



Short Report

COVID-19 infection and maternal morbidity in critical care units in Scotland: a national cohort study



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ABSTRACT

Background: Previous research has shown that, in comparison with non-pregnant women of reproductive age, pregnant women with COVID-19 are more likely to be admitted to critical care, receive invasive ventilation, and die. At present there are limited data in relation to outcomes and healthcare utilisation following hospital discharge of pregnant and recently pregnant women admitted to critical care.

Methods: A national cohort study of pregnant and recently pregnant women who were admitted to critical care in Scotland with confirmed or suspected COVID-19. We examined hospital outcomes as well as hospital re-admission rates.

Results: Between March 2020 and March 2022, 75 pregnant or recently pregnant women with laboratory-confirmed COVID-19 were admitted to 24 Intensive Care Units across Scotland. Almost two thirds (n = 49, 65%) were from the most deprived socio-economic areas. Complete 90-day acute hospital re-admission data were available for 74 (99%) patients. Nine (12%) women required an emergency non-obstetric hospital re-admission within 90 days. Less than 5% of the cohort had received any form of vaccination.

Conclusions: This national cohort study has demonstrated that pregnant or recently pregnant women admitted to critical care with COVID-19 were more likely to reside in areas of socio-economic deprivation, and fewer than 5% of the cohort had received any form of vaccination. More targeted public health campaigning across the socio-economic gradient is urgently required.

Introduction

Risk factors for the development of severe COVID-19 disease such as multimorbidity, socio-economic deprivation, ethnicity and age, are well established.^{1,2} Ongoing research has also shown that, in comparison with non-pregnant women of reproductive age, pregnant women with COVID-19 are more likely to be admitted to critical care, receive invasive ventilation, and die.^{3,4} Despite this, the clinical course of pregnant and recently pregnant women admitted to critical care warrants further investigation, especially in relation to hospital outcomes and healthcare utilisation following hospital discharge.

To understand the care trajectory of this patient group, we report a complete national cohort of pregnant and recently pregnant women admitted to critical care in Scotland with confirmed or suspected COVID-19. Uniquely, we also examined re-admission rates in the 90 days following hospital discharge.

Methods

The Scottish Intensive Care Audit Group (SICSAG) received approval by the Public Benefit and Privacy Panel for Health and Social

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Care (1920-0093) to undertake work relating to the COVID-19 pandemic.

Data sources were linked via the Community Health Index number, a unique patient identifier. This linkage included: the Scottish Morbidity Record (SMR) 01 which captures acute, non-obstetric hospital activity; the Electronic Communication of Surveillance in Scotland which captures virology testing; the National Records of Scotland death records; and the SICSAG database. The SICSAG database prospectively captures all adult intensive care unit (ICU) and general high dependency unit (HDU) activity within Scotland, including pregnancy status on admission, and is subject to regular validation assessments.

Using a cohort study design, we examined patients aged 16 years or older, admitted to Scottish critical care units, who were pregnant or recently pregnant (within six weeks of delivery), with a positive polymerase chain reaction test for nucleic acid for SARS CoV-2 before or during critical care admission.

Demographic and acute illness variables were obtained from the SICSAG dataset. Ethnicity was derived from categories of the Scottish Census (2011) with low frequencies aggregated. Socio-economic deprivation was defined using quintiles of the Scottish Index of Multiple Deprivation (SIMD), which is an area-based ranking index based on postcode of residence.⁵

Vaccination status was categorised as: one dose, two or more doses, or unvaccinated. We divided time periods into ‘waves’ of COVID-19 critical care admissions, which were defined by Public Health Scotland: Wave 1 from 1 March, 2020 to 31 July, 2020; Wave 2 from 1 August, 2020 to 18 May, 2021; Wave 3 from 19 May, 2021 to 13 March, 2022.⁶ We included waves in our descriptive analysis as these reflect the different predominant variants of SARS CoV-2 during the time period.⁶ Data were analysed using R version 3.6.1 (R Core Team (2018)).

Results

Between March 2020 and March 2022, 75 pregnant or recently pregnant women with laboratory-confirmed COVID-19 were admitted

to 24 ICUs across Scotland. The majority of women (n = 51, 68%) were admitted during the third pandemic ‘wave’ (Fig. 1).

The median age of the cohort was 31 (interquartile range (IQR) 27.5–35) years and almost two thirds (n = 49, 65%) were from the most deprived socio-economic geographical areas (SIMD 1 and 2). Across the cohort, 48 (64%) women were pregnant on admission to ICU and 27 (36%) were within six weeks of delivery. Less than 5% of the cohort had received any form of vaccination. In total, nine (12%) patients had a recorded comorbidity on admission (Table 1).

The median critical care length of stay (LOS) was 4 (IQR 1.5–9) days and median hospital LOS was 10 (IQR 6–17) days. Advanced respiratory support was required by 33 (44%) patients, while non-invasive support was required by 44 (59%) and one quarter (n = 19, 25%) required a combination of both types of respiratory support. Almost one third (n = 24, 32%) required cardiovascular support. Ultimate hospital mortality was 1.3% (n = 1).

Complete 90-day, acute hospital re-admission data were available for 74 (99%) patients. Nine (12%) women required an emergency non-obstetric hospital re-admission within 90 days.

Discussion

This complete national cohort of pregnant or recently pregnant women admitted to critical care with COVID-19 has shown a high need for organ support and a non-obstetric re-admission rate of 12%. Despite significant public health campaigning around the benefits of vaccination, vaccination rates were low in this cohort.

Less than 5% of this cohort had been vaccinated, findings which support the vital role that vaccination plays in pregnancy. Urgent public health attention is required to inform people of the benefits of vaccination and the significant impact that severe COVID-19 can have on the entire family unit. Moreover, future clinical trials which investigate vaccinations must explicitly include pregnant women to ensure that women can benefit fully from potentially life-saving treatments.⁷

Nearly two thirds of the cohort were from areas of socio-economic deprivation. This is higher than that reported for an unselected non-pregnant cohort, where fewer than half of the population were from

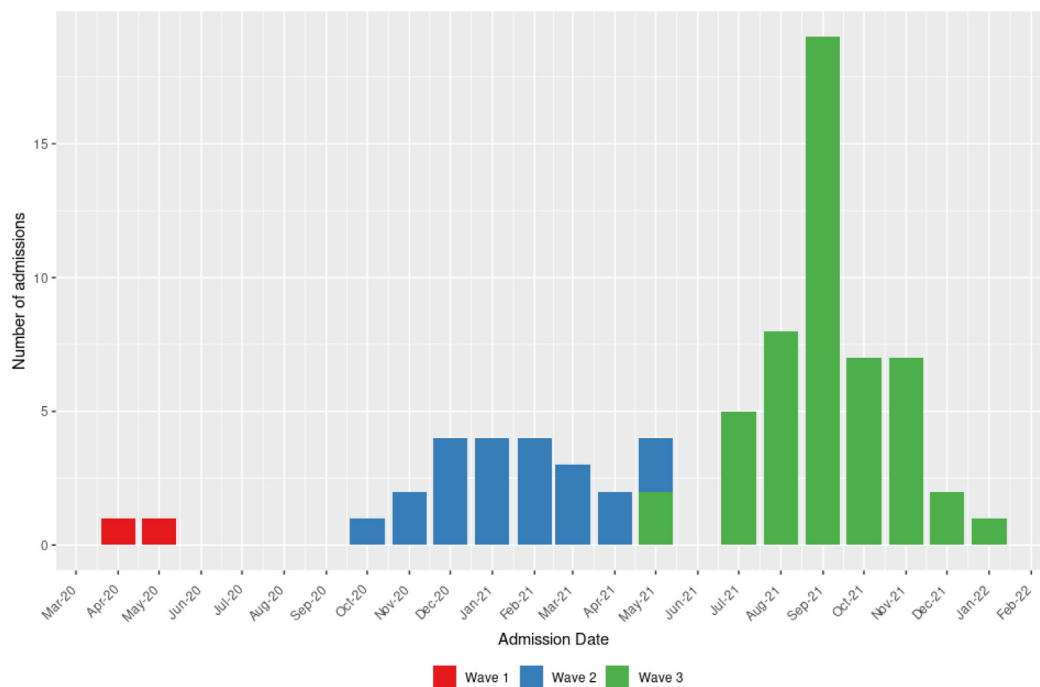


Fig. 1. Number of admissions of pregnant or recently pregnant patients with COVID-19 disease to Scottish Critical Care units by month, stratified by ‘wave’. Waves are defined as: Wave 1 from 1 March, 2020 to 31 July, 2020; Wave 2 from 1 August, 2020 to 18 May, 2021; Wave 3 from 19 May, 2021 to 13 March, 2022. May 2021 therefore incorporates the end of Wave 2 and beginning of Wave 3

Table 1
Demographics and outcomes of cohort

Characteristic	n=75
Age, years (median, IQR)	31 (27.5–35)
Pregnancy status on admission:	
- Antenatal	48 (64.0%)
- Postnatal	27 (36.0%)
Socio-economic status quintile (SIMD)	
- 1 (most deprived)	31 (41.3%)
- 2	18 (24.0%)
- 3	12 (16.0%)
- 4	9 (12.0%)
- 5 (least deprived)	5 (6.7%)
Vaccination status on admission	
- One dose	1 (1.3%)
- Two or more doses	1 (1.3%)
- Unvaccinated	73 (97.3%)
Admission diagnosis	
- COVID-19 confirmed chest infection/viral chest infection	57 (76%)
- Other	18 (24%)
Ethnicity	
- White	58 (79.5%)
- Black/Caribbean/African	4 (5.5%)
- Asian	8 (11.0%)
- Other	3 (4.1%)
- Missing	2 (2.7%)
Count of previous comorbidity*	
- 0	66 (88.0%)
- 1 or more	9 (12.0%)
Admission wave	
- Wave 1	2 (2.7%)
- Wave 2	22 (29.3%)
- Wave 3	51 (68.0%)
Critical care length of stay, days (median, IQR)	4 (1.5–9)
Total hospital length of stay, days (median, IQR)	10 (6–17)
Requirement for advanced respiratory support	33 (44.0%)
Requirement for non-invasive respiratory support	44 (58.7%)
Requirement for non-invasive and invasive respiratory support	19 (25.3%)
Duration of advanced respiratory support, days (median, IQR)	5 (2–10)
Requirement for cardiovascular support	24 (32.0%)
Duration of cardiovascular support, days (median, IQR)	2.5 (2.8–5)
Requirement for renal replacement therapy	1 (1.3%)
Hospital mortality	1 (1.3%)
Emergency hospital re-admission for non-obstetric causes (n=74)	
- within 30 days	7 (9.5%)
- within 60 days	8 (10.8)
- within 90 days	9 (12.2%)

* SICSAG-defined severe comorbidities were combined with Charlson-defined comorbidities in order to report the most prevalent comorbidities.

areas of socio-economic deprivation.¹ Lower levels of vaccination uptake have been associated with socio-economic position.⁸ More targeted public health campaigning across the socio-economic gradient is urgently required.

Following discharge, one in eight women in this cohort experienced an emergency re-admission in the 90 days following hospital discharge. Although this re-admission rate was lower than that of the wider critical care COVID-19 cohort in Scotland (16%) and other critical care cohorts, these non-maternity cohorts are older and have a higher prevalence of comorbidity.⁹ Previous research has demonstrated that those most at risk of re-admission following critical illness are likely to be those survivors with established frailty or complex comorbidity, a distinctly different group from this current cohort.⁹ This analysis was unable to delineate reasons for re-admission, so future research should seek to understand the causes of re-admission in this cohort.

In parallel with understanding the medical management of this cohort, it is also essential that psychological sequelae are addressed.

It is well known that patients can have psychological problems such as anxiety and post-traumatic stress symptomology following a critical illness and following a pregnancy complicated by severe morbidity.^{10,11} Well-established psychological interventions in pregnancy or the postpartum period may not have been available for this cohort due to the nature of their illness, which may worsen these psychological issues further. Clinicians should ensure that patients have access to rehabilitation services across the recovery trajectory.

The strengths of our study include the complete, nationwide capture of critically ill pregnant or recently pregnant women with COVID-19, and the ability to report hospital re-admission. Limitations include being unable to report more person-centred outcomes, such as psychological sequelae, and neonatal outcomes. Moreover, we do not have data on why women were re-admitted to hospital or which women gave birth during their critical care admission. Finally, this cohort lacks a comparator cohort, and as such we are unable to determine if the problems described were unique to the pregnant or recently pregnant cohort.

This national cohort study has demonstrated that pregnant or recently pregnant women admitted to critical care with COVID-19 were more likely to reside in areas of socio-economic deprivation and that <5% of the cohort had received any form of vaccination. More targeted public health campaigning across the socio-economic gradient is urgently required.

Declaration of interests

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