

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. ICD9 and CPT codes used to identify deliveries and outcomes of interest

Diagnosis	Code	Code type	Description
Delivery	V27.0	ICD9	Single liveborn
	V27.9	ICD9	Unspecified outcome of deliver
	650	ICD9	Normal delivery
Procedure			
Cesarean Section	59510	CPT	Routine obstetric care including antepartum care, cesarean delivery and postpartum care
	59514	CPT	Cesarean only
	59515	CPT	Cesarean only, including postpartum care
	740	ICD9P	Classical c-section
	741	ICD9P	Low cervical c-section
	742	ICD9P	Extraperitoneal c-section
	744	ICD9P	C-section of other specified type
	749	ICD9P	C-section unspecified type
	7499	ICD9P	Other c-section
Vaginal	59400	CPT	Routine obstetric care, vaginal del (w-w/o episiotomy or forceps) and postpartum care
	59409	CPT	Vaginal del only (w-w/o episiotomy or forceps)
	59410	CPT	Vaginal del only + postpartum care
	59412	CPT	External cephalic version
Vaginal after previous cesarean	59610	CPT	Routine obstetric care including antepartum care, cesarean delivery and postpartum care, after previous cesarean delivery
	59612	CPT	Vaginal del only after previous c-section (w-w/o episiotomy or forceps)
	59614	CPT	Vaginal del only after previous c-section (w-w/o episiotomy or forceps) , including postpartum care
	59618	CPT	Routine obstetric care including antepartum care, cesarean delivery and postpartum care, following attempted vaginal del, after previous cesarean delivery
	59620	CPT	Cesarean del only, following attempted vag del after prev c-section
	59622	CPT	Cesarean del only, following attempted vag del after prev c-section; including postpartum care

Diagnosis/Procedure	Code	Code type	Description
Obstetric Trauma	664.2	ICD9	Third-degree perineal laceration
	664.20	ICD9	Third-degree perineal laceration unspecified as to episode of care or not applicable
	664.21	ICD9	Third-degree perineal laceration delivered, with or without mention of antepartum condition
	664.24	ICD9	Third-degree perineal laceration postpartum condition or complication
	664.3	ICD9	Fourth-degree perineal laceration
	664.30	ICD9	Fourth-degree perineal laceration unspecified as to episode of care or not applicable
	664.31	ICD9	Fourth-degree perineal laceration delivered, with or without mention of antepartum condition
	664.34	ICD9	Fourth-degree perineal laceration postpartum condition or complication
	665	ICD9	Other obstetrical trauma
	665.3	ICD9	Laceration of cervix
	665.30	ICD9	Laceration of cervix unspecified as to episode of care or not applicable
	665.31	ICD9	Laceration of cervix delivered, with or without mention of antepartum condition
	665.34	ICD9	Laceration of cervix postpartum condition or complication
	665.4	ICD9	High vaginal laceration
	665.41	ICD9	High vaginal laceration delivered, with or without mention of antepartum condition
	665.44	ICD9	High vaginal laceration postpartum condition or complication
	75	ICD9P	Other obstetric operations
	75.5	ICD9P	Repair of current obstetric laceration of uterus
	75.50	ICD9P	Repair of current obstetric laceration of uterus, not otherwise specified
	75.51	ICD9P	Repair of current obstetric laceration of cervix
	75.52	ICD9P	Repair of current obstetric laceration of corpus uteri

	75.6	ICD9P	Repair of other current obstetric laceration
	75.61	ICD9P	Repair of current obstetric laceration of bladder and urethra
	75.62	ICD9P	Repair of current obstetric laceration of rectum and sphincter ani
	75.69	ICD9P	Repair of other current obstetric laceration
Cesarean	59510	CPT	Routine obstetric care including antepartum care, cesarean delivery and postpartum care
	59514	CPT	Cesarean only
	59515	CPT	Cesarean only, including postpartum care
	740	ICD9P	Classical c-section
	741	ICD9P	Low cervical c-section
	742	ICD9P	Extraperitoneal c-section
	744	ICD9P	C-section of other specified type
	749	ICD9P	C-section unspecified type
	7499	ICD9P	Other c-section
	59618	CPT	Routine obstetric care including antepartum care, cesarean delivery and postpartum care, following attempted vaginal del, after previous cesarean delivery
	59620	CPT	Cesarean del only, following attempted vag del after prev c-section
	59622	CPT	Cesarean del only, following attempted vag del after prev c-section; including postpartum care
NICU admission	99295	CPT	First day of NICU , newborns
	99468	CPT	Critical care code – Initial day
	99477	CPT	Intensive care services- Initial day neonates
Respiratory Distress	770.84	ICD9	Respiratory failure of newborn
	770.87	ICD9	Respiratory arrest of newborn
	770.89	ICD9	Other respiratory problems after birth
	770.9	ICD9	Unspecified respiratory condition of fetus and newborn
Hypo-glycemia	775.6	ICD9	Neonatal Hypoglycemia
	775.0	ICD9	Syndrome of Infant of diabetic mother
Jaundice	36450	CPT	Exchange transfusion blood, newborn

	9983	ICD9P	Phototherapy (bilirubin) light with photometer
	9982	ICD9P	Phototherapy (bilirubin) -uv
	7741	ICD9	Othe jaundice from excessive hemolysis
	7745	ICD9	Perinatal jaundice from other causes
	7746	ICD9	Unspecified fetal and neonatal jaundice
Birth Trauma	653.4	ICD9	Fetopelvic disproportion
	653.41	ICD9	Fetopelvic disproportion delivered, with or without mention of antepartum condition
	653.42	ICD9	Fetopelvic disproportion delivered, with mention of postpartum complication
	653.44	ICD9	Fetopelvic disproportion postpartum condition or complication
	653.5	ICD9	Unusually large fetus causing disproportion
	653.51	ICD9	Unusually large fetus causing disproportion delivered, with or without mention of antepartum condition
	653.52	ICD9	Unusually large fetus causing disproportion delivered, with mention of postpartum complication
	660.4	ICD9	Shoulder (girdle) dystocia
	660.41	ICD9	Shoulder (girdle) dystocia delivered, with or without mention of antepartum condition
	660.42	ICD9	Shoulder (girdle) dystocia delivered, with mention of postpartum complication
	660.44	ICD9	Shoulder (girdle) dystocia postpartum condition or complication
	767	ICD9	Birth trauma
	767.0	ICD9	Subdural and cerebral hemorrhage
	767.1	ICD9	Injuries to scalp
	767.11	ICD9	Epicranial subaponeurotic hemorrhage (massive)
	767.19	ICD9	Other injuries to scalp
	767.2	ICD9	Fracture of clavicle
	767.3	ICD9	Other injuries to skeleton

	767.4	ICD9	Injury to spine and spinal cord
	767.5	ICD9	Facial nerve injury
	767.6	ICD9	Injury to brachial plexus
	767.7	ICD9	Other cranial and peripheral nerve injuries
	767.8	ICD9	Other specified birth trauma
	767.9	ICD9	Birth trauma, unspecified
	959	ICD9	Injury, other and unspecified
	959.0	ICD9	Head, face and neck
	959.01	ICD9	Head injury, unspecified
	959.09	ICD9	Injury of face and neck
	959.1	ICD9	Trunk
	959.11	ICD9	Other injury of chest wall
	959.12	ICD9	Other injury of abdomen
	959.13	ICD9	Fracture of corpus cavernosum penis
	959.14	ICD9	Other injury of external genitals
	959.19	ICD9	Other injury of other sites of trunk
	959.2	ICD9	Shoulder and upper arm
	959.3	ICD9	Elbow, forearm, and wrist
	959.4	ICD9	Hand, except finger
	959.5	ICD9	Finger
	959.6	ICD9	Hip and thigh
	959.7	ICD9	Knee, leg, ankle, and foot
	959.8	ICD9	Other specified sites, including multiple
	959.9	ICD9	Unspecified site
Preterm	765.1	ICD9	Other preterm infants
	765.10	ICD9	Other preterm infants unspecified [weight]
	765.11	ICD9	Other preterm infants

			less than 500 grams
	765.12	ICD9	Other preterm infants 500-749 grams
	765.13	ICD9	Other preterm infants 750-999 grams
	765.14	ICD9	Other preterm infants 1,000-1,249 grams
	765.15	ICD9	Other preterm infants 1,250-1,499 grams
	765.16	ICD9	Other preterm infants 1,500-1,749 grams
	765.17	ICD9	Other preterm infants 1,750-1,999 grams
	765.18	ICD9	Other preterm infants 2,000-2,499 grams
	765.19	ICD9	Other preterm infants 2,500 grams and over
	765.21	ICD9	Less than 24 completed weeks of gestation
	765.22	ICD9	24 weeks of gestation
	765.23	ICD9	25-26 weeks of gestation
	770.84	ICD9	Respiratory failure of newborn
	770.87	ICD9	Respiratory arrest of newborn
	770.89	ICD9	Other respiratory problems after birth
	770.9	ICD9	Unspecified respiratory condition of fetus and newborn
LGA	766.0	ICD9	Exceptionally large baby
	766.1	ICD9	Other heavy for dates infants
	656.6	ICD9	Excessive fetal growth
Infertility Diagnosis			
	V26	ICD9	Procreative management
	V26.8	ICD9	Other specified procreative management
	V26.81	ICD9	Encounter for assisted reproductive fertility procedure cycle

	89252	CPT	Assisted oocyte fertilizatio
	89268	CPT	Insemination of oocytes
	89280	CPT	Assist oocyte fertilization
	89281	CPT	Assist oocyte fertilization
	58310	CPT	Artificial insemination
	58311	CPT	Artfcl insemntn w sperm wshng
	58321	CPT	Artificial insemination
	58322	CPT	Artificial insemination
	58323	CPT	Sperm washing
	58970	CPT	Retrieval of oocyte
	58972	CPT	Culture & fert of oocytes
	58974	CPT	Transfer of embryo
	58976	CPT	Transfer of embryo
	89250	CPT	Cultr oocyte/embryo <4 days
	89251	CPT	Cultr oocyte/embryo <4 days
	89252	CPT	Assisted oocyte fertilizatio
	89253	CPT	Embryo hatching
	89254	CPT	Oocyte identification
	89255	CPT	Prepare embryo for transfer
	89256	CPT	Preparation of cryopreserved
	89257	CPT	Sperm identification
	89268	CPT	Insemination of oocytes
	89272	CPT	Extended culture of oocytes
	89280	CPT	Assist oocyte fertilization
	89281	CPT	Assist oocyte fertilization
	89290	CPT	Biopsy, oocyte polar body
	89291	CPT	Biopsy, oocyte polar body

	89352	CPT	Thawing cryopresrved embryo
	89353	CPT	Thawing cryopresrvd sperm
	89354	CPT	Thaw cryoprsvrd reprod tiss
Covariates			
	278.0X	ICD9	Obesity
	649.1X	ICD9	
	V77.8	ICD9	
	V85.3X	ICD9	
	V85.4	ICD9	
	244.x	ICD9	Hypothyroidism
	704.0x	ICD9	Hyperandrogenism (defined as a code for alopecia , hirsutism or acne
	704.1	ICD9	
	706.0	ICD9	
	706.1	ICD9	
	277.7	ICD9	Metabolic syndrome
	256.4	ICD9	Polycystic ovarian syndrome
	642.40-.43	ICD9	Preeclampsia
	642.50-.53	ICD9	
	642.60-.63	ICD9	
	642.70-.73	ICD9	

eTable 2. Comparison of relative risks and 95% CI between crude and adjusted models with and without obesity as a covariate in the propensity score model used to estimate IPTWs

	No. Events				Crude		IPTW-Adjusted		Excluding obesity from IPTW	
	Glyburide	%	Insulin	%	RR	95%CI	RR	95%CI	RR	95%CI
Obstetric trauma	111	2.2	102	2.4	0.92	0.70,1.20	0.92	0.71, 1.20	0.91	0.70, 1.19
Cesarean	2522	50.6	2201	52.5	0.96	0.93,1.00	0.97	0.93, 1.00	0.97	0.93, 1.01
NICU	509	10.2	302	7.2	1.42	1.24,1.63	1.41	1.23, 1.62	1.39	1.22, 1.60
Respiratory distress	144	2.9	73	1.7	1.66	1.26,2.19	1.63	1.23, 2.15	1.60	1.21, 2.12
Hypoglycemia	95	1.9	55	1.3	1.45	1.05,2.02	1.40	1.00, 1.95	1.43	1.03, 1.99
Jaundice	17	0.3	15	0.4	0.95	0.48,1.91	0.96	0.48, 1.91	0.94	0.47, 1.89
Birth injury	110	2.2	69	1.6	1.34	1.00,1.81	1.35	1.00, 1.82	1.32	0.98, 1.78
Preterm	472	9.5	371	8.9	1.07	0.94,1.22	1.06	0.93, 1.21	1.03	0.90, 1.17
Large for Gestational Age	234	4.7	134	3.2	1.47	1.19,1.81	1.43	1.16, 1.76	1.47	1.19, 1.81

After excluding obesity from the propensity score model used to estimate the IPTW, we observe slight changes in the estimate of effect. For most outcomes the magnitude of the RR is underestimated, except for neonatal hypoglycemia and large for gestational age.

eTable 3. Comparison of the magnitude of the association between obesity and maternal or neonatal outcomes of interest, by treatment groups

	Overall		Glyburide		Insulin	
	RR	95%CI	RR	95%CI	RR	95%CI
Trauma	0.57	0.21, 1.04	0.52	0.23, 1.17	0.66	0.27, 1.60
Cesarean	1.21	1.13, 1.28	1.26	1.16, 1.35	1.16	1.05, 1.28
NICU	1.38	1.13, 1.69	1.23	0.96, 1.59	1.62	1.15, 2.27
RDS	1.80	1.25, 2.61	1.46	0.92, 2.31	2.51	1.36, 4.60
Hypoglycemia	1.80	1.15, 2.80	1.31	0.72, 2.38	2.83	1.44, 5.56
Jaundice	1.49	0.52, 4.23	2.79	0.91, 8.51	-	-
Birth trauma	0.49	0.24, 0.98	0.43	0.18, 1.05	0.58	0.18, 1.83
Preterm	1.14	0.91, 1.41	1.00	0.75, 1.33	1.37	0.99, 1.89
LGA	1.95	1.49, 2.56	1.76	1.26, 2.45	2.24	1.41, 3.54

Overall we observe that neonates from women with gestational diabetes who have a code for obesity are more likely to have adverse neonatal outcomes, when compared to those without the ICD9 code. The risk of obstetric and birth trauma seems to be lower among obese women, which may be related to a higher proportion of women with cesarean section. When comparing women with an obesity code who initiated glyburide versus insulin, we observe differences in the magnitude of the risk of adverse outcomes between treatment groups. The direction of the association is consistent between treatment groups for a given outcome.

eTable 4. Assessment of the effect of changes in coding over time: Comparison of RRs and 95%CIs from different periods (2001-2003, 2004-2006, 2007-2009, 2010-2011). For the latter, period specific IPTWs were estimated to adjust for covariates.

			N	No. Events	Crude		IPTW-Adjusted		
					RR	95%CI	RR	95%CI	
Obstetric trauma	No exclusion	Glyburide	4986	111	0.92	0.70, 1.20	0.92	0.71, 1.20	
		Insulin	4194	102					
	2004-2011	Glyburide	4884	107	1.00	0.75, 1.32	1.00	0.75, 1.33	
		Insulin	3777	83					
	2005-2011	Glyburide	4696	101	1.02	0.76, 1.37	1.02	0.75, 1.37	
		Insulin	3411	72					
	2007-2011	Glyburide	4020	87	1.01	0.72, 1.40	0.99	0.71, 1.39	
		Insulin	2556	55					
Cesarean	No exclusion	Glyburide	4986	2526	0.96	0.93, 1.00	0.97	0.93, 1.00	
		Insulin	4194	2201					
	2004-2011	Glyburide	4884	2476	0.96	0.92, 1.00	0.97	0.93, 1.01	
		Insulin	3777	1987					
	2005-2011	Glyburide	4696	2390	0.96	0.92, 1.00	0.96	0.92, 1.00	
		Insulin	3411	1813					
	2007-2011	Glyburide	4020	2041	0.95	0.90, 0.99	0.96	0.91, 1.00	
		Insulin	2556	1370					
NICU	No exclusion	Glyburide	4986	511	1.42	1.24, 1.63	1.41	1.23, 1.62	
		Insulin	4194	302					
	2004-2011	Glyburide	4884	503	1.37	1.19, 1.57	1.34	1.17, 1.55	
		Insulin	3777	284					
	2005-2011	Glyburide	4696	494	1.36	1.18, 1.57	1.34	1.16, 1.55	
		Insulin	3411	264					

	2007-2011	Glyburide	4020	458	1.30	1.12,	1.51	1.29	1.11,	1.50
		Insulin	2556	224						
Respiratory distress	No exclusion	Glyburide	4986	145	1.66	1.26,	2.19	1.63	1.23,	2.15
		Insulin	4194	73						
	2004-2011	Glyburide	4884	143	1.56	1.18,	2.06	1.50	1.13,	1.99
		Insulin	3777	71						
	2005-2011	Glyburide	4696	140	1.54	1.15,	2.06	1.49	1.11,	2.00
		Insulin	3411	66						
	2007-2011	Glyburide	4020	127	1.39	1.02,	1.89	1.37	1.01,	1.87
		Insulin	2556	58						
Hypoglycemia	No exclusion	Glyburide	4986	95	1.45	1.05,	2.02	1.40	1.00,	1.95
		Insulin	4194	55						
	2004-2011	Glyburide	4884	95	1.39	0.99,	1.93	1.34	0.96,	1.87
		Insulin	3777	53						
	2005-2011	Glyburide	4696	94	1.34	0.95,	1.88	1.30	0.93,	1.83
		Insulin	3411	51						
	2007-2011	Glyburide	4020	88	1.14	0.81,	1.55	1.12	0.79,	1.58
		Insulin	2556	49						
Jaundice	No exclusion	Glyburide	4986	17	0.95	0.48,	1.91	0.96	0.48,	1.91
		Insulin	4194	15						
	2004-2011	Glyburide	4884	17	0.94	0.46,	1.90	0.94	0.46,	1.91
		Insulin	3777	14						
	2005-2011	Glyburide	4696	17	0.95	0.46,	1.95	0.95	0.46,	1.95
		Insulin	3411	13						
	2007-2011	Glyburide	4020	17	0.83	0.40,	1.71	0.83	0.40,	1.71
		Insulin	2556	13						

Birth injury	No exclusion	Glyburide	4986	111	1.34	1.00,	1.81	1.35	1.00,	1.82
		Insulin	4194	69						
	2004-2011	Glyburide	4884	111	1.32	0.98,	1.79	1.32	0.98,	1.80
		Insulin	3777	65						
	2005-2011	Glyburide	4696	104	1.30	0.95,	1.79	1.31	0.95,	1.81
		Insulin	3411	58						
	2007-2011	Glyburide	4020	90	1.17	0.83,	1.65	1.16	0.82,	1.64
		Insulin	2556	49						
Preterm	No exclusion	Glyburide	4986	474	1.07	0.94,	1.22	1.06	0.93,	1.21
		Insulin	4194	371						
	2004-2011	Glyburide	4884	463	1.08	0.95,	1.24	1.04	0.91,	1.19
		Insulin	3777	331						
	2005-2011	Glyburide	4696	442	1.06	0.92,	1.22	1.03	0.89,	1.18
		Insulin	3411	303						
	2007-2011	Glyburide	4020	391	1.09	0.93,	1.27	1.06	0.91,	1.24
		Insulin	2556	228						
Large for Gestational Age	No exclusion	Glyburide	4986	234	1.47	1.19,	1.81	1.43	1.16,	1.76
		Insulin	4194	134						
	2004-2011	Glyburide	4884	228	1.39	1.12,	1.72	1.36	1.10,	1.68
		Insulin	3777	127						
	2005-2011	Glyburide	4696	221	1.34	1.08,	1.66	1.31	1.05,	1.63
		Insulin	3411	120						
	2007-2011	Glyburide	4020	200	1.32	1.04,	1.68	1.30	1.02,	1.65
		Insulin	2556	96						

Because use of ICD 9 codes could have changed over the 11 year period we assessed changes in the adjusted RR estimates by selected calendar periods. For all outcomes we observe widening of the confidence intervals with the exclusion of the earlier years, mostly due to reduction in sample size. Although the magnitude of effect for the crude and adjusted RRs decreases when only considering the 2007-2011 years, the direction of the effect remains the same for all outcomes. To account for the effect of calendar year, this variable was included in the propensity score model used to estimate the IPTW in the final model.

eTable 5. Crude relative risks (RR), risk differences (RD) and 95% confidence intervals (CI) for adverse maternal and neonatal outcomes

	No. Events				Crude		Crude	
	Glyburide	%	Insulin	%	RR	95%CI	RD	95%CI
Obstetric trauma	111	2.2	102	2.4	0.92	0.70,1.20	-0.20	-0.83, 0.42
Cesarean	2522	50.6	2201	52.5	0.96	0.93,1.00	-1.82	-3.88, 0.23
NICU	509	10.2	302	7.2	1.42	1.24,1.63	3.02	1.87, 4.17
Respiratory distress	144	2.9	73	1.7	1.66	1.26,2.19	1.15	0.54, 1.76
Hypoglycemia	95	1.9	55	1.3	1.45	1.05,2.02	0.60	0.08, 1.11
Jaundice	17	0.3	15	0.4	0.95	0.48,1.91	-0.02	-0.26, 0.23
Birth injury	110	2.2	69	1.6	1.34	1.00,1.81	0.56	0.00, 1.12
Preterm	472	9.5	371	8.9	1.07	0.94,1.22	0.63	-0.56, 1.81
Large for Gestational Age	234	4.7	134	3.2	1.47	1.19,1.81	1.50	0.71, 2.30

eTable 6. Women with laboratory test results, by drug class

	Glyburide (N=4,982)	%	Insulin (N=4,191)	%
Screening	155	2.1	88	3.1
Fasting	137	1.5	61	2.7
One hour	134	1.4	60	2.7
Two hour	139	1.5	61	2.8

eTable 7. Descriptive statistics of results for glucose tests in women with laboratory results, by drug class

	Mean (SD)	
	Glyburide	Insulin
Screening	168.8 (32.9)	173.1 (39.6)
Fasting	92.2 (11.5)	92.5 (13.8)
One- hour	195.2 (26.2)	194.6 (28.4)
Two- hour	175.3 (28.1)	174.3 (30.3)

eAppendix 1. Sensitivity Analysis

To evaluate the effect of residual confounding by maternal obesity, we conducted the following sensitivity analyses: 1) we compared estimates obtained from propensity score models that adjusted for all covariates except obesity versus the fully adjusted model (eTable 2); 2) we explored the association between obesity and outcomes of interest, by modeling outcomes as a function of obesity. We also estimated the association by treatment group to explore important differences between the groups (eTable 3); 3) to assess the effect of changes in coding over time, we compared RRs and 95% CIs from different periods (2001-2003, 2004-2006, 2007-2009, 2010-2011) (eTable 4). For the latter, period specific IPTWs were estimated to adjust for covariates.

eAppendix 2. Laboratory Values: Glucose Test Results

Laboratory data from Truven Health MarketScan® Lab Database was available for a small proportion (n=243, 2.6%) of the cohort. To assess whether glucose levels at the time of GDM diagnosis could influence choice of medication, we compared the distribution of screening, fasting, 1 and 2 hour post-test glucose values between treatment groups. No differences were observed between drug classes. These results should be interpreted with caution since lab values were available for only a small proportion of women, and these women differed from the full cohort in their covariate distribution. Potentially glucose values at time of initiation are stronger predictors of drug class at initiation.