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Estimating Effects of Birth Indicators on Health Care Utilization Costs and Infant Mortality: *Technical Appendix*

This Technical Appendix outlines WSIPP's methodology for estimating the average health care utilization costs and average risk of infant mortality related to birth indicators in the first year postpartum for mother-infant pairs in Washington State. We use birth certificate data linked to a dataset of inpatient hospital charges to estimate health care utilization costs[1] and infant mortality. The data include uninsured, publicly insured, and privately insured births from 2009-2013 in Washington State.

This research improves and extends WSIPP's benefit-cost model by quantifying the monetary consequences of five key birth indicators: preterm birth, low birthweight (LBW) births, very low birthweight (VLBW) births, small for gestational age (SGA) births, and neonatal intensive care unit (NICU) admissions. We apply results from this analysis to the causal effect sizes developed through meta-analysis to produce formal benefit-cost analyses of programs that promote healthy pregnancy and birth in Washington State. Full benefit-cost findings are detailed in *Interventions to Promote Health and Increase Health Care Efficiency: May 2017 Update*,[2] and can be found on our website.

The rest of this Technical Appendix proceeds as follows: Section I provides background on key birth indicators in Washington State; Section II outlines our methodology; Section III describes results; and Section IV details analysis limitations.

Definitions

Preterm birth: Infant is born at less than 37 weeks gestation.

Low birthweight (LBW): Infant is born weighing less than 2,500 grams (5 pounds, 8 ounces).

Very low birthweight (VLBW): Infant is born weighing less than 1,500 grams (3 pounds, 5 ounces).

Small for gestational age (SGA): Infant is born with a weight lower than the 10th percentile for their gestational age and sex, compared to a national sample.

Neonatal intensive care unit (NICU) admission: Infant is admitted to a NICU.

Infant mortality: Infant death within 12 months after birth.

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[1] For this analysis, we assume that the difference between average inpatient hospital costs for mother-infant pairs with and without a particular birth indicator will approximate average differences in total health care utilization costs. See Section II for additional detail.
[2] Westley, E., Cramer, J., Bauer, J., Lee, S., Hirsch, M., Burley, M., & Kay, N. (2017). *Interventions to promote health and increase health care efficiency: May 2017 update. (Document Number 17-05-3401).* Olympia: Washington State Institute for Public Policy.

I. Background

WSIPP carries out practical, non-partisan research at the direction of the state legislature or its Board of Directors. WSIPP is often asked to review the effectiveness and conduct benefit-cost analyses of programs and policies that could be implemented in Washington State.

In 2015 WSIPP's Board of Directors authorized WSIPP to work with the Results First Initiative, a joint project with the MacArthur Foundation and the Pew Charitable Trusts, with additional support from the Robert Wood Johnson Foundation. The project expands WSIPP's benefit-cost analyses of interventions to promote health and increase health care efficiency. Through this board-approved project, WSIPP has conducted comprehensive meta-analyses of interventions that promote healthy pregnancy and birth—such as smoking cessation programs, programs that promote appropriate gestational weight gain, group prenatal care, and supportive counseling during pregnancy—to establish their effect on pregnancy and birth indicators.[3] These studies frequently report how those interventions affect birth indicators such as preterm birth, LBW birth, VLBW birth, SGA[4] birth, and NICU admission (see definitions on page 1).

There is insufficient literature linking changes in these birth outcomes to health care costs and infant mortality risk, particularly among diverse populations in the United States. WSIPP conducted a literature review and found that a comprehensive assessment of health care utilization costs in the first year after birth (including costs of delivery) has not been conducted in the United States. There are some cost studies from countries with universal health coverage, such as Canada and Denmark but these may not reflect the costs in the United States.[5] There are also some cost studies of privately insured populations[6], but costs and health care utilization in a privately insured population are likely different than in a publicly insured population. With 49% of births in Washington State paid for by Medicaid as of 2014, we cannot generalize estimates derived from a privately-insured population to the whole of Washington State.[7] In addition, our literature review indicates that state- and national-level descriptive statistics regarding trends in infant mortality are available.[8] However, there is not sufficient rigorous literature on the causal links between the analyzed birth indicators and infant mortality for us to estimate an applicable effect size for use in our benefit-cost model from the research literature alone.

The analysis outlined in this technical appendix addresses this gap in the literature and therefore makes it possible for WSIPP to conduct benefit-cost analyses of interventions that promote healthy pregnancy and birth.

[3] Westley et al. (2017).
[4] Small for gestational age based on weight-for-age curves, calculated separately for males vs females. We used percentiles from Olsen et al. (2010). New intrauterine growth curves based on United States data. *Pediatrics 125*, e214-e224. This is the standard currently adopted by the American Academy of Pediatrics for the U.S.
[5] Thanh, N.X., Toye, J., Savu, A., Kumar, M., & Kaul, P. (2015). Health Service Use and Costs Associated with Low Birth Weight—A Population Level Analysis. *The Journal of Pediatrics, 167*(3), 551-556 and Wisborg K., Henriksen, T.B., Obel, C., Skajaa, E., & Østergaard, J.R. (1999). Smoking during pregnancy and hospitalization of the child. *Pediatrics, 104*(4), e46-e46.
[6] Adams, E.K., Miller, V.P., Ernst, C., Nishimura, B.K., Melvin, C. & Merritt, R. (2002). Neonatal healthcare costs related to smoking during pregnancy. *Health Economics, 11*(3), 193-206.
[7] Washington State Department of Health (2016). *Perinatal Indicators Report for Washington State: 2014 Data.* Washington State Department of Health (Document Number 950-153).
[8] Matthews, T.J., MacDorman, M.F., & Thoma, M.E. (2015). Infant mortality statistics from the 2013 period linked birth/infant death data set. *National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 64*(9), 1-30.

II. Methods

This analysis uses propensity score matching and generalized linear regression analysis to determine how preterm birth, LBW birth, VLBW birth, SGA birth, and NICU admission affect the average inpatient health care utilization costs for the mother and the infant in the first year after delivery and the average risk of infant mortality. The following subsections describe the data, outcome measures, and methodology used in this analysis.

Data

This analysis uses birth certificate data linked to Comprehensive Hospital Abstract Reporting System (CHARS) hospital discharge data from the Washington State Department of Health (DOH).[9] Birth certificate data include information related to the pregnancy and birth, including maternal characteristics, prenatal care, infant health, and method of delivery.[10] CHARS data contain inpatient hospital discharge data from hospital billing systems and include demographic patient data as well as billed charges.[11]

To build the analytic dataset, we linked birth certificates to hospital discharge records for both mother and infant, in the first year postpartum.[12] We include live singleton births[13] that took place in civilian hospitals[14] from 2009-2013.[15] We restrict our analysis to in-hospital births because the majority of inpatient hospitalization costs in the first year after a delivery occur at delivery, and in-hospital births represent approximately 96% of total births in Washington State.[16] We excluded births if we were unable to match the mother or infant to CHARS data (1.8% of all records). We dropped individuals with implausible values including birth weight < 700 grams or missing and gestational age < 20 weeks or > 44 weeks. The resulting dataset includes 377,658 births in Washington State from 2009-2013 with inpatient hospitalization costs for the mother or the infant. We conducted analyses on three populations: all births in Washington, births funded by Medicaid, and births funded by private payers. Samples are further described in Exhibits A1 & A2.

[9] The project was approved by the Washington State Institutional Review Board and the Washington State Department of Health in fall of 2016. See https://www.dshs.wa.gov/sesa/research-and-data-analysis/human-research-review-section for details on the review process. We used the following data sources: Washington State Department of Health (2016). *Comprehensive Hospital Abstract Reporting System (CHARS) 1987-2016.* [Data file, 2009-2014]. http://www.doh.wa.gov/DataandStatisticalReports/VitalStatisticsData/OrderDataFiles. Center for Health Statistics, Washington State Department of Health (2016). *Birth Statistical Files, 1980 through 2015.* [Data file, 2009-2013]. http://www.doh.wa.gov/DataandStatisticalReports/VitalStatisticsData/OrderDataFiles.

[10] Center for Health Statistics, Washington State DOH (2016).

[11] Washington State DOH (2016).

[12] We link birth certificate data to CHARS data using first and last names, date of birth, and infant sex. Using this method, we are able to link birth certificate data to all subsequent hospital discharge records for mother-infant pairs. WSIPP used a two-stage approach to build our analytic dataset to maximize data security. This approach minimized the amount of time that individually identifiable data was available to the researchers and leveraged only de-identified data in the final analytic dataset.

[13] In Washington, 98.5% of all live births are singleton births (Washington State DOH 2016). Infants born in multiple births have differ biological characteristics than singleton infants (they tend to be lower birth weight and lower gestational age). Most of the interventions reviewed that promote healthy pregnancy and birth limit their interventions to singleton infants. Limiting our analysis to singleton infants is consistent with this approach.

[14] CHARS records do not include military hospitals.

[15] We restrict to these years due to data availability. Years prior to 2009 did not report full names on birth certificate data, which reduced our ability to match CHARS records to birth certificate records. In addition, to conduct our analysis we required one full year of follow-up data after a delivery. Since 2014 data was the most current year of CHARS data available, we had to restrict our analysis to births through 2013. Therefore 2009-2013 births are the most current data we could have used in this analysis.

[16] Center for Health Statistics, Washington State DOH (2016).

Outcome measures

Our outcomes of interest include average health care utilization costs in the first year after delivery, and average risk of infant mortality. We analyze these outcomes separately.

Health care utilization costs. We use inpatient hospitalization costs to represent health care utilization costs. We recognize that inpatient hospitalization costs make up only a piece of health care utilization costs. For this analysis, we assume that the difference between average inpatient hospitalization costs for mother-infant pairs with and without a particular birth indicator will approximate average differences in total health care utilization costs.

Inpatient charges reported in the linked CHARS records are the source for inpatient hospitalization cost data.[17] CHARS charges data represent the amount that hospitals billed for services, but do not reflect how much these services actually cost. We apply the cost-to-charge ratios from the Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project (HCUP) to convert these charges into costs, on a per-discharge basis.[18] We adjust costs for each discharge to 2014 U.S. dollars, using the U.S. Bureau of Economic Analysis' Implicit Price Deflator for Health Services.[19] Finally, we sum the costs of all discharges for each mother and each infant to produce total inpatient hospitalization costs for the first year after birth, inclusive of delivery costs. We refer to these as "health care utilization costs" throughout the rest of this report. We analyze average health care utilization costs given preterm birth, LBW birth, VLBW birth, SGA birth, and NICU admission.[20]

Infant mortality. In our analyses of interventions that are intended to promote healthy pregnancy and birth, some interventions directly measure effects on infant mortality. We monetize infant mortality using standard WSIPP procedures, which present-value the estimated value of statistical life years remaining at the time of death.[21]

Through the current analysis, we estimate the effects of measured birth indicators (e.g., preterm birth) on infant mortality. Thus, in the case where infant mortality is not directly measured, this estimate allows us to model the indirect effect of an intervention on infant mortality through the birth indicators that are measured. For example, consider a WSIPP meta-analysis on an enhanced prenatal care program in which the studies report an effect on preterm birth but not on infant mortality. We can model the effect that this program may have on infant mortality through our estimate of the risk of infant mortality given preterm birth. By including the indirect effect of birth indicators on infant mortality, our benefit-cost model better approximates the total benefits and costs associated with these indicators.

We analyze the odds of infant mortality given preterm birth, LBW, VLBW, and SGA births. We convert this to a D-cox effect size for use in our benefit-cost model.[22] Infant mortality data are readily available in the birth

[17] Washington State DOH (2016).
[18] Agency for Healthcare Research and Quality (2016). *HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2006-2009.,* Available from www.hcup-us.ahrq.gov/db/state/costtocharge.jsp. Accessed January 13, 2017.
[19] Bureau of Economic Analysis, (2017). Implicit Price Deflator-Personal Consumption Expenditures for Health Services. National income and Product Account Tables. Table 2.3.4 Price Indexes for Personal Consumption Expenditures by Major Type of Product, Line 16. Accessed from: https://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&904=1971&903=64&906=a&905=2016&910=x&911=0. January 27, 2017.
[20] WSIPP's uses a standard method to avoid double-counting benefits. Only one of the outcomes will be monetized for each mother and each child. See WSIPP's Technical Documentation for details. Washington State Institute for Public Policy (May 2017). *Benefit-cost technical documentation.* Olympia, WA: Author.
[21] WSIPP (May 2017).
[22] Ibid.

certificate data provided by DOH. We did not need to conduct any additional data processing on the infant mortality variable.

Statistical analysis

Propensity score matching procedures allow us to approximate treatment and comparison groups by matching mother-infant pairs with a particular birth indicator to similar mother-infant pairs without that indicator, which balances the two groups on observable variables. This procedure helps to reduce selection bias and ensures that we are not comparing mother-infant pairs with a particular birth indicator to highly dissimilar mother-infant pairs who are not likely to have similar risks.

After the propensity score matching procedure, we conduct a generalized linear model (GLM) on the matched sample using the variables included in the matching model to further control for residual bias. This method provides "double robustness,"[23] leveraging a regression approach to adjust for residual covariate imbalance that matching did not address. This approach is the preferred method for causal inference on a matched sample, according to our reading of the literature.[24]

Propensity score matching. We first estimate a propensity score (the predicted probability of a given birth indicator) for each subject in the sample. We use a statistical model that includes a variety of factors that may affect the probability that an individual has a particular birth indicator. We match on demographics, maternal characteristics, delivery characteristics, payer,[25] facility characteristics, and birth year.[26]

After estimating the probability of a particular birth indicator and assigning each subject a propensity score, we randomly sort the individuals and match mother-infant pairs with that indicator to comparison group mother-infant pairs. In our preferred model, we use one-to-one nearest neighbor caliper matching with replacement and match on the logit of the propensity score. We use a caliper equal to 0.001 and include ties (comparison group mother-infant pairs with identical propensity scores). We tested alternative matching models, including nearest neighbor without replacement, alternative calipers (e.g. 0.01, 0.05, 0.005), and others. We selected our preferred model based on recommendations in the literature, ease of interpretation, and parsimony.[27]

We used several approaches to assess how well our models improved balance and reduced bias between the two groups.[28] Exhibits in Section III present results before and after matching, employing a frequently used method to assess balance called the absolute standardized difference (bias). This method yields the difference in the mean or proportion for each covariate for the treated and comparison groups divided by the pooled standard deviation prior to matching. An absolute standardized difference greater than 25 indicates substantial imbalance between the two groups and recommendations indicate that in order to consider the covariate balanced, the difference should be less than ten.[29] Our preferred method

[23] Stuart, E.A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical science: a review journal of the Institute of Mathematical Statistics, 25*(1), 1.
[24] We use the following key references: Stuart (2010) and Austin, P.C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research, 46*(3), 399-424.
[25] Defined as payer at delivery, according to the birth certificate.
[26] The propensity score estimation and matching were conducted in STATA using version 4.0.11 of the following: Leuven, E. & Sianesi, B. (2003). "PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing". From http://ideas.repec.org/c/boc/bocode/s432001.html.
[27] Stuart (2010) and Austin (2011).
[28] All calculations used to assess balance were conducted using pstest in STATA.
[29] Stuart (2010).

successfully balanced the treatment and control groups with an absolute standardized difference well below ten for each covariate after matching.

In addition to absolute standardized bias for each covariate, we assessed our approach using measures based on the balance of the overall model. Exhibits in Section III also present these statistics for each model. We assessed each model using Rubin's B (the standardized difference in the means of the linear prediction of the propensity score), Rubin's R (the ratio of variance in the treated and comparison group for the linear prediction of the propensity score), and the mean and median standardized difference (bias) across all of the covariates included in the model. Mean and median bias below 25 indicates sufficient balance, while Rubin's B should be less than 25 and Rubin's R should be between 0.5 and 2.[30] As shown in the results, the groups are imbalanced prior to matching in each of the samples. After matching, balance measures improve for every model, with all measures within the recommended ranges.

Generalized linear models (GLM) for healthcare utilization costs. After propensity score matching, we use GLM to estimate the average health care utilization costs given each birth indicator. We use the propensity score matched sample in the analysis, and apply frequency weights to account for the fact that some of the mother-infant pairs who have the indicator of interest are matched to multiple pairs in the comparison group.[31] This "double-robust" approach strengthens our analysis on the matched sample.[32]

GLMs with a gamma distribution and log link function are commonly used in health expenditure analyses. The gamma distribution is a flexible distribution for positive, continuous dependent variables (such as health care utilization costs) that incorporates the assumption that the standard deviation is proportional to the mean.[33] We use robust standard errors to give valid standard errors even when the assumed form of variance is incorrect. Our models include fixed effects for year and birth facility.[34] We conducted standard diagnostics for each model to ensure appropriate model fit, including plots of residuals deviance and comparisons of the Akaike information criterion (AIC) value across similar models.[35] Our preferred models fit well, according to these diagnostics.

Using our models, we can calculate the average difference in inpatient health care utilization costs between mother-infant pairs with a given indicator of interest (such as those who were born preterm) compared to those without that indicator (such as those who were not born preterm), holding all other relevant variables constant. Results are reported in Section III.

Generalized linear models (GLM) for infant mortality. For consistency, we also used a GLM to estimate the odds of infant mortality given each birth indicator. Similar to the healthcare utilization cost model, we use the propensity score matched sample in the analysis and apply frequency weights in our analysis. We use

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[30] Austin (2011).

[31] We employ this method for our main analysis based in part on recommendations in Austin, P.C. (2014). A comparison of 12 algorithms for matching on the propensity score. *Statistics in Medicine*, 33, 1057-1069 and Rosenbaum, P.R., & Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician*, *39*(1), 33-38.

[32] Stuart (2010).

[33] Hardin, J.W., & Hilbe, J.M. (2012). *Generalized Linear Models and Extension, 3rd edition.* College Station, Texas: Stata Press.

[34] Fixed effects on year and on facility capture the influence of underlying trends within years (e.g., if rates of preterm birth decrease over time) and facilities (e.g., if a particular facility has higher costs).

[35] In a GLM model with a log link function, plots of residual deviance against fitted values should have a log-normal distribution if model fit is acceptable. Preferred models had an appropriate log-normal distribution. The AIC value is used in model selection. AIC values are only comparable across models applied to the same sample. Hardin & Hilbe (2012). We compared AIC values between models on the same sample (such as across models for infant costs related to preterm birth on an all Washington sample). We use backward selection to select the model with the lowest AIC value. Therefore, some GLM models include fewer covariates in the final model than in the propensity score matching procedure.

a binomial distribution and a logit link function to model the dichotomous infant mortality indicator. We use robust standard errors and include fixed effects on year. We conducted standard diagnostics for each model to ensure appropriate model fit, including plots of residuals deviance and comparisons of the AIC value across similar models. Our preferred models fit well, according to these diagnostics.

This model allows us to calculate the odds of infant mortality for infants with a given indicator of interest (such as those who were born preterm) compared to those without that indicator (such as those who were not born preterm), holding all other relevant variables constant. Results are reported in Section III.

III. Model Results

We report model results on the effect of preterm, LBW, VLBW, and SGA births on health care utilization costs for infants, health care utilization costs for mothers, and odds of infant mortality. For NICU admission, we only model infant health care utilization costs. Cost results are reported separately for each of three populations: all Washington, Medicaid, and private payer. Infant mortality estimates are reported for the all Washington population only. These results are presented in the following exhibits:

- Exhibit A1 & A2: Descriptive information on the populations.
- Exhibit A3: Final estimates of average health care utilization costs given each birth indicator and within each population.
- Exhibit A4: Final estimates of risk of infant mortality given each birth indicator.
- Exhibits A5 – A66: Propensity score matching and GLM output for individual analyses.

Exhibit A1

Description of Study Population – All Washington

Study variable		All Washington (n=377,658) % (n) or mean +/- sd	Missing % (n)
Infant costs		$5,058.38 +/- $33,009.23	11.44% (43,203)
Maternal costs		$5,293.74 +/- $5,895.34	5.76% (21,743)
Infant mortality		0.29% (1,085)	--
Preterm		6.64% (25,076)	--
Low birthweight		4.66% (17,599)	--
Very low birthweight		0.61% (2,304)	--
Small for gestational age		4.54% (17,160)	0.70% (2,642)
NICU admission		6.09% (22,999)	--
Any smoking during pregnancy		8.93% (33,725)	--
Adequate prenatal care[1]		74.91% (282,888)	7.95% (30,010)
Mother's age	Less than 20	6.64% (25,076)	0.01% (29)
	20-34	81.11% (306,296)	
	35+	12.25% (46,257)	
Mother's race	Non-Hispanic White	70.20% (265,125)	1.90% (7,161)
	Black	5.12% (19,341)	
	Hispanic	9.59% (36,218)	
	Other	13.19% (49,813)	
Parity	0	41.62% (156,076)	0.69% (2,616)
	1	31.46% (188,000)	
	2+	26.92% (100,966)	
Mother is married		65.79% (248,452)	0.017% (628)
Mother has at least a high school education		83.23% (314,358)	0.81% (3,049)
Infant is male		51.34% (193,900)	--
Cesarean section		33.02% (124,703)	--
Payer at delivery	Medicaid	40.57% (153,212)	1.22% (4,642)
	Other public payer[2]	5.49% (20,742)	
	Private insurance	51.74% (195,391)	
	Self-pay/ uninsured	0.97% (3,671)	
Facility size	Fewer than 100 beds	10.40% (39,280)	4.43% (16,740)
	100-300 beds	48.43% (182,907)	
	More than 300 beds	36.73% (138,731)	
Facility is in an urban county[3]		76.11% (287,425)	--
Facility has a NICU		31.51% (118,998)	--
Year of delivery	2009	20.48% (77,363)	--
	2010	19.69% (74,374)	
	2011	19.85% (74,952)	
	2012	19.86% (74,984)	
	2013	19.86% (74,985)	

Notes:

[1] Adequate prenatal care according to the Kotelchuck Index (also called the Adequacy of Prenatal Care Utilization [APNCU] Index). This is a standardized index that accounts for both the adequacy of prenatal care initiation (i.e., the month that prenatal care began) and the total number of prenatal visits. Kotelchuck, M. (1994). An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index. *American Journal of Public Health, 84*(9), 1414-1420.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State Department of Health (2017). Office of Community Health System Series on Rural-Urban Disparities (Document Number 346-091). Retrieved from: http://www.doh.wa.gov/Portals/1/Documents/Pubs/346091.pdf.

Exhibit A2

Description of Study Populations – Medicaid and Private Payer

Study variable		Medicaid (n=153,212) % (n) mean +/- sd	Missing % (n)	Private payer (n=195,391) % (n) mean +/- sd	Missing % (n)
Infant costs		$5,975.95 +/- $37,900.59	14.35% (21,993)	$4,370.99 +/- $29,198.28	7.82% (15,274)
Maternal costs		$5,478.40 +/- $6,197.26	7.26% (11,128)	$5,154.44+/- $5,767.60	4.69% (9,169)
Infant mortality		0.38% (582)	--	0.21% (404)	--
Preterm		7.36% (11,272)	--	6.03% (11,789)	--
Low birthweight		5.46% (8,362)	--	4.01% (7,841)	--
Very low birthweight		0.73% (1,123)	--	0.50% (986)	--
Small for gestational age		5.20% (7,971)	0.71% (1,087)	3.97% (7,755)	0.70% (1,360)
NICU admission		6.40% (9,802)	--	5.77% (11,269)	--
Any smoking during pregnancy		14.48% (22,185)	--	4.01% (7,828)	--
Adequate prenatal care[1]		69.88% (107,070)	8.18% (12,531)	80.15% (156,605)	6.86% (13,403)
Mother's age	Less than 20	12.11% (18,556)	0.0009% (14)	2.04% (3,986)	0.0007% (14)
	20-34	80.27% (122,987)		81.59% (159,419)	
	35+	7.61% (11,655)		16.36% (31,972)	
Mother's race	Non-Hispanic White	59.09% (90,534)	3.20% (4,903)	78.90% (154,154)	0.85% (1,661)
	Black	7.58% (11,606)		2.82% (5,511)	
	Hispanic	19.16% (29,348)		2.58% (5,038)	
	Other	10.98% (16,821)		14.86% (29,027)	
Parity	0	36.41% (55,787)	0.58% (886)	45.09% (88,095)	0.57% (1,104)
	1	28.13% (43,102)		33.97% (66,378)	
	2+	34.88% (53,437)		20.38% (39,814)	
Mother is married		42.22% (64,688)	0.29% (443)	85.04% (166,163)	0.006% (111)
Mother has at least a high school education		67.26% (103,047)	1.34% (2,050)	95.87% (187,319)	0.38% (733)
Infant is male		51.28% (78,572)	--	51.40% (100,434)	--
Cesarean section		30.53% (46,780)	--	35.33% (69,041)	--
Facility size	Fewer than 100 beds	15.24% (23,348)	5.49% (8,404)	6.60% (12,892)	2.91% (5,680)
	100-300 beds	50.34% (77,132)		48.51% (94,785)	
	More than 300 beds	28.93% (44,328)		41.98% (82,024)	
Facility is in an urban county[2]		66.05% (101,191)	--	83.46% (163,067)	--
Facility has a NICU		27.97% (42,852)	--	36.95% (72,199)	--
Year	2009	20.45% (31,334)	--	20.64% (40,330)	--
	2010	19.78% (30,299)		20.16% (39,384)	
	2011	20.05% (30,724)		19.60% (38,295)	
	2012	19.57% (29,984)		20.07% (39,217)	
	2013	20.15% (30,871)		19.53% (38,165)	

Notes:

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

Exhibit A3

Effect of Birth Indicators on Health Care Utilization Costs in the First Year After Birth

Birth indicator	Individual	Population	Average health care utilization costs[1]	Robust standard error (RSE)	PSM output in exhibit:	GLM output in exhibit:
Preterm birth	***Infant***	All Washington	$24,583	$551	A5	A6
		Medicaid	$25,267	$873	A7	A8
		Private pay	$23,639	$705	A9	A10
	Mother	All Washington	$3,078	$77	A11	A12
		Medicaid	$3,071	$123	A13	A14
		Private pay	$3,075	$101	A15	A16
Low birthweight birth	***Infant***	All Washington	$31,299	$863	A19	A20
		Medicaid	$31,574	$1,435	A21	A22
		Private pay	$31,576	$1,002	A23	A24
	Mother	All Washington	$3,522	$90	A25	A26
		Medicaid	$3,270	$140	A27	A28
		Private pay	$3,714	$120	A29	A30
Very low birthweight birth	***Infant***	All Washington	$145,410	$4,423	A33	A34
		Medicaid	$145,379	$6,897	A35	A36
		Private pay	$144,923	$5,282	A37	A38
	Mother	All Washington	$8,592	$372	A39	A40
		Medicaid	$8,468	$590	A41	A42
		Private pay	$8,652	$493	A43	A44
Small for gestational age birth	***Infant***	All Washington	$3,525	$371	A47	A48
		Medicaid	$3,601	$489	A49	A50
		Private pay	$3,079	$445	A51	A52
	Mother	All Washington	$234	$47	A53	A54
		Medicaid	$179	$74	A55	A56
		Private pay	$250	$55	A57	A58
NICU admission	***Infant***	All Washington	$35,132	$721	A61	A62
		Medicaid	$40,865	$1,255	A63	A64
		Private pay	$31,254	$887	A65	A66

Notes:
[1] Net of costs for mother or infants without the birth indicator.

Exhibit A4

Effect of Birth Indicators on Infant Mortality

Birth indicator	D-cox effect size[1]	Standard error	PSM output in Exhibit:	GLM output in Exhibit:
Preterm	1.103	0.072	A17	A18
Low birthweight	1.437	0.078	A31	A32
Very low birthweight	2.020	0.132	A45	A46
Small for gestational age	0.794	0.078	A59	A60

Notes:
[1] Calculated from odds ratios, per WSIPP's standard procedures. See WSIPP's Technical Documentation. http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf.

1) Preterm birth

Infant health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A5) and the GLM (Exhibit A6) on a matched sample where the indicator of interest is preterm birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in Washington State, infants that are born preterm have $24,583 (in 2014 dollars; robust standard error [RSE] $551) in additional inpatient healthcare utilization costs compared to similar infants that are not born preterm (see Exhibit A3).

Exhibit A5

Infant Health Care Utilization Costs Related to Preterm Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.120	0.114	0.085	**11.1**	1.9
Mother received adequate prenatal care[1]	0.712	0.709	0.606	**-26.5**	0.6
Mother's age is 20-34	0.789	0.797	0.050	-7.0	-2.1
Mother's age is 35+	0.143	0.139	0.205	6.3	1.4
Mother is black	0.055	0.052	0.248	4.0	1.2
Mother is Hispanic/Latina	0.095	0.094	0.899	-0.2	0.1
Mother is other non-white or mixed race	0.151	0.149	0.602	6.5	0.6
Mother had one prior live birth	0.283	0.281	0.723	-8.5	0.4
Mother had two or more prior live births	0.279	0.277	0.695	4.8	0.4
Mother is married	0.632	0.632	0.965	**-11.8**	0.0
Mother has a high school education	0.831	0.841	0.014	-6.5	-2.6
Infant is male	0.549	0.552	0.638	7.3	-0.5
Cesarean delivery	0.428	0.427	0.932	**22.0**	0.1
Payer is a non-Medicaid public payer[2]	0.048	0.041	0.004	0.0	2.8
Payer is private insurance	0.507	0.506	0.823	**-10.0**	0.2
Payer is self or uninsured	0.012	0.009	0.034	1.5	2.3
Facility has 100-300 beds	0.446	0.450	0.461	4.8	0.4
Facility has >300 beds	0.476	0.475	0.882	**17.6**	0.2
Facility is in an urban county[3]	0.810	0.812	0.664	**14.6**	-0.4
Facility has a NICU	0.403	0.404	0.888	**14.3**	-0.2
Year of birth is 2010 (index)	0.202	0.201	0.711	0.8	0.4
Year of birth is 2011 (index)	0.188	0.187	0.870	-1.0	0.2
Year of birth is 2012 (index)	0.205	0.207	0.627	0.0	-0.5
Year of birth is 2013 (index)	0.204	0.204	0.722	-0.7	0.0
Overall statistics					
Preterm group N	17,695	Median overall bias	0.5	Rubin's R	6.4
Comparison group N[4]	188,545	Mean overall bias	0.8	Rubin's B	1.16

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A6

Infant Health Care Utilization Costs Related to Preterm Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		6.907	***	0.201
Mother smoked during pregnancy		1.117	**	0.046
Mother received adequate prenatal care[2]		0.943	#	0.031
Mother's age *(reference age 20-34)*	Age <20	0.938		0.050
	Age 35+	1.045		0.054
Mother's race *(reference is non-Hispanic white)*	Black	1.002		0.077
	Hispanic/Latina	0.950		0.053
	Other non-white or mixed race	1.005		0.050
Parity *(reference is one prior live birth)*	No previous live births	1.138	***	0.036
	Two or more prior live births	1.144	**	0.046
Mother is married		0.902	**	0.030
Mother has at least a high school education		0.967		0.042
Infant is male		1.128	***	0.032
Cesarean delivery		1.637	***	0.046
Payer *(reference is other public payer[3])*	Medicaid	0.975		0.085
	Private insurance	0.827	*	0.070
	Self or uninsured	0.848		0.125
Constant		5,579.519	***	661.460
N[4]	206,240			
Residual df	206,153			
AIC	3.458254			
BIC	-2,449,596			

Notes:

GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.

[1] # p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

[2] Adequate prenatal care according to the Kotelchuck Index.

[3] Indian Health Service, Champus/Tricare, or other government payer.

[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular preterm infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A7) and the GLM (Exhibit A8) on a matched sample where the indicator of interest is preterm birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, infants that are born preterm have $25,267 (in 2014 dollars; RSE $873) in additional inpatient healthcare utilization costs compared to similar infants that are not born preterm (see Exhibit A3).

Exhibit A7

Infant Health Care Utilization Costs Related to Preterm Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.195	0.186	0.188	**12.2**	2.3
Mother received adequate prenatal care[1]	0.668	0.668	0.986	**-22.2**	0.0
Mother's age is 20-34	0.785	0.801	0.014	-5.9	-4.0
Mother's age is 35+	0.097	0.087	0.020	9.4	3.8
Mother is black	0.078	0.073	0.285	2.1	1.7
Mother is Hispanic/Latina	0.174	0.173	0.865	-6.3	0.3
Mother is other non-white or mixed race	0.135	0.127	0.158	8.7	2.3
Mother has had one prior live birth	0.265	0.259	0.398	-6.2	1.4
Mother has had two or more prior live births	0.370	0.374	0.558	6.2	-1.0
Mother is married	0.404	0.398	0.382	-6.4	1.4
Mother has at least a high school education	0.688	0.697	0.201	-0.7	-2.0
Infant is male	0.541	0.545	0.581	6.3	-0.9
Cesarean delivery	0.403	0.404	0.856	**23.5**	-0.3
Facility has 100-300 beds	0.477	0.483	0.518	-9.9	-1.0
Facility has >300 beds	0.412	0.412	0.948	**24.9**	-0.1
Facility is in an urban county[2]	0.736	0.739	0.594	**20.2**	-0.8
Facility has a NICU	0.393	0.401	0.322	**18.7**	-1.7
Year of birth is 2010 (index)	0.198	0.198	0.951	0.4	-0.1
Year of birth is 2011 (index)	0.193	0.192	0.967	-1.5	0.1
Year of birth is 2012 (index)	0.203	0.205	0.794	0.7	-0.4
Year of birth is 2013 (index)	0.206	0.207	0.936	0.9	-0.1

Overall statistics					
Preterm group N	7,659	Median overall bias	1.0	Rubin's R	1.12
Comparison group N[3]	56,386	Mean overall bias	1.2	Rubin's B	7.3

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score.

We use a caliper of 0.001 in the matching model.

Exhibit A8

Infant Health Care Utilization Costs Related to Preterm Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		6.008	***	0.265
Mother smoked during pregnancy		1.186	**	0.060
Mother received adequate prenatal care[2]		0.958		0.044
Mother's age *(reference age 20-34)*	Age <20	0.936		0.058
	Age 35+	1.14		0.117
Mother's race *(reference is non-Hispanic white)*	Black	0.947		0.093
	Hispanic/Latina	1.010		0.068
	Other non-white or mixed race	1.105		0.098
Parity *(reference is one prior live birth)*	No previous live births	1.181	**	0.062
	Two or more prior live births	1.123	*	0.063
Mother is married		0.942		0.041
Mother has at least a high school education		1.052		0.049
Infant is male		1.137	**	0.049
Cesarean delivery		1.482	***	0.063
Constant		6,594.745	***	892.508
N[3]	64,045			
Residual df	63,961			
AIC	4.865525			
BIC	-675,469			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular preterm infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A9) and the GLM (Exhibit A10) on a matched sample where the indicator of interest is preterm birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a private payer population in Washington State, infants that are born preterm have $23,639 (in 2014 dollars; RSE $705) in additional inpatient healthcare utilization costs compared to similar infants that are not born preterm (see Exhibit A3).

Exhibit A9

Infant Health Care Utilization Costs Related to Preterm Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.052	0.048	0.233	6.4	1.9
Mother received adequate prenatal care[1]	0.757	0.755	0.768	**-29.0**	0.5
Mother's age is 20-34	0.790	0.794	0.496	-8.2	-1.0
Mother's age is 35+	0.188	0.186	0.716	7.0	0.6
Mother is black	0.033	0.031	0.473	**13.0**	-0.3
Mother is Hispanic/Latina	0.030	0.030	0.931	2.6	0.1
Mother is other non-white or mixed race	0.166	0.163	0.615	6.1	0.8
Mother has had one prior live birth	0.300	0.298	0.922	-9.8	0.1
Mother has had two or more prior live births	0.200	0.197	0.537	-1.0	0.9
Mother is married	0.830	0.833	0.590	**-10.3**	-0.8
Mother has at least a high school education	0.955	0.963	0.007	-6.6	-3.9
Infant is male	0.560	0.565	0.489	8.7	-1.0
Cesarean delivery	0.452	0.450	0.799	**22.1**	0.4
Facility has 100-300 beds	0.434	0.434	0.988	-9.2	0.0
Facility has >300 beds	0.518	0.520	0.811	**14.8**	-0.4
Facility is in an urban county[2]	0.872	0.875	0.559	**14.6**	-0.8
Facility has a NICU	0.432	0.434	0.833	**13.0**	-0.3
Year of birth is 2010 (index)	0.207	0.208	0.840	1.2	-0.3
Year of birth is 2011 (index)	0.184	0.182	0.671	-1.4	0.6
Year of birth is 2012 (index)	0.209	0.212	0.714	0.1	-0.6
Year of birth is 2013 (index)	0.199	0.197	0.708	-2.5	0.6

Overall statistics					
Preterm group N	8,976	Median overall bias	0.6	Rubin's R	1.23
Comparison group N[3]	127,506	Mean overall bias	0.8	Rubin's B	5.0

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A10

Infant Health Care Utilization Costs Related to Preterm Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		7.728	***	0.276
Mother smoked during pregnancy		1.032		0.069
Mother received adequate prenatal care[2]		0.924	#	0.043
Mother's age *(reference age 20-34)*	Age <20	1.052		0.147
	Age 35+	0.966		0.045
Mother's race *(reference is non-Hispanic white)*	Black	0.984		0.098
	Hispanic/Latina	1.035		0.120
	Other non-white or mixed race	0.981		0.055
Parity *(reference is one prior live birth)*	No previous live births	1.113	**	0.042
	Two or more prior live births	1.115	*	0.057
Mother is married		0.886	*	0.043
Mother has at least a high school education		0.884		0.088
Infant is male		1.109	**	0.038
Cesarean delivery		1.692	***	0.058
Constant		4,339.633	***	562.413
N[3]	136,482			
Residual df	136,398			
AIC	2.625847			
BIC	-1,577,329			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular preterm infant.

Maternal health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A11) and the GLM (Exhibit A12) on a matched sample where the indicator of interest is preterm birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in Washington State, mothers of infants that are born preterm have $3,078 (in 2014 dollars; RSE $77) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born preterm (see Exhibit A3).

Exhibit A11

Maternal Health Care Utilization Costs Related to Preterm Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.132	0.115	0.031	**11.1**	2.4
Mother received adequate prenatal care[1]	0.711	0.714	0.530	**-26.5**	-0.7
Mother's age is 20-34	0.790	0.801	0.008	-7.0	-2.8
Mother's age is 35+	0.140	0.134	0.079	6.3	1.9
Mother is black	0.057	0.055	0.399	4.0	0.9
Mother is Hispanic/Latina	0.089	0.089	0.985	-0.2	0.0
Mother is other non-white or mixed race	0.148	0.146	0.635	6.5	0.5
Mother has had one prior live birth	0.281	0.278	0.489	-8.5	0.7
Mother has had two or more prior live births	0.278	0.279	0.814	4.8	-0.2
Mother is married	0.623	0.625	0.778	**-11.8**	-0.3
Mother has at least a high school education	0.835	0.845	0.011	-6.5	-2.6
Infant is male	0.548	0.554	0.224	7.3	-1.3
Cesarean delivery	0.427	0.429	0.625	**22.0**	-0.5
Payer is a non-Medicaid public payer[2]	0.051	0.046	0.042	0.0	2.0
Payer is private insurance	0.503	0.500	0.584	**-10.0**	0.6
Payer is self or uninsured	0.012	0.009	0.012	1.5	2.6
Facility has 100-300 beds	0.460	0.459	0.908	-8.9	0.1
Facility has >300 beds	0.467	0.470	0.541	**17.6**	-0.7
Facility is in an urban county[3]	0.816	0.819	0.406	**14.6**	-0.8
Facility has a NICU	0.423	0.428	0.425	**14.3**	-0.9
Year of birth is 2010 (index)	0.206	0.206	0.917	0.8	0.1
Year of birth is 2011 (index)	0.189	0.189	0.946	-1.0	0.1
Year of birth is 2012 (index)	0.199	0.199	0.854	0.0	-0.2
Year of birth is 2013 (index)	0.199	0.199	0.979	-0.7	0.0
Overall statistics					
Preterm group N	18,064	Median overall bias	0.7	Rubin's R	1.16
Comparison group N[4]	190,884	Mean overall bias	1.0	Rubin's B	6.6

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A12

Maternal Health Care Utilization Costs Related to Preterm Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		1.555	***	0.015
Mother smoked during pregnancy		1.053	**	0.020
Mother's age *(reference age 20-34)*	Age <20	0.909	***	0.016
	Age 35+	1.098	***	0.015
Mother's race *(reference is non-Hispanic white)*	Black	1.089	**	0.029
	Hispanic/Latina	1.005		0.018
	Other non-white or mixed race	0.981		0.015
Parity *(reference is one prior live birth)*	No previous live births	1.160	***	0.013
	Two or more prior live births	1.070	***	0.014
Mother is married		0.964	**	0.012
Infant is male		0.988		0.009
Cesarean delivery		1.637	***	0.046
Payer *(reference is other public paye2[2])*	Medicaid	1.050	**	0.022
	Private insurance	0.982		0.020
	Self or uninsured	0.962		0.046
Constant		6,580.678	***	210.587
N[3]	208,948			
Residual df	208,862			
AIC	3.387599			
BIC	-2,543,506			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a preterm infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A13) and the GLM (Exhibit A14) on a matched sample where the indicator of interest is preterm birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, mothers of infants that are born preterm have $3,071 (in 2014 dollars; RSE $123) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born preterm (see Exhibit A3).

Exhibit A13

Maternal Health Care Utilization Costs Related to Preterm Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.198	0.187	0.078	**12.2**	3.0
Mother received adequate prenatal care[1]	0.667	0.672	0.519	**-22.2**	-1.1
Mother's age is 20-34	0.785	0.799	0.023	-5.9	-3.6
Mother's age is 35+	0.097	0.089	0.088	9.4	2.8
Mother is black	0.081	0.072	0.033	2.1	3.3
Mother is Hispanic/Latina	0.163	0.160	0.603	-6.3	0.8
Mother is other non-white or mixed race	0.137	0.139	0.764	8.7	-0.5
Mother has had one prior live birth	0.262	0.255	0.316	-6.2	1.6
Mother has had two or more prior live births	0.366	0.371	0.574	6.2	-0.9
Mother is married	0.387	0.396	0.961	-6.4	0.1
Mother has at least a high school education	0.699	0.710	0.124	-0.7	-2.4
Infant is male	0.541	0.546	0.543	6.3	-1.0
Cesarean delivery	0.403	0.407	0.548	**23.5**	-1.0
Facility has 100-300 beds	0.490	0.492	0.823	-9.9	-0.4
Facility has >300 beds	0.407	0.409	0.833	**24.9**	-0.3
Facility is in an urban county[2]	0.747	0.750	0.672	**20.2**	-0.6
Facility has a NICU	0.420	0.427	0.374	**18.7**	-1.5
Year of birth is 2010 (index)	0.204	0.204	0.937	0.4	-0.1
Year of birth is 2011 (index)	0.191	0.194	0.613	-1.5	-0.8
Year of birth is 2012 (index)	0.195	0.194	0.936	0.7	0.1
Year of birth is 2013 (index)	0.203	0.201	0.796	0.9	0.4

Overall statistics					
Preterm group N	7,852	Median overall bias	0.9	Rubin's R	1.13
Comparison group N[3]	58,110	Mean overall bias	1.3	Rubin's B	7.3

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A14

Maternal Health Care Utilization Costs Related to Preterm Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		1.537	***	0.023
Mother smoked during pregnancy		1.039	#	0.021
Mother's age *(reference age 20-34)*	Age <20	0.928	**	0.022
	Age 35+	1.076	**	0.026
Mother's race *(reference is non-Hispanic white)*	Black	1.079	**	0.041
	Hispanic/Latina	0.992		0.022
	Other non-white or mixed race	1.006		0.029
Parity *(reference is one prior live birth)*	No previous live births	1.153	***	0.023
	Two or more prior live births	1.071	***	0.021
Mother is married		0.986		0.017
Infant is male		0.974	#	0.015
Constant		7,682.696	***	410.005
N[2]	66,062			
Residual df	65,979			
AIC	4.667027			
BIC	-725,338			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a preterm infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A15) and the GLM (Exhibit A16) on a matched sample where the indicator of interest is preterm birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a private pay population in Washington State, mothers of infants that are born preterm have $3,075 (in 2014 dollars; RSE $101) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born preterm (see Exhibit A3).

Exhibit A15

Maternal Health Care Utilization Costs Related to Preterm Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.055	0.050	0.143	6.4	2.3
Mother received adequate prenatal care[1]	0.757	0.754	0.666	**-29**	0.7
Mother's age is 20-34	0.792	0.794	0.742	-8.2	-0.5
Mother's age is 35+	0.183	0.182	0.788	7.0	0.4
Mother is black	0.034	0.033	0.681	4.4	0.6
Mother is Hispanic/Latina	0.029	0.028	0.623	2.6	0.7
Mother is other non-white or mixed race	0.159	0.155	0.428	6.1	1.1
Mother has had one prior live birth	0.297	0.295	0.733	-9.8	0.5
Mother has had two or more prior live births	0.200	0.199	0.941	-1.0	0.1
Mother is married	0.823	0.826	0.572	**-10.3**	-0.9
Mother has at least a high school education	0.954	0.961	0.015	-6.6	-3.6
Infant is male	0.557	0.558	0.905	8.7	-0.2
Cesarean delivery	0.451	0.449	0.754	**22.1**	0.5
Facility has 100-300 beds	0.449	0.447	0.811	-9.2	0.4
Facility has >300 beds	0.506	0.509	0.678	**14.8**	-0.6
Facility is in an urban county[2]	0.845	0.879	0.404	**14.6**	-1.2
Facility has a NICU	0.453	0.455	0.766	**13.0**	-0.5
Year of birth is 2010 (index)	0.208	0.209	0.869	1.2	-0.2
Year of birth is 2011 (index)	0.186	0.182	0.528	-1.4	0.9
Year of birth is 2012 (index)	0.205	0.206	0.811	0.1	-0.4
Year of birth is 2013 (index)	0.194	0.193	0.807	-2.5	0.4
Overall statistics					
Preterm group N	9,083	Median overall bias	0.5	Rubin's R	1.21
Comparison group N[3]	127,527	Mean overall bias	0.8	Rubin's B	5.0

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched pairs in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A16

Maternal Health Care Utilization Costs Related to Preterm Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		1.567	***	0.019
Mother received adequate prenatal care[1]		0.960	*	0.016
Mother smoked during pregnancy		1.111	*	0.050
Mother's age *(reference age 20-34)*	Age <20	0.873	**	0.039
	Age 35+	1.108	***	0.018
Mother's race *(reference is non-Hispanic white)*	Black	1.073	*	0.038
	Hispanic/Latina	1.090	*	0.044
	Other non-white or mixed race	0.959	*	0.017
Parity *(reference is one prior live birth)*	No previous live births	1.161	**	0.017
	Two or more prior live births	1.043	*	0.019
Mother is married		0.949	**	0.018
Mother has at least a high school education		0.922		0.047
Infant is male		0.992		0.012
Constant		6,864.240	***	383.918
N[3]	136,610			
Residual df	136,527			
AIC	2.60,208			
BIC	-1,607,235			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a preterm infant.

Infant mortality

We report the results of propensity score matching procedures (Exhibit A17) and the GLM (Exhibit A18) on a matched sample where the indicator of interest is preterm birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant mortality.

We find that, in Washington State, infants that are born preterm have 6.2 times greater odds of infant mortality (D-cox effect size 1.103, RSE 0.072) compared to similar infants that are not born preterm (see Exhibit A3).

Exhibit A17

Infant Mortality Related to Preterm Birth in Washington State –
Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	Preterm group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.121	0.114	0.024	**11.1**	2.4
Mother received adequate prenatal care[1]	0.711	0.709	0.621	**-26.5**	0.5
Mother's age is 20-34	0.787	0.803	0.000	-7.0	-4.0
Mother's age is 35+	0.142	0.132	0.005	6.3	2.3
Mother is black	0.056	0.054	0.518	4.0	0.7
Mother is Hispanic/Latina	0.097	0.098	0.810	-0.2	-0.2
Mother is other non-white or mixed race	0.151	0.149	0.588	6.5	0.6
Mother had one prior live birth	0.281	0.279	0.602	-8.5	0.5
Mother had two or more prior live births	0.281	0.282	0.821	4.8	-0.2
Mother is married	0.623	0.624	0.809	**-11.8**	-0.2
Mother has a high school education	0.827	0.837	0.015	-6.5	-2.5
Infant is male	0.549	0.553	0.390	7.3	-0.9
Cesarean delivery	0.429	0.428	0.918	**22.0**	0.1
Payer is a non-Medicaid public payer[2]	0.050	0.045	0.040	0.0	1.9
Payer is private insurance	0.497	0.493	0.457	**-10.0**	0.8
Payer is self or uninsured	0.012	0.010	0.037	1.5	2.1
Facility has 100-300 beds	0.458	0.459	0.846	-8.9	-0.2
Facility has >300 beds	0.465	0.467	0.706	**17.6**	-04
Facility is in an urban county[3]	0.814	0.818	0.287	**14.6**	-1.0
Facility has a NICU	0.419	0.420	0.757	**14.3**	-0.3
Year of birth is 2010 (index)	0.204	0.203	0.800	0.8	0.3
Year of birth is 2011 (index)	0.188	0.189	0.948	-1.0	-0.1
Year of birth is 2012 (index)	0.201	0.202	0.879	0.0	-0.2
Year of birth is 2013 (index)	0.199	0.199	0.959	-0.7	-0.1
Overall statistics					
Preterm group N	19,270	Median overall bias	0.5	Rubin's R	1.14
Comparison group N[4]	204,015	Mean overall bias	1.0	Rubin's B	6.9

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A18

Infant Mortality Related to Preterm Birth in Washington State –
GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Preterm birth (birth indicator of interest)		6.176	***	0.733
Mother smoked during pregnancy		1.173		0.186
Mother's age *(reference age 20-34)*	Age <20	1.233		0.251
	Age 35+	0.718	#	0.126
Mother's race *(reference is non-Hispanic white)*	Black	0.764		0.181
	Hispanic/Latina	0.784		0.160
	Other non-white or mixed race	0.995		0.149
Parity *(reference is one prior live birth)*	No previous live births	0.803	#	0.106
	Two or more prior live births	1.001		0.138
Mother is married		0.816		0.106
Mother has at least a high school education		0.740	*	0.105
Infant is male		1.298	*	0.139
Cesarean delivery		1.544	***	0.165
Payer *(reference is other public payer[2])*	Medicaid	1.334		0.384
	Private insurance	1.094		0.317
	Self or uninsured	2.507	*	1.143
Constant		0.00145	***	0.000596
N[3]	223,285			
Residual df	223,260			
AIC	0.016486			
BIC	-2,746,085			

Notes:

GLM using a logit link and a binomial distribution. Model also had fixed effects on year and birth facility.

[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular preterm infant.

2) Low birthweight

Infant health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A19) and the GLM (Exhibit A20) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in Washington State, infants that are born LBW have $31,299 in 2014 dollars (RSE $863) in additional inpatient healthcare utilization costs compared to similar infants that are not born LBW (see Exhibit A3).

Exhibit A19

Infant Health Care Utilization Costs Related to Low Birthweight Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.151	0.143	0.072	**19.4**	2.5
Mother received adequate prenatal care[1]	0.704	0.706	0.710	**-27.6**	-0.5
Mother's age is 20-34	0.783	0.792	0.088	-8.2	-2.2
Mother's age is 35+	0.139	0.133	0.226	4.5	1.6
Mother is black	0.075	0.071	0.266	**12.4**	1.5
Mother is Hispanic/Latina	0.096	0.096	0.915	0.8	0.1
Mother is other non-white or mixed race	0.168	0.168	0.946	**10.4**	-0.1
Mother had one prior live birth	0.256	0.252	0.497	**-14.1**	0.8
Mother had two or more prior live births	0.237	0.235	0.646	-5.3	0.6
Mother is married	0.599	0.596	0.547	**-18.4**	0.8
Mother has a high school education	0.814	0.820	0.198	**-10.5**	-1.6
Infant is male	0.473	0.477	0.545	-8.3	-0.8
Cesarean delivery	0.456	0.459	0.614	**27.5**	-0.7
Payer is a non-Medicaid public payer[2]	0.048	0.045	0.231	-1.0	1.4
Payer is private insurance	0.479	0.477	0.734	**-15.1**	0.4
Payer is self or uninsured	0.013	0.010	0.020	2.5	3.0
Facility has 100-300 beds	0.426	0.425	0.909	**-13.5**	0.1
Facility has >300 beds	0.502	0.507	0.458	**23.3**	-0.9
Facility is in an urban county[3]	0.821	0.824	0.532	**17.2**	-0.7
Facility has a NICU	0.414	0.418	0.540	**17.8**	-0.8
Year of birth is 2010 (index)	0.204	0.202	0.790	-0.1	0.3
Year of birth is 2011 (index)	0.191	0.191	0.974	-1.2	0.0
Year of birth is 2012 (index)	0.196	0.196	0.924	-1.0	0.1
Year of birth is 2013 (index)	0.208	0.211	0.676	2.2	-0.5
Overall statistics					
LBW group N	12,634	Median overall bias	0.8	Rubin's R	1.13
Comparison group N[4]	169,198	Mean overall bias	1.0	Rubin's B	7.3

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A20

Infant Health Care Utilization Costs Related to Low Birthweight Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
LBW birth (birth indicator of interest)		7.541	***	0.286
Mother smoked during pregnancy		0.967		0.041
Mother received adequate prenatal care[2]		0.943		0.037
Mother's age *(reference age 20-34)*	Age <20	0.998		0.062
	Age 35+	0.943		0.048
Mother's race *(reference is non-Hispanic white)*	Black	0.804	**	0.055
	Hispanic/Latina	0.932		0.099
	Other non-white or mixed race	0.982		0.057
Parity *(reference is one prior live birth)*	No previous live births	1.026		0.036
	Two or more prior live births	1.255	***	0.068
Mother is married		0.959		0.037
Mother has at least a high school education		0.881	*	0.049
Infant is male		1.204	***	0.039
Cesarean delivery		1.473	***	0.050
Payer *(reference is other public payer[3])*	Medicaid	1.181	*	0.085
	Private insurance	1.057		0.078
	Self or uninsured	1.049		0.168
Constant		5,232.647	***	629.689
N[4]	181,832			
Residual df	181,744			
AIC	2.855			
BIC	-2,145,478			

Notes:

GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.

[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001

[2] Adequate prenatal care according to the Kotelchuck Index.

[3] Indian Health Service, Champus/Tricare, or other government payer.

[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular LBW infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A21) and the GLM (Exhibit A22) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, infants that are born LBW have $31,574 (in 2014 dollars; RSE $1,435) in additional inpatient healthcare utilization costs compared to similar infants that are not born LBW (see Exhibit A3).

Exhibit A21

Infant Health Care Utilization Costs Related to Low Birthweight Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.234	0.233	0.913	**21.7**	0.2
Mother received adequate prenatal care[1]	0.655	0.661	0.519	**-24.1**	-1.3
Mother received infertility treatment	0.071	0.079	0.127	-3.8	-2.7
Mother's age is 20-34	0.781	0.800	0.013	-6.3	-4.6
Mother's age is 35+	0.090	0.075	0.004	6.2	5.3
Mother is black	0.103	0.097	0.266	**11.5**	2.1
Mother is Hispanic/Latina	0.169	0.169	1.000	-7.4	0.0
Mother is other non-white or mixed race	0.135	0.131	0.567	7.7	1.1
Mother had one prior live birth	0.248	0.246	0.797	-8.8	0.5
Mother had two or more prior live births	0.315	0.309	0.576	-6.0	1.0
Mother is married	0.373	0.367	0.539	**-13.0**	1.1
Mother has a high school education	0.671	0.682	0.198	-3.1	-2.4
Infant is male	0.477	0.478	0.882	-6.6	-0.3
Cesarean delivery	0.418	0.418	0.940	**25.8**	-0.1
Facility has 100-300 beds	0.450	0.450	0.926	**-15.9**	0.2
Facility has >300 beds	0.444	0.451	0.456	**31.8**	-1.4
Facility is in an urban county[2]	0.751	0.754	0.699	**23.6**	-0.7
Facility has a NICU	0.407	0.419	0.201	**23.3**	-2.5
Year of birth is 2010 (index)	0.204	0.206	0.854	0.7	-0.3
Year of birth is 2011 (index)	0.197	0.198	0.889	-0.7	-0.3
Year of birth is 2012 (index)	0.193	0.192	0.851	-1.4	0.3
Year of birth is 2013 (index)	0.199	0.200	0.926	0.9	-0.2

Overall statistics					
LBW group N	5,825	Median overall bias	0.9	Rubin's R	1.10
Comparison group N[3]	46,648	Mean overall bias	1.3	Rubin's B	8.6

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A22

Infant Health Care Utilization Costs Related to Low Birthweight Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
LBW birth (birth indicator of interest)		6.675	***	0.310
Mother smoked during pregnancy		1.029		0.050
Mother received adequate prenatal care[2]		0.976		0.046
Mother's age *(reference age 20-34)*	Age <20	0.977		0.062
	Age 35+	1.004		0.103
Mother's race *(reference is non-Hispanic white)*	Black	0.703	***	0.060
	Hispanic/Latina	0.826	**	0.054
	Other non-white or mixed race	1.069		0.108
Parity *(reference is one prior live birth)*	No previous live births	1.003		0.051
	Two or more prior live births	1.207	**	0.076
Mother is married		0.997		0.050
Mother has at least a high school education		0.952		0.049
Infant is male		1.242	***	0.057
Cesarean delivery		1.388	***	0.059
Constant		7,032.787	***	899.537
N[3]	52,473			
Residual df	52,389			
AIC	4.586877			
BIC	-543,202			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular LBW infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A23) and the GLM (Exhibit A24) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a private payer population in Washington State, infants that are born LBW have $31,576 (in 2014 dollars; RSE $1,002) in additional inpatient healthcare utilization costs compared to similar infants that are not born LBW (see Exhibit A3).

Exhibit A23

Infant Health Care Utilization Costs Related to Low Birthweight Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.065	0.064	0.739	**11.1**	0.7
Mother received adequate prenatal care[1]	0.757	0.757	0.983	**-28.4**	0.0
Mother received infertility treatment	0.138	0.144	0.364	-3.0	-1.7
Mother's age is 20-34	0.784	0.790	0.437	-9.4	-1.4
Mother's age is 35+	0.190	0.186	0.530	7.3	1.2
Mother is black	0.045	0.044	0.691	**10.4**	0.8
Mother is Hispanic/Latina	0.031	0.029	0.522	3.6	1.2
Mother is other non-white or mixed race	0.201	0.201	0.982	**15.6**	0.0
Mother had one prior live birth	0.262	0.259	0.634	**-17.7**	0.8
Mother had two or more prior live births	0.159	0.157	0.672	**-12.3**	0.7
Mother is married	0.818	0.823	0.492	**-13.4**	-1.3
Mother has a high school education	0.951	0.959	0.031	-8.6	-3.9
Infant is male	0.474	0.475	0.913	-9.0	-0.2
Cesarean delivery	0.496	0.498	0.841	**31.2**	-0.4
Facility has 100-300 beds	0.414	0.411	0.712	**-13.2**	0.7
Facility has >300 beds	0.547	0.551	0.648	**20.6**	-0.8
Facility is in an urban county[2]	0.888	0.891	0.582	**18.8**	-0.9
Facility has a NICU	0.444	0.445	0.898	**16.4**	-0.2
Year of birth is 2010 (index)	0.206	0.204	0.787	-0.8	0.5
Year of birth is 2011 (index)	0.184	0.184	0.944	-2.3	-0.1
Year of birth is 2012 (index)	0.201	0.202	0.928	-0.8	-0.2
Year of birth is 2013 (index)	0.216	0.213	0.707	3.7	0.7
Overall statistics					
LBW group N	6,048	Median overall bias	0.7	Rubin's R	1.17
Comparison group N[3]	118,958	Mean overall bias	0.8	Rubin's B	5.8

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A24

Infant Health Care Utilization Costs Related to Low Birthweight Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
Low birthweight birth (birth indicator of interest)		9.119	***	0.361
Mother smoked during pregnancy		0.840	*	0.065
Mother received adequate prenatal care[2]		0.870	*	0.052
Mother's age *(reference age 20-34)*	Age <20	1.059		0.147
	Age 35+	0.969		0.049
Mother's race *(reference is non-Hispanic white)*	Black	0.869		0.081
	Hispanic/Latina	0.964		0.109
	Other non-white or mixed race	0.900		0.062
Parity *(reference is one prior live birth)*	No previous live births	1.032		0.044
	Two or more prior live births	1.169	**	0.069
Mother is married		0.871	*	0.051
Mother has at least a high school education		0.889		0.088
Infant is male		1.216	***	0.046
Cesarean delivery		1.560	***	0.059
Constant		5,159.405	***	748.498
N[3]	125,006			
Residual df	124,922			
AIC	1.970367			
BIC	-1,441,170			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular LBW infant.

Maternal health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A25) and the GLM (Exhibit A26) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in Washington State, mothers of infants that are born LBW have $3,552 (in 2014 dollars; RSE $90) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born LBW (see Exhibit A3).

Exhibit A25

Maternal Health Care Utilization Costs Related to Low Birthweight Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.155	0.150	0.254	**19.4**	1.6
Mother received adequate prenatal care[1]	0.704	0.701	0.654	**-27.6**	0.6
Mother's age is 20-34	0.784	0.791	0.162	-8.2	-1.8
Mother's age is 35+	0.135	0.131	0.323	4.5	1.2
Mother is black	0.078	0.074	0.281	**12.4**	1.4
Mother is Hispanic/Latina	0.092	0.090	0.635	0.8	0.6
Mother is other non-white or mixed race	0.163	0.164	0.920	**10.4**	-0.1
Mother had one prior live birth	0.255	0.253	0.721	**-14.1**	0.4
Mother had two or more prior live births	0.236	0.235	0.872	-5.3	0.2
Mother is married	0.589	0.590	0.850	**-18.4**	-0.2
Mother has a high school education	0.817	0.823	0.238	**-10.5**	-1.5
Infant is male	0.471	0.472	0.803	-8.3	-0.3
Payer is a non-Medicaid public payer[2]	0.050	0.047	0.224	-1.0	1.4
Payer is private insurance	0.474	0.474	0.911	**-15.1**	0.1
Payer is self or uninsured	0.013	0.009	0.014	2.5	3.0
Facility has 100-300 beds	0.440	0.439	0.890	**-13.5**	0.2
Facility has >300 beds	0.494	0.497	0.619	**23.3**	-0.6
Facility is in an urban county[3]	0.829	0.832	0.573	**17.2**	-0.6
Facility has a NICU	0.439	0.444	0.484	**17.8**	-0.9
Year of birth is 2010 (index)	0.205	0.204	0.805	-0.1	0.3
Year of birth is 2011 (index)	0.195	0.194	0.777	-1.2	0.3
Year of birth is 2012 (index)	0.189	0.190	0.975	-1.0	0.0
Year of birth is 2013 (index)	0.203	0.206	0.622	2.2	-0.6
Overall statistics					
LBW group N	12,953	Median overall bias	0.6	Rubin's R	1.20
Comparison group N[4]	202,609	Mean overall bias	0.8	Rubin's B	5.2

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A26

Maternal Health Care Utilization Costs Related to Low Birthweight Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
LBW birth (birth indicator of interest)		1.642	***	0.017
Mother smoked during pregnancy		1.060	**	0.022
Mother received adequate prenatal care[2]		0.990		0.012
Mother's age *(reference age 20-34)*	Age <20	0.903	***	0.017
	Age 35+	1.105	***	0.018
Mother's race *(reference is non-Hispanic white)*	Black	1.029		0.024
	Hispanic/Latina	1.004		0.021
	Other non-white or mixed race	0.966	*	0.016
Parity *(reference is one prior live birth)*	No previous live births	1.145	***	0.015
	Two or more prior live births	1.066	***	0.018
Mother is married		0.962	**	0.013
Mother has at least a high school education		1.011		0.017
Infant is male		1.027	*	0.011
Payer *(reference is other public payer[3])*	Medicaid	1.045	**	0.016
	Private insurance	1.039		0.028
	Self or uninsured	0.972		0.052
Constant		6,144.464	***	210.206
N[4]	215,562			
Residual df	215,475			
AIC	2.35884			
BIC	-2,635,202			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Indian Health Service, Champus/Tricare, or other government payer.
[4] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a LBW infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A27) and the GLM (Exhibit A28) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, mothers of infants that are born LBW have $3,270 (in 2014 dollars; RSE $140) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born LBW (see Exhibit A3).

Exhibit A27

Maternal Health Care Utilization Costs Related to Low Birthweight (LBW) Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.238	0.232	0.413	**21.7**	1.7
Mother received adequate prenatal care[1]	0.655	0.655	0.969	**-24.1**	-0.1
Mother's age is 20-34	0.782	0.799	0.015	-6.3	-4.4
Mother's age is 35+	0.088	0.078	0.051	6.2	3.6
Mother is black	0.108	0.106	0.745	**11.5**	0.6
Mother is Hispanic/Latina	0.159	0.162	0.672	-7.4	-0.7
Mother is other non-white or mixed race	0.136	0.136	1.000	7.7	0.0
Mother had one prior live birth	0.247	0.239	0.297	-8.8	1.9
Mother had two or more prior live births	0.312	0.316	0.609	-6.0	-0.9
Mother is married	0.362	0.357	0.607	**-13.0**	0.9
Mother has a high school education	0.683	0.688	0.555	-3.1	-1.1
Infant is male	0.478	0.479	0.884	-6.6	-0.3
Facility has 100-300 beds	0.462	0.460	0.798	**-15.9**	0.5
Facility has >300 beds	0.440	0.446	0.569	**31.8**	-1.1
Facility is in an urban county[2]	0.765	0.766	0.829	**23.6**	-0.4
Facility has a NICU	0.438	0.444	0.532	**23.2**	-1.2
Year of birth is 2010 (index)	0.208	0.208	0.964	0.7	0.1
Year of birth is 2011 (index)	0.200	0.199	0.873	-0.7	0.3
Year of birth is 2012 (index)	0.183	0.185	0.777	-1.4	-0.5
Year of birth is 2013 (index)	0.195	0.195	0.945	0.9	-0.1

Overall statistics					
LBW group N	5,997	Median overall bias	0.7	Rubin's R	1.11
Comparison group N[3]	64,635	Mean overall bias	1.0	Rubin's B	6.1

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A28

Maternal Health Care Utilization Costs Related to Low Birthweight Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
LBW birth (birth indicator of interest)		1.575	***	0.026
Mother smoked during pregnancy		1.060	*	0.026
Mother received adequate prenatal care[2]		1.013		0.019
Mother's age *(reference age 20-34)*	Age <20	0.915	***	0.021
	Age 35+	1.110	***	0.033
Mother's race *(reference is non-Hispanic white)*	Black	0.986		0.032
	Hispanic/Latina	0.978		0.025
	Other non-white or mixed race	1.011		0.035
Parity *(reference is one prior live birth)*	No previous live births	1.113	***	0.027
	Two or more prior live births	1.035		0.028
Mother is married		0.983		0.019
Mother has at least a high school education		1.032		0.020
Infant is male		1.016		0.018
Constant		7,306.765	***	394.725
N[3]	70,632			
Residual df	70,548			
AIC	3.336468			
BIC	-782,177			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a LBW infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A29) and the GLM (Exhibit A30) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a private pay population in Washington State, mother of infants that are born LBW have $3,714 (in 2014 dollars; RSE $120) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born LBW (see Exhibit A3).

Exhibit A29

Maternal Health Care Utilization Costs Related to Low Birthweight (LBW) Birth in a Private Payer Population in Washington State –Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.067	0.066	0.857	**11.1**	0.4
Mother received adequate prenatal care[1]	0.758	0.756	0.801	**-28.4**	0.5
Mother's age is 20-34	0.786	0.789	0.724	-9.4	-0.6
Mother's age is 35+	0.186	0.183	0.745	7.3	0.6
Mother is black	0.047	0.045	0.635	**10.4**	0.9
Mother is Hispanic/Latina	0.030	0.030	0.958	3.6	-0.1
Mother is other non-white or mixed race	0.192	0.192	0.927	**15.6**	0.2
Mother had one prior live birth	0.261	0.260	0.821	**-17.7**	0.4
Mother had two or more prior live births	0.157	0.157	1.000	**-12.3**	0.0
Mother is married	0.812	0.812	0.982	**-13.4**	0.0
Mother has a high school education	0.951	0.955	0.289	-8.6	-1.9
Infant is male	0.470	0.471	0.928	-9.0	-0.2
Facility has 100-300 beds	0.431	0.428	0.785	**-13.2**	0.5
Facility has >300 beds	0.535	0.537	0.842	**20.6**	-0.4
Facility is in an urban county[2]	0.892	0.892	0.954	**18.8**	0.1
Facility has a NICU	0.468	0.469	0.885	**16.4**	-0.3
Year of birth is 2010 (index)	0.201	0.203	0.875	-0.8	-0.3
Year of birth is 2011 (index)	0.188	0.186	0.736	-2.3	0.6
Year of birth is 2012 (index)	0.197	0.197	0.982	-0.8	0.0
Year of birth is 2013 (index)	0.213	0.213	0.930	3.7	-0.2

Overall statistics					
LBW group N	6,146	Median overall bias	0.3	Rubin's R	1.10
Comparison group N[3]	132,699	Mean overall bias	0.4	Rubin's B	2.6

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A30

Maternal Health Care Utilization Costs Related to Low Birthweight (LBW) Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
LBW birth (birth indicator of interest)		1.691	***	0.022
Mother smoked during pregnancy		1.109	*	0.053
Mother received adequate prenatal care[2]		0.963	*	0.017
Mother's age *(reference age 20-34)*	Age <20	0.908	*	0.042
	Age 35+	1.111	***	0.021
Mother's race *(reference is non-Hispanic white)*	Black	1.062	#	0.037
	Hispanic/Latina	1.082	#	0.050
	Other non-white or mixed race	0.935	***	0.018
Parity *(reference is one prior live birth)*	No previous live births	1.158	***	0.019
	Two or more prior live births	1.060	*	0.026
Mother is married		0.951	*	0.021
Mother has at least a high school education		0.970		0.041
Infant is male		1.049	**	0.015
Constant		6,152.883	***	340.351
N[3]	138,845			
Residual df	138,762			
AIC	1.73771			
BIC	-1,638,251			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a LBW infant.

Infant mortality

We report the results of propensity score matching procedures (Exhibit A31) and the GLM (Exhibit A32) on a matched sample where the indicator of interest is low birthweight (LBW) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant mortality.

We find that, in Washington State, infants that are born LBW have 10.7 times greater odds of infant mortality (D-cox effect size 1.437, RSE 0.078) compared to similar infants that are not born LBW (see Exhibit A3).

Exhibit A31

Infant Mortality Related to Low Birthweight (LBW) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	LBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.152	0.149	0.501	**19.4**	0.9
Mother received adequate prenatal care[1]	0.704	0.702	0.646	**-27.6**	0.6
Mother's age is 20-34	0.782	0.790	0.090	-8.2	-2.1
Mother's age is 35+	0.137	0.131	0.154	4.5	1.7
Mother is black	0.077	0.073	0.201	**12.4**	1.6
Mother is Hispanic/Latina	0.100	0.100	1.000	0.8	0.0
Mother is other non-white or mixed race	0.167	0.167	0.961	**10.4**	0.1
Mother had one prior live birth	0.254	0.253	0.868	**-14.1**	0.2
Mother had two or more prior live births	0.240	0.239	0.910	-5.3	0.1
Mother is married	0.589	0.590	0.922	**-18.4**	-0.1
Mother has a high school education	0.809	0.813	0.416	**-10.5**	-1.0
Infant is male	0.471	0.473	0.727	-8.3	-0.4
Payer is a non-Medicaid public payer[2]	0.0.048	0.046	0.321	-1.0	1.1
Payer is private insurance	0.469	0.468	0.801	**-15.1**	0.3
Payer is self or uninsured	0.012	0.010	0.039	2.5	2.5
Facility has 100-300 beds	0.438	0.436	0.726	**-13.5**	0.4
Facility has >300 beds	0.491	0.495	0.532	**23.3**	-0.8
Facility is in an urban county[3]	0.825	0.827	0.623	**17.2**	-0.6
Facility has a NICU	0.433	0.436	0.680	**17.8**	-0.5
Year of birth is 2010 (index)	0.204	0.204	0.893	-0.1	0.2
Year of birth is 2011 (index)	0.192	0.191	0.726	-1.2	0.4
Year of birth is 2012 (index)	0.192	0.192	0.976	-1.0	0.0
Year of birth is 2013 (index)	0.203	0.204	0.766	2.2	-0.4
Overall statistics					
LBW group N	13,871	Median overall bias	0.4	Rubin's R	1.16
Comparison group N[4]	217,265	Mean overall bias	0.7	Rubin's B	4.5

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A32

Infant Mortality Related to Low Birthweight (LBW) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
LBW birth (birth indicator of interest)		10.711	***	1.373
Mother smoked during pregnancy		1.129		0.169
Mother's age *(reference age 20-34)*	Age <20	1.232		0.256
	Age 35+	0.776		0.132
Mother's race *(reference is non-Hispanic white)*	Black	0.594	*	0.138
	Hispanic/Latina	0.799		0.161
	Other non-white or mixed race	0.919		0.139
Parity *(reference is one prior live birth)*	No previous live births	0.651	**	0.085
	Two or more prior live births	1.105		0.155
Mother is married		1.003		0.129
Mother has at least a high school education		0.774	#	0.109
Infant is male		1.190		0.126
Payer *(reference is other public payer[2])*	Medicaid	1.334		0.384
	Private insurance	1.094		0.317
	Self or uninsured	2.507	*	1.143
Facility size *(reference is 100-300 beds)*	<100 beds	1.317		0.346
	>300 beds	1.865	***	0.237
Facility is in an urban county[3]		0.697		0.161
Facility has a NICU		2.078	***	0.264
Constant		0.00185	***	0.000789
N[4]	231,136			
Residual df	231,111			
AIC	0.014906			
BIC	-2,851,002			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular LBW infant.

3) Very low birthweight (VLBW)

Infant health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A33) and the GLM (Exhibit A34) on a matched sample where the indicator of interest is very low birthweight (VLBW) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in Washington State, infants that are born VLBW have $145,410 (in 2014 dollars; RSE $4,423) in additional inpatient healthcare utilization costs compared to similar infants that are not born VLBW (see Exhibit A3).

Exhibit A33

Infant Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.147	0.140	0.570	**17.4**	2.3
Mother received adequate prenatal care[1]	0.768	0.761	0.670	-9.5	1.6
Mother received infertility treatment	0.094	0.109	0.185	-7.2	-4.7
Mother's age is 20-34	0.782	0.802	0.167	-9.7	-5.0
Mother's age is 35+	0.144	0.131	0.318	5.6	3.7
Mother is black	0.094	0.087	0.528	**18.9**	2.5
Mother is Hispanic/Latina	0.096	0.094	0.853	-1.7	0.7
Mother is other non-white or mixed race	0.138	0.124	0.238	1.8	4.2
Mother had one prior live birth	0.243	0.237	0.703	**-16.8**	1.3
Mother had two or more prior live births	0.252	0.254	0.868	-3.9	-0.6
Mother is married	0.579	0.577	0.912	**-22.4**	0.4
Mother has a high school education	0.807	0.814	0.612	**-11.3**	-1.9
Infant is male	0.511	0.514	0.856	-0.8	-0.7
Cesarean delivery	0.674	0.680	0.757	**73.3**	-1.1
Payer is a non-Medicaid public payer[2]	0.039	0.040	0.852	-3.8	-0.6
Payer is private insurance	0.470	0.472	0.913	**-17.2**	-0.4
Payer is self or uninsured	0.016	0.007	0.019	4.1	8.4
Facility has 100-300 beds	0.284	0.280	0.809	**-40.4**	0.8
Facility has >300 beds	0.693	0.697	0.814	**59.5**	-0.8
Facility is in an urban county[3]	0.928	0.931	0.778	**44.1**	-0.7
Facility has a NICU	0.566	0.561	0.798	**47.0**	1.0
Year of birth is 2010 (index)	0.204	0.208	0.754	-1.2	-1.2
Year of birth is 2011 (index)	0.176	0.172	0.811	-3.0	0.8
Year of birth is 2012 (index)	0.206	0.206	1.000	0.6	0.0
Year of birth is 2013 (index)	0.218	0.212	0.725	4.5	1.3

Overall statistics					
VLBW group N	1,526	Median overall bias	1.0	Rubin's R	1.56
Comparison group N[4]	56,513	Mean overall bias	1.8	Rubin's B	14.6

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A34

Infant Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		23.019	***	1.228
Mother smoked during pregnancy		1.032		0.076
Mother received adequate prenatal care[2]		0.789	**	0.055
Mother's age *(reference age 20-34)*	Age <20	1.030		0.097
	Age 35+	1.049		0.080
Mother's race *(reference is non-Hispanic white)*	Black	0.878		0.084
	Hispanic/Latina	0.878		0.091
	Other non-white or mixed race	1.036		0.176
Parity *(reference is one prior live birth)*	No previous live births	1.027		0.054
	Two or more prior live births	1.182		0.086
Mother is married		0.862	**	0.046
Mother has at least a high school education		1.033		0.081
Infant is male		1.174	**	0.056
Cesarean delivery		1.142	*	0.061
Payer *(reference is other public payer[3])*	Medicaid	0.868		0.185
	Private insurance	0.838		0.180
	Self or uninsured	0.709		0.177
Constant		9,540.224	***	2,377.588
N[4]	58,039			
Residual df	57,957			
AIC	1.183565			
BIC	-631,051			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Indian Health Service, Champus/Tricare, or other government payer.
[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular VLBW infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A35) and the GLM (Exhibit A36) on a matched sample where the indicator of interest is very low birthweight (VLBW) birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, infants that are born VLBW have $145,379 (in 2014 dollars; RSE $6,897) in additional inpatient healthcare utilization costs compared to similar infants that are not born VLBW (see Exhibit A3).

Exhibit A35

Infant Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.225	0.209	0.484	**19.5**	4.0
Mother received adequate prenatal care[1]	0.717	0.717	1.000	-7.1	0.0
Mother received infertility treatment	0.066	0.077	0.434	-6.6	-4.0
Mother's age is 20-34	0.760	0.776	0.455	**-12.1**	-4.0
Mother's age is 35+	0.120	0.104	0.317	**11.4**	5.7
Mother is black	0.128	0.127	0.937	**18.8**	0.4
Mother is Hispanic/Latina	0.156	0.162	0.774	**-13.9**	-1.5
Mother is other non-white or mixed race	0.120	0.111	0.565	2.9	3.0
Mother had one prior live birth	0.235	0.222	0.574	**-11.2**	2.8
Mother had two or more prior live births	0.329	0.330	0.955	-8.5	-0.3
Mother is married	0.377	0.381	0.871	**-13.9**	-0.9
Mother has a high school education	0.678	0.683	0.822	-1.2	-1.2
Infant is male	0.507	0.522	0.563	-1.1	-3.0
Cesarean delivery	0.641	0.646	0.826	**71.2**	-1.2
Facility has 100-300 beds	0.297	0.286	0.644	**-48.4**	2.3
Facility has >300 beds	0.671	0.680	0.737	**78.8**	-1.8
Facility is in an urban county[2]	0.909	0.909	1.000	**58.6**	0.0
Facility has a NICU	0.599	0.592	0.789	**58.4**	1.5
Year of birth is 2010 (index)	0.195	0.192	0.894	-2.3	0.7
Year of birth is 2011 (index)	0.163	0.160	0.887	-4.8	-0.7
Year of birth is 2012 (index)	0.217	0.218	0.949	3.6	-0.3
Year of birth is 2013 (index)	0.215	0.209	0.748	3.7	1.7
Overall statistics					
VLBW group N	724	Median overall bias	1.5	Rubin's R	1.09
Comparison group N[3]	8,159	Mean overall bias	1.9	Rubin's B	11.7

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A36

Infant Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Medicaid Population in Washington State–GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		20.857	***	1.520
Mother smoked during pregnancy		1.114		0.095
Mother received adequate prenatal care[2]		0.852	*	0.067
Mother's age *(reference age 20-34)*	Age <20	0.905		0.089
	Age 35+	1.023		0.114
Mother's race *(reference is non-Hispanic white)*	Black	0.815	#	0.098
	Hispanic/Latina	0.873		0.094
	Other non-white or mixed race	1.111		0.145
Parity *(reference is one prior live birth)*	No previous live births	1.093		0.098
	Two or more prior live births	1.079		0.111
Mother is married		0.771	***	0.056
Mother has at least a high school education		1.079		0.095
Infant is male		1.274	***	0.088
Cesarean delivery		1.102		0.079
Constant		9,508.658	***	2,107.651
N[3]	8,883			
Residual df	8,809			
AIC	3.690084			
BIC	-77,810.5			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular VLBW infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A37) and the GLM (Exhibit A38) on a matched sample where the indicator of interest is very low birthweight (VLBW) birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a private payer population in Washington State, infants that are born VLBW have $144,923 (in 2014 dollars; RSE $5,282) in additional inpatient healthcare utilization costs compared to similar infants that are not born VLBW (see Exhibit A3).

Exhibit A37

Infant Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.064	0.053	0.369	**10.0**	5.1
Mother received adequate prenatal care[1]	0.831	0.818	0.532	-7.6	3.5
Mother received infertility treatment	0.124	0.136	0.490	-5.0	-3.7
Mother's age is 20-34	0.806	0.827	0.306	-5.5	-5.3
Mother's age is 35+	0.166	0.155	0.565	3.2	3.0
Mother is black	0.054	0.059	0.732	**16.1**	-2.0
Mother is Hispanic/Latina	0.039	0.041	0.893	6.8	-0.8
Mother is other non-white or mixed race	0.160	0.154	0.717	4.2	1.9
Mother had one prior live birth	0.256	0.246	0.670	-2.0	2.2
Mother had two or more prior live births	0.173	0.166	0.725	-7.8	1.8
Mother is married	0.781	0.781	1.000	**-20.3**	0.0
Mother has a high school education	0.934	0.946	0.320	**-14.2**	-5.6
Infant is male	0.521	0.518	0.916	-0.4	0.6
Cesarean delivery	0.708	0.710	0.954	**76.2**	-0.3
Facility has 100-300 beds	0.271	0.270	0.953	**-38.6**	0.3
Facility has >300 beds	0.719	0.720	0.953	**51.3**	-0.3
Facility is in an urban county[2]	0.954	0.961	0.513	**41.2**	-2.3
Facility has a NICU	0.560	0.550	0.710	**41.0**	2.0
Year of birth is 2010 (index)	0.215	0.223	0.702	0.6	-2.1
Year of birth is 2011 (index)	0.186	0.173	0.536	-0.8	3.2
Year of birth is 2012 (index)	0.191	0.201	0.642	-3.1	-2.5
Year of birth is 2013 (index)	0.219	0.218	0.949	5.6	0.3
Overall statistics					
VLBW group N	716	Median overall bias	2.1	Rubin's R	1.28
Comparison group N[4]	47,675	Mean overall bias	2.2	Rubin's B	14.2

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A38

Infant Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		27.332	***	1.600
Mother smoked during pregnancy		1.062		0.162
Mother received adequate prenatal care[2]		0.789	*	0.074
Mother's age *(reference age 20-34)*	Age <20	0.697	#	0.150
	Age 35+	1.047		0.083
Mother's race *(reference is non-Hispanic white)*	Black	1.050		0.121
	Hispanic/Latina	0.765	*	0.096
	Other non-white or mixed race	1.070		0.121
Parity *(reference is one prior live birth)*	No previous live births	1.027		0.061
	Two or more prior live births	1.052		0.084
Mother is married		0.986		0.064
Mother has at least a high school education		0.827		0.154
Infant is male		1.151	**	0.061
Cesarean delivery		1.165	*	0.073
Constant		8,002.065	***	1,927.272
N[3]	48,391			
Residual df	48,320			
AIC	0.662331			
BIC	-519,254			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular VLBW infant.

Maternal health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A39) and the GLM (Exhibit A40) on a matched sample where the indicator of interest is very low birthweight (VLBW) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum.

We find that, in Washington State, mothers of infants that are born VLBW have $8,592 (in 2014 dollars; RSE $372) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born VLBW (see Exhibit A3).

Exhibit A39

Maternal Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.148	0.135	0.307	**17.4**	4.0
Mother received adequate prenatal care[1]	0.774	0.768	0.703	**-9.5**	1.4
Mother's age is 20-34	0.777	0.783	0.699	-9.7	-1.4
Mother's age is 35+	0.145	0.144	0.960	5.	0.2
Mother is black	0.098	0.096	0.857	**18.9**	0.7
Mother is Hispanic/Latina	0.085	0.082	0.797	-1.7	0.9
Mother is other non-white or mixed race	0.132	0.131	0.916	1.8	0.4
Mother had one prior live birth	0.243	0.240	0.835	**-16.8**	0.7
Mother had two or more prior live births	0.247	0.247	0.967	-3.9	0.1
Mother is married	0.569	0.565	0.829	**-22.4**	0.8
Mother has a high school education	0.807	0.810	0.821	**-11.3**	-0.8
Infant is male	0.513	0.509	0.831	-0.8	0.8
Payer is a non-Medicaid public payer[2]	0.039	0.032	0.248	-3.8	3.4
Payer is private insurance	0.472	0.474	0.887	**-17.2**	-0.5
Payer is self or uninsured	0.017	0.012	0.235	4.1	4.7
Facility has 100-300 beds	0.309	0.306	0.847	**-40.4**	0.7
Facility has >300 beds	0.672	0.676	0.790	**59.5**	-0.9
Facility is in an urban county[3]	0.932	0.935	0.721	**44.1**	-0.9
Facility has a NICU	0.598	0.596	0.913	**47.0**	0.4
Year of birth is 2010 (index)	0.209	0.210	0.965	-1.2	-0.2
Year of birth is 2011 (index)	0.181	0.181	1.000	-3.0	0.0
Year of birth is 2012 (index)	0.192	0.185	0.617	0.6	1.7
Year of birth is 2013 (index)	0.212	0.212	1.000	4.5	0.0
Overall statistics					
VLBW group N	1,577	Median overall bias	0.8	Rubin's R	1.29
Comparison group N[4]	90,957	Mean overall bias	1.1	Rubin's B	8.8

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A40

Maternal Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		2.474	***	0.068
Mother smoked during pregnancy		1.048		0.046
Mother received adequate prenatal care[2]		0.940	#	0.032
Mother's age *(reference age 20-34)*	Age <20	0.857	**	0.041
	Age 35+	1.099	*	0.046
Mother's race *(reference is non-Hispanic white)*	Black	1.035		0.056
	Hispanic/Latina	0.974		0.064
	Other non-white or mixed race	1.043		0.046
Parity *(reference is one prior live birth)*	No previous live births	1.107	**	0.038
	Two or more prior live births	1.054		0.047
Mother is married		0.983		0.034
Mother has at least a high school education		0.952		0.042
Infant is male		0.982		0.027
Payer *(reference is other public payer[3])*	Medicaid	1.054		0.056
	Private insurance	0.987		0.051
	Self or uninsured	0.986		0.102
Constant		6,748.380	***	635.241
N[4]	94,534			
Residual df	94,451			
AIC	0.674015			
BIC	-1,080,756			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Indian Health Service, Champus/Tricare, or other government payer.
[4] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a VLBW infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A41) and the GLM (Exhibit A42) on a matched sample where the indicator of interest is very low birthweight (VLBW) birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, mothers of infants that are born VLBW have $8,468 (in 2014 dollars; RSE $590) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born VLBW (see Exhibit A3).

Exhibit A41

Maternal Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.230	0.217	0.534	**19.5**	3.5
Mother received adequate prenatal care[1]	0.721	0.728	0.772	-7.1	-1.5
Mother's age is 20-34	0.759	0.760	0.952	**-12.1**	-0.3
Mother's age is 35+	0.114	0.116	0.935	**-12.1**	-0.3
Mother is black	0.137	0.128	0.593	**18.8**	3.1
Mother is Hispanic/Latina	0.136	0.137	0.940	**-13.9**	-0.4
Mother is other non-white or mixed race	0.121	0.122	0.937	2.9	-0.4
Mother had one prior live birth	0.237	0.238	0.951	**-11.2**	-0.3
Mother had two or more prior live births	0.315	0.312	0.911	-8.5	0.6
Mother is married	0.365	0.355	0.705	**-13.8**	1.9
Mother has a high school education	0.672	0.678	0.782	-1.2	-1.4
Infant is male	0.517	0.513	0.876	-1.1	0.8
Facility has 100-300 beds	0.310	0.303	0.779	**-48.4**	1.4
Facility has >300 beds	0.664	0.672	0.741	**78.8**	-1.7
Facility is in an urban county[2]	0.915	0.914	0.926	**58.6**	0.3
Facility has a NICU	0.633	0.629	0.872	**58.4**	0.9
Year of birth is 2010 (index)	0.202	0.195	0.745	-2.3	1.7
Year of birth is 2011 (index)	0.170	0.168	0.945	-4.8	0.3
Year of birth is 2012 (index)	0.205	0.205	1.000	3.6	0.0
Year of birth is 2013 (index)	0.205	0.207	0.898	3.7	-0.7
Overall statistics					
VLBW group N	743	Median overall bias	0.7	Rubin's R	1.11
Comparison group N[4]	16,932	Mean overall bias	1.1	Rubin's B	6.5

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A42

Maternal Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		2.394	***	0.102
Mother smoked during pregnancy		1.018		0.057
Mother received adequate prenatal care[2]		0.890	*	0.043
Mother's age *(reference age 20-34)*	Age <20	0.840	**	0.043
	Age 35+	1.071		0.074
Mother's race *(reference is non-Hispanic white)*	Black	0.969		0.079
	Hispanic/Latina	0.915		0.071
	Other non-white or mixed race	0.966		0.066
Parity *(reference is one prior live birth)*	No previous live births	1.036		0.062
	Two or more prior live births	1.022		0.070
Mother is married		0.989		0.050
Mother has at least a high school education		0.984		0.048
Infant is male		1.037		0.048
Constant		8,553.446	***	1,087.993
N[3]	17,675			
Residual df	17,601			
AIC	1.704737			
BIC	-171,438			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a VLBW infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A43) and the GLM (Exhibit A44) on a matched sample where the indicator of interest is very low birthweight (VLBW) birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a private pay population in Washington State, mother of infants that are born VLBW have $8,652 (in 2014 dollars; RSE $493) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born VLBW (see Exhibit A3).

Exhibit A43

Maternal Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.063	0.058	0.664	**10.0**	2.4
Mother received adequate prenatal care[1]	0.839	0.835	0.833	-7.6	1.1
Mother's age is 20-34	0.801	0.810	0.647	-5.5	-2.4
Mother's age is 35+	0.171	0.167	0.836	3.2	1.1
Mother is black	0.056	0.054	0.820	**16.1**	1.3
Mother is Hispanic/Latina	0.036	0.039	0.785	6.8	-1.5
Mother is other non-white or mixed race	0.145	0.138	0.710	4.2	1.8
Mother had one prior live birth	0.251	0.254	0.905	**-20.0**	-0.6
Mother had two or more prior live births	0.176	0.172	0.838	-7.8	1.0
Mother is married	0.772	0.767	0.854	**-20.3**	1.0
Mother has a high school education	0.941	0.949	0.496	**-14.2**	-3.6
Infant is male	0.513	0.516	0.917	-0.4	-0.5
Facility has 100-300 beds	0.306	0.306	1.000	**-38.6**	0.0
Facility has >300 beds	0.685	0.685	1.000	**51.3**	0.0
Facility is in an urban county[2]	0.956	0.957	0.899	**41.2**	-0.4
Facility has a NICU	0.593	0.594	0.958	**41.0**	-0.3
Year of birth is 2010 (index)	0.215	0.208	0.751	0.6	1.7
Year of birth is 2011 (index)	0.191	0.187	0.843	-0.8	1.0
Year of birth is 2012 (index)	0.179	0.190	0.593	-3.1	-2.7
Year of birth is 2013 (index)	0.220	0.219	0.950	5.6	0.3
Overall statistics					
VLBW group N	744	Median overall bias	1.1	Rubin's R	1.22
Comparison group N[3]	74,935	Mean overall bias	1.2	Rubin's B	7.2

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A44

Maternal Health Care Utilization Costs Related to Very Low Birthweight (VLBW) Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		2.546	***	0.083
Mother smoked during pregnancy		1.130		0.086
Mother received adequate prenatal care[2]		1.028		0.047
Mother's age *(reference age 20-34)*	Age <20	0.908		0.110
	Age 35+	1.101	#	0.055
Mother's race *(reference is non-Hispanic white)*	Black	1.148	*	0.072
	Hispanic/Latina	1.018		0.137
	Other non-white or mixed race	1.095	#	0.056
Parity *(reference is one prior live birth)*	No previous live births	1.226	***	0.042
	Two or more prior live births	1.110	#	0.060
Mother is married		1.015		0.042
Mother has at least a high school education		0.843		0.093
Infant is male		0.959		0.030
Constant		5,898.236	***	796.624
N[3]	75,679			
Residual df	75,605			
AIC	0.397221			
BIC	-848,813			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a VLBW infant.

Infant mortality

We report the results of propensity score matching procedures (Exhibit A45) and the GLM (Exhibit A46) on a matched sample where the indicator of interest is very low birthweight birth (VLBW), the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant mortality.

We find that, in Washington State, infants that are born VLBW have 28.0 times greater odds of infant mortality (D-cox effect size 2.020, RSE 0.132) compared to similar infants that are not born VLBW (see Exhibit A3).

Exhibit A45

Infant Mortality Related to Very Low Birthweight (VLBW) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	VLBW group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.145	0.136	0.458	**17.4**	2.8
Mother received adequate prenatal care[1]	0.771	0.768	0.838	-9.5	0.7
Mother's age is 20-34	0.773	0.783	0.507	-9.7	-2.3
Mother's age is 35+	0.148	0.142	0.625	5.6	1.8
Mother is black	0.097	0.097	0.954	**18.9**	-0.2
Mother is Hispanic/Latina	0.094	0.094	1.000	-1.7	0.0
Mother is other non-white or mixed race	0.139	0.132	0.580	1.8	1.9
Mother had one prior live birth	0.243	0.240	0.841	**-16.8**	0.7
Mother had two or more prior live births	0.250	0.247	0.842	-3.9	0.7
Mother is married	0.571	0.571	1.000	**-22.4**	0.0
Mother has a high school education	0.802	0.801	0.897	**-11.3**	0.5
Infant is male	0.510	0.508	0.918	-0.8	0.4
Payer is a non-Medicaid public payer[2]	0.039	0.033	0.405	-3.8	2.4
Payer is private insurance	0.466	0.468	0.918	**-17.2**	-0.4
Payer is self or uninsured	0.016	0.009	0.091	4.1	6.0
Facility has 100-300 beds	0.310	0.306	0.794	**-40.4**	0.9
Facility has >300 beds	0.668	0.673	0.769	**59.5**	-1.0
Facility is in an urban county[3]	0.932	0.934	0.783	**44.1**	-0.7
Facility has a NICU	0.593	0.590	0.861	**47.0**	0.6
Year of birth is 2010 (index)	0.206	0.201	0.700	-1.2	1.3
Year of birth is 2011 (index)	0.177	0.180	0.857	-3.0	-0.6
Year of birth is 2012 (index)	0.200	0.201	0.966	0.6	-0.1
Year of birth is 2013 (index)	0.213	0.212	0.966	4.5	0.1
Overall statistics					
VLBW group N	1,686	Median overall bias	0.7	Rubin's R	1.46
Comparison group N[4]	99,617	Mean overall bias	1.1	Rubin's B	8.6

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A46

Infant Mortality Related to Very Low Birthweight (VLBW) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
VLBW birth (birth indicator of interest)		28.023	***	6.087
Mother received adequate prenatal care[2]		1.156		0.267
Mother smoked during pregnancy		0.857		0.234
Mother's age *(reference age 20-34)*	Age <20	1.339		0.452
	Age 35+	0.938		0.253
Mother's race *(reference is non-Hispanic white)*	Black	0.545		0.203
	Hispanic/Latina	0.433	*	0.172
	Other non-white or mixed race	1.039		0.262
Parity *(reference is one prior live birth)*	No previous live births	0.473	***	0.101
	Two or more prior live births	0.996		0.238
Mother is married		0.843		0.173
Mother has at least a high school education		0.729		0.171
Infant is male		1.464	*	0.267
Payer *(reference is other public payer[2])*	Medicaid	0.974		0.531
	Private insurance	1.261		0.689
	Self or uninsured	0.895		0.737
Facility size *(reference is 100-300 beds)*	<100 beds	1.778		1.333
	>300 beds	1.052		0.230
Facility is in an urban county[3]		0.760		0.430
Facility has a NICU		1.523	#	0.353
Constant		0.0033026	***	0.002592
N[4]	101,303			
Residual df	101,278			
AIC	0.009232			
BIC	-1,166,382			

Notes:
GLM using a logit link and a binomial distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular VLBW infant.

4) Small for gestational age (SGA)

Infant health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A47) and the GLM (Exhibit A48) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in Washington State, infants that are born SGA have $3,525 (in 2014 dollars; RSE $371) in additional inpatient healthcare utilization costs compared to similar infants that are not born SGA (see Exhibit A3).

Exhibit A47

Infant Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.079	0.075	0.190	7.9	1.6
Mother smoked during pregnancy	0.151	0.148	0.419	**19.9**	1.1
Mother received adequate prenatal care[1]	0.800	0.810	0.043	-4.7	-2.5
Mother received infertility treatment	0.110	0.113	0.344	-2.3	-1.2
Mother's age is 20-34	0.790	0.799	0.071	-6.8	-2.2
Mother's age is 35+	0.121	0.113	0.045	-1.0	2.4
Mother is black	0.082	0.080	0.445	**15.6**	1.0
Mother is Hispanic/Latina	0.097	0.095	0.519	2.1	0.8
Mother is other non-white or mixed race	0.180	0.187	0.113	**13.5**	-2.1
Mother had one prior live birth	0.245	0.243	0.775	**-16.4**	0.3
Mother had two or more prior live births	0.189	0.184	0.232	**-17.9**	1.4
Mother is married	0.601	0.598	0.662	**-17.4**	0.5
Mother has a high school education	0.818	0.823	0.330	-9.6	-1.2
Infant is male	0.518	0.520	0.759	1.0	-0.4
Cesarean delivery	0.376	0.370	0.287	**10.1**	1.3
Payer is a non-Medicaid public payer[2]	0.052	0.046	0.019	1.1	2.7
Payer is private insurance	0.485	0.487	0.825	**-13.6**	-0.3
Payer is self or uninsured	0.012	0.009	0.016	1.4	3.0
Facility has 100-300 beds	0.467	0.465	0.759	-4.8	0.4
Facility has >300 beds	0.421	0.423	0.710	5.8	-0.5
Facility is in an urban county[3]	0.759	0.758	0.786	2.2	0.3
Facility has a NICU	0.340	0.340	0.990	2.2	0.0
Year of birth is 2010 (index)	0.204	0.202	0.637	-0.2	0.6
Year of birth is 2011 (index)	0.196	0.196	0.877	-1.5	-0.2
Year of birth is 2012 (index)	0.193	0.196	0.546	-0.5	-0.7
Year of birth is 2013 (index)	0.208	0.206	0.694	2.9	0.5

Overall statistics					
SGA group N	13,312	Median overall bias	0.9	Rubin's R	1.13
Comparison group N[4]	165,441	Mean overall bias	1.1	Rubin's B	7.3

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A48

Infant Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		1.547	***	0.065
Preterm birth		7.442	***	0.383
Mother smoked during pregnancy		0.973		0.060
Mother received adequate prenatal care[2]		0.815	**	0.055
Mother's age *(reference age 20-34)*	Age <20	1.023		0.092
	Age 35+	1.072		0.077
Mother's race *(reference is non-Hispanic white)*	Black	0.789	**	0.070
	Hispanic/Latina	0.700	***	0.059
	Other non-white or mixed race	0.845	**	0.055
Parity *(reference is one prior live birth)*	No previous live births	0.997		0.052
	Two or more prior live births	1.198	*	0.089
Mother is married		0.915	#	0.049
Mother has at least a high school education		0.893		0.063
Infant is male		1.088	#	0.047
Cesarean delivery		1.590	***	0.064
Payer *(reference is other public payer[3])*	Medicaid	1.037		0.135
	Private insurance	0.819		0.109
	Self or uninsured	1.344		0.389
Constant		6,099.841	***	1,146.843
N[4]	178,753			
Residual df	178,663			
AIC	2.803757			
BIC	-2,110,457			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Indian Health Service, Champus/Tricare, or other government payer.
[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular SGA infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A49) and the GLM (Exhibit A50) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, infants that are born SGA have $3,601 (in 2014 dollars; RSE $489) in additional inpatient healthcare utilization costs compared to similar infants that are not born SGA (see Exhibit A3).

Exhibit A49

Infant Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.079	0.066	0.007	5.1	4.7
Mother smoked during pregnancy	0.232	0.235	0.746	**21.9**	-0.7
Mother received adequate prenatal care[1]	0.752	0.761	0.269	-3.4	-2.0
Mother received infertility treatment	0.071	0.076	0.294	-2.8	-1.8
Mother's age is 20-34	0.772	0.784	0.124	-8.6	-2.9
Mother's age is 35+	0.074	0.062	0.010	-0.2	4.5
Mother is black	0.115	0.110	0.387	**16.1**	1.7
Mother is Hispanic/Latina	0.177	0.178	0.924	-3.4	-0.2
Mother is other non-white or mixed race	0.119	0.120	0.910	3.1	-0.2
Mother had one prior live birth	0.234	0.228	0.386	**-10.6**	1.5
Mother had two or more prior live births	0.251	0.247	0.554	**-21.6**	1.0
Mother is married	0.351	0.369	0.331	**-15.0**	1.7
Mother has a high school education	0.666	0.668	0.756	-5.0	-0.6
Infant is male	0.525	0.531	0.546	2.7	-1.1
Cesarean delivery	0.343	0.337	0.452	8.3	1.4
Facility has 100-300 beds	0.480	0.481	0.956	-8.5	-0.1
Facility has >300 beds	0.351	0.348	0.716	**10.3**	0.7
Facility is in an urban county[2]	0.660	0.656	0.672	4.3	0.8
Facility has a NICU	0.311	0.304	0.417	3.2	1.5
Year of birth is 2010 (index)	0.214	0.214	0.964	2.3	0.1
Year of birth is 2011 (index)	0.192	0.196	0.564	-2.7	-1.1
Year of birth is 2012 (index)	0.191	0.190	0.871	-0.9	0.3
Year of birth is 2013 (index)	0.198	0.196	0.801	1.2	0.5
Overall statistics					
SGA group N	5,996	Median overall bias	1.1	Rubin's R	1.19
Comparison group N[4]	45,901	Mean overall bias	1.3	Rubin's B	8.5

Notes:

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched students in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A50

Infant Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		1.540	***	0.082
Preterm birth		6.644	***	0.476
Mother smoked during pregnancy		1.088		0.078
Mother received adequate prenatal care[2]		0.848	*	0.058
Mother's age *(reference age 20-34)*	Age <20	1.000		0.080
	Age 35+	1.092		0.144
Mother's race *(reference is non-Hispanic white)*	Black	0.666	***	0.068
	Hispanic/Latina	0.709	***	0.062
	Other non-white or mixed race	0.914		0.083
Parity *(reference is one prior live birth)*	No previous live births	0.914		0.063
	Two or more prior live births	1.071		0.100
Mother is married		0.923		0.057
Mother has at least a high school education		0.836	*	0.062
Infant is male		1.121	*	0.060
Cesarean delivery		1.612	***	0.089
Constant		7,677.470	***	1,191.590
N[3]	51,897			
Residual df	51,811			
AIC	4.38971			
BIC	-539,289			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular SGA infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A51) and the GLM (Exhibit A52) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a private payer population in Washington State, infants that are born SGA age have $3,079 (in 2014 dollars; RSE $445) in additional inpatient healthcare utilization costs compared to similar infants that are not born SGA (see Exhibit A3).

Exhibit A51

Infant Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.081	0.079	0.795	**11.0**	0.5
Mother smoked during pregnancy	0.069	0.064	0.230	**12.8**	2.3
Mother received adequate prenatal care[1]	0.852	0.855	0.534	-2.7	-1.1
Mother received infertility treatment	0.144	0.147	0.644	0.4	-0.8
Mother's age is 20-34	0.806	0.809	0.705	-3.7	-0.7
Mother's age is 35+	0.170	0.170	0.925	1.8	0.2
Mother is black	0.047	0.042	0.161	**11.4**	2.7
Mother is Hispanic/Latina	0.026	0.025	0.698	0.8	0.7
Mother is other non-white or mixed race	0.239	0.245	0.460	**25.0**	-1.4
Mother had one prior live birth	0.256	0.253	0.777	**-20.4**	0.5
Mother had two or more prior live births	0.132	0.126	0.306	**-19.5**	1.6
Mother is married	0.827	0.829	0.744	-9.1	-0.6
Mother has a high school education	0.956	0.963	0.067	-5.5	-3.1
Infant is male	0.516	0.514	0.874	0.3	0.3
Cesarean delivery	0.406	0.400	0.473	**12.7**	1.3
Facility has 100-300 beds	0.466	0.465	0.916	-2.4	0.2
Facility has >300 beds	0.473	0.477	0.698	5.1	-0.7
Facility is in an urban county[2]	0.847	0.852	0.476	6.2	-1.2
Facility has a NICU	0.391	0.392	0.857	4.7	-0.3
Year of birth is 2010 (index)	0.200	0.200	0.982	-2.0	0.0
Year of birth is 2011 (index)	0.197	9.193	0.610	-0.7	0.9
Year of birth is 2012 (index)	0.197	0.200	0.708	0.0	-0.7
Year of birth is 2013 (index)	0.215	0.217	0.781	4.3	-0.5
Overall statistics					
SGA group N	6,459	Median overall bias	0.7	Rubin's R	1.18
Comparison group N[4]	115,874	Mean overall bias	1.0	Rubin's B	5.4

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[3] The number of matched students in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A52

Infant Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		1.493	***	0.076
Preterm birth		8.762	***	0.567
Mother smoked during pregnancy		0.869	#	0.069
Mother received adequate prenatal care[2]		0.665	***	0.071
Mother's age *(reference age 20-34)*	Age <20	0.993		0.177
	Age 35+	1.016		0.069
Mother's race *(reference is non-Hispanic white)*	Black	0.883		0.105
	Hispanic/Latina	0.635	***	0.059
	Other non-white or mixed race	0.846	*	0.059
Parity *(reference is one prior live birth)*	No previous live births	1.081		0.061
	Two or more prior live births	1.159		0.107
Mother is married		0.888	#	0.060
Mother has at least a high school education		0.995		0.117
Infant is male		1.050		0.053
Cesarean delivery		1.583	***	0.077
Constant		4,348.986	***	817.686
N[3]	122,333			
Residual df	122,248			
AIC	1.954539			
BIC	-1,410,536			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular SGA infant.

Maternal health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A53) and the GLM (Exhibit A54) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in Washington State, mothers of infants that are born small for gestational age have $234 (in 2014 dollars; RSE $47) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born SGA (see Exhibit A3).

Exhibit A53

Maternal Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.079	0.074	0.170	7.9	1.7
Mother smoked during pregnancy	0.156	0.154	0.638	**19.9**	0.6
Mother received adequate prenatal care[1]	0.798	0.800	0.554	-4.7	-0.7
Mother's age is 20-34	0.791	0.800	0.101	-6.8	-2.0
Mother's age is 35+	0.117	0.111	0.086	-1.0	2.0
Mother is black	0.085	0.082	0.524	**15.6**	0.8
Mother is Hispanic/Latina	0.096	0.096	0.934	2.1	-0.1
Mother is other non-white or mixed race	0.177	0.179	0.824	**13.5**	-0.3
Mother had one prior live birth	0.243	0.242	0.766	**-16.4**	0.3
Mother had two or more prior live births	0.189	0.185	0.350	**-17.9**	1.0
Mother is married	0.591	0.586	0.444	**-17.4**	0.9
Mother has a high school education	0.819	0.821	0.580	-9.6	-0.7
Infant is male	0.518	0.515	0.601	1.0	0.6
Payer is a non-Medicaid public payer[2]	0.056	0.052	0.107	1.1	1.9
Payer is private insurance	0.478	0.477	0.894	**-13.6**	0.2
Payer is self or uninsured	0.011	0.009	0.135	1.4	1.8
Facility has 100-300 beds	0.481	0.482	0.884	-2.8	-0.2
Facility has >300 beds	0.413	0.412	0.824	5.8	0.3
Facility is in an urban county[3]	0.766	0.761	0.399	2.2	1.0
Facility has a NICU	0.356	0.354	0.761	2.2	0.4
Year of birth is 2010 (index)	0.205	0.205	0.952	-0.2	0.1
Year of birth is 2011 (index)	0.199	0.199	0.879	-1.5	0.2
Year of birth is 2012 (index)	0.190	0.191	0.769	-0.5	-0.4
Year of birth is 2013 (index)	0.202	0.203	0.856	2.9	-0.2

Overall statistics					
SGA group N	13,556	Median overall bias	0.6	Rubin's R	1.11
Comparison group N[4]	194,538	Mean overall bias	0.8	Rubin's B	4.7

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A54

Maternal Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		1.041	***	0.008
Preterm birth		1.913	***	0.044
Mother smoked during pregnancy		1.066	***	0.015
Mother received adequate prenatal care[2]		0.983		0.012
Mother's age *(reference age 20-34)*	Age <20	0.907	***	0.014
	Age 35+	1.114	***	0.014
Mother's race *(reference is non-Hispanic white)*	Black	1.060	*	0.025
	Hispanic/Latina	0.975	#	0.014
	Other non-white or mixed race	0.986		0.011
Parity *(reference is one prior live birth)*	No previous live births	1.188	***	0.012
	Two or more prior live births	1.006		0.015
Mother is married		0.956	***	0.009
Mother has at least a high school education		1.002		0.014
Infant is male		1.005	#	0.008
Payer *(reference is other public payer[3])*	Medicaid	1.052	***	0.012
	Private insurance	1.071	**	0.027
	Self or uninsured	0.960		0.037
Constant		5,441.844	***	167.444
N[4]	208,094			
Residual df	208,004			
AIC	2.504705			
BIC	-2,539,045			

Notes:

GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.

[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001

[2] Adequate prenatal care according to the Kotelchuck Index.

[3] Indian Health Service, Champus/Tricare, or other government payer.

[4] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of an SGA infant.

Medicaid. We report the results of propensity score matching procedures (Exhibit A55) and the GLM (Exhibit A56) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, mothers of infants that are born SGA have $179 (in 2014 dollars; RSE $74) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born SGA (see Exhibit A3).

Exhibit A55

Maternal Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.078	0.070	0.086	5.1	3.0
Mother smoked during pregnancy	0.238	0.239	0.916	**21.9**	-0.2
Mother received adequate prenatal care[1]	0.749	0.755	0.452	-3.4	-1.4
Mother's age is 20-34	0.773	0.783	0.165	-8.6	-2.5
Mother's age is 35+	0.073	0.063	0.031	-0.2	3.7
Mother is black	0.119	0.115	0.466	**16.1**	1.4
Mother is Hispanic/Latina	0.173	0.173	0.943	-3.4	-0.1
Mother is other non-white or mixed race	0.120	0.122	0.803	3.1	-0.5
Mother had one prior live birth	0.232	0.232	0.932	**-10.6**	0.1
Mother had two or more prior live births	0.249	0.243	0.368	**-21.6**	1.5
Mother is married	0.351	0.342	0.298	**-15.0**	1.8
Mother has a high school education	0.673	0.675	0.818	-5.0	-0.4
Infant is male	0.525	0.526	0.914	2.7	-0.2
Facility has 100-300 beds	0.497	0.499	0.787	-8.5	-0.5
Facility has >300 beds	0.344	0.339	0.595	**10.3**	1.0
Facility is in an urban county[2]	0.670	0.662	0.320	4.3	1.8
Facility has a NICU	0.330	0.324	0.442	3.2	1.4
Year of birth is 2010 (index)	0.214	0.209	0.566	2.3	1.1
Year of birth is 2011 (index)	0.196	0.197	0.892	-2.7	-0.2
Year of birth is 2012 (index)	0.186	0.186	0.945	-0.9	-0.1
Year of birth is 2013 (index)	0.194	0.196	0.767	1.2	-0.5

Overall statistics					
SGA group N	6,155	Median overall bias	1.0	Rubin's R	1.14
Comparison group N[4]	61,105	Mean overall bias	1.1	Rubin's B	5.9

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched students in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A56

Maternal Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		1.031	*	0.013
Preterm birth		1.865	***	0.064
Mother smoked during pregnancy		1.060	***	0.017
Mother received adequate prenatal care[2]		0.987		0.016
Mother's age *(reference age 20-34)*	Age <20	0.916	***	0.015
	Age 35+	1.168	***	0.036
Mother's race *(reference is non-Hispanic white)*	Black	1.016		0.028
	Hispanic/Latina	0.974		0.017
	Other non-white or mixed race	0.956	*	0.019
Parity *(reference is one prior live birth)*	No previous live births	1.178	***	0.019
	Two or more prior live births	1.027		0.021
Mother is married		0.954	**	0.013
Mother has at least a high school education		1.020		0.015
Infant is male		1.008		0.012
Cesarean delivery		1.612	***	0.089
Constant		7,677.470	***	1,191.590
N[3]	67,170			
Residual df	67,085			
AIC	3.529828			
BIC	-741,718			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a SGA infant.

Private payer. We report the results of propensity score matching procedures (Exhibit A57) and the GLM (Exhibit A58) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is maternal health care utilization costs in the first year postpartum, inclusive of delivery costs.

We find that, in a private pay population in Washington State, mother of infants that are born SGA have $250 (in 2014 dollars; RSE $55) in additional inpatient healthcare utilization costs compared to similar mothers of infants that are not born SGA (see Exhibit A3).

Exhibit A57

Maternal Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.081	0.082	0.724	**11.0**	-0.6
Mother smoked during pregnancy	0.069	0.065	0.361	**12.8**	1.8
Mother received adequate prenatal care[1]	0.851	0.852	0.902	-2.7	-0.2
Mother's age is 20-34	0.809	0.811	0.823	-3.7	-0.4
Mother's age is 35+	0.166	0.164	0.831	1.8	0.4
Mother is black	0.048	0.045	0.337	**11.4**	1.8
Mother is Hispanic/Latina	0.026	0.025	0.655	0.8	0.8
Mother is other non-white or mixed race	0.237	-/242	0.510	**25.0**	-1.3
Mother had one prior live birth	0.255	0.254	0.920	**-20.4**	0.2
Mother had two or more prior live births	0.131	0.128	0.620	**-19.5**	0.8
Mother is married	0.822	0.824	0.713	-9.1	-0.7
Mother has a high school education	0.956	0.960	0.272	-5.5	-1.9
Infant is male	0.515	0.513	0.833	0.3	0.4
Facility has 100-300 beds	0.480	0.480	0.944	-2.4	-0.1
Facility has >300 beds	0.464	0.466	0.819	5.1	-0.4
Facility is in an urban county[2]	0.851	0.855	0.536	6.2	-1.1
Facility has a NICU	0.407	0.409	0.872	4.7	-0.3
Year of birth is 2010 (index)	0.199	0.200	0.947	-2.0	-0.1
Year of birth is 2011 (index)	0.199	0.199	0.982	-0.7	0.0
Year of birth is 2012 (index)	0.197	0.197	0.982	0.0	0.0
Year of birth is 2013 (index)	0.210	0.208	0.796	4.3	0.5

Overall statistics					
SGA group N	6,483	Median overall bias	0.4	Rubin's R	1.11
Comparison group N[4]	128,238	Mean overall bias	0.7	Rubin's B	3.7

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched students in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A58

Maternal Health Care Utilization Costs Related to Small for Gestational Age (SGA) Birth in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		1.045	***	0.010
Preterm birth		1.979	***	0.061
Mother smoked during pregnancy		1.034		0.023
Mother received adequate prenatal care[2]		0.970	*	0.015
Mother's age *(reference age 20-34)*	Age <20	0.963		0.054
	Age 35+	1.099	***	0.016
Mother's race *(reference is non-Hispanic white)*	Black	1.092	*	0.039
	Hispanic/Latina	1.005		0.027
	Other non-white or mixed race	0.994		0.013
Parity *(reference is one prior live birth)*	No previous live births	1.206	***	0.014
	Two or more prior live births	0.971	#	0.015
Mother is married		0.951	***	0.013
Mother has at least a high school education		0.970		0.033
Infant is male		0.999		0.010
Constant		5,481.807	***	264.568
N[3]	134,721			
Residual df	134,636			
AIC	1.847217			
BIC	-1,586,711			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group mothers matched to a particular mother of a SGA infant.

Infant mortality

We report the results of propensity score matching procedures (Exhibit A59) and the GLM (Exhibit A60) on a matched sample where the indicator of interest is small for gestational age (SGA) birth, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant mortality.

We find that, in Washington State, infants that are born SGA have 3.7 times greater odds of infant mortality (D-cox effect size 0.794, RSE 0.078) compared to similar infants that are not born SGA (see Exhibit A3).

Exhibit A59

Infant Mortality Related to Small for Gestational Age (SGA) Birth in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	SGA group	Comparison group	p-value	Before matching	After matching
Preterm birth	0.080	0.077	0.346	7.9	1.1
Mother smoked during pregnancy	0.153	0.150	0.577	**19.9**	0.7
Mother received adequate prenatal care[1]	0.797	0.801	0.363	-4.7	-1.1
Mother's age is 20-34	0.789	0.795	0.182	-6.8	-1.6
Mother's age is 35+	0.120	0.115	0.182	-1.0	1.5
Mother is black	0.084	0.082	0.55	**-15.6**	0.8
Mother is Hispanic/Latina	0.102	0.100	0.520	2.1	0.8
Mother is other non-white or mixed race	0.181	0.185	0.370	**13.5**	-1.1
Mother had one prior live birth	0.244	0.244	0.870	**-16.4**	0.2
Mother had two or more prior live births	0.192	0.188	0.393	**-17.9**	0.9
Mother is married	0.592	0.588	0.542	**-17.4**	0.7
Mother has a high school education	0.812	0.816	0.380	-9.6	-1.1
Infant is male	0.517	0.517	0.944	1.0	0.1
Cesarean delivery	0.376	0.370	0.287	**10.1**	1.3
Payer is a non-Medicaid public payer[2]	0.055	0.052	0.183	1.1	1.5
Payer is private insurance	0.474	0.473	0.906	**-13.6**	0.1
Payer is self or uninsured	0.012	0.009	0.023	1.4	2.7
Facility has 100-300 beds	0.477	0.479	0.733	-4.8	-0.4
Facility has >300 beds	0.411	0.411	0.943	5.8	0.1
Facility is in an urban county[3]	0.762	0.762	0.956	2.2	0.1
Facility has a NICU	0.352	0.352	0.971	2.2	0.0
Year of birth is 2010 (index)	0.205	0.205	0.919	-0.2	0.1
Year of birth is 2011 (index)	0.198	0.197	0.825	-1.5	0.3
Year of birth is 2012 (index)	0.192	0.193	0.905	-0.5	-0.1
Year of birth is 2013 (index)	0.201	0.202	-.918	2.9	-0.1

Overall statistics					
SGA group N	19,270	Median overall bias	0.7	Rubin's R	1,15
Comparison group N[4]	203,772	Mean overall bias	0.7	Rubin's B	4.7

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Indian Health Service, Champus/Tricare, or other government payer.

[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A60

Infant Mortality Related to Small for Gestational Age (SGA) Birth in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
SGA birth (birth indicator of interest)		3.709	***	0.476
Preterm birth		4.593	***	0.740
Mother smoked during pregnancy		1.172		0.227
Mother received adequate prenatal care[2]		0.798		0.132
Mother's age *(reference age 20-34)*	Age <20	1.993	**	0.494
	Age 35+	0.909		0.202
Mother's race *(reference is non-Hispanic white)*	Black	0.653		0.180
	Hispanic/Latina	0.644		0.190
	Other non-white or mixed race	0.970		0.186
Parity *(reference is one prior live birth)*	No previous live births	0.655	*	0.113
	Two or more prior live births	1.356		0.262
Mother is married		1.156		0.189
Mother has at least a high school education		0.857		0.168
Infant is male		1.010		0.138
Payer *(reference is other public payer[3])*	Medicaid	0.748		0.233
	Private insurance	0.648		0.204
	Self or uninsured	1.404		0.836
Facility size *(reference is 100-300 beds)*	<100 beds	0.933		0.275
	>300 beds	1.769	**	0.303
Facility is in an urban county[4]		0.691		0.176
Facility has a NICU		1.942	***	0.316
Constant		0.0030793	***	0.001573
N[5]	223,042			
Residual df	223,016			
AIC	0.00954			
BIC	-2,744,392			

Notes:
GLM using a logit link and a binomial distribution. Model also had fixed effects on year.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Indian Health Service, Champus/Tricare, or other government payer.
[4] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[5] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular SGA infant.

5) Neonatal intensive care unit (NICU) admissions

Infant health care utilization costs

All Washington. We report the results of propensity score matching procedures (Exhibit A61) and the GLM (Exhibit A62) on a matched sample where the indicator of interest is NICU admission, the sample includes all births in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in Washington State, infants that are admitted to a NICU have $3,525 (in 2014 dollars; RSE $371) in additional inpatient healthcare utilization costs compared to similar infants that are not admitted to a NICU (see Exhibit A3).

Exhibit A61

Infant Health Care Utilization Costs Related to NICU Admission in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	NICU group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.121	0.115	0.107	**12.8**	1.8
Mother received adequate prenatal care[1]	0.762	0.762	0.900	**-13.8**	0.1
Mother received infertility treatment	0.136	0.135	0.925	4.4	0.1
Mother's age is 20-34	0.801	0.806	0.224	-3.6	-1.3
Mother's age is 35+	0.136	0.130	0.129	3.4	1.7
Mother is black	0.062	0.060	0.347	7.1	-1.0
Mother is Hispanic/Latina	0.075	0.074	0.822	-7.2	0.2
Mother is other non-white or mixed race	0.142	0.139	0.506	3.5	0.7
Mother had one prior live birth	0.252	0.251	0.795	**-15.1**	0.3
Mother had two or more prior live births	0.236	0.235	0.752	-4.9	0.3
Mother is married	0.642	0.640	0.745	**-10.9**	0.3
Mother has a high school education	0.856	0.861	0.185	-0.3	-1.3
Infant is male	0.564	0.565	0.762	9.9	-0.3
Payer is a non-Medicaid public payer[2]	0.053	0.050	0.139	2.9	1.5
Payer is private insurance	0.532	0.529	0.525	-6.1	0.7
Payer is self or uninsured	0.013	0.010	0.001	2.4	2.8
Facility has 100-300 beds	0.432	0.430	0.633	**-13.7**	0.5
Facility has >300 beds	0.543	0.545	0.682	**32.3**	-0.4
Facility is in an urban county[3]	0.913	0.913	0.864	**41.9**	-0.1
Facility has a NICU	0.404	0.402	0.693	**16.0**	0.4
Year of birth is 2010 (index)	0.176	0.176	0.977	-6.5	0.0
Year of birth is 2011 (index)	0.179	0.177	0.674	-3.8	0.4
Year of birth is 2012 (index)	0.214	0.215	0.793	4.2	0.3
Year of birth is 2013 (index)	0.241	0.241	0.980	**10.5**	0.0
Overall statistics					
NICU group N	17,334	Median overall bias	0.4	Rubin's R	1.16
Comparison group N[4]	196,848	Mean overall bias	0.7	Rubin's B	5.3

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Indian Health Service, Champus/Tricare, or other government payer.
[3] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[4] The number of matched individuals in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A62

Infant Health Care Utilization Costs Related to NICU Admission in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
NICU admission (birth indicator of interest)		12.346	***	0.343
Mother smoked during pregnancy		1.136	**	0.051
Mother received adequate prenatal care[2]		0.896	**	0.034
Mother received infertility treatment		0.957		0.058
Mother's age *(reference age 20-34)*	Age <20	0.936		0.052
	Age 35+	1.093	**	0.041
Mother's race *(reference is non-Hispanic white)*	Black	1.023		0.083
	Hispanic/Latina	0.932		0.048
	Other non-white or mixed race	1.062		0.058
Parity *(reference is one prior live birth)*	No previous live births	0.987		0.028
	Two or more prior live births	1.118	**	0.043
Mother is married		0.878	***	0.027
Mother has at least a high school education		0.892	**	0.037
Infant is male		1.092	**	0.029
Payer *(reference is other public payer[3])*	Medicaid	0.973		0.073
	Private insurance	0.885	#	0.065
	Self or uninsured	0.956		0.164
Constant		6,433.253	***	680.403
N[4]	214,182			
Residual df	214,093			
AIC	3.277309			
BIC	-2,566,116			

Notes:

GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.

[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001

[2] Adequate prenatal care according to the Kotelchuck Index.

[3] Indian Health Service, Champus/Tricare, or other government payer.

[4] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular infant admitted to the NICU.

Medicaid. We report the results of propensity score matching procedures (Exhibit A63) and the GLM (Exhibit A64) on a matched sample where the indicator of interest is NICU admission, the sample includes Medicaid-funded deliveries in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a Medicaid population in Washington State, infants that are admitted to a NICU have $3,601 (in 2014 dollars; RSE $489) in additional inpatient healthcare utilization costs compared to similar infants that are not admitted to a NICU (see Exhibit A3).

Exhibit A63

Infant Health Care Utilization Costs Related to NICU Admission in a Medicaid Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	NICU group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.207	0.201	0.412	**16.4**	1.5
Mother received adequate prenatal care[1]	0.707	0.710	0.668	**-12.5**	-0.8
Mother received infertility treatment	0.101	0.099	0.821	5.3	0.4
Mother's age is 20-34	0.797	0.803	0.397	-2.4	-1.4
Mother's age is 35+	0.090	0.083	0.140	6.3	2.5
Mother is black	0.094	0.092	0.704	7.4	0.7
Mother is Hispanic/Latina	0.142	0.142	0.942	**-15.5**	-0.1
Mother is other non-white or mixed race	0.117	0.115	0.615	4.0	0.8
Mother had one prior live birth	0.245	0.240	0.527	**-10.7**	1.0
Mother had two or more prior live births	0.318	0.317	0.913	-4.7	0.2
Mother is married	0.411	0.408	0.809	-5.7	0.4
Mother has a high school education	0.722	0.727	0.471	6.1	-1.2
Infant is male	0.559	0.564	0.539	9.2	-1.0
Facility has 100-300 beds	0.461	0.459	0.878	**-14.0**	0.3
Facility has >300 beds	0.501	0.503	0.826	**43.0**	-0.4
Facility is in an urban county[2]	0.869	9,870	0.860	**51.8**	-0.2
Facility has a NICU	0.409	0.411	0.850	**22.4**	-0.3
Year of birth is 2010 (index)	0.170	0.167	0.603	-7.6	0.9
Year of birth is 2011 (index)	0.179	0.181	0.791	-4.6	-0.4
Year of birth is 2012 (index)	0.214	0.216	0.757	6.5	-0.5
Year of birth is 2013 (index)	0.243	0.240	0.649	**11.7**	0.8
Overall statistics					
NICU group N	6,959	Median overall bias	0.7	Rubin's R	1.09
Comparison group N[4]	60,529	Mean overall bias	0.8	Rubin's B	4.2

Notes:

Bolded text indicates imbalance.

[1] Adequate prenatal care according to the Kotelchuck Index.

[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).

[3] The number of matched students in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A64

Infant Health Care Utilization Costs Related to NICU Admission in a Medicaid Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
NICU admission (birth indicator of interest)		12.029	***	0.499
Mother smoked during pregnancy		1.126	*	0.052
Mother received adequate prenatal care[2]		0.948		0.041
Mother received infertility treatment		0.914		0.073
Mother's age *(reference age 20-34)*	Age <20	0.895	#	0.053
	Age 35+	1.236	**	0.091
Mother's race *(reference is non-Hispanic white)*	Black	0.948		0.095
	Hispanic/Latina	0.844	*	0.049
	Other non-white or mixed race	0.981		0.063
Parity *(reference is one prior live birth)*	No previous live births	0.996		0.043
	Two or more prior live births	1.115	*	0.059
Mother is married		0.899	*	0.038
Mother has at least a high school education		0.854	**	0.040
Infant is male		1.123	**	0.040
Constant		7,380.645	***	866.583
N[3]	67,488			
Residual df	67,404			
AIC	4.232301			
BIC	-724,192			

Notes:
GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.
[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001
[2] Adequate prenatal care according to the Kotelchuck Index.
[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular infant admitted to a NICU.

Private payer. We report the results of propensity score matching procedures (Exhibit A65) and the GLM (Exhibit A66) on a matched sample where the indicator of interest is NICU admission, the sample includes deliveries funded by a private payer in Washington from 2009-2013, and the outcome of interest is infant health care utilization costs in the first year after birth, inclusive of delivery costs.

We find that, in a private payer population in Washington State, infants that are admitted to a NICU have $3,079 (in 2014 dollars; RSE $445) in additional inpatient healthcare utilization costs compared to similar infants that are not admitted to a NICU (see Exhibit A3).

Exhibit A65

Infant Health Care Utilization Costs Related to NICU Admission in a Private Payer Population in Washington State – Covariate Balance Before and After Propensity Score Matching

Variable	After matching			Absolute standardized difference	
	NICU group	Comparison group	p-value	Before matching	After matching
Mother smoked during pregnancy	0.051	0.048	0.248	6.5	1.8
Mother received adequate prenatal care[1]	0.809	0.808	0.911	**-15.1**	0.2
Mother received infertility treatment	0.160	0.160	0.984	4.4	0.0
Mother's age is 20-34	0.803	0.080	0.392	-4.2	-1.3
Mother's age is 35+	0.174	0.170	0.447	3.0	1.1
Mother is black	0.037	0.038	0.846	7.1	-0.3
Mother is Hispanic/Latina	0.027	0.025	0.488	1.0	1.0
Mother is other non-white or mixed race	0.159	0.159	0.968	4.2	-0.1
Mother had one prior live birth	0.261	0.259	0.801	**-18.2**	0.4
Mother had two or more prior live births	0.175	0.173	0.786	-7.7	0.4
Mother is married	0.821	0.822	0.892	**-13.1**	-0.2
Mother has a high school education	0.958	0.962	0.167	-5.2	-2.0
Infant is male	-.569	0.572	0.721	**10.8**	-0.5
Facility has 100-300 beds	0.418	0.418	0.988	**-14.2**	0.0
Facility has >300 beds	0.567	0.566	0.953	**25.7**	0.1
Facility is in an urban county[2]	0.946	0.947	0.844	**37.5**	-0.2
Facility has a NICU	0.426	0.424	0.800	**13.4**	0.4
Year of birth is 2010 (index)	0.182	0.184	0.834	-5.7	-0.3
Year of birth is 2011 (index)	0.176	0.175	0.786	-4.5	0.4
Year of birth is 2012 (index)	0.220	0.222	0.709	4.5	-0.6
Year of birth is 2013 (index)	0.238	0.237	0.931	9.9	0.1
Overall statistics					
NICU group N	9,226	Median overall bias	0.4	Rubin's R	1.11
Comparison group N[4]	130,560	Mean overall bias	0.5	Rubin's B	3.3

Notes:
Bolded text indicates imbalance.
[1] Adequate prenatal care according to the Kotelchuck Index.
[2] Used rural/urban classifications from April 2014 Office of Financial Management designations. Washington State DOH (2017).
[3] The number of matched students in the comparison group includes individuals with a tie on the propensity score. We use a caliper of 0.001 in the matching model.

Exhibit A66

Infant Health Care Utilization Costs Related to NICU Admission in a Private Payer Population in Washington State – GLM on Propensity Score Matched Sample

Covariate		Coefficient[1]		Robust SE
NICU admission (birth indicator of interest)		12.844	***	0.429
Mother smoked during pregnancy		1.067		0.085
Mother received adequate prenatal care[2]		0.873	*	0.048
Mother received infertility treatment		0.944		0.079
Mother's age *(reference age 20-34)*	Age <20	1.386	*	0.192
	Age 35+	1.076	#	0.046
Mother's race *(reference is non-Hispanic white)*	Black	1.042		0.083
	Hispanic/Latina	0.974		0.099
	Other non-white or mixed race	1.091		0.070
Parity *(reference is one prior live birth)*	No previous live births	0.978		0.034
	Two or more prior live births	1.092	#	0.056
Mother is married		0.923	#	0.042
Mother has at least a high school education		0.982		0.091
Infant is male		1.047		0.035
Constant		4,621.499	***	546.1774
N[3]	139,786			
Residual df	139,701			
AIC	2.643085			
BIC	-1,623,658			

Notes:

GLM using a log-link and a gamma distribution. Model also had fixed effects on year and birth facility.

[1] # p < 0.1; * p < 0.05; ** p < 0.01;*** p < 0.001

[2] Adequate prenatal care according to the Kotelchuck Index.

[3] Weighted using a normalized weight proportional to the number of comparison group infants matched to a particular infant admitted to a NICU.

V. Limitations

This analysis excludes data from federal hospitals and excludes multiple births. Therefore, these results may not be generalizable to populations receiving care in federal hospitals or to women giving birth to multiples/multiple-born infants. In addition, this analysis only controls for measured socio-economic factors and pregnancy risk factors. There are likely other factors such as social support, genetics, and maternal health that influence both the predictors of interest and the inpatient hospital charges and infant mortality. Our inability to control for these factors could bias the results.

There is a chance that birth certificate data and CHARS charges data may have inherent flaws and biases. In addition, some mother-infant pairs in our dataset were missing values for either maternal costs or infant costs (see Exhibit A1). We assume that these biases are non-differential, and that these data will produce adequate estimates of average costs at a population level.

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