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.

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Commentary

‘Shining a light on the gaps for learning’

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We are privileged to work at the interface between medicine and maternity; one a consultant midwife and the other an obstetric physician. With expertise in the urgent and emergency setting of pre-hospital care and acute medicine, we view maternal medicine and critically unwell pregnant women, with a unique lens, one that sees “gaps” in care, into which women can and do fall in.

We reflect upon these months and the story unfolding in front of us, as we stepped into the pandemic of the novel coronavirus SARS-CoV-2 infection. As rapid as the disease has taken over the world, so has the acquisition of ’new’ knowledge as we have been thrown against the rocks, caught in the rapids of this very bumpy ride. The challenge of the unknown and the lessons learnt from history were very much at the forefront of our minds at the start of the pandemic. We were apprehensive and focused on immediate actions as the outcomes of the Spanish flu pandemic and swine flu epidemic made us fearful of the risk to pregnant women with SARS-CoV-2; COVID-19 disease - particularly the knowledge of the 4–5 fold increased risk of dying from swine flu for pregnant woman (Harris, 1919; Saunders-Hastings and Krewski, 2016). This encounter has forced us to relook at what we need to do in the immediate and intermediate term for our women. The Royal College of Obstetrics and Gynaecology COVID-19 guidelines to date have under gone 10 reiterations up to the 19th June 2020 to keep up with the new knowledge and insights (Royal College of Obstetrics and Gynecology, 2020).

New evidence is expanding for COVID-19 during pregnancy and fortuitously the disease profile, though menacing, is not that much of a greater risk to our women than non-pregnant women of the same age (Chen et al., 2020; Breslin et al., 2020). Regrettably the disparity and inequalities again lie in the ethnic predominance and metabolic risk factors including diabetes in pregnancy and hypertension that make groups of our women more vulnerable to the disease. The ethnic inequalities echo tales from the non COVID-19 maternal deaths reports (Knight et al., 2019). The largest cohort described, 427 women, are from a study of COVID-19 positive pregnant women hospitalised with confirmed SARS-CoV-2 infection in the UK (Knight et al., 2020). The national cohort study using the UK Obstetric Surveillance System (UKOSS) found 18 of these women were intubated due to maternal respiratory compromise and 10 were intubated to allow for urgent delivery. Approximately 1 in 10 pregnant women were admitted to hospital in the UK requiring respiratory support in a critical care setting with the SARS-CoV-2 infection. Black and other minority ethnicity (BAME) women, the presence of pre-existing multi-morbidity (diabetes mellitus and hypertension), advanced maternal age and BMI > 26 kg/m^2 were all correlated with admission with SARS-CoV-2 infection in pregnancy. In this study’s sensitivity analysis the BAME association persisted (OR 3.67, 95% CI 2.55–5.28).

The early challenges as the system of healthcare was learning to respond, hour by hour, was indeed a reality that no one had truly experienced. Of note, the rapid onset of dyspnoea, the level of oxygen saturation inconsistent with patients without complex morbidities. These were hours where those on the front-line of patients in their homes, where experiencing a new dawn, a very different reality. But what of maternity? Women couldn’t get through to their maternity units, they were scared to access hospitals; they wanted their care provided to them in the perceived safety of their home.

As a midwife, within an emergency service, the priority was twofold; provide strategic leadership allied to the Heads of Midwifery, and clinical leadership within the control room environment with the maternity team. Working clinically afforded opportunity to focus purely on pregnancy related emergency calls. Covid-19 afforded us established technologies that had been used by existing trauma teams (Ter Avest et al., 2019). Using the “GoodSam” application, women were assessed by way of their mobile phones to establish early pregnancy bleeding, labour, and provide ‘scene’ assessment. The use of visual assessment guides provided an emergency assessment that we had not experienced as clinicians. The vignette below details one example.

> *“the woman said she had soaked through four towels, she sounded drowsy on the phone, we triaged her with Covid questions to pre inform the crew of any further protective equipment they would be requiring, the woman was on the floor, her colour was pale and waxy, my priority was to keep her talking, we were able to view her front door, with clutter in the hallway, this enabled me to ensure an emergency response was on route, we instructed the husband to clear the hallway, prepare for the ambulance teams”*

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The simple innovation of being able to virtually assess someone, gave a reality check to the needs of women in emergency situations. This had a positive outcome, with an observed birth, over the ''Goodsam app'', observing the membranes neatly cushioning the crowning vertex, the cries of celebration as the incoming paramedics took over care from myself and a call taker on a recorded telephone line.

As a clinician on the frontline in the hospital we were learning about COVID-19 alongside our critical care and physician colleagues within the hospital. The chief aims of management of the COVID-19 pneumonitis is prevention and improvement of maternal hypoxia. The specifics of a maternity-focussed escalation pathway in our unit was established after our encounter of our first case of a pregnant woman with COVID-19 due to a rapid deterioration in her health and preterm delivery warranted by maternal compromise. Our maternity escalation pathway was developed as a framework for managing pregnant women during COVID-19 with the nuances of the hypoxic parameters and respiratory compromise during pregnancy. The 4P study has re-confirmed that an oxygen saturation SpO2 <94% was an abnormal finding during pregnancy (Green et al., 2020). This supported our pathway too. The escalation pathway was divided into a traffic light system; green, amber and red areas with recommendations of when these parameters are reached who to contact and what to consider, such as stabilisation, delivery and consideration of fetal steroids. The importance of having the right team for senior decision-making is essential with the anaesthetists, obstetricians, critical care and physicians. The focus should be on having the experts' discussing the pregnant woman determining and individualising the care. The important question is where women reach a certain threshold of acuity (e.g. amber), should we be considering early intubation or defer this pending use of other non-invasive strategies including high flow nasal cannula, continuous positive airway pressure (CPAP) or awake proning in the COVID-19 era? Evidence for methods of oxygen delivery is unknown currently, and we seek more UKOSS and Intensive Care National Audit and Research Centre (ICNARC) data for direction. Until we have this evidence we should remain cautious. We would advocate these decisions of oxygen therapy only occurs in a suitable location such as a critical care setting where prompt escalation and management is deliverable if required for our pregnant women. Our maternity escalation pathway enables us all to provide the timely optimal care for our women. We believe without more universal process agreements the discrepancies of outcome and management will remain.

The COVID-19 era has highlighted the importance of identifying maternal physiological factors and providing a transparent escalation pathway that can work in all areas where pregnant women present when unwell. The challenge for us all is to have critical care input, with access to invasive ventilators and level 2–3 beds availability in all settings where pregnant women present at all times, not only during COVID-19 pandemic times but any emergency in maternity requiring critical care support and intervention. We hope we can take this forward as we develop a national MEOWs chart and recognise and escalate care for our deteriorating pregnant woman.

It was, perhaps, the large scale impact upon providers or urgent and emergency services i.e. the NHS 111, and 999 services that experienced the first, and most significant headline of the pandemic. From a regular daily call volume of 3500, calls in first four days exceeded 8000 within the "999″ service, this number was matched within the "111″ providers, the busiest days ever recorded (Emmerson, 2020). A doubling of calls, with the respective doubling of vehicles and staff needed, was a challenge akin to no other. It was not long before military aid was called upon to support that critical infrastructure at the time.

Why was this impact so critical for maternity care? From a commissioned ambulance service, the ability to respond to a call for help, within seconds, is the expected quality the public have come to expect, and when life-threatening complications happen, every minute can make a significant difference to the chances of survival and prognosis, notably when life-saving interventions are instigated by the 999 call operators (Commissioning Framework, 2020).

The ability to traverse networks, and "champion" the dialogue across pan London trust boards and the London Ambulance Service, was critical (Royal College of Midwives, 2020). The ability for a midwife to escalate the potential impact of delays to responding to maternity emergencies was critical amidst many priority demands within the service.

Experiences of staff attending COVID-19-related emergency calls, were fraught with the challenges around the length of time surrounding dispatch and arrival with the patient, the reality that in cases, the person had died, the reality of complex personal protective clothing impacting on the provision of hands-on direct patient care, that hands on care being the difference between life and death, notably when high quality cardiac compressions were all that could bridge the gap toward survival.

It will become clearer how COVID-19 impacts on pregnancy/postnatal health as we begin to learn and reflect from the growing evidence from the non-pregnant COVID veterans of the life-changing psychosocial and physical demands left by this disease (Stam et al., 2020). For our women what guidance or interventions could minimise consequences going forward for those seriously ill as a result of the COVID-19?

Moving forward learning from good clinical practice in the absence of strong scientific data will support a second surge and beyond.

What can we take away from our experience of COVID-19 infection in our women? Early identification, with rapid tests if possible and isolation and shielding is crucial for our women in preventing the spread of infection. The RCOG in the UK has been exemplary aiming to keep us up to date and support us pragmatically. What are the challenges and needs to help support our BAME women? With the BAME women how do we determine if this risk is fixed or modifiable? Will a vaccination against SARS-CoV-2 be available for pregnant women in the near future?

Overall, we have learnt much from this pandemic, but there are many unanswered questions remaining.

Declaration of competing interest

AB and AM report no conflict of interest.

CRediT authorship contribution statement

Anita Banerjee: Conceptualization, Writing - original draft, Writing - review & editing. **Amanda Mansfield:** Writing - original draft, Writing - review & editing.

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