Females in Hospital with SARS-CoV-2 infection, the association with pregnancy and pregnancy outcomes: A UKOSS/ISARIC/CO-CIN investigation

Marian Knight[1], Rema Ramakrishnan[1], Kathryn Bunch[1], Nicola Vousden[1], Jennifer J Kurinczuk[1], Sarah Dunn[2], Lisa Norman[2], Aisling Barry[2], Ewen Harrison[2], Annemarie Docherty[2], Calum Semple[3]

1. University of Oxford, 2. University of Edinburgh, 3. University of Liverpool.

Executive summary:

- The apparent excess of hospitalisations in women of reproductive age with covid-19 compared to men is likely to be largely due to admission screening of women admitted for labour and birth and other pregnancy-related complications.
- Of symptomatic pregnant women hospitalised with covid-19, 10% received critical care and 1% died. 18% had a preterm birth, about 2.5 times the background rate.
- Symptomatic pregnant women received treatments for covid-19 late or not at all. Recruitment to therapeutic clinical trials remains low.
- Pregnant women hospitalised in areas/periods since the B117 variant became predominant were more likely to require respiratory support.
- Indirect effects are also evident, with maternal deaths due to women delaying attendance at hospital or concealing pregnancy.
- We have no evidence on the long-term effects of covid-19 in pregnancy for either women or their children.
- It would be useful to have systematic evidence on vaccination and pregnancy collected and analysed and when it exists from clinical trials for this to be presented at the earliest opportunity.

Policy points:

- Any assessment of priority groups for vaccination/vaccine research needs to take into account the lifelong developmental, educational, economic and societal impact of pre-term births to pregnant women with covid and not just solely women's mortality.
- Future pandemic planning must include mechanisms for early inclusion of pregnant women in both treatment and vaccine trials, ideally through regulatory requirements.
- Further study of long-term outcomes of hospitalisation with covid-19 in pregnancy for both women and offspring would be facilitated by support and resources for collection of NHS numbers of included women and their infants to allow linkage to health and educational datasets.
- This paper may be shared with JCVI to inform their decision-making and future priorities.

Introduction

Approximately one million women in the UK are pregnant each year, of whom 700,000 give birth, 96% in hospital settings. Thus around 14,000 women are admitted to NHS hospitals each week to give birth. Around 50,000 women annually have a hospital stay as a result of a miscarriage or ectopic pregnancy, approximately 1000 per week. An additional 250,000 women have pregnancy terminations, around 5000 per week.

Pregnant women are known to be at increased risk of severe outcomes of other respiratory infections, such as influenza, as was observed in the 2009 A/H1N1 pandemic. Reports from the US have suggested that pregnant women are at higher risk of intensive care admission than non-pregnant women of reproductive age and ISARIC data suggest women aged 20-39 with SARS-CoV-2 infection are over-represented in the hospital cohort.

The objectives of this study were to investigate:

1. The contribution of pregnancy to this over-representation of women aged 20-39.
2. The characteristics and respiratory support requirements of women admitted to hospital with SARS-CoV-2 infection in pregnancy.
3. The management and outcomes of infection for pregnant women and their babies.
4. Any changes in patterns over time.

Methods

Three sources of data were used for this analysis:

1. ISARIC4C / CO-CIN.

The ISARIC Coronavirus Clinical Characterisation Consortium (ISARIC4C) is a UKRI and NIHR funded collaboration of named investigators from universities and public health agencies. It collates routine clinical data (and in select cases samples for research and development) from a network of over 300 NHS hospitals across the UK known as the Covid-19 Clinical Information Network. CO-CIN includes all hospitals in England Wales and Scotland and a few in Northern Ireland. Cases are enrolled with proven SARS-CoV-2 infection or high suspicion of COVID-19. Clinical data is collated from usual health care records to a generic case report form prepared in readiness for use in outbreaks of infection of public health interest.

2. The UK Obstetric Surveillance System (UKOSS)

The UK Obstetric Surveillance System (UKOSS) is a research platform in operation in all consultant-led obstetric units in the UK (n=194) to enable national observational studies of pregnancy complications. For the purposes of this NIHR funded covid-19 study, nominated reporting clinicians (midwives, obstetricians and anaesthetists) notify cases through a live reporting link and subsequently complete an electronic data collection form with details of women's characteristics, management and outcomes. Confirmation of the number of women admitted meeting the case definition is requested on a monthly basis, including zero reports.

Cases were defined as any pregnant woman admitted with confirmed maternal SARS-CoV-2 infection defined as detection of viral RNA on polymerase chain reaction (PCR) testing of blood or a nasopharyngeal swab, respiratory compromise in the presence of characteristic radiographic changes of covid-19, or both.

Characteristics, management and outcomes were described for women admitted between 01/03/2020 and 28/02/2021 using frequencies and percentages. Respiratory outcomes were compared between Mar 2020-Nov 2020 and Dec 2020-Feb 2021 to investigate the impact of the B117 variant using multivariable logistic regression and results presented as odds ratios with 95% confidence intervals.

3. The MBRRACE-UK Confidential Enquiry into Maternal Deaths

The MBRRACE-UK Confidential Enquiry into Maternal Deaths conducts surveillance of all deaths of women during pregnancy and up to a year after the end of pregnancy, regardless of how the pregnancy ends. Maternal deaths are notified through a variety of sources including hospitals, pathologists, coroners and procurators fiscal and cross-checked with birth and death registration data. After notification women's medical records are anonymised and assessed by multidisciplinary clinical assessors to identify causes of death and messages to improve care. For the purposes of this analysis, deaths occurring between 01/03/2020 and 28/02/2021 were examined.

Results

At all stages of the pandemic the number of female versus male patients admitted was approximately equal amongst those aged 0-19, aged 20-39 more females than males were admitted, and at all ages 40 and over, a greater number of males than females were admitted (Figure 1). The higher prevalence of young females versus males admitted to hospital can largely but not entirely be explained by the relatively large number of admissions of pregnant females (Figure 2) [ISARIC4C / CO-CIN].

Pregnant females have a shorter length of stay in hospital than those who are not pregnant, even when excluding asymptomatic pregnant women. This suggests that there is a lower threshold for admission of pregnant women regardless of symptom status, and that pregnant women are typically discharged after a short period of inpatient observation (Figure 3) [ISARIC4C / CO-CIN].

Pregnant females are admitted with lower 4C mortality scores than non-pregnant females, indicating a lower severity of illness at time of admission even when excluding asymptomatic females (Figure 4). This is consistent with there being a lower threshold for admission to hospital of pregnant women. [ISARIC4C / CO-CIN]

- 606 of the 3448 non-pregnant females aged 20-39, (18%), were admitted to hospital with no COVID-19 symptoms
- 455 of the 1134 pregnant females aged 20-39, (40%), were admitted to hospital with no COVID-19 symptoms

In general pregnant females count for a low percentage (1.62%) of overall admissions and require less intensive treatment (Table 1), but this is in part reflects the lower threshold for admission [ISARIC4C / CO-CIN]. When compared with males and non-pregnant females in the 20-39 year age bracket:

- Pregnant females were less likely to require oxygen, non-invasive (BIPAP, CPAP) or invasive (intubation) ventilation.
- Pregnant females were less likely to be admitted to ICU

- Pregnant females were more likely to be discharged alive, rather than die or be admitted to on-going care

In absolute terms pregnant women admitted to hospital with symptomatic COVID-19 were not at greater risk of adverse outcome[1], but this is in part because of the lower threshold for admission. The odds ratio plot of the likelihood of arriving at an adverse outcome following admission to hospital with COVID-19 for symptomatic females aged 20-39 years is shown in figure 5. In women age 20-39 years, obesity was strongly associated with adverse outcome (OR 2.22 95%Ci 1.81 to 2.71, p<0.001) [ISARIC4C/ CO-CIN].

Between 01/03/2020 and 28/02/2021, 5479 pregnant women with confirmed SARS-CoV-2 infection were admitted across the UK, 48% were symptomatic and 52% asymptomatic (Figure 6). The numbers of pregnant women and proportions of those admitted who were symptomatic has varied over time (Figure 7). The peak number of pregnant women admitted with a positive test for SARS-CoV-2 was more than two times higher in the second wave. The proportion admitted who were symptomatic increased over time after national guidance recommending universal screening was introduced on 27th May 2020 (72% Mar-May 2020 before universal screening, 35% Jun-Aug 2020, 40% Sep-Nov 2020, 46% Dec 2020-Feb 2021, p<0.001 for trend over time June 2020-Feb 2021) [UKOSS].

The majority of women admitted were in their third trimester of pregnancy (Figure 8). The median gestational age at admission (IQR) for symptomatic pregnant women was 35 completed weeks (29-38) and for asymptomatic pregnant women 39 completed weeks (37-40). Older women, those of Black, Asian or other minority ethnic group, women with obesity and co-morbidities including hypertension, diabetes and asthma were over-represented amongst those admitted (Table 2) (Figure 9). Only 42% of symptomatic women were admitted for the primary indication of covid-symptoms (824/1960 symptomatic women admitted June 2020-Feb 2021 (data not collected prior to June)); 31% (601/1960) were admitted to give birth and the remainder for a variety of pregnancy-related reasons or other non-specific symptoms which may have been covid-related. Eighteen percent of symptomatic pregnant women required respiratory support, 10% received critical care (mostly, but not exclusively in intensive care units) (Table 3). [UKOSS]

Covid-specific medical therapies were used infrequently, even for women who were critically ill (Table 4a). Steroids for maternal indication were only administered in around 7% of symptomatic pregnant women admitted to hospital, and 18% of those who received critical care. Three percent of symptomatic pregnant women admitted to hospital were recruited to the RECOVERY trial. After release of results on dexamethasone from the RECOVERY trial, rates of usage of steroids for maternal indications remained low (Table 4b), 9.3% of women overall, 22.6% of those receiving critical care. [UKOSS]

Overall 16 women in the cohort died, one of whom was asymptomatic, case fatality among symptomatic women 0.6% (95% confidence interval 0.3%-0.6%). Eighty-four percent of women (4,577/5,479) had completed their pregnancy by the time of this analysis (Table 5).

[1] Adverse Outcome defined as any of death or need of invasive mechanical ventilation or admission to a critical care area.

Twenty-one percent of symptomatic women who have given birth gave birth preterm compared to 10% of asymptomatic women. Restricting the analysis to symptomatic women admitted Mar-Nov 2020, 90% of whom have completed their pregnancy, 18% of symptomatic women who have given birth gave birth preterm (Table 6). 20.9% of infants were admitted to a neonatal unit; very few neonates had confirmed postnatal infection. [UKOSS]

Symptomatic women admitted during the period when the B117 variant became predominant were significantly more likely to require respiratory support (Table 7 and Figure 10). [UKOSS]

No data are available for long-term outcomes for either women or their children.

Data from MBRRACE-UK suggest that maternal mortality rates have increased during the pandemic, but not solely due to covid-19. Deaths of 24 women with SARS-CoV-2 infection have been notified to the MBRRACE-UK Confidential Enquiry into Maternal Deaths over the past year, 19 occurred during pregnancy or up to six weeks postpartum, 5 between six weeks and a year postpartum (late maternal deaths). Nineteen women's deaths (16 early, 3 late) were due to COVID-related respiratory or thrombotic disease. ONS report 319 deaths of women aged 20-39 in England and Wales with Covid-19 mentioned on the death certificate over the same time period. Note that linked birth and death registration data are only available to MBRRACE-UK from August of the calendar year after which deaths took place, thus ascertainment has not yet been fully checked, however, on the basis of deaths already notified, the UK maternal mortality rate for March 2020-February 2021 is likely to be at least 20% higher than in previous recent years (12 per 100,000 maternities compared to 10 per 100,000). [MBRRACE-UK]

The Confidential Enquiry is required to escalate concerns over care in specific instances where these concerns have not been identified locally, or where system factors are associated with the death. More cases have been escalated in the past year compared to the total escalated in the previous ten years. These escalations include three deaths at home in women in late pregnancy who had not booked for antenatal care. At least two of these women's deaths were indirectly related to the pandemic. [MBRRACE-UK]

Delays in units notifying stillbirths and neonatal deaths and time lags in receipt of data from ONS to allow for cross-checking are such that we cannot yet make any confident interpretation of stillbirth and neonatal mortality rates for 2020. [MBRRACE-UK]

Figure 1: Female likelihood of admission compared to male over time [ISARIC4C / CO-CIN]

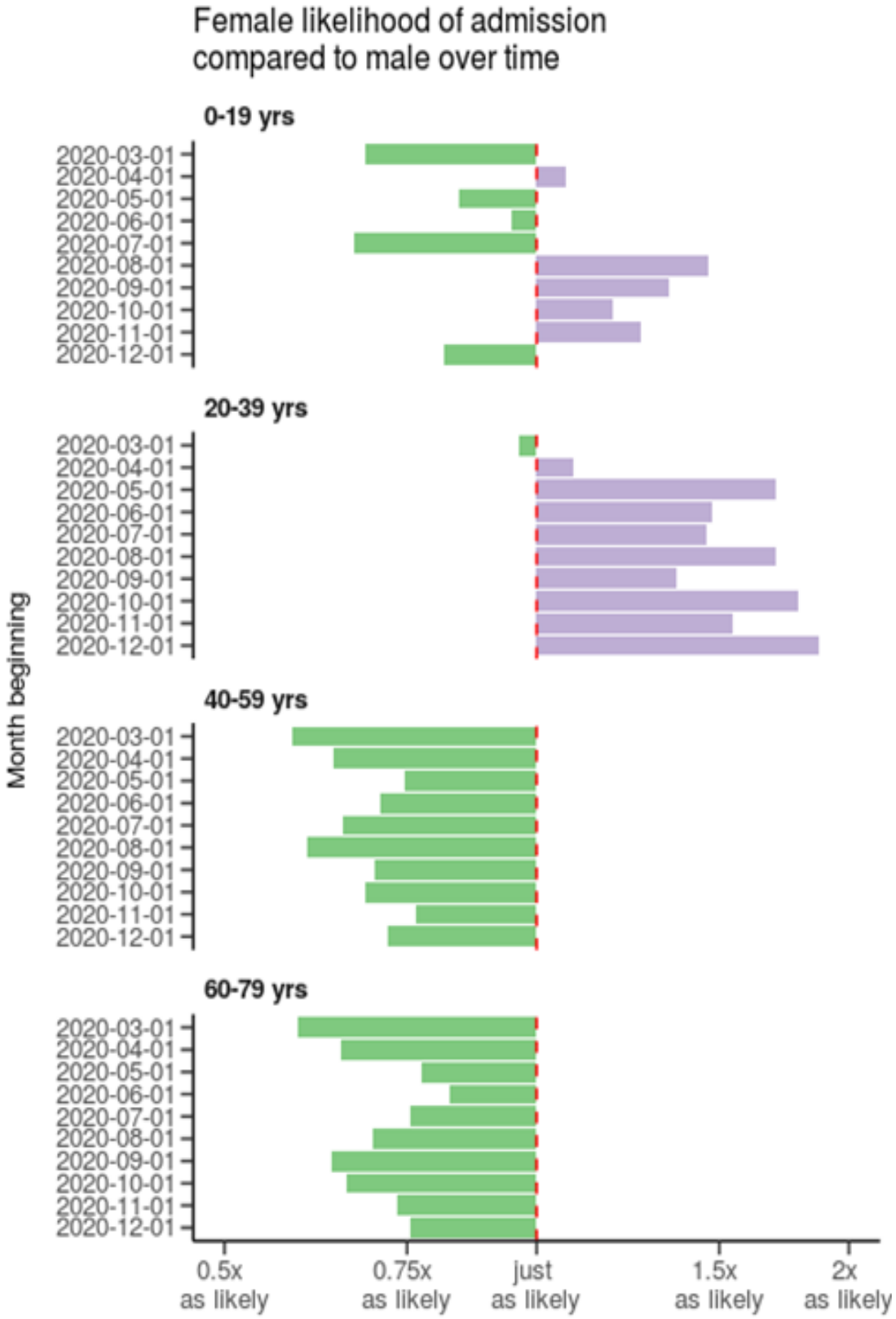


Figure 2: Comparison of male and female covid-19 admissions and pregnancy status [ISARIC4C / CO-CIN]

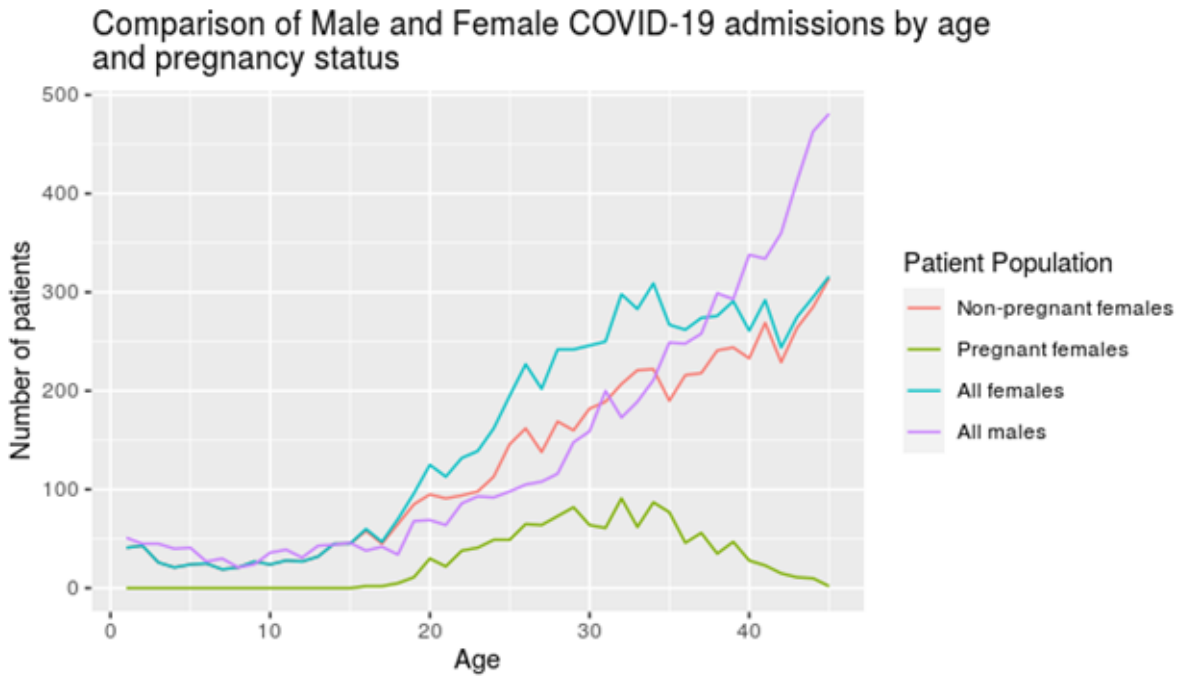
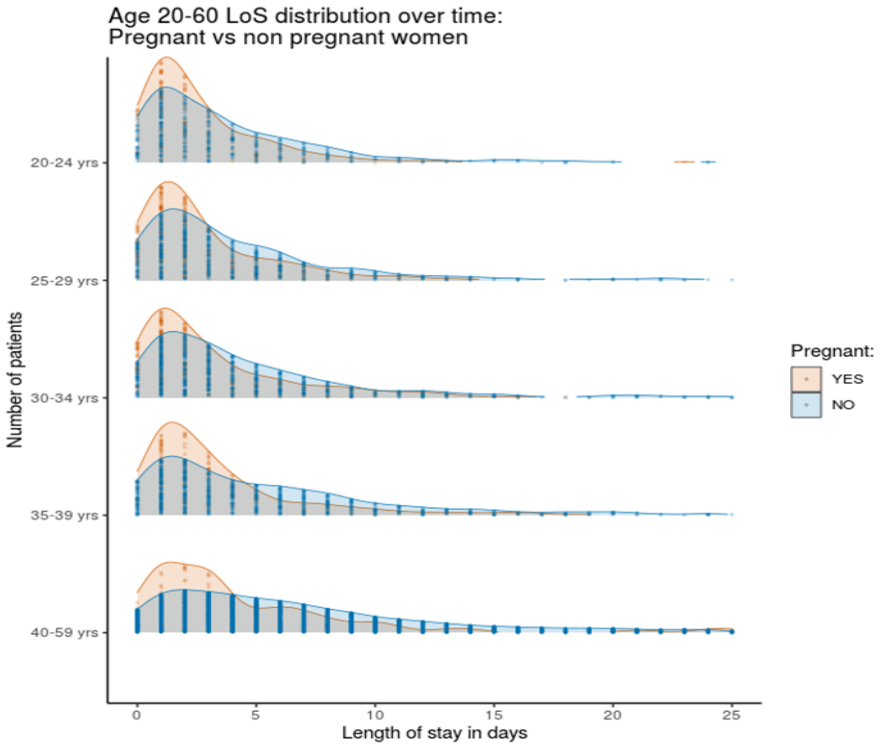


Figure 3: Length of stay amongst pregnant versus non-pregnant women aged 20-60 [ISARIC4C / CO-CIN]

a) All pregnant women



b) Symptomatic pregnant women

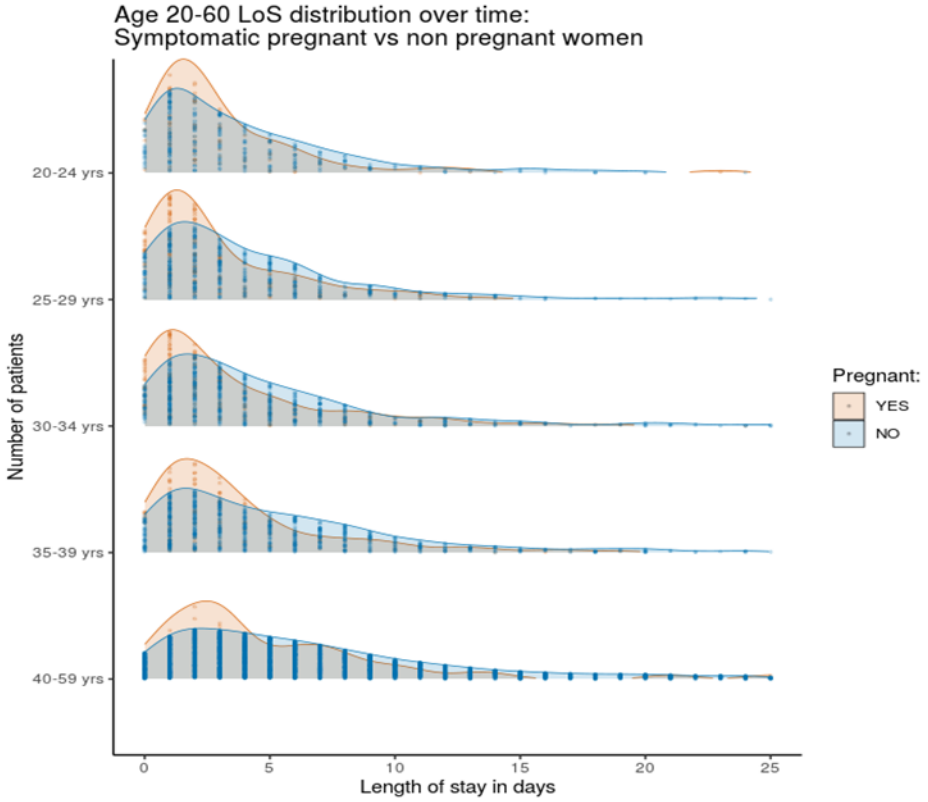
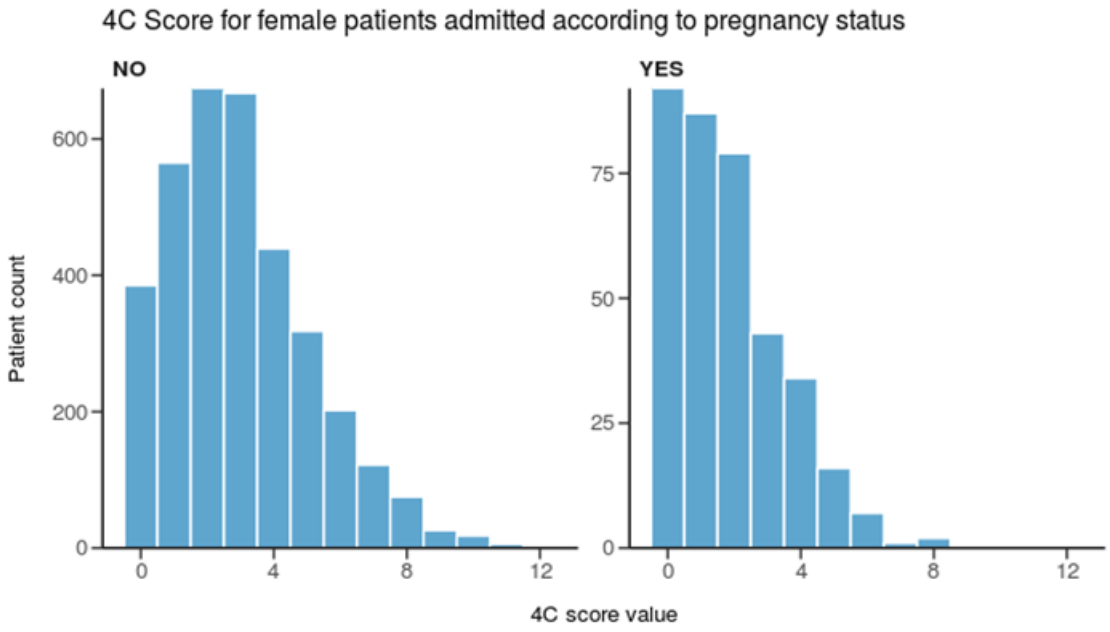


Figure 4: 4C score for female patients admitted according to pregnancy status [ISARIC4C / CO-CIN]

a) All female patients



b) Symptomatic female patients

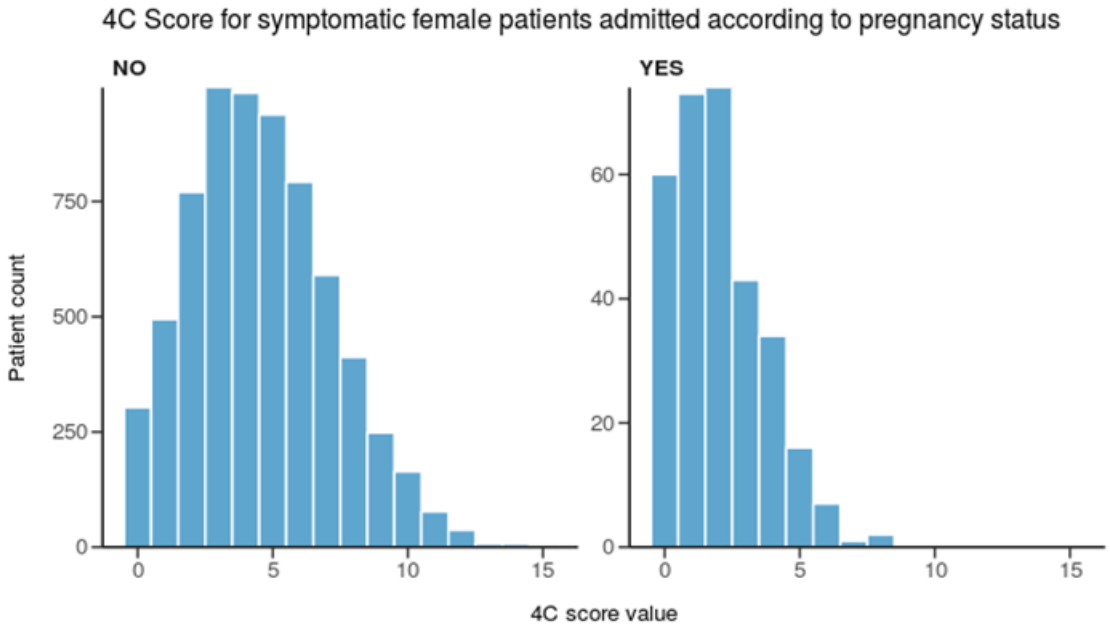


Figure 5: Odds Ratio plot of the likelihood of arriving at an adverse outcome following admission to hospital with COVID-19 for symptomatic females aged 20-39 years [ISARIC4C/ CO-CIN]

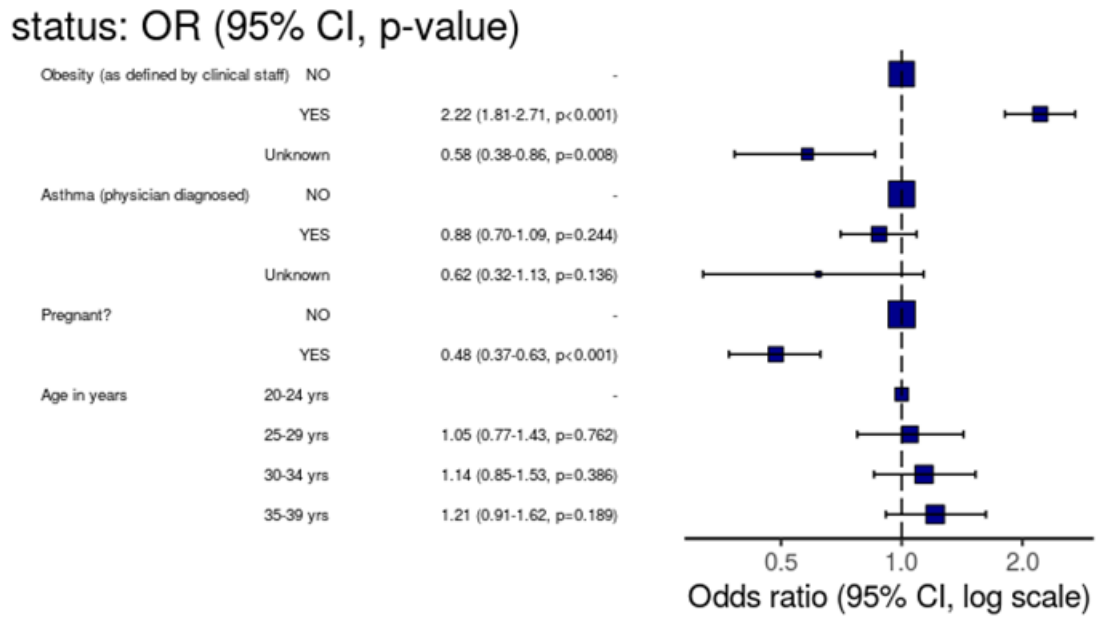


Figure 6: Women notified to UKOSS March 2020-February 2021

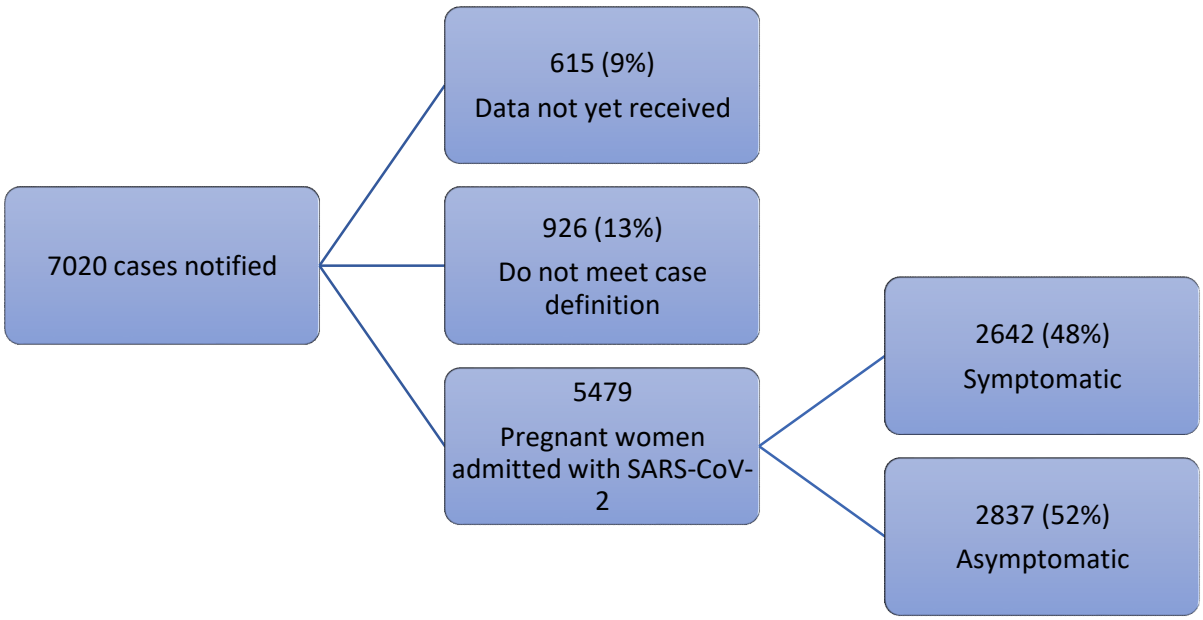
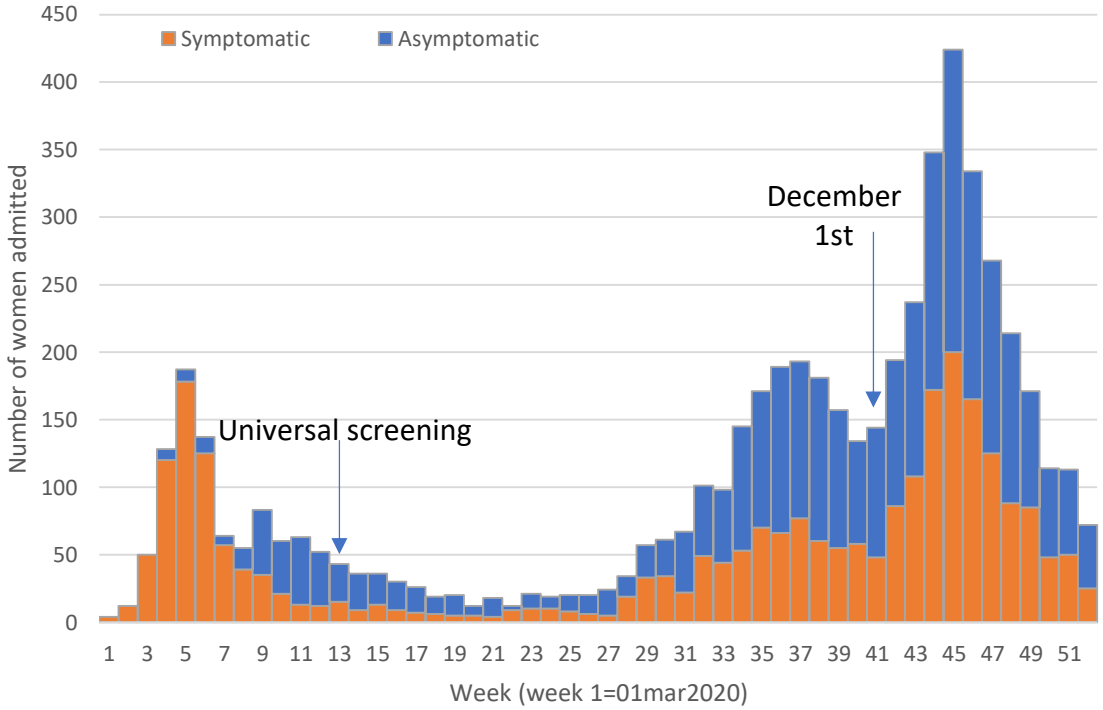


Figure 7: Admissions of pregnant women with confirmed SARS-CoV-2 to UK hospitals and symptomatology (n=5490) [UKOSS]

a) Number of women admitted



b) Proportion of admissions according to symptomatology

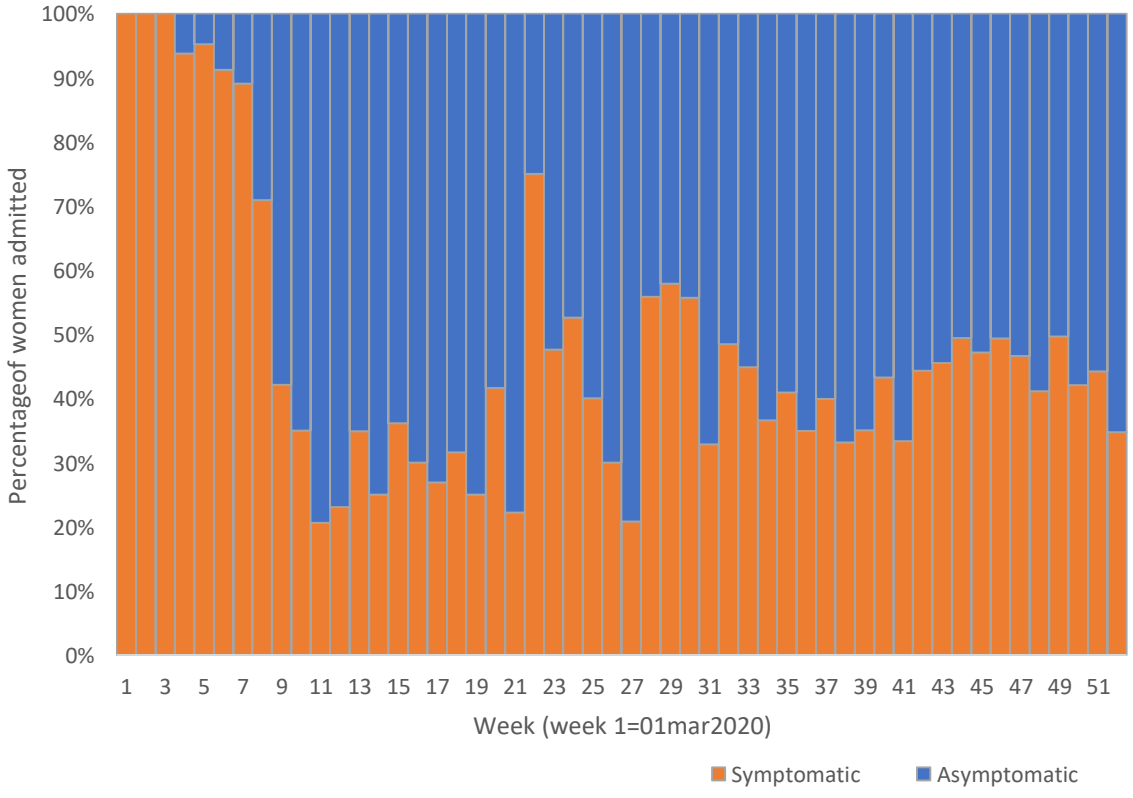


Figure 8: Gestational age at admission [UKOSS]

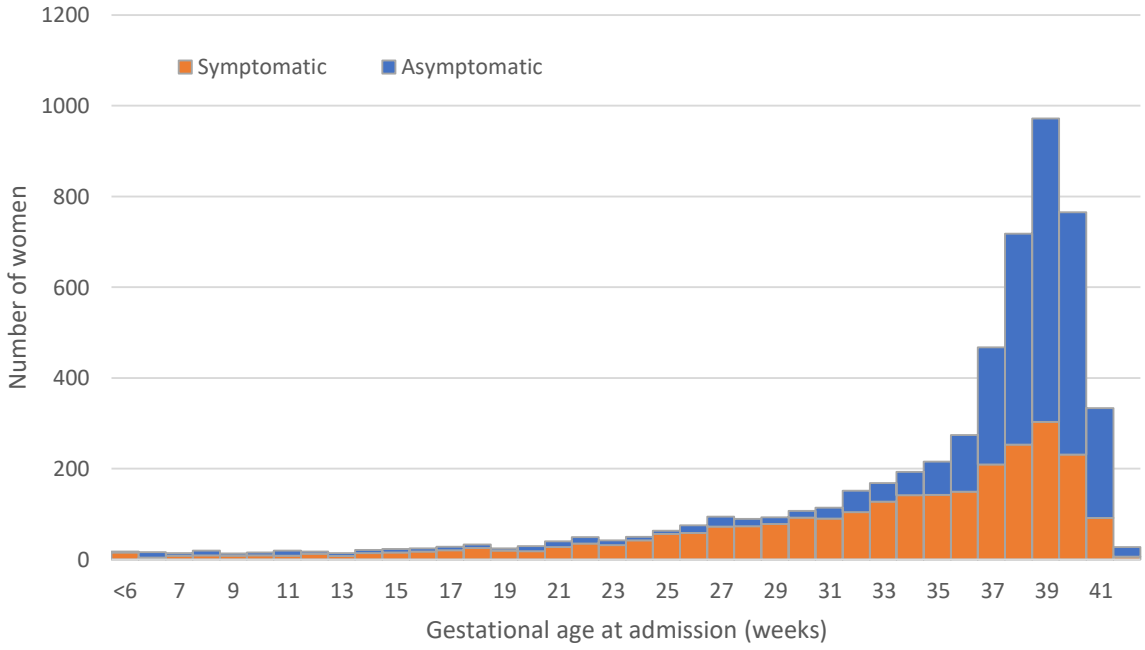


Figure 9: Estimated incidence of admission with SARS-CoV-2 infection in pregnancy among different population subgroups [UKOSS]

Characteristic	Estimated No of maternities	No of pregnant women admitted with SARS-CoV-2	Incidence per 1000 maternities (95% CI)
Age, years			
<20	19758	96	4.86 (3.98, 5.93)
20-34	518596	3890	7.50 (7.27, 7.74)
≥35	166198	1484	8.93 (8.49, 9.39)
Body mass index			
Normal (<25)	338843	1998	5.90 (5.64, 6.16)
Overweight (25 to <30)	206017	1559	7.57 (7.20, 7.95)
Obese (≥30)	159723	1626	10.18 (9.70, 10.68)
Ethnic group (England only)			
White	558241	3084	5.52 (5.33, 5.72)
Asian	73547	1328	18.06 (17.12, 19.04)
Black	30436	573	18.83 (17.36, 20.42)
Other	42359	346	8.17 (7.35, 9.07)

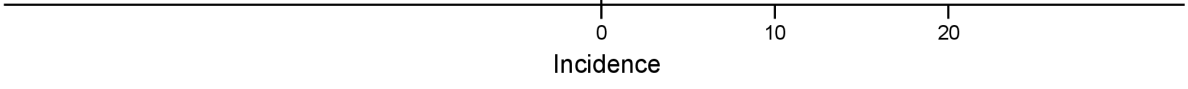
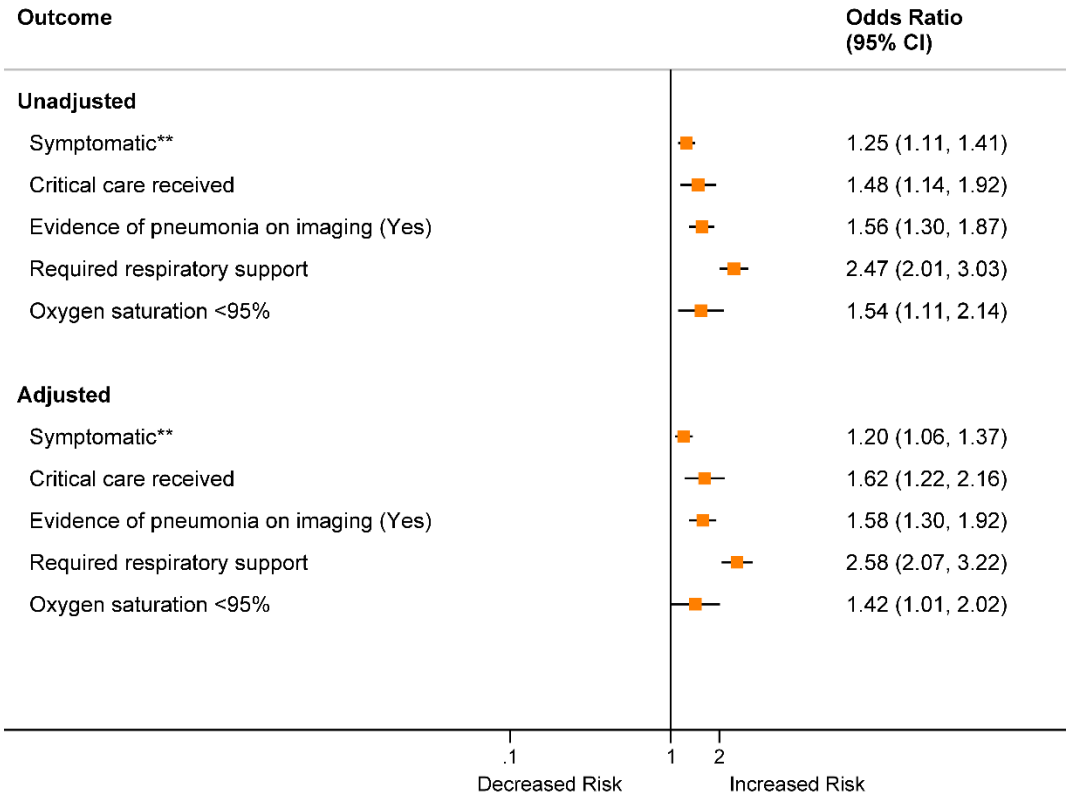


Figure 10: Selected respiratory characteristics and outcomes in symptomatic pregnant women admitted to hospital with confirmed SARS-CoV-2 Dec 2020-Feb 2021 compared to Mar-Nov 2020 [UKOSS]



Note: **Odds ratios for symptomatic versus asymptomatic calculated for June 2020-February 2021 when screening was in place
Adjusted for age, ethnicity, BMI, and selected pre-existing conditions (asthma, hypertension, cardiac disease, and diabetes)

Table 1a: Intervention required by all male and female patients aged 20-39 admitted to hospital with COVID-19 according to pregnancy status (men + non-pregnant women vs pregnant women) [ISARIC4C / CO-CIN]

label	Total not missing (%)	levels	Men + Nonpregnant	Pregnant	Total
Total N (%)			6810 (85.7)	1134 (14.3)	7944
any_oxygen	7528 (94.8)	No	2918 (45.2)	815 (76.3)	3733 (49.6)
		Yes	3542 (54.8)	253 (23.7)	3795 (50.4)
any_noninvasive	7492 (94.3)	No	5649 (87.9)	1029 (96.4)	6678 (89.1)
		Yes	776 (12.1)	38 (3.6)	814 (10.9)
any_invasive	7502 (94.4)	No	5925 (92.1)	1045 (97.7)	6970 (92.9)
		Yes	507 (7.9)	25 (2.3)	532 (7.1)
any_icu	7631 (96.1)	No	5188 (79.3)	1007 (92.6)	6195 (81.2)
		Yes	1355 (20.7)	81 (7.4)	1436 (18.8)
status	7628 (96.0)	Died	186 (2.9)	5 (0.5)	191 (2.5)
		On-going care	667 (10.2)	46 (4.2)	713 (9.3)
		Discharged alive	5672 (86.9)	1052 (95.4)	6724 (88.1)

Table 1b: Intervention required by all symptomatic male and female patients aged 20-39 admitted to hospital with COVID-19 according to pregnancy status (men + non-pregnant women vs pregnant women) [ISARIC4C / CO-CIN]

label	Total not missing (%)	levels	Men + Nonpregnant	Pregnant	Total
Total N (%)			5828 (89.6)	679 (10.4)	6507
any_oxygen	6156 (94.6)	No	2160 (39.1)	412 (65.6)	2572 (41.8)
		Yes	3368 (60.9)	216 (34.4)	3584 (58.2)
any_noninvasive	6120 (94.1)	No	4730 (86.1)	590 (94.1)	5320 (86.9)
		Yes	763 (13.9)	37 (5.9)	800 (13.1)
any_invasive	6129 (94.2)	No	5015 (91.2)	607 (96.3)	5622 (91.7)
		Yes	484 (8.8)	23 (3.7)	507 (8.3)
any_icu	6229 (95.7)	No	4277 (76.5)	567 (88.6)	4844 (77.8)
		Yes	1312 (23.5)	73 (11.4)	1385 (22.2)
status	6267 (96.3)	Died	175 (3.1)	5 (0.8)	180 (2.9)
		On-going care	552 (9.8)	38 (5.8)	590 (9.4)
		Discharged alive	4881 (87.0)	616 (93.5)	5497 (87.7)

Table 2. Characteristics of pregnant women admitted to hospital with confirmed SARS-CoV-2 during Mar 2020-Nov 2020 and Dec 2020-Feb 2021 [UKOSS]

	Admitted Mar-Nov 2020 (n=2,828)		Admitted Dec 2020-Feb 2021 (n=2,651)	
	Symptomatic (n=1,437)	Asymptomatic (n=1,391)	Symptomatic (n=1,205)	Asymptomatic (n=1,446)
Age, years				
<20	19 (1.3)	39 (2.8)	11 (0.9)	27 (1.9)
20-34	993 (69.2)	1,020 (73.4)	844(70.1)	1,033 (71.6)
≥35	423 (29.5)	330 (23.8)	349 (29.0)	382 (26.5)
Missing/unknown	2	2	1	4
Ethnic group				
White	712 (50.5)	834 (61.6)	675 (57.9)	863 (61.5)
Asian	415 (29.4)	334 (24.7)	265 (22.8)	314 (22.4)
Black	180 (12.8)	116 (8.6)	137 (11.8)	140 (10.0)
Other	103 (7.3)	69 (5.1)	88 (7.6)	86 (6.1)
Missing/unknown	27	38	40	43
Employed (Yes)	987 (68.7)	893 (64.2)	664 (55.1)	783 (54.2)
Body mass index				
Underweight (<18.5)	24 (1.8)	31 (2.3)	16 (1.4)	28 (2.1)
Normal (18.5 to <25)	447 (32.5)	535 (40.1)	373 (33.5)	544 (40.0)
Overweight (25 to <30)	441 (32.1)	403 (30.2)	312 (28.0)	403 (29.7)
Obese (≥30)	463 (33.7)	366 (27.4)	413 (37.1)	384 (28.3)
Missing/unknown	62	56	91	87
Multiparous	868 (60.9)	775 (56.5)	771 (65.4)	846 (59.3)
Missing data	12	20	26	19
Multiple pregnancy	36 (2.5)	12 (0.9)	25 (2.1)	33 (2.3)
Pre-existing medical conditions[a]				
Asthma	96 (6.7)	86 (6.2)	123 (10.2)	85 (5.9)
Hypertension	38 (2.6)	11 (0.8)	25 (2.1)	22 (1.5)
Cardiac disease	22 (1.5)	19 (1.4)	17 (1.4)	14 (1.0)
Diabetes	41 (2.9)	20 (1.4)	23 (1.9)	28 (1.9)
Gestational diabetes (Yes)	145 (10.1)	134 (9.6)	113 (9.4)	114 (7.9)
Preeclampsia (Yes)	30 (2.1)	25 (1.8)	22 (1.8)	26 (1.8)
Gestation at admission, weeks:				
<22	122 (8.5)	67 (4.9)	113 (9.5)	64 (4.5)
22 - 27	151 (10.6)	37 (2.7)	143 (12.0)	42 (2.9)
28 - 31	185 (13.0)	35 (2.5)	148 (12.4)	35 (2.5)
32 - 36	343 (24.0)	158 (11.4)	320 (26.9)	180 (12.6)
≥37	627 (43.9)	1,084 (78.5)	466 (39.2)	1,107 (77.5)
Missing	9	10	15	18

Note: [a] 616 women had any/all of the four conditions.

Table 3: Respiratory characteristics and support needs of symptomatic pregnant women admitted to hospital with confirmed SARS-CoV-2 [UKOSS]

	Symptomatic (n=2,642) N (%)
Oxygen saturation measured on admission (Yes)	2,392 (90.5)
Median (IQR) oxygen saturation %	97 (96-99)
Oxygen saturation <95%	190 (13.5)
Oxygen saturation ≥95%	1,223 (86.5)
Missing	979
Evidence of pneumonia on imaging (Yes)	612 (23.2)
Required respiratory support (Yes)	475 (18.0)
Non-invasive oxygen (nasal canulae, mask or non-rebreathe mask)	339 (12.8)
CPAP	44 (1.7)
Invasive ventilation or ECMO	71 (2.7)
Required support but level not known	21 (0.8)
Critical care received (Yes)	250 (9.5)

Table 4a: Covid-specific medical therapies used for symptomatic pregnant women admitted a) Mar 2020-Feb 2021 and b) June 2020-Feb 2021 [UKOSS]

a)

	Symptomatic (n=2642) N (%)	Symptomatic and received critical care (n=250) N (%)
Antivirals Total	63 (2.4%)	27 (10.8%)
Oseltamivir	12 (0.5%)	3 (1.2%)
Remdesivir	51 (1.9%)	24 (9.6%)
Tocilizumab	9 (0.3%)	7 (2.8%)
Steroids for maternal indication	192 (7.3%)	46 (18.4%)
Hydroxychloroquine	2 (0.1%)	1 (0.4%)
Azithromycin	15 (0.6%)	3 (1.2%)
Recruited to RECOVERY	76 (2.9%)	25 (10%)
Steroids for fetal lung maturation	462 (17.5%)	143139 (55.6%)

b)

	Symptomatic (n=1960) N (%)	Symptomatic and received critical care (n=190) N (%)
Antivirals Total	50 (2.6%)	22 (11.6%)
Oseltamivir	2 (0.1%)	0 (0%)
Remdesivir	48 (2.4%)	22 (11.6%)
Tocilizumab	9 (0.5%)	7 (3.7%)
Steroids for maternal indication	182 (9.3%)	43 (22.6%)
Hydroxychloroquine	2 (0.1%)	0 (0%)
Azithromycin	8 (0.4%)	2 (1.1%)
Recruited to RECOVERY	74 (3.8%)	23 (12.1%)
Steroids for fetal lung maturation	354 (18.1%)	99 (52.1%)

Table 5: Pregnancy and infant outcomes according to women's symptom status [UKOSS}

Pregnancy outcomes	Symptomatic women (n=2,642) N (%)	Asymptomatic women (n=2,837) N (%)
Birth	1926 (72.4)	2531 (91.4)
Ongoing pregnancy	663 (25.1)	239 (8.4)
Pregnancy loss	53 (2.1)	67 (2.4)
Gestation at end of pregnancy (weeks)		
<22	43 (2.2)	46 (1.8)
22-27	28 (1.4)	26 (1.0)
28-31	77 (3.9)	25 (1.0)
32-36	314 (16.0)	211 (8.2)
37 or more	1501 (76.5)	2262 (88.0)
Missing	16	28
Median (IQR)	38 (37-40)	39 (38-40)
Mode of birth		
Caesarean – maternal indication due to SARS-CoV2 infection	137 (7.1)	2 (0.1)
Caesarean – other indication	821 (42.7)	940 (37.2)
Operative vaginal	202 (10.5)	311 (12.3)
Unassisted vaginal	761 (39.6)	1,276 (50.4)
Missing	58	69

Infant outcomes	Infants of symptomatic mothers (n=1963) N (%)	Infants of asymptomatic mothers (n=2566) N (%)
Stillbirth	24 (1.2)	20 (0.8)
Live birth[a]	1939 (98.8)	2546 (99.2)
Neonatal death	4 (0.5)	5 (0.2)
NICU Admission	405 (20.9)	239 (9.4)
SARS-CoV2 status (Liveborn infants only)		
Negative test or not tested and no evidence of infection	1762 (98.0)	2380 (99.0)
Positive test <12 hrs of age	15 (0.8)	8 (0.3)
Positive test ≥12 hrs of age	21 (1.2)	16 (0.7)
Missing	141	142

[a]Two infants' status at birth unknown

Table 6: Outcomes among symptomatic women admitted Mar-Nov 2020 and Dec 2020-Feb 2021 [UKOSS]

Pregnancy outcomes	Admitted Mar-Nov 2020 (n=1,437) N (%)	Admitted Dec 2020-Feb 2021 (n=1,205) N (%)
Birth	1260 (87.5)	666 (55.2)
Ongoing pregnancy	148 (10.3)	515 (42.7)
Pregnancy loss	29 (2.0)	24 (2.0)
Gestation at end of pregnancy (weeks)		
<22	25 (1.9)	18 (2.6)
22-27	13 (1.0)	15 (2.2)
28-31	41 (3.2)	36 (5.3)
32-36	183 (14.3)	131 (19.2)
37 or more	1,018 (79.5)	483 (70.7)
Missing	9	7
Median (IQR)	39 (37-40)	39 (37-40)
Mode of birth		
Caesarean – maternal indication due to SARS-CoV2 infection	85 (6.8)	52 (7.9)
Caesarean – other indication	516 (41.1)	305 (45.9)
Operative vaginal	133 (10.6)	69 (10.4)
Unassisted vaginal	522 (41.6)	239 (35.9)
Missing	4	1

Infant outcomes	Infants of women admitted Mar-Nov 2020 (n=1,286) N (%)	Infants of women admitted Dec 2020-Feb 2021 (n=677) N (%)
Stillbirth	14 (1.1)	10 (1.5)
Live birth[a]	1272 (98.9)	667 (98.5)
Neonatal death	1 (0.1)	4 (0.6)
NICU Admission	223 (17.5)	182 (27.3)
SARS-CoV2 status (Liveborn infants only)		
Negative test or not tested and no evidence of infection	1179 (97.8)	583 (98.3)
Positive test <12 hrs of age	11 (0.9)	4 (0.7)
Positive test ≥12 hrs of age	15 (1.2)	6 (1.0)
Missing	67	74

[a]Two infants' status at birth unknown

Table 7. Comparison of characteristics of symptomatic pregnant women admitted to hospital with confirmed SARS-CoV-2 [UKOSS]

	Admitted Mar-Nov 2020 (n=1,437) N (%)	Admitted Dec 2020-Feb 2021 (n=1,205) N (%)
Critical care received (Yes)	114 (7.9)	136 (11.3)
Evidence of pneumonia on imaging (Yes)	281 (19.6)	331 (27.5)
Required respiratory support (Yes)	172 (12.0)	303
Oxygen saturation measured on admission (Yes)	1,328 (92.4)	1,064 (88.3)
Median (IQR) oxygen saturation %	98 (96-99)	97 (96-98)
Oxygen saturation <95%	58 (10.5)	132 (15.3)
Oxygen saturation ≥95%	494 (89.5)	729 (84.7)
Missing	776	203