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Maternity services in the UK during the COVID-19 pandemic: a national survey of modifications to standard care

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Running title:

UK maternity service modifications during COVID-19

Abstract

Objective:

To explore the modifications to maternity services across the UK, in response to the COVID-19 pandemic, in the context of the pandemic guidance issued by the Royal College of Obstetricians and Gynaecologists (RCOG), Royal College of Midwives (RCM) and NHS England.

Design:

National survey.

Setting:

UK maternity services during the COVID-19 pandemic.

Population or Sample:

Healthcare professionals working within maternity services.

Methods:

A national electronic survey was developed to investigate local modifications to general and specialist maternity care during the COVID-19 pandemic, in the context of the contemporaneous national pandemic guidance. After a pilot phase, the survey was distributed through professional networks by the RCOG and co-authors. The survey results were presented descriptively in tabular and graphic formats, with proportions compared using chi-squared tests.

Main Outcome Measures:

Service modifications made during the pandemic.

Results:

81 respondent sites, 42% of 194 obstetric units in the UK, were included. They reported substantial and heterogeneous maternity service modifications. 70% of units reported a reduction in antenatal appointments and 56% in postnatal appointments; 89% reported using remote consultation methods. 70% reported a change to screening pathways for gestational diabetes mellitus. 59% had temporarily removed the offer of births at home or in a midwife-led unit. 86% of units experienced a reduction in emergency antenatal presentations.

Conclusions:

This national survey documents the extensive impact of the COVID-19 pandemic on maternity services in the UK. More research is needed to understand the impact on maternity outcomes and experience.

Funding:

No funding was received for the conduct or reporting of this survey.

Keywords:

COVID-19, maternity, workforce survey, service modifications

Tweetable abstract:

A national survey showed UK maternity services were modified extensively and heterogeneously in response to COVID-19.

Introduction

The SARS-CoV-2 coronavirus that causes COVID-19 was first identified in the UK on 29 January 2020.^{1,2} The ensuing pandemic mandated urgent modifications to the National Health Service (NHS), responding to anticipated staffing shortages,³⁻⁵ a possible surge in patients requiring critical care,^{6,7} and the need to reduce face-to-face contact to minimise the risk of nosocomial transmission of SARS-CoV-2. NHS-wide modifications included the cancellation of non-urgent activity,⁷ redeployment of physical and workforce resources from elective to critical care services,⁶ and a rapid roll-out of digital resources to support remote consultations.⁸

During the COVID-19 pandemic, the demand for maternity care was not expected to change.⁶ However, the UK Government placed pregnant women into the group of people who were considered 'vulnerable' to the severe effects of COVID-19,⁹ and recommended that they 'stringently apply social distancing measures', including attendance at clinical settings only for essential medical care. In response to the SARS-CoV-2 pandemic situation in the UK, the Royal College of Obstetricians and Gynaecologists (RCOG) urgently convened a COVID-19 guidance development team, which included input from the Royal College of Midwives (RCM), Royal College of Paediatrics and Child Health (RCPCH) and Royal College of Anaesthetists (RCOA), on 4 March 2020. This resulted in publication of version 1 of the guidance document 'Coronavirus (COVID-19) Infection in Pregnancy' on 9 March 2020, intended to support clinicians providing maternity care for pregnant women during the pandemic; version 10.1 of this document was published 19 June 2020.¹⁰ All previous versions are available from the RCOG upon request. There has also been a parallel suite of RCOG, RCM and NHS-England guidance and frameworks advising maternity units on suitable modifications to maternity services.¹⁰⁻¹²

During the pandemic, the RCOG became aware of substantial workforce changes, and undertook a survey of staffing rearrangements in obstetrics and gynaecology (O&G).¹³ This reported junior staff were redeployed to other specialties from 53% of O&G units and that at least one in five other staff were unavailable for patient facing clinical work in 40% of units at the peak of the pandemic. A separate survey of O&G trainees, reported that 79% of units had reduced face-to-face antenatal clinics.¹⁴

The objective of this study was to explore in detail the extent to which maternity services were modified across the UK in response to the pandemic, in the context of contemporaneous national pandemic guidance and frameworks issued by the RCOG, RCM and central NHS organisations.

Methods

Data collection

Proposed modifications to maternity services during the COVID-19 pandemic were collected from the following contemporaneous RCOG and RCM COVID-19 documents: guidance for antenatal and postnatal services v1.0, for antenatal screening and ultrasound in pregnancy v1.0, for fetal medicine units (FMUs) v1.0, for maternal medicine services v2.1, and for provision of midwife-led settings and home birth v1.1.¹⁵ Also, we referred to the NHS England guidance for the temporary reorganisation of intrapartum maternity care and the suggested modification to fetal growth surveillance during the pandemic in Appendix G of the Saving Babies' Lives care bundle.^{11 12} These NHS England documents do not apply to Northern Ireland, Scotland and Wales, and there are no applicable equivalents.

A survey was developed to investigate variations in the reported provision of maternity services nationally. The survey was designed to be completed quickly by any healthcare professional working within a maternity service, and so largely featured multiple choice-style questions. It was mandatory to respond to each multiple-choice question; it was possible to select more than one option, or specify none, where implementation of multiple different service modifications was envisaged. In case provided options did not account for specific local modifications, free text boxes were provided. Additional data were requested on the professional role and grade of respondents, and if available, both the monthly number of births and also the attendances at maternity day assessment or triage units. It was anticipated that responding clinicians may not have immediate access to data on attendances to the unit, and so a question was also incorporated for the clinician to estimate the change in antenatal day/triage unit attendance at the peak of the pandemic, compared to pre-pandemic levels.

The draft survey was circulated and modified by the authorship group in the first instance, and then piloted by 11 obstetricians (consultants and trainees) at a range of secondary and tertiary maternity services in England. Iterative improvements were then made. The survey was hosted on smartsurvey.co.uk, a UK-based online survey building tool which is compliant with the requirements of the General Data Protection Regulation (GDPR).¹⁶ The final survey has been included in Appendix S2.

The final survey was circulated by the RCOG via email, over a 4-week period: to the RCOG Trainees' Committee and through it, to all regional trainee representatives on 17 May 2020 (for local distribution amongst trainees); in the RCOG President's weekly update on 22 May 2020; and throughout this period, amongst the co-authors' professional networks. On 1 June 2020, the results were reviewed by all co-authors, and a decision was made to extend the survey period to obtain more responses. The survey was

then circulated by the RCOG to all Clinical Directors of UK maternity services on 8 June 2020. The cumulative survey responses were reviewed on 15 June and a decision made to stop pursuing survey responses as they had reached 'saturation', a method used commonly in qualitative research to describe the point at which no new information or themes are observed in the data.¹⁷ Nevertheless, responses received up until 10 July 2020, were still included in the results.

Data analysis

A list of all maternity sites known to be hosting an obstetric-led delivery suite, with or without associated midwifery-led units (n=194), was collated from the National Maternity and Perinatal Audit Organisational Survey and from the Northern Ireland Maternity System (NIMATS) metadata.^{18 19} The response rate is based on the number of these sites from which a response was received. Where more than one response was received from the same site, the response from the most senior person was included (consultant/band 8 midwife). For one site where both a response from two consultants and a band 8 midwife were received, these were checked alongside each other, and the most common response selected.

Characteristics of sites were derived from publicly available information. The size of a maternity unit was derived from statistics published for the financial year 2018-19.²⁰⁻²³ Where more than one site was included in a trust in England, information from that maternity site was taken from what was published on the organisation's website or from the NMPA Clinical Report for 2016-17, as the most recently available data.²⁴ Information about the level of neonatal unit was derived from the National Maternity and Perinatal Audit Organisational Survey and in Northern Ireland from information available from the Neonatal Network for Northern Ireland. Locations of sites were derived from Google Maps. For sites in England, they were considered to be in 'London' if the provider was commissioned by the London Commissioning Hub.²⁵

Chi-square tests and Fisher's exact test as appropriate were used to examine the representativeness of the survey responses, by comparing characteristics of respondents vs. non-respondent sites (i.e., size of unit as more or less than 4000 births per annum; setting in London, England outside London, Wales, Northern Ireland, and Scotland; and level of neonatal unit), and the practice modifications reported by early (to 1 June 2020) vs. late respondents (after 1 June 2020). Chi-squared tests were also used to examine the impact of selection of responses from sites that submitted multiple returns. A p value less than 0.05 was considered statistically significant. All analyses were performed in Stata version 16.0 and MS Excel v16. Maps were plotted using Google Sheets.

Service modifications were summarised descriptively, in tabular and graphic format, according to the number and percentage of sites in which the modification was reported, compared to all sites for which the information was available. Service modifications were reported overall, and according to the location of the unit (i.e., London, England excluding London, or the devolved nations of the UK [Scotland, Wales and Northern Ireland]).

Core outcome sets

The use of core outcome sets is not relevant to this research article, which reports on service modifications and not on outcomes for women and babies.

Patient involvement

A member of the RCOG Women's Voices lay group has been involved in the development and writing of all RCOG guidance and frameworks produced for the COVID-19 pandemic, including those which advise on ways in which services could be modified. Monthly meetings have also been held to discuss current issues with a small group of other members from RCOG and RCM Women's Voices. These women were not directly involved in the design, dissemination, analysis or reporting of the survey described in this article.

Ethical approval

Ethical approval was not required for this workforce survey. We did not involve patients or the public in the development of the survey, but we did involve a lay reviewer from the RCOG Women's Voices group during the development of all RCOG and RCM guidance on service modifications during the COVID-19 pandemic.

Study funding

There was no funding allocated for the design, conduct or analysis and reporting of this national survey.

Results

101 complete responses were received from 83 sites providing maternity care; two sites do not provide obstetric services (instead providing only a midwifery-led unit) and were excluded, leaving 81 respondent sites, 41.8% of the 194 obstetric units in the UK. A list of respondent units is available in Appendix S1. The majority of responses (69.1%) came from consultants in obstetrics and gynaecology, but 15 (18.5%) came from trainee doctors in obstetrics and gynaecology, one from an obstetric physician (1.2%), and 9 from midwives (11.1%). Responses came from across the four nations (England, Northern Ireland, Scotland and Wales) of the UK (Figure S1). Responder and non-responder units are compared in Table S1; respondent units were more likely to have >4000 births (65.4% responders versus 46.9% non-responders, $p=0.01$) and be based in London (19.8% responders versus 6.2% non-responders, $p=0.02$). Responses were similar between early and late responders (Table S2).

There were substantial changes to the nature and frequency of antenatal care appointments. More than two-thirds of units reported a reduction in antenatal appointments, most frequently to routine midwife-led appointments and least often to specialist appointments e.g. maternal medicine, fetal medicine, or specialist midwifery (Table 1). Almost all services conducted at least some appointments remotely; almost all reported telephone consultations, and over a third of units reported additional use of video calling, usually with specialised software. The vast majority of sites also provided remote care specifically for low-risk women (Figure 1a). The most common appointments modified or cancelled were those in the first and second trimesters (Figure 1b). Only a small proportion (14.8%) of units reported a reduction in routine antenatal screening, but a third of units reported a reduction in fetal medicine scans.

There were significant changes to specialist maternity care services. There was widespread uptake of home blood pressure monitoring (79.0%), almost always for women with a hypertensive disorder (Table 1). However, most units did not undertake associated home urine testing for proteinuria. Few units undertook home blood pressure monitoring for women at higher risk of a hypertensive disorder, and no unit reported that this monitoring was undertaken as part of routine antenatal care.

Over two-thirds of units reported a change to their screening pathway for gestational diabetes mellitus (GDM). However, the pattern of modification varied; most commonly a single blood test for HbA1c at 26-28 weeks (Figure 2a), with only 35.8% of units reported continuing screening with the oral glucose tolerance test (Figure 2a) either in the same (23.5%) or a new (12.3%) location. For women with diagnosed diabetes, almost all units reported decreased face-to-face contact with the diabetes team.

Finally, just over half of units reduced the provision of fetal growth surveillance scans for babies at risk of being small for gestational age (Figure 2b), and about one-third suspended some indications for antenatal corticosteroids.

Intrapartum services were also altered (Table 1). Just over half of units stopped providing a previously offered birth setting for a week or more, most commonly home birth, but also some water births (Table 1, Figure 3). Only one unit reported stopping provision of intrapartum services altogether, with care provided in a neighbouring hospital. A small number of units commissioned additional transport services to support community births, and others requested additional resources from a local maternity unit. Some units reported suspension of some indications for induction of labour, but few were unable to support caesarean births requested when there was no clinical indication. Some units reported reductions in anaesthetic provision, but others reported an increase.

Almost all units reported a subjective reduction in emergency antenatal attendances, particularly maternity assessment unit/triage, with equal proportions reporting small ($\leq 25\%$), moderate (25-50%), or large reductions ($\geq 50\%$). However, two units reported an increase (Table 1).

There were specific reported modifications to postnatal services (Table 1). While just over half of units reduced routine postnatal contacts for low-risk women, units often used ancillary members of staff or students to deliver them. Telephone or videoconferencing was used by only half of units to deliver at least some postnatal contacts, and a small number of units increased the capacity of hospital-based postnatal clinics.

Our analysis of survey responses by location identified some differences. Units in London and the rest of England were more likely to have introduced home blood pressure monitoring (100% [London] vs. 75.9% [rest of England] vs. 63.6% [devolved nations], $p=0.047$) and remote consultations (100% [London] vs. 90.7% [rest of England] vs. 63.6% [devolved nations], $p=0.01$), without differences apparent in other key responses, including a reduction in the number of antenatal and postnatal appointments, modifications to the screening pathway for GDM and fetal growth, and provision of birth settings. (Table S3). An analysis that incorporated potential changes to responses from duplicate submissions showed no difference to results ($p>0.1$ in all key responses, Table S4).

Discussion

Main Findings

We have described reports of substantial and heterogeneous maternity service modifications during the COVID-19 pandemic, primarily to antenatal and postnatal services, but also some intrapartum services. Most changes were reported across the UK, although remote consultation and home blood pressure monitoring were more likely to be undertaken in England (particularly London). The modifications undertaken by most units consisted of a reduction in the number of antenatal contacts offered by any method; conversion of some antenatal appointments to remote consultations, particularly in the first and second trimesters; an increase in self-monitoring of blood pressure; modification of GDM screening; a reduction in the frequency of fetal growth surveillance by ultrasound; and reduced options for place of birth. There were few changes to labour induction indications or the offer of caesarean by request.

Strengths and limitations

The main strength of this survey is its timing. The survey was conducted in May-June 2020, just as the UK was starting to enter the recovery phase following the early acute peak of COVID-19. Respondents were asked to report modifications in place during the national peak of the pandemic (April 2020).² The contemporaneous nature of the survey also has the benefit of minimising recall bias.

The response rate to this survey was just over 40%; however, the aggregated responses received at two time points were not different, and it was therefore agreed that we had data saturation. The study team felt that waiting for more responses was unlikely to change the findings and would delay dissemination of results at a time when sites are planning for a potential second wave and future post-pandemic service provision. While study respondents were more likely to be from larger units and those in London than non-respondents, the only differences in services reported from those units were associated with funding initiatives, as discussed below.^{26 27}

Some of the survey questions rely on responses which are subjective, particularly the question about changes in emergency antenatal attendances to hospital. This type of response was chosen over a more objective alternative to reduce the burden on clinicians during the pandemic response and is preferable in the acute phase to waiting for more objective data from analysis of electronic patient records. Regardless, these reports of reductions in emergency antenatal attendances are consistent with other reports of reduced attendances with acute presentations,²⁸ and are informative particularly in the context of local reports of an increase in stillbirth.²⁹

During the pandemic, the RCOG COVID-19 guidance group received thanks and feedback on the guidance products from across the world, notably from Asia and the Middle East. It is expected that uptake of these guidelines vary internationally. This study should prompt similar investigation regarding changes to services in countries outside the UK.

Interpretation (in light of other evidence)

The survey findings demonstrate the extent of maternity service modifications made, presumably with reference to RCOG/RCM and NHS guidance, and following assessment of local needs, in the context of the COVID-19 pandemic and its impact on both women and healthcare staff.

Service modifications were advised following expert and stakeholder consensus on the balance of risk, in the context of a small and rapidly changing evidence base. It is currently unclear what the impact of these emergency service modifications has been on women and their families.

A single-centre study demonstrated a significant increase in the rate of stillbirths, suggesting that this was one adverse outcome.²⁹ It is unclear whether this was related to the direct effects of COVID-19, or indirectly due to reduced antenatal appointments or attendances for urgent care. The RCOG/RCM guidance advised that the frequency of antenatal appointments should be reduced in a structured fashion, when staffing shortages precluded offer of the standard NICE schedule;^{30 31} the risk of perinatal mortality increases if the number of antenatal appointments falls below six.³² It was not advised that antenatal emergency attendances to hospitals should be minimised, but this was reported by survey respondents. This raises concerns about women delaying care-seeking during the pandemic.

A separate RCOG survey reported widespread maternity staffing shortages;¹³ midwifery shortages are expected to have been similar. However, site-level staff data are not available to correlate with the service changes and so we are unable to assess whether modifications were made in direct response to decreases in staffing.

The conversion of some face-to-face appointments to remote consultations when physical examination or investigation is not required, was recommended by across health services to reduce the risk of nosocomial transmission to pregnant women.^{8 31} Previously published reports on the clinical and patient acceptability of remote consultations are sparse, but generally conclude that they are acceptable.³³⁻³⁶ However, more research is required into their safety and implications of potential data insecurity, before planning widespread adoption of remote care options in the post-pandemic period.

Some service changes had resource implications. Videoconferencing software was offered free of charge across the UK.^{26 37} Home blood pressure monitoring was recommended, with women with hypertensive disorders given highest priority.²⁷ This had higher uptake in England, perhaps facilitated by funding committed by NHS England early in the pandemic for rapid procurement and purchase of home blood pressure measurement devices.²⁷ This funding did not encompass home urine dip testing, which had a lower uptake. This highlights the impact of funding decisions and fragmentation of the NHS across the four nations of the UK and a possible area for improvement in response to future emergencies.

Changes to the screening pathway for GDM were consistent with those advised by the RCOG guidance on maternal medicine service modifications.¹⁵ This was a pragmatic strategy intended to protect women from nosocomial transmission of SARS-CoV-2 by encouraging the use of single blood tests which could be conducted alongside other routine essential care, but with an expected reduction in GDM diagnoses for women with the mildest cases. A modelling study using existing data suggests the extent to which complications of GDM may have been missed as a result of this strategy;³⁸ the number of women protected from SARS-CoV-2 is not known.

Conclusion

This national survey of maternity service modifications documents the extent to which maternity services were impacted by the COVID-19 pandemic. More research is needed to understand whether these service modifications have been associated with changes in maternal or perinatal outcomes. These survey data will be invaluable in understanding the indirect effects of COVID-19 on pregnancy outcomes, including implications of delays in accessing care because of concerns of nosocomial transmission.

As the prevalence of SARS-CoV-2 in UK communities is falling and with it, the risk of transmission, the RCOG, the RCM, the NHS and maternity services themselves should reflect on the impacts of modifications to both staffing and service provision, and prepare action plans to achieve as high quality care as possible should they be faced with a 'second wave' of the pandemic or health system shocks in the future.

Acknowledgements

We wish to acknowledge the assistance of Dr Adalina Sacco and Dr Karolina McDowell in distributing the survey through professional networks. We thank all the healthcare professionals who kindly completed the survey. We also wish to thank the other members of the RCOG COVID-19 guidance cell including Dr Pat O'Brien, Mrs Anita Powell and Dr Gemma Goodyear, Ms Gemma Thurston, Mrs Louise Thomas and Ms Emma Gilgunn-Jones; colleagues at the RCM and officials within NHS England, the Scottish and Welsh Governments, who developed the suite of guidance products on which this survey was built.

Disclosure of interests

EM is President and Trustee of the RCOG, Trustee for the British Menopause Society and Chair of the Multiprofessional Advisory Panel at Baby Lifeline. TD is Vice President of the RCOG. JJ and SR are employed by the RCOG as obstetric clinical fellows. MRD is a full-time employee of the Royal College of Midwives. The remaining authors declare no competing interests. Completed disclosure of interest forms are available to view online as supporting information.

Contribution to authorship

AK, TD, LM, PvD and EM conceived the plan for a survey. JJ, SR, EM, MRD and TD are members of the RCOG COVID-19 in pregnancy guidance development group. All authors contributed ideas for its development. SR and JJ wrote the survey, distributed by all authors through professional networks. JJ conducted the analysis for results. SR and JJ wrote the first manuscript draft. All authors reviewed, edited and approved the final manuscript. All authors accept responsibility for the paper as published.

Table / Figure caption list

Table 1. Modifications to maternity care during COVID-19 pandemic

Figure 1. Detailed service modifications: (a) provision of antenatal outpatient consultations (b) provision of routine antenatal appointments for women with uncomplicated pregnancies

Figure 2. Detailed modifications to (a) screening for GDM (b) growth scan protocols

Figure 3. Detailed modifications to available birth settings

References

1. World Health Organisation. Coronavirus disease (COVID-2019) situation reports 2020 [Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/> accessed 01 June 2020.
2. UK Government. Coronavirus (COVID-19) in the UK 2020 [Available from: <https://coronavirus.data.gov.uk/> accessed 16 June 2020.
3. NHS Employers. COVID-19 guidance for NHS workforce leaders 2020 [Available from: <https://www.nhsemployers.org/covid19> accessed 17 June 2020.
4. UK Government. Stay at home: guidance for households with possible coronavirus (COVID-19) infection 2020 [Available from: <https://www.gov.uk/government/publications/covid-19-stay-at-home-guidance/stay-at-home-guidance-for-households-with-possible-coronavirus-covid-19-infection> accessed 17 March 2020.
5. UK Government. Guidance on shielding and protecting people who are clinically extremely vulnerable from COVID-19 2020 [updated 18 May. Available from: <https://www.gov.uk/government/publications/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19> accessed 27 May 2020.
6. National Health Service. Redeploying your secondary care medical workforce safely 2020 [Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/Redeploying-your-secondary-care-medical-workforce-safely_26-March.pdf accessed 17 June 2020.
7. NHS England and NHS Improvement. Letter to chief executives of all NHS trusts and foundation trusts, CCG accountable officers, GP practices and primary care networks, and providers of community health services. 2020 [updated 17 March 2020. Available from: <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/urgent-next-steps-on-nhs-response-to-covid-19-letter-simon-stevens.pdf>. accessed 17 June 2020.
8. NHS England. Clinical guide for the management of remote consultations and remote working in secondary care during the coronavirus pandemic 2020 [Available from: <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/C0044-Specialty-Guide-Virtual-Working-and-Coronavirus-27-March-20.pdf> accessed 27 May 2020.

9. UK Government. COVID-19: guidance on social distancing and for vulnerable people 2020 [Available from: <https://www.gov.uk/government/publications/covid-19-guidance-on-social-distancing-and-for-vulnerable-people> accessed 17 March 2020.
10. Royal College of Obstetricians & Gynaecologists, Royal College of Midwives. Coronavirus (COVID-19) Infection in Pregnancy v10.1 2020 [updated 19 June 2020. Available from: <https://www.rcog.org.uk/globalassets/documents/guidelines/2020-06-18-coronavirus-covid-19-infection-in-pregnancy.pdf> accessed 02 July 2020.
11. NHS England. Saving babies' lives care bundle Version 2: COVID-19 information 2020 [Available from: <https://www.england.nhs.uk/publication/saving-babies-lives-care-bundle-version-2-covid-19-information/> accessed 27 May 2020.
12. NHS England. Clinical guide for the temporary reorganisation of intrapartum maternity care during the coronavirus pandemic 2020 [updated 9 April. Available from: <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/04/C0241-specialty-guide-intrapartum-maternity-care-9-april-2020.pdf> accessed 27 May 2020.
13. Royal College of Obstetricians & Gynaecologists. The impact of the redeployment of maternity staff during COVID-19 2020 [Available from: <https://www.rcog.org.uk/en/careers-training/workplace-workforce-issues/impact-redeployment/> accessed 02 July 2020.
14. Rimmer M, Al Wattar B, UKARCOG Members. Provision of obstetrics and gynaecology services during the COVID-19 pandemic: a survey of junior doctors in the UK National Health Service. *BJOG: An International Journal of Obstetrics & Gynaecology*;n/a(n/a) doi: 10.1111/1471-0528.16313
15. Royal College of obstetricians & Gynaecologists. Coronavirus (COVID-19) infection and pregnancy 2020 [Available from: <https://www.rcog.org.uk/en/guidelines-research-services/guidelines/coronavirus-pregnancy/> accessed 19 June 2020.
16. Smart Survey Ltd. SmartSurvey and GDPR [Available from: <https://www.smartsurvey.co.uk/gdpr> accessed 17 June 2020.
17. Guest G, Bunce A, Johnson L. How many interviews are enough?: An experiment with data saturation and variability. *Field Methods* 2006;18(1):59-82.
18. National Maternity and Perinatal Audit. Organisational Report 2019 2019 [Available from: <https://maternityaudit.org.uk/FilesUploaded/NMPA%20Organisational%20Report%202019.pdf> accessed 15 June 2020.
19. Northern Ireland Health and Social Care: Business Services Organisations. Northern Ireland Maternity Services (NIMATS) metadata 2017 [Available from: <http://www.hscbusiness.hscni.net/services/2512.htm> accessed 17 June 2020.

20. NHS Digital. NHS Maternity Statistics, England 2018-19 [PAS] 2019 [Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/nhs-maternity-statistics/2018-19> accessed 02 July 2020.
21. Public Health Scotland. Births in Scottish Hospitals 2020 [Available from: <https://www.opendata.nhs.scot/dataset/births-in-scottish-hospitals> accessed 02 July 2020.
22. Welsh Government. Maternity and birth statistics 2019 [Available from: <https://gov.wales/sites/default/files/statistics-and-research/2019-10/maternity-and-birth-statistics-quality-report-272.pdf> accessed 02 July 2020.
23. Northern Ireland Statistics and Research Agency. Birth Statistics 2020 [Available from: <https://www.nisra.gov.uk/publications/birth-statistics> accessed 02 July 2020.
24. National Maternity and Perinatal Audit. Clinical Report 2019: Based on births in NHS maternity services between 1 April 2016 and 31 March 2017 2019 [Available from: <https://maternityaudit.org.uk/FilesUploaded/NMPA%20Clinical%20Report%202019.pdf> accessed 10 July 2020.
25. NHS Digital. Other NHS organisations 2020 [Available from: <https://digital.nhs.uk/services/organisation-data-service/data-downloads/other-nhs-organisations> accessed 10 July 2020.
26. NHS Digital. Approved video consultation systems 2020 [Available from: <https://digital.nhs.uk/services/future-gp-it-systems-and-services/approved-econsultation-systems> accessed 11 July 2020.
27. Royal College of Obstetricians & Gynaecologists. Self-monitoring of blood pressure in pregnancy 2020 [Available from: <https://www.rcog.org.uk/globalassets/documents/guidelines/2020-03-30-self-monitoring-of-blood-pressure-in-pregnancy.pdf> accessed 02 July 2020.
28. NHS England. A&E Attendances and Emergency Admissions: May 2020 Statistical Commentary 2020 [Available from: <https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2020/06/Statistical-commentary-May-2020-jf8hj.pdf> accessed 02 July 2020.
29. Khalil A, von Dadelszen P, Draycott T, Ugwumadu A, O'Brien P, Magee L. Change in the Incidence of Stillbirth and Preterm Delivery During the COVID-19 Pandemic. *JAMA* 2020 doi: 10.1001/jama.2020.12746 [published Online First: 2020/07/11]
30. National Institute for Health and Care Excellence. Antenatal care for uncomplicated pregnancies 2008 [Available from: <https://www.nice.org.uk/Guidance/CG62> accessed 02 July 2020.

31. Royal College of Obstetricians & Gynaecologists. Guidance for antenatal and postnatal services in the evolving coronavirus (COVID-19) pandemic 2020 [Available from: <https://www.rcog.org.uk/globalassets/documents/guidelines/2020-07-10-guidance-for-antenatal-and-postnatal.pdf> accessed 01 July 2020.
32. Dowswell T, Carroli G, Duley L, Gates S, Gülmezoglu AM, Khan-Neelofur D, Piaggio G . Alternative versus standard packages of antenatal care for low-risk pregnancy. *Cochrane Database Syst Rev* 2015(7):CD000934. doi: 10.1002/14651858.CD000934.pub3
33. Greenhalgh T, Shaw S, Wherton J, Vijayaraghavan S, Morris J, Bhattacharya S, et al. Real-World Implementation of Video Outpatient Consultations at Macro, Meso, and Micro Levels: Mixed-Method Study. *J Med Internet Res* 2018;20(4) doi: 10.2196/jmir.9897
34. Gentles S, Lokker C, McKibbin K. Health information technology to facilitate communication involving health care providers, caregivers, and pediatric patients: a scoping review. *J Med Internet Res* 2010;12
35. Armfield N, Gray L, Smith A. Clinical use of Skype: a review of the evidence base. *J Telemed Telecare* 2012;18:125-7.
36. Gund A, Sjöqvist B, Wigert H, Hentz E, Lindecrantz K, Bry K. A randomized controlled study about the use of eHealth in the home health care of premature infants. *BMC Med Inform Decis Mak* 2013;13
37. Welsh Government. Digital services introduced in NHS Wales during coronavirus are here to stay 2020 [updated 07 June. Available from: <https://gov.wales/digital-services-introduced-nhs-wales-during-coronavirus-are-here-stay> accessed 16 July 2020.
38. David McIntyre H, Gibbons KS, C W Ma R, Tam WH, Sacks DA, Lowe J, et al. Testing for gestational diabetes during the COVID-19 pandemic. An evaluation of proposed protocols for the United Kingdom, Canada and Australia. *Diabetes Research and Clinical Practice* 2020:108353. doi: <https://doi.org/10.1016/j.diabres.2020.108353>

Supplementary information

Table S1: Characteristics of respondents to the survey, and respondent and non-respondent units

Table S2: Comparison of completed responses up until May 31, 2020 with later responses

Table S3. Analysis of summary responses by unit location

Appendix S1. List of all respondent units

Appendix S2: Final version of survey

Figure S1: Map of Responding Units

Table 1. Modifications to maternity care during COVID-19 pandemic

Type of modifications		Number (%)
Modifications to antenatal appointments	Reduced number of antenatal appointments ^α	57 (70.4)
	Routine midwife-led antenatal appointments ^β	43 (53.1)
	Obstetric appointments for women at higher risk of complications	23 (28.4)
	Maternal medicine service appointments	18 (22.2)
	Fetal medicine service appointments	20 (24.7)
	Specialist midwifery appointments	21 (25.9)
	Any antenatal appointments (midwifery or obstetric) conducted remotely ^α	72 (88.9)
	Telephone call	71 (87.7)
	Video call using widely available software	10 (12.4)
	Video call using specially designed software	21 (25.9)
	Some routine antenatal visits for low risk women conducted remotely ^{α,β}	65 (81.3)
Modifications to screening services	Reduction in screening services as part of fetal anomaly screening programme	12 (14.8)
Modifications to specialist antenatal services	Home blood pressure monitoring (any)	64 (79.0)
	For women with hypertensive disorders	62 (76.5)
	For all women	0 (0)
	For a defined group of women at higher risk of hypertensive disorders	4 (4.9)
	Home urine testing for women undertaking home blood pressure monitoring	26 (32.1)
	Modification to screening pathway for GDM ^χ	57 (70.4)
	For women with diabetes in pregnancy, reduction in face-to-face appointments	71 (87.7)
	Suspension of some indications for antenatal corticosteroids e.g. prior to term CS	27 (33.3)
Reduction in provision of fetal growth surveillance ultrasound scans ^δ	45 (55.6)	
Changes in fetal medicine services	Reduction in scans performed by fetal medicine unit (among 59 units with an FMU)	21 (35.6)
Modifications to intrapartum services	Employment of independent midwives	0 (0)
	Removal of previously offered birth setting (home or midwife-led unit) ^ε	48 (59.3)
	Change in provision of water birth ^ε	26 (32.1)
	Commissioning of additional transport services to support community births	6 (7.4)
	Additional resources (staff or space) requested from a local maternity unit	9 (11.1)

	Suspension of some indications for induction of labour	14 (17.3)
	Service unable to support caesarean births without clinical indication	4 (4.9)
	Reduction in anaesthetic cover	10 (12.4)
	Increase in anaesthetic cover	17 (21.0)
Changes in emergency antenatal presentations (among all units)	Increased number of attendances	2 (2.5)
	Reduction in attendances of approximately up to 25%	23 (28.8)
	Reduction in attendances of approximately 25 to 50%	25 (31.2)
	Reduction in attendances of approximately 50% or more	22 (27.5)
Modifications to postnatal services	Reduction in routine postnatal contacts, to less than 3 for low-risk women	45 (55.6)
	Increase in use of other members of staff (e.g. students, care assistants)	9 (11.1)
	Use of tele/videoconferencing to perform some routine postnatal visits	46 (56.8)
	Provision of additional postnatal clinics for routine midwife appointments in hospital	7 (8.6)
	Provision of additional postnatal clinics in community settings	17 (21.0)
	No change in postnatal care	14 (17.3)

FMU: Fetal Medicine Unit; GDM: gestational diabetes mellitus

Figure 1. Detailed service modifications: (a) provision of antenatal outpatient consultations (b) provision of routine antenatal appointments for women with uncomplicated pregnancies

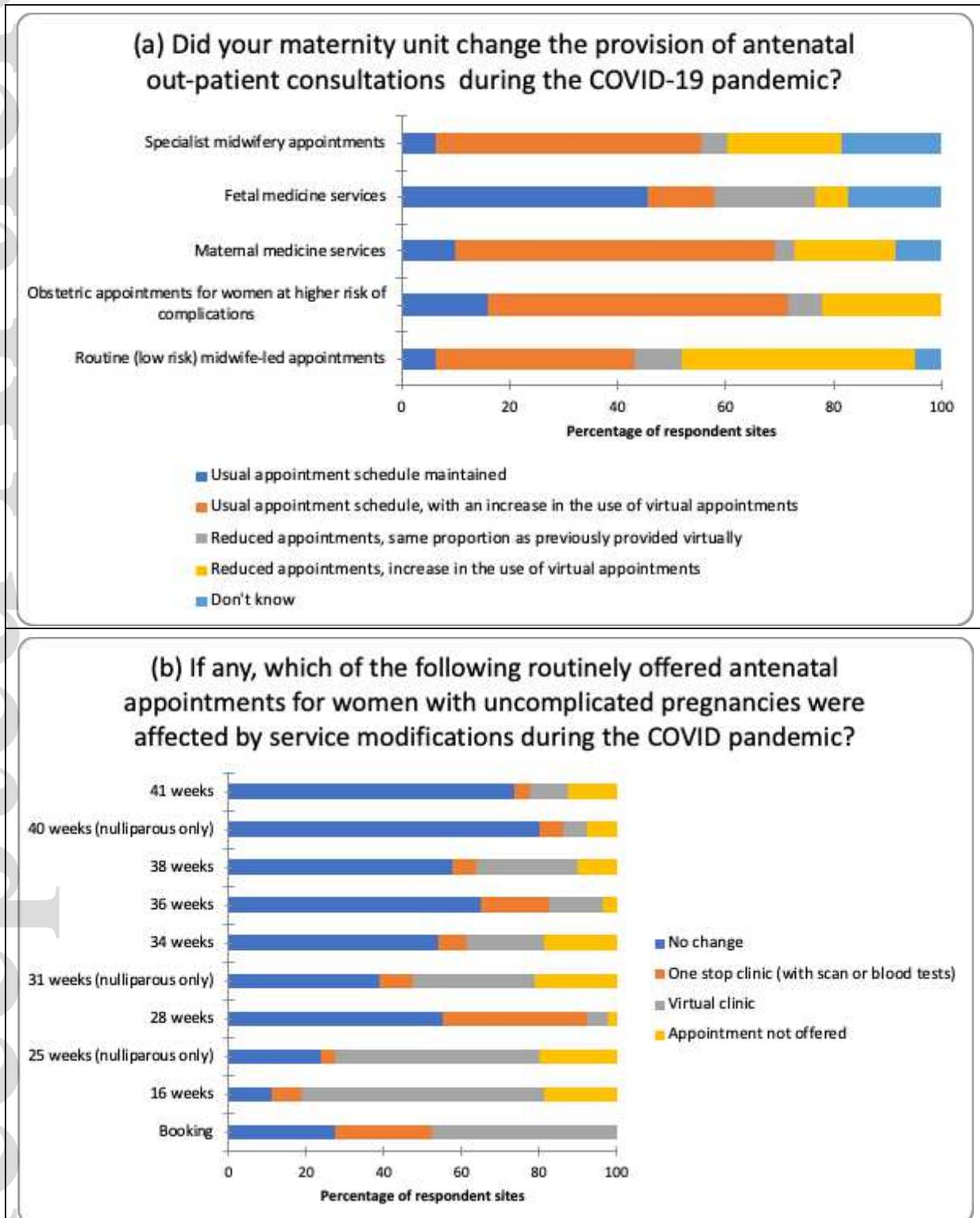


Figure 2. Detailed modifications to (a) screening for GDM (b) growth scan protocols

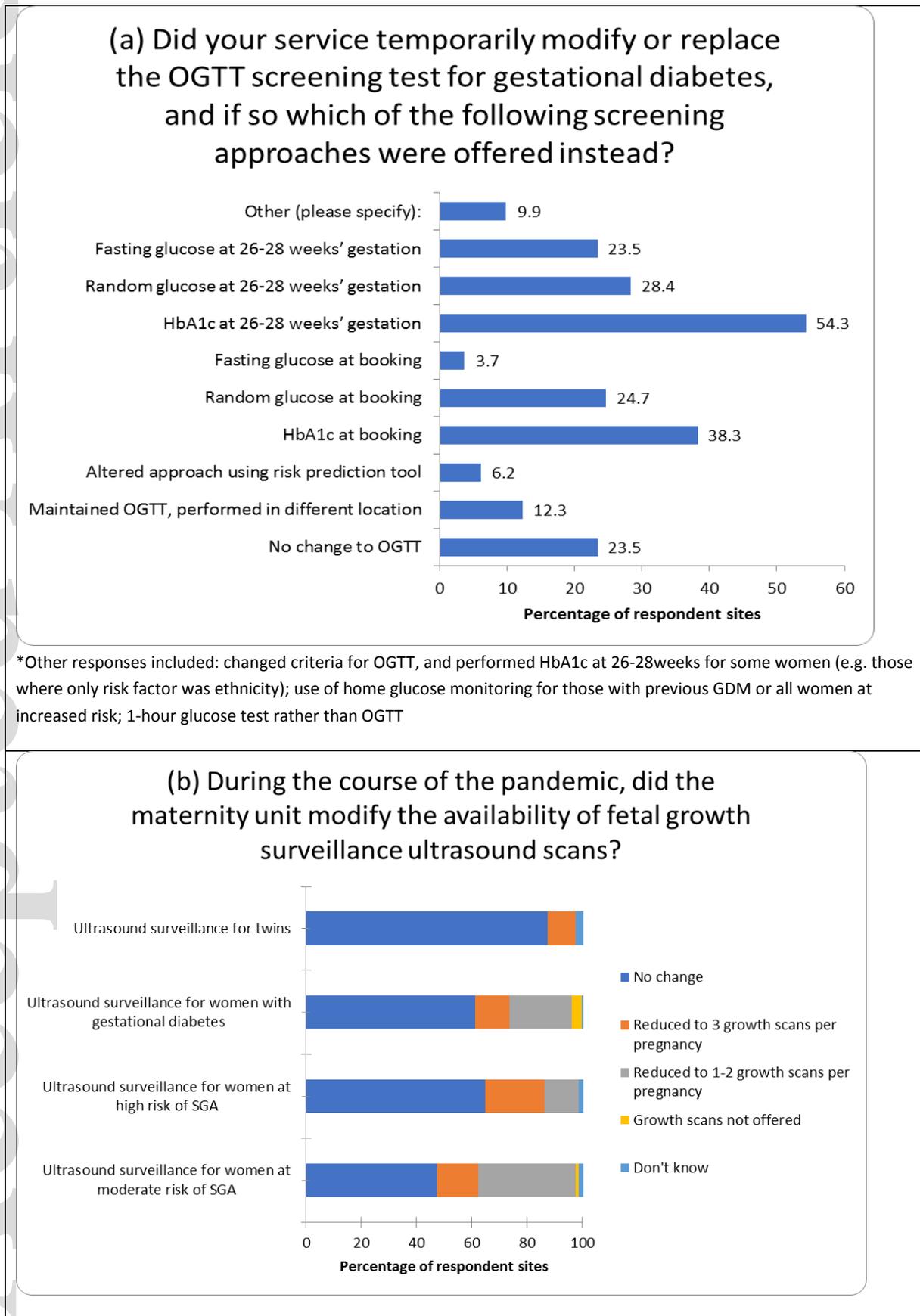


Figure 3. Detailed modifications to available birth settings

