

## Appendix 1. Methodology for Identifying Three Pregnancy Study Cohorts

The approach outlined by Dr. Phibbs and others from collaborative research team at Stanford University (unpublished study design) was applied to develop the three pregnancy study population cohorts for preeclampsia, hypertension, and normal pregnancies with details provided below.

Pregnancies were included in the preeclampsia cohort or hypertension cohort based on ICD-9/10 codes during the pregnancy or delivery period that are detailed below. The normal cohort was generated by first excluding pregnancies with any preeclampsia/eclampsia or hypertension diagnosis codes, and then applying the following inclusion criteria: infant birthweight  $\geq 2500$  grams and gestational age at birth between 37-42 weeks. Exclusion criteria for the normal pregnancy cohort included: any early delivery indicators (based on ICD-9/10 codes specified in the Joint Commission National Quality Core Measures 2015 <sup>1</sup> for conditions justifying an elective delivery prior to 39 weeks) as well as any congenital malformations, other fetal placental conditions, or maternal drug use (based on the corresponding ICD-9/10 codes listed in the California Maternal Quality Care Collaborative Unexpected Complications in Term Newborns <sup>2,3</sup>).

### Preeclampsia ICD Codes

#### *Preeclampsia ICD-9 Codes*

642.40	Mild or unspecified pre-eclampsia, unspecified as to episode of care or not applicable
642.41	Mild or unspecified pre-eclampsia, delivered, with or without mention of antepartum condition
642.42	Mild or unspecified pre-eclampsia, delivered, with mention of postpartum complication
642.43	Mild or unspecified pre-eclampsia, antepartum condition or complication

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642.44	Mild or unspecified pre-eclampsia, postpartum condition or complication
642.50	Severe pre-eclampsia, unspecified as to episode of care or not applicable
642.51	Severe pre-eclampsia, delivered, with or without mention of antepartum condition
642.52	Severe pre-eclampsia, delivered, with mention of postpartum complication
642.53	Severe pre-eclampsia, antepartum condition or complication
642.54	Severe pre-eclampsia, postpartum condition or complication
642.60	Eclampsia, unspecified as to episode of care or not applicable
642.61	Eclampsia, delivered, with or without mention of antepartum condition
642.62	Eclampsia, delivered, with mention of postpartum complication
642.63	Eclampsia, antepartum condition or complication
642.64	Eclampsia, postpartum condition or complication
642.70	Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, unspecified as to episode of care or not applicable
642.71	Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, delivered, with or without mention of antepartum condition
642.72	Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, delivered, with mention of postpartum complication
642.73	Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, antepartum condition or complication
642.74	Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, postpartum condition or complication

#### Preeclampsia ICD-10 Codes

O14.00	Mild to moderate pre-eclampsia, unspecified trimester
O14.90	Unspecified pre-eclampsia, unspecified trimester
O14.02	Mild to moderate pre-eclampsia, second trimester
O14.03	Mild to moderate pre-eclampsia, third trimester
O14.04	Mild to moderate pre-eclampsia, complicating childbirth
O14.92	Unspecified pre-eclampsia, second trimester
O14.93	Unspecified pre-eclampsia, third trimester
O14.94	Unspecified pre-eclampsia, complicating childbirth
O14.02	Mild to moderate pre-eclampsia, second trimester
O14.03	Mild to moderate pre-eclampsia, third trimester
O14.05	Mild to moderate pre-eclampsia, complicating the puerperium
O14.95	Unspecified pre-eclampsia, complicating the puerperium
O14.02	Mild to moderate pre-eclampsia, second trimester
O14.03	Mild to moderate pre-eclampsia, third trimester
O14.92	Unspecified pre-eclampsia, second trimester
O14.93	Unspecified pre-eclampsia, third trimester
O14.05	Mild to moderate pre-eclampsia, complicating the puerperium

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O14.95	Unspecified pre-eclampsia, complicating the puerperium
O15.2	Eclampsia complicating the puerperium
O14.10	Severe pre-eclampsia, unspecified trimester
O14.20	HELLP syndrome (HELLP), unspecified trimester
O14.12	Severe pre-eclampsia, second trimester
O14.13	Severe pre-eclampsia, third trimester
O14.14	Severe pre-eclampsia complicating childbirth
O14.22	HELLP syndrome (HELLP), second trimester
O14.23	HELLP syndrome (HELLP), third trimester
O14.24	HELLP syndrome, complicating childbirth
O14.12	Severe pre-eclampsia, second trimester
O14.13	Severe pre-eclampsia, third trimester
O14.15	Severe pre-eclampsia, complicating the puerperium
O14.22	HELLP syndrome (HELLP), second trimester
O14.23	HELLP syndrome (HELLP), third trimester
O14.25	HELLP syndrome, complicating the puerperium
O14.12	Severe pre-eclampsia, second trimester
O14.13	Severe pre-eclampsia, third trimester
O14.22	HELLP syndrome (HELLP), second trimester
O14.23	HELLP syndrome (HELLP), third trimester
O14.12	Severe pre-eclampsia, second trimester
O14.13	Severe pre-eclampsia, third trimester
O14.15	Severe pre-eclampsia, complicating the puerperium
O14.22	HELLP syndrome (HELLP), second trimester
O14.23	HELLP syndrome (HELLP), third trimester
O14.25	HELLP syndrome, complicating the puerperium
O15.9	Eclampsia, unspecified as to time period
O15.00	Eclampsia complicating pregnancy, unspecified trimester
O15.02	Eclampsia complicating pregnancy, second trimester
O15.03	Eclampsia complicating pregnancy, third trimester
O15.1	Eclampsia complicating labor
O15.2	Eclampsia complicating the puerperium
O15.02	Eclampsia complicating pregnancy, second trimester
O15.03	Eclampsia complicating pregnancy, third trimester
O15.2	Eclampsia complicating the puerperium
O11.9	Pre-existing hypertension with pre-eclampsia, unspecified trimester
O11.1	Pre-existing hypertension with pre-eclampsia, first trimester
O11.2	Pre-existing hypertension with pre-eclampsia, second trimester
O11.3	Pre-existing hypertension with pre-eclampsia, third trimester
O11.4	Pre-existing hypertension with pre-eclampsia, complicating childbirth
O11.4	Pre-existing hypertension with pre-eclampsia, complicating childbirth
O11.1	Pre-existing hypertension with pre-eclampsia, first trimester

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O11.2	Pre-existing hypertension with pre-eclampsia, second trimester
O11.3	Pre-existing hypertension with pre-eclampsia, third trimester
O11.5	Pre-existing hypertension with pre-eclampsia, complicating the puerperium

## Hypertension ICD Codes

### Hypertension ICD-9 Codes

642.00	Benign essential hypertension complicating pregnancy, childbirth, and the puerperium, unspecified as to episode of care or not applicable
642.01	Benign essential hypertension complicating pregnancy, childbirth, and the puerperium, delivered, with or without mention of antepartum condition
642.02	Benign essential hypertension, complicating pregnancy, childbirth, and the puerperium, delivered, with mention of postpartum complication
642.03	Benign essential hypertension complicating pregnancy, childbirth, and the puerperium, antepartum condition or complication
642.04	Benign essential hypertension complicating pregnancy, childbirth, and the puerperium, postpartum condition or complication
642.10	Hypertension secondary to renal disease, complicating pregnancy, childbirth, and the puerperium, unspecified as to episode of care or not applicable
642.11	Hypertension secondary to renal disease, complicating pregnancy, childbirth, and the puerperium, delivered, with or without mention of antepartum condition
642.12	Hypertension secondary to renal disease, complicating pregnancy, childbirth, and the puerperium, delivered, with mention of postpartum complication
642.13	Hypertension secondary to renal disease, complicating pregnancy, childbirth, and the puerperium, antepartum condition or complication
642.14	Hypertension secondary to renal disease, complicating pregnancy, childbirth, and the puerperium, postpartum condition or complication
642.20	Other pre-existing hypertension complicating pregnancy, childbirth, and the puerperium, unspecified as to episode of care or not applicable
642.21	Other pre-existing hypertension, complicating pregnancy, childbirth, and the puerperium, delivered, with or without mention of antepartum condition
642.22	Other pre-existing hypertension, complicating pregnancy, childbirth, and the puerperium, delivered, with mention of postpartum complication
642.23	Other pre-existing hypertension, complicating pregnancy, childbirth, and the puerperium, antepartum condition or complication
642.24	Other pre-existing hypertension, complicating pregnancy, childbirth, and the puerperium, , postpartum condition or complication

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642.30	Transient hypertension of pregnancy, unspecified as to episode of care or not applicable
642.31	Transient hypertension of pregnancy, delivered , with or without mention of antepartum condition
642.32	Transient hypertension of pregnancy, delivered, with mention of postpartum complication
642.33	Transient hypertension of pregnancy, antepartum condition or complication
642.34	Transient hypertension of pregnancy, postpartum condition or complication
642.90	Unspecified hypertension complicating pregnancy, childbirth, or the puerperium, unspecified as to episode of care or not applicable
642.91	Unspecified hypertension,complicating pregnancy, childbirth, or the puerperium, delivered, with or without mention of antepartum condition
642.92	Unspecified hypertension, complicating pregnancy, childbirth, or the puerperium, delivered, with mention of postpartum complication
642.93	Unspecified hypertension complicating pregnancy, childbirth, or the puerperium, antepartum condition or complication
642.94	Unspecified hypertension complicating pregnancy, childbirth, or the puerperium, postpartum condition or complication

#### Hypertension ICD-10 Codes

O10.019	Pre-existing essential hypertension complicating pregnancy, unspecified trimester
O10.919	Unspecified pre-existing hypertension complicating pregnancy, unspecified trimester
O10.011	Pre-existing essential hypertension complicating pregnancy, first trimester
O10.012	Pre-existing essential hypertension complicating pregnancy, second trimester
O10.013	Pre-existing essential hypertension complicating pregnancy, third trimester
O10.02	Pre-existing essential hypertension complicating childbirth
O10.911	Unspecified pre-existing hypertension complicating pregnancy, first trimester
O10.912	Unspecified pre-existing hypertension complicating pregnancy, second trimester
O10.913	Unspecified pre-existing hypertension complicating pregnancy, third trimester
O10.92	Unspecified pre-existing hypertension complicating childbirth
O10.03	Pre-existing essential hypertension complicating the puerperium
O10.011	Pre-existing essential hypertension complicating pregnancy, first trimester

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O10.012	Pre-existing essential hypertension complicating pregnancy, second trimester
O10.013	Pre-existing essential hypertension complicating pregnancy, third trimester
O10.911	Unspecified pre-existing hypertension complicating pregnancy, first trimester
O10.912	Unspecified pre-existing hypertension complicating pregnancy, second trimester
O10.913	Unspecified pre-existing hypertension complicating pregnancy, third trimester
O10.03	Pre-existing essential hypertension complicating the puerperium
O10.93	Unspecified pre-existing hypertension complicating the puerperium
O10.419	Pre-existing secondary hypertension complicating pregnancy, unspecified trimester
O10.411	Pre-existing secondary hypertension complicating pregnancy, first trimester
O10.412	Pre-existing secondary hypertension complicating pregnancy, second trimester
O10.413	Pre-existing secondary hypertension complicating pregnancy, third trimester
O10.42	Pre-existing secondary hypertension complicating childbirth
O10.43	Pre-existing secondary hypertension complicating the puerperium
O10.411	Pre-existing secondary hypertension complicating pregnancy, first trimester
O10.412	Pre-existing secondary hypertension complicating pregnancy, second trimester
O10.413	Pre-existing secondary hypertension complicating pregnancy, third trimester
O10.43	Pre-existing secondary hypertension complicating the puerperium
O10.119	Pre-existing hypertensive heart disease complicating pregnancy, unspecified trimester
O10.219	Pre-existing hypertensive chronic kidney disease complicating pregnancy, unspecified trimester
O10.319	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, unspecified trimester
O10.111	Pre-existing hypertensive heart disease complicating pregnancy, first trimester
O10.112	Pre-existing hypertensive heart disease complicating pregnancy, second trimester

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O10.113	Pre-existing hypertensive heart disease complicating pregnancy, third trimester
O10.12	Pre-existing hypertensive heart disease complicating childbirth
O10.211	Pre-existing hypertensive chronic kidney disease complicating pregnancy, first trimester
O10.212	Pre-existing hypertensive chronic kidney disease complicating pregnancy, second trimester
O10.213	Pre-existing hypertensive chronic kidney disease complicating pregnancy, third trimester
O10.22	Pre-existing hypertensive chronic kidney disease complicating childbirth
O10.311	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, first trimester
O10.312	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, second trimester
O10.313	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, third trimester
O10.32	Pre-existing hypertensive heart and chronic kidney disease complicating childbirth
O10.13	Pre-existing hypertensive heart disease complicating the puerperium
O10.111	Pre-existing hypertensive heart disease complicating pregnancy, first trimester
O10.112	Pre-existing hypertensive heart disease complicating pregnancy, second trimester
O10.113	Pre-existing hypertensive heart disease complicating pregnancy, third trimester
O10.211	Pre-existing hypertensive chronic kidney disease complicating pregnancy, first trimester
O10.212	Pre-existing hypertensive chronic kidney disease complicating pregnancy, second trimester
O10.213	Pre-existing hypertensive chronic kidney disease complicating pregnancy, third trimester
O10.311	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, first trimester
O10.312	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, second trimester
O10.313	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, third trimester
O10.13	Pre-existing hypertensive heart disease complicating the puerperium
O10.23	Pre-existing hypertensive chronic kidney disease complicating the puerperium

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O10.33	Pre-existing hypertensive heart and chronic kidney disease complicating the puerperium
O13.9	Gestational [pregnancy-induced] hypertension without significant proteinuria, unspecified trimester
O13.1	Gestational [pregnancy-induced] hypertension without significant proteinuria, first trimester
O13.2	Gestational [pregnancy-induced] hypertension without significant proteinuria, second trimester
O13.3	Gestational [pregnancy-induced] hypertension without significant proteinuria, third trimester
O13.4	Gestational [pregnancy-induced] hypertension without significant proteinuria, complicating childbirth
O16.1	Unspecified maternal hypertension, first trimester
O16.2	Unspecified maternal hypertension, second trimester
O16.3	Unspecified maternal hypertension, third trimester
O13.1	Gestational [pregnancy-induced] hypertension without significant proteinuria, first trimester
O13.2	Gestational [pregnancy-induced] hypertension without significant proteinuria, second trimester
O13.3	Gestational [pregnancy-induced] hypertension without significant proteinuria, third trimester
O13.5	Gestational [pregnancy-induced] hypertension without significant proteinuria, complicating the puerperium
O13.1	Gestational [pregnancy-induced] hypertension without significant proteinuria, first trimester
O13.2	Gestational [pregnancy-induced] hypertension without significant proteinuria, second trimester
O13.3	Gestational [pregnancy-induced] hypertension without significant proteinuria, third trimester
O16.1	Unspecified maternal hypertension, first trimester
O16.2	Unspecified maternal hypertension, second trimester
O16.3	Unspecified maternal hypertension, third trimester
O13.1	Gestational [pregnancy-induced] hypertension without significant proteinuria, first trimester
O13.2	Gestational [pregnancy-induced] hypertension without significant proteinuria, second trimester
O13.3	Gestational [pregnancy-induced] hypertension without significant proteinuria, third trimester
O13.5	Gestational [pregnancy-induced] hypertension without significant proteinuria, complicating the puerperium
O16.9	Unspecified maternal hypertension, unspecified trimester
O16.1	Unspecified maternal hypertension, first trimester
O16.2	Unspecified maternal hypertension, second trimester

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O16.3	Unspecified maternal hypertension, third trimester
O16.4	Unspecified maternal hypertension, complicating childbirth
O16.5	Unspecified maternal hypertension, complicating the puerperium
O16.9	Unspecified maternal hypertension, unspecified trimester
O16.1	Unspecified maternal hypertension, first trimester
O16.2	Unspecified maternal hypertension, second trimester
O16.3	Unspecified maternal hypertension, third trimester
O16.1	Unspecified maternal hypertension, first trimester
O16.2	Unspecified maternal hypertension, second trimester
O16.3	Unspecified maternal hypertension, third trimester
O16.5	Unspecified maternal hypertension, complicating the puerperium

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## **Appendix 2. Methodology for Calculating Prepregnancy Body Mass Index**

### Overview

An advantage of the EHR data is the availability of patient weight and height measurements recorded during clinical encounters, enabling calculation of accurate pre-pregnancy BMI estimates. This availability contrasts with many prior pregnancy-related studies which rely on less accurate self-reported pre-pregnancy weight or height to calculate BMI.

Over three-fourths of the final cohort had either a pre-pregnancy weight recorded in the EHR from a clinical encounter within 6 months of the pregnancy start date (40%) or during the first trimester (37%). The approach used to estimate pre-pregnancy weight and BMI for the remaining 23% is described in the following sections of this appendix. Pregnancy cases with insufficient data to estimate a pre-pregnancy weight were excluded for the following reasons: 1) mother was pregnant within 6 months of the pregnancy start date; and 2) insufficient data to estimate a pre-pregnancy weight (i.e., no weight measurement record available within 6 months of pregnancy start date or during pregnancy).

### Method

Weight and height information available in the EHR is used to calculate an estimated pre-pregnancy BMI for creating an obesity variable using the following approach.

- The height variable is calculated using height measurements recorded in the patient EHR (electronic health record) with the following algorithm.
  1. Use the median of all height measurements taken during pregnancy. If this is not available then,

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2. if age  $\geq 18$  years, use the median of all height measurements taken after patient is 18 years old.

If this is not available, or if patient  $< 18$  years old,

3. use the maximum height measurement.
- Since weight data were not uniformly available for pregnant women, the following algorithm is applied to estimate pre-pregnancy weight using a recorded weight from the EHR.
    1. Use weight recorded within six months prior to the start of pregnancy. If not available then,
    2. use weight recorded during the first trimester of pregnancy. If this is not available then,
    3. use the earliest recorded weight during pregnancy to create a pre-pregnancy weight estimate using the average weight gain by gestational age week (See Adjusting Pregnancy Weight to Pre-Pregnancy Weight Estimate-Second and Third Trimester).

#### Adjusting Pregnancy Weight to Pre-Pregnancy Weight Estimate – Second and Third Trimester

Johnson et al. 2015 estimate mean gestational weight gain in underweight, normal weight, overweight, and obese women based on Body Mass Index (BMI) status using ten years of data (2000 to 2009) from the Pregnancy Risk Assessment Monitoring System (PRAMS) for 124,348 women who delivered live infants in 14 states from geographically distinct regions.<sup>4</sup> Johnson et al.'s estimate of mean gestational weight gain for women with term births (gestation between 37-41 weeks and 6 days) is 31.3 lbs. We subtract the average of first trimester weight gain estimates based on Siega-Riz et al. 1994, Abrams et al. 1995, and Carmichael et al., 1997, which were used

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by the Institute of Medicine to inform assumptions on weight gain in the first trimester for its development of Recommendations for Rates of Weight Gain (in constant lbs/week) in the 2nd and 3rd Trimester.<sup>5-8</sup> We thus assume 27.66 lbs are gained in the second and third trimesters at a constant rate of 0.99 lbs/week. The first available weight measurement recorded during the pregnancy is adjusted by subtracting the estimated cumulative pounds gained by week of pregnancy in order to estimate a pre-pregnancy weight.

### Cumulative Weight Gain by Week in Pregnancy

Assumptions	
	(lbs)      Reference
Mean Gestational Weight Gain	31.3 <sup>4</sup>
Mean Weight Gain (1 <sup>st</sup> trimester)*	3.64 <sup>6-8</sup>
Mean Weight Gain (2 <sup>nd</sup> and 3 <sup>rd</sup> trimesters)	27.66
	(lbs/wk)
Rate of Weight Gain (2 <sup>nd</sup> and 3 <sup>rd</sup> trimesters)**	0.99
Cumulative Weight Gain by Week	
Week	Cumulative Weight Gain (lbs)
13	4.63
14	5.62
15	6.60
16	7.59
17	8.58
18	9.57
19	10.56
20	11.54
21	12.53
22	13.52
23	14.51
24	15.49
25	16.48
26	17.47
27	18.46
28	19.45

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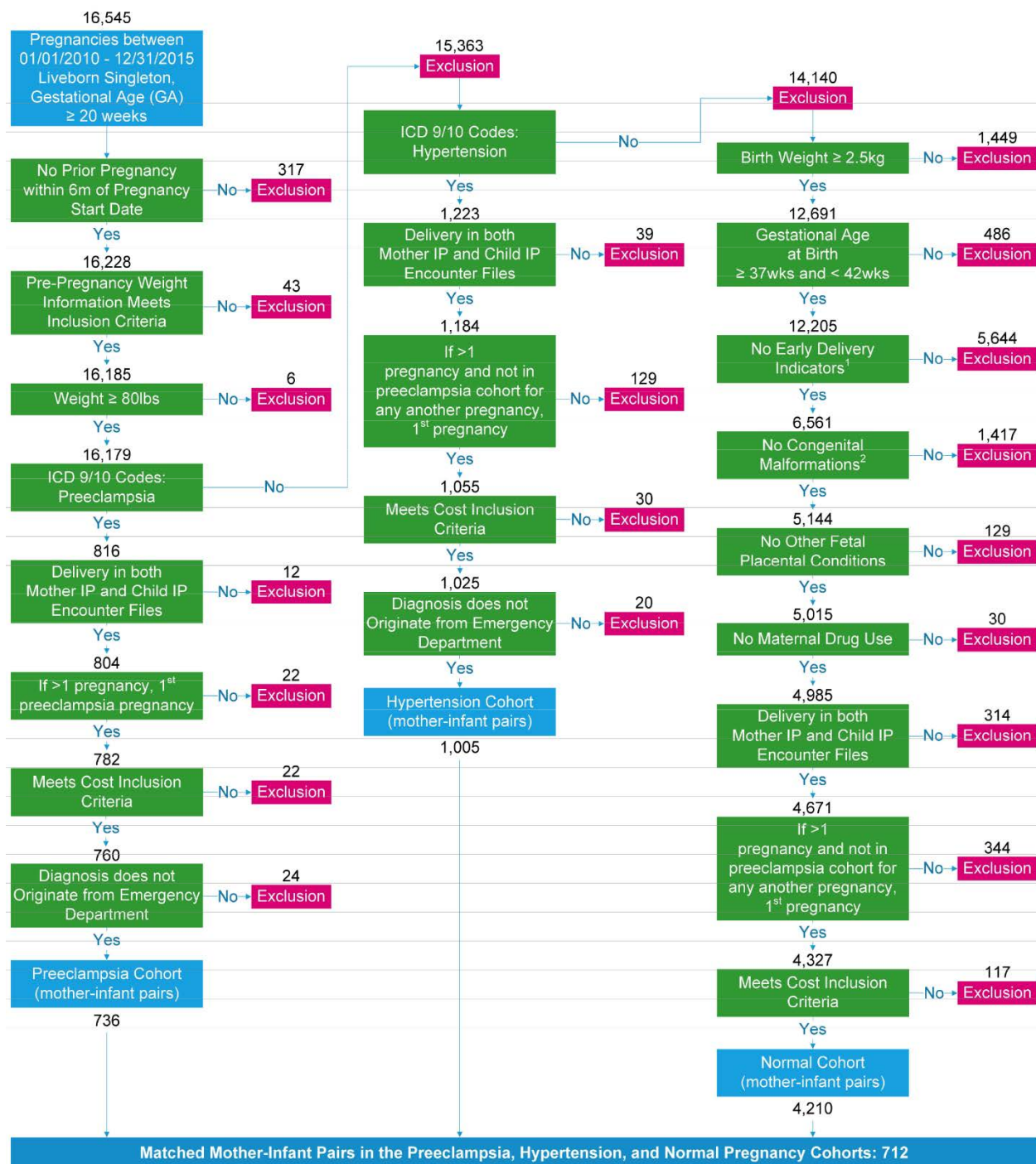
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29	20.43
30	21.42
31	22.41
32	23.40
33	24.39
34	25.37
35	26.36
36	27.35
37	28.34
38	29.32
39	30.31
40	31.30

\* The Institute of Medicine uses Siega-Riz et al., 1994<sup>8</sup>, Abrams et al., 1995<sup>7</sup>, and Carmichael et al., 1997<sup>6</sup> to inform assumptions on weight gain in the first trimester in its Recommendations for Rates of Weight Gain in the 2nd and 3rd Trimester.

\*\* We assume a constant rate of weight gain in the 2nd and 3rd trimesters. The Institute of Medicine uses a constant rate (lbs/week) in its Recommendations for Rates of Weight Gain in the 2nd and 3rd Trimester.

### Appendix 3. Flowchart of Normal, Hypertension and Preeclampsia Pregnancy Cohorts Identification (Maternal-Infant Pairs).



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## Appendix 4. Maternal and Infant Adverse Events ICD Codes

The maternal and infant adverse events included in our analysis were obtained from Stevens et al.,<sup>9</sup> but did not include the less common adverse events. Maternal adverse events in our analysis were thus limited to renal failure, eclamptic seizure, thrombocytopenia, and severe intra- and post-partum haemorrhage (and excluded cerebrovascular and transient ischemic accidents, disseminated intravascular coagulation, myocardial infarction, and death, since they were less common). The infant adverse events in our analysis were limited to fetal distress, respiratory distress syndrome, bronchopulmonary dysplasia, retinopathy of prematurity (stage >3), necrotizing enterocolitis, Bell's (grade >2), intraventricular haemorrhage (stage>3), sepsis, and excluded cystic periventricular leukomalacia and seizures.

### Adverse Maternal Outcomes ICD-9 Codes

	ICD9	ICD9 Stevens Description
Renal failure		
	584.5	Acute renal failure
	584.6	Acute renal failure
	584.7	Acute renal failure
	584.8	Acute renal failure
	584.9	Acute renal failure
	586	Renal failure, unspecified
	593.9	Unspecified disorder of kidney and ureter
	669.30	Acute renal failure following labor and delivery
	669.32	Acute renal failure following labor and delivery
	669.34	Acute renal failure following labor and delivery
Eclamptic seizure		
	780.31	Convulsions
	780.32	Convulsions
	780.33	Convulsions
	780.39	Convulsions
Thrombocytopenia		
	287.30	Primary thrombocytopenia
	287.3	Congenital and hereditary thrombocytopenic purpura
	287.4	Other primary thrombocytopenia
	287.41	Secondary thrombocytopenia
	287.49	Secondary thrombocytopenia
	287.5	Thrombocytopenia, unspecified

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	289.8	Heparin-induced thrombocytopenia
	446.6	Thrombotic microangiopathy
	776.1	Transient neonatal thrombocytopenia
Severe intra- and post-partum hemorrhage		
	666.00	Third-stage hemorrhage
	666.02	Third-stage hemorrhage
	666.04	Third-stage hemorrhage
	666.10	Other immediate postpartum hemorrhage
	666.12	Other immediate postpartum hemorrhage
	666.14	Other immediate postpartum hemorrhage
	666.20	Delayed and secondary postpartum hemorrhage
	666.22	Delayed and secondary postpartum hemorrhage
	666.24	Delayed and secondary postpartum hemorrhage
	641.90	Unspecified antepartum hemorrhage
	641.91	Unspecified antepartum hemorrhage
	641.93	Unspecified antepartum hemorrhage

Data from Stevens W, Shih T, Incerti D, Ton TGN, Lee HC, Peneva D, et al. Short-term costs of preeclampsia to the United States health care system. Am J Obstet Gynecol 2017;217:237–48.

#### Adverse Maternal Outcomes ICD-10 Codes

	ICD10	ICD10 Description
Renal failure		
	N17.0	Acute kidney failure with tubular necrosis
	N17.1	Acute kidney failure with acute cortical necrosis
	N17.2	Acute kidney failure with medullary necrosis
	N17.8	Other acute kidney failure
	N17.9	Acute kidney failure, unspecified
	N19	Unspecified kidney failure
	N28.9	Disorder of kidney and ureter, unspecified
	O90.4	Postpartum acute kidney failure
	O90.4	Postpartum acute kidney failure
	O90.4	Postpartum acute kidney failure
Eclamptic seizure		
	R56.00	Simple febrile convulsions
	R56.01	Complex febrile convulsions
	R56.1	Post traumatic seizures
	R56.9	Unspecified convulsions
Thrombocytopenia		

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	D69.49	Other primary thrombocytopenia
	D69.42	Congenital and hereditary thrombocytopenia purpura
	D69.3	Immune thrombocytopenic purpura
	D69.49	Other primary thrombocytopenia
	D69.51	Posttransfusion purpura
	D69.59	Other secondary thrombocytopenia
	D69.6	Thrombocytopenia, unspecified
	D75.82	Heparin induced thrombocytopenia (HIT)
	M31.1	Thrombotic microangiopathy
	P61.0	Transient neonatal thrombocytopenia
Severe intra- and post-partum hemorrhage		
	O72.0	Third-stage hemorrhage
	O43.211	Placenta accreta, first trimester
	O43.212	Placenta accreta, second trimester
	O43.213	Placenta accreta, third trimester
	O43.221	Placenta increta, first trimester
	O43.222	Placenta increta, second trimester
	O43.223	Placenta increta, third trimester
	O43.231	Placenta percreta, first trimester
	O43.232	Placenta percreta, second trimester
	O43.233	Placenta percreta, third trimester
	O72.0	Third-stage hemorrhage
	O72.0	Third-stage hemorrhage
	O43.211	Placenta accreta, first trimester
	O43.212	Placenta accreta, second trimester
	O43.213	Placenta accreta, third trimester
	O43.221	Placenta increta, first trimester
	O43.222	Placenta increta, second trimester
	O43.223	Placenta increta, third trimester
	O43.231	Placenta percreta, first trimester
	O43.232	Placenta percreta, second trimester
	O43.233	Placenta percreta, third trimester
	O72.0	Third-stage hemorrhage
	O72.0	Third-stage hemorrhage
	O72.1	Other immediate postpartum hemorrhage
	O72.1	Other immediate postpartum hemorrhage
	O72.1	Other immediate postpartum hemorrhage

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	O72.2	Delayed and secondary postpartum hemorrhage
	O72.2	Delayed and secondary postpartum hemorrhage
	O72.2	Delayed and secondary postpartum hemorrhage
	O46.90	Antepartum hemorrhage, unspecified, unspecified trimester
	O46.91	Antepartum hemorrhage, unspecified, first trimester
	O46.92	Antepartum hemorrhage, unspecified, second trimester
	O46.93	Antepartum hemorrhage, unspecified, third trimester
	O67.9	Intrapartum hemorrhage, unspecified
	O46.91	Antepartum hemorrhage, unspecified, first trimester
	O46.92	Antepartum hemorrhage, unspecified, second trimester
	O46.93	Antepartum hemorrhage, unspecified, third trimester

#### Adverse Infant Outcomes ICD-9 Codes

	ICD9	ICD9 Stevens Description
Fetal distress		
	656.80	Other specified fetal and placental problems affecting management of mother
	656.81	Other specified fetal and placental problems affecting management of mother
	656.30	Fetal distress affecting management of mother
	656.31	Fetal distress affecting management of mother
	656.33	Fetal distress affecting management of mother
	768.2	Fetal distress before onset of labor, in liveborn infant
	768.3	Fetal distress first noted during labor and delivery, in liveborn infant
	768.4	Fetal distress, unspecified as to time of onset, in liveborn infant
Respiratory distress syndrome		
	769	Respiratory distress syndrome in newborn
Bronchopulmonary dysplasia		
	770.7	Chronic respiratory disease arising in the perinatal period

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	516.34	Respiratory bronchiolitis interstitial lung disease
	516.69	Other interstitial lung diseases of childhood
	517.8	Lung involvement in other diseases classified elsewhere
	518.89	Other diseases of lung not elsewhere classified
Retinopathy of prematurity, stage >3		
	362.25	Retinopathy of prematurity, stage 3
	362.26	Retinopathy of prematurity, stage 4
	362.27	Retinopathy of prematurity, stage 5
Necrotizing enterocolitis, Bell's grade >2		
	777.52	Stage 3 necrotizing enterocolitis in newborn
	777.53	Stage 3 necrotizing enterocolitis in newborn
Intraventricular hemorrhage, stage>3		
	772.13	Intraventricular hemorrhage, grade 4
	772.14	Intraventricular hemorrhage, grade 4
Sepsis		
	659.30	Generalized infection during labor
	659.31	Generalized infection during labor
	659.33	Generalized infection during labor
	670.20	Puerperal sepsis
	670.22	Puerperal sepsis
	670.24	Puerperal sepsis
	771.81	Septicemia [sepsis] of newborn
	995.91	Sepsis
	995.92	Severe sepsis

Data from Stevens W, Shih T, Incerti D, Ton TGN, Lee HC, Peneva D, et al. Short-term costs of preeclampsia to the United States health care system. Am J Obstet Gynecol 2017;217:237–48.

#### Adverse Infant Outcomes ICD-10 Codes

	ICD10	ICD10 Description
Fetal distress		
	O36.8990	Maternal care for other specified fetal problems, unspecified trimester, not applicable or unspecified
	O68	Labor and delivery complicated by abnormality of fetal acid-base balance
	O77.0	Labor and delivery complicated by meconium in amniotic fluid
	O36.8910	Maternal care for other specified fetal problems, first trimester, not applicable or unspecified
	O36.8920	Maternal care for other specified fetal problems, second trimester, not applicable or unspecified

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	O36.8930	Maternal care for other specified fetal problems, third trimester, not applicable or unspecified
	O68	Labor and delivery complicated by abnormality of fetal acid-base balance
	O77.0	Labor and delivery complicated by meconium in amniotic fluid
	O68	Labor and delivery complicated by abnormality of fetal acid-base balance
	O68	Labor and delivery complicated by abnormality of fetal acid-base balance
	O68	Labor and delivery complicated by abnormality of fetal acid-base balance
	P19.0	Metabolic acidemia in newborn first noted before onset of labor
	P19.1	Metabolic acidemia in newborn first noted during labor
	P19.9	Metabolic acidemia, unspecified
Respiratory distress syndrome		
	P22.0	Respiratory distress syndrome of newborn
Bronchopulmonary dysplasia		
	P27.0	Wilson-Mikity syndrome
	P27.1	Bronchopulmonary dysplasia originating in the perinatal period
	P27.8	Other chronic respiratory diseases originating in the perinatal period
	J84.115	Respiratory bronchiolitis interstitial lung disease
	J84.848	Other interstitial lung diseases of childhood
	J99	Respiratory disorders in diseases classified elsewhere
	J98.4	Other disorders of lung
Retinopathy of prematurity, stage >3		
	H35.149	Retinopathy of prematurity, stage 3, unspecified eye
	H35.159	Retinopathy of prematurity, stage 4, unspecified eye
	H35.169	Retinopathy of prematurity, stage 5, unspecified eye
Necrotizing enterocolitis, Bell's grade >2		
	P77.2	Stage 2 necrotizing enterocolitis in newborn
	P77.3	Stage 3 necrotizing enterocolitis in newborn
Intraventricular hemorrhage, stage>3		
	P52.21	Intraventricular (nontraumatic) hemorrhage, grade 3, of newborn
	P52.22	Intraventricular (nontraumatic) hemorrhage, grade 4, of newborn
Sepsis		

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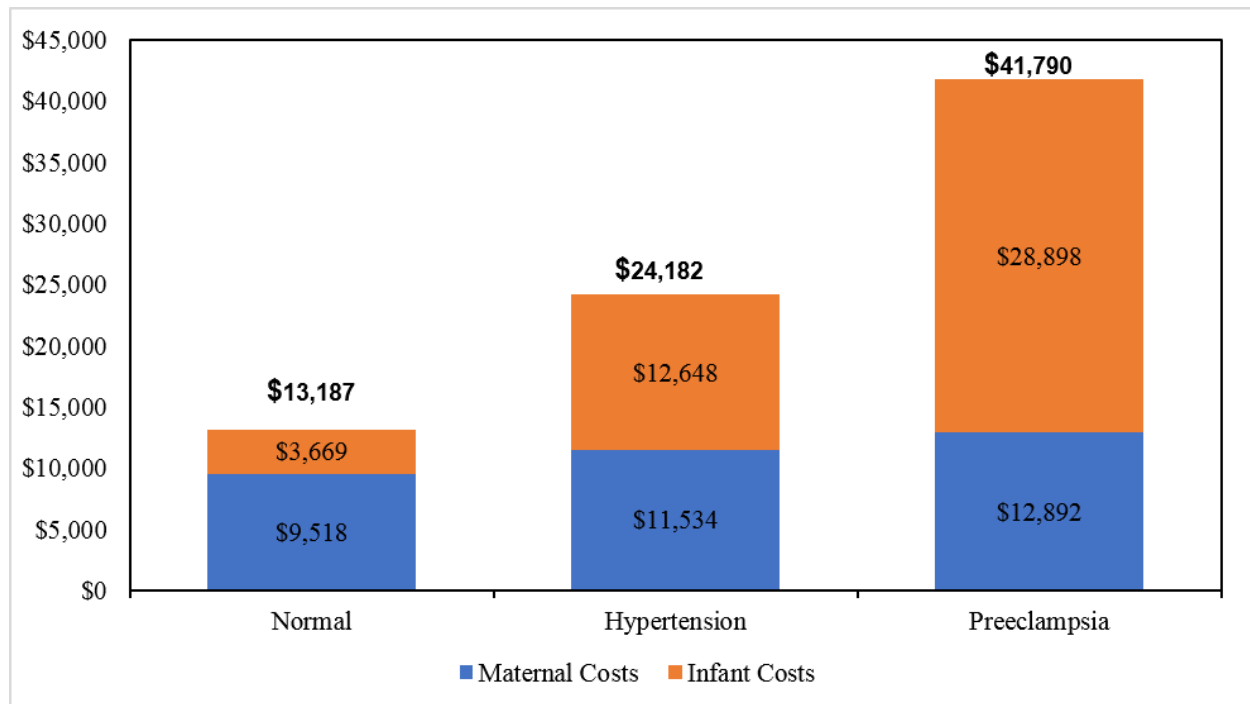
	O75.3	Other infection during labor
	O75.3	Other infection during labor
	O75.3	Other infection during labor
	O85	Puerperal sepsis
	O85	Puerperal sepsis
	O85	Puerperal sepsis
	P36.9	Bacterial sepsis of newborn, unspecified
	A41.9	Sepsis, unspecified organism
	R65.20	Severe sepsis without septic shock

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## Appendix 5. Maternal and Infant Costs by Cohort (2015 USD).

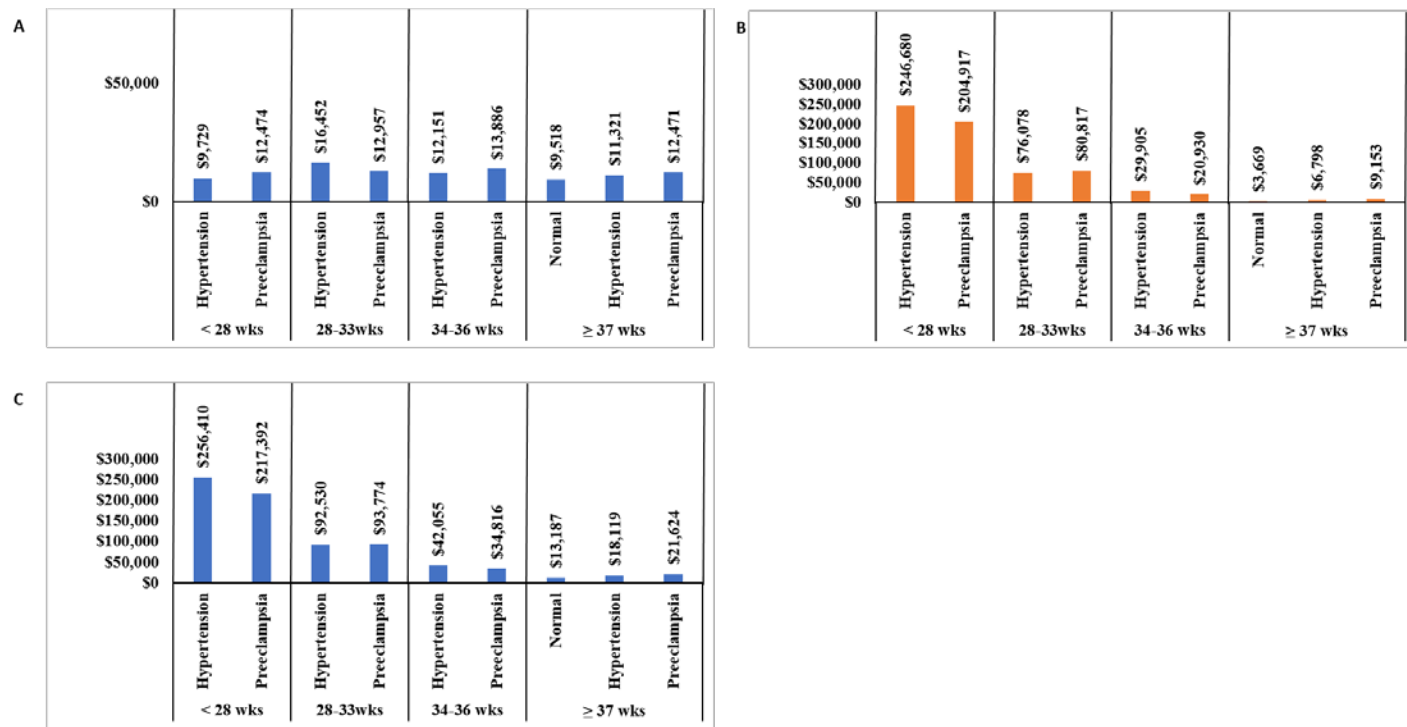


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**Appendix 6. Costs by Cohort by Gestational Week (2015 USD). A. Maternal costs; B. Infant costs; C. Maternal and infant combined costs.**



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## Appendix 7. Maternal, Infant, and Maternal and Infant Costs by Cohort Stratified by Payor (2015 USD)

Cohort	Payer	N (%)	Maternal Costs		Infant Costs		Maternal and Infant Costs	
			Mean	Median	Mean	Median	Mean	Median
<b>Normal</b>	Commercial	360 (50.6)	\$12,934	\$11,369	\$4,882	\$2,569	\$17,816	\$14,921
	Medicaid	331 (46.5)	\$5,929	\$5,630	\$2,432	\$1,841	\$8,360	\$7,825
	Other	21 (3.0)	\$7,528	\$6,885	\$2,377	\$1,577	\$9,906	\$9,330
	Total	712 (100.0)	\$9,518	\$8,142	\$3,669	\$2,176	\$13,187	\$11,166
<b>Hypertension</b>	Commercial	362 (50.8)	\$14,958	\$12,606	\$14,052	\$3,265	\$29,010	\$19,775
	Medicaid	316 (44.4)	\$7,569	\$6,827	\$10,474	\$2,227	\$18,043	\$9,573
	Other	34 (4.8)	\$11,933	\$9,359	\$17,906	\$3,407	\$29,839	\$13,203
	Total	712 (100.0)	\$11,534	\$10,474	\$12,648	\$2,769	\$24,182	\$14,684
<b>Preeclampsia</b>	Commercial	407 (57.2)	\$15,225	\$12,908	\$33,120	\$14,984	\$48,345	\$32,760
	Medicaid	272 (38.2) ‡	\$9,095	\$8,149	\$23,275	\$4,310	\$32,369	\$14,204
	Other	33 (4.6)	\$15,416	\$12,299	\$23,165	\$4,808	\$38,581	\$22,408
	Total	712 (100.0)	\$12,892	\$11,294	\$28,898	\$8,744	\$41,790	\$23,343

‡ Denotes statistically significant differences when comparing the proportion of Medicaid as payor type between the preeclampsia cohort and the normal cohort ( $p=0.003$ ) and between the preeclampsia cohort and the hypertension cohort ( $p=0.036$ ).



## Appendix 8. Maternal and Infant Adverse Events

Cohort	Gestational Week	N	Maternal Adverse Events N (%)	Infant Adverse Events N (%)	Infant Death N (%)	Caesarean Section Delivery N (%)
<b>Normal</b>	< 28	0	0 (.0%)	0 (.0%)	0 (.0%)	
	28-33	0	0 (.0%)	0 (.0%)	0 (.0%)	
	34-36	0	0 (.0%)	0 (.0%)	0 (.0%)	
	≥ 37	712	29 (4.1%)	5 (.7%)	2 (.3%)	211 (29.6%)
	Total	712	29 (4.1%)	5 (.7%)	2 (.3%)	211 (29.6%)
<b>Hypertension</b>	< 28	6	1 (16.7%)	6 (100.0%)	1 (16.7%)	5 (83.3%)
	28-33	24	2 (8.3%)	15 (62.5%)	1 (4.2%)	14 (58.3%)
	34-36	46	6 (13.0%)	5 (10.9%)	0 (.0%)	23 (50.0%)
	≥ 37	636	58 (9.1%)	8 (1.3%)	4 (.6%)	231 (36.3%)
	Total	712	67 (9.4%)	34 (4.8%)	6 (.8%)	273 (38.3%)
<b>Preeclampsia</b>	< 28	19	3 (15.8%)	19 (100.0%)	2 (10.5%)	19 (100.0%)
	28-33	116	22 (19.0%)	61 (52.6%)	0 (.0%)	78 (67.2%)
	34-36	172	25 (14.5%)	14 (8.1%)	2 (1.2%)	82 (47.7%)
	≥ 37	405	49 (12.1%)	10 (2.5%)	1 (.3%)	177 (43.7%)
	Total	712	99 (13.9%) <sup>a</sup>	104 (14.6%) <sup>b</sup>	5 (.7%) <sup>c</sup>	356 (50.0%) <sup>d</sup>

a: There is a statistically significant difference in the frequency of maternal adverse events between the preeclampsia, normal, and hypertension cohorts ( $p<0.001$ ), comparing preeclampsia and normal ( $p<0.0001$ ) and preeclampsia and hypertension ( $p=0.016$ ).

b: There is a statistically significant difference in the frequency of infant adverse events between the preeclampsia, normal, and hypertension cohorts ( $p<0.001$ ), comparing preeclampsia and normal ( $p<0.0001$ ) and preeclampsia and hypertension ( $p<0.001$ ).

c: There is no statistically significant difference in the frequency of infant death between the preeclampsia, normal, and hypertension cohorts ( $p=0.366$ ), comparing preeclampsia with normal ( $p=0.4460$ ) and preeclampsia and hypertension ( $p=0.943$ ).

d: There is a statistically significant difference in the frequency of caesarean section delivery between the preeclampsia, normal, and hypertension cohorts ( $p<0.001$ ), comparing preeclampsia and normal ( $p<0.0001$ ) and preeclampsia and hypertension ( $p<0.001$ ).

Maternal adverse events in our analysis were limited to renal failure, eclamptic seizure, thrombocytopenia, and severe intra- and post-partum haemorrhage. The infant adverse events included fetal distress, respiratory distress syndrome, bronchopulmonary dysplasia, retinopathy of prematurity

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(stage >3), necrotizing enterocolitis, Bell's (grade >2), intraventricular haemorrhage (stage>3), and sepsis.

#### Supplementary Material References

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