Appendix Tables and Data Appendices, Effects of Increased Access to Infertility Treatment on Infant and Child Health: Evidence from Health Insurance Mandates

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Appendix Table 1: Means, State Controls, Sample of Twins, Natality Data

	All, 81–99	Twin matched, 81–99
% Hispanic	9.50	9.49
% black	12.51	12.53
Medicaid eligibility threshold as share of FPL	108.56	111.81
Real annual max. AFDC/TANF ben., family of 4 (97 $1000)	6.46	6.40
Real median income, family of 4 (97 $1000)	50.66	50.73
Overall unemployment rate (as share)	0.06	0.06
Employment growth rate (as share of employment)	0.02	0.02
Share under the poverty level	0.14	0.14
Share of births to unmarried women	0.28	0.28
Obstetric beds/1000 women 15–44	1.03	1.03
Neonatal intensive care beds/1000 women 15–44	0.19	0.19
Neonatal intermediate care beds/1000 women 15–44	0.08	0.08

Summary statistics for all state-level controls for sample of all twin births. Column 1 contains means for sample of all twins during 1981–99 and column 2 contains means for sample of all twins whose other twin was matched to them during 1981–99. Statistics weighted to account for 50% sampling in some states before 1985.

Appendix Table 2: Determinants of Being a Twin, Coefficients on Mandates and Their Interactions with Mother's Age ≥ 30, Sample of Singletons and Twins, PUMS and ACS

Controls for	Any mandate and Any mandate $*$ age ≥ 30	IVF/no IVF and IVF/no IVF $*$ age ≥ 30	Cover/offer and Cover/offer $*$ age ≥ 30
HI for infert.	-0.00395***		
	(0.00110)		
HI for infert. $*\geq 30$	0.00188		
	(0.00150)		
HI for infert. may incl. IVF		-0.00343**	
		(0.00154)	
HI for infert. may incl. IVF $*\geq 30$		0.00184	
		(0.00224)	
HI for infert. excl. IVF		-0.00497***	
		(0.00118)	
HI for infert. excl. IVF $*\geq 30$		0.00198	
		(0.00185)	
HI must cover infert.			-0.00527***
			(0.00155)
HI must cover infert. $*\geq 30$			0.00556***
			(0.00195)
HI must offer to cover infert.			-0.00320*
			(0.00188)
HI must offer infert. $*\geq 30$			-0.00124
			(0.00159)

Table presents coefficients on insurance mandate variables in regressions of determinants of birth being a twin. Sample is all children aged 5–17 in combined 2000 5% and 1% PUMS and 2001–02 ACS whose mother is in the household, who are either the only child or one of two children their age, both of whom are a child or grandchild of the householder and share the same mother, and whose age and sex and relationship to the head are not allocated. Twins are identified as children of the same age, whose mother lives in the household, who share the same mother, and for whom the householder is their parent or grandparent. Each column represents the results of one regression. The coefficient in column 1 is for an indicator for any mandate that insurers cover/offer to cover infertility treatment and its interaction with the mother being ≥ 30, those in column 2 for indicators for infertility treatment mandates for insurers that exclude IVF treatment or that may include IVF and their interactions with the mother being ≥ 30, and those in column 3 for indicators for mandates for insurers to cover or offer to cover infertility treatment and their interactions with the mother being ≥ 30. Regressions also include state of residence at birth fixed effects (for the child), and year fixed effects. Regressions also include indicators for the mother's education; for the mother's age in 5-year intervals; for the child being black, Asian, American Indian, or other non-white; for the child being Hispanic; for the child's gender; and for state-level economic, demographic, and public assistance variables. Standard errors clustered at the state level. Regressions are weighted. N is 2,690,368. Pre-reform mean of dependent variable is 0.0307 and that for children with mothers 30 or older is 0.0323. $^{***}p < .01$,$^{**}p < .05$,$^{*}p < .10$.

Appendix Table 3: Determinants of Gestation (Weeks), Coefficients on Mandates and Their Interactions with Mother's Age ≥ 30, Sample of Singletons, Natality Data

Controls for	Any mandate and Any mandate $*$ age ≥ 30	IVF/no IVF and IVF/no IVF $*$ age ≥ 30	Cover/offer and Cover/offer $*$ age ≥ 30
HI mandate for infert.	0.009		
	(0.018)		
HI for infert. $*\geq 30$	-0.017		
	(0.011)		
HI for infert., may incl. IVF		0.006	
		(0.019)	
HI for infert., may incl. IVF $*\geq 30$		-0.027**	
		(0.012)	
HI for infert., excl. IVF		0.018	
		(0.032)	
HI for infert., excl. IVF $*$ mother ≥ 30		-0.006	
		(0.011)	
HI must cover infert.			0.036**
			(0.015)
HI must cover infert. $*\geq 30$			-0.021
			(0.013)
HI must offer infert. coverage			-0.062**
			(0.029)
HI must offer infert. $*\geq 30$			-0.015
			(0.014)

Table presents coefficients on insurance mandate variables. Sample is one in fifty random sample of singleton births in states reporting outcome for 1981–99. Each column represents one regression. The coefficient in column 1 is for an indicator for any mandate that insurers cover/offer to cover infertility treatment and its interaction with the mother being ≥ 30, those in column 2 for indicators for infertility treatment mandates for insurers that exclude IVF treatment or may include IVF and their interactions with the mother being ≥ 30, and those in column 3 for indicators for mandates for insurers to cover or offer to cover treatment and their interactions with the mother being ≥ 30. Regressions include state of residence at birth fixed effects, year fixed effects, and month of birth fixed effects. Regressions also include indicators for the mother's education or for education missing or unreported; for the mother's age in 5-year intervals; for the mother being black, Asian/Pacific Islander, or other non-white or race missing; for the mother being Hispanic or ethnicity missing or unreported; for parity or parity missing; for the child's gender; and for state-level economic, demographic, and public assistance variables. Standard errors clustered at the state level. Regressions are weighted to account for 50% sampling in some states before 1985. N is 1,366,019. Pre-reform mean of dependent variable is 39.2 and that for infants with mothers 30 or older is 39.1. $^{***}p < .01$,$^{**}p < .05$,$^{*}p < .10$.

Appendix Table 4: Determinants of 5-Minute Apgar Score, Coefficients on Mandates and Their Interactions with Mother's Age ≥ 30, Sample of Singletons, Natality Data

Controls for	Any mandate and Any mandate $*$ age ≥ 30	IVF/no IVF and IVF/no IVF $*$ age ≥ 30	Cover/offer and Cover/offer $*$ age ≥ 30
HI mandate for infert.	-0.006		
	(0.023)		
HI for infert. $*\geq 30$	-0.001		
	(0.006)		
HI for infert., may incl. IVF		0.020	
		(0.013)	
HI for infert., may incl. IVF $*\geq 30$		-0.008	
		(0.007)	
HI for infert., excl. IVF		-0.060*	
		(0.031)	
HI for infert., excl. IVF $*$ mother ≥ 30		0.013	
		(0.008)	
HI must cover infert.			-0.005
			(0.024)
HI must cover infert. $*\geq 30$			-0.002
			(0.006)
HI must offer infert. coverage			-0.018
			(0.017)
HI must offer infert. $*\geq 30$			0.016***
			(0.006)

Table presents coefficients on insurance mandate variables. Sample is one in fifty random sample of singleton births in states reporting outcome for 1981–99. Each column represents one regression. The coefficient in column 1 is for an indicator for any mandate that insurers cover/offer to cover infertility treatment and its interaction with the mother being ≥ 30, those in column 2 for indicators for infertility treatment mandates for insurers that exclude IVF treatment or may include IVF and their interactions with the mother being ≥ 30, and those in column 3 for indicators for mandates for insurers to cover or offer to cover treatment and their interactions with the mother being ≥ 30. All regressions include state of residence fixed effects, year fixed effects, and month of birth fixed effects. Regressions also include indicators for the mother's education or for education missing or unreported; for the mother's age in 5-year intervals; for the mother being black, Asian/Pacific Islander, or other non-white or race missing; for the mother being Hispanic or ethnicity missing or unreported; for parity or parity missing; for the child's gender; and for state-level economic, demographic, and public assistance variables. Standard errors clustered at the state level. Regressions are weighted to account for 50% sampling in some states before 1985. N is 1,080,284. Pre-reform mean of dependent variable is 8.98 and that for infants with mothers 30 or older is 8.99. $^{***}p < .01$,$^{**}p < .05$,$^{*}p < .10$.

Appendix Table 5: Estimates of Costs of Imposing Various Types of Mandates Regarding Infertility Treatment Nationally, Costs from Additional Triplet and Higher Order Births to Older Women Assuming Same Increase in Triplet and Higher Order Birth Rate as in Twin Birth Rate

Mandate type	Any mandate	IVF	No IVF	Cover	Offer
(1) Effect of mandates on share of births which are twins to women ≥ 30 (assumes is same effect for higher order births)	0.104			0.229	
(2) # of additional higher-order births to women ≥ 30 (= total higher order births to women $\geq 30 *$ row (1)	541			1,191	
(3) Average total cost of higher-order birth ($)	68,888				
(4) Average total cost of singleton birth ($)	7,306				
(5) National costs of extra births, if not born without mandate ($ millions)	37			82	
(6) National costs of displaced singletons ($ millions)	4			9	
(7) National costs of extra births, if they displace singletons ($ millions, $= (5) - (6)$)	33			73	

Shown are the components of the cost estimates for the added cost of extra triplets and higher order births to older women (rows (5) and (7)) due to imposing national mandates of various types. Each column represents estimates for the type of mandate in the column label. Calculations use the distribution of costs by birth weight and the actual birth weight distribution for triplets and higher order births and the one in fifty subset of singletons from the Detailed Natality data for 1999. Estimates assume the increase in the share of births that are higher order births from mandates is the same as that of twins. Two estimates are presented for the cost of the extra triplets and higher order births, one assuming that the new triplets and higher order births are born to women who otherwise would not have had live births (row (5)), and one assuming that the new triplets and higher order births are born to women who otherwise would have had singletons (row (7)). Estimates are all for imposing a national mandate of the relevant type relative to a no-mandate baseline. Estimates only shown where effects of mandates are significant at the 10 percent level. Estimates are in constant 2003 dollars.

A Detailed Natality Data, Pooled Public Use Micro Sample (PUMS) Census Data and American Community Survey (ACS) Data, and Twin Delivery Rates per 1000 Women

This appendix discusses the main individual level-data sets used here, Detailed Natality data from the National Center for Health Statistics for 1981–99 and 5 percent and 1 percent Public Use Micro Sample data from the decennial Census and the 2001 and 2002 American Community Surveys. It also discusses the twin delivery rate data, created by combining the Detailed Natality Data (data on number of twin births by mother's age and race divided by two) and Census Bureau data (data on female population by race and age).

A.1 Detailed Natality data

We use a subset of the National Center for Health Statistics Detailed Natality Data for the years 1981–99. The Detailed Natality data are either a one-half sample or the universe of birth certificates for live births in the U.S., depending on the state and year. For the analysis of birth rates, the data consist of one in fifty random sample of both singleton and twin births. For the analysis of infant health outcomes, the data includes all twin births in the Detailed Natality data or a one in fifty random sample of singleton births.[1]

From 1985 through 1999, the Natality data include all live births to U.S. residents. Before 1985, some states submitted a 50 percent sample of birth certificates; for these years, the micro-data contain a weight of one or two that allows calculation of statistics representative of the full population. Some states did not report maternal education or Hispanic ethnicity until the early 1990s; all regressions include dummy variables for these variables being missing or unreported. We weight the data in the regressions with this weight of one or two for 1981–84, and with a weight of one for the period 1985–99.

We also are able to match probabilistically a large share of the twins. We do this by matching records for groups of births with the same state of occurrence, state of residence of the mother, county of residence of the mother, race of the mother, marital status of the mother, month of initiation of prenatal care of the mother, maternal education, place of birth of the mother, age of the father, month and year of birth, length of gestation, and number of prenatal care visits. Using this algorithm, 88 percent of the total records were matched to one other record, about 12 percent were matched to zero other records, and less than 0.05

[1] We do not include triplets or higher order births because the data do not separately identify them until 1989.

percent were matched to more than one other record. Any match where one of the records had a weight of two (indicating it was from a state reporting only 50 percent of the birth certificates that year) was dropped (this resulted in dropping 1.3 percent of the matches).

Individual level regressions using the Natality data control for age of mother (20–24, 25–29, 30–34, 35–39, 40–44, and 45 and older), race (black, Asian or Pacific Islander, American Indian, and other non-white), Hispanic ethnicity (or an indicator for Hispanic ethnicity not being reported), education (high-school graduate, some college, four-year college degree, or unreported), gender of child, month of birth, and the number of previous live births (1, 2, 3, 4, 5 or more, or missing) in addition to state and year fixed effects and other state-level controls.

A.2 PUMS and ACS data

We pool data from the 5 percent and 1 percent Public Use Micro Sample (PUMS) of the 2000 decennial Census with the 2001–02 American Community Survey (ACS) data. The PUMS data are 1- or 5-percent samples of data for occupied or vacant housing units, collected as part of the 2000 Census. The American Community Survey collects information for about one million households each year.

We use the subset of children 0–17 from this pooled data, and thus create a panel of children still alive in 2000–02 born from 1982–2002. The only children omitted from the PUMS/ACS are children with no permanent home, children residing in group quarters, children who have died between birth and the survey, and children who have left the U.S. between birth and the survey. The decennial Census and ACS both report state of residence at birth of the children, so we can link children to their likely state of residence during conception.

For children in the primary family, we also know their relationship to the householder and can infer whether their mother is in the household. By matching children of the same age and the same relationship to the householder whose age and relationship variables were not allocated, one can identify multiple births. For example, two children would be identified as twins if they were the only two children in the primary family of the same age and same relationship to the householder. This procedure will slightly overstate the number of twins because it uses age (the PUMS and ACS do not contain information on quarter of birth). Some children 9–11 months apart will have the same age, but would not be twins.

We restrict our sample of children to grandchildren or children of the householder to be more certain these "twins" are primarily biological siblings. We also link the children's records to information about their

"mother." If the child is a biological child of the householder, the "mother" will be the biological mother if she is the householder and the wife of the biological father otherwise. If the child is a grandchild, we can use the subfamily number and subfamily relationship to tie children to their likely "mothers."

Subfamily information is only available for related subfamilies (married couples with or without never-married minor children or single parents with never-married minor children), where some subfamily member is related to the householder. For subfamily units where no member is related to the householder, no relationship information is available. Thus we cannot match children to their parents in such cases.

All regressions are run on the sample of children satisfying the conditions above who are 5–17. The age restriction is required because the disability questions in the PUMS/ACS are only asked about persons 5 and older.

Individual level regressions using the PUMS/ACS data control for age of mother (20–24, 25–29, 30–34, 35–39, 40–44, and 45 and older), race (black, Asian or Pacific Islander, American Indian, and other non-white), Hispanic ethnicity, mother's education (high-school graduate, some college, four-year college degree), and gender of child, in addition to state and year fixed effects and other state-level controls.

A.3 Twin Delivery Rate Data

The data on twin delivery rates come from two sources. The numerator for the delivery rates is one-half times the aggregated counts of the number of twin infants by age/race/state/year from the Detailed Natality Data discussed above in Section A.1. Because education and Hispanic ethnicity are not reported consistently for all states over the time period in the Natality data, these are the only cells which are consistently available. Age groups are 14–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–54. For most of the period births are not reported for women older than 49, but the number of births to women over 49 is very small. We chose to leave them in rather than recode them. Observations for mothers under 14 are dropped (this is 784 twin births over the period 1981–1999, out of more than 1.4 million total twin births in the data). During the period when a 50 percent sample of data is available for some states, each birth is given a weight of two when aggregating the data up. The race groups are white, black, Asian or Pacific Islander, or other/unknown.

The denominator for the delivery rates is from the U.S. Census Bureau data on the female population by age/race/state/year. This data is aggregated to the age by race by state by year cell. Age groups are 14–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–54. Race groups are white, black, Asian or Pacific Islander, or other. Observations with no births have the count of births set to zero.

There are 27,132 cells (7 age groups by 4 race groups by 51 states by 19 years), of which 15,993 had a twin birth. Very few of the white cells had no twin births (789 out of 6784).

Regressions using the grouped delivery rate data control for age of mother cells (20–24, 25–29, 30–34, 35–39, 40–44, and 45 and older), and race of mother cells (black, Asian or Pacific Islander, American Indian, and other non-white) in addition to fixed effects and state-level controls.

B Sources for State-Level Variables

This appendix discusses the sources for the laws on infertility mandates, insurance coverage of infertility treatment for state employees, other state-level controls, health insurance coverage for women 15–44, HMO penetration, and the share of women who work or whose husbands work at firms of various sizes or at public or private firms.

B.1 Laws on infertility mandates

The dates laws were passed, information on whether insurance companies were required to cover or to offer to cover infertility treatment, and information on whether laws included all firms, excluded HMOs, or only applied to HMOs came from the ASRM website, the RESOLVE website, and information generously provided by Lucie Schmidt.

B.2 Coverage of infertility treatment for state employees

This information came from a combination of sources, including state websites on employee benefits, personal communications with state employees, and information generously provided by Lucie Schmidt.

B.3 Unemployment rate

The unemployment rate is the annual average unemployment rate for states from the Bureau of Labor Statistics Local Area Unemployment Statistics.

B.4 Employment growth rate

The employment growth rate is the growth rate of the state's nonfarm wage and salary employment from the Bureau of Economic Analysis's Tables SA27N, Regional Economic Information System.

B.5 Medicaid eligibility threshold as a share of the Federal Poverty Level

This variable is the share of the Federal Poverty Level at which poverty-expansion related coverage for a pregnant woman ends in the state. Coding for this variable through 1997 was generously provide by Aaron Yelowitz. Coding for later years and cross-checking of earlier years was done using the National Governor's Association Maternal and Child Health Updates.

B.6 Median household income for a family of four

This number is provided by the Census Bureau for use by the Department of Health and Human Services for Low Income Home Energy Assistance Program (LIHEAP), and is calculated from the March Current Population Survey and the decennial census as well as per capita personal income estimates from the Bureau of Economic Analysis. The LIHEAP numbers for a given Fiscal Year are the median income levels from the calendar year three years before; here we use the calendar year values.

B.7 Poverty rates

The state poverty rates comes from the Census Bureau's Annual Social and Economic Supplements or the Annual Demographic Files.

B.8 Share of population that is black or Hispanic

This is calculated from the Census Bureau's state population estimates by race and Hispanic origin for the share of the population that is black (before 2000), the share that is black only from the Census Bureau's state population estimates by race alone and Hispanic origin (2000 on), or from similar shares from the Statistical Abstract.

B.9 Share of the population living in a metropolitan area

This information came from the Statistical Abstract for various years. Data for 1989, 1991, 1995, and 1999 were linearly interpolated from data for the year before and after.

B.10 Share of births to unmarried parents

This information came from the National Center for Health Statistics Preliminary or Final Data Reports on Births for various years.

B.11 Maximum AFDC/TANF benefits for a family of 4

This variable is the maximum benefit for a family of 4. Data through 1998 were generously provided by Robert Moffitt at his website. Later data came from various Ways and Means Committee Greenbooks or from the State Policy Documentation Program website.

B.12 Obstetric, NICU, and neonatal intermediate care beds per 1000 women 15–44

Data for the numerator on the number of beds in each state came from American Hospital Association surveys for 1982, 1984, 1991, 1992, 1994, 1995, and 1997. The denominator data are the number of women in each state aged 15–44 from the Census. For years with missing data, we used earlier years, and for 1981, we used 1982 data.

B.13 Share of women aged 15–44 with various types of insurance coverage

These data are constructed from Unicon extracts of the March Supplements to the Current Population Survey. Each number is the weighted average share for women aged 15–44 in that state, using the March Supplement weight. Due to survey questionnaire changes, this number does not include those covered by "other health insurance (that provided by another person in the household)" because this question was not asked in the earliest years.

The share of women with private coverage from an employer is the share of women with any private coverage, whether own or provided by someone else in the household. The share of women with any coverage includes private coverage, Medicaid coverage, Champus coverage, or Medicare coverage.

B.14 HMO Penetration

HMO penetration data were generously provided by Loren Baker for some years and by Lucie Schmidt for others.

B.15 Share of women who work or whose husbands work at firms of various sizes and share who work or whose husbands work for private employers, state government, local government, or the federal government

These data are constructed from Unicon extracts of the March Supplements to the Current Population Survey for all years for the class of worker, and for years 1987 on for the employer size. For calendar years 1981–86, the employment size data are linearly interpolated from the 1979 May CPS and 1988 survey year March CPS data. Each number is the weighted average share for women age 15–44 for their and/or their husband's main job, using the March Supplement weight or May Supplement weight.

B.16 PCE

All real $ amounts are deflated using the Chain-Type Price Index for Personal Consumption Expenditures, from the Bureau of Economic Analysis's National Income and Product Accounts.