**Impacts of COVID-19 mitigation measures on pregnancy and birth outcomes in Scotland: a protocol for a natural experiment study using administrative data**

Paul M. Henery, Ruth Dundas, Alastair H. Leyland, Anna Pearce

### Why this study?
- The early years are crucial to long-term health and wellbeing.
- The COVID-19 pandemic, and resultant mitigation measures, has impacted antenatal care in Scotland, as well as professional and social support for parents.
- Trend data collected during mitigation has shown increased abortion and stillbirths, and lower gestational age.
- Socially disadvantaged families and first time mothers, will be disproportionately affected.

### What data do we have?

The study population is ~650,000 mother and child pairs for births in Scotland between March 2010 and August 2021. The below birth datasets (Fig. 1) were linked together using the Community Health Index, a population register used for health care in Scotland. Each person on the CHI has a unique identification number.

<table>
<thead>
<tr>
<th>Scottish Morbidity Record 02 (SMR02)</th>
<th>Record of all antenatal inpatient admissions</th>
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<tbody>
<tr>
<td>National Records of Scotland (NRS) birth data</td>
<td>Register of the child’s birth, suspended during pandemic</td>
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<tr>
<td>National Health Service (NHS) live birth notifications</td>
<td>Counterpart to NRS birth data used when it is not available</td>
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</tbody>
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**Fig. 1: Overview of datasets used in the study (SMR02, NRS births and NHS birth alerts)**

Linking these datasets together provides us with information on birth characteristics, antenatal services, maternal behaviour, and socio-economic and demographic characteristics.

### How are we measuring exposure?

We will compare an unexposed cohort (where pregnancy and birth occurred prior to lockdown) to a number of exposed cohorts. Exposure will be defined by duration and timing of exposure to lockdown and partial relaxation measures during pregnancy, birth, and infancy; the complexity will be dependent on frequency of cases.

It should be noted that services available were not consistent throughout each mitigation period; Fig. 2 serves as a low-level example of different kinds of cohorts, but we expect there to be far greater complexity.

### What are our outcomes?

We will examine three groups of outcomes, all of which are both impacted by lockdown, and crucial for long-term health and development:

- **Maternal behaviour**, e.g. smoking or alcohol use in pregnancy, infant feed status
- **Birth characteristics**, e.g. birth weight, gestational age, head circumference
- **Service use**, e.g. doctor/midwife present during delivery, inpatient admissions during pregnancy, length of HOSPITAL stay during birth

### What are our analyses?

- **Checks for missing data by year** (to examine whether the pandemic impacted data quality)
- **Prevalence of outcomes** by exposure windows outlined in Fig. 2.
- **Interrupted time series analyses** to examine the risk difference in outcomes in births born during/after lockdown compared to the baseline group.
- **Effect modification** will examine if any elevated risk related to pregnancy/birth during lockdown varied across social groups.

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**Fig. 2: Overview of potential exposure cohorts in our study. Each block represents a pregnancy with the endpoint denoting birth. Each shade represents COVID-19 mitigation measures (none, lockdown and partial lockdown).**