Cancer centre supportive oncology service: health economic evaluation

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ABSTRACT

Objectives There have been many models of providing oncology and palliative care to hospitals. Many patients will use the hospital non-electively or semielectively, and a large proportion are likely to be in the last years of life. We describe our multidisciplinary service to treatable but not curable cancer patients at University Hospitals Sussex. The team was a mixture of clinical nurse specialists and a clinical fellow supported by dedicated palliative medicine consultant time and oncology expertise.

Methods We identified patients with cancer who had identifiable supportive care needs and record activity with clinical coding. We used a baseline 2019/2020 dataset of national (secondary uses service) data with discharge code 79 (patients who died during that year) to compare a dataset of patients seen by the service between September 2020 and September 2021 in order to compare outcomes. While this was during COVID-19 this was when the funding was available.

Results We demonstrated a reduction in length of stay by an average of 1.43 days per admission and a reduction of 0.95 episodes of readmission rates. However, the costs of those admissions were found to be marginally higher. Even with the costs of the service, there is a clear return on investment with a benefit cost ratio of 1.4.

Conclusions A supportive oncology service alongside or allied to acute oncology but in conjunction with palliative care is feasible and cost-effective. This would support investment in such a service and should be nationally commissioned in conjunction with palliative care services seeing all conditions.

INTRODUCTION

It is estimated that one in two people in the UK will develop cancer in their lifetime[1] and there are currently 110 000 people in England living with 'Treatable but not Curable' cancer.[2] It has been

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Patients have complicated cancer treatments and multiple unplanned hospital admissions in the last years of life often as part of ageing or multiple morbidities.
⇒ Does a supportive oncology service reduce length of stay and unplanned admission rate, and is it cost-effective.

WHAT THIS STUDY ADDS

⇒ The service reduced length of stay and unplanned readmissions, and had a favourable benefit cost ratio—indicating return on investment.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ We think this should be a widely adopted service and provided in conjunction with 7-day acute oncology and palliative care provision.

shown that early palliative care intervention can improve quality of life outcomes and even survival for patients.[3] The National Institute for Health and Care Excellence acknowledges the role of palliative care throughout the disease course alongside active anticancer treatment; however, barriers to referral and the association with 'End of Life care' can restrict access.[4]

Early palliative care can have a beneficial effect on various patient outcomes, including prognostic awareness and has been shown to be cost effective.[5] The best way to deliver these interventions is uncertain, as variability in how interventions are delivered and methodology of studies can make direct comparisons of research and integration challenging.[6] Recommendations for early integration and increased access to palliative care input is at odds with workforce constraints.[7]

Oncologists and haematologists often act as 'gate-keepers' to palliative care referral and timing of referral may be influenced by physician, patient or family attitudes to the concept of 'palliative care'. Suggestions to improve referral rates include a more integrated model and renaming to 'Supportive Care'.[8]

National Health Service England (NHSE) has funded Enhanced Supportive Care (ESC) services developed from a pilot project at The Christie NHS Foundation Trust to address the gap between service provision and need and to upskill the cancer workforce to recognise earlier need for supportive care.[9] This can be carried out in conjunction with a holistic needs assessment or patient-reported outcome measures (PROMs).[10 11]

A supportive oncology (SO) service was introduced at the Royal Sussex County Hospital, Brighton with funding from an NHSE Improvement grant, with an overarching aim of providing early access to supportive and palliative care for patients living with treatable but not curable cancers. We sought to investigate economic impacts of earlier palliative care input as an incentive to future funding of such a service.

Setting and aims

The Royal Sussex County Hospital, Brighton, part of University Hospitals Sussex, is an acute hospital offering secondary care to the local population and tertiary-level care, including cancer services to Brighton and the surrounding area.

The SO team in Brighton composed of four programmed activity sessions of consultant time, a clinical fellow and three band 7 clinical nurse specialists (CNS)—from critical care and acute care backgrounds. A band 7 CNS has at least 5 years' experience and is able to work autonomously. They may or may not be able to prescribe medicines but would also work closely with a consultant where indicated. This is UK-specific terminology but we are certain there are comparative roles globally. The model in Brighton was based largely on the acute floor (emergency department (ED)), ambulatory care unit and acute admissions unit), with close links to the established hospital inpatient specialist palliative care team and acute oncology service.

The main aims of the SO team were to identify all cancer patients on a daily basis (Monday to Friday), to determine need from an expert perspective and to provide links to oncological expertise where indicated—such as urgent radiotherapy or immunotherapy toxicity services. A secondary stream of work was via electronic PROMs—the My Clinical Outcomes Platform.[11] This was offered to patients to proactively identify changes in symptoms which may be due to treatment toxicity or disease progression, and direct them to the appropriate teams in order to avoid further hospital contact.

As an evaluation of the project we sought to understand what impact the service had on patients and the

Table 1 Scenario 1, intervention patients who had a recorded death discharge destination ID, compared with baseline SUS 2019/2920 data for patients with cancer in the last year of life

	Baseline	Intervention	Change
NEL admission rate	2.72	1.77	−0.95
Average NEL LOS (days)	9.60	8.17	−1.43
Average cost per spell	£4282.63	£4490.04	+207.41
Average cost per hospital day	£446.41	£549.56	+103.46

(Sourced from NHS England ESC data collection template).
ESC, Enhanced Supportive Care; LOS, length of stay; NEL, non-elective; NHS, National Health Service; SUS, secondary uses service.

healthcare system through analysing readmission rate and length of stay (LOS) in collaboration with unity insights (formerly part of Kent Surrey Sussex Academic Health Science Network).

METHODS

The SO team reviewed patients with supportive and palliative care needs both with and without a cancer diagnosis on the Acute Floor. In this evaluation, we assessed the NHSE-funded arm of the project, not including those without a cancer diagnosis. While this work started and continued between the COVID-19 pandemic, this was the period of available funding and the project and recruitment had begun prior to this so we were fixed on time points for data collection and analysis.

Between 23 September 2020 and 22 September 2021, the team reviewed 260 patients who presented as an emergency, some of whom will have been seen on more than one admission. Coding information for any subsequent admissions after intervention by the SO team was collected in a secure database, pseudonymised and sent to unity insights for analysis. Intervention data were compared with a baseline 2019/2020 dataset of national SUS+ (secondary uses service) data of patients with a cancer diagnosis and with discharge code 79 (patients who died during that year). We looked at two benefit streams (table 1):

► Non-elective (NEL) admission rate: calculated by taking the difference in admissions per patient between the intervention data and baseline, multiplied by the cost per NEL admission supplied by the SUS+2019/2020 national dataset before being multiplied by the population cohort for the given scenario.
► Average NEL LOS: calculated by taking the LOS (days) difference between the intervention data and baseline, multiplied by the cost per day in hospital supplied by the SUS+2019/2020 national dataset before being multiplied by the population cohort for the given scenario.

Two different scenarios were reported:
► Scenario 1 (table 2): Intervention patients admitted NEL who had a recorded admission with death discharge ID (code 79). Population size=53 patients (20% of total intervention number).
► Scenario 2 (table 3): All intervention patients—all admissions received. Population size=260 patients.

Table 2 Health economic evaluation for intervention patients who had a recorded admission with death discharge ID (code 79—only non-elective admissions scenario 1)

Scenario 1* (£ represented as net present value in 2020/21 figures)	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	5 years (2021/2022–2025/2026)
Benefits						
Reduction in NEL admissions	£113 k	£110 k	£106 k	£103 k	£101 k	£526 k
Reduction in NEL hospital LOS	£18 k	£17 k	£16 k	£16 k	£16 k	£81 k
Total benefits	£131 k	£127 k	£123 k	£119 k	£117 k	£607 k
Costs						
Total costs	£106 k	£102 k	£98 k	£95 k	£93 k	£495 k
NPV						
Total NPV	£25 k	£25 k	£25 k	£24 k	£24 k	£121 k
Total BCR	1.2	1.2	1.3	1.3	1.3	1.2

*The figures above have been rounded to the nearest whole pound for presentation and as such totals may not sum.

BCR, benefit–cost ratio; LOS, length of stay; NEL, non-elective; NPV, net present value.

The sensitivity analysis performed within the health economic modelling ran 10 000 iterations through Monte Carlo simulation (via Palisade's @Risk software) to calculate, using 90% CIs, the predicted results; therefore, the upper and lower bounds can be provided on request. The results included within tables 2 and 3 use the mean outputs, as these are the most likely estimated outcomes.

When looking at the health economic analysis staffing costs were scaled in line with patient population, and accounted for time when the workforce was redeployed due to the COVID-19 pandemic—that is, for scenario 1 (20% of the actual intervention set) the proportion of patients seen is weighted against the staffing costs applied). This makes an assumption that the time and cost of staffing is equal across patients in the cohort; however, it is a more realistic interpretation than including the full SO team staffing costs for only a small subset. As we understand some of the assumptions might not be reflective of actual outcomes, and may be overly optimistic about the outcomes that will be achieved by the intervention and the financial requirements, we assume that the degree

of over-optimism will be greater when the data and evidence on which the cost–benefit model is based are uneven, old or incomplete. Therefore, the model applies optimism bias correction factors in response to the level of uncertainty in the data or assumptions used, based on a confidence grade. This is in line with the HM Treasury Green Book[12] methodology for appraisal and evaluation, resulting in a percentage decrease of 15% and 25% applied to the benefits for scenarios 1 and 2, respectively.

RESULTS
Table 1 demonstrates that while the NEL admission rate and average LOS per patient in SO intervention cohort was lower than the baseline data, the average cost per spell and per hospital day was higher.

Tables 2 and 3 demonstrate the projected health economic impacts for Scenario 1 (patients only in the last year of life) and scenario 2 (all patients seen by the SO team) over a 5-year period. Both demonstrate favourable net present value (NPV) and benefit–cost ratio (BCR), indicating a projected cost saving on investment in the service.

Table 3 Health economic evaluation for all intervention patients (scenario 2)

Scenario 2 (£ represented as net present value in 2020/2021 figures)	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	5 year (2021/2022 - 2026/2027)
Benefits						
Reduction in NEL admissions	£390 k	£378 k	£365 k	£354 k	£349 k	£1836 k
Reduction in NEL hospital LOS	£60 k	£58 k	£56 k	£55 k	£54 k	£283 k
Total benefits	£450 k	£436 k	£422 k	£409 k	£403 k	£2120 k
Costs						
Total costs	£319 k	£307 k	£295 k	£284 k	£279 k	£1484 k
NPV						
Total NPV	£131 k	£129 k	£127 k	£124 k	£124 k	£636 k
Total BCR	1.4	1.4	1.4	1.4	1.4	1.4

*The figures above have been rounded to the nearest whole pound for presentation and as such totals may not sum.

BCR, benefit–cost ratio; LOS, length of stay; NEL, non-elective; NPV, net present value.

DISCUSSION

The data support a positive impact of SO intervention in reducing emergency hospital admissions by an average 0.95 admissions per patient in the year of intervention, and LOS by an average of 1.43 days. It also demonstrates a favourable economic impact—both when adjusted just for patients in the final year of life, and for all patients seen by the team. These findings indicate that investment in early supportive and palliative care for patients living with treatable but not curable cancer presenting as an emergency to hospital is cost-effective and would support increased commissioning. We would also recommend this is linked to hospital specialist palliative care services as there was homogeneity in what SO and the palliative care team provided. The SO team also worked closely with the acute oncology service offering their expertise. This evaluation only quantified the benefits of a Monday to Friday service, the patient experience and health economic outcomes of expanding to a 7-day service are an area for further exploration.[13]

The population forecasted within the model uses statistical time-series methodology in addition to exponential smoothing based on 1 year's data from 23 September 2020 to 22 September 2021. The trend is used to forecast for the rest of the 2021/2022 financial year before following the UK standard population growth rate. This forecast should be updated as further data is collected, especially as the SO project team experienced staff capacity limitations due to COVID-19 pressures over this time. If the staffing full time equivalent levels remain constant but more patients are seen, this will likely increase the estimated NPV/BCR values of the intervention.

Choice of baseline data

While SO aims to support patients with treatable but not curable cancer, the SO team in Brighton took an inclusive approach to this analysis and included any patient with a cancer diagnosis who presented on the Acute Floor with supportive and palliative care needs. This lack of clearly defined criteria for patients meant that identifying a baseline data set for comparison was challenging.

We initially considered an alternative source of baseline data to compare to our intervention: a sample of patients who had a primary cancer code and secondary palliative code admitted to the trust in an 18-month period before the SO intervention was available. While this has the advantage of being locally applicable, further analysis showed that it was unlikely to be a truly representative sample. This dataset recorded a readmission rate of only 5%–9%, while NHS data for emergency readmissions within 30 days of discharge in England for 2018–2019 indicates a 14.4% readmission rate.[14] Of note, admissions for cancer and obstetrics were excluded in this national level data, and studies have shown that people with cancer access all health

services (excluding critical care) more than those dying of other causes.[13] Furthermore, when analysing the SO intervention data, only 34% of admissions had a primary cancer code, thus using baseline data with this requirement was not felt to be directly comparable.

The NHSE ESC national tool uses SUS data for patients with a cancer diagnosis in the last year of life as a baseline dataset, therefore we opted to compare to this cohort. However, a disadvantage of using national data is that it is not specific to local population demographics—age, socioeconomic status, rural/urban living and ethnicity can all influence emergency admission rates.[15] Not all SO intervention patients were in the last year of life, although the breakdown of analysis into scenario 1 accounts for those SO patients who were in the last year of life, to allow a direct comparison.

An unexpected finding was that for SO patients in the final year of life, each admission had on average a higher cost per spell and per hospital day than the baseline national SUS data. Potential reasons for this include low numbers in the intervention sample (53 patients) meaning that any outliers may skew the results. The baseline data considers a national rather than a local population, therefore may not be entirely representative of local coding practices or healthcare associated costs. These are areas for further investigation. We also know that many patients will have multiple co-morbidities and are living with cancer alongside other long term conditions. This was beyond the scope of the project but could feed into a national analysis on how this growing ageing population should be coded for when examining their healthcare usage.[13]

Limitations

The methodology relied on multiple steps of data extraction, at a trust level to gain coding information, then pseudonymisation, followed by analysis—all of which may be open to human error. Additionally, we were reliant on coding information, which is not always accurate.[16] For example, we found that some ED attendances where patients were discharged and not admitted to hospital were inconsistently coded or recorded. Therefore, we can only draw conclusions about emergency hospital admissions, not unplanned A&E accident and emergency attendances.

Given the real-world focus of the evaluation and pragmatic approach, we did not match age, socioeconomic status, education, tumour type or other comorbidities in baseline and intervention groups—all of which may be potentially confounding factors for emergency presentation and LOS.[15 17]

There have been widespread changes in society and the healthcare landscape due to the COVID-19 pandemic which are evolving still. The SO intervention period included periods of national lockdowns and the second wave of the pandemic in the UK—which bought an additional 85 000 COVID-19 deaths.[18] Therefore,

any 'baseline' dataset or comparison time frame is difficult to define or match for these changes. The SUS data includes the very beginning of the COVID-19 pandemic (a year up to March 2020). We feel this is an acceptable compromise with the extra adjustments for optimism bias to make this entirely applicable to any population of treatable but not curable cancer patients.

The pandemic has also resulted in an increasing number of patients presenting with late stage cancer with reduced treatment options and increased palliative care needs and therefore a potentially increased need for SO intervention.[19] Anecdotally a lot of patients reviewed by the SO team were also first seen on their final admission and either died during that admission or shortly after. We know that one in three adult patients admitted to hospital acutely are likely in the last year of life, further demonstrating a need for supportive and palliative care on the Acute Floor.[20 21]

Implications of findings and areas for further exploration

We focused our analysis on the cost benefits and health economics of early palliative care intervention for patients with a cancer diagnosis, without considering quality of life or patient experience. This is an acknowledged limitation within our evaluation. The use of PROMs was beneficial in exploring patient symptom perspective—this is detailed in a separate publication.[11]

While reducing LOS and readmissions to hospital is beneficial for the hospital trust we did not explore whether it had an impact on referrals to other services such as the Community Palliative Care team, or for site specific cancer CNS teams.[7] Previous research has demonstrated that early palliative care leads to higher 'hospice costs' but lower spending on chemotherapy in the last 30 days of life.[6]

There is scope to further investigate different models of working and staffing mix. We feel this is a readily adaptable model but required training of staff, availability of consultant time, and relationships with cancer site specific teams; all of which are open to marked local variation. However, a national training programme such as that offered through the advanced clinical practice scheme could be a method to address this for non-medical staff. For training doctors there are a large number of transferable skills in palliative and internal medicine training in the management of deteriorating and dying patients. Palliative medicine as part of the Royal College of Physicians could work with the Association of Cancer Physicians and Royal College of Radiologists to provide guidelines to ensure appropriate onward referrals where indicated. This would ensure a safe effective and equitable service nationally, with no detrimental unforeseen consequences from the perception of palliative care versus acute treatment. We would argue a parallel approach which we have used locally supports this ethos.

CONCLUSION

We have demonstrated that a SO service on the acute floor is feasible and cost-effective. With cancer treatments becoming more complex and patients living with cancer for longer, non-cancer clinicians will need ready and direct access to expertise. This would support further investment in such a service and should be nationally commissioned in conjunction with a palliative care service able to see patients regardless of underlying condition 7 days a week.

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REFERENCES

1 Cancer Research UK. Available: https://www.cancerresearchuk.org/health-professional/cancer-statistics/risk#heading-Four [Accessed Dec 2021].

2 White R, Stanley F, Than J, *et al*. Treatable but not curable cancer in England: a retrospective cohort study using cancer registry data and linked data sets. *BMJ Open* 2021;11:e040808.

3 Temel JS, Greer JA, Muzikansky A, *et al*. Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med* 2010;363:733–42.

4 National Institute for Clinical Excellence, Guidance on Cancer Services. Improving supportive and palliative care for adults with cancer: the manual, 2004. Available: https://www.nice.org.uk/guidance/csg4/resources/improving-supportive-and-palliative-care-for-adults-with-cancer-pdf-773375005 [Accessed Dec 2021].

5 Yadav S, Heller IW, Schaefer N, *et al*. The health care cost of palliative care for cancer patients: a systematic review. *Support Care Cancer* 2020;28:4561–73.

6 Kaasa S, Loge JH, Aapro M, *et al*. Integration of oncology and palliative care: a Lancet oncology Commission. *Lancet Oncol* 2018;19:e588–653.

7 Curie M. Association of palliative medicine and Marie Curie survey of palliative care practitioners, 2021. Available: https://www.mariecurie.org.uk/globalassets/media/documents/policy/marie-curie-and-apm-survey-analysis-12.01.22-1.pdf

8 Salins N, Ghoshal A, Hughes S, *et al*. How views of oncologists and haematologists impacts palliative care referral: a systematic review. *BMC Palliat Care* 2020;19:175.

9 England NHS. Enhanced supportive care. Available: https://www.england.nhs.uk/wp-content/uploads/2016/03/ca1-enhncd-supprtv-care-guid.pdf [Accessed Dec 2021].

10 Howell D, Fitch M, Bakker D, *et al*. Core domains for a person-focused outcome measurement system in cancer (PROMS-Cancer core) for routine care: a scoping review and Canadian Delphi consensus. *Value Health* 2013;16:76–87.

11 Stewart E, Tavabie S, White N. Minton O. A short report examining the introduction of routine use of patient-reported outcome measures in a mixed oncology population. *Clin Oncol* 2021;S0936-6555:00435-0.

12 Treasury HM. *The Green Book: Central Government Guidance on Appraisal and Evaluation*, 2020. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938046/The_Green_Book_2020.pdf

13 Wiltshire J, Battye F. Health service use in the last two years of life - Sussex Health and Care Partnership ICS; 2021, The Strategy Unit. https://www.strategyunitwm.nhs.uk/sites/default/files/2021-06/Health%20service%20use%20in%20last%202%20years%20of%20life%20in%20Sussex.pdf [Accessed 04 Aug 2021].

14 NHS digital. 3.2 emergency readmissions within 30 days of discharge from hospital 2021 https://digital.nhs.uk/data-and-information/publications/statistical/ccg-outcomes-indicator-set/october-2020/domain-3-helping-people-to-recover-from-episodes-of-ill-health-or-following-injury-ccg/3-2-emergency-readmissions-within-30-days-of-discharge-from-hospital

15 Purdy S. Avoiding hospital admissions, what does the research evidence say? 2010, The Kings Fund. https://www.kingsfund.org.uk/sites/default/files/Avoiding-Hospital-Admissions-Sarah-Purdy-December2010.pdf [Accessed 14 Feb 2022].

16 Nouraei SAR, Virk JS, Hudovsky A, *et al*. Accuracy of clinician-clinical coder information handover following acute medical admissions: implication for using administrative datasets in clinical outcomes management. *J Public Health* 2016;38:352–62.

17 Abel GA, Shelton J, Johnson S, *et al*. Cancer-Specific variation in emergency presentation by sex, age and deprivation across 27 common and rarer cancers. *Br J Cancer* 2015;112 Suppl 1:S129–36.

18 Raleigh V. Deaths from Covid-19 (coronavirus): how are they counted and what do they show? 2022, The Kings Fund. https://www.kingsfund.org.uk/publications/deaths-covid-19 [Accessed 18 Feb 2022].

19 Maringe C, Spicer J, Morris M, *et al*. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study. *Lancet Oncol* 2020;21:e5:1023–34.

20 Bailey S-J, Cogle K. Talking about dying: how to begin honest conversations about what lies ahead; 2018, Royal College of Physicians. https://www.rcplondon.ac.uk/projects/outputs/talking-about-dying-how-begin-honest-conversations-about-what-lies-ahead

21 Clark D, Armstrong M, Allan A, *et al*. Imminence of death among hospital inpatients: prevalent cohort study. *Palliat Med* 2014;28:474–9.