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Impact of COVID-19 Public Health Safety Measures on Births in Scotland between March and May 2020

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Abstract

Objective: To combat the wide-spread transmission of COVID-19, many countries, including the United Kingdom, have imposed nationwide lockdowns. Little is known about how these public health safety measures affect pregnant mothers and their offspring. This study aimed to explore the impact of COVID-19 public health safety measures on births in Scotland.

Study Design: Cross-sectional study

Methods: Using routinely collected health data on pregnancy and birth in Scotland, this study compares all births (N = 7342) between 24th of March and May 2020 to births in the same period in 2018 (N = 8323) to investigate the potential negative impact of public health safety measures introduced in Scotland in spring 2020. Birth outcomes were compared using Mann-Whitney-U tests and chi-square tests.

Results: Mothers giving birth during the pandemic tended to combine breastfeeding and formula-feeding rather than exclusively breastfeed or exclusively formula-feed, stayed in hospital for fewer days and more often had an epidural or a spinal anaesthetic compared to women giving birth in 2018.

Conclusion: Overall, results suggest little impact of public health safety measures on birth outcomes. Further research is needed to explore the longer-term impacts of being born in the pandemic on both maternal mental health and child development.

Keywords: COVID-19; social-distancing; pregnancy; birth outcomes;

Coronavirus disease 2019 (COVID-19) is spreading rapidly around the globe after first identification in Wuhan, China, in December of 2019. In response, many countries, including the United Kingdom, have imposed nationwide lockdowns to combat the wide-spread transmission of COVID-19. In Scotland, the first Covid-19 cases were reported on March 1st 2020 and a strict lockdown was put in place on March 24th. These public health safety measures have had wide ranging effects on everyone, but certain groups, such as pregnant women, might be particularly vulnerable to changes in social contacts and care provisions (1,2). Pregnant women were ordered to stay at home and self-isolate, partners were only allowed in hospital for the last stages of labour and were not allowed any visitors during their hospital stay. The lessening of parental choice, reduced social and formal support, and poorer maternal health compared to pre-pandemic life may have adverse effects on maternal and neonatal wellbeing. Social-distancing has been shown to lead to an increase in mental health difficulties in the general population (1) and specifically in pregnant women (2,3). Compared to pre-COVID-19 pregnancy cohorts, women expecting a child during the COVID-19 pandemic in the UK suffer from substantially elevated psychological distress, with 57% reporting clinically relevant symptoms of anxiety, 37% reporting clinically relevant symptoms of depression, and 68% reporting elevated pregnancy-related anxiety (3). Public health safety measures have further led to a marked rise in domestic violence incidents in the United Kingdom as is reflected in a 49% increase in calls to the national domestic abuse helpline run by the charity Refuge (4), with pregnant women being of particularly high risk to experience violence also under normal circumstances (5). As has been shown in pre-pandemic studies, domestic violence and elevated levels of depression or anxiety in pregnancy are risk factors for adverse maternal and neonatal outcomes (6).

Taken together, these findings highlight the need to investigate the impact of nationwide public health safety measures on pregnancy and birth. This study gives some

preliminary evidence on the impact of public health safety measures on 11240 births in Scotland between March and May 2020 using routinely collected health data on pregnancy and birth in Scotland.

The study population comprised 7219 women giving birth to 7342 children (7096 singletons, 246 multiples) in Scotland between 24th of March and 31st of May 2020 as well as a control group of 8185 women giving birth to 8323 children (8043 singletons, 280 multiples) between March and May 2018. Harmonised routine health data on pregnancy and birth was provided by Public Health Scotland. In particular, obstetric records from the Scottish Morbidity Records (SMR02) were matched with Scottish Birth Records (SBR) and COVID-19 test results from the Electronic Communication of Surveillance in Scotland (ECOSS). Eight women were excluded from analyses as they tested positive for COVID-19 (198 women were tested). While sample sizes for COVID-19 positive women did not allow for further analyses, the data suggested that none of the women or babies had any particularly negative outcome. One important caveat that has to be kept in mind when interpreting the findings of this study is that the cohorts were recruited in two different years. Thus, they may have potentially been exposed to different non-Covid-19 related factors such as changes in health care provisions which could have influenced the results presented here.

A variety of maternal and infant outcomes were analysed: **induction of labour** (yes, no), **mode of delivery** (unassisted vaginal delivery, planned caesarean section, emergency caesarean section, other (e.g. use of forceps)), **analgesia during labour** (none, gas and air, opioids, epidural, spinal anaesthetic, general anaesthetics, other), **birth outcome** (livebirth, stillbirth, infant death), **Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) score** (low = 0-3, moderately abnormal = 4-6, reassuring = 7-10 (7)) , **age of gestation**, **birthweight**, **length of hospital stay**, and **feeding method on discharge** (breastfeeding, formula, mixed feeding, other). Data were analysed using Mann-Whitney U tests for

continuous outcomes and chi-square tests of independence for nominal outcomes. If the chi-square test was significant ($\alpha < 0.05$), post-hoc tests (Fisher's exact tests) were conducted to examine all possible comparisons. These were additionally corrected for multiple comparisons using Bonferroni adjustment.

Descriptive Statistics are given in Table 1. Mann-Whitney U tests showed significant results for length of hospital stay with women in 2020 leaving the hospital around 6 hours earlier than women in 2018 ($Z = 9.75, p < .001$). There were no significant differences in birthweight ($Z = 0.75, p = .454$), or age of gestation ($Z = -0.69, p = .488$). Chi-squared tests showed no significant differences in APGAR scores ($\chi^2(2) = 1.28, p = .527$), mode of delivery ($\chi^2(3) = 5.53, p = .137$), induction of labour ($\chi^2(1) = 0.08, p = .783$) and birth outcomes ($\chi^2(2) = 0.60, p = .740$), however, there were significant differences in feeding methods on discharge ($\chi^2(3) = 14.70, p = .033$) and analgesia during labour and delivery ($\chi^2(6) = 64.56, p < .001$). Post-hoc tests revealed that women were more likely to combine breastfeeding with formula-feeding (13.2% in 2018 vs 14.8% in 2020) than to exclusively breastfeed (43.4% in 2018 vs 42.9% in 2020, $p = 0.011, P = .069$) or exclusively formula-feed (42.8% in 2018 vs 41.8% in 2020, $p = 0.006, P = .038$) Women in 2020 were also more likely to require spinal anaesthetics (29.1% in 2018 vs 33.1% in 2020) compared to using no pain relief air ($p = 0.011, P = .226$), gas and air ($p = 0.001, P < .001$) or opioids ($p < 0.001, P < .001$) as well as more likely to have an epidural (17.6% in 2018 vs 19.9% in 2020) compared to using gas and air ($p < 0.001, P < .001$) or opioids ($p < 0.001, P < .001$).

Overall, results suggest that the public health safety measures implemented as a response to the COVID-19 pandemic have had relatively little impact on maternal and neonatal outcomes in Scotland. In line with findings from American hospitals (8), women giving birth in a Scottish hospital during the pandemic tended to leave maternity wards slightly faster than women who gave birth in the same months of 2018. This reduction in hospital stay duration is

likely the result of policy modifications that were implemented to protect women as well as hospital staff against COVID-19 infections. Birth partners having to leave the hospital right after delivery and limited visitor numbers likely prompted women to go home as soon as possible. There has been some concern that reduction in hospital stays could lead to increases in the rate of adverse neonatal and maternal outcomes. However, in agreement with other studies looking at the impact of reducing hospital stay durations, our results do not support these concerns (8).

Women giving birth during the COVID-19 pandemic in Scotland were further found to be more likely to combine breastfeeding with formula-feeding rather than to exclusively breastfeed or exclusively formula-feed. There has been some evidence from British hospitals that women giving birth during the pandemic were more likely to exclusively breastfeed than pre-pandemic cohorts (9). This has been attributed to women having more time for themselves and their new-born as they had more help from their partners once home and fewer visitors. There has, however, also been some evidence that women were less likely to continue breastfeeding long term due to a reduction of face-to-face services for breastfeeding support (10). The increase in mixed feeding that was found in the current study could, however, also be the result of a more general change in feeding practises that is unrelated to the pandemic. For instance, it is possible that more hospitals are now encouraging mothers to supplement breastfeeding with bottle-feeding to counteract infant weight loss which otherwise puts a lot of pressure on women who may struggle with producing enough breastmilk to exclusively breastfeed. This is however purely speculative and further research is needed to investigate general trends in infant feeding practices.

Results further indicated that women giving birth between March and May 2020 more often had an epidural or received spinal anaesthetics than women giving birth in the same period in 2018. One potential reason for this finding is that birth partners were restricted to just

one person who often was only allowed into the labour ward once the expectant mum was already in active labour. This could have resulted in women having reduced pain tolerance in active labour as they were left to cope with the pain of early labour without a supportive birth partner present. Another potential reason for this finding is that during COVID-19, an increased number of consultants and anaesthetic staff were present to provide care for any women that may have presented with COVID-19. Thus, this could have made it easier for women to receive an epidural or spinal anaesthetic. However, it is also possible that epidurals and spinal anaesthetics are gaining in popularity independently of the COVID-19 pandemic.

In conclusion, findings of the current study suggest that public health safety measures implemented in Scotland as a response to the COVID-19 pandemic had limited impact on maternal and neonatal outcomes. While these findings are reassuring, future research is needed to gain better insights into the impact of COVID-19 and associated public health safety measures on maternal and child health.

Table 1 Descriptive Statistics**Continuous Variables**

	Cohort 2018				Cohort 2020				Overall				<i>p</i>
	<i>M</i>	<i>Median</i>	<i>SD</i>	<i>Range</i>	<i>M</i>	<i>Median</i>	<i>SD</i>	<i>Range</i>	<i>M</i>	<i>Median</i>	<i>SD</i>	<i>Range</i>	
Maternal Age	30.02	30	5.60	14-53	30.34	31	5.49	15-53	30.17	30	5.55	14-53	<.001
Length of Hospital Stay (days)	2.56	2	2.38	0-38	2.29	2	2.50	0-84	2.43	2	2.44	0-84	<.001
Birthweight	3318.19	3360	608.24	610-5640	3325.73	3374	603.70	620-6000	3321.73	3368	606.11	610-6000	.454
Age of Gestation	38.74	39	2.17	21-44	38.76	39	2.18	22-42	38.75	39	2.17	21-44	.488

Categorical Variables

	Category	Cohort 2018		Cohort 2020		Overall		Relative Risk Ratio	<i>p</i>
		<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>		
Number of Births	Singleton	8043	96.6	7096	96.6	15139	96.7	Reference Group 1.00 (0.99-1.01)	.998
	Multiples	280	3.3	246	3.4	526	3.3		
Sex	Male	4218	50.7	3703	50.4	7921	50.6	Reference Group 1.01 (0.98-1.04)	.734
	Female	4079	49.3	3638	49.6	7735	49.4		
Mode of Delivery	Unassisted Vaginal	4344	52.5	3788	51.6	8132	52.3	Reference Group 1.02 (0.99-1.04) 1.01 (0.99-1.04) 0.99 (0.97-1.01)	.137
	Planned C-Section	1367	16.5	1288	17.5	2655	17.0		
	Emergency C-Section	1488	18.0	1363	18.6	2851	18.3		
	Other (e.g. Forceps)	1079	13.0	901	12.3	1980	12.7		
Induction of Labour	No	5541	67.4	4910	67.2	10451	67.3	Reference Group 1.00 (0.98-1.03)	.783
	Yes	2678	32.6	2398	32.8	5075	32.7		
Birth Outcome	Alive	8273	99.5	7292	99.4	15565	99.4	Reference Group 1.00 (1.00-1.00) 1.00 (1.00-1.00)	.740
	Stillbirth	10	0.1	9	0.1	19	0.1		
	Infant Death	36	0.4	38	0.5	74	0.5		

APGAR Score	0-3	39	0.5	31	0.4	70	0.5	Reference Group	.527
	4-6	144	1.8	112	1.6	256	1.7	0.98 (0.65-1.49)	
	7-10	7959	97.8	7063	98.0	15022	97.9	1.11 (0.69-1.78)	
Method of Feeding at Discharge	Breastfed	3505	43.4	3066	42.9	6571	43.2	Reference Group	.033
	Formula-fed	3452	42.8	2990	41.8	6442	42.3	1.00 (0.96-1.03)	
	Mixed	1066	13.2	1059	14.8	2125	14.0	1.03 (1.01-1.06)	
	Other	54	0.6	33	0.5	78	0.5	1.00 (0.99-1.01)	
Analgesia during Labour and Delivery	None	328	4.7	285	4.3	613	4.5	Reference Group	<.001
	Epidural	1230	17.6	1324	19.9	2554	18.7	1.19 (1.03-1.37)	
	Opioids	1129	16.2	852	12.8	2981	14.5	0.90 (0.78-1.03)	
	Gas and Air	1908	27.4	1710	25.7	3618	26.5	1.03 (0.89-1.19)	
	General Anaesthetics	160	2.3	119	1.8	279	2.0	0.95 (0.87-1.04)	
	Spinal Anaesthetics	2032	29.1	2204	33.1	4236	31.1	1.21 (1.05-1.41)	
Other	168	2.7	167	2.5	353	2.6	1.05 (0.95-1.15)		

Note. Relative Risk Ratio are given in comparison to the reference group, e.g., breastfed vs formula-fed and breastfed vs mixed with higher/lower ratios indicating that an outcome was more/less likely in the 2020 cohort than in the 2018 cohort, *p*-values are based on Mann-Whitney U tests for continuous variables and on chi-square tests for categorical variables.

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