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# The Unmet Need for Intrathecal Drug Delivery Pumps for the Treatment of Cancer Pain in England: An Assessment of the Hospital Episode Statistics Database

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## ABSTRACT

**Objectives:** Intrathecal drug delivery (ITDD) devices have been shown to be a clinically effective and cost-effective option for the management of cancer pain and recommended for use in England. The aim of this study is to assess the impact of the 2015 NHS England Clinical Commissioning Policy on the uptake of ITDD pumps for the management of cancer pain or if there is an ongoing unmet need for this intervention in England.

**Materials and Methods:** Hospital Episode Statistics (HES) were obtained for all patients undergoing ITDD for the management of cancer pain between 2014 and January 2020. In addition, HES were utilized to estimate the number of patients with cancer potentially eligible for ITDD pump during the same period.

**Results:** The number of patients with cancer and those potentially suitable to receive an ITDD for the management of cancer pain have increased year on year since 2014. This increase has not been matched by an uptake in the provision of ITDD. Conservative estimates suggest that at least 8000 people with cancer pain would be eligible for ITDD; 458 patients received an intervention for pain management between April 2018 and March 2019 and only 30 ITDD pumps were implanted in that same period.

**Conclusions:** We observed a substantial gap between the need and provision of ITDD for patients with refractory cancer pain in England despite the recommendation for the use of ITDD for this patient population. In addition, we present suggestions for improvement of access to and provision of ITDD in England.

**Keywords:** Cancer pain, Hospital Episode Statistics, intrathecal drug delivery pumps, NHS England Clinical Commissioning Policy, policy uptake

**Conflict of Interest:** Sam Eldabe has received consultancy fees from Medtronic Ltd, Mainstay Medical, Boston Scientific Corp, and Abbott. He has received Department Research funding from the National Institute of Health Research, Medtronic Ltd, and Nevro Corp. Rui V. Duarte has received consultancy fees from Medtronic Ltd, Boston Scientific Corp, and Saluda Medical. Theresa Marshall and Alicia Sale are employees of Medtronic Ltd. Pallav Desai has no conflicts to declare.

## INTRODUCTION

Pain is a major symptom affecting patients with cancer. Pain has been found to be a common symptom in people with cancer, with 56% of patients suffering moderate-to-severe pain at least monthly and 41% taking strong opioids either alone or with other drugs for cancer-related pain (1). Cancer pain may be nociceptive, neuropathic, or mixed (2). It may arise as a result of the disease, or its treatment (3).

Cancer incidence and prevalence is rising, with the number of people living with cancer in the UK estimated to rise to 4 million by 2030 from 2.1 million in 2015 (4). A 2016 systematic review of the prevalence of pain in patients with cancer reported pain prevalence rates of 39.3% after curative treatment; 55.0% during anti-cancer treatment; 66.4% in advanced, metastatic, or terminal disease; and 50.7% in studies that included all cancer stages (5). Overall, 38.0% of the patients reported moderate to severe pain.

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The National Cancer Survivorship Initiative (NCSI) estimate that 10% of cancer survivors, about 200,000 live with chronic moderate to severe pain (6).

NHS England estimated that 5–15% of cancer patients have refractory pain and require advanced techniques (6). Intrathecal drug delivery (ITDD) devices have been shown to be a clinically effective and cost-effective means of pain relief with fewer side effects than oral opioids in cancer patients and have potential for improved survival (2,8).

ITDD consists of a catheter inserted into the intrathecal space and connected to an implanted pump. The catheter tip is placed according to the pain site to enable targeted drug delivery. The pump is usually implanted in the subcutaneous tissues of the anterior abdominal wall to enable easy refill and programming. The pump is an active battery operated and programmable medical device, which acts as both reservoir of drug and driver to deliver the drug. Programmable pumps are the gold standard for ITDD (6).

NHS England commissions ITDD as an advanced stage intervention where other conservative interventions have failed or are contraindicated and where the uncontrolled pain is causing a significant impact on physical and mental health (6). NHS England has recommended ITDD to be used equally in patients with limited life expectancy as those patients with near normal life expectancy.

As per National Health Service (NHS) cancer data, 303,135 new cases of cancer were diagnosed in the year 2016 (9). Employing conservative estimates published previously, at least 15,156 (5%) patients are likely to have refractory pain and require advanced techniques.

The aim of this study is to explore the need and contrast this with the provision of ITDD pumps in the treatment of cancer pain throughout the NHS in England from 2014 to January 2020.

## MATERIALS AND METHODS

Aggregate data were obtained from the Hospital Episode Statistics (HES) database for the years 2014 to January 2020. HES is a publicly available data source and aggregate data for this study were provided by Harvey Walsh Ltd under a data sharing agreement issued by the NHS Digital.

Estimates of patients with cancer and pain potentially eligible for ITDD were derived from HES using cancer-related International

Statistical Classification of Diseases and Related Health Problems 10th revision (ICD-10) codes (see Supporting Information for codes used) and refined to identify patients with either cancer receiving palliative care (code Z515), with metastatic spread (C77/8/9) and those that died (derived from mortality data) as a proxy for severe/terminal cancer pain. An alternative estimate of patients with cancer potentially eligible for ITDD were derived from HES using a combination of cancer-related ICD-10 codes and Office of Population Censuses and Surveys (OPCS) codes for interventional pain procedures (ICD-10 and OPCS codes are presented in Supporting Information). We did not include ICD-10 cancer codes in D\*s as these tend to be mild and noninvasive/malignant or C44 as these are nonmalignant skin cancers.

ITDD procedural activities for patients with cancer were investigated using OPCS code A543 (implantation of ITDD device adjacent to spinal cord) in combination with relevant cancer-related ICD-10 codes (see Supporting Information for codes used). Since 2017, a healthcare resource group (HRG) code for the implantation of ITDD specifically for pain management has been implemented (i.e., AB13Z; insertion of ITDD device for pain management). Since ITDD for nonmalignant pain is not routinely commissioned by NHS England (7), we assumed that procedures coded under AB13Z represented ITDD for cancer pain. ITDD procedural activity for patients with cancer using AB13Z code was investigated to substantiate the data derived from the analysis based on OPCS codes in combination with ICD-10 codes.

## RESULTS

The number of people with cancer in HES (England) has continued to rise year on year since 2014 (Table 1). A similar rise is observed in HES for cancer patients receiving palliative care, with metastatic spread and number of deaths up to 2017/18. A reduction in the total number of patients receiving palliative care and number of deaths was observed from 2017/18 to 2018/19, although this reduction is in part due to a proportion of patients in 2018/19 and 2019/20 not having a full year worth of data post ICD10 cancer code.

Using a conservative estimate of 5–15% of cancer patients having refractory pain and requiring advanced techniques such as

**Table 1.** Estimate of Patients With Cancer Pain in England Potentially Suitable for ITDD.

HES year	Total cancer patients	Total cancer patients with palliative care *	Total cancer patients with metastases *	Total cancer patients with death <sup>†,‡</sup>	Mean of total cancer patients with palliative care, metastases and death	Estimate of cancer patients requiring ITDD (5–15%) <sup>§</sup>
2014/15	727,607	99,900	196,140	190,971	162,337	8117–24,351
2015/16	736,736	104,725	203,480	193,722	167,309	8365–25,096
2016/17	776,454	110,939	219,620	196,972	175,844	8792–26,377
2017/18	801,649	115,759	225,493	198,214	179,823	8991–26,973
2018/19 <sup>¶</sup>	820,815	117,136	230,684	197,133	181,651	9083–27,248
2019/20 <sup>¶,**</sup>	743,748	75,469	193,170	115,534	128,238	6412–19,236

\*Up to one year post-ICD10 cancer code.

†Death taken from mortality data.

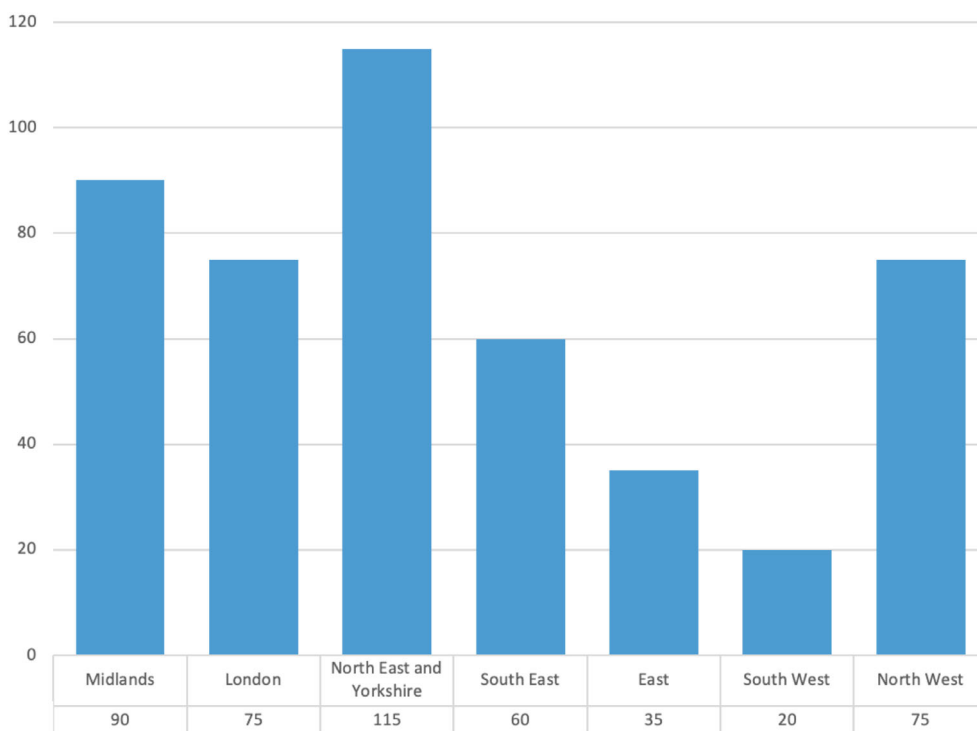
‡Total died used as a proxy for severe/terminal/pain.

§Based on NHS England estimate that 5–15% of cancer patients have refractory pain and require advanced techniques (7).

¶Not all patients have a full year post-ICD10 cancer code.

\*\*Up to January 2020.

HES, Hospital Episode Statistics; ITDD, intrathecal drug delivery device.



**Figure 1.** Patients with cancer pain receiving pain management procedures between April 2018 and March 2019 (per commissioning region in England). [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

ITDD (7), at least 8000 people with cancer pain would be potentially eligible for an ITDD procedure.

A total of 458 patients with cancer diagnosis had a pain relief procedure code between April 2018 and March 2019 (Fig. 1).

Assessment of ITDD implanted for cancer pain shows a decrease of 55% in the number of patients receiving ITDD from the year 2014/15 to 2015/16 (Table 2). The number of ITDD implanted has not increased as a result of the NHS England commissioning policy in 2015.

Use of cancer-specific procedure code for ITDD AB13Z shows that only 30 patients per year have received an ITDD for cancer pain (Table 3).

## DISCUSSION

Our results suggest the existence of a large discrepancy between the number of patients with cancer pain potentially eligible for ITDD and those that receive an ITDD in England. Even the most conservative estimate of potentially eligible patients (i.e., 458 patients with cancer pain that received a pain procedure) is greatly superior to the actual number of ITDD implanted.

ITDD is recommended in England for patients with cancer pain where other conservative interventions have failed or are contraindicated and where the uncontrolled pain is causing a significant impact on physical and mental health either with limited life

**Table 2.** Number of ITDD Implanted in NHS England (Using OPCS Code A543).

HES year	Total patients receiving an ITDD *	Total patients with cancer receiving an ITDD †
2014/15	378	109
2015/16	289	49
2016/17	268	70
2017/18	279	54
2018/19	265	64
2019/20 ‡	196	52

\*2014–2019 includes ITDD for management of spasticity; 2014 and 2015 includes ITDD for noncancer pain.

†Patients with an ICD10 C code up to 180 days prior to receiving an ITDD.

‡Up to January 2020.

HES, Hospital Episode Statistics; ITDD, intrathecal drug delivery device.

**Table 3.** Patients Receiving ITDD for Cancer Pain in the UK From 2017 to 2019 (Using HRG Code AB13Z).

Region	YearH	
	2017/18	2018/19
South West	5*	5*
South East	5*	5*
Midlands	10	5*
East	5*	5*
North West	5*	5*
North East and Yorkshire	10	15
England	30	30

H Represents NHS financial year, that is, April to March.

\*Figures between 1 and 7 procedures across regions are masked for patient confidentiality and numbers are rounded to the nearest 5 or 10 under agreement with NHS digital.

expectancy or with near normal life expectancy (7). Despite the recommendation in 2015, there is still a clear gap between the number of ITDD implants per year and the number of patients with cancer pain potentially eligible for ITDD. The NHS England policy has not resulted in an increase in the provision of ITDD for cancer pain. Possible reasons include 1) high initial cost of ITDD devices; 2) complexity of the therapy interface between a number of NHS professionals including oncology, palliative care, anesthesia, neurosurgery, pharmacy, and nursing plus community care including hospices make delivery complex and possible only in larger centers; NHS England policy document stipulates that patient referrals are made to the “Multidisciplinary team lead of specialized pain center only from networked secondary care pain services or other tertiary specialties, for example, palliative medicine, cancer center, orthopedic (bony metastases)” (6); 3) however, candidates for ITDD often present with advanced ill health due to cancer and other comorbidities limiting their ability to travel to bigger centers for implantation/pump refills and subsequent care; and 4) lack of licensed, ITDD compatible, therapeutic alternatives to opioids where opioid tolerance and resistance has developed following long term systemic opioid therapy.

In line with the NHS England policy, the use of ITDD as part of a cancer management strategy for patients with limited life expectancy as well as those patients with near normal life expectancy also has been recommended by the recent European Society for Medical Oncology (ESMO) clinical practice guidelines (10). The ESMO guidelines recommend ITDD earlier in the treatment pathway than other neurosurgical interventions such as craniotomy.

NHS policy on ITDD stresses that the service should be a tertiary referral service providing equity of access over England. Data specific to ITDD for cancer between 2017 and 2019 shows continuing inequity of access. Access across England could be improved by adopting a different model of provision of ITDD via cancer networks of care where patients are implanted in larger specialized pain centers allied to cancer centers supported by a regional network of specialist pain centers delivering ongoing care nearer to the patient's domicile, in direct liaison with the implanting center. Specialist pain centers should aim to deliver an ITDD refill service at the patient's local NHS facilities and in the community. In this, Specialist Pain centers can be supported by ITDD specialist nurses working across regions to facilitate the refill and management of ITDD particularly in terminally ill cases where domiciliary or hospice refill become necessary. Pharmacies can play a key role both for the quality of mixture compounding and to facilitate home refills (11). Specialist nurses also should aim to educate and supervise provision of care. A team of regional ITDD nurses would act as the link between the implanting specialized center and the regional specialists pain center, providing continuity of care and easing the burden of ITDD refills on specialist centers where resources may be overstretched. While NHS England policy recognizes that “The specialized team will work jointly with the patient's primary care team, referring secondary care pain teams and the clinical teams with responsibility for the primary condition,” (6) the policy fails to describe precisely how the network of primary, secondary, and tertiary care may interact to ensure best care and timely management of complications even where patients reside some distance from a specialized center. The more recently published framework for provision of pain services for adults across the UK with cancer or life-threatening disease (12) presents a more detailed operational guidance on the interaction between level 3 specialist pain services and level 4

highly specialist services as well as the interaction between these services and palliative care. Additionally, video conferencing facilities may further enable multidisciplinary meetings with caregivers in local hospitals to provide additional support. Despite suggestions to improve provision and access to ITDD, dissemination of information on the technology in particular to cancer patients' caregivers is paramount to awareness of ITDD for this patient population, potentially enabling access at an earlier stage of disease.

The cost implications of cancer pain treatments is an important consideration because cancer survivors are living longer and may require many years of analgesia—this is particularly true of adult survivors of childhood cancers. Cost analyses of ITDD systems performed from a US commercial payer perspective have demonstrated that ITDD patients afforded lower total healthcare utilization (and resultant cost savings) compared with conventional opioid therapy alone as early as two months and through to 12 months postimplant (13). In selected patients on high-cost conventional opioid regimens, ITDD management of cancer-related pain can result in cost savings as early as 7.6 months compared with conventional opioid therapy (8). It also has been reported that public funding from a Canadian regional perspective for ITDD systems for cancer pain could result in a small budget impact of several hundred thousand (Canadian dollars) per year, with a potential for cost savings over time (14).

The advantages of using ITDD for cancer pain should be carefully weighed with potential disadvantages on an individual patient basis. Studies have suggested that opioids may have a role in the development of some tumors (15–17). Nevertheless, these studies conclude that the clinical relevance and direct effect of opioids on tumor has not been demonstrated in humans and animal models have a short duration and findings are not always translatable to human disease.

In France, the number of ITDD implanted has risen by 20% annually since 2015 (18). The provision of ITDD is considerably higher than in England with 245 and 313 devices implanted in 2017 and 2018, respectively (18). These figures exclude ITDD for spasticity but contain those implanted for noncancer pain. Expert opinion suggests that currently approximately  $300 \pm 30$  implants of ITDD are performed in France for a cancer pain indication on an annual basis (19). The incidence of the use of ITDD for cancer pain in other countries has not been reported on an annual basis. A health technology assessment conducted in Belgium reported that 718 ITDDs were implanted between 2002 and 2008 (20). The proportion of ITDD that were implanted for cancer pain during this period is unclear. The authors suggest that the ICD diagnosis codes for patients receiving an implant were in general rather unspecific (20). A retrospective study using MarketScan commercial claims data identified 1251 patients receiving ITDD for cancer pain between January 2009 and September 2015 (13).

### Strengths and Weaknesses

To our knowledge, this is the first article to explore the current provision of ITDD for cancer pain in NHS England and contrast this with an estimate of the population need for this therapy. Use of NHS coding data to identify the exact number of ITDD implants for cancer pain is limited as a specific HRG code (AB13Z) for this procedure was not introduced until 2017. Thus, estimates for ITDD provision for cancer pain from 2017 onwards are predicted to be more accurate. However, even after the introduction of a procedure and condition-specific HRG code, some miscoding may have

occurred as activity was observed in centers not implanting ITDDs for cancer. Therefore, despite the low number of ITDD implants for cancer pain across England reported in our analysis, this may represent an overestimate of the exact number of ITDD pumps implanted over the study period. Moreover, the increasing trend observed in HES for cancer patients receiving palliative care is merely an estimate because hospice data have not been considered.

Despite proven efficacy and the presence of an NHS England policy recommending its use, to our knowledge few centers provide ITDD for cancer pain.

In conclusion, we observed a substantial gap between the need and provision of ITDD for patients with refractory cancer pain in England. The publication of NHS England commissioning policy recommending ITDD for this patient population has not resulted in a decrease of this gap. Provision of ITDD across England can be improved to address the unmet need for ITDD in cancer pain patients.

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## Authorship Statement

Sam Eldabe conceptualized the study. Sam Eldabe and Rui V. Duarte designed the study. Alicia Sale acquired the aggregate data. Alicia Sale and Rui V. Duarte conducted the analysis of the data. All authors contributed to the interpretation of the data. All authors contributed to drafts of the manuscript and approved the final version of the manuscript.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article.

## COMMENTS

So far, it is the first paper representing the gap between the need and the provision of ITDD. It is really important to underline that pain management in patients with cancer is very difficult and can be managed effectively by ITDD. Unfortunately, the problem has only been observed in the United Kingdom so the results could be considered limited. It would be rather useful to involve other pain physicians from different European countries in order to obtain a situation as close to reality as possible.

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This paper highlights the unmet need of IDDS for cancer patients in England and tries to find solutions to facilitate implantations and management. The solutions identified in this paper could be also useful for other countries.

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