Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Anaesth Crit Care Pain Med 41 (2022) 101137

Contents lists available at ScienceDirect

Anaesthesia Critical Care & Pain Medicine

journal homepage: www.elsevier.com

Original Article

Obstetric services in the UK during the COVID-19 pandemic: A national survey

James Edward O'Carroll [a,*], Liana Zucco [b], Eleanor Warwick [c], Gill Arbane [b], Ramani Moonesinghe [d], Kariem El-Boghdadly [b], N Guo [a], Brendan Carvalho [a], Pervez Sultan [a] on behalf of the ObsQoR Collaborators

[a] Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Stanford, CA, USA
[b] Guy's and St Thomas' NHS Foundation Trust, London, UK
[c] University College Hospitals, London, London, UK
[d] Surgical Outcomes Research Centre, Centre for Peri-Operative Medicine, University College London, London, UK

ARTICLE INFO

Article history:
Available online 29 July 2022

Keywords:
COVID-19
Obstetric guidelines
Survey
Quality of recovery
Vaccination
Personal protective equipment

ABSTRACT

Background: The management of obstetric patients with coronavirus disease 2019 (COVID-19) due to human-to-human transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) requires unique considerations. Many aspects of labour and delivery practice required adaptation in response to the global pandemic and were supported by guidelines from the Royal College of Obstetrics and Gynaecologists. The adoption and adherence to these guidelines is unknown.
Methods: Participating centres in "Quality of Recovery in Obstetric Anaesthesia study—a multicentre study" (ObsQoR) completed an electronic survey based on the provision of services and care related to COVID-19 in October 2021. The survey was designed against the Royal College of Obstetricians and Gynaecologists COVID-19 guidelines.
Results: One hundred and five of the 107 participating centres completed the survey (98% response rate representing 54% of all UK obstetric units). The median [IQR] annual number of deliveries among the included sites was 4389 [3000–5325]. Ninety-nine of the 103 (94.3%) sites had guidelines for the management of peripartum women with COVID-19. Sixty-one of 105 (58.1%) sites had specific guidance for venous thromboembolism (VTE) prophylaxis. Thirty-seven of 104 (35.6%) centres restricted parturient birthing plans if a positive diagnosis of COVID-19 was made. A COVID-19 vaccination referral pathway encouraging full vaccination for all pregnant women was present in 63/103 centres (61.2%).
Conclusion: We found variability in care delivered and adherence to guidelines related to COVID-19. The clinical implications for this related to quality of peripartum care is unclear, however there remains scope to improve pathways for immunisation, birth plans and VTE prophylaxis.

1. Introduction

The management of obstetric patients with coronavirus disease 2019 (COVID-19) due to human-to-human transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) requires unique considerations [1]. Those who are pregnant or recently postpartum and symptomatic with COVID-19 are at higher risk than those without the disease for requiring additional medical care [2]. Furthermore, symptomatic infection during pregnancy is associated with maternal admission to critical care, preterm birth and neonatal admission [3,4].

Many aspects of labour and delivery practice required adaptation in response to the global pandemic [5]. Modifications and restructuring of obstetric care services across the National Health Service (NHS) were recommended to maintain standards in quality of care for all parturients. This included care for critically ill pregnant and postpartum women, and the implementation of new protocols designed to reduce exposure and transmission among

* Corresponding author at: 300 Pasteur Drive, Stanford University School of Medicine, Stanford, USA.
E-mail address: jamesoc@stanford.edu (J. E. O'Carroll).

https://doi.org/10.1016/j.accpm.2022.101137

patients, healthcare providers, staff and family members whilst in the hospital environment [6]. These changes in practice were supported by additional guidance from the Royal College of Obstetricians and Gynaecologists (RCOG) [7]. The Coronavirus (COVID-19) infection in pregnancy guideline includes updates in recommendations for testing for infection, vaccination in pregnancy, venous thromboembolism (VTE) prophylaxis, personal protective equipment (PPE) labour and delivery and clinical deterioration.

RCOG guidelines recommend that women should be offered testing for SARS-CoV-2 when they are admitted to maternity units to give birth and strongly recommend vaccination (two doses before delivery, or before entering the third trimester). In addition, a VTE risk assessment should be completed, with dosing of VTE prophylaxis determined on an individual basis. To reduce the risk of nosocomial infection, hospitals should consider guidance from Public Health England and local infection control policies, keeping visitors to a minimum and providing PPE for partners. Any alterations to birth plans for women who have tested positive for COVID-19 should follow maternal and neonatal assessment and multidisciplinary team discussion. The adoption and adherence to these published guidelines in UK obstetric units is unknown.

The "Quality of Recovery in Obstetric Anaesthesia, a multicentre study" (ObsQoR) was a prospective study conducted in the United Kingdom (UK) obstetric units, which aimed to evaluate the quality of postpartum recovery in women following anaesthetic intervention in the NHS across England, Scotland, Wales and Northern Ireland. As part of this study, an institutional survey was sent to each site to evaluate site-level factors related to the quality of peripartum care and included specific questions related to compliance with COVID-19 specific guidelines. The study was conducted in October 2021 during the pandemic allowing for assessment of adherence to guidelines and the impact of COVID-19 on quality of care in the peripartum period.

2. Methods

NHS obstetric units with anaesthetic services across England, Wales, Scotland and Northern Ireland were invited to participate in the ObsQoR study *via* National Institute for Health Research (NIHR) clinical research networks and anaesthesia trainee research networks. The study was designed to assess the quality of postpartum inpatient and outpatient recovery following anaesthetic or analgesic intervention during the peripartum period. The aims included evaluation of demographic, obstetric, anaesthetic and institutional factors, which may impact the quality of postpartum recovery.

The ObsQoR study included an institutional survey, developed based on best currently available evidence, guidelines and expert opinion to identify site-level differences in care that may affect the quality of postpartum recovery. Using the RCOG COVID-19 guideline version 14 (July 2021), supplementary questions related to COVID-19 were developed to assess the impact of the pandemic on peripartum care. The survey was piloted in 6 hospitals and modified in an iterative fashion. The paper survey was distributed electronically via email to all participating principal investigators of the ObsQoR study, requesting completion at the start of the initial data collection period.

Surveys were completed with input from clinical leads for obstetrics, anaesthesia and midwifery and responses uploaded to a web-based platform (FormAssembly; www.formassembly.com Bloomington, IN, USA). Data were collected by local investigators and then collated centrally. A list of all obstetric units known to have anaesthetic services was collated from the National Maternity and Perinatal Audit Organisational Survey and from the Northern Ireland Maternity System metadata (n = 194) [8,9]. Responses to survey questions were analysed as one group and the data reported using frequencies and percentages. The data were exported and checked using Microsoft Excel (v.16.5 Redmond, WA, USA). Any errors or missing data were verified and clarified with site study teams. Statistical analyses were performed using Stata Version 14.0 (StataCorp., College Station, TX, USA). The additional free text responses were examined using a method of thematic analysis for trends and categorised by two authors.

3. Results

Survey responses were received from 105 out of 107 study centres. This represents a 98% response rate for the 54% of all 194 institutions in the UK with consultant-led maternity units, which participated in this study (Table 1). A list of collaborating units is available in Appendix A. The median [IQR] reported annual number of deliveries among the included sites was 4389 [3000–5325]. Hospital sites consisted of 77 English NHS Trusts, 3 Scottish NHS Boards, 4 Welsh Health Boards, and 4 Northern Irish Health and Social Care Trusts. Results relating to guidelines, isolation, birthing partners, birth plans, personal protective equipment, VTE and vaccination pathways are summarised in Table 2.

One hundred and three sites provided responses to questions regarding testing, with variations in how routine testing for COVID-19 was performed at participating centres. Ninety (87.4%) sites had provider performed Polymerase Chain Reaction (PCR) testing, 18 (17.5%) sites relied on provider performed lateral flow antigen testing. Self-testing by PCR and lateral flow were performed by 7 and 16 institutions, respectively.

Thirty-seven centres out of 104 (35.6%) had routine restrictions on birthing plans, for example birthing location or changes to labour and delivery preferences if a positive diagnosis of COVID-19

Table 1
Summary of included sites.

Country and region	Total number of participating sites	Total number of deliveries per annum			
		Under 2500	2500–3999	4000–5999	6000 or more
England					
North-East and Yorkshire	16	4	5	5	2
Midlands	11	1	1	5	4
North-West	13	2	4	5	2
East of England	10	1	1	8	0
London	20	0	3	12	5
South-East	14	1	10	3	0
South-West	8	3	3	2	0
Scotland	3	0	0	2	1
Wales	6	4	1	1	0
Northern Ireland	4	0	2	2	0

Table 2
Summary of survey questions and responses.

Survey Questions	Number responding "yes"/total response (%)
Does your hospital have guidelines for how to manage the COVID-19 positive parturient?	99/105 (94.3)
Isolation precautions: are COVID-19 positive parturients kept in an isolated room throughout their entire admission? (incl. admission, labour & delivery, recovery and postnatal experience)	101/105 (96.2)
Birthing partners: is the birthing partner allowed to be present if the parturient is COVID-19 negative?	103/105 (98.1)
Birthing partners: is the birthing partner allowed to be present if the parturient is COVID-19 positive?	79/104 (76.0)
Birthing partners: if a parturient's partner is COVID-19 positive but asymptomatic, are they allowed to be present?	29/105 (27.6)
Birthing plans: if a parturient is COVID-19 positive at the time of labour, does this limit her birth plan options?	37/104 (35.6)
PPE: are parturients instructed to wear any form of PPE during their labour and delivery (*e.g.*: facemask), even if they are COVID-19 negative?	42/104 (40.4)
VTE prophylaxis: is there a guideline for VTE prophylaxis specifically for COVID-19 positive parturients that you follow within your hospital?	61/105 (58.1)
Vaccination: is there a referral pathway or process to encourage COVID-19 vaccination in all pregnant women?	63/103 (61.2)

was made. Isolation precautions were present in 101/105 (96.2%) of centres, with COVID-19 positive parturients isolated on labour and delivery, recovery and postnatal wards throughout their admission. One hundred and three out of 105 (98.1%) centres allowed birthing partners to be present during delivery if the parturient was COVID-19 negative, however only 79/104 (76%) allowed birthing partners to be present if the parturient was COVID-19 positive. If birthing partners were COVID-19 positive but asymptomatic, 29/105 (27.6%) of centres allowed them to be present. Requirements for parturients to wear personal protective equipment (*e.g.*, facemask), during their labour and delivery were reported by 42/104 (40.4%) centres, irrespective of infection status.

Specific guidelines pertaining to VTE prophylaxis were found in 61/105 (58.1%) institutions. Of these 61 centres with VTE guidelines, 36 (59.0%) aligned with the RCOG guidance in terms of prophylaxis dose and duration of low molecular weight heparin (LMWH). Seven centres advocated the use of enhanced or intermediate dosing of LMWH, and it was unclear (including no information provided) in 13 centres. Two centres routinely advocated discussing the case with a haematologist.

A COVID-19 vaccination referral pathway was present in 63/103 centres (61.2%) encouraging full vaccination for all pregnant women. Fifty-three sites described their vaccination referral protocol, which varied in its approach from local advertising, drop-in clinics, community engagement and dedicated vaccination midwifery services.

4. Discussion

The main finding from this study is the variation among UK institutional guidelines, adherence to guidance and inpatient care delivered to peripartum women during the COVID-19 pandemic. Almost all centres have guidelines in place for the management of COVID-19 positive peripartum women. However, there is variability in the management of patients with regard to testing, isolation precautions and personal protective equipment for patients or birthing partners, irrespective of infection status. In addition, there is inconsistency in the approach to birthing plans for the parturient who tests positive. Whilst there are specific guidelines for VTE prophylaxis in pregnancy with COVID-19 in 58.1% of institutions, there is variation in the dosing and duration of LMWH. There are various strategies employed to increase the rate of vaccinations against COVID-19 in the pregnant population.

To our knowledge, this is the first survey assessing institutional guideline adherence and clinical practices relating to COVID-19 across a large number of centres. This sample is likely to be a representative sample of peripartum care in the UK. It provides insight into the variability of guidelines or implementation of recommendations present across the range of centres caring for women in the peripartum period. The data collection occurred between surges of COVID-19, when centres were in the position to focus on guideline implementation and ensure continuity of care. In addition, it highlights the feasibility of making widespread changes and the degree to which national guidance has resulted in modifications to local practice.

There is rapidly evolving evidence as to what constitutes best practice related to the management and prevention of COVID-19 infection. This survey provides a contemporary snapshot of peripartum practice; however, we acknowledge that amendments to guidelines may have subsequently occurred. We acknowledge that guidance in this area is dynamic and there may have been a lag between guidance change and local practice at the time of survey completion. We also relied on self-reporting and are not able to verify that all patients receive the care outlined in survey responses.

The survey findings demonstrate the variability and disparity in obstetric practice received by patients and safety to healthcare workers in the context of the COVID-19 pandemic. It highlights the heterogeneous alterations to care in the peripartum period, modifications to care were required in order to balance risk and a rapidly changing evidence base, with two previous surveys of maternity services highlighting staffing changes and modification in care related to COVID-19 [5,6]. The full impact these changes will have on maternal and neonatal health is unclear. However, it is recognised the pandemic has impacted the quality of care delivery, anaesthesia, maternal psychological wellbeing and breastfeeding [5,10–14].

Many institutions introduced restrictions on maternity services including prohibiting attendance of a birth partner during labour, with concerns regarding the balance between reducing risk of infection and maintaining optimum maternal care [15]. All women should have the right to a safe and positive childbirth experience, irrespective of infection status for COVID-19 and this includes birth companion of choice [16]. We note the variation in this practice across the UK particularly related to birth partner presence and use of PPE in the context of COVID-19 infection.

COVID-19 increases the risk of thrombotic complications, which are associated with increased mortality and morbidity [17]. The RCOG-issued guidance is in line with non-pregnant patients admitted to hospital with COVID-19. We report variability in the presence of local guidelines and recommendations with regards to dosing strategy and duration of LMWH therapy. Therefore, adherence to national guidance appears to be inconsistent.

Routine testing for COVID-19 should be used to prevent nosocomial infections, allow isolation precautions, limit staff exposure and for patient risk stratification. This is particularly applicable in the pregnant population as evidence suggests that

there is significant asymptomatic carriage [18]. The routine testing was recommended in the UK for all parturients and their birthing partners, we have highlighted various methods obstetric units use for the routine testing at, or prior to admission of parturients. These considerations are important to protect other patients including staff and maintain safe services. This inconsistency in practice means that staff and hospitals in certain areas may be disadvantaged by the lack of systems in place to protect them. This in turn may have had an adverse impact on the hospital's other services. Appropriate testing before admission can ensure appropriate surveillance, assess the effectiveness of vaccinations and risk mitigation for the higher risk obstetric population.

Immunisation against SARS-CoV-2 with mRNA vaccines remains the most effective way of preventing COVID-19-related morbidity and mortality, with efficacy of two doses of mRNA vaccination lasting at least 6 months [19]. Vaccination can occur at any time during pregnancy and the postpartum period [20]. Despite strong recommendations, the rates of vaccination remain low and this is particularly true for women who are younger, non-White ethnicity, and from lower socioeconomic backgrounds [21,22]. There are different approaches employed to encourage vaccination, and there is an absence of consistency among pathways to ensure that those unvaccinated are informed and referred to vaccine centres. Further work is required to highlight the most appropriate methods to ensure full vaccination in groups with low uptake. This is particularly true as the pandemic evolves, new variants of concern emerge, and time-dependent decreases in immunity becoming evident following previous infections or vaccinations [23–25].

5. Conclusions

Overall, this survey highlights the feasibility of widespread implementation of change. Despite the urgency of the pandemic and the high likelihood of buy-in from stakeholders, variability was observed across the UK. This finding suggests a further in-depth analysis is required to identify the barriers to implementation success. The provision of care varies amongst obstetric units in the UK. As the COVID-19 pandemic continues, it is important that obstetric care and teams deliver the best evidence-based quality of care possible. There should be standardised care that follows national recommendations for the management of the parturient with COVID-19 infection. In addition, maintenance of equity in the care delivered irrespective of location and infection status must be prioritised.

Ethics approval and consent

The ObsQoR study received ethical approval from the UK National Research Ethics Service (South Central - Berkshire B REC ref. 19/SC/0333) and trial registration was obtained prospectively (ClinicalTrials.gov Identifier: NCT04192045).

Disclosure of interest

No author has any conflicts of interest to declare. Funding for this study is via an Obstetric Anaesthetists' Association (OAA) grant awarded to JOC. PS is an Arline and Pete Harman Endowed Faculty Scholar of the Stanford Maternal and Child Health Research Institute. SRM receives support from the National Institute for Health Research University College London Hospitals Biomedical Research Centre.

Funding

The funding for this study was provided by a grant from the Obstetric Anaesthetists' Association (OAA) and supported by NIHR portfolio adoption.

Authors contributions

JOC, LZ, and EW conceived the idea and plan for the COVID-19 survey. JOC, LZ, EW designed the institutional survey. PS and JOC distributed the survey to all site leads. JOC and NG conducted the analysis. All co-authors actively drafted, reviewed and commented on the final manuscript.

Acknowledgements

ObsQoR Collaborators

Abby Rand; Abby Medniuk; Abdul Rehman; Abegail Salvana; Abhilash Das; Adam Windle; Adam Sturmey; Aditi Kelkar; Ahmed Elfaioumy; Ahmed Yousef; Aidan Melia; Aishling Hill; Aisling Connolly; Alex Mills; Alexander Sharp; Alexander Ware; Alexander Cowan; Alice Arch; Alice Gerth; Alice Carey; Alina Van-Hien; Alison Colhoun; Alistair Sawyerr; Amad Hania; Amanda Scott; Amanda Sanderson; Amar Malik; Ameerah Mohd Azmil; Amrit Gosal; Amrita Kaul; Amy Ellison; Amy Hunt; Amy Hughes; Andal Soundararajan; Andrea Nevis; Andreas Kostroglou; Andrew Parrish; Aneeta Sinha; Angela Chrisopoulou; Angela Nicklin; Angela Garnder; Angela Foulds; Angela Moon; Anil Kumar; Anish Harish Dave; Anna Reyes; Anna Quinn; Anne Isherwood; Anne Nicholson; Anthony Short; Arani Pillai; Arlene Wise; Arran Morgan; Arti Gulati; Asela Wimalaratne; Ashley Mcilroy; Ashley Thomson; Atia Qaiser; Attam Singh; Austin Mathews; Avinash Kapoor; Ayub Khan; Azher Ashraf; Bagrat Benjamin Lalabekyan; Barbara Macafee; Basant Bhattari; Beena Saji; Beenu Madhavan; Belinda Roberts; Ben Prince; Ben Goodman; Ben Brown; Ben Joakim; Benedict Williams; Benjamin Jones; Beth Lally; Beth Peers; Bev Hammond; Bhavesh Gohil; Bibi Badal; Bijal O'Gara; Brett Doleman; Brian Johnston; Brittany Downs; Bryony Shelton; Bryony Reed; Carina Craig; Carol Kenyon; Carol Muir; Caroline Cormack; Caroline Fox; Caroline Thomas; Caroline Dixon; Catherine Townsend; Catherine Bressington; Catherine Challifour; Catriona Hussain; Celia Whelan; Ceri Mowat; Chamika Abayasinghe; Chamil Uduwela; Chantal Busby; Charaka Abeywardana; Charles Moore; Charles Cross; Charlotte Brathwaite-Shirley; Charlotte Crossland; Charlotte Hunt; Cheryl Wyatt; Chiara Ellis; Chibuzo Hemeson; Chimverly Diaz; Chinwe Obiozo; Chloe Rishton; Chris Mullington; Chris Graham; Christine Lanaghan; Christopher Elton; Christopher Marsh; Christopher Mcgrath; Christy Ord; Ciara Crail; Claire Cooper; Claire Williams; Claire Prince; Claire Mccaul; Clare Taylor; Clare Denford; Clifford Shelton; Con Papageorgiou; Constance Weston; Constantinos Papoutsos; Coralie Huson; Corinne Rimmer; Cristina De La Iglesia; Dabeer Ahmed; Damien Hughes; Daniel Bruynseels; Daniel Cottam; David Bromley; David Uncles; David Mccretton; Dawn Athorn-Wright; Dean Wilkinson; Debbie Moore; Deborah Mccartney; Del Endersby; Denise Wyndham; Desire Onwochei; Donata Banni; Donna Wixted; Duncan Cochran; Eftychia Sousi; Eileen Walton; Eilidh Waddell; Eilir Roberts; Elaine Hart; Eleanor Tanqueray; Elise Hindle; Elizabeth Kalam-Sakit; Elizabeth Smee; Ellen Brown; Elliott Wells; Emily Duckham; Emily Gott; Emily Rice; Emma Clarey; Emma Underhill; Emma Meadows; Emma Tanton; Emma Plunkett; Emma Collins; Emma Dooks; Emma Lloyd-Davies; Emma Finlay; Emma Thompson; Emma Searle; Emma Derby; Erin Innes; Eva Beranova; Felicity Gallop; Fozia Hayat; Frances Beatty; Francesca Brewer; Gail Castle; Gareth Allen; Gary Colville; Garry Davenport; Gayatri Khanvelkar; Gayle Wallace; Gemma Crossingham; Gemma Suddick; Genu John; Georgia Knight; Georgia Kirby; Georgia Perkins; Geraldine Landers; Gill Hobden; Gill Arbane; Gladys Martir; Grace Mcclune; Grainne Garvey; Grainne O'Connor; Gulia Suleymanova; Hagar Aly; Handapangoda Hemantha; Hani Ali; Hannah Bennett; Hannah Davies; Hannah Barnes; Hannah Bethell; Hannah Waddington; Hannah Dudhill; Harish Venkatesh; Harriet Pearson; Harriet Anderson; Harriette Beard; Heather Sellers; Heba Ibrahim; Heidi Hollands; Helen Mcnamara; Helen Iliff; Helen T-Michael; Helen Wild; Helen Lindsay; Helen Grant; Helena Jennison; Henry Boyle;

Hilary Rosser; Holly Ingram; Hugo Manteigas; Huw Griffiths; Ian Chadderton; Ime Eka; Imran Sharieff; Ingrid Volikas; Irmina Bukowska; Jack Haslam; Jacqueline Tipper; Jacqui Jacqui Jennings,; Jagjit Johal; Jaime Greenwood; Jaishri Nagari Radhakrishna; James Wilkinson; James Collins; James Dunning; Jane Cantliffe; Jane Radford; Jane Shaw; Jane Gavin; Jane Hillen; Janet Brown; Jason Lie; Jayne Wagstaff; Jennifer Hooper; Jennifer Syson; Jennifer Reynolds; Jenny Ritzema; Jenny Butler; Jenny Pullen; Jessica Reynolds; Jessica Johnston; Jessica Bell; Jessica Towning; Jessica Wilson; Jessie Brain; Joanna Walker; Joanna Parker; Joanne Bland; Joanne Rothwell; Joanne Deery; Joanne Finn; Jodi Carpenter; Joelle Pike; Johanna Rochester; Johannes Retief; John Stewart; Johnathan Kenworthy; Jonathan Hudsmith; Jonathan Coppel; Jonathan Biss; Jonathan Short; Jonathan Evans; Jonathan Major; Jonathon Dearden; Julia Critchley; Julia Bowditch; Julie Grindey; Julie Le Bas; Julie Woollaston; Julie-Ann Davies; Junaid Desai; Kailash Bhatia; Karen Chadwick; Karen Salmon; Karen Conolloy; Kari Swettenham; Karina Maclachlan; Kate Evans; Kate Stoddard; Kate Robinson; Kate Jones; Katherine Lake; Kathryn Spence; Kathryn Norman; Katy Foreman; Katy Whitehouse; Kaumudi Patel; Kausar Peshimam; Kay Robins; Kay Mak; Kelly Death; Kelly Smith; Kerry Colling; Kim Rhodes; Kimberley Hoyland; King Cheong; Kirsty House; Konstantinos Miltsios; Laura Adams; Laura Fulton; Laura Mitchell; Laura Garden; Laura Brady; Laura Vickers; Laura Helley; Laura Evans; Lauren Robbins; Lauren Williams; Lauren Sach; Leanne Gentle; Lema Imam; Liam Austin; Lindsey Mcdowell; Lisa Canclini; Lisa Kavanagh; Lisa Elam; Lisa Bouras; Liz Taylor; Lolade Oshodi; Louise Sanderson; Louise Baxendale; Louise Swaminathan; Lucy Powell; Lucy Willsher; Lucy Stephenson; Lucy Barnes; Lydia Ufton; Lydia Rhodes; Lyndon Harkett; Maame Aduse-Poku; Madhavi Keskar; Manasi Mittal; Mansi Vaidya; Marcelina Zawadzka; Marcus Hickson; Maria Marta; Marian Flynn-Batham; Mario Shekar; Mark Mccague; Mark Louie Guanco; Martyn Traves; Mateusz Klukowski; Matthew Wikner; Matthew Bigwood; Matthew Sinnott; Matthew Stubbs; Matthew Law; Matthew Simpson; Matthew Gaines; Matthew Roche; Matthew Milner; Matthew Sherwin; Matthew Baker; Matthew Henwood; Mcallister Victoria; Meenakshi Agarwal; Mel Rich; Mel Woolnough; Melanie Poole; Melchizedek Penacerrada; Melissa Ogbomo; Michael Jarvis; Michelle Bradshaw; Michelle Walters; Mihiri Dissanayake; Miranda Forsey; Miranda Usher; Mitul Patel; Muditha Mawathage; Myrna Maquinana; Nadhya Qureshi; Naomi Freeman; Natasha Campbell; Natasha Kennedy; Nayer Guirguis; Neil Mcloughlin; Neil Brown; Nerea Rodal-Prieto; Nicholas Coker; Nicholas Kurunaratne; Nicki Martin; Nicola Jacques; Nicole Richards; Nidhi Gautam; Nikki White; Niraj Barot; Niranjala Wickramasinghe; Noah John; Oliver Froud; Oliver Cummin; Oliver Blightman; Olivia Flood; Oluseye Balogun; Orlagh Mcnally; Palbha Jain; Partha Annamalai; Patricia Nabayego; Paul Wyatt; Paul Swift; Paul Jackson; Perumal Tamilselvan; Peter Yoxall; Philip Jackson; Phillipa Squires; Ping Coutts; Pippa Surgey; Piyush Pankhadiwala; Pooja Kamath; Pragya Ahuja; Prateek Nalwaya; Preetam Tamhane; Pricilla Botchway; Priyan Odedra; Priyash Verma; Rachael Lucas; Rachel Kearns; Rachel Atkinson; Rachel Heard; Rachel Burnish; Rachel Cassin; Rachel Burnell; Rachel Campbell; Rachel Scale; Radhika Plachikkattle Velu; Rajesh Shankar; Rajesh Bhimanaboina; Raji Prabhakaran; Raju Puttaswamy; Rama Varadan; Raphael Holmes; Raul Benlloch; Reanne Solly; Rebecca Parker; Rebecca Barr; Rebecca Phillips; Rebecca Fishwick; Rebecca Hawes; Rebecca Crosby; Rebecca Smith; Rebecca Powell; Rebekah Mostyn; Reena Ellis; Reza Khorasanee; Rhiannon Ions; Rhidian Jones; Rhys Volk; Richard Robley; Rishabh Bassi; Rob Jesty; Robert Watson; Rocio Ochoa-Ferraro; Rohan Lakhani; Rohan Goel; Rohit Rohit; Roman Hyrniv; Rosanna Greaves; Rose Jama; Rose Warren; Rose Buckley; Rosie Cortaville; Ross Holcombe-Law; Roxana Sandhar; Ru Davies; Ruby Fronda; Ruby Carrington; Rudra Pallab; Sabi Rai; Sabrina Carta; Saju Sharafudeen; Sally Hammond; Sam Nugent; Samantha Brayshaw; Samuel Hird; Samuel Kestner; Sandra Essien; Sanjoy Bhattacharyya; Santosh Poon; Sara Leach; Sara Burnard; Sara Henry; Sarah Napier; Sarah Bell; Sarah Armstrong; Sarah Miller; Sarah Stone; Sarah Knights; Sarah Bircham; Sarah Purvis; Sarah Hazeldine; Sarah-Kate Mcleavey; Saul Sundayi; Sean Roberts; Sean Howells; Sean Cope; Seema Pai; Seema Quasim; Shaila Seraj; Shannen Beadle; Sharon Turney; Sharon Gowans; Sharwend Supermanian; Shayne Yun Xuan Ng; Sherina Peroos; Shweta Appiah; Sian Saha; Simon Jones; Simon Cousins; Sinead Donlon; Sinead Mcguirk; Sioned Phillips; Sleem Rahim; Sohail Bampoe; Sophia Beeby; Sophie Curtis; Sophie Cusick; Sophie Kreppel; Sophie Fisk; Sophie Kimber-Craig; Sophie Harris; Sophie-Mae Wheeler-Davies; Sripriya Sivaramakrishnan; Stacey Pepper; Stacey Cotterell; Stacy Wilson; Stefan Milewczyk; Stephanie Connelly; Stephanie Kent; Stephen Berry; Steve Thomas; Steven Liggett; Sumit Bajaj; Susan Hendy; Suzanna Twiss; Suzanne Taylor; Talia Wieder; Tessa Dean; Thomas Lewis; Thomas Hall; Thomas Hussey; Thomas Sharp; Timothy Orr; Tineesh Mathew; Toby Keown; Tom Wooten; Tracey Christmas; Tracey Camburn; Tracey Benn; Tracy Hazelton; Tracy Langcake; Trino Cruz Cervera; Vanessa Fludder; Vicky Collins; Vicky Singler; Victoria Laxton; Victoria Turnock; Victoria Lowden; Vikas Jain; Vinanti Cherian-Mciver; Vishal Salota; Vishnu Sundararajan; Viv Cannons; Whiston Research Team; Xantha Holmwood; Xenia David; Xiaobei Zhao; Yasmin Prior; Yavor Metodiev; Zainab Sarwar; Zoe Grindley; Zoe Garner; Zoe Eke.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.accpm.2022.101137.

References

[1] Bauer M, Bernstein K, Dinges E, Delgado C, El-Sharawi N, Sultan P, et al. Obstetric anesthesia during the COVID-19 pandemic. Anesth Analg 2020;131:7–15.

[2] Villar J, Ariff S, Gunier RB, Thiruvengadam R, Rauch S, Kholin A, et al. Maternal and neonatal morbidity and mortality among pregnant women with and without COVID-19 infection. JAMA Pediatr [Internet] 2021;175:817–26. Available from:https://jamanetwork.com/journals/jamapediatrics/fullarticle/2779182.

[3] Allotey J, Stallings E, Bonet M, Yap M, Chatterjee S, Kew T, et al. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. BMJ [Internet] 2020;370m3320 Available from:https://www.bmj.com/lookup/doi/10.1136/bmj.m3320.

[4] Vousden N, Ramakrishnan R, Bunch K, Morris E, Simpson N, Gale C, et al. Management and implications of severe COVID-19 in pregnancy in the UK: data from the Obstetric Surveillance System national cohort. Acta Obstet Gynecol Scand [Internet] United States 2022;101:461–70. Available from:https://onlinelibrary.wiley.com/doi/10.1111/aogs.14329.

[5] Rimmer M, Al Wattar B, Barlow C, Black N, Carpenter C, Conti-Ramsden F, et al. Provision of obstetrics and gynaecology services during the COVID-19 pandemic: a survey of junior doctors in the UK National Health Service. BJOG An Int J Obstet Gynaecol [Internet] 2020;127:1123–8. Available from:https://onlinelibrary.wiley.com/doi/10.1111/1471-0528.16313.

[6] Jardine J, Relph S, Magee L, Dadelszen P, Morris E, Ross-Davie M, et al. Maternity services in the UK during the coronavirus disease 2019 pandemic: a national survey of modifications to standard care. BJOG An Int J Obstet Gynaecol [Internet] 2021;128:880–9. Available from:https://onlinelibrary.wiley.com/doi/10.1111/1471-0528.16547.

[7] Royal College of Obstetricians and Gynaecologists. Coronavirus (COVID-19) infection and pregnancy [Internet]. 2021 [cited 2021 Sep 29]. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/coronavirus-pregnancy/.

[8] Royal College of Obstetricians and Gynaecologists. NMPA Project Team. National maternity and perinatal audit: Clinical report 2019. Based on births in NHS maternity services between 1 April 2016 and 31 March 2017 [Internet]. London; 2019 Available from: www.hqip.org.uk/national-programmes.

[9] Northern Ireland Maternity Services (NIMATS). Northern Ireland Health and Social Care: Business Services Organisations. http://www.hscbusiness.hscni.net/services/2512.htm. 2017.
[10] Lalor J, Ayers S, Celleja Agius J, Downe S, Gouni O, Hartmann K, et al. Balancing restrictions and access to maternity care for women and birthing partners during the COVID-19 pandemic: the psychosocial impact of suboptimal care. BJOG An Int J Obstet Gynaecol [Internet] 2021;128:1720–5. Available from:https://onlinelibrary.wiley.com/doi/10.1111/1471-0528.16844.
[11] Vasilevski V, Sweet L, Bradfield Z, Wilson AN, Hauck Y, Kuliukas L, et al. Receiving maternity care during the COVID-19 pandemic: experiences of women's partners and support persons. Women Birth [Internet] 2021 IN PRESS. Available from:https://linkinghub.elsevier.com/retrieve/pii/S1871519221000780.
[12] Brown A, Shenker N. Experiences of breastfeeding during COVID-19: lessons for future practical and emotional support. Matern Child Nutr [Internet] 2021;17e13088 Available from:https://onlinelibrary.wiley.com/doi/10.1111/mcn.13088.
[13] Lucas DN, Bamber JH. Pandemics and maternal health: the indirect effects of COVID-19. Anaesthesia [Internet] 2021;76:69–75. Available from:https://onlinelibrary.wiley.com/doi/10.1111/anae.15408.
[14] Townsend R, Chmielewska B, Barratt I, Kalafat E, van der Meulen J, Gurol-Urganci I, et al. Global changes in maternity care provision during the COVID-19 pandemic: a systematic review and meta-analysis. eClinicalMedicine [Internet] 2021;37100947 Available from:https://linkinghub.elsevier.com/retrieve/pii/S2589537021002273.
[15] Topalidou A, Thomson G, Downe S. COVID-19 and maternal and infant health: are we getting the balance right? A rapid scoping review. Pract Midwife 2020;23.
[16] World Health Organization. Clinical management of COVID-19: interim guidance, 27 May 2020 [Internet]. Geneva PP - Geneva: World Health Organization; Available from: https://apps.who.int/iris/handle/10665/332196.
[17] Daru J, White K, Hunt BJ. COVID-19, thrombosis and pregnancy. Thromb Updat [Internet] 2021;5 Available from:https://linkinghub.elsevier.com/retrieve/pii/S2666572721000468.
[18] Metz TD, Clifton RG, Hughes BL, Sandoval G, Saade GR, Grobman WA, et al. Disease severity and perinatal outcomes of pregnant patients with coronavirus disease 2019 (COVID-19). Obstet Gynecol 2021;137:571–80.
[19] Thomas SJ, Moreira ED, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al. Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine through 6 months. N Engl J Med [Internet] 2021;385:1761–73. Available from:http://www.nejm.org/doi/10.1056/NEJMoa2110345.
[20] Public Health England. COVID-19: the green book, chapter 14a. Coronavirus (COVID-19) vaccination information for public health professionals. [Internet]. 2020 [cited 2022 Mar 20]. Available from: https://www.gov.uk/government/publications/covid-19-the-green-book-chapter-14a.
[21] Blakeway H, Prasad S, Kalafat E, Heath PT, Ladhani SN, Le Doare K, et al. COVID-19 vaccination during pregnancy: coverage and safety. Am J Obstet Gynecol [Internet] 2022;226:236.e1–236.e14. Available from:https://linkinghub.elsevier.com/retrieve/pii/S0002937821008735.
[22] Stock SJ, Carruthers J, Calvert C, Denny C, Donaghy J, Goulding A, et al. SARS-CoV-2 infection and COVID-19 vaccination rates in pregnant women in Scotland. Nat Med [Internet] 2022;28:504–12. Available from:https://www.nature.com/articles/s41591-021-01666-2.
[23] Townsend JP, Hassler HB, Wang Z, Miura S, Singh J, Kumar S, et al. The durability of immunity against reinfection by SARS-CoV-2: a comparative evolutionary study. Lancet Microbe 2021;2:e666–75.
[24] Levin EG, Lustig Y, Cohen C, Fluss R, Indenbaum V, Amit S, et al. Waning immune humoral response to BNT162b2 Covid-19 vaccine over 6 months. N Engl J Med [Internet] 2021;385:e84. Available from:http://www.nejm.org/doi/10.1056/NEJMoa2114583.
[25] World Health Organization. Tracking SARS-CoV-2 variants: Variants of concern (VOC) [Internet]. 2022 [cited 2021 Mar 20]. Available from: https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/.