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Original Article

The delivery of obstetric anaesthetic care in UK maternity units: a survey of practice in 2021

J.H. Bamber [a], D.N. Lucas [b,*], R. Russell [c]

[a] Department of Anaesthesia, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK
[b] Department of Anaesthesia, London North West University Healthcare NHS Trust, London, UK
[c] Nuffield Department of Anaesthetics, Oxford University Hospitals NHS Foundation Trust, Oxford, UK

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ABSTRACT

Background: Anaesthetists are crucial members of the maternity unit team, providing peri-operative analgesia and anaesthesia, and supporting the delivery of medical care to high-risk women. The effective contribution from obstetric anaesthetists to safety in maternity units depends on how anaesthesia services are organised and resourced. There is a lack of information on how obstetric anaesthetic care is resourced in the UK.

Methods: The Obstetric Anaesthetists' Association surveyed UK clinical leads for their hospital's obstetric anaesthetic service and examined compliance with national recommendations.

Results: There were 153 responses by lead obstetric anaesthetists from 184 maternity units in the UK (83%). The number of consultants per 1000 deliveries was 2.2 [1.6–2.7] (median [IQR]). In 20% of units, there was a dedicated on-call rota (on-call only for obstetric anaesthesia), whilst the remainder had a 'combined' on-call rota (on-call for other clinical areas in addition to obstetrics). Multidisciplinary ward rounds were held in 83% of units. Twenty-five (16%) units reported having no regular multidisciplinary ward rounds, of which nine (6%) did not have any multidisciplinary ward rounds. Planned operating lists for elective caesarean sections were provided in 77% of units.

Conclusions: In the largest survey of obstetric anaesthesia workload to be reported for any health system, we found significant disparities between obstetric anaesthesia service provision and current national recommendations for areas including consultant staffing, support for elective caesarean section lists, antenatal anaesthetic clinics, and consultant support for service development. Wide national variation in service provision was identified.

Introduction

Obstetric anaesthetists have an integral role in many aspects of maternal care beyond the provision of anaesthesia and analgesia and have a shared responsibility for the delivery of safe care. The capability of obstetric anaesthetists to effectively contribute to maternity unit safety is dependent on how these services are organised and resourced.

Safety of maternity care in the UK is under renewed scrutiny following publication of the Ockenden Report,[1] an independent review of maternity services at Shrewsbury and Telford NHS Trust investigating neonatal and maternal harm. In contrast to similar previous reports, this report makes specific recommendations for obstetric anaesthesia, including guidance on the adequacy of staffing.[2–3] In 2021, the UK Parliament's Health and Social Care Committee highlighted the importance of adequate staffing levels for safety in maternity units.[4] The Committee recommended that the anaesthetic workforce should be considered in Department of Health reviews of staffing levels, and it acknowledged anaesthetists' contribution to the delivery of safe and personalised care in maternity units. Despite these recommendations, there is a paucity of published information on current anaesthetic staffing levels in UK maternity care and how anaesthetic care is organised and provided.

To address the information deficit about UK obstetric anaesthetic staffing and service delivery, the Obstetric Anaesthetists' Association (OAA) surveyed UK consultant members identified as clinical leads for the obstetric anaesthetic service in their maternity unit. This survey was designed to assess current obstetric anaesthesia staffing resources and service delivery to better inform maternity service planning for the delivery of safer care and to facilitate benchmarking. In the aftermath of the publication of the Ockenden Report, it also provides an

* Corresponding author at: Department of Anaesthesia, London North West University Healthcare NHS Trust, Watford Road, Harrow HA1 3UJ, UK.
E-mail address: Nuala.lucas@nhs.net (D.N. Lucas).

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important opportunity for a snapshot census of how key recommendations of the Report are being implemented and supported in the UK.

Methods

An online survey was set using Microsoft Forms (Microsoft Corp., Redmond, WA, USA). Questions were based on recommendations in the Royal College of Anaesthetists (RCoA) guidelines for the provision of obstetric anaesthetic services (GPAS)[5] which were developed using a peer-review, evidence-based process accredited by the National Institute for Health and Care Excellence (NICE). There were 23 survey questions, some of which were branch questions depending on the answers given (Supplementary Table S1). A free-text box allowed participants to post comments about the survey, their responses, or other information.

Participants were consultant anaesthetists identified as clinical leads for obstetric anaesthesia in UK hospitals. Maternity care in the UK is provided, with rare exceptions, within the National Health Service (NHS), a publicly funded healthcare system free at the point of delivery. The weblink for survey participation was posted on an OAA WhatsApp group for lead obstetric anaesthetists and emailed to OAA members who were registered on the OAA membership database as clinical leads. The weblink was open in two phases: January 15, 2021 to February 10, 2021 and August 17, 2021 to October 4, 2021. There were 205 maternity units whose clinical leads were registered with the OAA database. However, acknowledging that this information may be inaccurate, we undertook an extensive interrogation of various sources to compile an accurate list of UK consultant maternity units. Information sources included the OAA National Obstetric Anaesthetic Database, NHS Digital Maternity Statistics, Scottish Perinatal Network, Welsh Government Maternity and Birth Statistics, RCM State of Maternity Services Report 2018 – Northern Ireland, Northern Ireland Statistics and Research Agency Birth Statistics.[6–11] This list was reviewed by OAA Executive Committee members who practised in the various UK regions, and websites for all hospitals were viewed for further confirmatory information. One of the authors (DNL) directly contacted all listed hospitals in England to confirm the presence of obstetric anaesthetic services.

Using national maternity statistics, Care Quality Commission reports and maternity unit websites, the most recently available data on annual deliveries were obtained for all identified hospitals.[7–11] Data from consultant units in the UK islands of Isle of Man, Guernsey and Jersey have been included, although their local health systems are separate to the NHS (Supplementary Table S2).

The terminology and definitions used in the survey and its analysis are shown in Supplementary Table S3.

For analysis preparation, survey data on Microsoft Forms were migrated to Microsoft Excel for Mac (Microsoft Corp., Redmond, WA, USA). Maternity units were categorised into NHS Regions by postcode location[12] and into size category by the number of annual deliveries: Small (≤2000), Medium (2001–4000), Large (4001–6000), Very large (>6000).

To standardise data for comparisons among maternity units, rates per 1000 deliveries were calculated for total weekly number of consultant weekday Programmed Activities (PA),[12] total weekly consultant weekday hours (derived from number of PA), number of consultant anaesthetists with contracted PA for maternity unit work, and number of elective caesarean section (CS) lists.

Multiple imputation (Bayesian model, Markov chain Monte Carlo algorithm, 500 iterations, ten imputation sets, Blimp version 3. Los Angeles, CA, USA)[13] was used to supply values for missing data for the rate of the number of consultant PA sessions and hours. Estimations for missing discrete data of consultant numbers in non-participating units were derived by substitution imputation strategy using the known published annual delivery rate in the unit and the median value (and 25th and 75th percentiles for an estimated range) for the rate of consultant numbers per 1000 deliveries in the relevant maternity unit size category.

Survey variables analysed included survey participation, annual number of deliveries, unit size category, NHS region location, number of consultant PA, number of consultants with PA, rate of PA hours per 1000 deliveries, number of elective CS lists, rate of weekly number of elective caesarean section lists per 1000 deliveries, dedicated on-call rota for obstetric anaesthesia, number of consultants participating in on-call rota, rate of number of consultants participating in on-call rota per 1000 deliveries, number of anaesthetists on duty on maternity unit during weekday daytime, number of multidisciplinary ward rounds and anaesthetist participation, and availability of PA time for clinic work and for lead consultant work.

Numerical data were tested for normality (Shapiro-Wilk and Q-Q plots) to determine choice of parametric or parametric tests. As appropriate, data descriptions include means (standard deviations [SD], 95% confidence intervals [CI]) and median (interquartile range [IQR]). The effect of unit size and geographical location were analysed by multinominal regression and chi-trend analysis for survey response rate and by multiple linear regression and one-way ANOVA analysis for consultant PA rates. The differences between unit sizes for number of elective CS lists per 1000 deliveries were analysed by a Kruskal-Wallis ANOVA. The effect of unit size on frequency of anaesthetists' attendance at multidisciplinary ward rounds was analysed by ordered logistic regression. Linear regression was used to analyse the effect of the consultant PA rate (number of consultant PA per week per 1000 deliveries) on the proportion of multidisciplinary ward rounds attended by an anaesthetist. Statistical significance was accepted at $P < 0.05$ (Supplementary Table S4).

Statistical analysis was undertaken using StatPlus for Mac (AnalystSoft Inc., Walnut, CA, USA) and Stata/BE 17.0 for Mac (StataCorp, College Station, TX, USA). Funnel plots were generated using a Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) macro calculator created by Public Health England.[14]

Finally, we undertook a qualitative review of submitted comments.

Results

Number of UK consultant maternity units and survey response rate

We identified 184 consultant maternity units throughout the UK (including the Isle of Man, Guernsey and Jersey). The overall survey response rate was 83% (153/184). The response rate increased with unit size ($P = 0.004$) but was not influenced by unit location in a particular NHS region ($P = 0.59$). Large units represent 53% of all deliveries in consultant-led maternity units, while Medium and Small units represent 27% and 5% of all deliveries, respectively.

Consultant obstetric anaesthetists: number, contracted sessional time and on-call commitments

We estimate that there are 1730 (1686 and 1774, respectively, for lower and upper estimates) consultant obstetric anaesthetists with regular contracted sessions working in UK maternity units (using a missing data substitution strategy described in Methods). Nationally, the overall mean values for the number of consultant PA (hours) per week for obstetric anaesthesia per 1000 deliveries was 4.23 (16.9 h), whilst the mean number of consultants with regular obstetric anaesthetic sessions was 2.55 per 1000 deliveries (SD 2.04, 95% CI 2.25 to 2.84) (Fig. 1). The median number of consultants [IQR] for each unit size category is shown in Table 1. The number of contracted PA per week per 1000 deliveries is shown in Fig. 1.

For consultant weekday (Monday–Friday 07:00 to 19:00) contracted sessional time (PA) per 1000 deliveries ('PA rate'), increasing

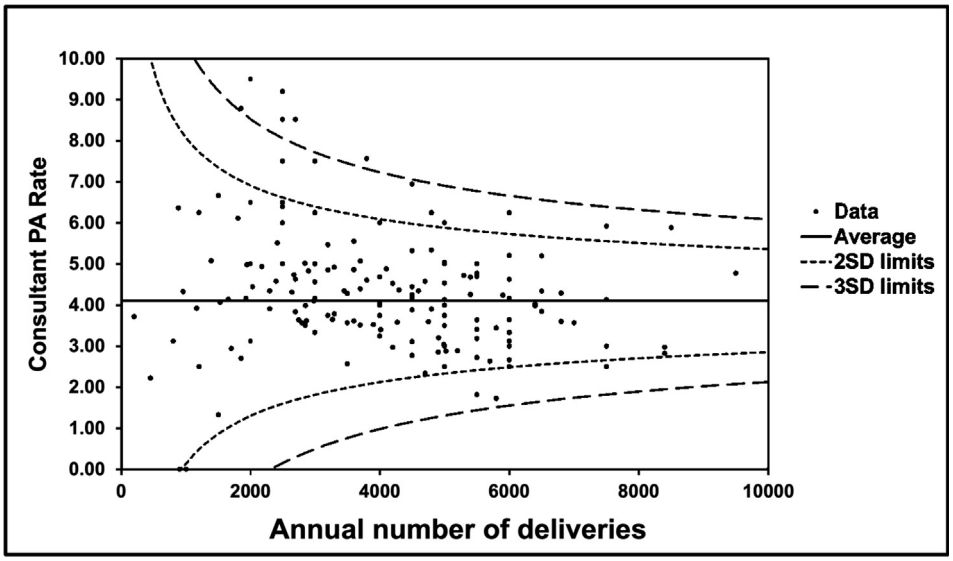

Fig. 1. Contracted consultant PA each week per 1000 deliveries for every UK maternity unit (n = 184 maternity units, mean 4.23)

Table 1
Survey data

	Very large (n = 15)[a]	Large (n = 77)[a]	Medium (n = 65)[a]	Small (n = 27)[a]	All units (n = 184)[a]
Units participating in survey	15 [100%]	70 [91%]	51 [79%]	17 [63%]	153 [83]
consultants per 1000 deliveries (median [IQR])	1.6 [1.4,1.9]	2.2 [1.8,2.4]	2.7 [2.2,3.2]	2.5 [2.1,2.9]	2.2 [1.6,2.7]
Units with weekday premium PA sessions (%)	60%	21%	10%	6%	20%
Units with weekend Premium PA sessions (%)	33%	7%	4%	0%	8%
Median [IQR] values for PA	0.75 [0.5, 1.0]	0.5 [0.25, 0.5]	0.5 [0.5, 1.0]	0.25 [0, 0.5]	
Dedicated consultant on-call rota (%)	67%	21%	2%	0%	17%
Consultant PA provided for anaesthetic clinics	93%	91%	86%	71%	86%
Consultant PA provided for service lead management time	100%	87%	86%	77%	87%
Units with elective CS list (%)	100%	87%	67%	41%	77%
Elective CS list per 1000 deliveries (median [IQR])	1.2 [0.9,1.3]	1.0 [0.9,1.3]	1.2 [0.8,1.4]	1.5 [1.2,2.2]	1.1 {0.9, 1.3]

PA: programmed activity. CS: caesarean section.
[a] Total number of units in the UK.

unit size had a small negative effect ($P = 0.002$), with a significant difference ($P < 0.001$) between the PA rate for Medium size units (mean 'PA rate' = 4.71, 95% CI 4.40 to 5.04) and Large units (mean 'PA rate' = 3.64, 95% CI 3.44 to 3.84) (Fig. 2). This finding was replicated when premium time PA was included. The percentage of units with consultants contracted to work weekday (19:00–07:00) and weekend premium time PA is shown in Table 1. Geographical location of a unit by NHS region had no effect on PA rate ($P = 0.34$).

For survey respondents, 20% of units had a 'dedicated' consultant on-call rota (on-call only for obstetric anaesthesia), whilst the remainder had a 'combined' on-call rota (on-call for other clinical areas in addition to obstetrics). Larger units were more likely to have dedicated on-call rotas (Table 1). The median number of consultants on the rota was 11 [IQR 10,14] in units with a dedicated on-call rota (n = 26) and 16 [IQR 12.5,20.5] in units with a combined on-call rota (n = 127). The median [IQR] 'consultant on-call rates' (number of consultants on on-call rota per 1000 deliveries) for dedicated and combined on-call rotas were 2.0 [1.6, 2.2] and 4.2 [3.2, 6.0], respectively.

In 88% of units with a dedicated on-call rota, all consultants who participated in the rota also had regular contracted daytime sessions in the maternity unit. In 95% of units that had a combined rota, some consultants participating on the rota did not have contracted daytime sessions in the maternity unit. Only three units reported that the on-call consultant was expected to be in-house: one Very large unit and two Small units. Three Small units reported having no dedicated anaesthetic cover for the maternity unit, but of these, there was an in-house on-call consultant covering all anaesthesia services, including maternity.

Consultant clinics and clinical lead management time

In 86% of units there was consultant PA time provided for obstetric anaesthetic clinic work. The percentage of units with this sessional time was not significantly different among units of varying size (Table 1). Similarly, in 87% of units there was consultant PA time or payment provided for management work as service lead. Only 14 units reported a value for PA per week given to the clinical lead for service management work.

Anaesthetist staffing levels

The minimum number of anaesthetists (all grades, i.e. consultants, Specialty Doctors and Associate Specialists or anaesthetists in training) routinely expected to be working in the maternity unit during weekday 'normal hours' (on-call shifts excluded) is shown in Fig. 3. Most Large and Very large units had always at least two anaesthetists avail-

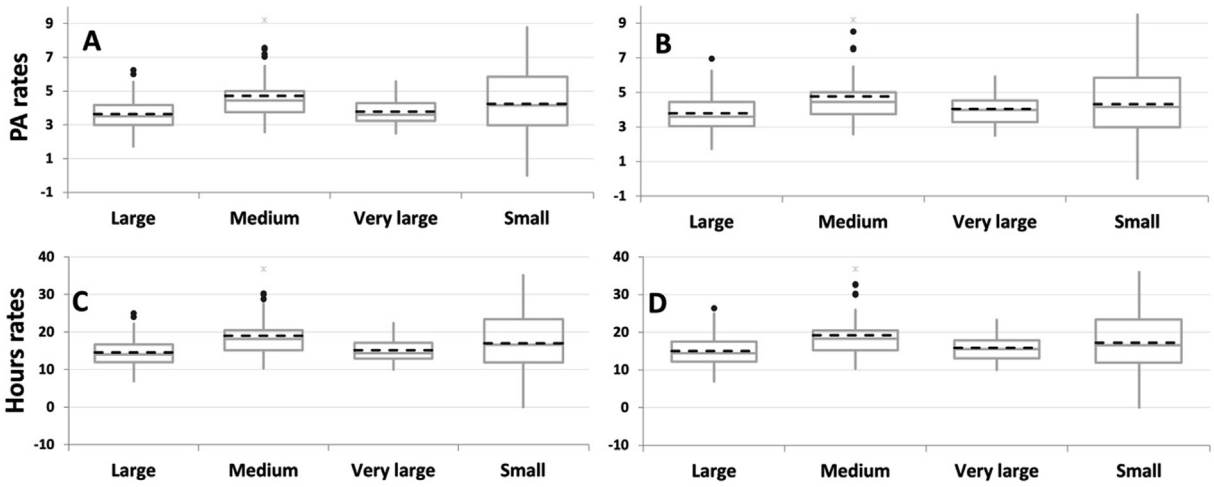

Fig. 2. Weekly consultant PA and hours rates for unit size category. A. Weekday (07:00–19:00) 'PA rate'; B. All weekly 'PA rate' (including premium PA); C. Weekday 'hours rate' (07:00–19:00); D. All 'hours rate' (including premium time hours). Horizontal line is median, boxes are IQR, whiskers are lowest and highest values, circles outliers and dashed horizontal line is mean. The median [IQR] "All" PA rates are: Small 4.2 [3.0, 5.9]; Medium 4.4 [3.8, 5.0]; Large 3.6 [3.0, 4.4]; Very large 4.0 [3.3, 4.5]. The median [IQR] "All" hours rates are: Small 16.6 [11.9, 23.4]; Medium 18.3 [15.2, 20.5]; Large 14.4 [12.2, 17.6]; Very large 15.5 [13.1, 17.9]. Increasing unit size had a small negative effect ($P = 0.002$) with a significant difference ($P < 0.001$) between the PA rate for Medium units and Large units

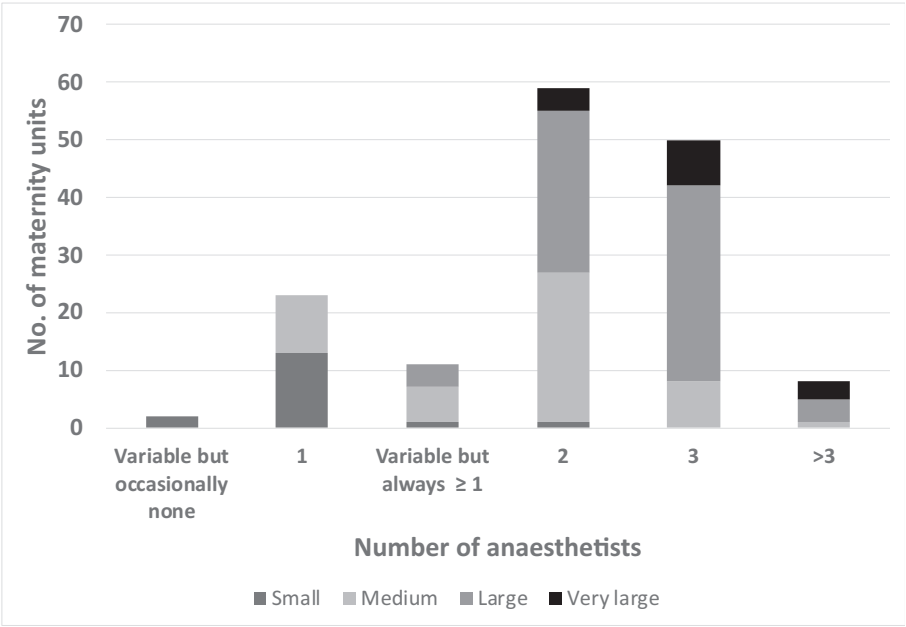

Fig. 3. Minimum number of anaesthetists routinely expected to be working in the maternity unit during weekday 'normal hours' by unit size (Small, Medium, Large, Very large)

able. In 10% of Medium units there was only a single anaesthetist during some weekday hours.

Elective caesarean section lists

The percentage of respondent units in each unit size category with scheduled dedicated elective CS lists resourced separately from emergency work is shown in Table 1. For those units with elective CS lists (n = 117), the difference between unit size categories for the number of lists each week per 1000 deliveries was not significant ($P = 0.076$). The median [IQR] number of lists per 1000 deliveries for each unit size category is shown in Table 1. For all units with elective lists, the mean number of lists per 1000 deliveries was 1.18 (SD 0.44, 95% CI 1.10 to 1.26) or one elective CS list per 847 deliveries.

Multidisciplinary ward rounds

Multidisciplinary ward rounds were held in 128 units. Twenty-five (16%) units reported having no regular multidisciplinary ward rounds, of which nine (6%) did not have any multidisciplinary ward rounds, whereas 16 reported having ward rounds occasionally. Multidisciplinary ward rounds did not take place in five Large units. Three units had regular multidisciplinary ward rounds which did not include attendance by an anaesthetist. In 72 (56%) units with ward rounds, an anaesthetist attended every ward round, whilst in 125 (98%) units

with ward rounds, an anaesthetist attended at least one ward round during a 24-h period (Supplementary Fig. S1).

Among units with multidisciplinary ward rounds, there was no significant relationship between unit size and anaesthetist attendance ($P = 0.09$). There was no significant relationship between the proportion of multidisciplinary ward rounds attended by an anaesthetist and the consultant PA rate ($P = 0.38$).

Narrative review of comments

Themes identified included lack of recognition within consultant contracts of time required and spent undertaking clinic work for antenatal reviews of complex maternity patients, for clinical management of the obstetric anaesthesia service, and delivery of multidisciplinary training. On evenings and weekends, it was noted that attendance at multidisciplinary ward rounds depended on whether this time was recognised within consultant job plans. For some units, multidisciplinary ward rounds were only introduced after the publication of the Ockenden Report. Other common themes included the lack of maternity resources, including midwives' and obstetricians' availability to support and deliver elective CS lists. The detrimental impact of inadequate staffing resources on the quality of patient care was highlighted. For some units, additional work was delivered as additional clinical sessions, without support to convert these sessions into substantive consultant jobs.

In contrast, several units did have good support to deliver separately resourced CS lists, consultant time for clinic work, service management, and multidisciplinary training and education. On-call cover by consultants who were not subspecialists in obstetric anaesthesia was considered a risk to quality of maternity patient care by some respondents. In other units, consultants without regular contracted time in the maternity unit often work flexible sessions to provide cross-cover.

Discussion

We report the first comprehensive survey of UK obstetric anaesthetic service provision, one of the largest such surveys to be reported for any health system. The 83% response rate compares favourably with the most recently published obstetric anaesthesia workforce survey in the United States, which had a response rate of 29% (equivalent to a 12% response rate for all US maternity units, based on the sampling frame).[15] We identified the absence of a single, publicly available, current and accurate list of all UK hospitals with obstetric anaesthetic services. For example, NHS Maternity Statistics for England [16] does not account for hospital trusts which incorporate more than one maternity unit as part of recent service reconfigurations.

The main findings of this study are that significant disparities exist between UK obstetric anaesthesia service provision and current national recommendations, and that there is wide variation in service provision nationally. These deficits affect vital areas of service delivery, including consultant staffing, support for elective CS lists, anaesthetic antenatal clinics, and consultant support for service development.

Adequate staffing has been identified as a crucial factor in supporting safety in obstetric units.[17] We estimate that there are more than 1700 consultants in the UK who work as subspecialists in obstetric anaesthesia and who have regular contracted sessions. Large and Very large units represent two-thirds of all deliveries in consultant-led units in the UK. Since most deliveries occur in Large units, it may be expected that there would be standardisation of service provision, however only 21% of Large units have a subspecialist-only on-call cover for obstetric anaesthesia. Additionally, 13% of Large units and 33% of Medium units do not have separate elective CS lists, highlighting inequity in providing maternity services care compared with elective surgery in other specialities. The dedicated provision for planned CS lists has been recommended by NICE.[18] We acknowledge that the categorisation of unit size using number of annual deliveries is broad and arbitrary, which may account for some inconsistencies between units.

Smaller units had proportionately more consultants and consultant sessional time than larger units, but geographical location had no significant effect on differences between units. These data provide useful national benchmarks together with the subset benchmarks using hospital size categories. Early iterations of national guidelines for obstetric anaesthesia suggested one consultant per 500 deliveries,[19] but subsequent national guidance emphasised the need for full consultant cover during the working week in all consultant units (i.e. at least 10 PA per week).[20] As the epidemiology of the obstetric population changes, it is recognised that the number of consultant sessions should be based on a broad range of criteria such as elective CS provision and the number of women presenting with complex needs.[5].

This survey provides the first national census data on the prevalence of multidisciplinary ward rounds, a key recommendation of the Ockenden Report. The Report recommended minimum twice-daily consultant-led multidisciplinary ward rounds.[1] Our survey found that in units with regular multidisciplinary ward rounds, an anaesthetist attended at least one of the ward rounds in 98% of units and attended all the scheduled ward rounds in 56% of units. However, 16% of units, which included 7% of Large units, reported having no regular multidisciplinary ward rounds. We expect that implementation and delivery of multidisciplinary ward rounds will improve as maternity and anaesthesia service managers embrace the Ockenden Report recommendations.

The 2016–2018 Confidential Enquiries into Maternal Deaths Report highlighted the crucial contribution of anaesthetists to the care of high-risk women.[21] It recommended that "pregnant women with complex needs or a complex medical history should have timely antenatal multidisciplinary planning, and an experienced obstetric anaesthetist should contribute to the planning." However, we found that 9% of Large units and 7% of Very large units have no consultant sessional time to support planning of multidisciplinary care, despite these units being expected to provide care for women with complex needs.

A limitation of our survey is that we did not collect specific data on the important and indispensable support provided by non-consultant grade anaesthetists or anaesthetists in training, whose contribution to service delivery in maternity units merits further study. Another limitation is that our findings were not compared against clinical or safety outcomes, but relevant hospital level outcome data are difficult to obtain. However, the relationship between structure, process and outcomes (the Donabedian model) underpins quality improvement in healthcare.[22–23] Our survey provides unique data on some elements of "structure" and "process" that may be of value in advancing quality improvement in obstetric anaesthesia and in addressing the safety issues in maternity care highlighted by the UK Parliament and the Ockenden Report.

A quality improvement domain addressed by our survey was service provision, specifically that related to obstetric anaesthetic staffing and service delivery in the UK, information which is not currently available. Our data provides a useful baseline for future service benchmarking. The other quality domains of service quality and clinical outcomes, including complications, require data that are not routinely collected in the UK. The lack of routine data on anaesthetic activity is not unique to the UK.[24] The meagre data collected on anaesthesia in the NHS Maternity Statistics for England represent the only national data on anaesthetic care for any speciality, aside from minimal data collected by a few restricted surgical registries.[25–27] The OAA has previously collected some outcome data for obstetric anaesthesia, but this was challenging due to the difficulties experienced by clinical leads in accessing and reporting their local uncoded hospital data.[6,28] Recommendations for useful quality indicators for obstetric anaesthesia that

could be used for benchmarking and quality improvement have been published.[29] These include indicators for service provision, the quality improvement domain about which service users are most concerned and which our survey has addressed.

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Declaration of interests

The authors serve on the Executive Committee of the Obstetric Anaesthetists' Association. DN Lucas is an editor of the International Journal of Obstetric Anesthesia but had no involvement in the evaluation of this manuscript for publication.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijoa.2022.103618.

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