Cost impact of introducing a treatment escalation/limitation plan during patients' last hospital admission before death

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Running title: Cost impact of TELP

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ABSTRACT

Objective

A recent study found the use of a treatment escalation / limitation plan (TELP) was associated with a significant reduction in non-beneficial interventions (NBIs) and harms in patients admitted acutely who subsequently died. We quantify the economic benefit of the use a TELP.

Design

NBIs were micro-costed. Mean costs for patients with a TELP were compared to patients without a TELP using generalised linear model regression, and results were extrapolated to the Scottish population.

Setting

Medical, surgical and intensive care units of district general hospital in Scotland, UK.

Participants

287 consecutive patients who died over three months in 2017. Of these, death was 'expected' in 245 (85.4%) using Gold Standards Framework criteria.

Intervention

Treatment escalation / limitation plan

Main Outcome Measure

Between group difference in estimated mean cost of NBIs.

Results

The group with a TELP (n=152) had a mean reduction in hospital costs due to NBIs of GB £220.29 (US \$281.97) compared to those without a TELP (n=132) (95% confidence intervals GB £323.31 (US \$413.84) to GB £117.27 (US \$150.11), $p=<0.001$). Assuming that a TELP could be put in place for all expected deaths in Scottish hospitals the potential annual saving would be GB £2.4 million (US \$3.1 million) from having a TELP in place for all ‘expected’ deaths in hospital.

Conclusions

The use of a TELP in an acute hospital setting may result in a reduction in costs attributable to NBIs.

KEY WORDS

Treatment escalation plan, advance care planning, cost savings, futile treatment

INTRODUCTION

Life expectancy over the last 50 years has increased significantly in almost all Western countries. New and often expensive medical treatments have contributed to the demographic changes. However, as a corollary, the number of people living and dying with multiple long-term conditions is increasing. In Scotland, 64.9% of people aged 65-84 have more than one significant health condition [1] and during the last 2-3 years of life, any or all of these conditions often result in hospital admission.

These trends have major resource implications [2]. In OECD countries between 11% and 25% of overall health expenditure is devoted to patients who are in the last 3 years of life [3]. In certain circumstances the overall costs are much greater [4]. These costs would be justified if the quality of end-of-life care is improved or meaningful recovery is achieved. But this is frequently not the case. Again, in Scotland, nearly 30% of patients in acute hospitals are likely to be in the last year of life [5]. In these circumstances, interventions aimed at "cure" may be inappropriate [6,7]. In a systematic review, comprising data from 38 studies in 1.2 million patients, Cardona-Morrrell *et al.* [8] found that 33%-38% of treatments given in hospital to patients in the last 12 months of life were non-beneficial.

The interventions are also costly. In three Australian hospitals, the estimated annual cost of non-beneficial treatments to such patients was AUS $12.4 million (US $9.7 million), equivalent to AUS $153.1 million (US $119.4 million) if extrapolated across Australia [9].

Futile treatments - in the sense that they offer no prospect of preventing death and/or achieving alleviation of symptoms - are not only costly and wasteful, they are likely to result in harms [10]. Avedis Donabedian (1919-2000) highlighted that the relative risk of medical harms increases with regard to whether an intervention is necessary, appropriate, inappropriate or futile [11]. For example, continuing antibiotic treatment after it has been determined that a patient is terminally ill may result in diarrhoea as a side effect. This is likely to cause distress to a dying patient without providing any benefit, and is therefore inappropriate or even futile.

Harms associated with futile interventions are not limited to pathophysiological effects e.g. nausea, diarrhoea. In patients at risk of dying, they include delayed introduction of palliative treatments and reduced quality of care while dying [12,13]. Further, in one study there was an inverse relationship between the costs incurred during patients' last admission and the quality of end-of life care they received as judged by a deceased patient's next of kin [13].

Decisions about what is appropriate or inappropriate are based on realistic goals of treatment by considering illness trajectory and prognosis, the risk of harms as well as potential benefits, and patient preferences [6]. The last of these are increasingly identified as important [14], especially given that patients often receive aggressive treatment that is not what they or their families would have chosen [,8,13]. In hospital, particularly among patients who are unstable or at risk of dying, care should be consistent with the agreed goals of treatment and should also be well communicated. This is the aim of a Treatment Escalation and Limitation Plan (TELP).

A recent study reported the impact of a TELP on quality of care in patients at the end of life [15]. This study compared the rates of non-beneficial interventions (NBIs) and harms among patients provided with both a TELP and a DNACPR order (Do Not Attempt Cardiopulmonary Resuscitation) with those who had a DNACPR order only or neither a TELP nor a DNACPR order. The rates of NBIs and harms (per 1000 bed days) were significantly lower in the TELP group: NBIs: 27.4, 92.1 (p<0.001), and 172.4 (p<0.001) respectively; harms: 17.1, 76.9 (p<0.001) and 197.8 (p<0.001) respectively.

Our aim was to extend the scope of the previous study [15] to estimate the economic impact of using the TELP.

METHODS

Data collection

Data were obtained from 287 consecutive patients admitted acutely between February and May 2017 to University Hospital Hairmyres, and who died during that hospital admission. A detailed retrospective case note review for each case was undertaken by a team of four clinicians, each with experience in undertaking mortality case-note reviews, using an adaptation of the Structured Judgement Review Method (SJRM) used in the National Mortality Case Record Review Programme [16].

The principal outcomes in the first study analysis were non-beneficial interventions (NBIs) and harms [15]. An NBI was defined as 'a treatment undertaken or continued with the intention of stabilising or reversing the patient's clinical status but failing to do so'. Palliative care or any treatment undertaken to improve the comfort of the patient was excluded from the definition of NBI. Harms were defined as 'an identifiable event resulting from treatment overuse or underuse, or where the potential benefits of an intervention were significantly outweighed by detriment'. However, although data for both NBIs and harms are provided in the original report [15], only the costs of NBIs were explored in the present study as quantification of the costs or quality of life impact of the harms was not possible with the data from the underlying clinical study [15].

Cost determination

We adopted a UK healthcare perspective in the analysis i.e. costs incurred by the UK national health and social services are included. This is in line with the method adopted by the National Institute for Health and Care Excellence [17]. The NBIs identified were micro-costed at an individual patient level using publicly available data in the UK. These are set out in Table 1.

For antibiotics and superfluous drugs, case records were interrogated to identify the drug name and the duration of treatment. Dose estimates were based on information from the Indications and Doses section of British National Formulary [18]. Intravenous or injection formulations were assumed unless the reviewed data indicated otherwise. Where a weight estimate was required, 70kg was used.

The daily cost for patient care in a hospital ward, high dependency unit (HDU) and Intensive Care Unit (ICU) are publicly available for University Hospital Hairmyres [19]. Where patient care involved a greater level of surveillance and care within the same ward (ward escalation), we costed this at the midway point between the daily cost for ward care and the daily cost for HDU care. Similarly, when the reviewer judged that a patient was *inappropriately* moved (escalated) from a ward setting to the HDU or ICU, the cost ascribed was the difference between the daily HDU or ICU cost and cost of one day on a general ward. The number of days of escalation was extracted from individual patient records. We did not apply the daily cost of routine ward care, thus making an implicit assumption that it was appropriate for all patients to be in hospital for the full period from admission to death. All cost estimates were based on 2017-2018 prices (Supplementary Appendix – Table A1).

[Table 1 here]

Statistical analyses

Analysis was undertaken in Stata 16. Comparisons were made between two groups. Group 1 comprised patients with both a TELP and a DNACPR order. Group 2 comprised patients who did not have a TELP: they had either a DNACPR order only or neither a TELP nor a DNACPR. Patients with neither TELP or DNACPR comprised only 7% of the sample so it was not feasible to include them as a separate group in the analysis.

The mean cost per patient was calculated for each Group and the means were compared using generalised linear model (glm) regression which is well adapted to modelling cost data [20]. Distribution of the data was tested using a modified Park Test [20,21] and a gamma distribution was found to be appropriate. The difference between the Groups was estimated using the 'compare margins' command in Stata 16 which predicts a mean value, whilst holding other independent variables at mean values. Adjustment was made for age at death, sex and length of stay between admission and death. The code for the modified Park test and the glm regression is included in the Supplementary Appendix.

Extrapolation

We calculated an estimate for maximum potential cost savings nationally if all patients who died an 'expected' death in hospital in Scotland had a TELP and DNACPR. An 'expected' (as opposed to an 'unexpected' death) was determined by the reviewers as 'likely to die within the next 12 months' using a modification of the Gold Standard Framework (GSF) Prognostic Indicator Guidance (PIG) and based on clinical information available on the day of admission [22].

The proportion of deaths that were 'expected' (85.5%) as reported by Lightbody et al. [15] was assumed to represent the likely proportion of 'expected' deaths in all other Scottish hospitals. It was assumed that TELPs could be put in place for all expected deaths. Similarly, it was assumed that the effect of introducing a TELP and the proportion of patients who would be given a TELP (53%) across all Scottish hospitals would be in keeping with the proportion found in the Lightbody et al. study [15]. These are strong assumptions and, accordingly, the extrapolated estimate should be treated with caution. Data for the proportion of all deaths which took place in hospitals in Scotland in 2016 was obtained from Finucane et al. [23]. It was assumed that this proportion remained similar for 2018.

Ethics

Data collection for the original study was approved by the NHS Lanarkshire Quality Improvement department. All data were anonymised. NHS Lanarkshire and the University of Glasgow both confirmed that ethical approval was not required for the economic analysis.

RESULTS

The characteristics of the patients in the two study groups are set out in Table 2. The number of days from admission to death was significantly greater for Group 1 patients than for Group 2 (p=0.001). This does not affect our quantification of the difference in cost between the patients as only inappropriate days of ward escalation or ICU care were costed and length of stay was adjusted for in the statistical analysis. In Group 1 patients with "expected" deaths (n=141), the TELP was endorsed a mean of 11.3 days (Standard Deviation (SD) 19.4) after admission and 7.9 days (SD 10.7) prior to death. In Groups 1 and 2 combined (n=234), DNACPR was documented on average 5.5 days (SD 11.1) after admission and 11.5 days (SD 19.6) prior to death.

[Table 2 here]

Table 3 shows NBIs per group given as a rate per 100 admissions and as a rate per 1000 bed days. In all cases the difference between Groups measured by the chi-squared statistic was significant at the 95% level, indicating that there were fewer NBIs in the Group with a TELP.

The unadjusted mean cost of NBIs per patient is shown in Table 2. The adjusted figures (age at death, sex, and length of stay prior to death) are shown in Table 3. The between-group difference in mean cost per patient was GB £220.29 (95% Confidence Intervals (C.I.) 323.31 to 117.27, p<0.001). This means that on average having a TELP resulted in a saving per patient of GB £220. The corresponding figures in US$ are: between-group difference in mean cost per patient US $281.97 (95% C.I. 413.84 to 150.11).

[Table 3 here]

Table 4 sets out a calculation of the maximum potential savings which might accrue if TELPs were introduced to all hospitals in Scotland. With the strong assumptions noted in the Methods section, the estimated annual saving by reducing NBIs would be GB £2.4 million (US $3.1 million). A table including more detail on the calculation of the estimate is included in the Supplementary Appendix.

[Table 4 here]

DISCUSSION

In this study, we found that the use of a TELP (along with a DNACPR order) compared to DNACPR alone or neither TELP or DNACPR resulted in a per-patient saving of just over GB £220 (US $282) in the mean cost attributable to NBIs during the hospital admission prior to their death. The magnitude of the savings that we identified is smaller than those identified elsewhere in the literature [13,24]. We believe this is at least partly due to the costing methodology used.

Cost savings attributable to the use of Advance Care Plans reported in a systematic review by Klingler et al. [25] varied from US $1,041 to US $64,827 per patient. In this study, we costed aspects of care judged to be non-beneficial but did not include the cost of hospitalisation itself. This is because our intervention is a hospital-based intervention which would not impact whether the patient was in hospital or not, but should impact on his or her treatment in hospital.

Our figures do not take account of any additional savings that might be associated with the reduction in medical harms that was also reported for these patients nor is any value placed on the improvement in quality of life which is likely to improve through the use of a TELP [15]. Although the primary aim of using a TELP is to improve quality of care in patients who are unstable and/or at risk of dying, and this goal is achieved by reducing actual NBIs *and* harms [15], the potential cost savings is also an important secondary consideration.

We estimated that, if applied across the 25 acute hospitals in Scotland, the use of a TELP would have the potential to result in annual saving of GB £2.4 million (US $3.1 million). However, this estimate must be approached with caution. It is based on the generalisability of a local experience in which there was a substantial TELP training programme for staff across the hospital. The cost of implementing the TELP would need to be considered in any prospective cost-effectiveness study. At present, TELPs are used in only a proportion of Scottish hospitals. Moreover, the characteristics of the patients we studied, namely that they all died and in 85% of cases the death was 'expected', means that the same savings may not be available for patients for whom the anticipated illness trajectory and goals of treatment are different.

Numerous studies have explored the relationship between Advance Care Planning and the costs of end-of-life care [26-28] including systematic reviews [25,29]. The results have been mixed. Several have reported that there are no significant cost savings [30,31], although none has reported that costs actually increase. Whereas Klingler et al. [25] identified seven studies that assessed advanced care planning on costs of care - of which six reported reductions in costs - Dixon et al. concluded that among 18 studies, there were none whose design could be considered adequate in determining cost-effectiveness [29]. Dixon summarised by saying that Advance Care Planning appears to be associated with savings for 'some people in some circumstances'.

There are many variables that perhaps explain the different between-study conclusions. In the literature Advance Directives are not distinguished from Advance Care Plans (ACPs), but they ought to be: they are not the same thing [30]. The ACP setting – home [32], nursing home [33] and hospital [13]; the nature and intention of end-of-life discussions - alone or directed towards completing an ACP [13,28]; the duration of follow-up; and the personnel involved when discussing the contents of a Plan [34], all vary substantially in the reviewed studies. They underscore that Advance Care Planning is a complex intervention with multiple measurable outcomes.

The TELP is a specific type of ACP, is used in a hospital setting and, in our study was applied over a mean interval of only 7.9 days (which is the difference between the TELP being put in place and the date of death). With this in mind, comparisons with the study by Zhang et al. seems most relevant [13]. In that study, the intervention was an "end-of-life discussion" not a TELP and its effects were measured over the last week of life. Significant cost savings were achieved. In our own practice, staff are trained and encouraged to engage in such conversations as an integral precursor to completing a TELP.

Strengths of this study

Our study adds meaningfully to a small body of evidence exploring the cost of NBIs at the end of life and the potential impact of a TELP in avoiding these costs. It adds weight to the existing outcomes i.e. that using a TELP significantly reduces the frequency of NBIs and harms. The study was based on a detailed review of individual case records by experienced clinicians using the Structured Judgement Review method [16] and costs were added at patient-level using a micro-costing approach.

Limitations of the study

This was a retrospective observational study and patients were not randomised. It is possible that there may be differences in clinical characteristics and management that were not detected but may account for the reduced costs of NBIs in Group 1. Moreover, Groups 1 and 2 differed significantly in their length of stay (the period between admission and death). A longer length of stay increases the potential for NBIs given that the patient is in hospital for a longer period of time. Analyses were adjusted to take this into account. It is also possible that group allocation was impacted by length of stay as a longer stay provided more opportunity for a TELP to be put in place. It may also indicate that the patients in the groups with and without TELP had different clinical characteristics. It is worth noting that the length of stay was longer in the group with TELP who also had the least NBIs (over the full length of stay). The economic impact of harms was not included as an outcome of interest in the present study because categorising and costing harms is not possible using only hospital case records. Capturing costs and valuing the quality of life decrements caused by harms would have required a prospective study using research tools designed to evaluate these aspects more accurately. However, it should be noted that the level of harms in patients with a TELP were significantly lower than in the groups with DNACPR only or with neither TELP nor DNACPR [15]. This means that the inclusion of harms in the between-group comparisons would likely have resulted in a greater difference in favour of TELP. Finally, as the sample in this study was taken from one district general hospital during a four-month period over winter and spring 2017, the extent to which our results are generalisable to other time periods or health-care settings or populations is not known.

Conclusions

This study has shown that the introduction of a TELP to medical and surgical wards in an acute hospital not only reduces NBIs but also saves on financial costs. However, the *non*-financial costs of NBIs are also important. These have not hitherto been mentioned. Particularly when patients are on an end-of-life trajectory, continuing or commencing treatments that involve over-use of some interventions and underuse of others notably palliative treatments, prejudices quality of care, perpetuates illusions of recovery and may even prolong the process of dying [6]. Further research to clarify that a reduction in medical harms contributes to the cost-benefit of using a TELP is needed.

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Table 1: Non-beneficial interventions, unit costs and source of data

Description of non-beneficial intervention	Detail (where appropriate)	Unit cost (£)	Notes and sources
Administration of anti-biotics	Vancomycin	5.49	500mg of powder for infusion vials (18)
	Amoxicillin (injection)	0.55	500mg of powder for solution for injection vials (18)
	Clarithromycin (oral)	0.10	250mg tablet (18)
	Clarithromycin (IV)	9.45	500mg of powder for concentrate for solution to infusion vials (18)
	Fosfomycin	30.00	4g of powder for infusion vials (18)
	Amphotericin – AmBisome	82.29	500mg of powder for infusion vials (18).
	Co-amoxiclav (injection)	1.06	1000mg/200mg of powder for injection (18)
	Levofloxacin	12.00	500mg/100ml solution for infusion (18)
	Ciprofloxacin	22.85	400mg/200ml solution for infusion (18)
	Meropenem (injection)	8.89	500mg of powder for injection(18)
	Gentamicin	8.70	360mg/120ml infusion bags (18)
	Tazocin	7.65	Piperacillin with Tazobactam 2g/250mg powder for infusion (18)
	Doxycycline (injection)	7.65	No price available – use Tazocin
Superfluous drug therapy (other than anti-biotics)	Digoxin	0.70	500 micrograms per 2ml solution for infusion (18)
	Heparin	6.46	10,000 units/10ml solution for injection (18)
	Warfarin (tablet)	0.05	500 microgram tablet (18)
	Furosemide (injection)	2.06	20mg/2ml solution for injection (18)
	Terlipressin acetate (injection)	19.39	1mg/8.5ml solution for injection (18)
	Morphine	5.78	50mg/50ml for infusion (18)
	Naloxone (injection)	4.05	400micrograms/1ml for injection (18)
Intravenous fluids-		8.00	Based on NICE Guideline 174 (Table 36 for unit cost) Cost of fluid for 70kg patient, 2 litres per day for five days
Non-invasive ventilation-		577.00	Non-invasive ventilation support assessment (DZ37A) in Non-elective Short Stay in NSRC
Gastric tube feeding-		110.00	Enteral feeding nursing services (N16AF) in Other currencies in NSRC)
Blood transfusion-		502.00	Blood transfusion (SA44A) in HRG data in NSRC
Endoscopy-		650.00	Diagnostic endoscopic upper gastrointestinal tract procedures with biopsy (FE21Z) in HRG data in NSRC
Blood tests-		2.00	Integrated blood services (DAPS03) in Directly Accessed Pathology Services in NSRC
Arterial blood gas		138.00	Oximetry or Blood Gas Studies (DZ57Z) in Directly Accessed Diagnostic Services in NSRC
Computerised Tomography scan-		120.00	Computerised Tomography Scan of One Area, Post-Contrast Only, (RD21A) in Imaging Direct Access in NSRC
Other radiology-		96.00	Ultrasound scan, mobile or intraoperative procedures with duration 20-40 minutes (RD45Z)
Cardio-pulmonary resuscitation-		2,169.00	Cardiac arrest with CC score 9+ (EB05A) in HRG data in NSRC
Escalation on ward-		270.27	Represents median point between general medical ward and high dependency ward cost for University Hospital, Hairmyres as reported in the Specialty Costs for the NHS Scotland for 2017-18 (19)
Escalation to High Dependency Unit (HDU)-		540.53	Represents the difference between HDU and ward cost
Escalation to Intensive Care Unit (ICU)-		1812.83	Represents the difference between ICU and ward cost

IV – intravenous, NSRC National Schedule of Reference Costs for 2017-8 available at https://improvement.nhs.uk/resources/reference-costs/#rc1718, NICE -National Institute for Health and Care Excellence, HDU – High Dependency Unit, ICU – Intensive Care Unit

Table 2: Patient characteristics

	Total	Group 1 TELP and DNACPR	Group 2 DNACPR only or neither TELP nor DNACPR
Patients	287	152	135
Age at death: mean (range)	78.0 (28-99)	79.2 (49-99)	76.6 (28-98)
Male (% of sample)	143 (50%)	73 (48%)	70 (52%)
Female (% of sample)	144 (50%)	79 (52%)	65 (48%)
Days from admission to death Mean (SD)	15.6 (21.33)	19.4 (25.12)	11.3 (15.8)

Table 3: Non-beneficial interventions and mean costs of non-beneficial interventions per patient

	Total	Group 1 TELP and DNACPR	Group 2 DNACPR only or neither TELP nor DNACPR
Patients (n)	287	152	135
NBIs (n)	312	106	206
Patients with at least one NBI	124	55*	69*
Rate of NBIs per 100 admissions	108.7	69.7**	152.6**
Rate of NBIs per 1,000 bed days	230.5	106.9***	375.8***
Mean cost (95% CI) of NBIs per patient (unadjusted)	GBP 169.54 (117.04-222.05) USD 217.01 (149.81-284.22)	GBP 61.91 (40.06-83.77) USD 79.24 (51.28-107.23)	GBP 290.72 (181.85-399.60) USD 372.12 (232.77-511.49)
Mean cost (95% CI) of NBIs per patient (adjusted for age at death, sex and days from admission to death)	GBP 181.20 (120.77-241.64) USD 231.94 (154.59-309.30)	GBP 67.53 (42.98-92.07) USD 86.44 (55.01-117.85)	GBP 287.82 (183.91-391.73) USD 368.41 (235.40-501.41)
Difference between groups (adjusted) (mean, 95% CI and p value)	-GBP 220.29 (-GBP 323.31 to -GBP 117.27, p=<0.001) -USD 281.97 (-USD 413.84 to -USD 150.11, p=<0.001)		

*p=0.011; **p=0.001; ***p=0.006. CI – confidence intervals

Table 4: Extrapolation of cost savings for all deaths in hospital in Scotland

	Total	Group 1 TELP and DNACPR	Group 2 DNACPR only or neither TELP nor DNACPR
Patients - n (% of patients in study)	287 (100%)	152 (53%)	135 (47%)
Estimated mean cost of NBIs per patient adjusted for age at death, sex and days from admission to death	GBP 181.20 (USD 231.94)	GBP 67.53 (USD 86.44)	GBP 287.82 (USD 368.41)
Estimated costs in this study for patients in this study	GBP 52,004 (USD 66,565)	GBP 10,265 (USD 13,139)	GBP 38,856 (USD 49,736)
Proportion of deaths in hospital in Scotland 2016 [23]	0.501	n/a	n/a
Total deaths registered in Scotland – 2018 [VERT]]	58,503	n/a	n/a
Estimated deaths in hospital in Scotland – 2018	29,310	15,534	13,776
Estimated cost of NBIs for patients dying in hospital	GBP 5,310,972 (USD 6,798,044)	GBP 1,049,011 (USD 1,342,734)	GBP 4,261,961 (USD 5,455,310)
Estimated cost if 85.5% of patients had TELP and DNACPR [15]	GBP 2,915,526 (USD 3,737,854)	GBP 1,692,305 (USD 2,166,150)	GBP 1,223,221 (USD 1,565,723)
Estimated saving if 85.5% of patients had TELP and DNACPR [15]	GBP 2,395,446 (USD 3,071,085)	n/a	n/a

VERT - Vital Events Reference Tables 2018. Table 5.02: Deaths, by sex, age, and administrative area, Scotland.. Available from:https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/vital-events-reference-tables/2018/section-5-deaths