# Delivery models and health economics of supportive care services in England: a multicentre analysis.

## Abstract

**Background** Improvements in cancer treatment have led to more people living with and beyond cancer. These patients have symptom and support needs unmet by current services. The development of Enhanced Supportive Care (ESC) services may meet the longitudinal care needs of these patients, including at end of life. This study aimed to determine the impact and health economic benefits of ESC for patients living with treatable but not curable cancer.

**Methods** A prospective observational evaluation was undertaken over 12 months across 8 cancer centres in England. ESC service design and costs were recorded. Data relating to patients' symptom burden was collected using IPOS. For patients in the last year of life, secondary care use was compared against an NHS England published benchmark.

**Results** 4,594 patients were seen by ESC Services of whom 1,061 died during follow up. Mean IPOS scores improved across all tumour groups. £1,676,044 was spent delivering ESC across the eight centres. Reductions in secondary care usage for the 1,061 patients who died saved a total of £8,490,581.

**Conclusions** People living with cancer suffer with complex and unmet needs. ESC services appear to be effective at supporting these vulnerable people and significantly reduce the costs of their care.

## Background

In England there were estimated to be approximately 110,000 people living with "treatable but not curable cancer" (TBNC) in 2015 [1]. This number has been predicted to increase, owing to advances in treatments which have led to a 6-fold increase in average survival time over the last 40 years [2]. These patients may have a prognosis of years, although are unlikely to achieve cure [1]. People living with TBNC have specific support needs which differ from those which might be catered for by end of life services. These needs may include pain, fatigue or more cancer specific or cancer treatment-related symptoms [3]. The challenge of living with incurable illness with uncertain prognosis adds complexity to these patients' psychosocial and spiritual care needs [2]. There are specific issues associated with distress e.g. 'scanxiety' as well issues around functional, employment, financial and information needs often associated with terminal illness, but without clear prognosis.

Due to the breadth of complex needs in this patient group, living with metastatic disease prior to the last year of life is suggested to be one of the most resource-dependent phases of care [4]. Management of acute side effects and toxicities, support for chronic disease needs, and an increased need for clear communication and coordination between specialist hospital and community based services is uniquely challenging in delivering holistic care for people who will at some stage die from their disease [4].

Cancer statistics, patient reported outcome measures [1] and clinical investigations assist in recognising patients entering the last year of life [5]. However, clinician estimates of prognosis have a wide margin of error and this lack of recognition can lead to a 'default' of ongoing active treatment [6]. As such, patients with incurable cancer and uncertain prognoses suffer a variety of complex medical, psychosocial and practical needs that are not met by existing services [7,8]. These needs may be unrecognised, resources to address them limited and services not structured to facilitate proactive identification and support.

The growth of this patient cohort and the unique challenge in meeting their needs has led to the development of supportive care services [9], adopting the principles of earlier recognition, coordinated care and access to expertise where indicated. This includes management of physical and psychological symptoms and side effects across the continuum of the cancer experience from diagnosis through treatment to post-treatment care" [9]. There is international evidence that closer integration of supportive care (including palliative care) in cancer positively impacts patient care including improved quality of life [10], improved survival [11-13], improved tolerance of systemic therapies [14] and reduced healthcare cost [15]. In response to this evidence and international recommendations that supportive care be integrated into oncology care [16], there have been calls for an evidence-based national strategy in the UK to implement supportive care across the cancer spectrum, led by clinicians in each cancer centre [17]. However, whilst conceptual frameworks for delivery of supportive care in cancer exist [18], no service specification for the delivery of these services in practice is currently in use in the UK.

In England from 2016-2020 attempts were made using Commissioning for Quality and Innovation (CQUIN) [19] to develop service models to better support patients living with and beyond cancer. This has not led to a universal model for the delivery of supportive care in England nor designated funding for the delivery of the care needed by these patients. Furthermore, due to the devolution of NHS leadership across the nations of the UK, the scope of this intervention was limited to England only. Despite these limitations, a number of Enhanced Supportive Care (ESC) services, delivering supportive care for patients with TBNC have been developed in 22 cancer centres in England. ESC is the integration of supportive care earlier in the patient's cancer journey and includes timely access to palliative care, therapies, psycho-oncology, nutritional support and treatment toxicity management alongside anticancer treatment. The model of staffing, delivery and accessibility has developed organically in each centre, led by the needs of its local population and delivered by those with local expertise.

Small studies from these ESC centres have demonstrated improvements to patients' symptoms [20,21] and cost savings from reduced secondary care usage [7]. However, no large scale studies exist which describe the core elements of ESC, demonstrate its impact or assess financial sustainability of the service as a core component of cancer care.

This paper aims to describe service and funding models of ESC across England and to compare hospital use and costs in the last 12 months of life against national benchmarks. This national service evaluation was carried out in conjunction with and led by NHS England Specialised Services Improving Value team.

## Method

This was an observational study of anonymised routinely collected data comparing patients who had been seen through an ESC service with national benchmarks.

ESC service cohort:

In 2020, cancer centres offering ESC in England were invited to participate in data collection and sharing with NHS England Specialised Services Improving Value team.

Data collection:

From April 2021 to July 2022 prospective data were collected using a bespoke ESC data collection tool which captured service level data relating to the staffing models and costs of running the ESC services and outcomes of all patients seen within the ESC services who were new to these services in the 12 months from 1st April 2021 to 31st March 2022.

Service delivery data included the service model (i.e.: inpatient, ambulatory, outpatient or domiciliary), and staff resources (numbers and roles of healthcare professionals involved).

Clinical outcomes included:

- Symptom burden- measured using change in Integrated Palliative Care Outcome Scale (IPOS) [22] between baseline and 3 months following access to ESC. IPOS is a 17 item Likert scale questionnaire which rates each symptom and psychological distress domain severity from 0 (not at all) to 4 (overwhelming). The IPOS tool is validated to measure the severity and complexity of palliative care needs of patients and their families and has been used in other studies assessing impact of ESC services on quality of life [20,21].
- Number of hospital appointments
- Number of deaths
- Place of Death

For those patients who died, further data was collected (including retrospectively from electronic patient records) detailing secondary care usage in the last 12 months of life including:

- Number of Non-elective admissions
- Lengths of stay for those who had ≥1 admission in the last 12 months of life
- Number of A&E attendances

Economic data collection:

Cost of delivery of the service was established by costing professionals' time spent with patients. This data included salaries and local on costs (e.g. clinical space) but not medications and capital equipment costs.

National benchmarks:

Routinely collected population-level data were used to define a comparative benchmark cohort based on primary tumour diagnosis. 62,100 patients were identified nationally between 1 April 2019 and 30 March 2020 with a cancer ICD10 diagnostic codes (available on request) recorded in any position of diagnosis in Secondary Uses Service (SUS) [23]. Unplanned admissions and A&E attendances in the last 12 months of life in any hospital for the same population were described. Indicators for fourteen major tumour groups were populated independently to include patients who may have tumour in multiple sites.

The estimated national average cost per hospital admission, and A&E attendances were calculated using the payment by results national tariff payment system data generated from SUS [24]. Mean cost per hospital day was derived using the total numbers of unplanned admissions and hospital spell length of stays for each tumour group. The regional benchmark was generated using the same methods referenced in the ESC tool.

Data Analysis:

IPOS scores were analysed per tumour group. The average change in individual IPOS item scores from initial assessment by ESC team (baseline) and 3 months later were calculated. The average change in total IPOS score was also calculated.

In order to control for differences in stage of illness between our cohort and the SUS dataset, only those patients (and their secondary care usage) within the last 12 months of life was reported and matched against the regional and national averages in the SUS dataset for patients in the last 12 months of life.

Secondary care use for patients seen by the eight ESC services was pooled and descriptively compared to regional and national averages from the SUS dataset and cost differences were compared using average costs reported in the SUS dataset, as described in previously [7]. Non-elective hospital admissions were expressed in per patient per year and length of stay was expressed as mean average per admission in the last year of life, as presented in existing national data reporting [25]. Cost utility analysis was conducted comparing costs of service delivery against savings from avoided secondary care usage in the last year of life in the proportion of ESC patients who died during follow up.

Ethics and Finance:

Local permissions to collect and share these data were established. All data were anonymised prior to provision to NHS England Specialised Services Improving Value team for analysis. This service evaluation was exempt from HRA ethics committee approval as it involved the secondary use of anonymised routinely collected data.

This service evaluation was funded by NHS England Specialised Services Improving Value team.

## Results

Data was submitted from eight centres across England. Service models and staffing required to deliver each service for 1 year are shown in table 1.

*Table 1. Description of ESC service models and staffing across 8 centres*

| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Site 7 | Site 8 |
|---|---|---|---|---|---|---|---|---|
| Service Model | Outpatient | Ambulatory | Inpatient | Ambulatory | Outpatient | Outpatient | Domiciliary | Outpatient |
| **Staffing (Whole time equivalents)** | | | | | | | | |
| Consultant Palliative Medicine | 0.6 | | 0.2 | 0.05 | 0.5 | 0.1 | | 0.6 |
| Consultant Psychiatric Medicine | 0.6 | | | | | | | |
| Clinical Fellow (ST3) | | | 1 | | | | | |
| Associate Specialist | | | | | | | | 0.4 |
| General Practitioner with a Special Interest | | | | 0.3 | | 0.7 | | |
| CNS Band 8 | | 1.2 | | 1 | 1 | | | |
| CNS Band 7 | 0.6 | 1 | 2 | 0.8 | 0.1 | 1 | 1 | 1 |
| CNS Band 6 | | | | | | | | 1.4 |
| Physiotherapist Band 7 | 1.2 | | | 0.4 | | | | |
| Physiotherapist Band 6 | | | | 0.5 | 0.6 | | 1 | |
| Occupational Therapist Band 7 | 0.9 | | | | | | | |
| Occupational Therapist Band 6 | | | | 0.6 | 0.6 | 0.4 | 1 | 0.8 |
| Dietitian Band 7 | 1.5 | | | | | | | |
| Dietitian Band 6 | | | | 0.6 | 0.5 | 0.2 | 1 | 0.2 |
| Speech and Language Therapist | 0.3 | | | | | | 1 | |
| Family Support Band 7 | 0.4 | | | | | | | |
| Counsellor Band 6 | | | | 0.4 | | | | |
| Counsellor Band 5 | | | | | | | 0.4 | |
| Cancer Support Worker Band 4 | | 1 | | | | | | |
| Administrator Band 5 | 0.5 | | | 0.8 | | 1 | | |
| Administrator Band 4 | | 1 | | | | | | |
| Administrator Band 3 | | | | | 1 | | | |
| Advance Communication Skills Facilitator Band 7 | | | | | | 0.4 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Total 12 month salary cost:** | £340,939 | £164,420 | £159,729 | £233,099 | £195,352 | £169,830 | £197,020 | £215,655 |

The most common roles within ESC teams regardless of model were clinical nurse specialists (8 centres), dietitians (6 centres), palliative medicine consultants (6 centres), occupational therapists (6 centres) and administrators (5 centres).

The average ESC staffing cost per service for 1 year was £209,506. £1,676,044 was spent delivering ESC across all eight centres over 12 months.

## Clinical Outcomes:

4,594 patients were seen in an ESC service across all eight centres. Average differences in IPOS score between baseline and three months was submitted from four centres serving eight primary tumour groups. Net difference in score broken down by domain and primary tumour group are shown in table 2.

*Table 2. Net difference in IPOS score between baseline and 3 months for ESC patients*

| | Breast | H&N | UGI | LGI | Melanoma | Sarcoma | Lung | HPB |
|---|---|---|---|---|---|---|---|---|
| Pain | -0.7 | -0.9 | -0.8 | -0.3 | -0.4 | 0.0 | -1.0 | -0.5 |
| SOB | 0.1 | -1.0 | 0.0 | -0.1 | -0.1 | 0.0 | 0.0 | 0.0 |
| Weakness | -0.9 | -0.1 | -0.1 | -0.3 | -1.0 | 0.0 | 0.0 | 0.1 |
| Nausea | -0.8 | -0.2 | -0.1 | -0.6 | -0.5 | 0.0 | 0.5 | -0.9 |
| Vomiting | 0.2 | -0.2 | -0.2 | 0.0 | -0.3 | 0.0 | 0.5 | -1.2 |
| Appetite | -1.1 | -0.1 | 0.2 | -0.6 | -1.5 | 0.0 | 0.0 | -0.3 |
| Constipation | -0.6 | -1.0 | 0.3 | -0.9 | -1.3 | 0.0 | 0.0 | -1.5 |
| Sore Mouth | -0.7 | -1.2 | -0.7 | -0.4 | -0.8 | 0.0 | 0.0 | -0.2 |
| Drowsiness | -0.3 | -0.3 | -0.6 | -0.1 | 0.0 | 0.0 | -2.0 | 0.4 |
| Mobility | -0.6 | 0.4 | -0.2 | 0.1 | -1.4 | 0.0 | -0.5 | 0.1 |
| Anxiety | -0.6 | -0.4 | 0.0 | -0.3 | -0.6 | 0.0 | -0.5 | -0.3 |
| Family Support | -0.6 | -0.9 | 0.3 | -0.4 | -0.1 | -1.0 | -1.5 | -0.4 |
| Depression | -0.1 | 0.1 | 0.1 | -0.2 | -0.2 | -1.0 | 0.0 | -0.4 |
| Peace | -0.4 | -0.6 | 0.2 | -0.4 | 0.0 | 0.0 | 2.0 | 0.5 |
| Shared Feelings | -0.4 | -0.3 | 0.4 | -0.7 | -0.2 | 0.0 | 0.5 | -0.6 |
| Information needs | -0.4 | -0.1 | 0.4 | -0.6 | -0.6 | 0.0 | 0.0 | 0.4 |
| Practical Support | -0.8 | -0.5 | 0.4 | -0.5 | 0.1 | 0.0 | 0.0 | -0.4 |
| **Total** | -8.8 | -7.1 | -0.5 | -6.4 | -9.0 | -2.0 | -2.0 | -5.3 |

Reduction in scores were seen across most domains. Most notable improvements in score when pooled were demonstrated for pain, constipation and family support. Feelings of peace was the only domain overall to worsen in the 3 month period from baseline and this was due to a significant reduction in the lung cancer group. The biggest overall score improvements were seen in patients with melanoma (-9), breast (-8.8) and head and neck (-7.1) cancers. Upper GI (-0.5), sarcoma (-2) and lung cancers (-2) had the overall least score change from baseline. These differences reflect that there were greater average improvements (as noted by bigger reductions in score) across a greater number of IPOS domains in melanoma, breast and head and neck cancers compared to upper GI, sarcoma and lung.

**Hospital Use in the last year of life:**

Of 4,594 patients seen, 1,061 (23%) died during the follow period for whom secondary care use data was available for the whole last 12 months of life. Table 3 shows the proportions of primary tumour groups within the 1,061 patients, numbers of admissions, average days in hospital and number of A&E attendances in the last year of life.

*Table 3. Number of deceased patients in each primary tumour category (n=1061) with associated number of admissions in the last year of life and average admission length per admission in last year of life*

| Tumour group | Number of deaths | Number of Non-Elective Admissions | Average Non-Elective admission per patient/year | Average length of stay per admission (days) |
|---|---|---|---|---|
| Breast | 65 | 51 | 0.78 | 3 |
| UGI | 431 | 404 | 1.19 | 5.4 |
| LGI | 106 | 88 | 0.84 | 5.8 |
| Melanoma | 29 | 44 | 1.52 | 6.4 |
| H&N | 37 | 19 | 0.58 | 3.3 |
| Lung | 366 | 422 | 1.72 | 4.8 |
| HPB | 218 | 217 | 1.18 | 6 |
| Sarcoma | 4 | 0 | 0 | - |
| CUP | 29 | 19 | 1.12 | 5.9 |
| Urological | 20 | 38 | 1.9 | 8 |
| Haemato-oncology | 6 | 7 | 1.17 | 1.3 |
| CNS | 13 | 8 | 0.62 | 7 |
| **Total:** | 1,061 | 1317 | - | - |

Non- Elective admissions to hospital in this group ranged from 0.58 admissions per patient per year (head and neck) to 1.9 admissions per patient per year (urological). Figure 1 shows Non elective admission rates, average lengths of stay and A&E attendances per patient per year by tumour group for ESC compared to national average and the average for the regions where the pilot sites were located.

The overall average rate of non-elective admissions for ESC patients was 1.14 admissions per patient per year, compared with the national average of 2.72 in the SUS dataset. The average cost of a non-elective admission varies between tumour groups. Overall, ESC patients had 1,472 fewer admissions to hospital than the national average, resulting in a cost saving of £6,074,655 (commissioner cost). The derivation of this cost saving is shown in the supplementary information.

When patients did have an admission to hospital in the last year of life, the duration was shorter than the national and regional averages (figure 1). The average length of stay for ESC patients (across all tumour groups) was 5.17 days compared to the national average of 9.6 days. The difference in length of stay across all admissions compared to national average resulted in 4,578 bed days in hospital avoided in the year. Using the SUS national average cost of per day in hospital (commissioner cost) for each tumour group, a total of £2,303,947 was saved in reduced lengths of stay. The derivation of this cost saving is shown in the supplementary information.

*Figure 1 Non-elective admission rates, average length of stay and A&E attendance rates in the last year of life. ESC patients (red) are compared against national average (blue) and regional averages for North West (Orange), South West (grey) and South East (yellow)*

Whilst there was an overall trend towards fewer A&E attendances for ESC patients compared with the national and regional averages (figure 1), not all primary tumour groups obtained the same benefit. Minimal reductions to A&E usage were seen for patients with lung (1.89), melanoma (2.07) and urological (2.5) cancers compared with the national benchmarks (2.41, 2.35 and 2.74 respectively). Furthermore the A&E attendance rate for Head and Neck cancer patients was slightly higher in the ESC cohort compared to average (2.5 compared to 2.46). The overall rate of A&E attendances per patient per year for ESC patients was 1.72 compared to the national average 2.41. The SUS national average cost for A&E attendances is £200 (although varies between primary tumour group). Overall ESC patients had 567 fewer A&E attendances than the national average, resulting in a cost saving of £111,980. The derivation of this cost saving is shown in the supplementary information.

Of the 1,061 patients who died, data relating to place of death was available for 499 of them. 195 (39%) of deaths occurred at home whilst 116 (23%) occurred in hospital. The national benchmark in existing published national data collection tools [26] report deaths at home as 27% and hospital as 42%, indicating that patients accessing ESC service are more likely to die out of hospital and more likely to die in their own home.

Financially, in total ESC services cost £1,676,044 to deliver and saved a total of £8,490,581 resulting in a net financial saving of £6,814,537.

## Discussion

This paper aims to describe service and funding models of ESC across England and to compare hospital use and costs in the last 12 months of life against national benchmarks. Our study suggests despite heterogeneity in service models, there are commonalities in ESC services including the presence of clinical nurse specialists, therapies, nutritional support and palliative care. These services cost £1,676,044 in the delivery of care to 4,594 people over 12 months. Patients who attended ESC benefitted from overall improvements in symptom burden. Furthermore those in the last year of life appeared to have fewer non-elective admissions to hospital, reduced length of stay and overall reduced A&E attendances compared to the SUS derived average for England. The reduced usage of secondary care by this group of patients saved more than the cost of the whole service for all patients. In fact, these data indicate a 5:1 return on investment when ESC services are provided as standard of care for these patients. ESC therefore appears both effective and cost-effective.

This study is the first UK, multicentre study to examine the impact of ESC in cancer care. These data indicate that ESC services can play an important role in the care of patients with TBNC. Our cohort is more than end of life care (i.e. those patients in the last year of life [27]). We note that 77% of the patients seen are still alive at the time of analysis more than 6 months after the completion of the service evaluation. This figure reassures us that the patient population supported by ESC in this study is truly those with “treatable but not curable cancer”. It is not possible to accurately identify people in the last year of life prospectively leading to challenges in service design. A supportive care service aims to support patients regardless of prognosis and this study therefore is a positive real-world evaluation of that model.

ESC is however, arguably, not new medicine. It is not the de novo establishment of palliative care, nor therapies, nor nutritional support even though each of these were present in the care of patients. Furthermore this study is not comparing care when these professionals are involved against care when it is not. The SUS dataset contains real-life outcome data for those that received usual care. In England, that includes palliative care for those with complex end of life needs, psychological support for patients with incurable cancer and the involvement of allied health professionals in cancer care. This study demonstrates that through effective organisation of existing services, making it easier to access and re-access them, the outcomes may be better than usual care and cost effectiveness can be improved. Whilst ESC is often conflated with earlier access to palliative care, the workforce described in this study is more multi-professional with more time contributed to the ESC services by allied health professionals than specialist palliative care.

The development of ESC services through CQUINs based around existing palliative care services has meant these services have naturally evolved with leadership from palliative medicine. However, these services may not require specific palliative medicine leadership as long as the principles of a broad holistic approach, delivered by a multidisciplinary team in a tumour agnostic manner are followed. We also note that supportive care departments outside the UK are commonly led by oncologists. Recognising that these leadership approaches and skills exist outside palliative medicine as well as outside cancer care altogether, invites the possibility for ESC services to be set up in other chronic conditions and with diverse leadership.

Earlier integration of complementary services as described here may have a synergistic effect on cancer care and elements of our models can be adapted and commissioned for local use. The services described in this study provide an outline which can be adapted to the local environment and indeed to specific tumour types such as head and neck cancer needing more speech and language support or lung cancer requiring more therapies support for breathlessness management. The availability and ready access and coordination of these services are core to any cancer care provision. Arguably, there is a specific additional need in a population with TBNC because the healthcare use can dramatically increase in this group of patients [28]. Thus there are large opportunity costs and potential for even incremental improvements to provide wider system savings from widespread adoption of an ESC model. There are broadly three types of cancer patients who may benefit from these services:

1) Those presenting de novo as an emergency (still approximately 20% of all patients [29]) would benefit from immediate involvement of supportive care services.
2) Those presenting with clear progressive disease or complications of treatment and unacceptable toxicities would benefit from earlier

introduction to ESC for proactive identification and management of needs, to establish routes of access in case of increased need and to establish a link to the established acute oncology services.

3) Those for whom there are additional needs from SACT toxicity but improved management of toxicities and functional impairment may aid treatment adherence which can positively impact survival.

## Limitations

In this study we were able to measure symptom burden alongside healthcare usage which showed a sustained improvement across a range of symptoms with a clinically significant score change [30] using IPOS. However this element of data interpretation was a single-system design since there are no routinely used PROMS present throughout all primary tumour groups and across settings for us to compare between groups. Thus it is not possible to conclusively state that symptom burden is better with ESC compared to usual care. Nevertheless our positive improvements in IPOS score reassures us that cost savings described in this study are not made at the expense of patient outcomes when it comes to symptoms. Routine widespread use of other more cancer specific quality of life tools [31] would allow more valid comparison between treatment groups.

Furthermore, as this study uses an observational design it is possible that those accessing ESC are a systematically different subgroup within the wider population from which the SUS data is derived and that this may have implications for the direction and magnitude of the observed impact of ESC. It is difficult to predict the direction of any effect but it is plausible to suspect that those accessing ESC are those most in need of support and thus most likely to require secondary care use. This would suggest that the benefit identified is possibly an underestimate of the actual impact. A further limitation of this observational study is that it is not possible to comment on the specific clinical significance of some of the mixed findings at this stage. For example not all groups had the same improvements in IPOS scores. Also head and neck cancer patients attending ESC had an increased A&E attendance rate compared to average yet a reduced tendency towards admission and reduced length of stay. Further work in supportive care should aim to describe the intervention for different groups of people and aim to delineate a clear cause and effect from intervention to specific outcomes.

A final limitation of this work is that it was not possible to use the SUS dataset to compare secondary care usage between ESC attenders who had not died and those receiving usual care. There is no facility to control for stage of disease or treatment toxicity burden in the interrogation of the SUS dataset which is why last year of life was used as matching criteria. Whilst this has proved promising in this study for determining cost metrics, further work should aim to use linked datasets with further variables controlled to compare outcomes between groups of patient receiving active anticancer treatment.

## Conclusion

This is the first UK, multicentre study of the structure and real-world impact of ESC services for people living with treatable but not curable cancer. Patients living with TBNC have improved outcomes with support from ESC regardless of service structure and their health service use and associated cost was reduced. With increasing numbers of people living with and beyond cancer, attention to the most effective models of care that can support them is vital, and this study demonstrates that ESC is potentially such a model.

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## Ethics approval and consent to participate

Local permissions to collect and share these data were established. All data were anonymised prior to provision to NHS England Specialised Services Improving Value team for analysis. This service evaluation was exempt from HRA ethics committee approval as it involved the secondary use of anonymised routinely collected data.

## Consent for publication

All authors give consent for publication

## Data availability

Summary data from each centre and pooled analyses available on request

## Competing interests

The authors have no competing interests to declare

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*Non-Elective admission related cost saving based on benchmarked average admissions rates and costs in the SUS dataset*

| | Number of patients | No. admissions | Rate | National Average rate | Difference | Multiplied by population | Average Cost per admission | Total cost saved |
|---|---|---|---|---|---|---|---|---|
| Breast | 65 | 51 | 0.78 | 2.61 | 1.83 | 118.65 | £3,880 | £460,361 |
| UGI | 339 | 404 | 1.19 | 2.62 | 1.43 | 484.18 | £4,110 | £1,990,057 |
| LGI | 105 | 88 | 0.84 | 2.57 | 1.73 | 181.85 | £4,286 | £779,476 |
| Melanoma | 29 | 44 | 1.52 | 2.78 | 1.26 | 36.62 | £3,989 | £146,075 |
| H&N | 33 | 19 | 0.58 | 2.57 | 1.99 | 65.81 | £4,373 | £287,770 |
| Lung | 246 | 422 | 1.72 | 2.65 | 0.93 | 229.9 | £3,907 | £898,254 |
| HPB | 184 | 217 | 1.18 | 2.57 | 1.39 | 255.88 | £4,193 | £1,073,025 |
| Sarcoma | 4 | 0 | 0.00 | 2.84 | 2.84 | 11.36 | £4,126 | £46,870 |
| CUP | 17 | 19 | 1.12 | 2.72 | 1.60 | 27.24 | £4,066 | £110,769 |
| Prostate | 20 | 38 | 1.90 | 2.82 | 0.92 | 18.4 | £4,295 | £79,025 |
| Haemato-oncology | 6 | 7 | 1.17 | 2.97 | 1.80 | 10.82 | £4,894 | £52,950 |
| CNS | 13 | 8 | 0.62 | 3.05 | 2.43 | 31.65 | £4,740 | £150,021 |
| | | | | | | | Total: | £6,074,655 |

*Length of Stay related cost saving based on benchmarked average admissions rates and costs in the SUS dataset*

| | Number of admissions | Days in Hospital | Average Length of stay | National Average | Difference | Multiplied by No of admission | Average cost | Cost saved |
|---|---|---|---|---|---|---|---|---|
| Breast | 51 | 153 | 3.00 | 8.99 | 5.99 | 305.49 | £468 | £142,994 |
| UGI | 404 | 2178 | 5.39 | 8.89 | 3.50 | 1413.56 | £508 | £718,654 |
| LGI | 88 | 514 | 5.84 | 9.36 | 3.52 | 309.68 | £503 | £155,719 |
| Melanoma | 44 | 280 | 6.36 | 8.87 | 2.51 | 110.28 | £484 | £53,327 |
| H&N | 19 | 62 | 3.26 | 10.13 | 6.87 | 130.47 | £482 | £62,875 |
| Lung | 422 | 2013 | 4.77 | 8.09 | 3.32 | 1400.98 | £517 | £724,377 |
| HPB | 217 | 1299 | 5.99 | 9.15 | 3.16 | 686.55 | £492 | £337,577 |
| Sarcoma | 0 | 0 | | 9.62 | 9.62 | 0 | £497 | £0 |
| CUP | 19 | 112 | 5.89 | 8.66 | 2.77 | 52.54 | £510 | £26,795 |
| Prostate | 38 | 305 | 8.03 | 10.07 | 2.04 | 77.66 | £463 | £35,963 |
| Haemato-oncology | 7 | 9 | 1.29 | 10.70 | 9.41 | 65.9 | £501 | £33,007 |
| CNS | 8 | 56 | 7.00 | 10.05 | 3.05 | 24.4 | £519 | £12,659 |
| | | | | | | | Total: | £2,303,947 |

*A&E related cost saving based on benchmarked average admissions rates and costs in the SUS dataset*

| | Population (contributing centres only) | A&E attendances | Rate | National Average | Difference | Multiplied by population | Average Cost | Cost Saved |
|---|---|---|---|---|---|---|---|---|
| Breast | 6 | 9 | 1.50 | 2.29 | 0.79 | 4.74 | £201 | £951 |
| UGI | 247 | 308 | 1.25 | 2.29 | 1.04 | 257.63 | £194 | £49,985 |
| LGI | 35 | 36 | 1.03 | 2.22 | 1.19 | 41.7 | £200 | £8,338 |
| Melanoma | 14 | 29 | 2.07 | 2.35 | 0.28 | 3.9 | £205 | £798 |
| H&N | 4 | 10 | 2.50 | 2.46 | -0.04 | -0.16 | £195 | -£31 |
| Lung | 246 | 466 | 1.89 | 2.41 | 0.52 | 126.86 | £200 | £25,424 |
| HPB | 92 | 106 | 1.15 | 2.15 | 1.00 | 91.8 | £199 | £18,261 |
| Sarcoma | 0 | 0 | 0.00 | 2.20 | 2.20 | 0 | £199 | £0 |
| CUP | 17 | 27 | 1.59 | 2.34 | 0.75 | 12.78 | £199 | £2,547 |
| Prostate | 20 | 50 | 2.50 | 2.78 | 0.28 | 5.6 | £199 | £1,112 |
| Haemato-oncology | 6 | 0 | 0.00 | 2.36 | 2.36 | 14.16 | £198 | £2,807 |
| CNS | 7 | 12 | 1.71 | 2.87 | 1.16 | 8.09 | £221 | £1,787 |
| | | | | | | | Total: | £111,979 |