

## Supplementary Material

Table S1. Search strategy for MEDLINE.

| Concept  | Step | Search Strategy  |
|--|------|--|
| <b>Study type = prediction modelling studies</b>   |      |  |
| Study type = prediction modelling studies<br>(Ingui filter for prediction models[1])                                   | 1    | Validat\$.mp. or Predict\$.ti. or Rule\$.mp.   |
|  | 2    | (Predict\$ and (Outcome\$ or Risk\$ or Model\$)).mp.   |
|  | 3    | ((History or Variable\$ or Criteria or Scor\$ or Characteristic\$ or Finding\$ or Factor\$) and (Predict\$ or Model\$ or Decision\$ or Identif\$ or Prognos\$)).mp.  |
|  | 4    | Decision\$.mp. and ((Model\$ or Clinical\$).mp. or Logistic Models/)   |
|  | 5    | (Prognostic and (History or Variable\$ or Criteria or Scor\$ or Characteristic\$ or Finding\$ or Factor\$ or Model\$)).mp.   |
|  | 6    | or/1-5   |
| Study type = prediction modelling studies<br>(Addition to Ingui filter proposed by Geersing to improve sensitivity[2]) | 7    | Stratification.mp. or "ROC Curve"/ or Discrimination.mp. or Discriminate.mp. or c-statistic.mp. or "c statistic".mp. or "Area under the curve".mp. or AUC.mp. or Calibration.mp. or Indices.mp. or Algorithm.mp. or Multivariable.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] |
|  | 8    | Combination of study type concepts   |
| <b>Population = women with gestational diabetes</b>  |      |  |
|  | 9    | exp diabetes, gestational/   |
|  | 10   | (gestation* adj4 diabet*).ti,ab.   |
|  | 11   | gdm.ti,ab.   |
|  | 12   | (glucose adj4 (pregnan* or gestation* or prenatal* or antenatal* or pre-natal* or ante-natal* or maternal*).ti,ab.   |
|  | 13   | or/9-12  |
| <b>Outcomes = pregnancy complications</b>  |      |  |
| Hypertensive disorders of pregnancy  | 14   | exp Hypertension, Pregnancy-Induced/   |
|  | 15   | ((hypertens* adj3 pregnan*) or gestational hypertens* or pre-eclamp* or preeclamp* or eclamp* or HELLP syndrome).ti,ab.  |
|  | 16   | 14 or 15   |
| Perinatal mortality  | 17   | exp Perinatal Mortality/ or Fetal Mortality/ or Perinatal Death/ or exp Fetal Death/   |
|  | 18   | ((perinatal or neonatal or fetal or intrauterine or intra-uterine) adj (mortalit* or death* or demise or loss)) or stillbirth*).ti,ab.   |
|  | 19   | 17 or 18   |
| Large-for-gestational age (LGA)  | 20   | exp Birth Weight/  |
|  | 21   | ((Large* adj3 gestation*) or LGA or large birth*).ti,ab.   |
|  | 22   | 20 or 21   |

|                           |    |  |
|---------------------------|----|--|
| Perinatal morbidity       | 23 | exp Birth Injuries/ or exp \$Dystocia/ or exp Brachial Plexus Neuropathies/ or exp Obstetric Labor Complications/  |
|                           | 24 | (birth injur* or ((birth or labo?r or obstetric* or perinatal or delivery) adj4 (trauma* or injur* or complication*1)) or (shoulder adj4 dystocia*) or (fracture*1 adj4 (clavic* or humerus or shoulder*1 or arm*1)) or ((neonat* or infant* or erb* or obstetric or brachial) adj5 (palsy or neuropath*)) or nerve palsy or plexus injury).ti,ab. |
|                           | 25 | 23 or 24   |
| Caesarean delivery        | 26 | exp Cesarean Section/  |
|                           | 27 | (c?esar* or (delivery adj abdominal) or c-section).ti,ab.  |
|                           | 28 | 26 or 27   |
| Maternal mortality        | 29 | Maternal Mortality/ or Maternal Death/   |
|                           | 30 | ((maternal or mother* or woman or women or pregnan* or gestation*) adj2 (mortalit* or death* or dies or died)).ti,ab.  |
|                           | 31 | 29 or 30   |
| Induction of labour       | 32 | exp Labor, Induced/  |
|                           | 33 | (induc* adj3 (labo?r or deliver*)).ti,ab.  |
|                           | 34 | 32 or 33   |
| Placental abruption       | 35 | Abruptio Placentae/  |
|                           | 36 | (placenta* adj2 abrupt*).ti,ab.  |
|                           | 37 | 35 or 36   |
| Perineal trauma           | 38 | Episiotomy/  |
|                           | 39 | ((perine* adj2 (trauma or injur* or tear*)) or ((birth or sphincter*) adj (injury or trauma)) or (third-degree adj tear*) or (fourth-degree adj tear*) or episiotom*).ti,ab.   |
|                           | 40 | 38 or 39   |
| Postpartum haemorrhage    | 41 | Postpartum Hemorrhage/   |
|                           | 42 | ((postpartum or post-partum) adj1 h?emorrhage).ti,ab.  |
|                           | 43 | 41 or 42   |
| Neonatal hypoglycaemia    | 44 | hypoglycemia/ and (infan* or neonat* or newborn* or baby or babies).ti,ab.   |
|                           | 45 | ((infan* or neonat* or newborn* or baby or babies) and hypoglyc?em*) or (((infan* or neonat* or newborn* or baby or babies) and low) adj2 (glucose or sugar)).ti,ab.   |
|                           | 46 | 44 or 45   |
| Fetal macrosomia          | 47 | exp Fetal Macrosomia/  |
|                           | 48 | macrosomi*.ti,ab.  |
|                           | 49 | 47 or 48   |
| Small-for-gestational age | 50 | Infant, Small for Gestational Age/   |
|                           | 51 | ((small* adj3 gestation*) or SGA).ti,ab.   |
|                           | 52 | 50 or 51   |
| Low birth weight          | 53 | exp Infant, Low Birth Weight/  |
|                           | 54 | (low-birth-weight or low birthweight*).ti,ab.  |
|                           | 55 | 53 or 54   |

|   |    |  |
|---|----|--|
| Intrauterine growth restriction (IUGR)    | 56 | exp Fetal Growth Retardation/  |
|   | 57 | (fetal growth restrict* or fetal growth retard* or intra-uterine growth retard* or intra-uterine growth restrict* or intrauterine growth retard* or intrauterine growth restrict* or IUGR).ti,ab.                |
|   | 58 | 56 or 57   |
| Preterm delivery or premature birth       | 59 | exp Obstetric Labor, Premature/ or exp infant, premature/  |
|   | 60 | ((pre-term* or preterm* or premature) adj birth*) or premat*).ti,ab.   |
|   | 61 | 59 or 60   |
| Admission to neonatal intensive care unit | 62 | Intensive Care, Neonatal/ or Intensive Care Units, Neonatal/   |
|   | 63 | ((neonatal or newborn*) adj1 (intensive or unit* or ICU*)) or ((neonatal or special) adj2 nursery) or NICU).ti,ab.   |
|   | 64 | 62 or 63   |
| Neonatal respiratory distress syndrome    | 65 | Respiratory Distress Syndrome, Newborn/  |
|   | 66 | ((infan* or neonat* or newborn* or baby or babies) and (respiratory distress or dyspn?ea or cyanosis or RDS)).ti,ab.   |
|   | 67 | 65 or 66   |
| Neonatal jaundice                         | 68 | exp Hyperbilirubinemia, Neonatal/  |
|   | 69 | ((infan* or neonat* or newborn* or baby or babies) adj5 (hyperbilirubin* or jaundice)).ti,ab.  |
|   | 70 | 68 or 69   |
| Neonatal hypocalcaemia                    | 71 | Hypocalcemia/ and (infan* or neonat* or newborn* or baby or babies).ti,ab.   |
|   | 72 | ((infan* or neonat* or newborn* or baby or babies) and (hypocalc?emi* or (low adj2 calcium))).ti,ab.   |
|   | 73 | 71 or 72   |
| Neonatal adiposity                        | 74 | Pediatric obesity/ and (infan* or neonat* or newborn* or baby or babies).ti,ab.  |
|   | 75 | ((infan* or neonat* or newborn* or baby or babies) adj5 (adipos* or skin-fold or skinfold or weight or body mass index or fat or abdominal circumference or obesity or anthropometr*)) or ponderal index).ti,ab. |
|   | 76 | 74 or 75   |
| Postpartum infection                      | 77 | Puerperal Infection/   |
|   | 78 | ((postpartum* or post-partum* or puerper*) and (infect* or sepsi*)).ti,ab.   |
|   | 79 | 77 or 78   |
| Apgar score < seven at 5 minutes          | 80 | Apgar Score/   |
|   | 81 | apgar*.ti,ab.  |
|   | 82 | 80 or 81   |
| Neonatal polycythaemia                    | 83 | Polycythemia/ and (infan* or neonat* or newborn* or baby or babies).ti,ab.   |
|   | 84 | ((infan* or neonat* or newborn* or baby or babies) adj3 polycyth?emia).ti,ab.  |
|   | 85 | 83 or 84   |
| Instrumental delivery                     | 86 | exp Extraction, Obstetrical/ or exp Delivery Obstetric/ or exp Vacuum Extraction, Obstetrical/   |

|   |    |  |
|---|----|--|
|   | 87 | ((obstetric* or instrument* or forcep* or vacuum*) adj2 (deliver* or extraction*)).ti,ab.  |
|   | 88 | 86 or 87   |
| 'Pregnancy complications' as a general concept            | 89 | exp Pregnancy Outcome/ or exp Pregnancy Complications/   |
|   | 90 | ((pregnan* or perinatal or obstetric* or labor or birth or neonatal or maternal) adj3 (outcome* or complication* or adverse)).ti,ab.                     |
|   | 91 | 89 or 90   |
| <b>Combination of all pregnancy complication concepts</b> | 92 | 16 or 19 or 22 or 25 or 28 or 31 or 34 or 37 or 40 or 43 or 46 or 49 or 52 or 55 or 58 or 61 or 64 or 67 or 70 or 73 or 76 or 79 or 82 or 85 or 88 or 91 |
| <b>Combination of concepts</b>                            | 93 | 8 and 13 and 92  |
| <b>Human filter</b>                                       | 94 | exp animals/ not humans/   |

**Table S2.** Model development characteristics of models for pregnancy complications in women with gestational diabetes.

| Model  | Presence of Missing Data and Handling  | Selection of Predictors for Inclusion in Modelling             | Modelling Method | Selection of Predictors During Multivariable Modelling  | Shrinkage of Predictor Weights or Regression Coefficients |
|--|--|--|------------------|---|---|
| A risk engine relating maternal glycaemia and body mass index to pregnancy outcomes (McIntyre <i>et al.</i> )[3]                   | Missing data for some independent variables reported but not quantified; participants excluded if missing data for these predictors. | Based on exploratory analyses                                  | LR               | Full-model approach (includes all candidate predictors) | NR  |
| Screening tool for predicting adverse outcomes of GDM (Park <i>et al.</i> )[4]   | NR   | Pre-selection based on unadjusted association with the outcome | LR               | NR  | NR  |
| A risk score based on clinical characteristics of GDM women for the development of preeclampsia (Phaloprakarn and Tangjitgamol)[5] | NR   | Pre-selection based on unadjusted association with the outcome | LR               | NR  | NR  |
| Subgroups at different risks of developing the composite adverse neonatal outcome (Pintaudi <i>et al.</i> )[6]                     | NR   | NR   | RECPAM           | Included in RECPAM method                               | NR  |
| The fetal overgrowth index (Tomlinson <i>et al.</i> )[7]   | Represents < 1% of data for predictors included in the final model; handling not reported.   | Pre-selection based on unadjusted association with the outcome | LR               | Forward stepwise method                                 | NR  |

Abbreviations: LR, logistic regression; NR, not reported; GDM, gestational diabetes; RECPAM, REursive Partitioning and AMalgamation.

**Table S3.** The risk of bias and concern regarding the applicability of the models developed in the five prediction modelling studies using the Prediction model Risk of Bias Assessment Tool.

| Model  | Risk of Bias |            |         |          | Concern Regarding Applicability |            |         | Overall      |                                 |
|--|--------------|------------|---------|----------|---------------------------------|------------|---------|--------------|---------------------------------|
|  | Participants | Predictors | Outcome | Analysis | Participants                    | Predictors | Outcome | Risk of Bias | Concern Regarding Applicability |
| A risk engine relating maternal glycaemia and body mass index to pregnancy outcomes (McIntyre <i>et al.</i> )[3]                   | High         | Low        | Low     | High     | High                            | Low        | Low     | High         | High                            |
| Screening tool for predicting adverse outcomes of GDM (Park <i>et al.</i> )[4]   | High         | Low        | Low     | High     | High                            | Low        | Low     | High         | High                            |
| A risk score based on clinical characteristics of GDM women for the development of preeclampsia (Phaloprakarn and Tangjitgamol)[5] | Low          | Low        | Unclear | High     | Low                             | Low        | Unclear | High         | Unclear                         |
| Subgroups at different risks of developing the composite adverse neonatal outcome (Pintaudi <i>et al.</i> )[6]                     | Low          | Low        | Low     | High     | Low                             | Low        | Low     | High         | Low                             |
| The fetal overgrowth index (Tomlinson <i>et al.</i> )[7]   | Low          | Low        | Low     | High     | Low                             | Low        | Low     | High         | Low                             |

## References

1. Ingui, B.J.; Rogers, M.A.M. Searching for Clinical Prediction Rules in Medline. *J. Am. Med Informatics Assoc.* **2001**, *8*, 391–397, doi:10.1136/jamia.2001.0080391.
2. Geersing, G.J.; Bouwmeester, W.; Zuithoff, P.; Spijker, R.; Leeftang, M.; Moons, K.G. Search Filters for Finding Prognostic and Diagnostic Prediction Studies in Medline to Enhance Systematic Reviews. *PLOS ONE* **2012**, *7*, e32844, doi:10.1371/journal.pone.0032844.
3. McIntyre, H.D.; Gibbons, K.; Lowe, J.; Oats, J.J. Development of a risk engine relating maternal glycemia and body mass index to pregnancy outcomes. *Diabetes Res. Clin. Pr.* **2018**, *139*, 331–338, doi:10.1016/j.diabres.2018.02.036.
4. Park, J.S.; Kim, D.W.; Kwon, J.Y.; Park, Y.W.; Kim, Y.-H.; Cho, H.Y. Development of a Screening Tool for Predicting Adverse Outcomes of Gestational Diabetes Mellitus. *Med.* **2016**, *95*, e2204, doi:10.1097/MD.0000000000002204.
5. Phaloprakarn, C.; Tangjitgamol, S. Risk assessment for preeclampsia in women with gestational diabetes mellitus. *J. Périnat. Med.* **2009**, *37*, 617–621, doi:10.1515/jpm.2009.108.
6. Pintaudi, B.; Fresa, R.; Dalfrà, M.; Dodesini, A.R.; Vitacolonna, E.; Tumminia, A.; Sciacca, L.; Lencioni, C.; Marcone, T.; Lucisano, G., et al. The risk stratification of adverse neonatal outcomes in women with gestational diabetes (STRONG) study. *Acta Diabetol.* **2018**, *55*, 1261–1273, doi:10.1007/s00592-018-1208-x.
7. Tomlinson, T.M.; Mostello, D.J.; Lim, K.-H.; Pritchard, J.S.; Gross, G. Fetal overgrowth in pregnancies complicated by diabetes: development of a clinical prediction index. *Arch. Gynecol. Obstet.* **2018**, *298*, 67–74, doi:10.1007/s00404-018-4758-9.



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