

Appendix 2. Data sources and variables

Discharge Abstract Database (DAD): The DAD is compiled by the Canadian Institute for Health Information and contains administrative, clinical (diagnoses and procedures/interventions), demographic, and administrative information for all admissions to acute care hospitals, rehab, chronic, and day surgery institutions in Ontario. At ICES, consecutive DAD records are linked together to form ‘episodes of care’ among the hospitals to which patients have been transferred after their initial admission.

MOMBABY: The ICES MOMBABY Database is an ICES-derived cohort that links the DAD inpatient admission records of delivering mothers and their newborns. From 2002 onward, this linkage is performed deterministically using a maternal-newborn chart matching number. Prior to 2002, mothers were linked to their children by matching on the institutions they were admitted, their postal codes, and their admission/discharge dates.

Registered Persons Database (RPDB): The RPDB provides basic demographic information (age, sex, location of residence, date of birth, and date of death for deceased individuals) for those issued an Ontario health insurance number. The RPDB also indicates the time periods for which an individual was eligible to receive publicly funded health insurance benefits.

Ontario Health Insurance Plan (OHIP): The OHIP claims database contains information on inpatient and outpatient services provided to Ontario residents eligible for the province’s publicly funded health insurance system by fee-for-service health care practitioners (primarily physicians) and “shadow billings” for those paid through non-fee-for-service payment plans. The main data elements include patient and physician identifiers (encrypted), code for service provided, date of service, associated diagnosis, and fee paid.

The datasets were linked using unique encoded identifiers and analyzed at ICES. The dataset from this study is held securely in coded form at ICES. While data sharing agreements prohibit ICES from making the dataset publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS. The full dataset creation plan and underlying analytic code are available from the authors upon request, understanding that the computer programs may rely upon coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification

Project Cohort													
Study Design	<input checked="" type="checkbox"/> Cohort study <input type="checkbox"/> Matched cohort study <input type="checkbox"/> Case-control study <input type="checkbox"/> Cross-sectional study <input type="checkbox"/> Other (specify):												
Index Event / Inclusion Criteria	<p>Pandemic Group: All females in Ontario delivering pregnancies (live and stillbirth, singleton and multiple) at ≥ 20 weeks' gestation (identified in MOMBABY M_STILLBIRTH='F' and M_STILLBIRTH='T') from March 15, 2020 to September 30, 2021</p> <p>Historic Group: All females in Ontario delivering singleton pregnancies (live and stillbirth) at ≥ 20 weeks' gestation (identified in MOMBABY) from March 15, 2015 to September 30, 2019</p> <p>Index Date: Date of delivery</p> <ul style="list-style-type: none"> • Use variable B_BDATE in MOMBABY • Use variable M_ADMDATE in MOMBABY if B_BDATE missing 												
Exclusions (in order)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Step</th> <th style="text-align: left;">Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>All births from MOMBABY during period where m_gestwks_del ≥ 20 and warn='N' (unique keys)</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Invalid IKN in RPDB</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Dthdate prior to indexdate or sex ne 'F'</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Not residing in Ontario (pr ne '35') at indexdate</td> </tr> <tr> <td style="text-align: center;">5</td> <td>Non-continuous OHIP eligibility over duration of pregnancy, missing INST or INST that did not report during pandemic period</td> </tr> </tbody> </table>	Step	Description	1	All births from MOMBABY during period where m_gestwks_del ≥ 20 and warn='N' (unique keys)	2	Invalid IKN in RPDB	3	Dthdate prior to indexdate or sex ne 'F'	4	Not residing in Ontario (pr ne '35') at indexdate	5	Non-continuous OHIP eligibility over duration of pregnancy, missing INST or INST that did not report during pandemic period
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Variable Definitions	
Main Exposure or Risk Factor	Birth (live or stillborn) ≥ 20 weeks' gestation during the pandemic period (MOMBABY)
Primary Outcome Definition	Severe pre-eclampsia/HELLP: CIHI-DAD ICD10: O11, O14, O15 see table A2 below
Secondary Outcome Definition(s)	Composite SMM: any of table A1 below Specific subtypes listed in Table A1 below
Baseline Characteristics	<ol style="list-style-type: none"> 1. Age at index date (RPDB) – continuous (mean/SD, median/IQR) 2. Area of residence (RPDB, CENSUS): categorical - rural/urban 3. Income quintile (CENSUS) – categorical, 5 quintiles (referent = highest income quintile) 4. Comorbidities (NACRS, DAD, SDS, OHIP) – ADG score, continuous. Categorical in table 1: no comorbidity (0), low comorbidity (1-5 ADGs), moderate comorbidity (6-9 ADGs), and high comorbidity (≥ 10 ADGs) 5. Pre-existing hypertension (HYPER derived ICES dataset) – dichotomous (yes/no) – yes if the patient is in HYPER within 3 years prior to index 6. Pre-existing diabetes (ODD derived ICES dataset) – dichotomous (yes/no) – yes if the patient is in ODD within 3 years prior to index 7. Parity: births ≥ 20 wks prior to index pregnancy (live and still, CIHI) Mandatory variables on OBS admissions in CIHI-DAD: <ol style="list-style-type: none"> i. Number of previous livebirths ('PREVBIRTH') ii. Number of previous term deliveries ('PREVTERM') iii. Number of previous preterm deliveries ('PREVPRETERM') iv. Number of previous spontaneous abortions (PREVSPABORT) v. Number of previous therapeutic abortions (PREVTHABORTH) vi. Report all variables as categorical (0,1,2+) Binary parity variable (0 previous live/still births, 1+ previous live/still births) 8. Use of ART (MOMBABY) – binary, Y/N 9. Multiple gestation (MOMBABY) – binary, 1 (singleton) />1 (twins, higher order multiples) 10. Mode of delivery (CIHI DAD, OHIP): categorical – Cesarean-section (CIHI-DAD CCI: 5.MD.60/OHIP: P018, P041, P042), operative vaginal delivery (CIHI-DAD CCI: 5.MD.53.^, 5.MD.54.^, 5.MD.55.^/OHIP: P020), spontaneous vaginal delivery (CIHI-DAD CCI: 5.MD.50.^, 5.MD.51.^, 5.MD.52.^/OHIP: P006) 11. Infection with SARS-CoV-2 (1) during pregnancy and/or (2) at delivery (OLIS)

Table A1. Codes to identify severe maternal morbidity types

SMM description	ICD & CCI Codes
Severe preeclampsia and HELLP syndrome	O14.1 or O14.2
Eclampsia	O15
Cerebral venous thrombosis in pregnancy, or in the puerperium	O22.5 or O87.3
Acute fatty liver with red blood cell (RBC) transfusion or plasma transfusion	O26.6 + (CIHI BTREDBC = 1 or CIHI BTPLASMA = 1)
Pulmonary, cardiac, and CNS complications of anaesthesia during pregnancy, the puerperium, or labour and delivery	O29.0, O29.1, O29.2, O89.0, O89.1, O89.2, O74.0, O74.1, O74.2 or O74.3
Placenta previa with hemorrhage with RBC transfusion	O44.1 + CIHI BTREDBC = 1
Placental abruption with coagulation defect	O45.0
Antepartum hemorrhage with coagulation defect	O46.0
Intrapartum hemorrhage with coagulation defect	O67.0
Intrapartum hemorrhage with RBC transfusion	O67 + CIHI BTREDBC = 1
Rupture of the uterus with RBC transfusion, procedures to the uterus or hysterectomy	(O71.0 or O71.1) + any of the following: <ul style="list-style-type: none"> • CIHI BTREDBC = 1, <u>or</u> • (1.RM.13, 1.KT.51, 5.PC.91.LA or 5.PC.91.HV) + CIHI BTREDBC = 1, <u>or</u> • (5.MD.60.RC, 5.MD.60.RD, 5.MD.60.KE, 5.MD.60.CB or 1.RM.89.LA^a), <u>or</u> • 1.RM.87.LA-GX <p>^aNOTE: 1.RM.89.LA is included only if codes 1.PL.74, 1.RS.74 or 1.RS.80 are NOT also present</p>
Postpartum hemorrhage with RBC transfusion, procedures to the uterus or hysterectomy	O72 + any of the following: <ul style="list-style-type: none"> • BTREDBC = 1, <u>or</u> • (1.RM.13, 1.KT.51, 5.PC.91.LA or 5.PC.91.HV) + BTREDBC = 1, <u>or</u> • (5.MD.60.RC, 5.MD.60.RD, 5.MD.60.KE, 5.MD.60.CB or 1.RM.89.LA^b), <u>or</u> • 1.RM.87.LA-GX <p>^bNOTE: 1.RM.89.LA is included only if codes 1.PL.74, 1.RS.74 or 1.RS.80 are NOT also present</p>
Cardiac conditions	O74.2, O89.1, O90.3, I21, I22, I42, I43, I46, I49.0, I50, J81, 1.HZ.09 or 1.HZ.30
Obstetric shock	O75.1, R57, T80.5 or T88.6
Septicemia during labour	O75.3
Complications of obstetric surgery and procedures	O75.4
Puerperal sepsis	O85
Obstetric embolism	O88
Acute renal failure	O90.4, N17, N19 or N99.0
Death, obstetric, cause unspecified	O95
Death, obstetric, after 42 days but 1 year after delivery	O96
Death from sequelae of direct obstetric causes	O97
Disseminated intravascular coagulation	D65

SUPPLEMENTAL MATERIAL. Snelgrove JW, Simpson AN, Sutradhar R, Everett K, Liu N, Baxter NN. **Preeclampsia and severe maternal morbidity during the COVID-19 pandemic: A population-based cohort study in Ontario, Canada.**

SMM description	ICD & CCI Codes
Sickle cell anemia with crisis	D57.0
Acute psychosis	F53.1 or F23
Status epilepticus	G41
Cerebral edema or coma	G93.6 or R40.2
Cerebrovascular diseases: subarachnoid and intracranial hemorrhage, cerebral infarction, stroke	I60, I61, I62, I63 or I64
Status asthmaticus	J45.01, J45.11, J45.81 or J45.91
Adult respiratory distress syndrome	J80
Acute abdomen	K35, K37, K65, N73.3 or N73.5
Hepatic failure	K71 or K72
Sudden death, death from unspecified cause	R96, R97, R98 or R99
Assisted ventilation through endotracheal tube	1.GZ.31.CA-ND
Assisted ventilation through tracheostomy	1.GZ.31.CR-ND
Hysterectomy	5.MD.60.RC, 5.MD.60.RD, 5.MD.60.KE, 5.MD.60.CB, 1.RM.89.LA (exclude if 1.PL.74, 1.RS.74 or 1.RS.80 code also present) or 1.RM.87.LA-GX
Dialysis	1.PZ.21
Evacuation of incisional hematoma with RBC transfusion	5.PC.73.JS + CIHI BTREDBC = 1
Repair of bladder, urethra, or intestine	5.PC.80.JR, 1.NK.80 or 1.NM.80
Procedures to the uterus/pelvic vessels with RBC transfusion	(1.RM.13, 1.KT.51, 5.PC.91.LA or 5.PC.91.HV) + CIHI BTREDBC = 1
Surgical or manual correction of inverted uterus for vaginal births only	5.PC.91.HQ or 5.PC.91.HP, restricted to vaginal births (i.e., absence of caesarean 5.MD.60)
Reclosure of caesarean wound	(5.PC.80.JM or 5.PC.80.JH) + CIHI BTREDBC = 1
Curettage with RBC transfusion	(5.PC.91.GA, 5.PC.91.GC or 5.PC.91.GD) + CIHI BTREDBC = 1
Maternal ICU admission	SCU in ('10','20','25','30','35','40','45','60','80')

Notes on selected diagnostic and procedure codes

- Coding specific to severe preeclampsia and HELLP (O14.1 and O14.2) began in **2012**.
- The codes under acute fatty liver (O26.6) - were expanded in ICD-10-CA version **2009**, to add codes for the sixth digits of "2" (Delivered, with mention of postpartum complication) and "4" (Postpartum condition or complication). Previously postpartum liver disorders would have been captured at O90.802 and O90.804 *Other complications of the puerperium, not elsewhere classified*, respectively. In addition, in ICD-10-CA version 2009 the conditions included at this code were expanded to include "Cholestasis (intrahepatic) in pregnancy" and "Obstetric cholestasis." Previously, cholestasis in pregnancy would have been classified to O99.6 *Diseases of the digestive system complicating pregnancy, childbirth and the puerperium* which included conditions in K80-K93, and more specifically, K83.1 Cholestasis NEC.
- The CCI code 5.PC.91.HV *Interventions to uterus (following delivery or abortion), compression using intrauterine balloon* was introduced in CCI version **2012**. This intervention would previously have been captured at 5.PC.91.HT *Interventions to uterus (following delivery or abortion) uterine (and vaginal) packing*.

References

Dzakpasu S, Deb-Rinker P, Arbour L, et al. Severe maternal morbidity surveillance: Monitoring pregnant women at high risk for prolonged hospitalisation and death. *Paediatr Perinat Epidemiol.* 2020;34:427-39.

SUPPLEMENTAL MATERIAL. Snelgrove JW, Simpson AN, Sutradhar R, Everett K, Liu N, Baxter NN. **Preeclampsia and severe maternal morbidity during the COVID-19 pandemic: A population-based cohort study in Ontario, Canada.**

Dzakpasu S, Deb-Rinker P, Arbour L, et al. Severe maternal morbidity in Canada: Temporal trends and regional variations, 2003-2016. *J Obstet Gynaecol Can.* 2019;41:1589-98.e16.

Joseph KS, Liu S, Rouleau J, et al. Severe maternal morbidity in Canada, 2003 to 2007: Surveillance using routine hospitalization data and icd-10ca codes. *J Obstet Gynaecol Can.* 2010;32:837-46.