in-hospital utilization reported in our secondary analysis, increased PMS involvement in the ED may result in increased referral to hospice, improved patient and family satisfaction, less utilization of intensive care and cost-savings.[37–39]

The most significant impact of the earlier referrals to the PMS was the reduction in mean LOS. The estimated magnitude of reduction is larger than that reported by a prior US study.[28] While the specific magnitude of estimated effect may be sensitive to outliers in our small-sample study, the LOS results we report are substantively unaffected by sensitivity analyses that exclude outliers. Our study also found that early referral to the PMS resulted in lower utilization of laboratory investigations and CT scans. These results are consistent with recent evidence that for a given hospital admission, earlier palliative care consultation is systematically associated with larger impact on utilization including LOS.[11]

Limitations

This is an observational study in which exposure assignation for each specific patient was not under investigator control. Reported results could therefore arise due to unobserved confounders associated with both treatment and outcome and not controlled for in our analyses.[39] It is possible that exogenous events within the wider hospital or health system context during the study period may have biased our analyses, e.g. increased incentives to refer to palliative care or to discharge seriously-ill inpatients. However, the research team was aware of this risk throughout the study and is unaware of any such changes in external influence. We have controlled for observed confounding using propensity scores, a well-established method in health services research on hospital palliative care.[30]

This study was conducted in a large urban university teaching hospital in Ireland with a well-established PMS. Results may not be generalizable to other settings and health systems, although it is notable that the background and rationale for our study are consistent with the national and international literature on PMS in the ED.[5,10,13–16,20,35,36,41] An additional strength is that the tool is applied to all patients with cancer and non-cancer diagnoses alike.

PAL.M.ED.™ represents a complex intervention, with four distinct though inter-related elements, namely, (i) the 'flagging' system, (ii) the P.A.U.S.E.™ checklist, (iii) proactive PMS engagement with the ED, and (iv) the education programme delivered to ED doctors and nurses. As such, it is not possible to determine to what extent the individual elements of PAL.M.ED.™ contributed to the overall outcomes. Further work would be required to isolate the effects of the individual elements, and determine their relative impact. This work should include validation of the P.A.

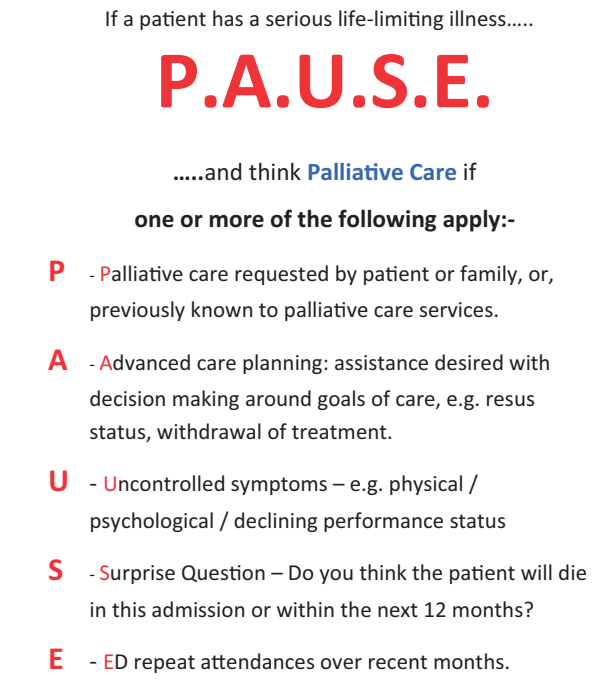

Figure 1. P.A.U.S.E. checklist.

U.S.E.™ tool, which was conceived and developed for use in this study, and analysis of adherence to the intervention over time. Utilizing the framework developed by the Medical Research Council for implementation of complex interventions would assist in deconstructing the individual component parts and refining the intervention further through piloting and modelling. Incorporation of a qualitative component to capture individual patient and family experience would further strengthen the design. Qualitative feedback from the ED physicians and nurses suggested that improved access to the PMS and a daily visit by a member of the PMS team were possibly the most valued element of the PAL.M.ED.™ intervention.

This study does not evaluate the impact of early PMS referral on patient outcomes. Reported impacts on in-hospital utilization, including shorter LOS, are therefore taken to be beneficial only on an assumption of treatment non-inferiority – i.e. outcomes are at least as good for patients who received a PMS in the ED as those who received one later.[39,42] While reduced LOS and associated utilization imply lower cost of hospital stay, meeting increased demand for PMS staff will require additional resources and any savings must be offset against these additional costs. The two phases of data collection were at different times of the year, which may have increased the risk of bias. Pre-intervention data (November/December 2013) were collected retrospectively at the outset of the project in 2014, while the protocol was developed and the training programme implemented. Post-intervention data (May/June 2015) were collected once all components of the PAL.M.ED.™ intervention had been implemented. This is a small-sample study in which specific treatment effect estimates may be sensitive to analytical approach and outliers. However, sensitivity analysis excluding high-utilization outliers, employing alternative modelling approaches and checking results without propensity scores did not substantively impact our main findings.

Generalizability

This is a small study, and it will be important to replicate the approach in more hospitals and in different health care systems. However, we report a setting that is typical of most European hospitals that offer services free at the point of use, and it is common for hospitals in Europe to face the problem of overuse of ED services by frail elderly people. We therefore consider that our results will be of relevance to international practice, albeit specifics of the reported approach may have to be altered and validated to meet local circumstances.

Conclusions

A four-part intervention resulted in a significant increase in referral to a hospital PMS from within the ED. Referral from the ED was also found to be associated with significantly lower in-hospital utilization, including reduced LOS, compared to referral subsequently during the admission. At a time when health systems internationally are trying to manage high numbers of burdensome, often avoidable hospital admissions among seriously-ill older adults, the PAL.M.ED.™ intervention offers scope to improve care and reduce hospital costs for adults with serious illness admitted via the ED.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics approval and consent to participate

The study received approval from the Clinical Audit Committee, St Vincent's Healthcare Group at the study site. The Audit Committee did not identify any ethical issues with the study. Patients did not provide informed consent; all data were collected as a part of routine clinical practice and anonymity measures were taken throughout the study.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The study was sponsored by the Palliative Care and Emergency Medicine National Clinical Programmes, and funded by the Irish Hospice Foundation. All authors are independent of the study sponsors and the views expressed in this article are those of the authors.

ORCID iD

Peter May http://orcid.org/0000-0001-8501-6500

References

1. Organisation for Economic Co-operation and development. Avoidable hospital admissions. *Health at a Glance*, www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2017/avoidable-hospital-admissions_health_glance-2017-31-en (2017, accessed 9 March 2019).
2. Fingar KR, Barrett ML, Elixhauser A, et al. *Trends in potentially preventable inpatient hospital admissions and emergency department visits*. Rockville, MD: H-CUP/AHRQ, 2015.
3. Lehnert T, Heider D, Leicht H, et al. Review: health care utilization and costs of elderly persons with multiple chronic conditions. *Med Care Res Rev* 2011; 68: 387–420.
4. Latham LP and Ackroyd-Stolarz S. Emergency department utilization by older adults: a descriptive study. *Canad Geriatr J* 2014; 17: 118–125.
5. Mierendorf SM and Gidvani V. Palliative care in the emergency department. *Perm J* 2014; 18: 77–85.
6. Centeno C, Lynch T, Donea O, et al. *EAPC atlas of palliative care in Europe*. Milan: European Association of Palliative Care, 2013.
7. Morrison RS. Models of palliative care delivery in the United States. *Curr Opin Support Palliat Care* 2013; 7: 201–206.
8. El-Jawahri A, Greer JA and Temel JS. Does palliative care improve outcomes for patients with incurable illness? A review of the evidence. *J Support Oncol* 2011; 9: 87–94.
9. May P, Normand C, Cassel JB, et al. Economics of palliative care for hospitalized adults with serious illness: a meta-analysis. *JAMA Intern Med* 2018; 178: 820–829.
10. Delgado-Guay MO, Rodriguez-Nunez A, Shin SH, C, et al. Characteristics and outcomes of patients with advanced cancer evaluated by a palliative care team at an emergency center. A retrospective study. *Support Care Cancer* 2016; 24: 2287–2295.
11. May P, Garrido MM, Cassel JB, et al. Prospective cohort study of hospital palliative care teams for inpatients with advanced cancer: earlier consultation is associated with larger cost-saving effect. *J Clin Oncol* 2015; 33: 2745–2752.
12. May P and Normand C. Analyzing the impact of palliative care interventions on cost of hospitalization: practical guidance for choice of dependent variable. *J Pain Symptom Manage* 2016; 52: 100–106.
13. Kistler EA, Sean Morrison R, Richardson LD, et al. Emergency department-triggered palliative care in advanced cancer: proof of concept. *Acad Emerg Med* 2015; 22: 237–239.
14. Quest TE, Asplin BR, Cairns CB, et al. Research priorities for palliative and end-of-life care in the emergency setting. *Acad Emerg Med* 2011; 18: e70–e76.
15. Elsayem AF, Elzubeir HE, Brock PA, et al. Integrating palliative care in oncologic emergency departments: challenges and opportunities. *World J Clin Oncol* 2016; 7: 227–233.
16. Grudzen CR, Hwang U, Cohen JA, et al. Characteristics of emergency department patients who receive a palliative care consultation. *J Palliat Med* 2012; 15: 396–399.
17. Health Service Executive. *Report of the national acute medicine programme*. Dublin: HSE, 2010.
18. National Advisory Committee on Palliative Care. *The report of the National Advisory Committee on Palliative Care*. Dublin: Department of Health and Children, Author, 2001.
19. Kane PM, Daveson BA, Ryan K, et al. The need for palliative care in Ireland: a population-based estimate of palliative care using routine mortality data, inclusive of nonmalignant conditions. *J Pain Symptom Manage* 2015; 49(4): 726–733.e1.
20. Wallace EM and Tiernan E. Referral patterns of non-malignant patients to an Irish specialist palliative medicine service. *Am J Hosp Palliat Care* 2013; 30: 399–402.
21. Meier DE and Beresford L. Fast response is key to partnering with the emergency department. *J Palliat Med* 2007; 10: 641–645.
22. Osta BE, Palmer JL, Paraskevopoulos T, et al. Interval between first palliative care consult and death in patients diagnosed with advanced cancer at a comprehensive cancer center. *J Palliat Med* 2008; 11: 51–57.
23. George N, Phillips E, Zaurova M, et al. Palliative care screening and assessment in the emergency department: a systematic review. *J Pain Symptom Manage* 2016; 51: 108–119.e2.
24. Richards CT, Gisondi MA, Chang CH, et al. Palliative care symptom assessment for patients with cancer in the emergency department: validation of the Screen for Palliative and End-of-life care needs in the Emergency Department instrument. *J Palliat Med* 2011; 14: 757–764.
25. The Joint Commission. *Facts about the advanced certification program for palliative care*. Washington, DC, www.jointcommission.org/facts_about_palliative_care/ (2016, accessed 9 March 2019).
26. Charlson ME, Pompei P, Ales KL, et al. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987; 40: 373–383.
27. Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care* 2005; 43: 1130–1139.
28. Department of Health. Health in Ireland: Key Trends in 2015. Dublin. Available at: https://health.gov.ie/wp-content/uploads/2015/12/Health_in_Ireland_KeyTrends2015.pdf (accessed 20 June 2019).
29. Rubin DB. The design versus the analysis of observational studies for causal effects: parallels with the design of randomized trials. *Statist Med* 2007; 26: 20–36.

30. Garrido MM. Propensity scores: a practical method for assessing treatment effects in pain and symptom management research. *J Pain Symptom Manage* 2014; 48: 711–718.
31. Austin PC. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. *Statist Med* 2009; 28: 3083–3107.
32. Jones AM. *Models for health care*. York: Health Economics and Data Group, University of York, 2010.
33. Brooks JM and Ohsfeldt RL. Squeezing the balloon: propensity scores and unmeasured covariate balance. *Health Serv Res* 2013; 48: 1487–1507.
34. Jones AM, Rice N, Bago d'Uva T, et al. *Applied health economics*. 2nd ed. Oxford: Routledge, 2013.
35. Wu FM, Newman JM, Lasher A, et al. Effects of initiating palliative care consultation in the emergency department on inpatient length of stay. *J Palliat Med* 2013; 16: 1362–1367.
36. Lukin W, Douglas C and O'Connor A. Palliative care in the emergency department: an oxymoron or just good medicine? *Emerg Med Austral* 2012; 24: 102–104.
37. Higginson IJ and Evans CJ. What is the evidence that palliative care teams improve outcomes for cancer patients and their families? *Cancer J* 2010; 16: 423–435.
38. May P, Garrido MM, Aldridge MD, et al. Prospective cohort study of hospitalized adults with advanced cancer: associations between complications, comorbidity, and utilization. *J Hosp Med* 2017; 12: 407–413.
39. Johnston BM, Normand C and May P. Economics of palliative care: measuring the full value of an intervention. *J Palliat Med* 2017; 20: 222–224.
40. May P, Garrido MM, Cassel JB, et al. Using length of stay to control for unobserved heterogeneity when estimating treatment effect on hospital costs with observational data: issues of reliability, robustness and usefulness. *Health Serv Res* 2016; 51: 2020–2043.
41. Gardiner C, Gott M, Ingleton C, et al. Extent of palliative care need in the acute hospital setting: a survey of two acute hospitals in the UK. *Palliat Med* 2013; 27: 76–83.
42. May P and Cassel JB. Economic outcomes in palliative and end-of-life care: current state of affairs. *Ann Palliat Med* 2018; 7: S244–S2S8.