

Technical Appendix: Health Start Evaluation for Mothers with Less than High School Education

The following appendix presents population-level summary statistics (where available), results from propensity score matching models, and post-match comparisons for the treatment and comparison populations: mothers whose birth-certificate reported education was less than high school completion in the years 2006-2016.¹ Following What Works Clearinghouse guidelines (WWC, 2020)² matching models were calibrated so that the standardized (effect size) differences between the intervention (Health Start) and comparison groups in the variables used for matching fell below 0.25. Where differences remained between 0.05-0.25, the intervention effect was adjusted via logistic regressions. These models included all variables used in the matching models plus the treatment (Health Start) indicator. Both the post-match unadjusted and regression-adjusted intervention effects are reported in Appendix Table 1 as odds ratios.

We did not attempt to impute missing outcome data and estimation models were limited to the populations for whom these measures were available. As a result, evaluation populations varied slightly between sets of outcomes. Accordingly, we include the matching results for each evaluation population.

¹ A General Educational Development (GED) degree is counted high school completion.

² U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse.

Appendix Table 1: Unadjusted and Regression-Adjusted Outcomes for Health Start Participants with Less than a High School Education

	Unadjusted Odds Ratio	Adjusted Odds Ratio†
Any prenatal care	1.25 (0.96, 1.62)	1.28 (0.97, 1.69)
Kotelchuck Index: >= Adequate	1.12* (1.00, 1.26)	1.13* (1.00, 1.27)
Kotelchuck Index: < Adequate	1.01 (0.90, 1.15)	1.03 (0.90, 1.17)
Kotelchuck Index: Adequate+	1.16* (1.01, 1.34)	1.18* (1.02, 1.36)
Low birth weight	0.96 (0.76, 1.19)	0.95 (0.76, 1.20)
Very low birth weight	1.18 (0.61, 2.25)	1.17 (0.61, 2.25)
Extremely low birth weight	0.96 (0.28, 3.27)	0.77 (0.21, 2.86)
Preterm birth	0.90 (0.73, 1.10)	0.90 (0.73, 1.10)
All Shots On Time	1.13 (0.98, 1.30)	1.14 (0.99, 1.32)
All Shots By 5	1.23* (1.10, 1.39)	1.25*** (1.11, 1.40)

† Regression (logit) adjusted, models include all variables used in matching models and post-matching weights.

*** p<.001; ** p<.01; * p<.05

Appendix Table 2: Missing Outcome Information

	AZ	Health Start
N	209,590	2,364
Insufficient/missing prenatal care information	0.52%	0.55%
Missing birthweight information	0.11%	0.13%
No match to ASIIS database	N/A	1.40%

Appendix Table 3: Summary Statistics & Propensity Score Matching Result for Birth Outcomes Population, Mothers with Less Than High School Completion

	AZ	Matching Model Results		Health	Matches	p-value difference	Standardized Difference
	Totals	OR	95% CI	Start			
N (Unweighted)	209,365			2,361	18,683		
Low birth weight	6.2%			6.9%	7.2%	0.691	0.012
Very low birth weight	0.9%			0.8%	0.7%	0.625	0.014
Extremely low birth weight	0.4%			0.2%	0.2%	0.945	0.002
Preterm birth	9.0%			8.2%	9.0%	0.311	0.030
Age<20	25.3%	1.50***	(1.29, 1.74)	30.8%	30.1%	0.569	0.023
Age 20-24	28.3%	1.12*	(0.99, 1.27)	27.1%	26.9%	0.819	
Age 25-30 (reference)	25.4%			21.1%	21.4%	0.803	
Age>30	21.0%	1.09	(0.95, 1.24)	20.9%	21.7%	0.522	
White	16.3%	0.57***	(0.44, 0.75)	14.6%	14.4%	0.869	0.010
American Indian	7.7%	1.37**	(1.03, 1.81)	11.2%	11.1%	0.890	
Hispanic	70.7%	1.00	(0.79, 1.26)	70.1%	70.2%	0.924	
Other race/ethnicity (reference)	5.3%			4.2%	4.4%	0.774	
Mother born in US (reference)	53.5%			58.6%	58.8%	0.883	0.024
Mother born in Mexico	41.5%	1.60***	(1.43, 1.79)	38.5%	37.9%	0.675	
Mother born outside US	5.0%	1.06	(0.80, 1.40)	2.9%	3.3%	0.451	
Hispanic & born outside US	2.3%			1.1%	1.0%	0.673	0.012
Private/commercial insurance	8.1%	0.83	(0.60, 1.15)	3.3%	3.2%	0.935	0.039
AHCCCS	87.4%	2.00***	(1.57, 2.53)	93.3%	94.0%	0.311	
Other insurance (reference)	4.5%			3.5%	2.8%	0.182	
Married	29.7%	0.88	(0.64, 1.19)	28.8%	27.4%	0.300	0.030
Married & cohabiting	28.4%	1.30	(0.93, 1.80)	26.9%	25.8%	0.428	0.023
Mother & father cohabiting	62.7%	0.95	(0.86, 1.06)	55.7%	54.7%	0.501	0.020
First birth	30.7%	1.08	(0.96, 1.21)	35.2%	35.1%	0.951	0.002
Pre-existing health risk	7.7%	0.99	(0.86, 1.14)	10.2%	10.7%	0.536	0.018

Appendix Table 3: Summary Statistics & Propensity Score Matching Result for Birth Outcomes Population, Mothers with Less Than High School Completion (continued)

	AZ	Matching Model Results		Health	Matches	p-value difference	Standardized Difference
	Totals	OR	95% CI	Start			
Maricopa (reference)	65.2%			31.2%	32.2%	0.453	0.064
Cochise	1.2%	20.38***	(17.24, 24.08)	10.0%	10.2%	0.735	
Mohave	2.5%	4.26***	(3.34, 5.44)	3.5%	3.6%	0.937	
Apache, Coconino, Navajo	4.3%	4.52***	(3.69, 5.53)	13.6%	11.7%	0.054	
Pima	11.7%	1.86***	(1.59, 2.17)	9.6%	9.2%	0.690	
Santa Cruz	0.8%	19.83***	(16.22, 24.24)	6.7%	6.6%	0.861	
Yavapai	2.1%	9.74***	(8.13, 11.67)	8.0%	8.2%	0.831	
Yuma	3.9%	6.07***	(5.24, 7.02)	12.8%	13.7%	0.367	
Other county	6.5%	1.08	(0.84, 1.37)	3.3%	3.3%	0.935	
County missing	1.8%	1.91***	(1.23, 2.95)	1.4%	1.2%	0.699	
Bottom income decile (reference)	5.1%			3.1%	2.5%	0.253	0.074
Income decile 2	11.6%	1.61***	(1.24, 2.09)	17.2%	17.3%	0.908	
Income decile 3	17.5%	2.19***	(1.70, 2.84)	17.8%	18.6%	0.474	
Income decile 4	10.8%	2.61***	(1.98, 3.43)	11.0%	12.0%	0.254	
Income decile 5	10.3%	2.12***	(1.62, 2.77)	14.5%	14.7%	0.869	
Income decile 6	12.4%	1.83***	(1.39, 2.42)	9.2%	8.3%	0.304	
Income decile 7	10.1%	2.11***	(1.61, 2.77)	11.1%	10.0%	0.217	
Income decile 8	9.1%	3.71***	(2.84, 4.85)	12.1%	12.3%	0.790	
Income decile 9	5.2%	1.39	(0.93, 2.08)	1.6%	1.9%	0.373	
Top income decile	1.6%	1.02	(0.52, 2.00)	0.4%	0.3%	0.637	
Income decile (zip code) missing	6.4%	1.66**	(1.09, 2.52)	2.1%	1.9%	0.677	
2006 (reference)	13.2%			0.5%	0.5%	0.834	0.060
2007	13.0%	1.13	(0.52, 2.48)	0.6%	0.4%	0.393	
2008	11.7%	2.88***	(1.47, 5.62)	1.3%	1.3%	0.897	
2009	10.0%	7.89***	(4.28, 14.55)	3.0%	3.0%	0.932	
2010	8.5%	25.70***	(14.32, 46.11)	8.0%	8.0%	0.957	
2011	7.5%	52.69***	(29.57, 93.87)	14.1%	15.2%	0.323	
2012	7.4%	56.48***	(31.70, 100.64)	14.7%	14.1%	0.534	
2013	6.8%	61.57***	(34.54, 109.74)	14.6%	14.2%	0.709	
2014	7.7%	57.23***	(32.13, 101.95)	15.1%	16.1%	0.336	
2015	7.3%	62.01***	(34.80, 110.51)	14.9%	13.7%	0.244	
2016	6.9%	57.20***	(32.05, 102.08)	13.1%	13.6%	0.669	
NHW x North counties	0.6%	5.41***	(3.95, 7.39)	4.4%	3.9%	0.344	0.028

*** p<.001; ** p<.01; * p<.05

Appendix Table 4: Summary Statistics & Propensity Score Matching Result for Prenatal Care Outcomes Population, Mothers with Less Than High School Completion

	AZ	Matching Model Results		Health	Matches	p-value difference	Standardized Difference
	Totals	OR	95% CI	Start			
N (Unweighted)	208,491			2,351	18,408		
Any prenatal care	95.8%			95.4%	94.4%	0.097	0.048
Kotelchuck Index: >= Adequate	58.4%			55.9%	53.1%	0.050	0.057
Kotelchuck Index: < Adequate	25.7%			31.3%	31.0%	0.827	0.006
Kotelchuck Index: Adequate+	22.7%			22.1%	19.6%	0.034	0.062
Age<20	25.3%	1.49***	(1.28, 1.73)	30.8%	30.3%	0.681	0.029
Age 20-24	28.3%	1.12	(0.98, 1.26)	27.1%	26.8%	0.793	
Age 25-30	25.4%			21.1%	20.8%	0.802	
Age>30	21.0%	1.08	(0.95, 1.23)	20.9%	22.1%	0.320	
White	16.2%	0.58***	(0.44, 0.75)	14.6%	14.5%	0.901	0.020
American Indian	7.7%	1.39*	(1.05, 1.84)	11.1%	10.7%	0.607	
Hispanic	70.7%	1.00	(0.79, 1.27)	70.1%	70.5%	0.799	
Other race/ethnicity	5.3%			4.1%	4.4%	0.665	
Mother born in US	53.4%			58.6%	58.1%	0.745	0.032
Mother born in Mexico	41.5%	1.60***	(1.43, 1.79)	38.5%	38.5%	0.952	
Mother born outside US	5.0%	1.04	(0.78, 1.37)	2.8%	3.4%	0.276	
Hispanic & born outside US	2.3%			1.1%	1.2%	0.892	0.004
Private/commercial insurance	8.1%	0.82	(0.59, 1.14)	3.3%	3.3%	1.000	0.022
AHCCCS	87.4%	1.98***	(1.56, 2.51)	93.3%	93.7%	0.595	
Other insurance	4.5%			3.4%	3.1%	0.460	
Married	29.7%	0.86	(0.63, 1.18)	28.8%	27.4%	0.270	0.032
Married & cohabiting	28.5%	1.32	(0.95, 1.84)	26.9%	25.8%	0.372	0.026
Mother & father same address	62.7%	0.95	(0.86, 1.06)	55.8%	54.8%	0.519	0.019
First birth	30.7%	1.08	(0.96, 1.21)	35.2%	35.8%	0.670	0.012
Pre-existing health risk	7.7%	0.99	(0.86, 1.14)	10.1%	9.6%	0.557	0.017

Appendix Table 4: Summary Statistics & Propensity Score Matching Result for Prenatal Care Outcomes Population, Mothers with Less Than High School Completion (continued)

	AZ	Matching Model Results		Health	Matches	p-value difference	Standardized Difference
	Totals	OR	95% CI	Start			
Maricopa (reference)	65.3%			31.2%	31.7%	0.730	0.064
Cochise	1.2%	20.34***	(17.21, 24.04)	10.0%	9.5%	0.555	
Mohave	2.5%	4.25***	(3.33, 5.43)	3.5%	3.3%	0.689	
Apache, Coconino, Navajo	4.3%	4.35***	(3.55, 5.34)	13.4%	11.7%	0.086	
Pima	11.7%	1.84***	(1.58, 2.15)	9.5%	9.6%	0.921	
Santa Cruz	0.8%	20.09***	(16.43, 24.56)	6.8%	6.8%	0.908	
Yavapai	2.2%	9.70***	(8.09, 11.61)	8.0%	8.4%	0.633	
Yuma	3.9%	6.04***	(5.22, 6.98)	12.8%	13.8%	0.345	
Other county	6.4%	1.08	(0.85, 1.38)	3.3%	3.4%	0.809	
County missing	1.8%	1.89**	(1.22, 2.92)	1.4%	1.7%	0.403	
Bottom income decile (reference)	5.1%			3.1%	2.6%	0.337	0.100
Income decile 2	11.6%	1.60***	(1.23, 2.08)	17.2%	16.4%	0.435	
Income decile 3	17.5%	2.17***	(1.68, 2.81)	17.8%	18.5%	0.570	
Income decile 4	10.8%	2.59***	(1.97, 3.40)	11.0%	12.0%	0.314	
Income decile 5	10.4%	2.10***	(1.60, 2.74)	14.5%	15.4%	0.437	
Income decile 6	12.4%	1.81***	(1.37, 2.38)	9.1%	8.1%	0.213	
Income decile 7	10.1%	2.07***	(1.58, 2.72)	11.0%	9.7%	0.137	
Income decile 8	9.1%	3.69***	(2.82, 4.83)	12.1%	12.1%	0.964	
Income decile 9	5.2%	1.34	(0.89, 2.02)	1.5%	2.0%	0.223	
Top income decile	1.6%	1.01	(0.52, 1.99)	0.4%	0.4%	0.818	
Income decile (zip code) missing	6.4%	1.66*	(1.09, 2.52)	2.1%	3.0%	0.051	
2006	13.3%			0.5%	0.4%	0.669	0.044
2007	13.0%	1.13	(0.52, 2.48)	0.6%	0.4%	0.393	
2008	11.7%	2.87**	(1.47, 5.62)	1.3%	1.2%	0.896	
2009	10.0%	8.00***	(4.34, 14.74)	3.1%	3.1%	1.000	
2010	8.5%	25.68***	(14.31, 46.09)	8.1%	8.5%	0.634	
2011	7.5%	52.88***	(29.68, 94.21)	14.2%	14.8%	0.535	
2012	7.4%	56.53***	(31.73, 100.72)	14.8%	15.2%	0.653	
2013	6.8%	61.13***	(34.29, 108.96)	14.6%	14.3%	0.772	
2014	7.6%	57.95***	(32.53, 103.24)	15.1%	14.8%	0.744	
2015	7.2%	62.04***	(34.81, 110.58)	14.8%	14.1%	0.481	
2016	6.8%	57.12***	(32.00, 101.97)	13.0%	13.1%	0.863	
NHW x North counties	0.6%	5.55***	(4.05, 7.60)	0.044	0.044	1.000	0.000

*** p<.001; ** p<.01; * p<.05

Appendix Table 5: Summary Statistics & Propensity Score Matching Result for Immunization Outcomes Population, Mothers with Less Than High School Completion †

	AZ	Matching Model Results		Health	Matches	p-value difference	Standardized Difference
	Totals	OR	95% CI	Start			
N (Unweighted)	209,590			2,364	18,464		
Age<20	25.3%	1.52***	(1.31, 1.76)	30.8%	28.6%	0.098	0.052
Age 20-24	28.3%	1.11*	(0.98, 1.26)	27.2%	28.2%	0.435	
Age 25-30 (reference)	25.4%			21.2%	21.1%	0.972	
Age>30	21.0%	1.08	(0.95, 1.23)	20.9%	22.1%	0.305	
White	16.3%	0.74**	(0.57, 0.95)	14.6%	14.3%	0.772	0.035
American Indian	7.7%	3.01***	(2.29, 3.97)	11.2%	10.2%	0.301	
Hispanic	70.7%	1.04	(0.83, 1.32)	70.1%	71.5%	0.291	
Other race/ethnicity (reference)	5.3%			4.2%	4.0%	0.769	
Mother born in US (reference)	53.5%			58.6%	56.7%	0.195	0.040
Mother born in Mexico	41.5%	1.58***	(1.41, 1.77)	38.5%	40.0%	0.297	
Mother born outside US	5.0%	1.11	(0.84, 1.46)	2.9%	3.3%	0.451	
Private/commercial insurance	8.1%	0.80	(0.58, 1.11)	3.3%	4.1%	0.141	0.044
AHCCCS	87.4%	1.96***	(1.55, 2.48)	93.3%	92.7%	0.426	
Other insurance (reference)	4.5%			3.5%	3.3%	0.687	
Married	29.7%	0.90	(0.66, 1.22)	28.8%	29.1%	0.873	0.005
Married & cohabiting	28.4%	1.31	(0.94, 1.81)	26.9%	26.9%	0.974	0.001
Cohabiting	62.7%	0.94	(0.85, 1.04)	55.7%	55.9%	0.884	0.004
First birth	30.7%	1.07	(0.95, 1.20)	35.2%	34.2%	0.502	0.020
Pre-existing health risk	7.7%	0.99	(0.86, 1.14)	10.2%	10.1%	0.923	0.003

†Immunization outcomes not available for full population

Appendix Table 5: Summary Statistics & Propensity Score Matching Result for Immunization Outcomes Population, Mothers with Less Than High School Completion (continued)

	AZ Totals	Matching Model Results		Health Start	Matches	p-value difference	Standardized Difference
		OR	95% CI				
Maricopa (reference)	65.2%			31.3%	31.2%	0.950	0.081
Cochise	1.2%	20.41***	(17.28, 24.11)	9.9%	8.8%	0.195	
Mohave	2.5%	3.72***	(2.91, 4.74)	3.5%	3.6%	0.875	
Apache, Coconino, Navajo	4.3%	17.07***	(14.43, 20.19)	13.6%	11.9%	0.081	
Pima	11.7%	1.69***	(1.45, 1.97)	9.6%	10.1%	0.526	
Santa Cruz	0.8%	20.14***	(16.47, 24.63)	6.7%	7.1%	0.606	
Yavapai	2.1%	9.17***	(7.67, 10.97)	8.0%	8.9%	0.250	
Yuma	3.9%	6.07***	(5.25, 7.02)	12.8%	14.0%	0.200	
Other county	6.5%	0.84	(0.65, 1.07)	3.3%	3.0%	0.619	
Bottom income decile (reference)	5.1%			3.1%	2.4%	0.129	0.071
Income decile 2	11.6%	1.41***	(1.09, 1.84)	17.2%	17.3%	0.939	
Income decile 3	17.5%	1.90***	(1.47, 2.46)	17.9%	18.4%	0.650	
Income decile 4	10.8%	2.17***	(1.65, 2.85)	11.0%	12.0%	0.274	
Income decile 5	10.3%	1.77***	(1.35, 2.31)	14.5%	15.2%	0.487	
Income decile 6	12.4%	1.54***	(1.17, 2.02)	9.2%	8.7%	0.541	
Income decile 7	10.1%	1.68***	(1.28, 2.21)	11.0%	11.0%	0.963	
Income decile 8	9.1%	2.67***	(2.03, 3.50)	12.1%	11.3%	0.442	
Income decile 9	5.2%	1.07	(0.72, 1.61)	1.6%	1.6%	0.817	
Top income decile	1.6%	0.82	(0.42, 1.61)	0.4%	0.3%	0.466	
Income decile (zip code) missing	6.4%	1.41*	(0.94, 2.14)	2.1%	1.8%	0.459	
2006 (reference)	13.2%			0.5%	0.5%	0.834	0.049
2007	13.0%	1.14	(0.52, 2.50)	0.5%	0.4%	0.531	
2008	11.7%	2.91***	(1.49, 5.68)	1.3%	1.1%	0.689	
2009	10.0%	8.11***	(4.40, 14.95)	3.1%	2.9%	0.669	
2010	8.5%	25.92***	(14.44, 46.52)	8.0%	8.2%	0.873	
2011	7.5%	53.55***	(30.05, 95.42)	14.1%	14.9%	0.433	
2012	7.4%	56.93***	(31.95, 101.45)	14.7%	14.6%	0.967	
2013	6.8%	61.90***	(34.72, 110.35)	14.6%	14.4%	0.837	
2014	7.7%	57.52***	(32.29, 102.48)	15.1%	15.1%	1.000	
2015	7.3%	62.66***	(35.15, 111.68)	14.8%	13.8%	0.319	
2016	6.9%	57.10***	(31.99, 101.92)	13.2%	14.0%	0.396	
County missing	1.8%	1.66**	(1.08, 2.56)	1.4%	1.3%	0.798	0.007
Native American x North counties	2.9%	0.06***	(0.04, 0.08)	3.3%	2.6%	0.143	0.043

*** p<.001; ** p<.01; * p<.05