Frequency, variation and cost of dental extractions for adults in secondary care in Great Britain

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Key points

- Presents data on anaesthetic modality for dental extractions as reported by hospitals in Great Britain.
- Highlights the opportunity cost for the NHS as a result of the potentially large volume and cost of dental extractions under general anaesthesia.
- Supports the need for improving access to and accuracy and reliability of anaesthetic data for dental extractions.

Abstract

Aims We have conducted a survey of administrative data, aiming to investigate the reported provision of dental extraction under general anaesthesia in the NHS for adults in secondary care in the following aspects: 1) anaesthetic data accessibility by NHS organisations; 2) the number and proportion of dental extraction episodes by anaesthetic modality and procedure type; 3) the economic cost of dental general anaesthesia (DGA) for adults; 4) variations in the anaesthetic provision between commissioning regions and organisation types.

Methods We collected data from individual secondary care NHS organisations that provide dental extraction services in England, Wales and Scotland. A data collection form was devised to capture the number of episodes of dental extraction under each relevant oral surgery procedure code per anaesthetic modality per institution from October 2015 to September 2016.

Results The majority (64.0%, n = 96,659) of the episodes were categorised into an anaesthetic modality; 39.2% (n = 37,902) under general anaesthesia, 18.7% (n = 18,050) under sedation, and 42.1% (n = 40,707) under local anaesthesia. The majority of sedation provision (84.9%) derived from dental hospitals. A substantial proportion (37.0%) of the episodes could not be assigned an anaesthetic modality. Variations in dental general anaesthesia activity were observed with respect to the commissioning regions and organisation types. The annual cost of adult DGA from 81 out of 150 organisations that provided DGA data was estimated to be over £19 million, based on the NHS payment by results tariff 2015–2016.

Conclusion Our data suggest that the number of adult DGA episodes and the associated cost are considerable, and highlights the scope for improving the quality of data for commissioners and providers to support discussions over patient pathways.

Introduction

Despite significant improvements in tooth retention over recent decades, tooth extraction remains an extremely common treatment experienced by a large majority of the population.[1,2,3] According to the Adult Dental Health Survey in 2009, 47% of adults over 85 years old were edentulous and the mean number of retained teeth fell gradually with age, from 23.2 teeth among 55–64-year-olds to 14.0 teeth among 85 years and above in England, Wales, and Northern Ireland.[4]

In the UK, dental extraction under general anaesthesia (GA) in primary care settings ended from January 2002, following the publication of *A conscious decision: a review of the use of general anaesthesia and sedation in primary dental care*,[5] due to safety concerns and the availability of effective local anaesthetic and sedation techniques.[6,7,8] However, GA continues to be used on a discretionary and regular basis in hospital settings in a healthcare system funded by taxation. GA is associated with risks of anaesthetic-related morbidities and, rarely, mortality.[9] In addition, an excess of demand over provision capacity and consequent waiting times may lead to complications for patients on a waiting list for GA.[10] Moreover, there is a risk of repeat GA to manage later occurring dental disease in the absence of a longer-term dental anxiety management plan.[11] In relation to the use of resources, GA carries the highest cost compared to local anaesthesia (LA), with or without sedation, when consideration is given to staff salaries, theatre time, ward space, and administration.[12]

The General Dental Council (GDC) states that GA should only be considered if there is overriding clinical need.[13] However, as expressed by clinicians in maxillofacial units, 'clinical need' is sensitive to definition.[14] In England, approximately half of all adults would feel anxious about going for dental treatment tomorrow or when in the dentist's waiting room. Furthermore, around 70% of all adults would feel some level of anxiety about having a tooth drilled or having an injection.[15] This does not, however, mean that everyone in this group requires a GA for dental extractions.

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The scale of dental extraction activity under GA is currently unknown. The hospital episode statistics (HES) system does not collect information on the anaesthetic modality for a dental procedure, and not all hospital day-case episodes are transferred to the HES.[16,17,18] Also, some episodes that are recorded are coded inaccurately.[17] In 2013, a questionnaire-based survey was distributed to UK hospitals on two consecutive days of a chosen week to estimate the annual anaesthetic activity. The authors estimated annual dental caseload to be 111,600 (encompassing all ages), placing dental procedures the eighth most common procedure among all UK anaesthetic activities.[19,20] Evidence based on longer-term actual GA activity data is scarce and limited to a regional scale; a study of the activity for a single year (2014) from a maxillofacial unit in Cornwall revealed that 42.6% (n = 1,442) of the total adult extraction episodes took place under GA.[21] There is currently no robust data source to enable the comparison of dental extraction activity under GA between institutions or regions.

The evidence to date on the extent of adult dental extraction under GA in the UK is limited in comparison to the literature on paedodontic GA activity, despite the risks and cost implications of over-prescription of GA being no more acceptable in adults than in children. The existing literature on adult GA dental extraction includes regional studies that highlighted the heterogeneity in anaesthetic provision between institutions and that the anaesthetic choice predominantly reflects non-clinical factors. A study undertaken in Edinburgh found significantly more wisdom tooth extractions were being undertaken under GA at a maxillofacial unit compared to a nearby dental hospital, and that this difference was unrelated to the technical difficulty of cases, but the nature of the unit.[22] A study in the West Midlands found hospitals with GA facilities relied heavily on the use of day-case GA for third molar extractions, whereas another hospital compensated successfully for their lack of GA facilities primarily with LA and sedation.[23] In Cornwall, the authors investigated dental extraction under GA explicitly for adults, and found the majority (93.4%) who underwent GA for a single tooth extraction in this unit had previously tolerated dental treatment without the need for GA and that no patient in this cohort had GA due to failure of sedation.[21]

In light of the relative lack of evidence, we aimed to investigate the following aspects of the adult GA dental extraction activity between October 2015 and September 2016 in NHS secondary care settings in Great Britain: 1) anaesthetic data accessibility by NHS organisations; 2) the number and proportion of dental extraction episodes by anaesthetic modality and procedure type; 3) the economic cost of dental extraction under GA for adults; 4) variations in GA activity with respect to commissioning regions and organisation types.

Methods

Study design

This was a survey of administrative data from individual NHS organisations in England, Wales, and Scotland from October 2015 to September 2016. We included secondary care NHS organisations that provide dental extractions. Research ethics approval by the National Research Ethical Committee was not required, as we did not use identifiable individual patient data.[24] Additionally, section 40(2) of the Freedom of Information Act 2000 ensured that information was withheld from NHS organisations where it would be possible to identify the individual.

Data source

We obtained a list of secondary care NHS organisations that provide dental extractions from healthcare evaluation data (HED). We sought to exclude providers who provided GA solely for adults with special needs, as the focus of our study was quantification of and variations in practice for patients without special needs in order to suggest the potential for reduction of avoidable GA; as opposed to provision of arguably more unavoidable GA for special needs patients.

Having compiled a list of provider trusts, we made a formal request for the anaesthetic activity information from these organisations. In the absence of a central data source for such information, the only way to investigate the national scale of dental extraction activity under GA was to collate data from individual organisations. Given that this information was likely to be held in data warehouses, we deemed it futile to contact clinicians for this corporate data , using a more informal survey methodology. A survey of administrative data via formal information request differs from an informal survey, in that the respondents are obliged to respond to the request under the Freedom of Information (FOI) Act 2000 or the FOI (Scotland) Act 2002. The NHS Trust/Health Board FOI departments delegated the response to the request to the most appropriate team or person to respond in their view.

Data collection

We devised a data collection form (Appendix 1) to capture the number of dental extraction cases per anaesthetic modality for adults (18 years or older) from October 2015 to September 2016. We defined an adult as a person aged 18 years or older, according to the legal age of adults in the Children Act 2004. We have collected data for children as well as adults. We intend to publish

Table 1 Characteristics of responsive and non-responsive organisations by organisation type and commissioning region

Organisation type	Number of organisations		Commissioning region	Number of organisations	
	Responsive	Non-responsive		Responsive	Non-responsive
Acute general trust	79	10	North	35	3
Acute teaching trust	28	3	Midlands and East of England	32	6
Acute specialist trust	5	1	South	32	4
Community trust	2	1	London	15	2
Wales NHS health board	7	0	Wales	7	0
Scotland NHS health board	11	3	Scotland	11	3
Total	**132**	**18**	**Total**	**132**	**18**

Table 2 Data return from the organisations

No.	Data return category	Number of organisations
I.	Complete data	34
II.	Supplied anaesthetic information for all day-case and in-patient data, but not supplied anaesthetic information for outpatient data or unclear whether outpatient data has been provided (request for further clarification made but no response received)	30
III.	Supplied anaesthetic information for most day-case, in-patient and outpatient data but a proportion of data was without anaesthetic information (median percentage of episodes without anaesthetic information (IQR): 8.3 (36.5)	21
IV.	Supplied only the number of episodes without any anaesthetic information	36
V.	Responded stating no data could be provided (FOI section 12)	11
VI.	No response at all	18

the results for children in a separate paper. The data collection table contained a column listing the relevant oral surgery procedure codes (Office of Population Censuses and Surveys version 4.7 [OPCS 4.7]), and a header row with anaesthetic modalities (GA, sedation, LA). We requested that, where an episode was given more than one code, this be counted only once in the 'total number of episodes' row.

The FOI Act sets timescales for a response, but we were permissive with late or non-respondents. Organisations are entitled to refuse to provide information and apply an exemption (section 12 of the FOI Act) where the cost of supplying the information would exceed the limit outlined in regulations. We were also mindful that this research methodology is potentially highly intrusive, so we sought to minimise the impact of our request on NHS bodies.

Cost

In order to estimate the cost of GA dental extraction episodes in the organisations that responded, we applied the NHS payment by results (PbR) tariff 2015–2016. As the tariff is indexed using Healthcare Resource Groups (HRG), we grouped OPCS 4.7 codes into HRG codes. We multiplied the number of GA episodes per HRG code by the adult elective/day-case NHS PbR tariff 2015–2016. We estimated the cost conservatively, without accounting for diagnosis, comorbidities, or complications. In addition, for the purpose of this investigation, we assumed all episodes were elective and the length of stay was fewer than two days. We present the estimated cost in pound sterling (£).

Data analysis

We produced descriptive statistics using STATA 14, based on the proportions of episodes per anaesthetic modality, rather than number of episodes considering the different sizes and types of the organisations. Given the extent of variation in the levels of data return from the organisations, we did not feel it was appropriate to perform statistical tests to make comparisons between organisation types or regions.

We present the variations between procedure types and commissioning regions using weighted mean percentages, obtained by ranking the organisations by the total number of dental extraction episodes under all anaesthetic modalities. Where the responsive organisations supplied the small values of the number of episodes suppressed as ≤5 or ≤10 in the interest of patient confidentiality, we imputed them with half values, 3 or 5, respectively. This occurred in 147 out of 4,191 values (3.5%).

Results

Characteristics of the organisations

This investigation yielded a response rate of 88.0%, 132 out of 150 NHS trusts/health boards that provide dental extraction services. The characteristics of responsive and non-responsive organisations could be classified into the organisation types and commissioning regions (Table 1). Although hospital-level data were requested, some organisations supplied trust-level data combining activities from all relevant hospitals within their organisation. Eight NHS trusts/health boards provided data for individual dental hospitals.

Anaesthetic data accessibility by the organisations

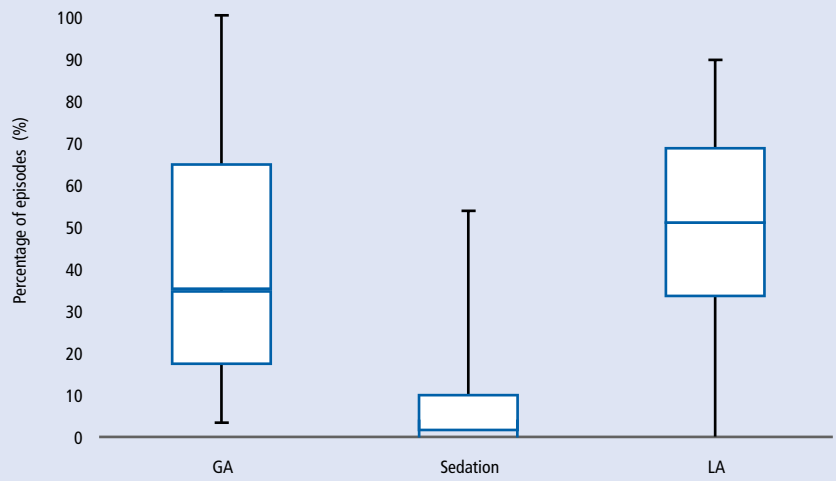
The level of completeness in data return from the organisations could be classified into six categories (Table 2). Thirty-four organisations provided all data categorised into each anaesthetic modality (category I). Thirty organisations provided all day-case and inpatient data, but either provided no anaesthetic information on outpatient data or unclear outpatient data (category II). A proportion of episodes from those in category III (n = 21) did not have anaesthetic information (median percentage of episodes without anaesthetic information (IQR): 8.3 (36.5)). Those in category IV (n = 36) supplied the number of episodes only, and applied FOI exemption section 12 for the missing anaesthetic information. Eleven organisations responded with no data at all and applied FOI exemption section 12 (category V). Eighteen organisations in category VI did not respond at all. The unanimous reason for not being able to specify the anaesthetic modality was that this information was not electronically recorded in their organisation (particularly for outpatient procedures), and obtaining this information would be time-consuming as it would require a manual search through the case notes. This resulted in 54,427 episodes (37.0%) not being assigned an anaesthetic modality, and 36% of these data were supplied split into the inpatient (11.0%) or outpatient (25.0%) category.

The organisations in data return category I comprised 16 acute general trusts, 11 acute teaching trusts (six dental hospitals and five non-dental hospitals), two acute specialist trusts, three Wales NHS health boards and two Scotland NHS health boards. These organisations could be classified into the following commissioning regions: North (11), Midlands and East of England (8), South (6), London (4), Wales (3) and Scotland (2).

Frequency of dental extraction episodes

Eighty-five organisations (categories one to three) supplied some or all of their data with anaesthetic information, resulting in 96,659 episodes (64.0%) being categorised into an anaesthetic modality; 39.2% (n = 37,902) under GA, 18.7% (n = 18,050) under sedation, and 42.1% (n = 40,707) under LA.

Fig. 1 Percentage of episodes under each anaesthetic modality in the 34 organisations in data return category I. Median (IQR): GA 34.8 (47.3); sedation 15.8 (10.1); LA 50.8 (34.8)



Within the 34 organisations in data return category I, the mean percentage of dental extraction episodes per organisation under GA, sedation, and LA was 44.7%, 8.2%, and 47.0%, respectively. The interquartile ranges are as shown in Figure 1. The most commonly used anaesthetic modality for surgical removal of impacted wisdom tooth was GA (46.0%), followed by LA (32.1%) and sedation (20.0%). GA was most commonly used (30.6%) for surgical removal of non-impacted wisdom tooth or impacted non-wisdom tooth (Table 3).

The data from the eight dental hospitals comprised 5,913 episodes under GA, 15,326 episodes under sedation, 17,692 episodes under LA, and 4,484 outpatient episodes without anaesthetic information (Table 4).

Table 3 Weighted mean percentages of anaesthetic modality by HRG codes in 34 organisations in data return category I, and the estimated cost of the episodes under GA in 81 organisations within data return categories I to III

HRG code	OPCS codes	34 organisations in data return category I			81 organisations* in data return categories one to three		
		LA row % column %	Sedation row % column %	GA row % column %	Number of episodes under GA	Adult Elective/ day-case tariff (£)**	Annual cost (£)
CZ41Y Major dental procedure	F09.1 Surgical removal of impacted wisdom tooth	32.1% 6.7%	20.0% 9.5%	46.0% 18.8%	7,762	619	4,804,678
CZ40Y Major surgical removal of tooth	F09.2 Surgical removal of impacted tooth NEC (NEC: not elsewhere classified)	37.3% 14.7%	19.0% 13.0%	41.9% 30.6%	11,169	549	6,131,781
	F09.3 Surgical removal of wisdom tooth NEC						
CZ37Y Surgical removal of tooth	F09.4 Surgical removal of tooth NEC	54.0% 18.6%	18.7% 11.2%	22.1% 12.1%	5,101	462	2,356,662
	F09.5 Surgical removal of retained root of tooth						
	F09.8 Other specified surgical removal of tooth						
	F09.9 Unspecified surgical removal of tooth						
CZ42Y Extraction of multiple teeth	F10.1 Full dental clearance	48.5% 19.3%	15.3% 12.3%	35.0% 27.8%	9,684	620	6,004,080
	F10.2 Upper dental clearance						
	F10.3 Lower dental clearance						
	F10.4 Extraction of multiple teeth NEC						
CZ30Y Minor extraction of tooth	F10.8 Other specified simple extraction of tooth	66.0% 32.2%	14.3% 23.0%	14.0% 8.7%	2,889	194	560,466
	F10.9 Unspecified simple extraction of tooth						
					Total: 36,605		**Total: 19,857,667**

*Only includes organisations that supplied breakdown of the total number of episodes into OPCS codes **NHS PbR tariff 2015–2016

The contribution of the activities from these eight dental hospitals to the total number of episodes in the organisations in data return category I–III was 15.6% (GA), 84.9% (sedation), and 43.5% (LA).

Variations in anaesthetic provision

There were variations in reported anaesthetic provision for dental extractions according to the organisation type and size (Fig. 2), and also between commissioning regions (Fig. 3).

Cost

The total cost of adult GA dental extraction from October 2015 to September 2016 conservatively estimated, using the adult elective/day-case NHS PbR tariff 2015–2016, was £19,857,667. This calculation included the GA dental extraction activities of only the 81 organisations that were within data return category I–III and supplied a breakdown of the total number of episodes into OPCS codes (Table 3). It should be noted that the paucity of anaesthetic information in the outpatient data in organisations within categories two and three did not impact on the cost calculation for GA activities. The 81 organisations included in the cost calculation form 54% of all NHS secondary care organisations that provide dental extraction services in Great Britain.

Discussion

The findings of this investigation contribute to elucidating the scale of adult GA dental extraction activity in Great Britain. Within the data with anaesthetic information, we found the most commonly used anaesthetic modality for dental extractions for adults to be LA (42.1%, n = 40,707), closely followed by GA (39.2%, n = 37,902), and sedation (18.7%, n = 18,050) in the year for which data were requested. This order was maintained within the data from the organisations that provided complete anaesthetic information (category I); LA (47.0%), GA (44.7%), and sedation (8.2%).

The majority of sedation provision derived from dental hospitals. In primary care, although some NHS dental practices are commissioned to providing conscious sedation, the vast majority of dental extractions are carried out under LA alone. Notwithstanding the limitations of this study, such as the exclusion of primary care settings, our data suggest that the number of adult GA dental extraction episodes and the associated annual cost (over £19 million based on 81 out of 150 organisations) are considerable. The lack of data on anaesthetic modality for 37% of the reported episodes highlights a paucity in the data in anaesthetic provision for dental extractions, which may have implications for future service planning.

The variations between commissioning regions and organisation types may reflect the variations in local arrangements with other dental service providers in the area and the hospital's capacity to provide sedation or GA in regards to the facility, staff training and availability of anaesthetic staff. An interesting finding was that the majority of sedation episodes (84.9%) of sedation activities in organisations in data return categories one to three was undertaken in the dental hospitals. One may speculate that this may reflect the teaching and training needs of dental hospitals and the locally-determined care pathways that direct patients to the most appropriate provider. However, this was not a finding in regional studies[21,22,23] and an alternative explanation is that this variation is unplanned and shaped by the preferences of providers. The difference in the anaesthetic provision between maxillofacial units and dental hospitals has been consistently demonstrated in the aforementioned regional studies in Cornwall, Edinburgh, and the West Midlands.[21,22,23] The discrepancy in the anaesthetic provision between hospitals was attributed to non-clinical reasons such as the availability of GA facilities and the nature of the unit. Our data provide a national scale evidence of this inequality and strengthen the case for improving the provision of sedation services in maxillofacial units as well as primary care settings.

The cost, conservatively estimated in this investigation based on 81 organisations using the NHS PbR tariff for elective episodes (over £19 million), highlights the economic consequences of dental extraction under GA for adults. Considering the fact that there are 150 secondary care settings in which dental extraction activity is carried out according to the HED, we estimate that the national annual cost of GA dental extractions for adults to the NHS is likely to significantly exceed £19 million. It should be noted that the paucity in the anaesthetic information in data return categories two and three was mainly in the outpatient data, which would not influence our cost calculation for GA activities, despite this paucity being the main cause of our limited comparison in the proportion of anaesthetic modalities between organisations. Our estimation of economic cost of dental extraction under GA engenders questions about the root cause of the current level of such activity for adults, especially in the presence of a body of evidence supporting the clinically successful, cost-effective, and safer techniques alternative to GA.[7,8,25,26]

The strengths of this investigation include its uniqueness, in that this is the first paper to present the annual dental extraction activity with anaesthetic modality information as reported by the organisations without extrapolating short-term data to annual activity or assuming the anaesthetic modality using the HES data. This investigation, however, also has several limitations. Our methodology relied heavily on clinicians and

Table 4 Frequency of dental extraction episodes for adults under each anaesthetic modality in the dental hospitals

Dental hospital	GA %(n)	Sedation %(n)	LA %(n)	Number of episodes without anaesthetic information
A	Not applicable	(1,134)	Not recorded	
B	9.5 (2,519)	53.3 (9,366)	37.3 (4,910)	2,715 outpatient episodes
C	Not applicable	25.7 (707)	74.3 (2,049)	
D	33.7 (399)	15.2 (180)	51.1 (606)	
E	17.3 (507)	31.7 (932)	51 (1,500)	
F	3.1 (247)	37.1 (2,930)	59.8 (4,719)	
G	Not applicable	Not recorded	Not recorded	1,769 outpatient episodes
H	36.0 (2,241)	1.2 (77)	62.8 (3,908)	

Fig. 2 Percentage of episodes under GA, sedation, and LA in the 34 organisations in data return category I: 16 acute general trusts, 11 acute teaching trusts of which, six were dental hospitals and five were non-dental hospitals, two acute specialist trusts, three Wales NHS health boards and two Scotland NHS health boards. The organisations are ranked on the horizontal axis according to the total number of episodes (all anaesthetic modalities combined) where organisation number one has the smallest number of episodes (17) and organisation number 34 has the largest number of episodes (13,177)

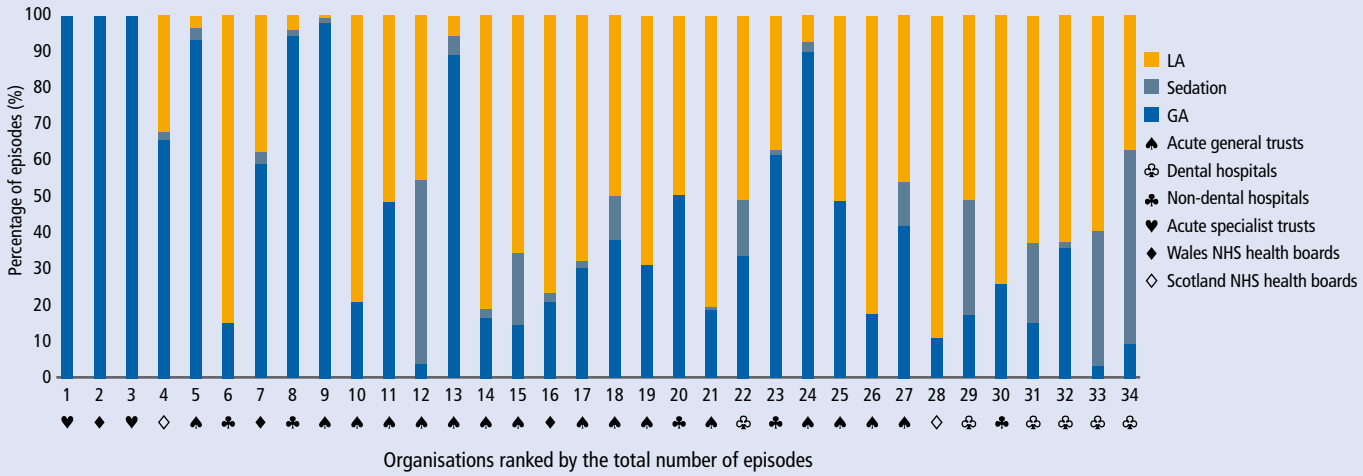
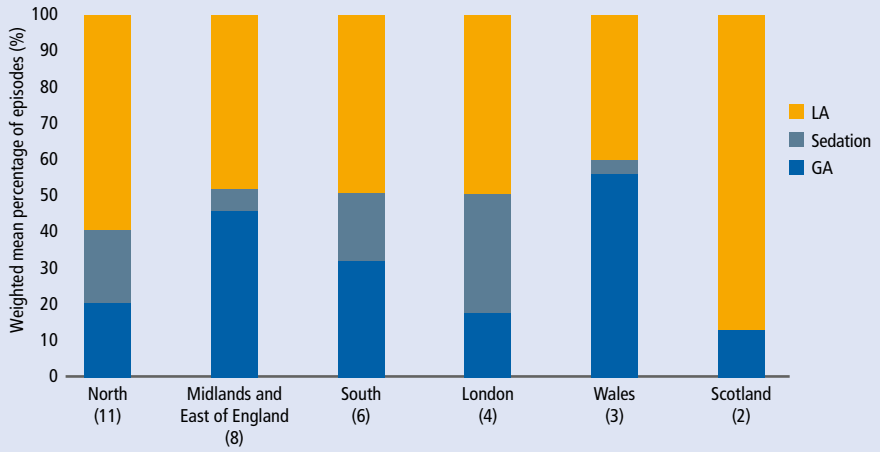


Fig. 3 Weighted mean percentages of episodes under GA, sedation and LA in each commissioning region in the 34 organisations in data return category I. The numbers in bracket indicate the number of organisations



coders at individual hospitals to accurately and completely record the data. The variations between organisations/regions should be cautiously interpreted due to the relatively small number of organisations that were able to provide complete data return on anaesthetic information. Given this paucity, especially in the outpatient data, we did not feel it was appropriate to perform statistical tests to make comparisons in the proportion of anaesthetic modalities prescribed between organisation types or regions. PbR tariff is commonly used for health economic analysis,[27,28] but the tariff represents the payment to the provider, and may not always reflect the actual cost as it does not account for the use of postoperative complication codes and national and local adjustment of the tariff.[29] For this reason, and because the cost calculation included only 54% of all NHS secondary care organisations with dental extraction provision in Great Britain, our estimated cost of dental extraction under GA for adults does not equate to the true annual cost to the NHS. In addition, it was not within the scope of this paper to investigate the social context of the episodes or primary care provision of dental extractions. We plan on conducting qualitative research which may be able to elucidate some context to the findings presented in this paper.

Conclusion

A large number of dental extractions are carried out under GA for adults in Great Britain, with an apparent high degree of variation between organisation types and commissioning regions, representing a considerable cost and potential implications for patient outcomes. Reducing the size of the cohort undergoing dental extractions under GA has a clear and close trajectory to patient benefit and efficient use of NHS resources. This investigation highlights the scope for improving access, accuracy and reliability of anaesthetic activity data for dental extractions to facilitate research, policy, delivery and, ultimately, improved patient outcomes.

Declaration of interests

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Appendix 1 Data collection form

Institution name and trust name (one table for each institution)

	Dental procedure	Number of episodes of dental extraction under GA	Number of episodes of dental extraction under sedation	Number of episodes of dental extraction under LA
Adults (18 years or older)	F09.1 Surgical removal of impacted wisdom tooth			
	F09.2 Surgical removal of impacted tooth NEC			
	F09.3 Surgical removal of wisdom tooth NEC			
	F09.4 Surgical removal of tooth NEC			
	F09.5 Surgical removal of retained root of tooth			
	F09.8 other specified surgical removal of tooth			
	F09.9 Unspecified surgical removal of tooth			
	F10.1 Full dental clearance			
	F10.2 Upper dental clearance			
	F10.3 Lower dental clearance			
	F10.4 Extraction of multiple teeth NEC			
	F10.8 Other specified simple extraction of tooth			
	F10.9 Unspecified simple extraction of tooth			
	Total number of episodes (if an episode was given more than one code, count this as one episode)			
Children (under 18 years)	F09.1 Surgical removal of impacted wisdom tooth			
	F09.2 Surgical removal of impacted tooth NEC			
	F09.3 Surgical removal of wisdom tooth NEC			
	F09.4 Surgical removal of tooth NEC			
	F09.5 Surgical removal of retained root of tooth			
	F09.8 Other specified surgical removal of tooth			
	F09.9 Unspecified surgical removal of tooth			
	F10.1 Full dental clearance			
	F10.2 Upper dental clearance			
	F10.3 Lower dental clearance			
	F10.4 Extraction of multiple teeth NEC			
	F10.8 Other specified simple extraction of tooth			
	F10.9 Unspecified simple extraction of tooth			
	Total number of episodes (if an episode was given more than one code, count this as one episode)			
	Grand total number of episodes			