

## **Supplementary Material**

### **Antidiabetic Medication Use during Pregnancy: An International Utilization Study**

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**Supplementary Table S1:** References for guidelines for antidiabetic medication use in pregnancy by country

Country	Reference
<b>Australia</b>	<b>G1</b> The Royal Australian College of General Practitioners and Diabetes Australia (2016) General Practice Management of Type 2 Diabetes: 2016-18. In. RACGP, East Melbourne, Vic.
<b>Denmark</b>	<b>G2</b> Sundhedsstyrelsens Diabetesstyregruppe (2010) Kliniske retningslinier for gestationel diabetes mellitus (GDM). Screening, diagnostik, behandling og kontrol samt follow-up efter fødslen. Available from <a href="http://www.endocrinology.dk/kliniske%20retningslinier%20-%20GDM.pdf">http://www.endocrinology.dk/kliniske%20retningslinier%20-%20GDM.pdf</a> , accessed 2019-07-01  <b>G3</b> Sundhedsstyrelsens Diabetesstyregruppe (2010) Kliniske retningslinier for diabetesbehandling ved graviditet hos kvinder med kendt diabetes (Type 1 og Type 2) før graviditeten. Available from <a href="http://www.endocrinology.dk/kliniske%20retningslinier%20-%20diabetes%20og%20graviditet.pdf">http://www.endocrinology.dk/kliniske%20retningslinier%20-%20diabetes%20og%20graviditet.pdf</a> , accessed 2019-07-01
<b>Finland</b>	<b>G4</b> Working group appointed by the Finnish Medical Society Duodecim and the Finnish Society of Internal Medicine and the Medical Advisory Board of the Finnish Diabetes Society (2018) Current Care Guideline Type 2 Diabetes and Insulin-deficient Diabetes. Available from <a href="http://www.kaypahoito.fi/web/english/guidelineabstracts/guideline?id=ccs00032">http://www.kaypahoito.fi/web/english/guidelineabstracts/guideline?id=ccs00032</a> , accessed 2019-07-01  <b>G5</b> Working group appointed by the Finnish Medical Society Duodecim and the Finnish Society of Internal Medicine and the Medical Advisory Board of the Finnish Diabetes Society (2018) Current Care Guideline Gestational diabetes Available from <a href="http://www.kaypahoito.fi/web/english/guidelineabstracts/guideline?id=ccs00047">http://www.kaypahoito.fi/web/english/guidelineabstracts/guideline?id=ccs00047</a> , accessed 2019-07-01
<b>Iceland</b>	<b>G6</b> Landspítala (2012) Klínískar leiðbeiningar um skimun, greiningu og meðferð sykursýki á meðgöngu, 2012. Available from <a href="https://www.landspitali.is/fagfolk/klínískar-leiðbeiningar/leit-i-klínískum-leiðbeiningum/">https://www.landspitali.is/fagfolk/klínískar-leiðbeiningar/leit-i-klínískum-leiðbeiningum/</a> , accessed 2019-07-01
<b>Norway</b>	<b>G7</b> Helsedirektoratet (2018) Nasjonal faglig retningslinje for diabetes: Svangerskap ved kjent diabetes. Available from <a href="https://helsedirektoratet.no/retningslinjer/diabetes">https://helsedirektoratet.no/retningslinjer/diabetes</a> , accessed 2019-07-01  <b>G8</b> Helsedirektoratet (2018) Nasjonal faglig retningslinje Svangerskapsdiabetes. Available from <a href="https://www.helsedirektoratet.no/retningslinjer/svangerskapsdiabetes">https://www.helsedirektoratet.no/retningslinjer/svangerskapsdiabetes</a> , accessed 2019-07-01
<b>Sweden</b>	<b>G9</b> Socialstyrelsen (2018) Nationella riktlinjer för diabetesvård: Stöd för styrning och ledning. Available from <a href="http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/21113/2018-10-25.pdf">http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/21113/2018-10-25.pdf</a> , accessed 2019-07-01  <b>G10</b> Socialstyrelsen (2015) Gränsvärden för graviditetsdiabetes. stöd för beslut om behandling. Available from <a href="https://www.socialstyrelsen.se/om-socialstyrelsen/pressrum/debattartiklar/socialstyrelsen-foreslar-sankta-gransvar-den-for-graviditetsdiabetes/">https://www.socialstyrelsen.se/om-socialstyrelsen/pressrum/debattartiklar/socialstyrelsen-foreslar-sankta-gransvar-den-for-graviditetsdiabetes/</a> , accessed 2019-07-01
<b>US</b>	<b>G11</b> Society of Maternal-Fetal Medicine (2018) SMFM Statement: Pharmacological treatment of gestational diabetes. Am J Obstet Gynecol 218(5): B2-b4. <a href="https://doi.org/10.1016/j.ajog.2018.01.041">https://doi.org/10.1016/j.ajog.2018.01.041</a>  <b>G12</b> American Diabetes Association (2015) (12) Management of diabetes in pregnancy. Diabetes care 38 Suppl(S77-79. <a href="https://doi.org/10.2337/dc15-S015">https://doi.org/10.2337/dc15-S015</a>

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	<p><b>G13</b> American College of Obstetricians and Gynecologists (2018) ACOG Practice Bulletin No. 190: Gestational Diabetes Mellitus. <i>Obstet Gynecol</i> 131(2): e49-e64. <a href="https://doi.org/10.1097/aog.0000000000002501">https://doi.org/10.1097/aog.0000000000002501</a></p> <p><b>G14</b> American Diabetes Association (2018) 13. Management of Diabetes in Pregnancy: Standards of Medical Care in Diabetes-2018. <i>Diabetes care</i> 41(Suppl 1): S137-s143. <a href="https://doi.org/10.2337/dc18-S013">https://doi.org/10.2337/dc18-S013</a></p>
<b>International</b>	<p><b>G15</b> Hod M, Kapur A, Sacks DA, et al. (2015) The International Federation of Gynecology and Obstetrics (FIGO) Initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. <i>International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics</i> 131 Suppl 3(S173-211. <a href="https://doi.org/10.1016/s0020-7292(15)30007-2">https://doi.org/10.1016/s0020-7292(15)30007-2</a></p>
<b>NICE</b>	<p><b>G16</b> Walker JD (2008) NICE guidance on diabetes in pregnancy: management of diabetes and its complications from preconception to the postnatal period. NICE clinical guideline 63. London, March 2008. <i>Diabet Med</i> 25(9): 1025-1027. <a href="https://doi.org/10.1111/j.1464-5491.2008.02532.x">https://doi.org/10.1111/j.1464-5491.2008.02532.x</a></p>
<b>WHO</b>	<p><b>G17</b> World Health Organization (2014) Diagnostic criteria and classification of hyperglycaemia first detected in pregnancy: a World Health Organization Guideline. <i>Diabetes Res Clin Pract</i> 103(3): 341-363</p>

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**Supplementary Table S2: Details of Data Sources**

Country and years of coverage	General Data Source information	Description of source for pregnancy data	Description of source for antidiabetic medication data
<b>New South Wales, Australia 2006-2012</b>	Administrative and claims data, probabilistically linked data based on name, date of birth, sex and address (link rate 99.4%, link accuracy 98.6%) <sup>1</sup>	<b>NSW Perinatal Data Collection</b> All pregnancies resulting in livebirth, or stillbirth of at least 20 weeks gestation or at least 400 grams birthweight. Restricted to pregnancies among concessional beneficiaries (i.e. women eligible due to low income, chronic illness, or disability), defined as women who had one or more dispensing of any medication in the period between 90 days prior to LMP and delivery, all as concessional beneficiaries. This restriction ensures complete capture of pharmaceutical dispensing (20.3% of births, 2006-2012).	<b>Pharmaceutical Benefits Scheme data (national pharmaceutical dispensing claims data)</b> Subsidized prescription drugs dispensed in outpatient settings and private hospitals.
<b>Denmark 2006-2012</b>	Population health registers linked by personal identity numbers.	<b>Medical Birth Register</b> All pregnancies resulting in the delivery of a live-born infant or stillbirths from week 22 of gestation.	<b>National Prescription Registry</b> All dispensed prescription drugs. Hospital administered drugs not included.
<b>Finland 2006-2016</b>	Population health registers linked by personal identity numbers.	<b>Medical Birth Register</b> All pregnancies resulting in the delivery of a live-born infant or stillbirths from week 22 of gestation.	<b>Register of Reimbursed Drug Purchases and Register of Medical Special Reimbursements</b> All dispensed <u>reimbursed</u> prescription drugs. Hospital administered drugs not included.
<b>Iceland 2006-2012</b>	Population health registers linked by personal identity numbers.	<b>Medical Birth Register</b> All pregnancies resulting in the delivery of a live-born infant or stillbirths from week 22 of gestation.	<b>National Medicines Registry</b> All dispensed prescription drugs. Hospital administered drugs not included.
<b>Norway 2006-2015</b>	Population health registers linked by personal identity numbers.	<b>Medical Birth Register</b> All pregnancies resulting in the delivery of a live-born infant or stillbirths from week 12 of gestation.	<b>Norwegian Prescription Database</b> All dispensed prescription drugs. Hospital administered drugs not included.
<b>Sweden 2006-2015</b>	Population health registers linked by personal identity numbers.	<b>Medical Birth Register</b> All pregnancies resulting in the delivery of a live-born infant or stillbirths from week 28 of gestation or from week 22 of gestation (1-July-2008 - onward).	<b>Prescribed Drug Register</b> All dispensed prescription drugs. Hospital administered drugs not included.
<b>USA, MarketScan 2012-2015</b>	<b>IBM MarketScan® Commercial Claims and Encounters Database</b> <sup>2</sup> Healthcare claims for commercially insured	All pregnancies continuously enrolled in health plan from before pregnancy until after birth.	All dispensed, reimbursed prescription drugs. Hospital administered drugs not included.

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	individuals, enrolled in various employer-sponsored insurance plans. Data linked on a unique enrollment identifier.	Gestational age is estimated based on the presence/absence of an ICD-9 <sup>a</sup> codes for preterm birth. <sup>3</sup>	
<b>USA, MAX 2006-2013</b>	<b>Medicaid Analytic eXtract Database (MAX)</b> <sup>4</sup> Healthcare claims for publicly insured individuals in all fifty states and the District of Columbia. Data linked on a unique enrollment identifier.	All live born pregnancies continuously enrolled in state Medicaid from before pregnancy until after birth. Gestational age is estimated based on the presence/absence of an ICD-9* codes for preterm birth. <sup>3</sup>	All dispensed, reimbursed prescription drugs. Hospital administered drugs not included.

<sup>a</sup>Gestational length nor the date of last menstrual period (LMP) is available in MarketScan or MAX databases. Therefore, LMP was assigned to be 245 days before the infant's date of birth for pregnancies that had maternal or infant ICD-9 codes indicative of preterm delivery (644.0, 644.2, and 765.x) and to be 270 days before the infant's DOB for all other pregnancies.

<sup>5</sup> Reference for Nordic countries

### Supplementary Table 2 References

1. Tran DT, Havard A, Jorm LR (2017) Data cleaning and management protocols for linked perinatal research data: a good practice example from the Smoking MUMS (Maternal Use of Medications and Safety) Study. *BMC Med Res Methodol* 17(1): 97. <https://doi.org/10.1186/s12874-017-0385-6>
2. MacDonald SC CJ, Panchaud A, (2019) Identifying Pregnancies in Insurance Claims Data: Methods and Application to Retinoid Teratogenic Surveillance. *Pharmacoepidemiol Drug Saf* [Accepted] (
3. Margulis AV, Setoguchi S, Mittleman MA, Glynn RJ, Dormuth CR, Hernandez-Diaz S (2013) Algorithms to estimate the beginning of pregnancy in administrative databases. *Pharmacoepidemiol Drug Saf* 22(1): 16-24. <https://doi.org/10.1002/pds.3284>
4. Palmsten K, Huybrechts KF, Mogun H, et al. (2013) Harnessing the Medicaid Analytic eXtract (MAX) to Evaluate Medications in Pregnancy: Design Considerations. *PLoS One* 8(6): e67405. <https://doi.org/10.1371/journal.pone.0067405>
5. Furu K, Wettermark B, Andersen M, Martikainen JE, Almarsdottir AB, Sorensen HT (2010) The Nordic countries as a cohort for pharmacoepidemiological research. *Basic Clin Pharmacol Toxicol* 106(2): 86-94. <https://doi.org/10.1111/j.1742-7843.2009.00494.x>

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**Supplementary Table S3:** Anatomical Therapeutic Chemical (ATC) classification codes for antidiabetic medication

Drug Name	ATC code
Insulin - all	A10A
Insulin – human	A10AB01, A10AC01, A10AD01
Insulin - analogue	A10AB04, A10AB05, A10AB06, A10AD04, A10AD05, A10AE04, A10AE05
Biguanides	A10BA
-metformin	A10BA02
Sulfonylureas	A10BB
-glibenclamide	A10BB01
Thiazolidinediones	A10BG
Combinations of oral blood glucose lowering drugs	A10BD
Alpha glucosidase inhibitors	A10BF
Dipeptidyl peptidase 4 (DPP-4) inhibitors	A10BH
Glucagon-like peptide-1 (GLP-1) analogues	A10BJ
Sodium-glucose co-transporter 2 (SGLT2) inhibitors	A10BK
Other blood glucose lowering drugs	A10BX

**Reference:** WHO Collaborating Centre for Drug Statistics Methodology (2017) ATC Classification Index with DDDs 2018. In, Oslo, Norway.