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Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Full length article

The impact of the Covid-19 pandemic on maternity services: A review of maternal and neonatal outcomes before, during and after the pandemic



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ARTICLE INFO

Article history:

Received 16 September 2020

Received in revised form 7 October 2020

Accepted 10 October 2020

Keywords:

Covid 19

Preterm birth

Perinatal death

Hypertension in pregnancy

ABSTRACT

Objective: To explore any apparent trends in maternal or neonatal outcomes during the Covid-19 pandemic by comparing the maternity outcomes before, during and after the pandemic.

Study design: A retrospective review was performed of maternity statistics recorded on the hospital database of a large tertiary referral centre in Dublin with over 8000 deliveries per annum from 1st January to 31st July 2020. This time period represented the months prior to, during the peak and following the pandemic in Ireland.

Results: There was no correlation between the monthly number of Covid deaths and the monthly number of perinatal deaths ($r = 0.465$, NS), preterm births ($r = 0.339$, NS) or hypertensive pregnancies ($r = 0.48$, NS).

Compared to the combined numbers for the same month in 2018 and 2019, there were no significant changes in perinatal deaths or preterm births in the months when Covid deaths were at their height. The rate of preterm birth was significantly less common in January–July 2020 compared to January–July in 2018/2019 (7.4 % v 8.6 %, chi-sq 4.53, $P = 0.03$).

Conclusion: There was no evidence of a negative impact of the Covid-19 pandemic on maternity services, as demonstrated by maternal and neonatal outcomes.

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Introduction

Covid-19 has been described as the pandemic of the century [1]. The Republic of Ireland (ROI) has been successful in its endeavour to 'flatten the curve' and reduce transmission of the virus through strict public health measures overseen by the National Public Health Emergency Team (NPHE). The first detected case of SARS CoV2 in the Republic of Ireland was reported on 29th February 2020. Schools, colleges and childcare facilities were closed on 12th March followed by a nationally enforced 'lockdown' on 27th March which saw government-mandated closure of all non-essential businesses, restricted non-essential journeys and advised isolation of vulnerable individuals. Ireland's strategy is synchronous with global strategies endorsed by the World Health Organisation and European Centre for Disease Control. During the containment phase, a policy of case identification, testing and contact tracing

was implemented. The country is now in the delay phase, with successful suppression of the virus in the community, although concern mounts for a possible 'second wave' [2,3]. Table 1 represents the incidence of and deaths with SARS-CoV2 in the Republic of Ireland from January to July 2020. There was widespread transmission and diagnosis of the virus, and virus-related deaths from March, peaking in April and declining sharply thereafter.

The initial response to the virus saw a radical overhaul of the Irish healthcare system in order to mitigate the impact of the pandemic on healthcare resources. Restrictions were placed on elective and outpatient services with a focus on maintaining emergent and essential clinical services [5]. As pregnancy is a time-limited condition, provision of maternity care is an essential service which continued to function throughout the pandemic, albeit with adjustment to care pathways [1,6,7]. Now in the delay phase, a retrospective analysis of the impact of the pandemic on maternity services is appropriate. It is possible that there are direct effects of the virus in pregnant women, but it is also plausible that there are subtle effects resulting from the change in service delivery, or possibly to due to maternal stress and anxiety arising during this period.

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Table 1

Cases of diagnosed SARS-CoV2 infection and deaths related to Covid-19 in the Republic of Ireland from January 1 to July 31, 2020 [4].

	January	February	March	April	May	June	July
Cases/month	0	1	3,235	17,377	4,378	483	591
Cumulative cases	0	1	3,235	20,612	24,990	25,473	26,064
Deaths/month	0	0	71	1,161	417	87	27
Cumulative deaths	0	0	71	1,232	1,649	1,736	1,763

The time is right to explore any apparent trends in maternal or neonatal outcomes during this time period by comparing the maternity outcomes before, during and after the pandemic.

Methods

This was a retrospective review of maternity outcomes over a 7-month period in the largest provider of women and infants healthcare in the Republic of Ireland. The Coombe Women & Infants University Hospital (CWIUH) is a large, stand-alone Obstetrics, Gynaecology and Neonatal tertiary referral centre serving a static catchment area with approximately 8000 deliveries per annum. All maternities are recorded on the hospital database that is used to generate a published annual report. Maternal and neonatal outcomes from 1st January to 31st July 2020 were reviewed. This time period encompasses the time from the pre-pandemic phase, through the peak incidence of Covid-19 cases in Ireland, to the period where national lockdown measures were eased following successful containment of the virus.

The monthly number of covid deaths was correlated with monthly birth statistics (Pearsons correlation co-efficient) to reveal any significant associations with the progress and resolution of the pandemic. In addition, the monthly perinatal mortality and preterm birth statistics from 2018 and 2019 were combined and then analysed against the statistics from 2020 using chi-squared analysis or Fishers exact test as appropriate.

The aim was to identify any statistically significant trends in maternal or neonatal outcomes during this period and examine the impact of the pandemic on healthcare delivery. Hospital senior management authorised the collection and analysis of data from the hospital database.

Results

Monthly maternity statistics for the Coombe Women & Infants University Hospital 2020 are shown in Table 2.

Fig. 1 demonstrates the perinatal death and preterm birth rate from January to July, contrasted with the number of Covid-19 related deaths in the ROI in the same time period.

Table 2

Monthly maternity statistics (January 1 to July 31, 2020) for Coombe Women & Infants University Hospital, Dublin.

	January	February	March	April	May	June	July	Pearson Correlation
Mothers (n)	687	549	585	581	598	637	672	–
Babies >500 g (n)	699	563	597	595	607	650	686	–
Preterm Births <37/40	53 (7.6 %)	30 (5.3 %)	47 (7.9 %)	55 (9.2 %)	40 (6.6 %)	48 (7.4 %)	52 (7.6 %)	0.339 p = NS
Preterm Births <26/40	4 (0.6 %)	0	1 (0.2 %)	1 (0.2 %)	2 (0.3 %)	1 (0.2 %)	0	–0.32 p = NS
Stillbirths	2	0	1	2	1	3	0	0.465
Early NND	2	2	0	2	1	0	0	p = NS
Late NND	2	0	0	0	2	0	0*	
PNMR (/1000)	5.7	3.6	1.7	6.7	3.3	4.6	0	

Early NND = neonatal death in the first 7 days of life.

Late NND = neonatal death between 7 and 28 days of life.

Stillbirths = babies stillborn weighing 500 g or more.

PNMR = perinatal mortality rate.

* Number incomplete at the time of analysis.

There was no correlation between the monthly number of Covid deaths and the monthly number of preterm deliveries <37 weeks ($r = 0.339$, $p = \text{NS}$), preterm deliveries <26 weeks ($r = -0.32$, $p = \text{NS}$) or with the monthly number of perinatal deaths ($r = 0.465$, $p = \text{NS}$).

The mode of delivery did not show any significant correlations but April (the month of highest Covid-related mortality) had the lowest normal delivery rate. The number of inductions of labour was negatively correlated with the number of Covid deaths ($r = -0.759$, $p < 0.05$) and the lowest labour induction rate was also seen in April. (Table 3 and Fig. 2).

The diagnosis of antenatal complications such as hypertensive diseases of pregnancy occurred at the same rate pre-pandemic as in the months during the pandemic (Table 3). No difference was seen in the rate of intrapartum or postpartum complications, and low birthweight infants were seen at the same frequency throughout the study period (Table 4).

There was no correlation in the rate of unbooked pregnancies, or infants born before arrival to hospital and the number of Covid deaths in the review period (Table 3). Disclosures of domestic violence at booking visit appear to be less during the peak pandemic period, although this was not found to be statistically significant.

Table 5 outlines the hospital statistics for the same months in 2018 and 2019. If the 2018 and 2019 numbers are combined and compared to the same month in 2020, there were significantly less preterm births in February 2020 and significantly less perinatal deaths in July 2020, however neither of these months were during the peak pandemic period. In comparison to the preceding two years, the rate of preterm delivery over the 7 month period in 2020 was significantly less (7.4 % v 8.6 %, $\text{chi-sq } 4.53$, 1df , $p = 0.03$).

In summary, there is no correlation between Covid deaths (representing the pandemic peak) and preterm births, perinatal mortality, mode of delivery or maternity complications across the months of January to July 2020. When 2020 monthly statistics are compared to 2018 and 2019 combined, there is an overall reduction in preterm births and more specifically, a difference observed in February 2020. There is a significant reduction in perinatal deaths in July 2020 compared to July 2018 and 2019 combined but no difference in the overall perinatal mortality rate during the pandemic period reviewed compared with previous years.

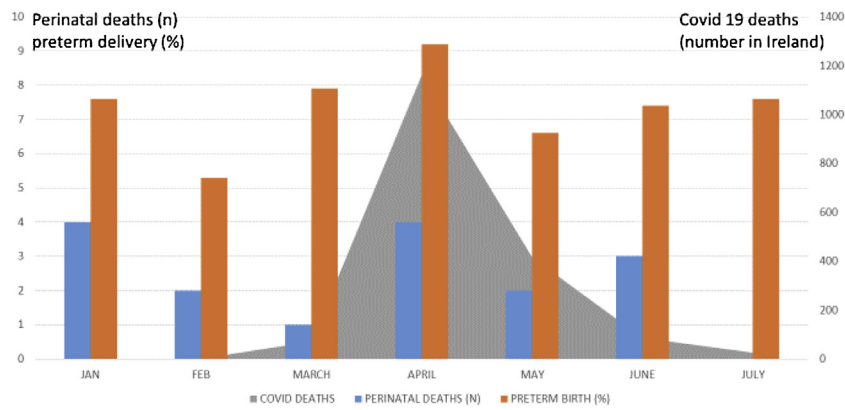


Fig. 1. Perinatal Deaths (n) and Preterm Delivery Rate (% of total births) in CWIUH versus Covid-19 related deaths in the ROI 2020. Perinatal Deaths = Stillbirths and Early Neonatal Deaths (first 7 days of life).

Table 3
Maternal, Neonatal and Delivery Statistics, CWIUH, January to July 2020.

	January	February	March	April	May	June	July	Correlation
Caesarean n (%)	231 (33.6 %)	185 (33.8 %)	185 (31.5 %)	215 (37 %)	198 (33.1 %)	221 (34.7 %)	236 (35.1 %)	0.008 p = NS
Vacuum n (%)	51 (7.4 %)	50 (9.1 %)	52 (8.9 %)	60 (10.3 %)	67 (11.2 %)	63 (9.9 %)	57 (8.5 %)	0.454 p = NS
Forceps n (%)	26 (3.8 %)	27 (4.9 %)	27 (4.6 %)	19 (3.3 %)	17 (2.8 %)	23 (3.6 %)	22 (3.3 %)	0.68 p = NS
Normal delivery n (%)	380 (55.3 %)	288 (52.5 %)	323 55.2 %	287 (49.4 %)	317 (53 %)	320 51.8 %	358 53.3 %	-0.533 p = NS
Labour induction n (%)	245 (35.7 %)	266 (41.2 %)	225 (38.5 %)	198 (34.1 %)	247 (41.3 %)	230 (36.1 %)	259 (38.5 %)	-0.759 p < 0.05
Pregnancy induced hypertension n (%)	30 (4.4 %)	30 (5.5 %)	31 (5.3 %)	41 (7.1 %)	29 (4.8 %)	31 (4.9 %)	44 (6.5 %)	0.48 p = NS
Pre-eclampsia n (%)	10 (1.5 %)	9 (1.6 %)	12 (2.1 %)	15 (2.6 %)	12 (2.0 %)	12 (1.9 %)	17 (2.5 %)	-0.144 p = NS
Unbooked n (%)	7 (1 %)	5 (0.9 %)	8 (1.4 %)	9 (1.5 %)	9 (1.5 %)	5 (0.8 %)	10 (1.5 %)	0.418 p = NS
Born before arrival n (%)	3 (0.4 %)	2 (0.4 %)	3 (0.5 %)	0	5 (0.8 %)	4 (0.6 %)	2 (0.3 %)	-0.508 p = NS
Disclosed domestic violence n (%)	12 (1.6 %)	10 (1.4 %)	2 (0.3 %)	2 (0.3 %)	6 (1.0 %)	6 (1.0 %)	10 (1.5 %)	-0.622 p = NS

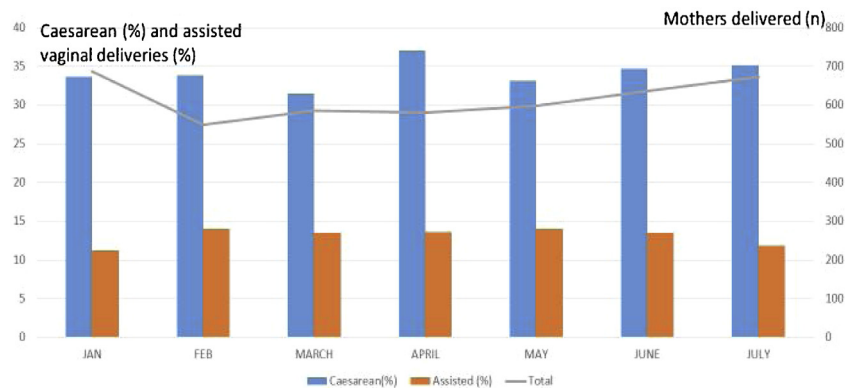


Fig. 2. Caesarean Section & Assisted Vaginal Delivery Rates (%) versus Total Deliveries (n), by month.

Table 4
Intrapartum and postnatal complications, CWIUH, Jan – July 2020.

	January	February	March	April	May	June	July	Correlation
Placental Abruption n (%)	3 (0.4 %)	1 (0.2 %)	0	1 (0.2 %)	2 (0.3 %)	2 (0.3 %)	1 (0.1 %)	-0.129 p = NS
Birthweight <2.5kg n (%)	50 (7.2 %)	28 (5.0 %)	42 (7.0 %)	37 (6.2 %)	40 (6.6 %)	39 (6.0 %)	28 (4.2 %)	-0.392 p = NS
HDU admission n (%)	21 (3.1 %)	7 (1.3 %)	19 (3.3 %)	8 (1.4 %)	10 (1.7 %)	11 (1.7 %)	10 (1.5 %)	-0.402 p = NS
Primary PPH n (%)	152 (22.1 %)	128 (23.3 %)	116 (19.8 %)	130 (22.4 %)	128 (21.4 %)	156 (24.5 %)	157 (23.4 %)	-0.313 p = NS
Massive Obstetric Haemorrhage n (%)	1 (0.2 %)	2 (0.4 %)	5 (0.9 %)	3 (0.5 %)	0	2 (0.3 %)	2 (0.3 %)	0.072 p = NS

Discussion

There has been a wealth of data published on Covid-19 infection in pregnancy and our knowledge of the effects of SARS-CoV2 on maternal and neonatal outcomes has rapidly evolved, with reports

of perinatal transmission increasing [8,9]. In contrast, although much has been written regarding potential unintended adverse effects of the pandemic on provision of maternity services and the resulting impact on maternal and neonatal outcomes, there has been little actual data to support or refute these concerns,

Table 5

Comparison of preterm birth rate (PTB) and perinatal mortality rate (PNMR) for Jan – July 2018, 2019 and 2020.

	2018 PTB/total (%)	2019 PTB/total (%)	2020 PTB/total (%)	Chi-sq, DOF, (p)	2018 PNMR	2019 PNMR	2020 PNMR	Fishers exact (p)
January	64/695 (9.2 %)	63/689 (9.1 %)	53/699 (7.6 %)	1.26, 1 (p = 0.26, NS)	1 (1.4)	4 (5.8)	4 (5.7)	p = 0.5 (NS)
February	51/590 (8.6 %)	48/572 (8.4 %)	30/563 (5.3 %)	4.85, 1 (p = 0.03)	1 (1.7)	1 (1.8)	2 (3.6)	p = 0.60 (NS)
March	45/716 (6.3 %)	63/626 (10.1 %)	47/597 (7.9 %)	0.015, 1 (p = 0.9, NS)	5 (10.5)	2 (3.2)	1 (1.8)	p = 0.45 (NS)
April	72/722 (10.0 %)	51/621 (8.2 %)	55/595 (9.2 %)	0.003, 1 (p = 0.96, NS)	2 (2.8)	4 (6.4)	4 (6.7)	p = 0.51 (NS)
May	54/713 (7.6 %)	74/725 (10.2 %)	40/607 (6.6 %)	2.59, 1 (p = 0.10, NS)	4 (5.6)	4 (5.5)	2 (3.3)	p = 0.73 (NS)
June	47/666 (7.1 %)	53/638 (8.3 %)	48/650 (7.4 %)	0.04, 1 (p = 0.84, NS)	1 (1.5)	6 (9.4)	3 (4.6)	p = 1.00 (NS)
July	59/725 (8.1 %)	57/675 (8.4 %)	52/686 (7.6 %)	0.26, 1 (p = 0.61, NS)	6 (8.3)	3 (4.4)	0 (0)	p = 0.04
TOTAL	392/4827 (8.1 %)	409/4546 (9.0 %)	325/4397 (7.4 %)	4.53, 1 (p = 0.03)	20/4827 (4.1)	24/4546 (5.3)	16/4397 (3.6)	0.76, 1 (p = 0.38, NS)

particularly since many countries continue to experience widespread infection and so are not yet in a position to perform reflective analysis [7,10,11]. This study of overall hospital statistics compares monthly outcomes and relates them to the severity of the pandemic and also to the combined hospital statistics of the same month in 2018 and 2019. The severity of the pandemic was assessed by the number of Covid related deaths in the ROI. The number of Covid deaths rather than Covid-19 infection rate was used as a disease marker as it is a more reliable measure, being unaffected by testing availability, inaccuracies, delayed reporting and missing asymptomatic individuals.

Published data suggests an increase in preterm births in Covid-19 affected pregnancies, the majority of which is iatrogenic due to maternal illness or fetal compromise [8,9]. A large population-based study in the UK by Knight et al. (2020) showed a 26 % preterm birth rate amongst Covid-19 affected pregnancies and 76 % of these were iatrogenic [9]. However, a regional maternity unit in Ireland has described a reduction in preterm deliveries of very low birth weight infants during the Covid-19 pandemic in their population. The authors postulated this resulted from a socio-environmental impact of mandated lockdown on pregnant women unaffected by Covid-19. The study is, however, based on a four month period from January to April 2020, which includes a 2 month period from when SARS-CoV2 was first diagnosed in Ireland (March and April), and a 6 week period of lockdown (from 12th March onwards) [12].

Yet data from our unit, with almost double the delivery rate and evaluating the complete course of the pandemic, does reveal a reduction in preterm deliveries in comparison to the same time period in the preceding two years. It could be reasoned that this may be secondary to social and health behaviours amongst the obstetric population in the midst of a pandemic with enforced lockdown. However, February 2020 was the only month individually to demonstrate a statistically significant difference from the same month in the preceding two years, which was prior to the first diagnosis of SARS-CoV2 in Ireland. The preterm delivery rate for March and April 2020 was not significantly different from the same months in 2018 and 2019 and overall there was no correlation between the preterm delivery rate in 2020 and the peak pandemic period, represented by incidence of Covid-related deaths. One factor which warrants consideration is the impact of the newly enacted legislation on 1st January 2019 allowing for termination of pregnancy in limited circumstances in Ireland. Termination of pregnancies with chromosomal or congenital anomalies which may have been predisposed to either spontaneous or iatrogenic preterm delivery may in part contribute to the noted reduction in preterm birth rate in 2020.

The perinatal mortality rate in CWIUH remained stable throughout the peak of the pandemic, however there was a significant reduction noted in July 2020 in comparison with previous years. In contrast, Khalil et al. (2020) compared birth trends in their London unit in a pre-pandemic and pandemic time period and found a significantly increased incidence of stillbirth,

none of which occurred in women diagnosed with Covid-19 [13]. However, the testing strategy in the UK at that time was limited to symptomatic individuals requiring hospitalisation and it is noted that surveillance data suggests up to 90 % asymptomatic infection rate among pregnant populations [13–16]. There is also no evidence of SARS-CoV2 testing of these women following the diagnosis of intrauterine fetal demise, nor postmortem testing of fetal or placental tissue.

There was a negative correlation between the induction rate and the number of Covid deaths ($p < 0.05$), with the lowest rate of inductions occurring in April (34 %), during the peak of Covid-19 case diagnoses and deaths. This may demonstrate less obstetric intervention, however this is negated by the mode of delivery statistics which show April had the lowest rate of normal deliveries (49 %) and the highest rate of caesarean sections (37 %) in the seven month period.

A statistically significant decrease in hypertensive disorders of pregnancy during the pandemic period was described in the study by Khalil et al. (2020). The authors hypothesised that this, together with the increased stillbirth incidence, may be secondary to reduced antenatal surveillance or women less likely to attend hospital during the pandemic if unwell or concerns with fetal movements [13]. Worries regarding the possibility of missed antenatal complications were also raised by other publications, secondary to the rapid reconfiguration of maternity services during the pandemic [7]. However, as shown in Table 4, there was no difference in pregnancy or delivery complications in the CWIUH during this time period. Antenatal visits continued with regular frequency and although anecdotally women may have been deterred from attending the hospital on an emergent basis, there was no demonstrable impact on pregnancy outcomes.

Corbett et al. (2020), in a study performed in an obstetric population during the first two weeks of the pandemic delay phase in Ireland, found that over half of women surveyed worried about their health often or all of the time, with 63 % reporting concern about their unborn baby. They reported an overall increased level of health anxiety in this population, which may explain why initial fears that women would be deterred from attending hospital or seeking emergent care in pregnancy have not been evidenced in our study [17]. There was no difference in unbooked pregnancies or infants born before arrival to hospital during the months pre- and post-pandemic peak or in the midst of it.

Concern regarding an increase in domestic violence due to the effects of social isolation and enforced lockdown measures during the pandemic has been well-documented [18]. The Irish Government ran a campaign across television, radio and social media to reassure victims of domestic violence that supports remained available in spite of the Covid-19 pandemic [19]. Pregnancy is an acknowledged risk factor for domestic violence which compounds the risk in the obstetric population during this period of mandated lockdown [7,18]. At the booking visit in our unit, all women are asked if they have or are experiencing domestic violence to identify

those at risk. Interestingly, less women disclosed domestic violence at booking during the peak pandemic period when lockdown was enforced in the months of March and April, 2 women in each month, in comparison with the pre-pandemic months of January and February where 12 and 10 women respectively, made disclosures (Table 3). This was consistent with a survey of 71 patients performed in the CWIUH on the effects of isolation on mood and relationships in pregnant women during the covid-19 pandemic (Milne et al., 2020). They found only 4.3 % of women reported a deterioration in their relationship with their partner during the pandemic, which is less than published reports of DV in pregnancy, with no reports of physical violence and the majority of women reporting improved relationships [20].

Conclusion

We continue to live through the Covid-19 era, with uncontrolled spread and resurgence of the virus in many countries across the world. The rapid control and ongoing successful suppression of the Covid-19 pandemic in the Republic of Ireland over a short timeframe affords us the ability to provide a unique insight into the effects of the pandemic on maternity services in a high-income country with universal access to healthcare. There was a statistically significant difference in the number of preterm births over the study period in comparison to previous years, however further research is required before attributing this finding to behavioural and environmental changes secondary to the effects of the pandemic. There were no differences in all other maternal and neonatal outcomes reviewed.

It is important to realise the impact of the pandemic on pregnant women, and information sharing with studies like ours will assist in reassuring the obstetric population that the overall results approximate to those expected. Ongoing review of maternity statistics also allows us to remain vigilant for developing trends or problems to enable us to adapt our services as needed. It is also important to validate the efforts of healthcare providers who continually strive to provide high quality healthcare in ever-challenging circumstances.

Contribution to authorship

The project was conceived by SL, who performed the statistical analysis and contributed to the final draft. SMD wrote the manuscript with support from SL and MOC. EMN performed the data collection. All authors approved the final version submitted for publication.

Details of ethical approval

Ethical approval was not required for this study. Hospital maternity statistics including those used for this study are published annually in a report which is publicly available. Permission was sought to utilise this data in advance of report publication from the Hospital CEO.

Funding

No funding was received for this study.

Declaration of Competing Interest

The authors report no declarations of interest.

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