Appendix A: Details on Medical Comorbidities and Pregnancy-Related Conditions

Leonard et al. (2020) and Leonard et al. (2022) develop and update an obstetric comorbidity score method for predicting SMM. The updated score uses twenty-seven patient-level risk factors that represent medical comorbidities, comorbidities related to the current pregnancy, previous C-section birth, and maternal age. Differences in pre-existing comorbidities affect the risk of an SMM event occurring, leading these authors to develop the scoring method in order to facilitate comparisons of rates across different patient populations. Following Leonard et al. (2022) we use the relevant ICD-9-CM and ICD-10-CM codes to generate indicators for each of the comorbidities used in their score. Rather than use aggregate scores, we include each condition separately and classify them as either medical comorbidities or pregnancy-related conditions. We repeat the ICD codes used by Leonard et. al (2022) in the table below, noting any changes we made for our purposes. We note that the authors took care to modify the code list over time to generate consistent time series of the comorbidity rates, nonetheless, visible breaks in trends occur for some of the comorbidities at the time of the code change. This issue will not be a problem when we examine the years with hospital IDs, 1998-2011. For models that include the later years, we include an indicator variable for the time periods with the ICD-10 codes to help account for the jump.

Medical Comorbidities (Preexisting or Chronic Conditions)

Comorbidity	Leonard et al. (2022) ICD-9-CM	Leonard et al. (2022) ICD-10-CM	Changes from Leonard et al. (2022)
Anemia, preexisting	280.0, 280.1, 280.9, 285.9, 280.8, 281, 282.0, 282.1, 282.3, 282.40, 282.41, 282.43, 282.44, 282.45, 282.46, 282.47, 282.49, 282.5, 282.60, 282.61, 282.63, 282.68, 282.7, 282.8, 282.9, 284, 285, 648.20, 648.21, 648.22, 628.23	O99.01, O99.02, D50, D55, D56, D58, D59, D57.1, D57.20, D57.3, D57.40, D57.80	
Asthma, acute or moderate-severe	493	O99.5, J45.21, J45.22, J45.31, J45.32, J45.4, J45.5, J45.901, J45.902	
Bleeding disorder, preexisting	286.0–286.5, 286.7 287	D66, D67, D68.0-D68.6, D69	
BMI (kg/m^2) at delivery 40 or greater	278.01	Z68.4, E66.01, E66.2	Definition changed to BMI $\geq$ 30. Codes added: ICD 9: 278.00, 278.01,278.03,649.1,V85.3,V85.4 ICD 10: E66.01, E66.2, E66.9, O99.21x, Z68.30-Z68.39, Z68.4x
Cardiac disease, preexisting	394–397, 402–405, 412–414, 416.2, 416.8, 416.9, 428.22, 428.23, 428.32, 428.33, 428.42, 428.43, 745, 746, 648.5, 648.60-648.63, 426, 427.0–427.4, 427.6–427.9	I05-I09, I11-I13, I15, I16, I20, I25, I27.8, I30-I41, I44-I49, I50.22, I50.23, I50.32, I50.33, I50.42, I50.43, I50.812, I50.813, O99.41, O99.42, Q20-Q24	Delete codes that are used in SMM definition: ICD 9: Delete 428.23, 428.33, 428.43 ICD 10: Delete I46, I49.0x, I50.23 I50.33, I50.43, I50.813
Chronic hypertension	401–405, 642.0–642.2, 642.7	O10, O11, I10	
Chronic renal disease	581–583, 585, 587, 588, 753, 250.4 249.4, 710.0	O26.83, I12, I13, N03-N05, N07, N08, N11.1, N11.8, N11.9, N18, N25.0, N25.1, N25.81, N25.89, N25.9, N26.9	
Connective tissue or autoimmune disease	710, 714, 279.4	M30-M36	
Gastrointestinal disease	539, 555–558, 570–579, 564, 646.7	K50-K52, K70-K77, K80-K83, K85-K87, K94, K95, O26.6	

HIV or AIDS	042, V08	O98.7, B20	
Neuromuscular disease	345, 358	G40, G70	
Preexisting diabetes mellitus	250, 648.0	E08-E13, O24.0, O24.1, O24.3, O24.8, O24.9, Z79.4	
Pulmonary hypertension	416.0, 416.8, 416.9	I27.0, I27.2	
Substance use disorder	291, 303, 304, 305, 648.30, 648.31, 648.32, 648.33	F10-F19, O99.31, O99.32	
Thyrotoxicosis	242	E05	
Uterine fibroids	218, 654.1	D25, O34.1	

Notes: Leonard et al. also include "major mental health disorder", "placenta accreta spectrum", and "maternal age 35 years and older". We exclude mental health disorders because of highly inconsistent trends across the ICD code change as well as the low correlation with SMM. Placenta accreta spectrum is excluded because of ICD-9 coding issues with no exact codes existing. Maternal age is included in the models as part of the maternal characteristics group.

Pregnancy-Related Comorbidities and Conditions

Comorbidity	**Leonard et al. (2022) ICD-9-CM**	**Leonard et al. (2022) ICD-10-CM**	**Changes from Leonard et al. (2022)**
Gestational diabetes mellitus	648.8	O24.4	
Placental abruption	641.2	O45	
Placenta previa, complete or partial	641.01, 641.11	O44.03, O44.13, O44.23, O44.33	
Preeclampsia with severe features	642.5	O14.1, O14.2, O11	ICD 9: Added 642.7
Preeclampsia without severe features or gestational hypertension	642.3, 642.4, 642.7	O13, O14.0, O14.9	ICD 9: Deleted 642.7
Preterm birth (less than 37 weeks)	644.21	Z3A.20-Z3A.36	
Previous cesarean birth	654.2	O34.21	
Twin or multiple pregnancy	651, V27.2-V27.7	O30, O31, Z37.2-Z37.7	ICD 10: Added O63.2

Appendix B: Details on Preventable Hospitalization Ratios

Preventable hospitalization ratios are created based on males only so we can avoid including conditions related to pregnancy and childbirth, which are captured by the dependent variables. The drawback of this approach is that women, and pregnant women in particular, may face different conditions than males. However, we think it is reasonable to assume that inequalities in the health care system affecting males is likely to be highly correlated with inequalities in the healthcare system affecting females of childbearing age.

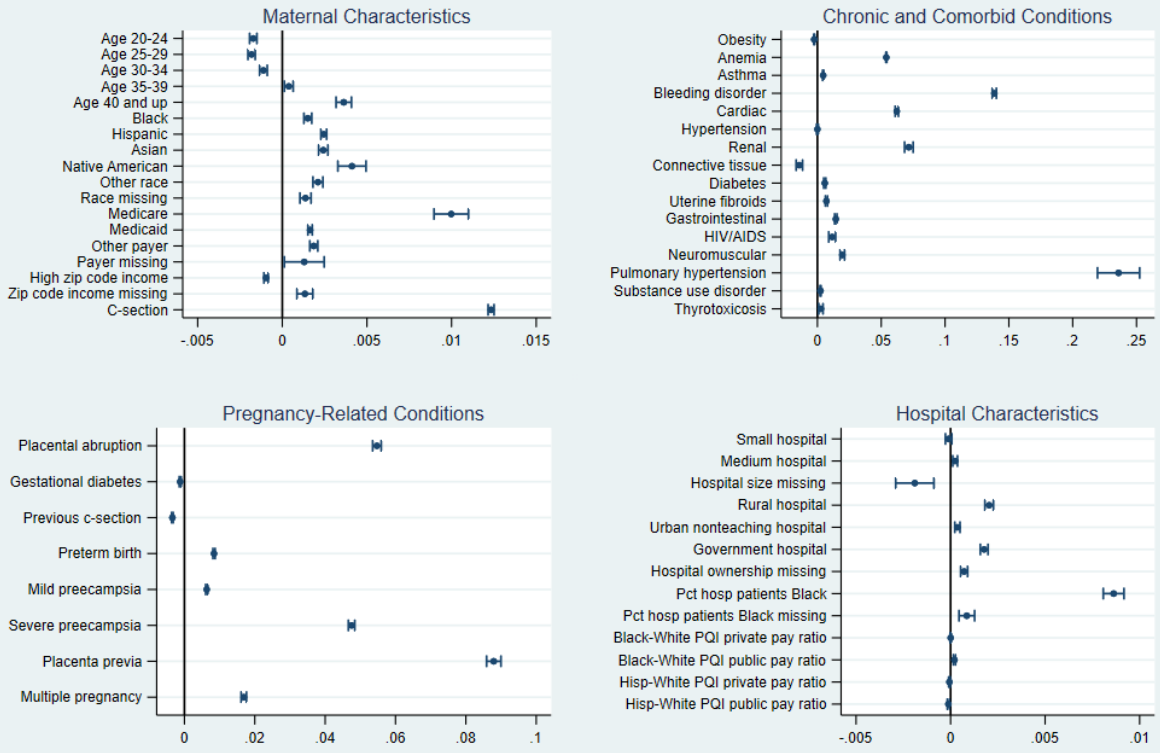
We compute the rate of privately and publicly insured admissions in the hospital in each year for preventable conditions for Blacks, Hispanics and Whites. The list of preventable hospitalizations includes ten quality of care indicators developed by AHRQ (https://qualityindicators.ahrq.gov/Modules/PQI_TechSpec_ICD10_v2021.aspx):

PQI #1 Diabetes Short-Term Complications Admission Rate
PQI #3 Diabetes Long-Term Complications Admission Rate
PQI #5 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate
PQI #7 Hypertension Admission Rate
PQI #8 Heart Failure Admission Rate
PQI #11 Community-Acquired Pneumonia Admission Rate
PQI #12 Urinary Tract Infection Admission Rate
PQI #14 Uncontrolled Diabetes Admission Rate
PQI #15 Asthma in Younger Adults Admission Rate
PQI #16 Lower-Extremity Amputation among Patients with Diabetes Rate

Appendix C: Linear Probability Models

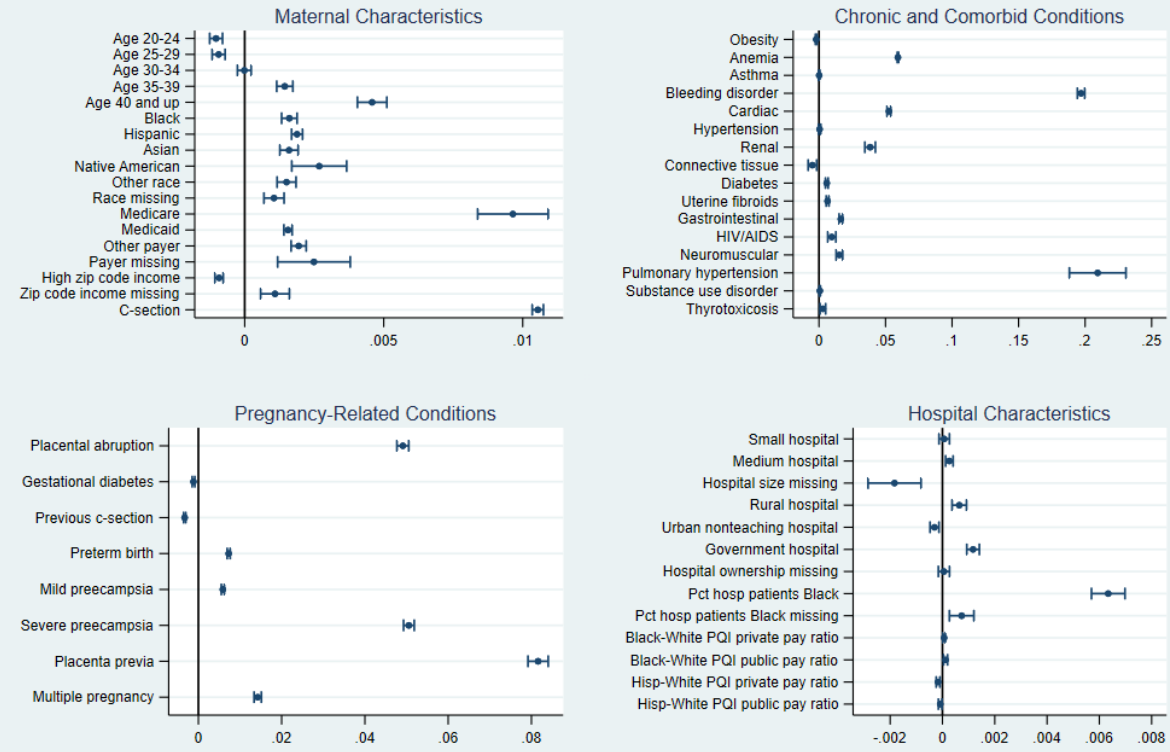
List of figures

Appendix Figure 1: SMM, 1998-2019



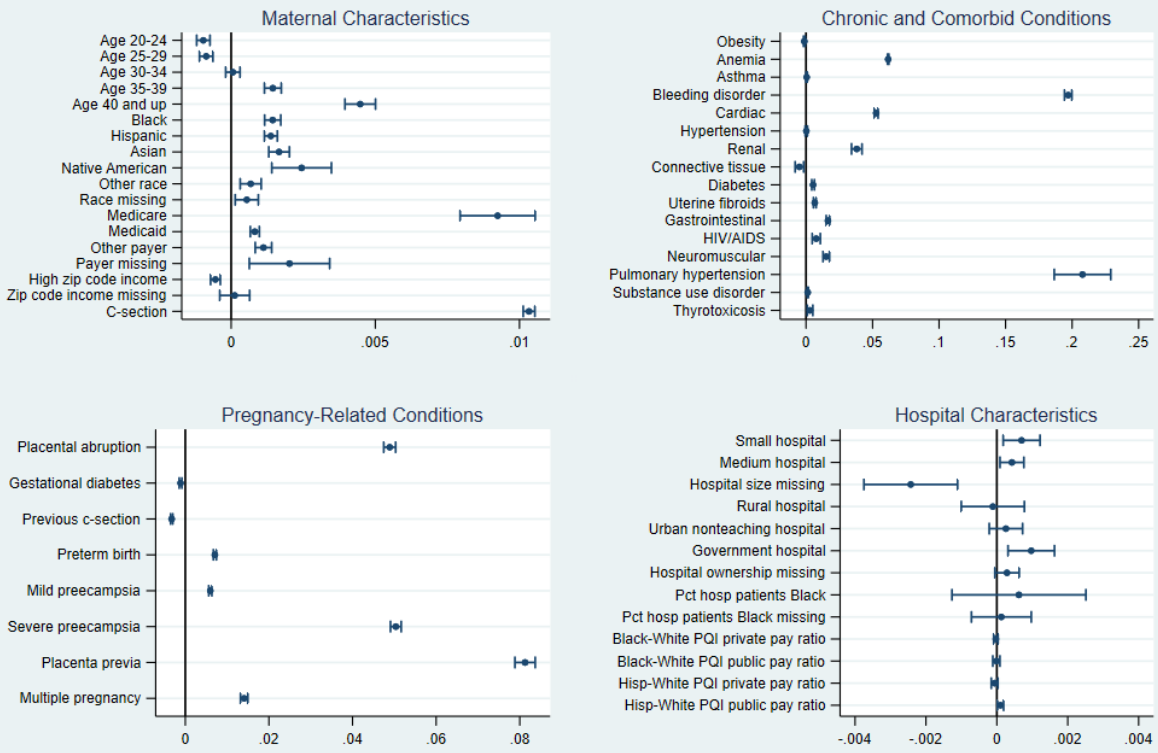
Notes: N=17,648,783. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes indicators for year, census division, ICD-CM-10 in use, and PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 2: SMM, 1998-2011, All Hospitals, Basic Model



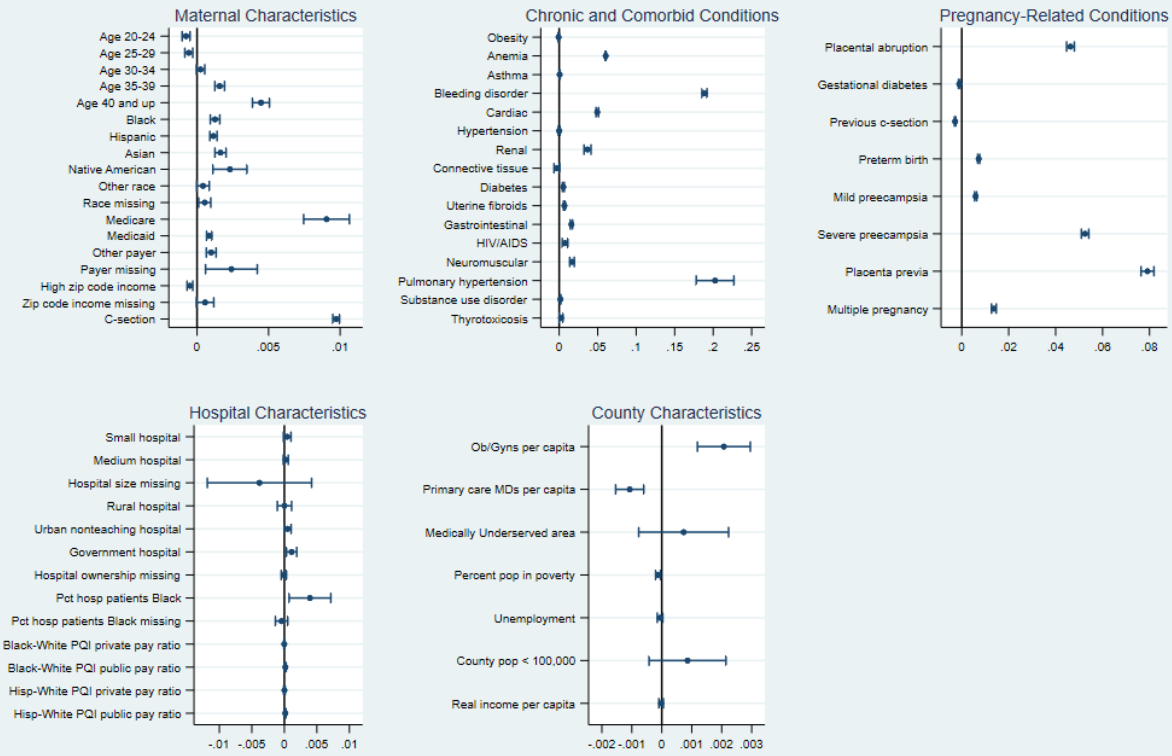
Notes: N=11,683,664. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes indicators for year, census division, and indicators for PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 3: SMM, 1998-2011, All Hospitals, Hospital Fixed Effects Model



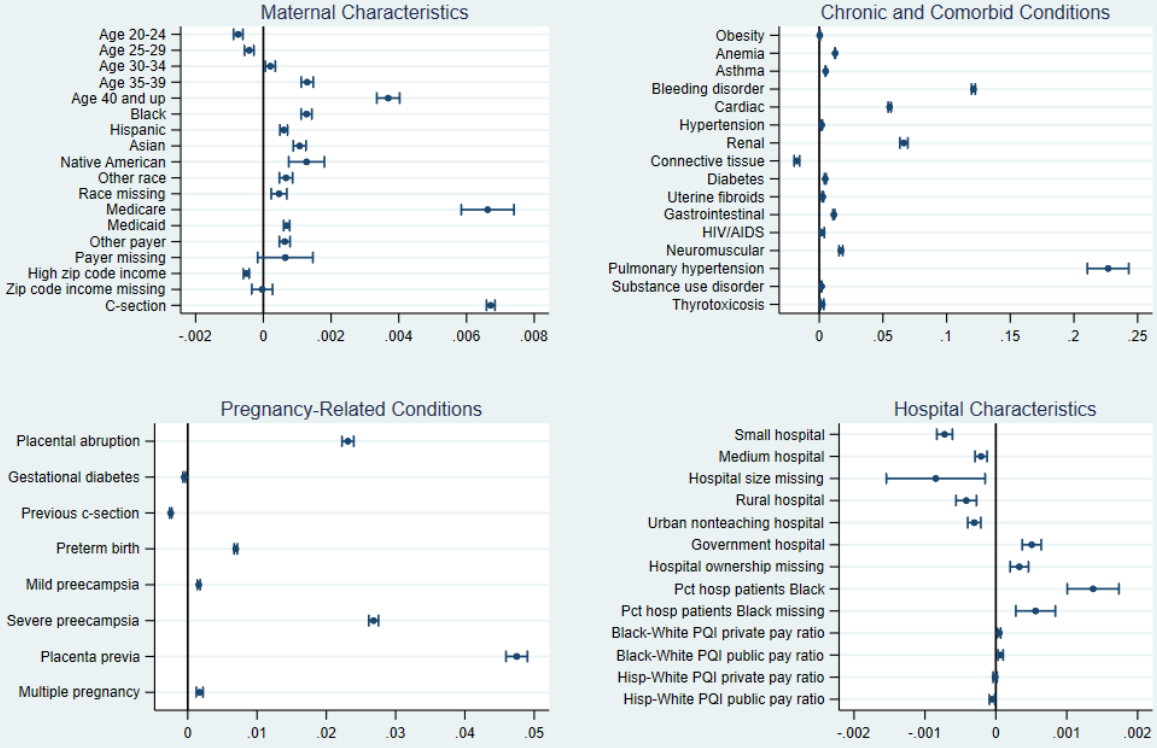
Notes: N=11,683,664. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes hospital fixed effects, indicators for year, and indicators for PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 4: SMM, 1998-2011, Hospitals with County Identifiers



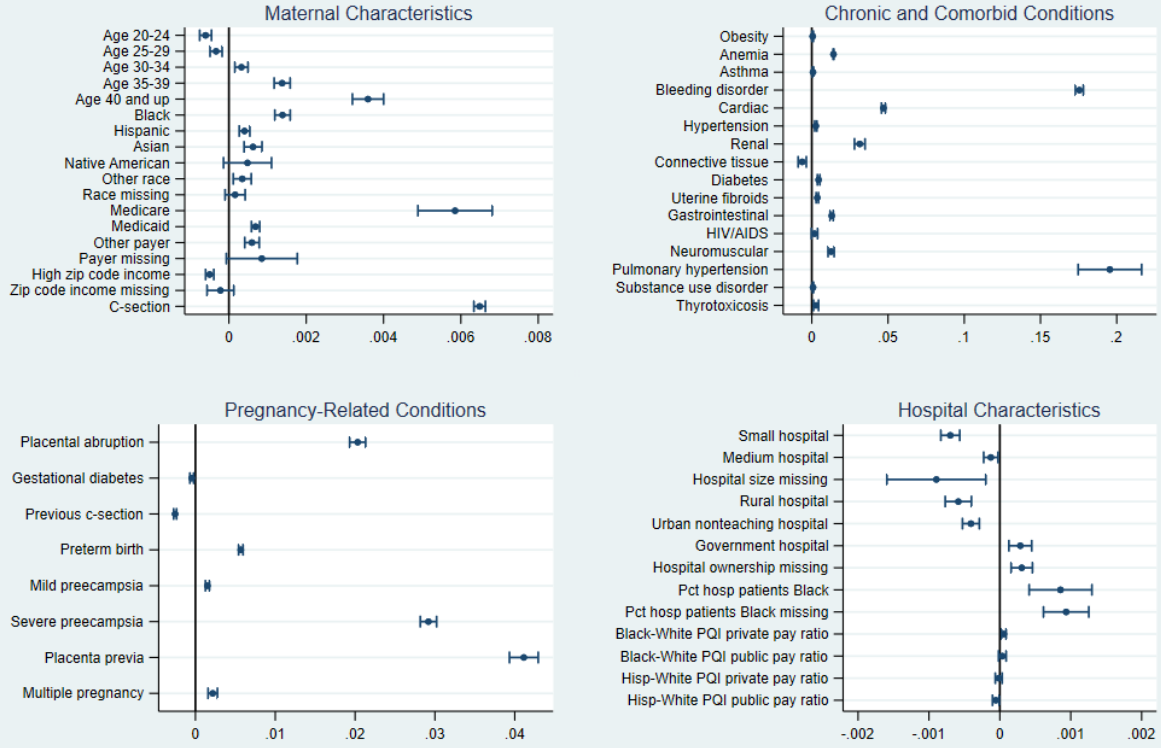
Notes: N=8,393,985. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes hospital fixed effects, indicators for year, and indicators for PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 5: Non-Transfusion SMM, 1998-2019



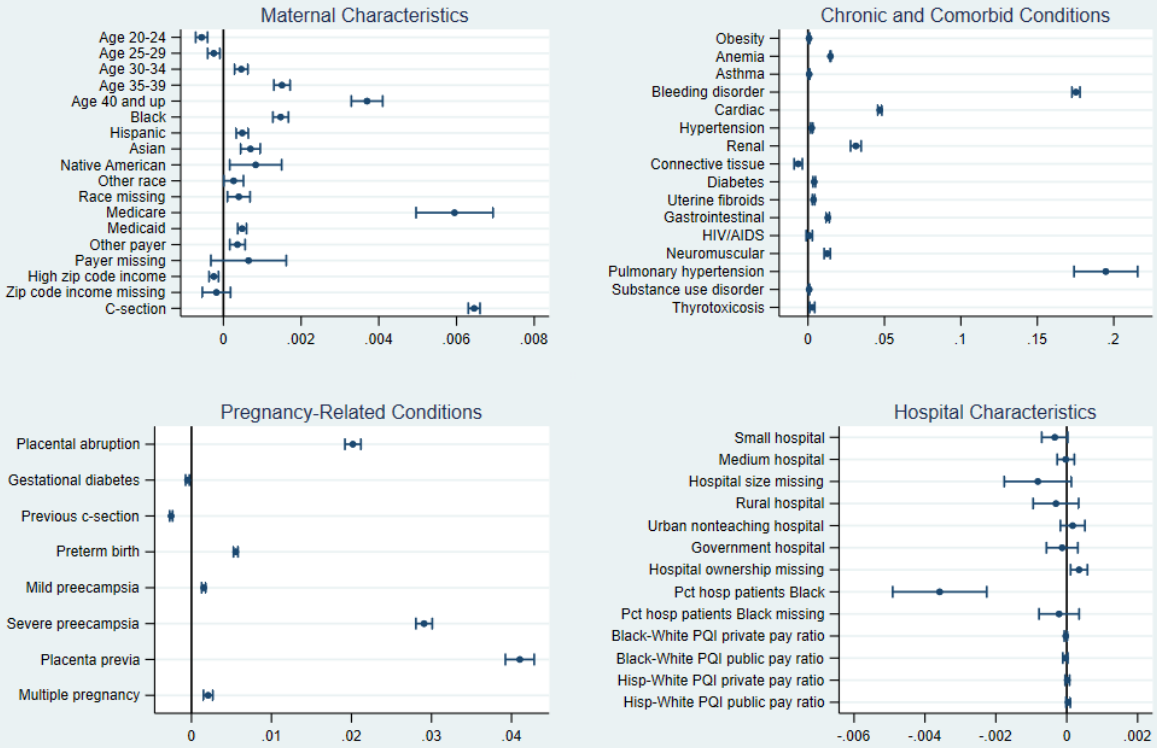
Notes: N=17,648,783. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes indicators for year, census division, ICD-CM-10 in use, and PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 6: Non-Transfusion SMM, 1998-2011, All Hospitals, Basic Model



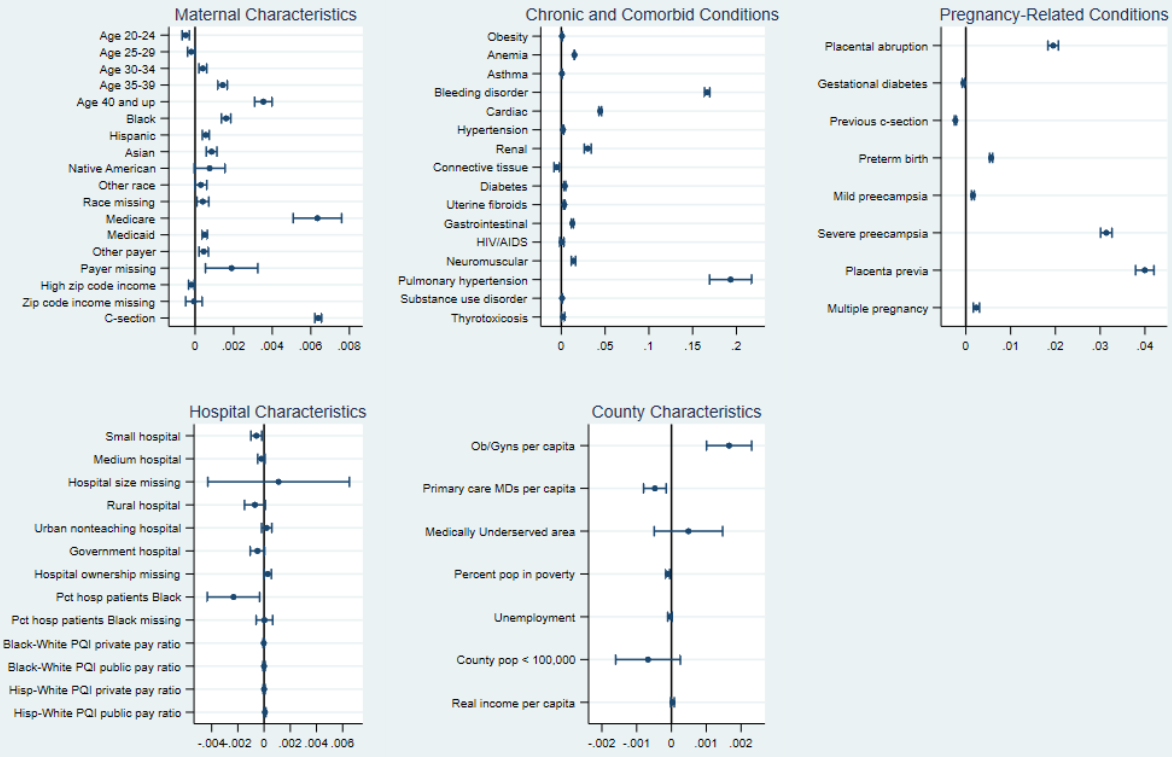
Notes: N=11,683,664. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes indicators for year, census division, and indicators for PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 7: Non-Transfusion SMM, 1998-2011, All Hospitals, Hospital Fixed Effects Model



Notes: N=11,683,664. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes hospital fixed effects, indicators for year, and indicators for PQI ratio missing and zeros in numerator and denominator.

Appendix Figure 8: Non-Transfusion SMM, 1998-2011, Hospitals with County Identifiers



Notes: N=8,393,985. Linear probability model. 95% CIs shown based on heteroskedasticity robust standard errors.
Model also includes hospital fixed effects, indicators for year, and indicators for PQI ratio missing and zeros in numerator and denominator.