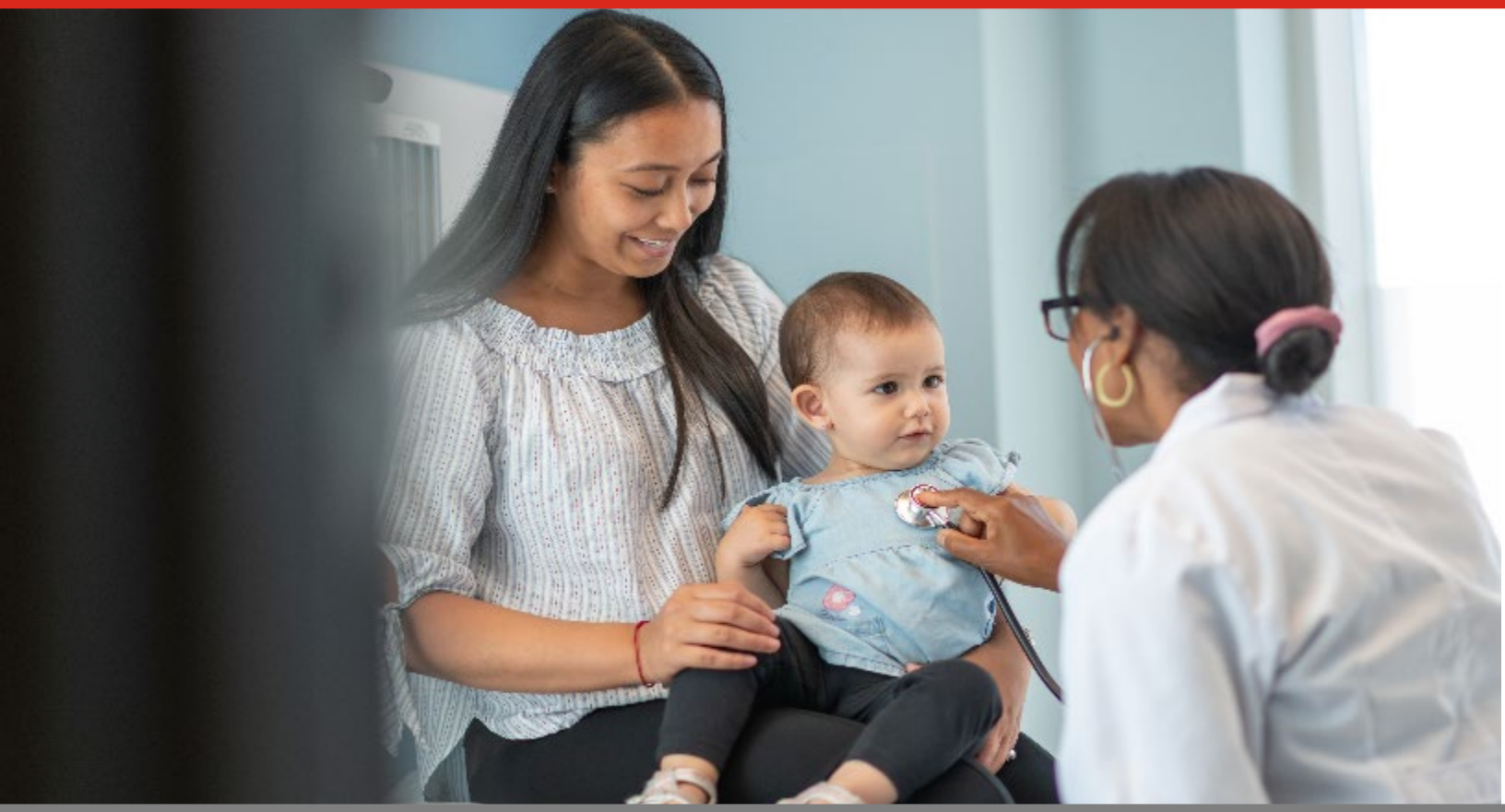
Analysis of the National Healthy Start Program of the Maternal and Child Health Bureau, Health Resources and Services Administration



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Contents

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Healthy Start Grantees

Participating Healthy Start grantees were vital to obtaining Healthy Start participant data. The following Healthy Start grantees obtained participant consent for inclusion in the analysis of the Healthy Start program (in alphabetical order):

- Access Community Health Network *(Illinois)*
- Alameda County Health Care Services Agency *(California)*
- Albert Einstein College of Medicine *(New York City)*
- Albert Einstein Healthcare Network *(Pennsylvania)*
- Aunt Martha's Youth Service Center, Inc. *(Illinois)*
- Baltimore City Healthy Start, Inc. *(Maryland)*
- BCFS Health and Human Services *(Texas)*
- Ben Archer Health Center, Inc. *(New Mexico)*
- Birmingham Healthy Start Plus, Inc. *(Alabama)*
- Center for Black Women's Wellness, Inc. *(Georgia)*
- Centerstone of Tennessee, Inc. *(Tennessee)*

- Central Mississippi Civic Improvement Association, Inc. *(Mississippi)*
- Charles Drew Health Center, Inc. *(Nebraska)*
- Children's Futures, Inc. *(New Jersey)*
- Children's Hospital Medical Center *(Ohio)*
- City of Minneapolis *(Minnesota)*
- City of New Orleans *(Louisiana)*
- Cleveland Department of Public Health *(Ohio)*
- Clinica de Familia, Inc. LA *(New Mexico)*
- Colorado Non-Profit Development Center *(Colorado)*
- Columbus Health Department *(Ohio)*
- Community Foundation for Greater New Haven, Inc. *(Connecticut)*
- Community Health Center of Richmond, Inc. *(New York City)*
- Community Health Centers, Inc. *(Oklahoma)*
- Community Service Council of Greater Tulsa *(Oklahoma)*
- County of Clayton *(Georgia)*
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- County of Ingham, Health Department *(Michigan)*
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- County of Multnomah *(Oregon)*
- County of Sedgwick *(Kansas)*
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- Crozer-Keystone Community Foundation *(Pennsylvania)*
- Dallas County Hospital District *(Texas)*
- DC Department of Human Services *(District of Columbia)*
- Delta Health Alliance, Inc. *(Mississippi)*
- Family Road of Greater Baton Rouge, Inc. *(Louisiana)*
- Family Tree Information Education & Counseling Center *(Louisiana)*
- Five Rivers Health Centers *(Ohio)*
- Florida Department of Health *(Florida)*
- Fund for Public Health in New York, Inc./Department of Mental Health and Hygiene *(New York City)*
- Genesee County Health Department *(Michigan)*
- Gift of Life Foundation *(Alabama)*
- Great Lakes Inter-Tribal Council, Inc. *(Wisconsin)*
- Great Plains Tribal Chairmen's Health Board *(South Dakota)*
- Hamilton Health Center, Inc. *(Pennsylvania)*
- Health & Hospital Corporation of Marion County *(Indiana)*
- Health Care Coalition of Southern Oregon *(Oregon)*
- Healthcare Consortium of Illinois *(Illinois)*
- Healthy Start, Inc. *(Pennsylvania)*
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- Inter-Tribal Council of Michigan, Inc. *(Michigan)*
- Johns Hopkins All Children's Hospital, Inc. *(Florida)*
- Kalamazoo County Health and Community Services Department *(Michigan)*
- Kansas Department of Health and Environment *(Kansas)*
- Laurens County Board of Health *(Georgia)*
- Little Dixie Community Action Agency, Inc. *(Oklahoma)*
- Louisville/Jefferson County Metro Government *(Kentucky)*
- Maricopa County Department of Health *(Arizona)*
- Mariposa Community Health Center, Inc. *(Arizona)*
- Massachusetts Department of Public Health *(Massachusetts)*
- Maternal & Child Health Coalition *(Missouri)*
- Maternal & Child Health Coalition of Greater Kansas City *(Kansas)*
- Maternity Care Coalition *(Pennsylvania)*
- MCG Health, Inc. *(Georgia)*
- Mississippi County Arkansas EOC, Inc. *(Arkansas)*
- Missouri Bootheel Regional Consortium, Inc. *(Missouri)*
- Newark Community Health Centers, Inc. *(New Jersey)*
- North Carolina Division of Public Health, Women's and Children's Health Section *(North Carolina)*
- Northeast Florida Healthy Start Coalition *(Florida)*
- Northern Manhattan Perinatal Partnership, Inc. *(New York City)*
- Northwest Indiana Health Department Co-Op *(Indiana)*
- Onondaga County Health Department *(New York State)*
- Palmetto Health Alliance *(South Carolina)*

- Perinatal Network of Monroe County, Inc. *(New York State)*
- Philadelphia Public Health Department *(Pennsylvania)*
- Project Concern International *(California)*
- Public Health Solutions *(New York City)*
- Reach Up, Inc. *(Florida)*
- Richmond Healthy Start Initiative *(Virginia)*
- Robeson Health Care Corporation *(North Carolina)*
- San Antonio City Department of Finance *(Texas)*
- SGA Youth & Family Services *(Illinois)*
- Shields for Families Project, Inc. *(California)*
- South Carolina State Office *(South Carolina)*
- Southern Illinois Healthcare Foundation *(Illinois)*
- Southern Nevada Health District *(Nevada)*
- Southern New Jersey Perinatal *(New Jersey)*
- Spectrum Health *(Michigan)*
- State of Connecticut Department of Public Health *(Connecticut)*
- The Center for Health Equity, Inc. *(Florida)*
- The Near North Health Service Corporation *(Illinois)*
- The Partnership for Maternal and Child Health of Northern New Jersey, Inc. *(New Jersey)*
- Tougaloo College *(Mississippi)*
- Tulsa City-County Health Department *(Oklahoma)*
- University of Miami *(Florida)*
- University of North Carolina at Pembroke *(North Carolina)*
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- Colorado Department of Public Health and Environment
- Connecticut Department of Public Health, Health Statistics and Surveillance
- District of Columbia Center for Health Statistics
- Florida Department of Health, Vital Records Office
- Georgia Department of Public Health, Vital Records Office
- Illinois Department of Public Health, Division of Vital Records
- Indiana State Department of Health, Vital Records
- Iowa Department of Public Health, Bureau of Health Statistics
- Kansas Department of Health and Environment
- Kentucky Department for Public Health
- Louisiana Bureau of Vital Records and Statistics
- Maricopa County Department of Public Health
- Maryland Department of Health and Mental Hygiene, Vital Statistics Administration
- Massachusetts Department of Public Health
- Michigan Department of Health and Human Services, Vital Records Office
- Minnesota Department of Health, Office of Vital Records
- Mississippi State Department of Health, Vital Records
- Missouri Department of Health and Senior Services
- Nebraska Health and Human Services
- Nevada Division of Public and Behavioral Health
- New Mexico Department of Health

- New York City Department of Health and Mental Hygiene, Office of Vital Statistics
- New York State Department of Health, Bureau of Vital Records
- North Carolina State Center for Health Statistics
- Ohio Department of Health, Bureau of Vital Statistics
- Oregon Health Authority
- Pennsylvania Department of Health, Division of Statistical Registries
- South Carolina Department of Health and Environmental Control, Public Health Statistics and Information Services
- South Dakota Department of Health, Office of Health Statistics
- Tennessee Department of Health
- Virginia Department of Health, Division of Vital Records
- West Virginia Bureau for Public Health
- Wisconsin Division of Public Health

PRAMS Programs

The following Pregnancy Risk Assessment Monitoring System (PRAMS) programs provided supplemental data for Healthy Start participants to the national CDC PRAMS program on a rolling basis (in alphabetical order):

- Alabama PRAMS Program
- Connecticut PRAMS Program
- Georgia PRAMS Program
- Iowa PRAMS Program
- Louisiana PRAMS Program
- Massachusetts PRAMS Program
- Missouri PRAMS Program
- Michigan PRAMS Program
- New York State PRAMS Program
- Oregon PRAMS Program
- Pennsylvania PRAMS Program

Executive Summary

Background

Infant mortality, defined as the death of an infant before their first birthday (CDC, 2019a), is a widely used indicator of the strength of a nation's health system and a measure of overall population health. To reduce infant mortality and related disparities among groups, as well as improve maternal and infant health, the Health Resources and Services Administration Maternal and Child Health Bureau established Healthy Start (HS) in 1991 with 15 demonstration projects. The program has since expanded in size and mission. In 2017, HS supported community interventions implemented by 100 grantees across 37 states and the District of Columbia.

The Agency for Healthcare Research and Quality's (AHRQ) concept of the Learning Health System (AHRQ, 2019) is designed to generate and apply the best evidence for the collaborative healthcare choices of each patient and provider. In alignment with AHRQ, the HS program has employed this concept and has been evaluated since its inception in 1991. This report describes the first analysis of the HS program since it transformed in 2014 to address recommendations from the Report of the Secretary's Advisory Committee on Infant Mortality (HRSA, 2013). The purpose of this analysis is to inform continued efforts to reduce infant mortality rates nationally as well as reduce racial and ethnic disparities in rates of infant death and other adverse maternal and infant health outcomes. The result of this transformation is a greater program emphasis on the lifecourse model (Lu & Halfon, 2003), which provides a comprehensive view of the individual, community, and societal factors that can influence health outcomes over the course of an individual's life.

The overarching goals of this analysis were to describe HS women, examine associations between individual characteristics and selected health and behavioral outcomes, and compare outcomes between HS women and matched non-HS women. This analysis sought to address the following four questions:

1) What are the observable characteristics of HS women?
2) Which observable characteristics of HS women are associated with differences in maternal and infant health outcomes?
3) Which maternal and infant health outcomes are different for HS women compared to non-HS women?
4) How do outcomes among HS women compare to national benchmarks and program targets?

Methods

This point-in-time assessment includes data from the third year of a five-year grant cycle for which the program targets are set. The use of three different data sources reflects a multimethod approach, which is generally considered to provide more robust and more complete results than single-method designs (Creswell & Plano Clark, 2018). Specifically, analytic samples were assessed using three different maternal and child health-related data sources from the calendar year 2017:

1) Program data for HS women (N=29,112) from 95 HS grantees from the Healthy Start Monitoring and Evaluation Data (HSMED) system across 36 states;
2) Live birth and infant death data from 32 states and the District of Columbia vital records offices (VROs) for HS women (N=7,932) from 71 HS grantees matched with non-HS women (N=459,196) based on geographic and sociodemographic characteristics; and
3) Centers for Disease Control and Prevention Pregnancy Risk Assessment Monitoring System (PRAMS) data from 11 states for HS women (N=655) from 16 HS grantees matched with non-HS women (N=1,736) based on geographic and sociodemographic characteristics.

We analyzed data for the program overall and by reproductive phase (preconception, prenatal, postpartum, and interconception/parenting). We conducted descriptive analyses to describe HS participant characteristics. We used multivariable logistic regression analyses to identify participant characteristics associated with a higher risk of adverse maternal and infant health outcomes. We also conducted two sets of propensity score matched multivariable regression analyses to examine differences in outcomes between HS women and demographically similar non-HS women.

Results

We organized results based on the four questions:

What are the observable characteristics of HS women? The majority of HS women included in the HSMED analytic sample consisted of pregnant women in the prenatal reproductive phase. HS women across the HSMED, VRO, and PRAMS analytic samples were primarily below the age of 35 years old, identified as non-Hispanic and black or African-American, had a high school degree/GED or less, and health insurance coverage through public insurance, such as Medicaid (see Table 1).

Table 1: 2017 U.S. HS Sample [a] Characteristics Using HSMED, VRO, and PRAMS

Sociodemographic Characteristic	Data Source		
	HSMED [b]	VRO	PRAMS
	%	%	%
35 years or below	88.4	90.5	90.6
Black or African-American	60.1	62.2	59.6
Non-Hispanic/Latina	76.3	82.5	85.3
High school degree/GED or less	68.6	65.0	61.9
Public health insurance	91.4	83.2	76.0

[a] Denominators vary based on non-missing data for each characteristic.
[b] Pooled data across four reproductive phases.

Which observable characteristics of HS women are associated with differences in maternal and infant health outcomes? We found consistent socioeconomic differences in maternal and infant outcomes within HS women across the reproductive phases of preconception, prenatal, postpartum, and interconception/parenting using the HSMED ($p<0.01$). These findings suggest the presence of both risk and protective factors for selected maternal and infant outcomes:

- HS women with higher educational attainment had more favorable maternal and infant outcomes, such as abstaining from tobacco use during pregnancy and breastfeeding, than HS women with less than a high school degree.
- HS women below FPL showed more adverse outcomes, such as tobacco use during pregnancy and lower father/partner involvement during pregnancy and with the child, than HS women above FPL.
- White HS women showed both favorable and adverse outcomes. They were more likely to follow infant safe sleep practices and use tobacco during pregnancy when compared to black or African-American HS women.
- Hispanic/Latina HS women were less likely to use tobacco during pregnancy than non-Hispanic/Latina HS women.
- HS women who spoke a language other than English showed both favorable and adverse outcomes. They were less likely to have health insurance coverage, but more likely to abstain from tobacco use during pregnancy and breastfeed than HS women who only spoke English.

Which maternal and infant health outcomes are different for HS women compared to those of non-participants? We found differences between HS women and demographically similar, propensity score matched non-HS women using the VRO and PRAMS ($p<0.01$). These analyses were used to identify pre-existing factors and results of HS participation. Results differed by data source as indicated in parentheses:

- HS women were more likely to have high blood pressure/hypertension, whether prior to or during pregnancy, than non-HS women (VRO).
- Compared to non-HS women, HS women had earlier initiation (VRO) and frequency of prenatal care (VRO and PRAMS).
- HS women also showed favorable results for infant birth weight and for following infant safe sleep practices compared to non-HS women (PRAMS).

How do outcomes among HS women compare to national benchmarks and program targets? This analysis intended to identify program targets to compare to national benchmarks. Although some similar benchmarks exist for the general population, no national benchmarks exist for populations similar to populations of focus for the HS program.

HS established high standards for program performance as a part of the recent transformation, with some performance measures set at 100 percent of individual participants achieving a given outcome. Our analyses show variability in achieving these ambitious performance measures. HS program outcomes met or were above program performance measures for having a usual source of care when sick and screening for depression. HS performance measures were consistently below program targets for breastfeeding practices and screening for IPV.

Limitations

Various constraints limited our ability to fully assess the current HS program, and in turn, make firm conclusions when comparing participant outcomes to similar groups and the general population. Nevertheless, given the richness and complexity of the dataset, our findings provide valuable insights regarding the program's opportunity for impact as well as considerations for more rigorous evaluation approaches in the future.

HS program targets are established based on expectations for the fifth and final year of the grant cycle; thus, this analysis may not reflect the full impact of HS participation since we assessed a point-in-time with data from only the third year in the cycle.

The HSMED data collection tools capture a wealth of data specific to each HS participant's reproductive health phase. The HS dataset is rich and complex, and some data were missing or incomplete in the questionnaires administered at the program level. In addition, when we could not accurately match participants in the HSMED to the PRAMS and VRO datasets in order to confirm consent for participation, we had to exclude those participants. The resulting smaller sample size inhibited full comparison to demographically similar non-HS women and limited our ability to make firm conclusions.

In addition, it is possible that the HS women who completed and returned the PRAMS survey, and/or the HS women who provided enough data for accurate linking to the VRO, are a self-selected population among HS women as a whole that may differ in systematic ways from HS women who did not. This highlights the need for sensitivity and awareness of the impact of demographic factors among HS women on participation in and representation within specific data sources, and our resulting ability to link data from a given individual across these different data sources.

This analysis encountered a number of limitations common to this type of assessment. We accounted for known sociodemographic characteristics in our statistical models, but we were unable to account for other

unobserved or unmeasured factors associated with program participation or nonparticipation that may confound our estimates. These factors may include severe social conditions (e.g., unstable living conditions, lack of continuous health insurance), psycho-social stressors, and relationships with service providers and the health care system as a whole (Thomas, et al., 2018).

These methodological considerations limit our ability to fully assess the current HS program and to make direct comparisons to other similar groups and the general population.

Conclusion and Recommendations

Our findings suggest that there were socioeconomic and racial/ethnic disparities in maternal and infant outcomes among HS women. HS women with higher educational attainment had favorable maternal and infant outcomes, such as abstaining from tobacco use during pregnancy and breastfeeding. HS women below FPL showed more adverse outcomes, such as tobacco use during pregnancy and lower father/partner involvement during pregnancy and with the child. White HS women and HS women who spoke a language other than English showed both favorable and adverse outcomes. White HS women were more likely to follow infant safe sleep practices and use tobacco during pregnancy when compared to black or African-American HS women, while HS women who spoke a language other than English were less likely to have health insurance coverage, but more likely to abstain from tobacco use during pregnancy and breastfeed than HS women who only spoke English. **HS may consider enhancing outreach to HS women who live below FPL and who have not graduated from high school, groups that have consistently demonstrated more adverse maternal and infant outcomes among HS women.**

Compared to demographically similar nonparticipants, HS women showed greater initiation and frequency of prenatal care, healthier infant birth weight, and greater use of infant safe sleep practices, but also more frequent reported comorbidities involving high blood pressure/hypertension**. Our findings suggest the presence of both risk and protective factors for HS women. Although, on many maternal and infant health indicators, including infant mortality, HS women appear to have similar health outcomes as demographically similar non-HS women.** However, it is difficult to assess program effectiveness without baseline estimates. Future studies may benefit from having a larger sample with baseline estimates for the population of interest. This would enable a deeper assessment of program performance.

Few local HS programs have undertaken the complex and resource-intensive process required to link program data to state vital records, and even fewer have incorporated surveillance data. **The present study not only linked HS program data to state vital live birth and infant death records, but also to CDC PRAMS survey data. This assessment is the first matched analysis for HS on a national level.**

The challenges and limitations we describe in our study may be addressed as the health care ecosystem (including the range of health datasets) moves toward a Learning Measurement System (Saha, 2020), calling for harmonized measures across health sectors monitoring health outcomes to improve population and community health. The present study illustrates the current limitations of the health data ecosystem and the need for a Learning Measurement System. However, this effort also highlights the promise of a Learning Measurement System when federal programs are seeking to learn from datasets collected in other sectors to achieve their missions.

Background

Infant mortality, defined as the death of an infant before their first birthday, is a widely used indicator of the strength of a nation's health system and is a measure of population health. The U.S. infant mortality rate (IMR) continues to rank as one of the worst among the 36 nations of the Organization for Economic Co-operation and Development, ranking 33rd in 2019. Between 2005 and 2017, the overall U.S. IMR declined from 6.9 per 1,000 live births to 5.8 in 2017, which is below the Healthy People 2020 target of 6.0 per 1,000 live births (OECD, 2019). However, differences in IMR exist between racial/ethnic groups. For example, the 2017 IMR among non-Hispanic black mothers (10.9 per 1,000 live births) was more than double that of non-Hispanic white mothers at 4.7 per 1,000 live births in 2017 ("CDC Wonder," 2019).

To improve health outcomes before, during, and after pregnancy, and reduce racial/ethnic differences in rates of infant death and other adverse maternal and infant health outcomes, the Health Resources and Services Administration (HRSA) Maternal and Child Health Bureau (MCHB) established the Healthy Start Program (HS) in 1991 with 15 demonstration projects. The program has since expanded in size and mission and, in 2017, included 100 grantees in 37 states and the District of Columbia.

In 2014, HS transformed based on recommendations from the Report of the Secretary's Advisory Committee on Infant Mortality (HRSA, 2013) and prior HS national evaluation findings. The result was a greater emphasis on the lifecourse model (Lu & Halfon, 2003), which provides a comprehensive view of the individual, community, and societal factors that can influence health outcomes. The purpose of the transformed HS program is to 1) reduce disparities in access to and use of health services, 2) improve the quality of the local health care system, 3) empower women and their families, and 4) increase consumer and community participation in health care decisions. This is carried out through the implementation of five strategic approaches: 1) improving women's health, 2) promoting quality services, 3) strengthening family resilience, 4) achieving collective impact, and 5) increasing accountability through performance monitoring, quality improvement and evaluation (HRSA, 2019).

The transformed HS program places a greater emphasis on evidence-based practices and quality improvement in the context of the lifecourse model. HS also incorporates standardized approaches to evaluating the program compared to past evaluation efforts.

The first national HS evaluation examined whether programs implemented between 1992 and 1996 achieved HS goals. The second national evaluation examined data from 2002 to 2007 to learn which program components were associated with improved maternal and infant health outcomes (Brand, Walker, Hargreaves, & Rosenbach, 2010; Rosenbach, Cook, O'Neil, Trebino, & Walker, 2010). The third national evaluation was conducted from 2009 through 2012 and assessed the effect of program components on long-term program and birth outcomes, in addition to factors that influence these relationships (Drayton, Walker, Ball, Donahue, & Fink, 2015). These last two evaluations revealed that there was wide variation in the implementation of HS and in the reporting of required performance measures of program implementation and outcomes. A key recommendation from the most recent study called for a more complete and rigorous national evaluation. The recommendations included an approach that used standardized grantee reporting guidance, and strategies to ensure that evaluations could generate findings based on standardized measures to inform policymakers and public health maternal and child health practitioners (Drayton, Walker, Ball, Donahue, & Fink).

These recommended changes to the evaluation approach were operationalized with the transformation of the HS program in 2014. By incorporating the recommendations made in past evaluations, HS now allows for a more robust and complete approach to evaluating the program by linking program participant data to multiple public health datasets. This multimethod approach may serve as an example of evaluating federally funded service delivery programs by linking program data to public health outcomes datasets.

This evaluation report is the first large-scale, independent analysis of the data yielded from HS since its transformation, and is intended to:

- Understand the characteristics of participants, allowing us to assess whether HS served specific, intended populations;
- Identify factors associated with a higher risk of adverse outcomes in order to inform targeted efforts of the program; and
- Discern whether HS program participation is associated with improved maternal and infant health outcomes for program participants when compared to sociodemographically similar non-participants and to the general population.

Taken all together, these three components listed above will provide a deeper understanding of HS women as a group and their health-related outcomes to identify any program areas that can be strengthened.

Part One: Description of Healthy Start Participants

Study Question: What are the observable characteristics of HS women?

In Part One, we use the HSMED data to describe HS women with the purpose of understanding participant-level characteristics, and their health insurance coverage and access to care. Participant data were collected from HS grantees and pertain to HS women who received services in 2017,[1] consented to be included in the study, and met eligibility requirements. The 2017 study period represents the third year of a five-year grant cycle; therefore, observed results reflect approximately halfway through the grant cycle.

Methodology

We constructed the analytic sample based on the data collected by 100 HS grantees across 37 states and the District of Columbia. HS grantees submitted data to the Healthy Start Monitoring and Evaluation Data (HSMED) System and comprise responses to questionnaires[2] administered to HS women following the four reproductive phases defined by HS:

1. **Preconception**– Before pregnancy
2. **Prenatal**– From pregnancy to birth
3. **Postpartum**– From birth to six months
4. **Interconception/Parenting**– Following the postpartum phase, from six months through two years

Based on the lifecourse model underpinning HS (Halfon, Larson, Lu, et al., 2014), the questionnaires covered topics such as social determinants of health, access to care, intimate partner violence (IPV), health behaviors, reproductive goals, access to and utilization of preventive health care services, breastfeeding practices, and infant safety. We received the HSMED from the Division of Healthy Start and Perinatal Services (DHSPS) within HRSA's MCHB. We used guidance from the HS EPIC Center (HRSA, 2016) to construct analysis measures. The HS EPIC Center provides training, consultation, and technical resources to community-based agencies working to give every child a healthy start. We organized four cohorts of HS women aligned with the four reproductive phases within our study population.

Sample Criteria

Many participants had to be excluded for various reasons, such as consent to participate, eligibility requirements, duplicate data, and missing data. We applied sample exclusion criteria based on HS participant consent, age, and duplicated records to our initial study population of 39,175 HS women from 100 HS grantees across 37 states and the District of Columbia. We first removed 6,942 (17.7%) observations with missing consent to participate based on program administrative records (see Table 1.1).

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[1] This study focuses on services administered to participants in 2017. However, study data also include HS women who received services in late-2016 for 2017 births and others who received services in 2017 for early-2018 births. These women could have received postpartum and/or interconception/parenting phase assessments in 2018.

[2] The HSMED consist of six different programmatic questionnaires: four questionnaires specific to each reproductive phase, a general demographic questionnaire, and a pregnancy history questionnaire. The demographic and pregnancy history questionnaires were administered to all participants regardless of reproductive phase. The pregnancy history questionnaire did not directly address program performance measures and therefore was excluded from analysis.

Table 1.1. Distribution of 2017 HS Sample by Study Consent Status Using HSMED

Reproductive Phases	Full Sample		Sample Missing Consent		Remaining Sample	
	N	%	N	%	N	%
Preconception	2,280	5.8	526	23.1	1,754	5.4
Prenatal	20,278	51.8	3,631	17.9	16,647	51.6
Postpartum	11,888	30.3	2,058	17.3	9,830	30.5
Interconception/Parenting	4,729	12.1	727	15.4	4,002	12.4
Total	**39,175**	**100.0**	**6,942**	**17.7**	**32,233**	**100.0**

We further restricted the sample by excluding 2,871 (8.9%) observations with missing or incomplete data on child participant age, or that did not meet the child age eligibility requirements specified within the HSMED questionnaires (see Table 1.2). These exclusion criteria were only applicable to the postpartum and interconception/parenting phases,[3] which include HS child participants. Of those excluded at this stage, 90.3 percent were excluded due to missing or incomplete data on child age reported in the postpartum questionnaire. The majority of observations in the interconception/parenting phase were excluded because questionnaires were administered to participants who did not meet eligibility requirements[4] (60.4%) compared to missing or incomplete data on child age (39.6%).

Table 1.2. Distribution of 2017 HS Sample after Applying Study Child Age Criteria Using HSMED

Reproductive Phases	Sample		Ineligible due to Child Age Restrictions		Remaining Sample	
	N	%	N	%	N	%
Preconception	1,754	5.4	N/A	N/A	1,754	6.0
Prenatal	16,647	51.6	N/A	N/A	16,647	56.7
Postpartum	9,830	30.5	1,549	15.8	8,281	28.2
Interconception/Parenting	4,002	12.4	1,322	33.0	2,680	9.1
Total	**32,233**	**100.0**	**2,871**	**8.9**	**29,362**	**100.0**

We then removed 250 observations (0.9%) with duplicate questionnaires within a phase (see Table 1.3). We retained HS women who received services during different phases (e.g., pregnancy and at postpartum) within the study period. For example, if a HS participant completed both the prenatal and postpartum questionnaires within the study year, she was counted once in the prenatal sample and once in the postpartum sample. In summary, duplicate data were addressed in one of three ways:

- We removed HS women with multiple pregnancies/pregnancy outcomes or plural births within a single pregnancy outcome (e.g., twins, triplets) during the study period.
- For HS women who received services multiple times within a perinatal phase (e.g., prenatal) and who completed more than one questionnaire within the study period (e.g., at each prenatal care visit), we retained data from the most recent questionnaire.

[3] The postpartum and interconception/parenting questionnaires shared similar content. However, we did not transfer participant data between analytic samples. For example, if a participant completed an interconception/parenting questionnaire and was deemed ineligible due to child's age, we did not transfer this particular participant's data from the interconception/parenting sample to the postpartum sample even if this particular participant met the eligibility criteria for the postpartum questionnaire based on child's age. We recognize that this could have been done to preserve sample; however, this could be viewed as a less methodologically rigorous practice.

[4] Based on HS child participant age at the time of questionnaire administration.

- For HS women who had more than one data entry on the same administrative date, we retained the most "complete" entry for our analytic sample.

Table 1.3. Distribution of 2017 HS Sample After Removing Duplicate Questionnaires within Phase Using HSMED

Reproductive Phases	Sample		Duplicate Questionnaires		Final Analytic Sample	
	N	%	N	%	N	%
Preconception	1,754	6.0	0	0.0	1,754	6.0
Prenatal	16,647	56.7	104	0.6	16,543	56.8
Postpartum	8,281	28.2	145	1.8	8,136	27.9
Interconception/Parenting	2,680	9.1	1	0.04	2,679	9.2
Total	**29,362**	**100.0**	**250**	**0.9**	**29,112**	**100.0**

Our resulting analytic sample consisted of 29,112 consented HS women from 95[5] grantees across 36 states.[6] The preconception phase was represented by the least number of grantees at 37, followed by 81 for interconception/parenting, 86 for postpartum, and 93 for prenatal. Refer to Appendix One Table 1 for an overview of the distribution of grantees across the analytic samples. We then merged the demographic questionnaire to each of the four phase-specific questionnaires in order to assess characteristics across the phases. Refer to Appendix One Table 2 for definitions of analysis measures using data from the HSMED. We conducted univariate descriptive analyses in order to assess characteristics of HS women within each reproductive phase. All analyses were conducted using Stata version 16 (StataCorp, 2019).

Findings

Of the 95 grantees included in the analytic sample, the largest proportion were located in urban areas (74.7%) followed by rural areas (20.0%) (see Table 1.4). Five percent of grantees were located along the U.S. southern border. The geographic distribution of grantees is fairly consistent with the geographic distribution of HS women.

Table 1.4. Geographic Distribution of HS Grantees (N=95) and HS Women (N=29,110) Included in 2017 Analytic Sample Using HSMED

Geographic Indicator	HS Grantees		HS Women	
	N	%	N	%
Urban	71	74.7	21,294	73.1
Rural	19	20.0	5,197	17.9
Border	5	5.3	2,621	9.0
Total	**95**	**100.0**	**29,112**	**100.0**

Prenatal women (56.8%) followed by postpartum mothers and their infants (27.9%) represented the majority of HS women (see Table 1.5). The least-represented group were women in the preconception phase (6.0%). The sample distribution suggests pregnant women and postpartum mothers and their infants represented the majority of HS women in the analytic sample, consistent with requirements outlined in the HS grant.

[5] Before restricting the analytic sample using study criteria, our sample included 100 HS grantees across 37 states and the District of Columbia. Four HS grantees were excluded from analysis when enforcing participant consent (17.7% of sample excluded) and child age requirements for the postpartum and interconception/parenting phases (8.9%). We lost less than 1 percent of the remaining sample by removing duplicate participants within phase.

[6] The HS grantee in the District of Columbia was excluded from the analytic sample by enforcing study sampling criteria.

Table 1.5. Distribution of 2017 HS Analytic Sample across Reproductive Phase Using HSMED

Reproductive Phases	HS Women	
	N	%
Preconception	1,754	6.0
Prenatal	16,543	56.8
Postpartum	8,136	27.9
Interconception/Parenting	2,679	9.2
Total	**29,112**	**100.0**

We present descriptive findings for each of the reproductive phases using the following topic areas: 1) demographics and socioeconomic characteristics; 2) health care; 3) psychosocial health screenings; 4) reproductive plans, parenting, and child care practices; and 5) substance use. Each table provides the amount of missing data for each data element[7]; the item-level non-missing data represent the denominator used for each estimate.

Demographics

Demographic characteristics were consistent across all phases (see Table 1.6). The majority of HS women identified as:

- Under 35 years of age
- Non-Hispanic and black or African-American race
- English as the only language spoken at home
- Living below the federal poverty level (FPL)
- Annual household income of less than $10,000
- High school graduates or having obtained a GED

Table 1.6. Demographic Characteristics of 2017 Analytic Sample of HS women Using HSMED

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Woman's age								
Missing data	15	0.9	192	1.2	55	0.7	9	0.3
Non-missing data	**1,739**	**99.2**	**16,351**	**98.8**	**8,081**	**99.3**	**2,670**	**99.7**
Less than 18 years old	151	8.7	669	4.1	283	3.5	64	2.4
18 to 24 years old	654	37.6	6,263	38.3	2,917	36.1	886	33.2
25 to 35 years old	737	42.4	7,651	46.8	3,919	48.5	1,306	48.9
Over 35 years old	197	11.3	1,768	10.8	962	11.9	414	15.5
Mean age (Standard Deviation)	25.5 (6.8)		26.3 (6.0)		26.8 (6.1)		27.6 (6.4)	
Child's age [a]								
Mean age in months (Standard Deviation)	N/A [b]		N/A		1.3 (1.4)		8.7 (2.8)	
Race								
Missing data	113	6.4	1,178	7.1	521	6.4	145	5.4
Non-missing data	**1,641**	**93.6**	**15,365**	**92.9**	**7,615**	**93.6**	**2,534**	**94.6**
Black or African-American	1,035	63.1	9,421	61.3	4,452	58.5	1,413	55.8

[7] Missing data include true missing values (i.e., item left blank or skipped); values recoded to missing due to data quality concerns (e.g., an age of 117 years); and declined, don't know, or not applicable responses.

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
White	517	31.5	4,917	32.0	2,619	34.4	867	34.2
Other race/multiracial	89	5.4	1,027	6.7	544	7.1	254	10.0
Hispanic/Latina ethnicity								
Missing data	62	3.5	201	1.2	64	0.8	11	0.4
Non-missing data	**1,692**	**96.5**	**16,342**	**98.8**	**8,072**	**99.2**	**2,668**	**99.6**
No	1,445	85.4	12,576	77.0	5,980	74.1	1,960	73.5
Yes	247	14.6	3,766	23.0	2,092	25.9	708	26.5
Language other than English spoken at home								
Missing data	56	3.2	850	5.1	215	2.6	46	1.7
Non-missing data	**1,698**	**96.8**	**15,693**	**94.9**	**7,921**	**97.4**	**2,633**	**98.3**
No	1,475	86.9	11,297	72.0	5,446	68.8	1,730	65.7
Yes	223	13.1	4,396	28.0	2,475	31.2	903	34.3
Federal Poverty Level								
Missing data	1,445	82.4	5,154	31.2	1,729	21.3	777	29.0
Non-missing data	**309**	**17.6**	**11,389**	**68.9**	**6,407**	**78.8**	**1,902**	**71.0**
Above FPL	105	34.0	4,951	43.5	3,173	49.5	927	48.7
Below FPL	204	66.0	6,438	56.5	3,234	50.5	975	51.3
Household income								
Missing data	975	55.6	3,174	19.2	1,809	22.2	689	25.7
Non-missing data	**779**	**44.4**	**13,369**	**80.8**	**6,327**	**77.8**	**1,990**	**74.3**
Less than $10,000	386	49.6	7,073	52.9	3,223	50.9	887	44.6
$10,000 to less than $15,000	122	15.7	1,969	14.7	921	14.6	327	16.4
$15,000 to less than $20,000	139	17.8	1,378	10.3	701	11.1	249	12.5
$20,000 to less than $25,000	68	8.7	1,151	8.6	600	9.5	209	10.5
$25,000 to less than $35,000	30	3.9	1,048	7.8	520	8.2	201	10.1
$35,000 to less than $50,000	25	3.2	545	4.1	244	3.9	88	4.4
$50,000 or more	9	1.2	205	1.5	118	1.9	29	1.5
Woman's educational attainment								
Missing data	49	2.8	628	3.8	471	5.8	64	2.4
Non-missing data	**1,705**	**97.2**	**15,915**	**96.2**	**7,665**	**94.2**	**2,615**	**97.6**
Less than high school	570	33.4	4,581	28.8	2,159	28.2	794	30.4
High school/GED completed	655	38.4	6,302	39.6	3,098	40.4	1,000	38.2
Some college/vocational school	335	19.6	3,654	23.0	1,730	22.6	590	22.6
College graduate	131	7.7	1,254	7.9	611	8.0	215	8.2
More than college	14	0.8	124	0.8	67	0.9	16	0.6
Geography								
Missing data	0	0.0	0	0.0	0	0.0	0	0.0
Non-missing data	**1,754**	**100.0**	**16,543**	**100.0**	**8,136**	**100.0**	**2,679**	**100.0**
Urban	1,607	91.6	12,085	73.1	5,684	69.9	1,918	71.6
Rural	117	6.7	3,112	18.8	1,506	18.5	462	17.3
Border	30	1.7	1,346	8.1	946	11.6	299	11.2

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
U.S. Census region								
Missing data	0	0.0	0	0.0	0	0.0	0	0.0
Non-missing data	**1,754**	**100.0**	**16,543**	**100.0**	**8,136**	**100.0**	**2,679**	**100.0**
Northeast	274	15.6	3,225	19.5	1,455	17.9	506	18.9
Midwest	1,183	67.4	5,981	36.2	2,509	30.8	917	34.2
South	267	15.2	5,559	33.6	2,931	36.0	841	31.4
West	30	1.7	1,778	10.7	1,241	15.3	415	15.5
US territories	0	0.0	0	0.0	0	0.0	0	0.0

[a] We previously restricted the analytic samples for the postpartum and interconception/parenting phases by missing data on child age. Therefore, no missing data are presented here.
[b] Not applicable for this phase.

Health Insurance Coverage and Access to Care

For HS women and their children with complete data on health insurance, the majority reported having public health insurance coverage (see Table 1.7). Although 89 percent of HS women in the preconception phase indicated that they had a usual source of care and over 80 percent were covered by public health insurance, 30 percent of preconception women described their usual source of care as the hospital emergency room.

While 92.9 percent of postpartum women reported having health insurance coverage and 94 percent reported a usual place of care, less than half (48.1%) reported a postpartum visit within six weeks after birth of their child. Compared to women in the other reproductive phases, women in the preconception phase had the lowest rates of health insurance coverage and a usual source of care when they were sick. Preconception women had the highest rate of identifying the emergency room as their usual source of care compared to women in other phases (see Table 1.7).

The rates of children with health insurance coverage was consistently high across the postpartum (97.7%) and interconception/parenting phases (98.9%) (see Table 1.7). The rates of children having a usual source of care was also high with 98.2 percent reported in the postpartum phase and 98.7 percent in the interconception/parenting phase. The majority of HS women reported that their child received on-time age-appropriate well-child visits during both the postpartum phase (89.6%) and interconception/parenting phase (77.6%)

Table 1.7. Health Care Characteristics of 2017 Analytic Sample of HS Women and Children Using HSMED

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Health insurance (women)								
Missing data	1,199	68.4	4235	25.6	1839	22.6	962	35.9
Non-missing data	**555**	**31.6**	**12,308**	**74.4**	**6,297**	**77.4**	**1,717**	**64.1**
No	74	13.3	808	6.6	448	7.1	199	11.6
Yes	481	86.7	11,500	93.4	5,849	92.9	1,518	88.4
Type of insurance (among women who reported) [a]								
Women with health insurance	**481**	**86.7**	**11,500**	**93.4**	**5,849**	**92.9**	**1,518**	**88.4**
Private insurance (via job, spouse/partners job, parents)	50	10.4	881	7.7	422	7.2	123	8.1
Private insurance purchased directly from an insurance company	3	0.6	33	0.3	17	0.3	6	0.4
Medicaid, medical assistance, or any kind of government assistance plan for those with low incomes or a disability	397	82.5	10,497	91.3	5,430	92.8	1,366	90.0
TRICARE or other military health care	3	0.6	37	0.3	21	0.4	7	0.5
Indian health insurance	1	0.2	50	0.4	27	0.5	9	0.6
Other insurance	25	5.2	246	2.1	57	1.0	28	1.8
Health insurance (child)								
Missing data	N/A[b]		N/A		358	4.4	240	9.0
Non-missing data					**7,778**	**95.6**	**2,439**	**91.0**
No					180	2.3	26	1.1
Yes					7,598	97.7	2,413	98.9
Type of insurance (among women who reported on behalf of child) [a]								
Children with health insurance	N/A		N/A		**7,598**	**97.7**	**2,413**	**98.9**
Private insurance (via job, spouse/partners job, parents)					302	4.0	98	4.1
Private insurance purchased directly from an insurance company					12	0.2	4	0.2
Medicaid, medical assistance, or any kind of government assistance plan for those with low incomes or a disability					7,272	95.7	2,320	96.1
TRICARE or other military health care					23	0.3	12	0.5
Indian health insurance					68	0.9	29	1.2
Other insurance					78	1.0	29	1.2
Usual place for care when sick (women)								
Missing data	536	30.6	1,744	10.5	477	5.9	270	10.1
Non-missing data	**1,218**	**69.4**	**14,799**	**89.5**	**7,659**	**94.1**	**2,409**	**89.9**
No	139	11.4	1,205	8.1	424	5.5	156	6.5
Yes	1,079	88.6	13,594	91.9	7,235	94.5	2,253	93.5
Place of care (among women who reported)								
Missing data	558	31.8	2,197	13.3	1,050	12.9	387	14.5
Non-missing data	**1,196**	**68.2**	**14,346**	**86.7**	**7,086**	**87.1**	**2,292**	**85.5**
Doctor's office	597	49.9	7,322	51.0	3,827	54.0	1,178	51.4
Hospital emergency room	363	30.4	1,876	13.1	619	8.7	170	7.4
Hospital outpatient department	20	1.7	423	2.9	153	2.2	49	2.1
Clinic or health center	196	16.4	4,530	31.6	2,421	34.2	837	36.5

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Retail store clinic or Minute Clinic	4	0.3	53	0.4	27	0.4	8	0.3
School (nurse's office, athletic trainer's office)	3	0.3	5	0.0	1	0.0	0	0.0
Some other place	13	1.1	137	1.0	38	0.5	50	2.2
Usual place for care when sick (child)								
Missing data	N/A		N/A		450	5.5	141	5.3
Non-missing data					**7,686**	**94.5**	**2,538**	**94.7**
No					135	1.8	34	1.3
Yes					7,551	98.2	2,504	98.7
Place of care (among women who reported on behalf of child)								
Missing data	N/A		N/A		749	9.2	139	5.2
Non-missing data					**7,387**	**90.8**	**2,540**	**94.8**
Doctor's office					4,773	64.6	1,590	62.6
Hospital emergency room					240	3.2	75	3.0
Hospital outpatient department					145	2.0	33	1.3
Clinic or health center					2,193	29.7	791	31.1
Retail store clinic or Minute Clinic					11	0.1	11	0.4
School (nurse's office, athletic trainer's office)					1	0.0	1	0.0
Some other place					24	0.3	39	1.5
Woman's well-visit								
Missing data	1,201	68.5	N/A		N/A		378	14.1
Non-missing data	**553**	**31.5**					**2,301**	85.9
No	105	19.0					306	13.3
Yes	448	81.0					1,995	86.7
Postpartum visit [c]								
Missing data	N/A		N/A		806	9.9	N/A	
Non-missing data					**7,330**	**90.1**		
No					3,806	51.9		
Yes					3,524	48.1		
Age-appropriate well-child visit								
Missing data	N/A		N/A		1,575	19.4	374	14.0
Non-missing data					**6,561**	**80.6**	**2,305**	**86.0**
No					685	10.4	516	22.4
Yes					5,876	89.6	1,789	77.6

[a] Type of health insurance coverage assessed using a "select all that apply" response option. Categories are not mutually exclusive, and therefore, do not total to 100 percent. Denominator consists of those who report insurance.

[b] Not applicable for phase.

[c] Postpartum visit is defined using parameters identified in the postpartum questionnaire: between four and six weeks after birth.

Psychosocial Health Screenings

All HS women were screened for depression during each reproductive phase, and most were screened for IPV (see Table 1.8). The highest rate of IPV screening occurred for HS women in the postpartum phase (94.4%).

Table 1.8. Psychosocial Health Screenings of 2017 Analytic Sample of HS women Using HSMED

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Screened for depression								
Missing data	0	0.0	0	0.0	0	0.0	0	0.0
Non-missing data	**1,754**	**100.0**	**16,543**	**100.0**	**8,136**	**100.0**	**2,679**	**100.0**
No	0	0.0	0	0.0	0	0.0	0	0.0
Yes	1,754	100.0	16,543	100.0	8,136	100.0	2,679	100.0
Screened for IPV								
Missing data	0	0.0	0	0.0	0	0.0	0	0.0
Non-missing data	**1,754**	**100.0**	**16,543**	**100.0**	**8,136**	**100.0**	**2,679**	**100.0**
No	612	34.9	1,984	12.0	452	5.6	269	10.0
Yes	1,142	65.1	14,559	88.0	7,684	94.4	2,410	90.0

Reproductive Life Plans, Parenting, and Child Care Practices

The majority of HS women reported having a reproductive life plan (see Table 1.9). HS women in the preconception phase had the lowest prevalence of a reproductive life plan (68.4%) and HS women in the prenatal phase had the highest prevalence (93.3%). The majority of postpartum women had an interpregnancy interval greater than 18 months (80.4%). About three-quarters of HS women reported breastfeeding for some period of time after the birth of their child (72.6% of postpartum women and 75.1% for interconception/parenting women); 13.5% of interconception/parenting women reported breastfeeding at six months after the birth of their child.

The majority of HS women also reported following safe sleep practices for infants by laying them to sleep alone in a crib or bed (ranged from 81.5% to 84.4%) and on their backs (ranged from 82.1% to 90.1%) for infants under 12 months old (see Table 1.9). Most HS women (72.5%) in the interconception/parenting phase reported reading to their child three or more days a week. The majority of HS women with complete data on father/partner indicators also reported father/partner involvement during pregnancy (94.7%) and with HS child after birth (approximately 56%).

Table 1.9. Reproductive Planning and Parenting Characteristics of 2017 Analytic Sample of HS Women and Children Using HSMED

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Has reproductive life plan								
Missing data	257	14.7	4,156	25.1	771	9.5	362	13.5
Non-missing data	**1,497**	**85.4**	**12,387**	**74.9**	**7,365**	**90.5**	**2,317**	**86.5**
No	473	31.6	830	6.7	1,238	16.8	328	14.2
Yes	1,024	68.4	11,557	93.3	6,127	83.2	1,989	85.8

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Partner/child's father involved [a]								
Missing data	N/A [b]		244	1.5	3,574	43.9	1,192	44.5
Non-missing data			**16,299**	**98.5**	**4,562**	**56.1**	**1,487**	**55.5**
No			863	5.3	265	5.8	183	12.3
Yes			15,436	94.7	4,297	94.2	1,304	87.7
Safe sleep practice: Child placed on back [c]								
Missing data/Not applicable [d]	N/A		N/A		725	8.9	449	16.8
Non-missing data					**7,411**	**91.1**	**2,230**	**83.2**
No					731	9.9	399	17.9
Yes					6,680	90.1	1,831	82.1
Safe sleep practice: Child sleeps alone in crib/bed [c]								
Missing data/Not applicable [d]	N/A		N/A		772	9.5	516	19.3
Non-missing data					**7,364**	**90.5**	**2,163**	**80.7**
No					1,152	15.6	400	18.5
Yes					6,212	84.4	1,763	81.5
Safe sleep practice: Child sleeps alone, on back, and in crib/bed [c]								
Missing data/Not applicable [d]	N/A		N/A		846	10.4	878	32.8
Non-missing data					**7,290**	**89.6**	**1,801**	**67.2**
No					1,656	22.7	550	30.5
Yes					5,634	77.3	1,251	69.5
Child ever breastfed								
Missing data	N/A		N/A		0	0.0	37	1.4
Non-missing data					**8,136**	**100.0**	**2,642**	**98.6**
No					2,230	27.4	659	24.9
Yes					5,906	72.6	1,983	75.1
Child breastfed at 6 months [d]								
Missing data	N/A		N/A		N/A		598	22.3
Non-missing data							**2,081**	**77.7**
No							1,800	86.5
Yes							281	13.5
Child read to 3 or more days/week								
Missing data	N/A		N/A		N/A		279	10.4
Non-missing data							**2,399**	**89.6**
No							660	27.5
Yes							1,739	72.5
Interpregnancy interval of 18 months or less								
Missing data/Not applicable [e]	N/A		N/A		6,966	85.6	N/A	
Non-missing data					**1,170**	**14.4**		
No					941	80.4		
Yes					229	19.6		

[a] Father/partner involvement and support during pregnancy for the prenatal phase, and involvement with child during the interconception/parenting phase.

[b] Not applicable for phase.

[c] Restricted to infants under 12 months of age using American Academy of Pediatrics guidelines.

[d] Missing data also includes those not applicable for this measure (HS children 12 months or older).

[e] Only applicable to HS women with a previous live birth indicated on an interconception/parenting questionnaire that predates the study period (see Appendix One Table 2 for additional measure detail).

Substance Use

Across all reproductive phases, the majority of HS women reported never having consumed four or more alcoholic drinks per day over the past 12 months (see Table 1.10). Most participants also reported abstaining from cigarettes or other tobacco products during pregnancy (prenatal at 87.1% and postpartum at 83.8%).

Table 1.10. Substance Use Characteristics of 2017 Analytic Sample of HS Women Using HSMED

Data Elements	Preconception		Prenatal		Postpartum		Parenting	
	N	%	N	%	N	%	N	%
Alcohol use (4 or more drinks/day)								
Missing data	536	30.6	1,564	9.5	1,897	23.3	381	14.2
Non-missing data	**1,288**	**69.5**	**14,979**	**90.6**	**6,239**	**76.7**	**2,298**	**85.8**
Never	1,029	84.5	13,181	88.0	5,670	90.9	2,037	88.6
Once or twice monthly	147	12.1	1,282	8.6	416	6.7	214	9.3
Weekly	28	2.3	349	2.3	77	1.2	34	1.5
Daily or almost daily	14	1.1	167	1.1	76	1.2	13	0.6
Smoked cigarettes/Used tobacco products during pregnancy								
Missing data	N/A[a]		1,212	7.3	437	5.4	N/A	
Non-missing data			**15,331**	**92.7**	**7,699**	**94.6**		
No			13,350	87.1	6,450	83.8		
Yes			1,981	12.9	1,249	16.2		

[a] Not applicable for phase.

Summary

The majority of HS women included in the analytic sample consisted of pregnant women in the prenatal phase, which is consistent with the requirements outlined in the HS grant for pregnant women to comprise about half of those served (Healthy Start, 2018). The least-represented participant group was women in the preconception phase. The smaller number of preconception women likely also reflects their recent inclusion in HS; prior to 2014, HS did not serve preconception women.

The analytic sample overviewed in this section indicated that a majority of HS women were below the age of 35 years old (88.4%), identified as non-Hispanic (76.3%) and black or African-American (60.1%), and obtained a high school degree/GED or less (68.6%). Among participants with complete data on health insurance status, the majority of HS women reported health insurance coverage from government-assisted programs (91.4%). All HS women were screened for depression. HS mothers reported following the American Academy of Pediatrics (AAP) recommendations for on-time well-child visits for HS child participants. Of HS women with complete data on the safe sleep indicators, a majority reported following safe sleep practices by placing their child alone, on his or her back, and in a crib or his or her own bed. In areas of family structure and resilience, a majority of HS women with complete data on these indicators reported support from her partner/child's father. In terms of health care utilization, the majority of postpartum mothers did not report having a postpartum visit after their child's birth. The majority of HS women reported breastfeeding at some point after birth. Of HS women with complete data on breastfeeding practices, the majority did not report breastfeeding at six months.

Compared to women with complete data in the other reproductive phases, preconception women had the lowest percentage of health insurance coverage and a usual source of care when sick. Further, preconception women more often reported using the emergency room as their usual source of care, were screened less for IPV, and had the lowest rate of having a reproductive life plan compared to women in other phases. Preconception women were the youngest participant sample, and also were the highest

proportion of women who reported living below FPL compared to women in other phases with complete data on these indicators. There may be something unique about preconception women driving these differences, such as limited resources or less motivation to seek reproductive care prior to pregnancy. These findings may also reflect the limited data on the preconception sample as they only comprised 6 percent of the overall analytic sample. Beginning in 2014, HS incorporated preconception as a new reproductive phase of focus. Additional research on this participant sub-group may be necessary in order to better understand these trends.

Part Two: Examine Associations among Individual Characteristics and Selected Outcomes

Study Question: Which observable characteristics of HS women are associated with differences in maternal and infant health outcomes?

The purpose of Part Two is to assess the demographic and socioeconomic characteristics of HS women and their association with selected maternal and infant outcomes in order to better target program efforts.

Methodology

We assessed the association between HS demographic and socioeconomic characteristics and maternal and infant outcomes using data from the HSMED. We analyzed associations separately across all four reproductive phases. We also conducted supplemental analyses on HS women and associated outcomes using VRO and PRAMS data. These analyses are available in Appendix Two under *Supplemental Analyses.*

Measures

We assessed the following demographic and socioeconomic measures as potential risk factors in each regression model using HSMED data: mother's 1) age, 2) race, 3) Hispanic/Latina ethnicity, 4) language other than English spoken at home, 5) poverty status, and 6) educational attainment.[8] We also controlled for child's age in the multivariable models for the postpartum and interconception/parenting phases. We incorporated a Bonferroni correction in order to determine the appropriate alpha level for each set of analyses based on reproductive phase (see Table M1 in the Methodological Appendix).

We assessed the following as dichotomous (Y/N) outcome measures reported by HS women: 1) had usual source of care when sick, 2) had health insurance coverage, 3) had well-woman visit (preconception and interconception/parenting only), 4) screened for IPV, 5) had reproductive life plan, 6) used tobacco during pregnancy (prenatal and postpartum only), 7) father/partner involved during pregnancy or with child (prenatal, postpartum, and interconception/parenting only), 8) had postpartum visit (postpartum only), 9) had on-time well-child visit according to AAP guidelines (postpartum and interconception/parenting only), 10) ever breastfed (postpartum and interconception/parenting only), 11) breastfed at six months (interconception/parenting only), 12) followed infant safe sleep practices (postpartum and interconception/parenting only), 13) had interpregnancy interval of 18 months or less (postpartum only), and 14) read to child three or more days per week (interconception/parenting only). Refer to Appendix One, Table 2 for definitions of analysis measures using data from the HSMED. Since all HS women were screened for depression (100%), regardless of reproductive phase, there was no variability within this outcome measure and thus we did not assess this outcome in the multivariable analyses.

Analytic Sample

Refer to Exhibit 2.1 for an overview of the analytic samples used in the multivariable analyses. In addition to removing observations based on consent for participation, eligibility criteria, and duplicate cases (from Part One), we removed observations with missing data on five of the six potential risk factors (maternal age, race, Hispanic/Latina ethnicity, language other than English spoken at home, and educational attainment[9]),[10] with the exception of poverty status, for all multivariable analyses. We also

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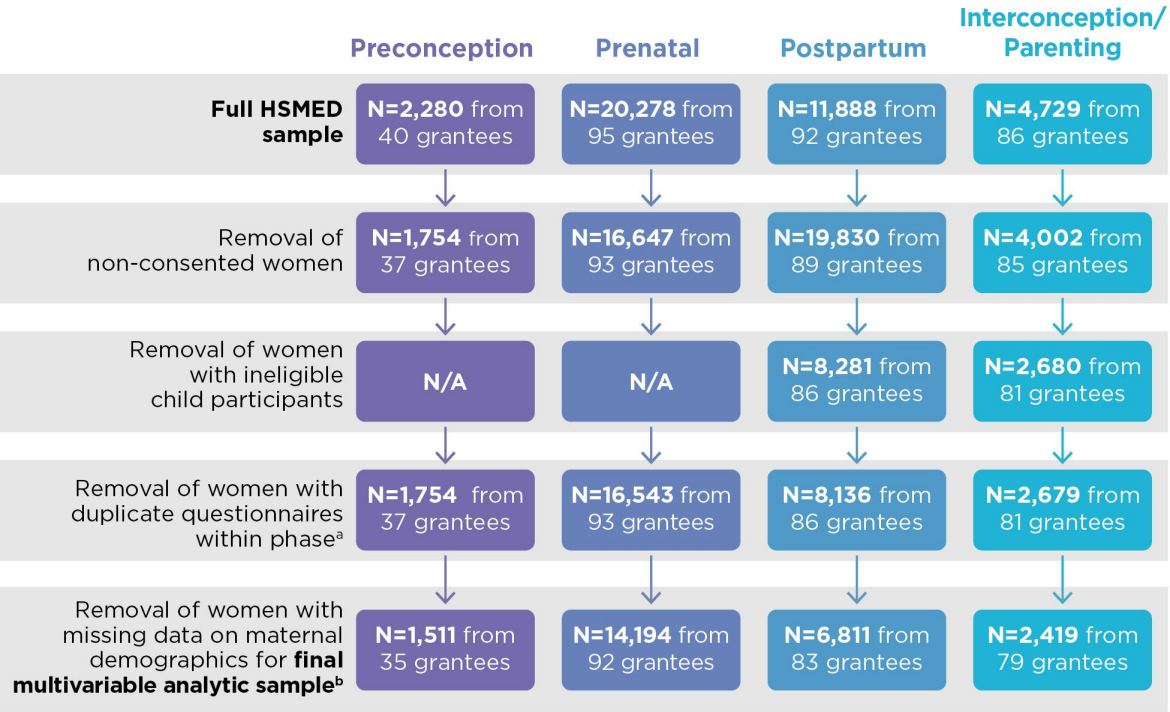
[8] We combined HS women who reported educational attainment of college or more than college into one "college or more" category for all multivariable analyses.

[9] Due to small cell size, we combined the educational attainment categories of "college" and "more than college" into "college or more" for analysis.

[10] We assessed the prevalence of missing data for each individual measure with particular attention given to missing data on the main independent variables, additional model covariates, and/or measures with over 15 percent

removed observations with missing data on child age for the postpartum and interconception/parenting analyses. We retained observations with missing data on poverty status by constructing a "Missing" category due to the high prevalence of missing data on this measure, which ranged from 21 to 82 percent across the four reproductive phases. We also removed observations with missing data on the outcome measure for each regression model, which resulted in varying sample sizes across the models.[11]

Exhibit 2.1. Multivariable Analytic Samples of 2017 HS Women and HS Grantees after Application of Exclusion Criteria Using HSMED



[a] Remaining samples at this stage align with descriptive samples used in Part One and Part Four

[b] We removed observations with missing data on the outcome measure for each regression model resulting in varying sample sizes across the models

Multivariable Analytic Strategy

Multivariable logistic regression models were used to assess the association between demographic and socioeconomic characteristics of HS women and maternal and infant outcomes while also accounting for age, race, ethnicity, language, educational attainment, and U.S. Census region. All analyses were conducted using Stata version 16 (StataCorp, 2019).

Multivariable Findings

We highlight the significant multivariable associations below. Refer to Appendix Two Tables 1 through 4B, for full results. Multivariable associations are expressed as odds ratios (ORs); an OR greater than 1 indicates that a factor was associated with greater odds of the outcome, while an OR less than one

missing data. The exclusion of observations based on missing demographic characteristics resulted in the exclusion of 13.9 percent of the preconception sample, 14.2 percent of the prenatal sample, 16.3 percent of the postpartum sample, and 9.7 percent of the interconception/parenting sample.

[11] HS women and grantees varied in each analysis due to exclusion of missing data on each outcome measure. Refer to Appendix Two Tables 1 through 4B for sample size (see "observations") and grantees (see "clusters") for each individual analysis.

indicates that a factor was associated with lower odds of the outcome. Standard errors (provided in parentheses) are clustered by HS grantee site.

Preconception

White preconception women were more likely to have a usual source of care when sick compared to black or African-American preconception women (see Table 2.1). Preconception women who spoke a language other than English at home were less likely to have a usual source of care, health insurance coverage, and be screened for IPV than preconception women who only spoke English. White preconception women were more likely to have a usual source of care when sick compared to black or African-American preconception women. Preconception women with some college or vocational school were less likely to be screened for IPV compared to prenatal women with less than a high school degree or GED. Hispanic/Latina preconception women, who were not excluded on the basis of missing data, were more likely to report having had a well-woman visit compared to non-Hispanic/Latina preconception women.[12]

Table 2.1. Associated Factors (p<0.01) with 2017 U.S. HS Preconception Women Using the HSMED

Sociodemographic Measure	Comparison Groups	Health Indicator	Odds Ratio (Standard Error)	Interpretation
Ethnicity	Hispanic/Latina (ref: Non-Hispanic/Latina)	Well-woman visit	5.04 (2.66)	Higher odds
Race	White (ref: Black or African-American)	Usual source of care	1.41 (0.15)	Higher odds
Language	Other language spoken at home (ref: Only English)		0.28 (0.12)	Lower odds
	Other language spoken at home (ref: Only English)	Health insurance coverage	0.27 (0.11)	Lower odds
	Other language spoken at home (ref: Only English)	IPV screening	0.29 (0.11)	Lower odds
Educational attainment	Some college/vocational school (ref: Less than high school)		0.87 (0.04)	Lower odds

Table notes: Reference group indicates comparison group.

Based on multivariable logistic regression analyses controlling for age, race, ethnicity, poverty status, educational attainment, language, and U.S. Census region.

Analysis only pertains to those with complete data on health indicator.

Prenatal

Prenatal women below FPL were more likely to use tobacco during pregnancy and less likely to report father/partner involvement during pregnancy than prenatal women above FPL (see Table 2.2). Prenatal women with a high school degree/GED, some college, and college or more were less likely to use tobacco during pregnancy compared to prenatal women with less than a high school degree/GED. Prenatal women with some college and college or more were more likely to report father/partner involvement during pregnancy than prenatal women with less than a high school degree/GED.

White prenatal women were less likely to be screened for IPV and have a reproductive life plan, and more likely to use tobacco during pregnancy than black or African-American prenatal women. Prenatal women who identified as other or more than one race were less likely to have a reproductive life plan and more likely to use tobacco during pregnancy compared to black or African-American prenatal women.

[12] Although, 68.5% of preconception women were missing data on well-woman visit. It is difficult to understand the implications of this finding without a better understanding of the patterns of missing data across measures.

Hispanic/Latina prenatal women were more likely to have a reproductive life plan and less likely to use tobacco during pregnancy than non-Hispanic/Latina women. Prenatal women who spoke a language other than English were less likely to have health insurance coverage than prenatal women who only spoke English. They also were less likely to use tobacco during pregnancy.

Table 2.2: Associated Factors (*p*<0.01) with 2017 U.S. HS Prenatal Women Using the HSMED

Sociodemographic Measure	Comparison Groups	Health Indicator	Odds Ratio (Standard Error)	Interpretation
Language spoken at home	Other language spoken at home (ref: Only English)	Tobacco use during pregnancy	0.20 (0.04)	Lower odds
Ethnicity	Hispanic/Latina (ref: Non-Hispanic/Latina)		0.42 (0.09)	Lower odds
Educational attainment	High school degree/GED (ref: Less than high school)		0.62 (0.05)	Lower odds
	Some college (ref: Less than high school)		0.45 (0.04)	Lower odds
	College or more (ref: Less than high school)		0.30 (0.04)	Lower odds
Race	White (ref: Black or African-American)		3.70 (0.40)	Higher odds
	Other/more than one race (ref: Black or African-American)		2.01 (0.25)	Higher odds
Poverty status	Below FPL (ref: Above FPL)		1.91 (0.13)	Higher odds
Educational attainment	Some college (ref: Less than high school)	Father/partner involvement during pregnancy	1.44 (0.19)	Higher odds
	College or more (ref: Less than high school)		1.63 (0.28)	Higher odds
Poverty status	Below FPL (ref: Above FPL)		0.58 (0.06)	Lower odds
Ethnicity	Hispanic/Latina (ref: Non-Hispanic/Latina)	Reproductive life plan	3.43 (1.20)	Higher odds
Race	White (ref: Black or African-American)		0.46 (0.13)	Lower odds
	Other/more than one race (ref: Black or African-American)		0.15 (0.08)	Lower odds
Language spoken at home	Other language spoken at home (ref: Only English)	Health insurance coverage	0.22 (0.06)	Lower odds
Race	White (ref: Black or African-American)	IPV screening	0.45 (0.10)	Lower odds

Table notes: Reference group indicates comparison group.

Based on multivariable logistic regression analyses controlling for age, race, ethnicity, poverty status, educational attainment, language, and U.S. Census region.

Analysis only pertains to those with complete data on health indicator.

Postpartum

Postpartum women below FPL were less likely to have a postpartum visit, breastfeed, and report father/partner involvement with child than postpartum women above FPL (see Table 2.3). Postpartum women below FPL also were more likely to use tobacco during pregnancy.

Postpartum women with a high school degree/GED, some college, and college or more were less likely to use tobacco during pregnancy than postpartum women with less than a high school degree/GED. Postpartum women with some college and college or more were more likely to breastfeed than those with less than a high school degree/GED.

White postpartum women were more likely to follow infant safe sleep practices than black or African-American postpartum women. White postpartum women were also more likely to use tobacco during pregnancy than black or African-American postpartum women.

Postpartum women who spoke a language other than English were less likely to have health insurance coverage for both mother and child than postpartum women who only spoke English. However, postpartum women who spoke a language other than English were less likely to use tobacco during pregnancy and more likely to breastfeed when compared to postpartum women who only spoke English.

Table 2.3. Associated Factors (p<0.01) with 2017 U.S. HS Postpartum Women Using the HSMED

Sociodemographic Measure	Comparison Groups	Health Indicator	Odds Ratio (Standard Error)	Interpretation
Ethnicity	Hispanic/Latina (ref: Non-Hispanic/Latina)	Tobacco use during pregnancy	0.33 (0.08)	Lower odds
Language spoken at home	Other language spoken at home (ref: Only English)		0.20 (0.07)	Lower odds
Educational attainment	High school degree/GED (ref: Less than high school)		0.68 (0.09)	Lower odds
	Some college (ref: Less than high school)		0.50 (0.06)	Lower odds
	College or more (ref: Less than high school)		0.33 (0.08)	Lower odds
Race	White (ref: Black or African-American)		2.74 (0.86)	Higher odds
Poverty status	Below FPL (ref: Above FPL)		1.62 (0.26)	Higher odds
Language spoken at home	Other language spoken at home (ref: Only English)	Ever breastfed	3.36 (0.60)	Higher odds
Educational attainment	Some college (ref: Less than high school)		2.10 (0.19)	Higher odds
	College or more (ref: Less than high school)		3.18 (0.46)	Higher odds
Poverty status	Below FPL (ref: Above FPL)		0.77 (0.05)	Lower odds
Race	White (ref: Black or African-American)	Infant safe sleep practices	1.88 (0.33)	Higher odds
Poverty status	Below FPL (ref: Above FPL)	Father/partner involvement with child	0.32 (0.07)	Lower odds
Language spoken at home	Other language spoken at home (ref: Only English)	Mother health insurance coverage	0.19 (0.04)	Lower odds
	Other language spoken at home (ref: Only English)	Child health insurance coverage	0.20 (0.07)	Lower odds
Poverty status	Below FPL (ref: Above FPL)	Postpartum visit	0.73 (0.06)	Lower odds

Table notes: Reference group indicates comparison group.

Based on multivariable logistic regression analyses controlling for age, race, ethnicity, poverty status, educational attainment, language, and U.S. Census region.

Analysis only pertains to those with complete data on health indicator.

Interconception/Parenting

Mothers with a high school degree/GED, some college, and college or more were more likely to ever breastfeed than those with less than a high school degree/GED (see Table 2.4). Mothers with college or more[13] were more likely to breastfeed at six months but less likely to report child health insurance coverage than mothers with less than a high school degree/GED. Mothers with a high school degree/GED were less likely to report an on-time child well visit following AAP guidelines than mothers with less than a high school degree/GED.

White mothers were more likely to follow infant safe sleep practices than black or African-American mothers. Mothers who identified as other or more than one race were less likely to have a well-woman visit than black or African-American mothers. Mothers who spoke a language other than English were less likely to have health insurance than mothers who only spoke English. However, mothers who spoke a language other than English were more likely to breastfeed and report breastfeeding at six months compared to mothers who only spoke English.

Table 2.4. Associated Factors (p<0.01) with 2017 U.S. HS Interconception/Parenting Women Using the HSMED

Sociodemographic Measure	Comparison Groups	Health Indicator	Odds Ratio (Standard Error)	Interpretation
Educational attainment	High school degree/GED (ref: Less than high school)	Ever breastfed	1.44 (0.14)	Higher odds
	Some college (ref: Less than high school)		2.91 (0.45)	Higher odds
	College or more (ref: Less than high school)		2.89 (0.65)	Higher odds
Language spoken at home	Other language spoken at home (ref: Only English)		4.46 (1.19)	Higher odds
Educational attainment	College or more (ref: Less than high school)	Breastfed at six months	2.66 (0.86)	Higher odds
Language spoken at home	Other language spoken at home (ref: Only English)		2.52 (0.59)	Higher odds
Race	White (ref: Black or African-American)	Infant safe sleep practices	2.00 (0.43)	Higher odds
Race	Other/more than one race (ref: Black or African-American)	Well-woman visit	0.48 (0.10)	Lower odds
Educational attainment	High school degree/GED (ref: Less than high school)	Child well visit on-time	0.81 (0.11)	Lower odds
Language spoken at home	Other language spoken at home (ref: Only English)	Mother health insurance coverage	0.26 (0.12)	Lower odds
Educational attainment	College or more (ref: Less than high school)	Child health insurance coverage	0.17 (0.09)	Lower odds

Table notes: Reference group indicates comparison group.

Based on multivariable logistic regression analyses controlling for age, race, ethnicity, poverty status, educational attainment, language, and U.S. Census region.

Analysis only pertains to those with complete data on health indicator.

[13] Although, only 231 interconception/parenting mothers reported educational attainments of college or more.

Summary

We assessed the demographic and socioeconomic characteristics of HS women and their association with selected maternal and infant outcomes. We found consistent findings across the reproductive phases for socioeconomic differences in maternal and infant outcomes within HS women using the HSMED. We also found consistent findings for racial, ethnic, and language differences in maternal and infant outcomes across the reproductive phases. These findings suggest the presence of both risk and protective factors for selected maternal and infant outcomes:

- HS women with higher educational attainment had more favorable maternal and infant outcomes, such as abstaining from tobacco use during pregnancy and breastfeeding, than HS women with less than a high school degree.
- HS women below FPL showed more adverse outcomes than HS women above FPL, such as tobacco use during pregnancy and lower father/partner involvement during pregnancy and with the child.
- White HS women showed both favorable and adverse outcomes. They were more likely to follow infant safe sleep practices and use tobacco during pregnancy when compared to black or African-American HS women.
- Hispanic/Latina HS women were less likely to use tobacco during pregnancy than non-Hispanic/Latina HS women.
- HS women who spoke a language other than English showed both favorable and adverse outcomes. They were less likely to have health insurance coverage, but more likely to abstain from tobacco use during pregnancy and breastfeed than HS women who only spoke English.

Part Three: Compare Outcomes among Healthy Start Participants and Non-participants

Study Question: Which maternal and infant health outcomes are different for HS women compared to non-HS women?

The purpose of Part Three is to assess the association between HS program participation and selected maternal and infant health indicators and outcomes with an external non-HS comparison group of demographically similar women. For Part Three, we used live birth and infant death data from state vital records offices (VROs), as well as the Centers for Disease Control and Prevention's (CDC) Pregnancy Risk Assessment Monitoring System (PRAMS) survey data.

Methodology

We conducted two sets of propensity score weighted regression analyses in order to examine the association between HS participation and selected outcomes, using a population-based external comparison group of non-HS women. The first analysis assessed HS and non-HS women using live birth and infant death data from state VROs. The second analysis assessed HS and non-HS women using live birth and infant death data from linked vital records and CDC PRAMS survey data. The non-HS comparison group data were selected by VROs[14] based on shared ZIP code to HS women.

We incorporated propensity weights to minimize the potential for confounding to increase the likelihood that significant differences between HS and non-HS maternal and infant outcomes would be attributable to the program rather than extraneous factors. We matched on propensity scores predicted based on several covariates, including age, race, educational attainment, health insurance, pregnancy intent (PRAMS only), and marital status (VRO only), in order to balance the demographic and socioeconomic characteristics between HS and non-HS women. Refer to the Methodological Appendix: *Propensity Score Methodology* for a full overview of the propensity score methodology.

Live birth and infant death data were collected from 37 VROs across 34 states and the District of Columbia representing 87 HS grantees. Eleven states participated in the PRAMS oversampling of HS women representing 17 HS grantees. HS women included those who received HS services in late 2016 for 2017 births and those who received services in 2017 for births occurring in 2017 or early 2018 and who could be linked to a live birth record (VRO sample) and/or HS mothers who completed the PRAMS survey (PRAMS sample). Therefore, the analytic samples for both the VRO and PRAMS contained births from 2017 and 2018, as well as infant deaths from 2017 to 2019 (representative of deaths occurring during the first year of life). In addition, it should be noted that the HS women used in these analyses were drawn from the subgroup of HS women who received services for births that occurred during the time frames described above.

Measures

Many of the measures were shared between the two data sources because CDC PRAMS incorporates live birth certificate data. However, the PRAMS data include additional outcomes, such as psychosocial screenings, pregnancy intention, and infant safe sleep practices. Although PRAMS includes additional measures from the survey, it does not include infant mortality, which we collected from the VROs. Both data sources included linked infant death records.

We assessed the following measures from the live birth and infant death records for both the VRO and PRAMS sample analyses:

- Maternal age

[14] Not all VROs followed these guidelines. We enforced shared ZIP code when necessary (see Exhibit 4.1).

- Maternal race
- Maternal Hispanic/Latina ethnicity
- Maternal educational attainment
- Marital status
- Receipt of services from Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) during pregnancy
- Payment at delivery (as a proxy for health insurance coverage)
- Hypertension (prior to pregnancy or high blood pressure during pregnancy)
- Gestational diabetes
- Maternal morbidity[15] indicated on birth certificate (CDC, 2003)
- Preterm birth (less than 37 weeks gestation)
- Low birth weight (less than 2,500 grams)
- Tobacco use during pregnancy
- Cigarette use prior to pregnancy
- Maternal weight gain
- Maternal medical risk factors[16] indicated on birth certificate (CDC)
- Timing of prenatal care (based on the difference between date of last menstrual period and date of first prenatal care visit to construct week of prenatal care initiation)
- Total number of prenatal care visits
- Breastfeeding at the time of birth certificate report[17]
- Infant mortality

We incorporated the following additional measures in the PRAMS sample analyses using the PRAMS survey data:

- Adequacy of prenatal care utilization (based on the Kotelchuck Index) (CDC, 2020)
- Pregnancy intention
- Preconception well-woman visit
- Postpartum visit

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[15] This variable is from the maternal morbidity section of the U.S. standard birth certificate. This variable is coded as "yes" if any complications are checked, it is coded as "no" if "none of the above" is checked, else it is coded "unknown." Complications include the following: maternal transfusion, third or fourth degree perineal laceration, ruptured uterus, unplanned hysterectomy, admission to ICU, unplanned operating room procedure following delivery.

[16] Risk factors include prepregnancy diabetes, gestational diabetes, prepregnancy hypertension, gestational hypertension, previous preterm births, poor pregnancy outcome, and vaginal bleeding. We reverse coded this measure from the original: No medical risk.

[17] For the PRAMS analyses, we used the PRAMS measure for ever breastfed and breastfeeding duration rather than the vital records measure for breastfeeding at the time of birth certificate report.

- Interpregnancy interval less than 18 months (based on date of last live birth, last other pregnancy outcome,[18,19] infant clinical estimate of gestational age, and infant date of birth)
- IPV screenings (preconception, prenatal)
- Depression screenings (preconception, prenatal, postpartum)
- Ever breastfed and duration of breastfeeding
- Infant safe sleep practices (on back in his or her own crib/bed) (CDC, 2018)

Analytic Sample

To construct the analytic samples we first matched the HS women who were identified using live vital records birth data (VRO sample), and separately, CDC PRAMS survey participants (PRAMS sample), back to HS program data using the HS identification (ID) number in order to verify consent for participation. The HS participant IDs provided by the HS grantees matched back to the HS program data less than 50 percent of the time for the VRO sample and 69 percent for the PRAMS sample. Through extensive technical assistance with HS grantees, we improved the VRO match rate to 69.5 percent and the PRAMS match rate to 79.4 percent. If a HS woman's consent status could not be confirmed, we had to exclude her from analyses. This resulted in the exclusion of 4,486 HS women (30.5% of VRO sample) and 314 PRAMS survey participants (20.6% of PRAMS sample). Of the VRO and PRAMS survey data that could be linked back to the HSMED, 88.8 percent were consented to participate in the VRO sample and 94.7 percent were consented to participate in the PRAMS sample.

Refer to Exhibit 3.1 for raw and final sample counts. We restricted the PRAMS sample to PRAMS survey participants, which excluded participants who were sampled for PRAMS survey participation but who did not complete the PRAMS survey. In order to limit based on shared geography, we restricted the VRO and PRAMS non-HS comparison groups using the ZIP codes of residence for HS women. We also removed those with multifetal gestation from both analytic samples. Finally, we removed HS women with duplicate HS IDs within a HS grantee.

For the multivariable analyses, we removed observations with missing data on participant age, race, and Hispanic/Latina ethnicity[20] prior to propensity score matching. The propensity score matched sample excludes HS and non-HS women with propensity scores outside the range identified through common support. The resulting analytic sample consists of 7,932 HS women from 71 HS grantees matched to 459,196 non-HS women for the VRO sample across 32 states and the District of Columbia, and 655 HS PRAMS participants from 16 HS grantees matched to 1,736 non-HS PRAMS participants across 11 states based on geographic and sociodemographic characteristics (i.e., age, race, educational attainment, health insurance, pregnancy intent (PRAMS only), and marital status (VRO only).

For each regression model, we also removed those with missing data on the maternal and infant outcome of interest. This resulted in varying sample sizes across analyses.

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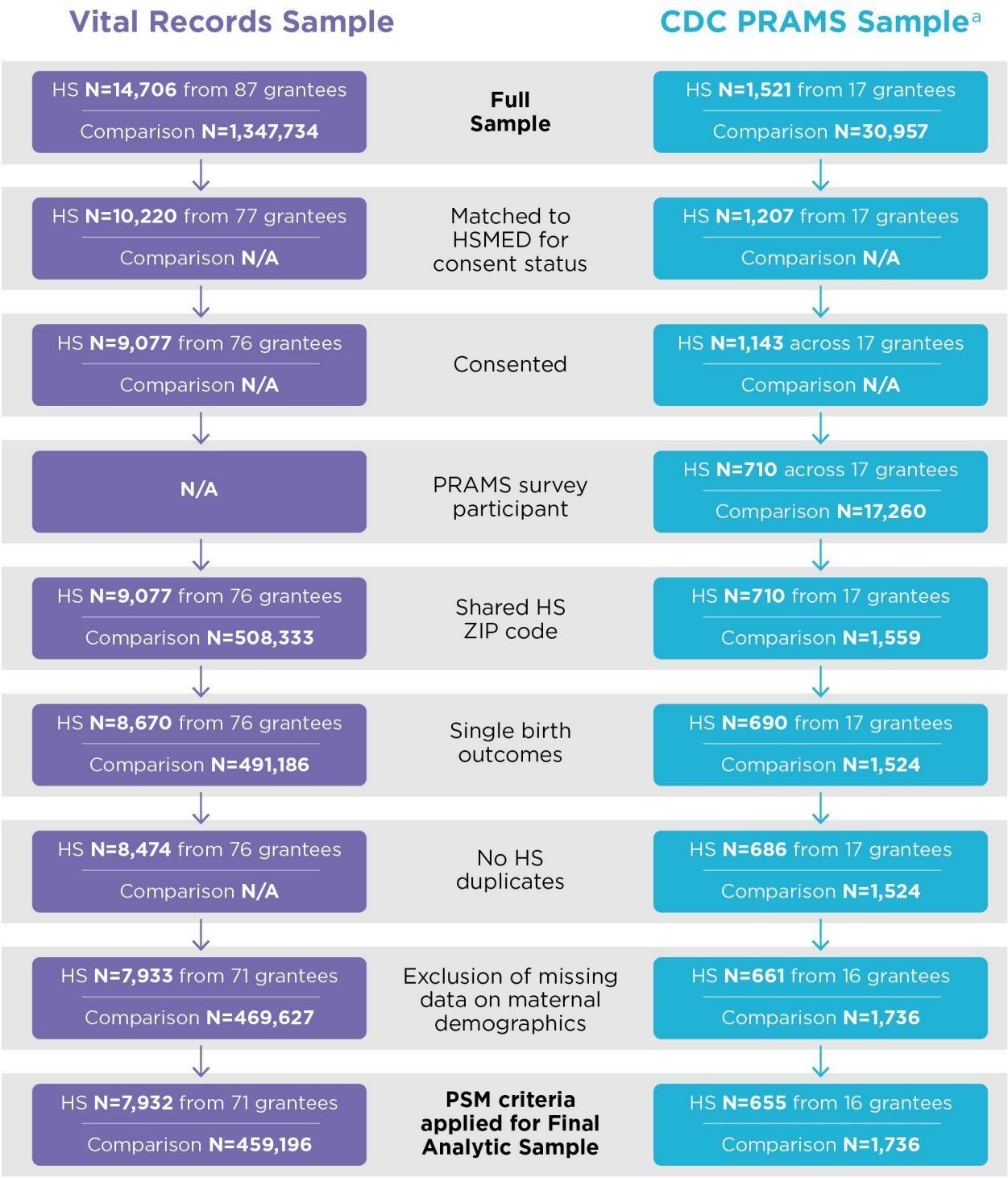
[18] We were unable to compute the interpregnancy interval for the VRO sample as we did not receive data on last other pregnancy outcome (month or day). The VRO data only indicated the year of last other pregnancy outcome.

[19] We imputed day of last live birth and last other pregnancy outcome as the 15th of the month (estimated midpoint) in order to construct these date-specific measures (MM/DD/YYYY).

[20] The overall percent of missing data on participant demographics consist of maternal age at 0.8 percent missing, race at 0.4 percent missing, and Hispanic/Latina ethnicity at 3.3 percent missing for the VRO sample, and maternal race at 0.4 percent missing and Hispanic/Latina ethnicity at 0.3 percent missing for the PRAMS sample. There were no missing data on maternal age for the PRAMS sample.

Exhibit 3.1. Distribution of 2017 HS Sample, HS Grantees, and Non-HS Comparison Groups using VRO and PRAMS Sub-sample



[a] CDC PRAMS sample not an exact sub-sample of the VRO sample. CDC PRAMS oversampled HS women. However, not all HS women were sampled, and not all HS women who were sampled participated in the PRAMS survey.

Analytic Strategy

We estimated the association between HS program participation and selected outcomes using standardized mortality ratio (SMR) weights and restricted the propensity scores to those identified using common support. We conducted multivariable logistic regression for dichotomous outcomes (e.g., screened for IPV, ever breastfed), ordinary least squares (OLS) regression for continuous outcomes (e.g., maternal weight gain, week of first prenatal care visit), and Poisson regression for outcomes with count data (i.e., total prenatal care visits).

All models controlled for age, race, ethnicity, educational attainment, marital status, payment at delivery, pregnancy intention (PRAMS only) and if applicable, child age. We also controlled for maternal medical risk factors (prepregnancy diabetes, gestational diabetes, prepregnancy hypertension, gestational hypertension, previous preterm births, poor pregnancy outcome, and vaginal bleeding) when assessing total prenatal care visits and low birth weight.

We assessed 11 maternal and infant outcomes in the VRO matched analyses and 20 for the PRAMS matched analyses. Similar to Part Two, we used a Bonferroni correction[21] to determine the appropriate alpha level (see Table M2 in the Methodological Appendix). We present results using the individual models with the Bonferroni correction.

Findings

Refer to Appendix Three Tables 1 through 11 for descriptive statistics of the HS VRO and PRAMS samples demographic and maternal and infant health indicators before and after the incorporation of propensity weights. We report on significant associations between HS and non-HS women and maternal and infant outcomes while controlling for additional factors in the multivariable analyses (see Table 3.1).

Table 3.1. Associated Indicators (p<0.01) for U.S. HS Women Compared to Matched Non-HS Women Using VRO and PRAMS, 2017

Maternal and Infant Health Indicator	Parameter (Standard Error)	Interpretation	Data Source
Hypertension	OR = 1.25 (0.05)	Higher odds	VRO
Infant safe sleep practices	OR = 1.47 (0.16)	Higher odds	PRAMS
Low birthweight	OR = 0.56 (0.10)	Lower odds	PRAMS
Prenatal Care	*B* = -0.48 (0.09)	Earlier first prenatal care visit	VRO
	B = 0.07 (0.01)	Higher total prenatal care visits	VRO
	B = 0.10 (0.02)	Higher total prenatal care visits	PRAMS

Table notes: Non-HS women as reference/comparison group.

Based on multivariable logistic, OLS, and Poisson regression analyses controlling for age, race, ethnicity, educational attainment, marital status, payment at delivery, pregnancy intention (PRAMS only) and if applicable, child age. We also controlled for maternal medical risk factors (prepregnancy diabetes, gestational diabetes, prepregnancy hypertension, gestational hypertension, previous preterm births, poor pregnancy outcome, and vaginal bleeding) when assessing total prenatal care visits and low birth weight.

We report odds ratios for multivariable logistic regressions (OR), betas (*B*) for OLS regressions, and betas (*B*) for Poisson regressions.

Vital Records (VRO)

We found both favorable and adverse findings in the multivariable propensity score matched analyses while adjusting for model covariates using the vital records data. HS women were more likely to have their first prenatal care visit earlier than non-HS women. HS women also had significantly more prenatal care visits than non-HS. HS women were more likely to have high blood pressure/hypertension, prior to or during pregnancy, than the non-HS comparison group.

[21] For each Bonferroni correction, we divided a p-value of 0.05 by the number of models (based on outcome measures) to calculate a corrected significance threshold to avoid Type I error.

PRAMS

We found favorable outcomes in the multivariable matched analyses while adjusting for model covariates using the PRAMS data. HS women were less likely to have a low birth weight infant than non-HS women. HS women were more likely to follow infant safe sleep practices than non-HS women. Similar to the VRO findings, HS women in the PRAMS sample also had significantly more prenatal care visits than non-HS women.

Summary

We assessed the association between HS program participation and maternal and infant health indicators and outcomes with an external non-HS comparison group of demographically similar women. In models accounting for selected sociodemographic characteristics, such as maternal age, race, ethnicity, education, marital status, and payment at delivery, HS women had consistent findings for utilization of prenatal care in both sets of analyses. In the VRO analyses, we found significant associations with favorable outcomes, including earlier initiation and frequency of prenatal care among HS women as compared to non-HS women. For the PRAMS sample, we similarly found a significant positive association for HS participation and total prenatal care visits.

In the VRO sample, there were no statistically significant associations between HS program participation and maternal morbidity, tobacco use during pregnancy, breastfeeding, gestational diabetes, preterm birth, infant mortality, and weight gain during pregnancy. For the PRAMS sample, there were no statistically significant associations between HS program participation and tobacco use during pregnancy, gestational diabetes, high blood pressure/hypertension, timing of first prenatal care visit, preterm birth, infant mortality, IPV screening, depression screening, breastfeeding, woman well-visit, postpartum visit, weight gain during pregnancy, and interpregnancy interval.

Women who are socioeconomically disadvantaged and in poorer overall health, and/or who exhibit maternal risk factors, are often referred to and participate in the HS program. As such, HS women may be at higher risk for adverse maternal and infant outcomes in comparison to sociodemographically similar women who are not referred to or who do not participate in HS. The lack of statistically significant findings may suggest that the HS program moved HS participant outcomes closer to those exhibited by their non-HS peers. However, it is difficult to assess program effectiveness without pre-intervention data on both HS and non-HS women.

We sought to account for observable and measured demographic and socioeconomic differences by incorporating propensity weights. However, unmeasured and unobservable differences may always exist when individuals are not randomized into treatment versus comparison groups. Thus, we cannot guarantee that the women who participate in HS do not differ systematically in some unmeasured way from women who do not participate in HS. Similarly, the large percentage of observations removed due to missing data (and due to nonconsent) raises the possibility that HS women who consented to the study and provided complete data could differ in some systematic way from HS women who did not provide consent or complete data, and therefore the findings presented here may not represent the full range of HS participants.

Moreover, without baseline estimates, we cannot fully adjust for preexisting risk factors. We attempted to address this methodological limitation by incorporating a measure for cigarette use prior to pregnancy as a potential risk factor for tobacco use during pregnancy. In order to test, we conducted a sequential model of tobacco use during pregnancy using the VRO sample (see Appendix Three Table 6). We ran our first model without the risk factor and found a significant association between HS participation and tobacco use during pregnancy. HS women were more likely to use tobacco during pregnancy than the comparison group. However, in the second model we incorporated the measure for cigarette use prior to pregnancy. The previous adverse finding became non-significant. Future evaluations of HS should include baseline data and, if possible, multiple years of data on program participants in order to more readily assess

program effectiveness. In addition, if a comparison group is again sought for future evaluations, a wait-listed group should be considered (that is, women who are waiting for HS services but have not yet received them). The use of a wait-list control would serve to minimize pre-existing differences that may occur between HS women and non-HS women as groups.

Part Four: Comparison of Outcome Data to Benchmarks

Study Question: How do outcomes among HS women compare to national benchmarks and program targets?

The goals of Part Four are twofold: (1) to compare selected outcomes of HS women presented in Part One to HS program performance measures using data from the HSMED, and (2) to compare those same outcomes to national benchmark, such as Healthy People 2020 (HP2020). The purpose of these comparisons is to assess if the analytic sample of HS women outperformed, met, or fell below performance measures set by the program, as well as similar benchmarks found within HP2020.

Healthy Start Program Performance Measures

We structure the findings presented here by highlighting where the 2017 HS women outperformed, met, and fell below HS program performance measures. The difference between analytic sample estimates and program targets are described as percentage point differences.

Above or at program targets. Prenatal and postpartum HS women exceeded program targets in terms of health insurance coverage[22] by approximately three percentage points (see Table 4.1). Similarly, HS child participants also exceeded health insurance coverage targets as reported by HS women in the postpartum and interconception/parenting phases. HS women also exceeded program targets for interconception intervals within 18 months of a previous live birth by approximately 10 percentage points.[23]

All HS women and their children met the benchmark for having a usual source of care when sick (see Table 4.1). Only participants in the prenatal phase met the performance measure target for having a documented reproductive life plan. All HS women were screened for depression, which met the program target for 100 percent depression screenings.[24] On strengthening family resilience, HS women exceeded the set targets for partner or child's father's involvement and support during pregnancy and with the HS child.

Below program targets. HS women in the preconception and interconception/parenting phases with complete data fell below the target for health insurance coverage (see Table 4.1). HS women in the preconception, postpartum, and interconception/parenting phases did not meet program targets for reproductive life planning. HS women in the preconception phase were furthest away from the reproductive life planning target by approximately 20 percentage points.

IPV screenings were below target across all reproductive phases (see Table 4.1), and were the lowest for HS women in the preconception phase who were approximately 35 percentage points below the program target of IPV screenings for 100 percent of participants. The percentage of HS women abstaining from

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[22] The amount of missing data in the HSMED, especially on questionnaire items used to examine HS program performance measures, impacted the overall assessment of program performance. We examined program performance using the item-level non-missing data as the denominator for each performance measure. Refer to Part One for overall counts and percentages of the item-level missing data within results tables. For certain performance measures (e.g., health insurance and father involvement with child), a large percentage of the sample was excluded due to missing data, and therefore, results may not be representative of the overall analytic sample of each phase or the program.

[23] Approximately 15 percent of the postpartum HS women sample met the inclusion criteria for the assessment of interpregnancy interval (previous live birth before the study period and completion of an interconception/parenting questionnaire prior to the study period).

[24] The program guidance indicated 100 percent depression screening, and, if applicable, referral. However, depression screening referral data were excluded due to overall data quality concerns with the collection of referral to services data.

cigarette use during pregnancy also fell short of the program target as reported by approximately three to six percentage points for prenatal and postpartum participants.

Participant breastfeeding practices fell below program targets. In terms of duration of breastfeeding, participants fell below the program target for breastfeeding at six months by approximately 48 percentage points (see Table 4.1). Safe sleep practices, which include infant sleep position, location, and surface, also fell below target by 2.7 percentage points for postpartum participants and 10.5 percentage points for participants in the interconception/parenting phase.

Table 4.1. Comparison of 2017 HS Participant Analytic Sample to HS Program Performance Measures Using Data from the HSMED

Performance Measure	HS Target %	Reproductive Phases % (% point difference)			
		Preconception	Prenatal	Postpartum	Parenting
Women with health insurance	90	86.7 (-3.3)	93.4 (+3.4)	92.9 (+2.9)	88.4 (-1.6)
Children with health insurance	90	N/A[a]	N/A	97.7 (+7.7)	98.9 (+8.9)
Usual source of medical care (women)	80	88.6 (+8.6)	91.9 (11.9)	94.5 (+14.5)	93.5 (+13.5)
Usual source of medical care (child)	80	N/A	N/A	98.2 (+18.2)	98.7 (+18.7)
Had documented reproductive life plan	90	68.4 (-21.6)	93.3 (+3.3)	83.2 (-6.8)	85.8 (-4.2)
Depression screening	100	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
IPV screening	100	65.1 (-34.9)	88.0 (-12.0)	94.4 (-5.6)	90.0 (-10.0)
Well-woman visit	80	81.0 (+1.0)	N/A	N/A	86.7 (+6.7)
Postpartum visit	80	N/A	N/A	48.1 (-31.9)	N/A
Age-appropriate well-child visit	90	N/A	N/A	89.6 (-0.4)	77.6 (-12.4)
Ever breastfed child	82	N/A	N/A	72.6 (-9.4)	75.1 (-6.9)
Breastfed child at six months	61	N/A	N/A	N/A	13.5 (-47.5)
Followed safe sleep practices	80	N/A	N/A	77.3 (-2.7)	69.5 (-10.5)
Abstained from cigarette smoking during pregnancy	90	N/A	87.1 (-2.9)	83.8 (-6.2)	N/A
Partner/child's father involved during pregnancy	90	N/A	94.7 (+4.7)	N/A	N/A
Partner/child's father involved with child	80	N/A	N/A	94.2 (+14.2)	87.7 (+7.7)
Read to child 3 or more days/week	50	N/A	N/A	N/A	72.5 (+22.5)
Interpregnancy interval of 18 months or less	30	N/A	N/A	19.6	N/A

[a] Not applicable for phase.

In summary, HS women were consistently at or above program targets on having a usual source of care for themselves and their children. HS women also consistently met program targets in terms of depression screenings. Participants fell below program targets in terms of IPV screenings in each of the four reproductive phases. Participants also fell substantially below program targets for duration of breastfeeding.

National Benchmarks and Estimates

There is substantial overlap between the topics of focus within the HS program performance measures and the national goals outlined for the general population in HP2020. Given this overlap, our original goal was to compare outcomes among HS women using the HSMED data with the targets described for

similar outcomes in HP2020. Similar to HS, HP2020 aims to increase health insurance coverage, intended pregnancies, postpartum care visits, sources of ongoing care, infant safe sleep practices, initiation and duration of breastfeeding, depression screenings, and reading to children. Both programs also aim to reduce cigarette use during pregnancy, as well as pregnancies conceived within 18 months of a previous birth.

Although there is some overlap in goals, complete alignment of HS performance measures to HP2020 targets was not necessarily the intention of the HS program. When setting program goals, the HS program considered additional factors, such as increased focus on promoting positive health behaviors of at-risk perinatal populations. For example, HS performance goals for following infant safe sleep practices and reading to children exceed the set targets for HP2020, reflecting the program's emphasis on these topics.[25]

HP2020 presents national goals for the general population. The demographic and socioeconomic characteristics of HS women were also considered when setting HS program goals, as these participant characteristics largely differ from national population estimates. For example, the 2017 HS analytic sample overviewed in Part One using data from the HSMED indicated that HS women primarily identified as non-Hispanic and black/African American. Similarly, the majority of HS women reported a level of educational attainment equal to that of a high school degree or GED. Further, the analytic sample, with complete data on health insurance status, reported health insurance coverage mainly from government-assisted programs. Additionally, there is not a one-to-one alignment between the HS performance measures and the HP2020 goals, with inconsistencies arising with regard to definitions and criteria. The 2017 HS analytic sample also lacks baseline estimates, which are necessary in order to facilitate a more direct comparison of change over time.

Because of these reasons, although we intended to make direct comparisons between HS and HP2020, this practice proved problematic. However, we made use of similar data from national sub-group population estimates in order to provide context when understanding the 2017 HS participant analytic sample using data from the HSMED. Unlike HP2020, 2017 national sub-group estimates better contextualize HS women within similar at-risk demographic and socioeconomic women during the same study year for selected measures. These national sub-groups include non-Hispanic women, black or African-American women, and women with household incomes falling below FPL (see Table 4.2).

[25] HS performance goals also exceeded those of HP2020 for reproductive life planning and screening for depression, but the measures are defined differently and do not fully align. The HP2020 goal for reproductive life planning is specific to unintended pregnancies. The HP2020 goal for depression screening is also specific to depression screenings by primary care providers for adults in the general population.

Table 4.2. 2017 National Estimates for Sub-groups below FPL and Non-Hispanic Black or African-American Samples

Measure	Sub-group	%
Children with health insurance [a]	Below FPL for household income	92.1
	Non-Hispanic black or African-American	93.9
Usual source of medical care (Child) [a]	Below FPL for household income	82.9
	Non-Hispanic black or African-American	91.4
Age-appropriate well-child visit [a, b]	Below FPL for household income	75.7[a]
		86.5[b]
	Non-Hispanic back or African-American	82.6[a]
		91.5[b]
Ever breastfed child [a]	Below FPL for household income	69.1
	Non-Hispanic black or African-American	68.2

[a] National Survey of Children's Health, 2017
[b] National Health Interview Survey, 2017

Our examination of the data revealed that the 2017 HS participant sample had higher percentages of having a usual source of medical care when sick compared to national sub-group estimates for those with incomes below FPL and non-Hispanic black or African-American race. The 2017 HS participant sample performed similarly to and slightly above the national sub-group estimates for black or African-American women and those below FPL in terms of ever breastfeeding.

Part Five: Key Findings and Recommendations

What do findings across the three data sources tell us about the 1) HS program participants, 2) differing service needs across different groups of HS women, and 3) differences in outcomes experienced by program participants compared to non-participants?

The purpose of Part Five is to triangulate results by identifying key findings across all parts of the analysis, discuss limitations, and offer matters for consideration for HS and future evaluation efforts.

The study analyzed HSMED data, state VRO live birth and infant death data, and CDC PRAMS survey data. The HSMED data allowed us to examine outcomes across all reproductive phases regardless of pregnancy status or birth outcomes. However, the HSMED contains data only from HS women. This enables us to focus on the assessment of within-participant differences, but does not allow for comparisons between HS and non-HS women.

The VRO and PRAMS data enabled us to compare HS women to sociodemographically similar,[26] propensity score matched non-HS women in order to assess meaningful differences in maternal and infant outcomes, such as infant mortality. The PRAMS data also enabled us to assess additional maternal and infant outcomes that are not collected in birth records, such as psychosocial screenings, pregnancy intention, and infant safe sleep practices. Propensity score matching increased the comparability of HS and non-HS women based on several measurable sociodemographic characteristics, strengthening our ability to suggest that the differences in outcomes were most likely attributable to HS and not extraneous factors. However, the VRO and PRAMS analyses focus on women who have given birth within a certain timeframe, and thus draw on only a subset of all HS women.

Key Findings

1) What do findings across the three data sources tell us about the HS program participants?

The majority of HS women in our analytic samples were below the age of 35 years old, identified as non-Hispanic and black or African-American, and had a high school degree/GED or less (see Table 5.1). The majority of HS women with complete data reported health insurance coverage primarily through public insurance, such as Medicaid. It appears that the HSMED contains more Hispanic/Latina women, more women with only a high school degree/GED or less, and more women who rely on public health insurance than the subset of HS women with data collected through VRO to some extent but through PRAMS in particular. PRAMS is a self-administered survey, whereas the HSMED data forms were administered by HS staff. It is possible that the English literacy demands associated with providing complete PRAMS data led to greater completion among non-Hispanic HS women, and also among HS women with slightly higher educational attainment, and with sources of income that led to less likelihood of reliance on public insurance.

[26] We matched on participant age, race, educational attainment, health insurance, and marital status for the VRO sample, and age, race, educational attainment, health insurance, and pregnancy intent form the PRAMS sample.

Table 5.1: 2017 U.S. HS Sample [a] Characteristics Using HSMED, VRO, and PRAMS

Sociodemographic Characteristic	Data Source		
	HSMED [b]	VRO	PRAMS
	%	%	%
35 years or below	88.4	90.5	90.6
Black or African-American	60.1	62.2	59.6
Non-Hispanic/Latina	76.3	82.5	85.3
High school degree/GED or less	68.6	65.0	61.9
Public health insurance	91.4	83.2	76.0

[a] Denominators vary based on non-missing data for each characteristic.

[b] Pooled data across four reproductive phases.

2) What do findings tell us about different groups of women within HS, and what their different needs might be?

The HSMED multivariable analyses suggested the presence of both risk and protective factors for maternal and infant outcomes among HS women within different reproductive phases.

Our findings suggest that there were socioeconomic and racial/ethnic disparities in maternal and infant outcomes among HS women (see Table 5.2). HS women with higher educational attainment had favorable maternal and infant outcomes, such as abstaining from tobacco use during pregnancy and breastfeeding. HS women below FPL showed more adverse outcomes, such as tobacco use during pregnancy and lower father/partner involvement during pregnancy and with the child. White HS women showed both favorable and adverse outcomes. They were more likely to follow infant safe sleep practices and use tobacco during pregnancy when compared to black or African-American HS women. Hispanic/Latina HS women were less likely to use tobacco during pregnancy than non-Hispanic/Latina HS women. HS women who spoke a language other than English showed both favorable and adverse outcomes. They were less likely to have health insurance coverage, but more likely to abstain from tobacco use during pregnancy and breastfeed than HS women who only spoke English.

HS program planning and efforts should provide increased targeting for these differing areas of high service need across different groups of HS women.

Table 5.2. Summarized Multivariable Findings ($p<0.01$) Among U.S. HS Women Using the HSMED, 2017

Comparison Groups	Maternal and Infant Health Indicator	Odds Ratio (Standard Error)	Interpretation
Education: High school degree <> Less than high school)	Tobacco use during pregnancy	Prenatal: 0.62 (0.05); Postpartum: 0.68 (0.09)	Lower odds
Education: Some college <> Less than high school	Tobacco use during pregnancy	Prenatal: 0.45 (0.04); Postpartum: 0.50 (0.06)	Lower odds
	Ever breastfed	Postpartum: 2.10 (0.19); Parenting: 2.91 (0.45)	Higher odds
Education: College or more <> Less than high school	Tobacco use during pregnancy	Prenatal: 0.30 (0.04); Postpartum: 0.33 (0.08)	Lower odds
	Ever breastfed	Postpartum: 3.18 (0.46); Parenting: 2.89 (0.65)	Higher odds

Comparison Groups	Maternal and Infant Health Indicator	Odds Ratio (Standard Error)	Interpretation
Ethnicity: Hispanic or Latina <> Non-Hispanic or Latina	Tobacco use during pregnancy	Prenatal: 0.42 (0.09); Postpartum: 0.33 (0.08)	Lower odds
Language: Other language spoken at home <> Only English spoken at home	Tobacco use during pregnancy	Prenatal: 0.20 (0.04); Postpartum: 0.20 (0.07)	Lower odds
	Ever breastfed	Postpartum: 3.36 (0.60); Parenting: 4.46 (1.19)	Higher odds
	Health insurance coverage	Preconception: 0.27 (0.11); Prenatal: 0.22 (0.06); Postpartum (mother): 0.19 (0.04); Postpartum (child): 0.20 (0.07); Parenting (mother): 0.26 (0.12)	Lower odds
Poverty status: Below FPL <> Above FPL	Tobacco use during pregnancy	Prenatal: 1.91 (0.13); Postpartum: 1.62 (0.26)	Higher odds
	Father/partner involvement during pregnancy and with child	Prenatal: 0.58 (0.06); Postpartum: 0.32 (0.07)	Lower odds
Race: White <> Black or African-American	Tobacco use during pregnancy	Prenatal: 3.70 (0.40); Postpartum: 2.74 (0.86)	Higher odds
	Infant safe sleep practices	Postpartum: 1.88 (0.33); Parenting: 2.00 (0.43)	Higher odds

Table notes: <> precedes reference/comparison group
Summarized findings based on consistent results across four reproductive phases.

Based on multivariable logistic regression analyses controlling for age, race, ethnicity, poverty status, educational attainment, language, and U.S. Census region.
Analyses only pertains to those with complete data on health indicator.

3) What do findings tell us about differences in outcomes experienced by program participants compared to non-participants?

Our findings suggest that while we found no statistically significant associations between HS program participation and most outcomes, including infant mortality, HS participation was associated with more prenatal care utilization (See Table 5.3). In addition, HS women were more likely to follow infant safe sleep practices, but also more likely to have high blood pressure/hypertension than non-HS women. These results suggest the presence of both risk and protective factors for HS women. However, without baseline estimates, we cannot fully adjust for preexisting risk factors. We also cannot account for other potentially confounding differences between individuals who participated in HS and those who did not.

Table 5.3. Summarized Multivariable Findings (p<0.01) for U.S. HS Women Compared to Matched Non-HS Women Using VRO and PRAMS, 2017

Maternal and Infant Health Indicator	Parameter (Standard Error)	Interpretation	Data Source
Hypertension	OR = 1.25 (0.05)	Higher odds	VRO
Infant safe sleep practices	OR = 1.47 (0.16)	Higher odds	PRAMS
Low birthweight	OR = 0.56 (0.10)	Lower odds	PRAMS
Prenatal care	*B* = -0.48 (0.09)	Earlier first prenatal care visit	VRO
	B = 0.07 (0.01); *B* = 0.10 (0.02)	Higher total prenatal care visits	VRO; PRAMS

Table notes: Non-HS women as reference/comparison group.

Based on multivariable logistic, OLS, and Poisson regression analyses controlling for age, race, ethnicity, educational attainment, marital status, payment at delivery, pregnancy intention (PRAMS only) and if applicable, child age. We also controlled for maternal medical risk factors (prepregnancy diabetes, gestational diabetes, prepregnancy hypertension, gestational hypertension, previous preterm births, poor pregnancy outcome, and vaginal bleeding) when assessing total prenatal care visits and low birth weight.

We report odds ratios for multivariable logistic regressions (OR), betas (*B*) for OLS regressions, and betas (*B*) for Poisson regressions.

Limitations and Matters for Consideration

Linking federal program data to public health data is a novel approach to understanding program performance in the context of public health surveillance. Few local HS programs have undertaken the complex and resource-intensive process required to link program data to state vital records, and even fewer have incorporated surveillance data. The present study not only linked HS program data to state vital live birth and infant death records, but also to CDC PRAMS survey data. This assessment is the first matched analysis for HS on a national level.

HSMED Data

The HSMED is a rich and complex dataset with numerous and diverse maternal and child health indicators and outcomes for HS women. The program tailors the data collection tools to the reproductive phase of each client. This practice requires six different programmatic questionnaires: four questionnaires specific to each reproductive phase (i.e., preconception, prenatal, postpartum, and interconception/parenting), a general demographic questionnaire, and a pregnancy history questionnaire. Our methods uncovered many instances in which HSMED program data collection and data quality could be streamlined and otherwise improved to ensure a more complete understanding of HS program participants in future evaluation efforts.

Key Recommendations for Future Evaluations

Future evaluations may benefit from considering alternative study designs, such as a pretest/posttest[27] or a longitudinal design to incorporate multiple years of data. It may particularly benefit from use of a wait-list comparison group in order to control for preexisting differences between HS women and the non-HS women used in this study. It may also be beneficial to incorporate a baseline risk assessment within the demographic participant questionnaire or participant consent form. Baseline estimates allow for more systematic and thorough adjustment for preexisting risk factors.

Future evaluations should also consider the timing of HS enrollment. This is relevant when assessing program impact on certain outcomes, such as preterm birth. HS cannot impact preterm birth if women enroll late in pregnancy or after pregnancy. Although propensity score matching was helpful at improving comparability between the two groups, there are certainly unobserved and unmeasured differences that may be associated with program participation. We also cannot account for other potentially confounding differences between people who participated in HS and those who did not.

HS may consider enhancing outreach to HS women who live below FPL and have not graduated from high school, groups that have consistently demonstrated more adverse maternal and infant outcomes among HS women. HS may also consider enhancing efforts to address tobacco use and hypertension, and seek more uniform screening for IPV. Although preconception represents a new perinatal phase for HS, the program may benefit from additional outreach and data collection on preconception women in order to better understand this new participant sub-group.

[27] However, pretest/posttest study designs may also be limited in conclusions they allow, particularly given that participants are not (and cannot be) randomly assigned to HS and a non-HS comparison group. Women who choose to participate in HS may differ in systematic ways from women who do not participate; moreover, non-HS women may be involved in different interventions that are not documented, which would attenuate group differences based on HS participation.

Overall Impact

This study represents the first matched analysis of the HS program on a national scale. Despite methodological challenges and data limitations, the present study was able to link program data to live birth and infant death data from vital records and CDC PRAMS. Although linking program datasets to public health surveillance data results in a richer dataset to inform program improvements, this approach is not common due to limitations based on time and resources.

The HS program has been evaluated since its early beginnings, and each evaluation has informed evidence-based improvements to the program. The challenges and limitations we describe in our study may be addressed as the health care ecosystem (including the range of health datasets) moves toward a greater integration across health sectors monitoring health outcomes to improve population and community health.

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Appendix One

A1 Table 1. Healthy Start 2017 Grant Organizations Distribution Across Analytic Samples Based on Reproductive Phase using HSMED

Organization Name	ID	Preconception	Prenatal	Postpartum	Parenting	Total
Birmingham Healthy Start Plus Inc.	2	X	X	X	X	4
Gift of Life Foundation	7		X	X	X	3
Mississippi County Arkansas EOC, Inc.	8		X	X	X	3
Maricopa County Department of Health	9	X	X	X	X	4
Mariposa Community Health Center, Inc.	10		X	X	X	3
Alameda County Health Care Services Agency	11	X	X	X		3
County of Fresno	12		X	X	X	3
Project Concern International	13		X	X	X	3
Shields for Families Project Inc.	14		X	X	X	3
Colorado Non-Profit Development Center	15	X	X	X	X	4
Community Foundation of Greater New Haven	16	X	X			2
State of Connecticut Department of Public Health	17		X	X		2
DC Department of Human Services	18					0
Health, Florida Department of	19	X	X	X	X	4
The Center for Health Equity, Inc.	20	X	X	X	X	4
University of Miami	21		X	X		2
All Children's Hospital, Inc.	22	X	X	X	X	4
Northeast Florida Healthy Start Coalition	23	X	X	X	X	4
Reach Up, Inc.	24		X			1
Center for Black Women's Wellness, Inc.	25		X	X	X	3
Clayton, County of	26		X	X	X	3
Laurens County Board of Health	27	X	X	X	X	4
MCG Health, Inc.	28		X	X	X	3
Visiting Nurse Services	29		X	X	X	3
Aunt Martha's Youth Service Center, Inc.	30	X	X	X	X	4
Access Community Health Network	31	X	X	X	X	4
Healthcare Consortium of Illinois	32		X	X	X	3
Near North Health Service Corporation, The	33	X	X	X		3
SGA Youth & Family Services NFP	34	X	X	X	X	4
Southern Illinois Healthcare Foundation	35		X	X	X	3
Health & Hospital Corp of Marion County	36		X			1
Northwest Indiana Health Department Coop	37		X	X	X	3
County of Sedgwick	38	X	X	X	X	4
Health and Environment, Kansas, Department of	39	X	X	X	X	4
Louisville/Jefferson County Metro Government	40		X	X	X	3
City of New Orleans	41		X	X	X	3

Organization Name	ID	Preconception	Prenatal	Postpartum	Parenting	Total
Crescent City WIC Services, Inc.	42	X	X	X	X	4
Family Road of Greater Baton Rouge, Inc.	43	X	X	X	X	4
Family Tree Information Education & Counseling Center	44		X	X	X	3
Boston Public Health Commission	45					0
Baltimore City Healthy Start, Inc.	46	X	X	X	X	4
Spectrum Health	47			X	X	2
County of Ingham, Health Department	48	X	X	X	X	4
Genesee County Health Department	49		X	X	X	3
Institute for Population Health, Inc.	50	X	X	X		3
Inter-Tribal Council of Michigan, Inc. Consortium of Michigan's Federal Tribes	51		X	X	X	3
Kalamazoo County Health and Community Services Department	52		X	X	X	3
City of Minneapolis	53		X			1
Maternal & Child Health Coalition	54		X	X	X	3
Missouri Bootheel Regional Consortium, Inc.	55		X	X	X	3
Central Mississippi Civic Improvement Association, Inc.	56		X			1
Delta Health Alliance, Inc.	57	X	X	X	X	4
Tougaloo College	58		X	X	X	3
Robeson Health Care Corp	59		X	X	X	3
University of North Carolina at Pembroke	60					0
NC Department of Health & Human Services	61		X	X	X	3
Charles Drew Health Center, Inc.	62		X	X	X	3
Children's Futures, Inc.	63		X	X	X	3
Newark Community Health Centers Inc.	64	X	X	X	X	4
Partnership for Maternal and Child Health of Northern New Jersey, Inc., The	65	X	X	X	X	4
Southern New Jersey Perinatal	66	X	X	X	X	4
Ben Archer Health Center, Inc.	67	X	X	X	X	4
Clinica de Familia Inc., La	68	X	X	X	X	4
Southern Nevada Health District	69		X	X	X	3
Albert Einstein College of Medicine	70		X	X	X	3
Community Health Center of Richmond, Inc.	71	X	X	X	X	4
Fund for Public Health in New York, Inc.	72		X		X	2
Northern Manhattan Perinatal Partnership, Inc.	73	X	X	X	X	4
Onondaga County Health Department	74		X	X	X	3
Perinatal Network of Monroe County, Inc.	75		X	X	X	3
Public Health Solutions	76		X	X	X	3
Columbus Health Department	77		X	X	X	3
Children's Hospital Medical Center	78	X				1
Cleveland Department of Public Health	79	X	X	X	X	4

Organization Name	ID	Preconception	Prenatal	Postpartum	Parenting	Total
Five Rivers Health Centers	80		X	X	X	3
Lucas, County of	81	X	X	X	X	4
Community Health Centers, Inc.	82		X	X	X	3
Community Service Council of Greater Tulsa	83		X	X	X	3
Little Dixie Community Action Agency, Inc.	84	X	X	X	X	4
Tulsa City-County Health Department	85		X	X	X	3
Health Care Coalition of Southern Oregon, Inc.	86		X	X	X	3
Multnomah County Dept. of Human Services	87	X	X	X	X	4
Albert Einstein Healthcare Network	88		X			1
Crozer-Keystone Health System	89		X	X	X	3
Hamilton Health Center, Inc.	90		X	X	X	3
Healthy Start, Inc.	91		X	X	X	3
Maternity Care Coalition	92		X	X		2
Philadelphia Public Health Department	93		X	X	X	3
Palmetto Health Alliance	94		X			1
South Carolina State office	95		X	X	X	3
Aberdeen Area Tribal Chairman's Health Board	96		X	X	X	3
Centerstone of Tennessee, Inc.	97	X	X	X	X	4
BCFS Health and Human Services	98	X	X	X	X	4
Dallas County Hospital District	99					0
San Antonio City Department of Finance	100		X	X	X	3
University of North Texas Health Science Center At Fort Worth	101		X	X	X	3
Richmond Healthy Start Initiative	102					0
Virginia State Department of Health	103		X	X	X	3
Great Lakes Inter-Tribal Council Inc.	104	X	X	X	X	4
West Virginia University Rsch Corp	105		X	X	X	3
Total	**100**	**37**	**93**	**86**	**81**	**N/A**

A1 Table 2. Definitions of HSMED Analysis Measures

Measure	HSMED Reproductive Phase Questionnaire	Definition
Consent	Program administrative data	Categorical measure based on participant consent to study participation and have data used: No or yes.
Region	Program administrative data	Categorical measure based on HS program state recoded using U.S. Census categories of region: Northeast, Midwest, South, West, and U.S. Territories.
Woman's age	Demographics	Continuous measure self-reported by participants (based on date of birth) recoded into categories: less than 18, 18-24 years, 24-35 years, over 35 years, missing.
Child's age	Postpartum Parenting	Continuous measure self-reported by participants (based on child's date of birth) recoded as age in months (for sample inclusion criterion) and age in weeks (in order to construct child-wellness visit according to AAP guidelines). Sample inclusion criteria restricts sample to children ages 0 to 6 months for postpartum analyses and children between 6 months and 24 months for parenting analyses.
Woman's race	Demographics	Select all that apply survey item based on self-reported race recoded into categorical measure: Black, white, other race or more than one race, missing (includes don't know and declined to answer).
Woman's ethnicity	Demographics	Select all that apply survey item based on self-reported Ethnicity recoded into categories: No, yes, missing (includes don't know and declined to answer).
Woman's educational attainment	Demographics	Categorical measure based on self-reported highest level of completed education reported as: Less than high school, high school or GED, some college, college, more than college, missing (includes don't know and declined to answer).
Language other than English spoken at home	Demographics	Categorical measure based on self-reported response to whether or not participant speaks a language other than English at home: Yes, no, missing (includes don't know and declined to answer).
Household income[1,2]	Preconception Prenatal Postpartum Parenting	Categorical measure based on self-reported combined yearly household income from all sources before taxes: less than $10,000; $10,000-$14,999; $15,000-$19,999; $20,000-$24,999; $25,000-$34,999; 35,000-$49,999; $50,000 or more; missing (includes don't know and declined to answer).
Federal Poverty Level	Preconception Prenatal Postpartum Parenting	Categorical measure constructed using two survey items on self-reported yearly household income and number of dependents in household, recoded using 2017 U.S. Census Bureau FPLs coded as: Above FPL, below FPL, missing (includes don't know or declined to answer on either item).
Woman's health insurance*	Preconception Prenatal Postpartum Parenting	Select all that apply survey item based on self-reported types of health care coverage recoded into categories: No, yes, missing (includes don't know and declined to answer). Indian health insurance recoded as "No."
Child's health insurance*	Postpartum Parenting	Select all that apply survey item based on self-reported types of health care coverage for child recoded into categories: No, yes, missing (includes don't know and declined to answer). Indian Health insurance recoded as "No."
Usual source of care*	Preconception Prenatal Postpartum Parenting	Categorical measure based on whether participant has a usual source of care when sick or in need of advice about health recoded as: No, yes (includes having more place), missing (includes don't know and declined to answer).

Measure	HSMED Reproductive Phase Questionnaire	Definition
Child's usual source of care*	Postpartum Parenting	Categorical measure based on whether child has a usual source of care when sick or in need of advice about health recoded as: No, yes (includes having more place), missing (includes don't know and declined to answer).
Usual place of care	Preconception Prenatal Postpartum Parenting	Categorical measure based on participant self-reported usual place of care: Doctor's office, hospital or emergency room, hospital outpatient department, clinic or health center, retail store clinic or "Minute Clinic," school (nurse's office, athletic trainer's office), some other place, missing.
Child's usual place of care	Postpartum Parenting	Categorical measure based on participant self-reported usual place of care for child: Doctor's office, hospital or emergency room, hospital outpatient department, clinic or health center, retail store clinic or "Minute Clinic," school (nurse's office, athletic trainer's office), some other place, missing.
Woman's well visit*	Preconception Parenting	Categorical measure based on self-reported well visit with a health care worker for preventive medical care within the past 12 months recoded: No, yes, missing (includes don't know and declined to answer).
Prenatal visit (First)	Prenatal	Categorical measure based on self-reported weeks or months into pregnancy participant received first prenatal check recoded: No, yes, missing (includes don't know and declined to answer).
Postpartum visit*	Postpartum	Categorical measure based on self-reported postpartum visit for mother recoded within 4 to 6 weeks after birth: No, yes, missing (includes don't know and declined to answer).
Child's well visit*	Postpartum Parenting	Constructed measure based on self-reported child's date of birth, date of instrument administration, and date of child's last well visit with a health care worker for preventive medical care recoded into categories according to the AAP schedule: No, not on time; yes, on time; missing (includes don't know and declined to answer on any date).
Depression screening*	Preconception Prenatal Postpartum Parenting	Categorical measure based on whether or not participant was screened for depression by staff, recoded: No (no item from screener was answered), yes (at least 1 item or all items from screener was answered), missing.
Intimate partner violence screening*	Preconception Prenatal Postpartum Parenting	Categorical measure based on whether or not participant was screened for IPV by staff, recoded: No (no item from screener was answered), yes (at least 1 item or all items from screener was answered), missing.
Reproductive life plan*	Preconception Prenatal Postpartum Parenting	Constructed measure based on participant plans to have children or not, recoded into categories: Yes, no, missing (includes don't know, not applicable, and declined to answer).
Cigarette use during pregnancy*	Prenatal Postpartum	Categorical measure based on self-reported use of cigarettes during pregnancy, recoded: No, yes, missing (includes don't know and declined to answer). Postpartum measure references cigarette use during last 3 months of pregnancy.
Alcohol use	Preconception Prenatal Postpartum Parenting	Categorical measure based on self-reported consumption of 4 or more alcohol drinks/day, recoded: Never, once or twice monthly, weekly, daily or almost daily, missing (includes declined to answer).

Measure	HSMED Reproductive Phase Questionnaire	Definition
Ever breastfeed*	Postpartum Parenting	Categorical measure based on self-reported breastfeeding of baby after delivery (directly or with a pump) for any period of time, recoded: No, yes, missing (includes don't know and declined to answer).
Breastfeed at 6 months*	Parenting	Categorical measure based on self-reported breastfeeding of baby at 6 months old, recoded: No, yes, missing (includes don't know and declined to answer).
Partner's/child's father's involvement during pregnancy*	Prenatal	Categorical measure based on self-reported partner's/child's father's involvement during pregnancy recoded as: Yes, no, missing (includes don't know, declined to answer, not applicable).
Partner's/child's father's involvement with child*	Postpartum Parenting	Categorical measures based on self-reported partner's/child's father's involvement: Yes, no, missing (includes don't know, declined to answer, not applicable).
Reading to child >3 days a week*	Parenting	Categorical measure for self-reported activity of reading to child 3 or more times a week, recoded: No (less than 3 days/week), yes (3 or more days/week), not applicable (child younger than 6 months or older than 23 months), missing (includes don't know and declined to answer).
Infant safe sleep practices*	Postpartum Parenting	Constructed measure based on participant's self-report baby sleep position and whether or not baby slept alone in crib/bed in the past 2 weeks recoded as categorical measure: No (includes slept on side and on stomach), yes (includes on back), not applicable (baby over 12 months in age), missing (includes don't know and declined to answer on either item).
Interpregnancy interval (IPI)	Postpartum[3]	Constructed measure using the interconception/parenting and postpartum questionnaire. Participants enrolled in HS prior to the study period were identified using the interconception/parenting questionnaire. We then used the postpartum questionnaire to identify which HS women had a birth within the designated study period. We used child date of birth and gestational age at time of birth from the postpartum questionnaire and last live birth from the interconception/parenting question to construct the IPI: Date of conception = Date of birth minus clinical gestational age; IPI = Date of conception (current birth) minus date of last live birth

*Indicates HS program performance measure.

[1]Household income included in addition to poverty status due to the amount of missing data on both household income and number of dependents in household, both needed for FPL calculation.

[2]Rather than a continuous measure, household income was collected using categories that do not align to FPL designations. We used the PRAMS guidance which uses the mid-point of the income categories aligned to FPL designations for the specified year based on income and household dependents. However, this constructed poverty measure most likely underreports participant poverty status. We recommend collecting income as a continuous measure in the future in order to best construct FPLs.

[3]We also intended to calculate IPI for HS women in the prenatal phase. However, this would require us to calculate an estimated conception date from the estimated due date from the prenatal questionnaire, which is not common practice in the literature on these calculations. We discussed these limitations with the HRSA MCHB DHSPS COR, who agreed. Therefore, we aligned the IPI metric, and associated analyses, with actual date of birth and gestational age from the postpartum questionnaire.

Appendix Two

Preconception

A2 Table 1. Characteristics of Preconception HS Women and Selected Outcomes Using the HSMED

	Has Usual Source of Care	Has Health Insurance	Well-Woman Visit	Screened for IPV	Has Reproductive Life Plan
Region (ref: Northeast)					
Midwest	0.44	-	1.73	0.01*	0.71
	(0.15)		(0.91)	(0.01)	(0.21)
South	0.32*	0.03*	0.94	0.08*	6.17*
	(0.11)	(0.01)	(0.28)	(0.06)	(2.35)
West	2.10	0.31	7.02	0.12*	3.48
	(1.90)	(0.29)	(8.60)	(0.08)	(2.61)
Poverty status (ref: Above FPL)					
Below FPL	1.13	0.92	1.80	0.33	0.49
	(0.45)	(0.29)	(0.68)	(0.17)	(0.33)
Missing	0.72	3.52	0.64	0.10*	0.56
	(0.35)	(2.90)	(0.45)	(0.07)	(0.14)
Educational attainment (ref: Less than high school)					
High school or GED	0.98	0.64	0.70	0.92	0.95
	(0.14)	(0.25)	(0.11)	(0.05)	(0.10)
Some college/ vocational school	0.94	0.34	0.85	0.87*	0.99
	(0.42)	(0.22)	(0.16)	(0.04)	(0.08)
College or more	1.19	0.37	0.92	1.12	1.15
	(0.52)	(0.23)	(0.53)	(0.12)	(0.14)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)					
Hispanic/Latina	1.03	0.85	5.04*	1.12	1.10
	(0.29)	(0.69)	(2.66)	(0.09)	(0.11)
Race (ref: Black or African-American)					
White	1.41*	1.46	0.61	0.92	0.92
	(0.15)	(1.08)	(0.23)	(0.08)	(0.09)
Other/more than one race	1.47	-	0.59	1.02	0.86
	(0.22)		(0.33)	(0.07)	(0.22)
Other language than English spoken at home (ref: No)					
Yes	0.28*	0.27*	0.71	0.29*	0.83
	(0.12)	(0.11)	(0.18)	(0.11)	(0.23)
Age	0.99	0.91*	0.98	1.01*	1.00
	(0.02)	(0.03)	(0.01)	(0.00)	(0.01)
Constant	30.40*	1,559.00*	8.38*	1,205.00*	4.62*
	(22.20)	(1,239.00)	(4.48)	(944.90)	(1.10)
Observations	1,088	421	484	1,511	1,314
Clusters	31	22	32	35	31

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.01 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).
- Indicates the omission of level due to low cell count.

Prenatal

A2 Table 2. Characteristics of Prenatal HS Women and Selected Outcomes Using the HSMED

	Has Usual Source of Care	Has Health Insurance	Screened for IPV	Has Reproductive Life Plan	Tobacco Use During Pregnancy	Father Has Role During Pregnancy
Region (ref: Northeast)						
Midwest	1.52	1.44	0.22	0.74	1.14	1.91
	(0.49)	(0.72)	(0.22)	(0.51)	(0.30)	(0.90)
South	1.75	2.24	1.47	1.24	0.90	2.14
	(0.52)	(1.13)	(0.93)	(0.55)	(0.24)	(0.93)
West	2.08	2.41	0.38	2.97	0.82	1.49
	(0.76)	(1.70)	(0.34)	(1.55)	(0.29)	(0.61)
Poverty status (ref: Above FPL)						
Below FPL	0.83	0.80	1.42	1.08	1.91*	0.58*
	(0.08)	(0.13)	(0.34)	(0.16)	(0.13)	(0.06)
Missing	1.87*	0.90	0.05*	0.67	1.67*	1.00
	(0.36)	(0.20)	(0.03)	(0.47)	(0.19)	(0.19)
Educational attainment (ref: Less than high school)						
High school or GED	1.00	0.97	1.04	0.88	0.62*	1.18
	(0.09)	(0.13)	(0.15)	(0.25)	(0.05)	(0.11)
Some college/ vocational school	1.03	1.40	1.03	0.99	0.45*	1.44*
	(0.13)	(0.35)	(0.21)	(0.30)	(0.04)	(0.19)
College or more	0.74	0.84	1.08	0.95	0.30*	1.63*
	(0.14)	(0.26)	(0.23)	(0.36)	(0.04)	(0.28)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)						
Hispanic/Latina	1.11	0.59	0.77	3.43*	0.42*	1.50
	(0.28)	(0.18)	(0.15)	(1.20)	(0.09)	(0.39)
Race (ref: Black or African-American)						
White	0.80	0.84	0.45*	0.46*	3.70*	1.08
	(0.11)	(0.15)	(0.10)	(0.13)	(0.40)	(0.18)
Other/more than one race	0.90	1.14	1.39	0.15*	2.01*	1.69
	(0.19)	(0.45)	(0.86)	(0.08)	(0.25)	(0.55)
Other language than English spoken at home (ref: No)						
Yes	0.60	0.22*	2.04	0.50	0.20*	1.34
	(0.14)	(0.06)	(0.67)	(0.27)	(0.04)	(0.30)
Age	1.01	0.98*	0.97*	0.99	1.08*	1.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	7.12*	55.67*	192.50*	43.65*	0.02*	7.18*
	(1.82)	(30.06)	(183.70)	(21.57)	(0.01)	(3.21)
Observations	13,117	10,658	14,194	10,957	13,416	13,985
Clusters	91	71	92	90	90	91

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0083 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99.17% confidence level (*p<0.0083).

Postpartum

A2 Table 3A. Characteristics of Postpartum HS Mothers and Selected Outcomes Using the HSMED (1 of 2)

	Mother Has Usual Source of Care	Mother Has Health Insurance	Mother Had Postpartum Visit	Child Has Usual Source of Care	Child Has Health Insurance	Child Well Visit On-time
Region (ref: Northeast)						
Midwest	0.82	0.84	0.71	1.05	0.27	1.26
	(0.31)	(0.74)	(0.23)	(0.48)	(0.14)	(0.30)
South	0.90	0.58	0.94	1.36	1.56	1.13
	(0.33)	(0.41)	(0.29)	(0.55)	(0.80)	(0.26)
West	1.39	1.22	1.51	1.28	3.40	0.68
	(0.69)	(1.11)	(0.59)	(0.55)	(2.03)	(0.24)
Poverty status (ref: Above FPL)						
Below FPL	0.83	0.74	0.73*	1.32	0.85	1.10
	(0.12)	(0.13)	(0.06)	(0.35)	(0.15)	(0.12)
Missing	1.10	0.81	1.09	0.58	1.22	0.89
	(0.27)	(0.31)	(0.17)	(0.16)	(0.54)	(0.16)
Educational attainment (ref: Less than high school)						
High school or GED	0.92	1.18	1.11	1.12	1.63	0.90
	(0.13)	(0.17)	(0.08)	(0.24)	(0.32)	(0.10)
Some college/vocational school	0.94	1.70	1.26	1.48	1.41	0.85
	(0.14)	(0.45)	(0.10)	(0.47)	(0.30)	(0.10)
College or more	0.72	0.85	1.32	1.15	0.96	0.89
	(0.15)	(0.25)	(0.17)	(0.46)	(0.34)	(0.16)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)						
Hispanic/Latina	0.96	0.51	1.27	0.95	2.02	0.60
	(0.35)	(0.17)	(0.23)	(0.36)	(1.04)	(0.12)
Race (ref: Black or African-American)						
White	0.63	0.53	1.28	1.73	0.62	0.95
	(0.15)	(0.13)	(0.19)	(0.54)	(0.16)	(0.16)
Other/more than one race	1.09	0.54	1.59	2.53	0.72	0.57
	(0.26)	(0.17)	(0.37)	(1.27)	(0.25)	(0.12)
Other language than English spoken at home (ref: No)						
Yes	0.79	0.19*	1.12	1.27	0.20*	1.16
	(0.20)	(0.04)	(0.12)	(0.40)	(0.07)	(0.14)
Mother's age	1.01	0.96*	1.00	1.00	0.99	1.00
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Child's age	0.91	0.91	2.29*	1.02	1.05	1.24*
	(0.04)	(0.09	(0.17	(0.07)	(0.10)	(0.08)
Constant	27.24*	294.90*	0.26*	33.83*	120.50*	7.51*
	(11.22)	(216.80)	(0.09)	(22.62)	(85.34)	(2.57)
Observations	6,688	5,373	6,560	6,721	6,797	5,967
Clusters	83	66	82	83	83	81

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99.62% confidence level (*$p < 0.0038$) confidence level.

A2 Table 3B. Characteristics of Postpartum Healthy Start Participants and Selected Outcomes Using the HSMED (2 of 2)

	Mother Screened for IPV	Mother Has Reproductive Life Plan	Mother Ever Breastfed	Tobacco Use During Pregnancy	Safe Sleep	Father Has Role with Child	IPI <18 Months
Region (ref: Northeast)							
Midwest	2.44	0.68	0.75	1.73	0.92	0.95	1.84
	(1.99)	(0.25)	(0.13)	(0.51)	(0.26)	(0.43)	(0.64)
South	1.52	1.10	0.54*	1.61	0.51	1.39	1.62
	(1.27)	(0.38)	(0.11)	(0.55)	(0.15)	(0.66)	(0.57)
West	0.48	1.30	1.28	0.92	0.32*	0.86	2.31
	(0.49)	(0.48)	(0.37)	(0.23)	(0.09)	(0.43)	(1.15)
Poverty status (ref: Above FPL)							
Below FPL	0.88	1.11	0.77*	1.62*	0.97	0.32*	0.82
	(0.24)	(0.11)	(0.05)	(0.26)	(0.08)	(0.07)	(0.14)
Missing	0.06*	0.53	0.60*	2.30	0.90	0.87	0.52
	(0.02)	(0.13)	(0.08)	(0.72)	(0.14)	(0.31)	(0.18)
Educational attainment (ref: Less than high school)							
High school or GED	1.11	0.84	1.19	0.68*	1.02	1.44	0.86
	(0.27)	(0.08)	(0.09)	(0.09)	(0.09)	(0.24)	(0.15)
Some college/ vocational school	0.90	0.76	2.10*	0.50*	1.08	1.24	0.83
	(0.25)	(0.09)	(0.19)	(0.06)	(0.09)	(0.22)	(0.17)
College or more	1.84	0.77	3.18*	0.33*	1.11	1.70	0.73
	(0.63)	(0.11)	(0.46)	(0.08)	(0.16)	(0.46)	(0.24)
Hispanic/Latina Ethnicity (ref: Non-Hispanic/Latina)							
Hispanic/Latina	0.70	1.77	1.09	0.33*	0.64	2.02	0.48
	(0.23)	(0.34)	(0.22)	(0.08)	(0.11)	(0.69)	(0.17)
Race (ref: Black or African-American)							
White	0.59	0.74	1.15	2.74*	1.88*	1.26	0.93
	(0.15)	(0.12)	(0.17)	(0.86)	(0.33)	(0.31)	(0.17)
Other/more than one race	0.70	0.56	1.46	2.88	1.55	1.73	0.76
	(0.34)	(0.19)	(0.36)	(1.13)	(0.32)	(0.70)	(0.28)
Other language than English spoken at home (ref: No)							
Yes	1.36	0.60	3.36*	0.20*	1.28	1.33	1.54
	(0.32)	(0.11)	(0.60)	(0.07)	(0.21)	(0.38)	(0.47)
Mother's age	1.00	1.01	0.98*	1.08*	1.01	1.00	0.90*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Child's age	1.01	1.00	0.95	0.99	0.87*	1.06	1.07
	(0.11)	(0.04)	(0.03)	(0.05)	(0.03)	(0.07)	(0.07)
Constant	69.01*	5.86*	5.38*	0.01*	4.17*	14.33*	4.11*
	(63.62)	(2.40)	(1.25)	(0.01)	(1.19)	(7.48)	(2.45)
Observations	7,040	6,669	7,040	6,710	6,599	4,125	1,063
Clusters	83	83	83	83	82	64	66

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99.62% confidence level (*$p < 0.0038$) confidence level.

Interconception/Parenting

A2 Table 4A. Characteristics of Interconception/Parenting HS Mothers and Selected Outcomes Using the HSMED (1 of 2)

	Mother Has Usual Source of Care	Mother Has Health Insurance	Mother Had Well Visit	Child Has Usual Source of Care	Child Has Health Insurance	Child Well Visit On-time
Region (ref: Northeast)						
Midwest	1.71	0.74	0.94	0.96	1.25	1.98
	(1.04)	(0.61)	(0.40)	(0.64)	(0.68)	(0.54)
South	1.58	0.56	0.80	1.38	1.81	1.30
	(0.79)	(0.34)	(0.21)	(0.89)	(1.20)	(0.31)
West	1.59	1.64	0.89	0.73	2.50	1.30
	(0.89)	(1.14)	(0.29)	(0.49)	(2.17)	(0.33)
Poverty status (ref: Above FPL)						
Below FPL	0.86	1.24	0.87	0.52	1.05	0.86
	(0.21)	(0.22)	(0.13)	(0.22)	(0.45)	(0.12)
Missing	2.11	2.44	1.60	0.44	1.15	0.64
	(1.19)	(1.32)	(0.49)	(0.23)	(0.81)	(0.13)
Educational attainment (ref: Less than high school)						
High school or GED	1.18	0.82	1.28	1.46	0.71	0.81*
	(0.28)	(0.15)	(0.20)	(0.60)	(0.41)	(0.11)
Some college/ vocational school	0.83	0.99	1.43	0.89	0.38	0.68
	(0.21)	(0.36)	(0.34)	(0.47)	(0.21)	(0.09)
College or more	1.07	1.14	1.38	0.56	0.17*	0.83
	(0.45)	(0.41)	(0.48)	(0.38)	(0.09)	(0.18)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)						
Hispanic/Latina	1.09	0.94	1.71	1.83	2.14	0.94
	(0.40)	(0.40)	(0.65)	(1.29)	(1.53)	(0.27)
Race (ref: Black or African-American)						
White	0.80	0.43	0.66	1.14	0.35	0.75
	(0.21)	(0.14)	(0.13)	(0.56)	(0.13)	(0.12)
Other/more than one race	0.67	0.96	0.48*	0.66	0.24	0.73
	(0.24)	(0.38)	(0.10)	(0.42)	(0.21)	(0.18)
Other language than English spoken at home (ref: No)						
Yes	0.75	0.26*	0.69	1.11	0.69	1.30
	(0.34)	(0.12)	(0.27)	(0.59)	(0.35)	(0.33)
Mother's age	1.00	0.97	1.02	1.08	1.03	1.02
	(0.02)	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)
Child's age	1.00	1.03	0.92*	0.91	0.96	0.94
	(0.03)	(0.04)	(0.03)	(0.06)	(0.06)	(0.02)
Constant	11.89	49.89*	10.85*	31.99	118.40	3.85*
	(10.22)	(33.23)	(5.48)	(44.39)	(205.80)	(1.65)
Observations	2,178	1,531	2,109	2,307	2,206	2,101
Clusters	78	57	76	77	77	76

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99.62% confidence level (*$p < 0.0038$) confidence level.

A2 Table 4B. Characteristics of Interconception/Parenting HS Mothers and Selected Outcomes Using the HSMED (2 of 2)

	Mother Screened for IPV	Mother Has Reproductive Life Plan	Mother Ever Breastfed	Breastfed at Six Months	Safe Sleep	Father Has Role with Child	Read to Child 3+ times/week
Region (ref: Northeast)							
Midwest	3.08	0.76	1.45	1.15	1.60	0.65	1.10
	(2.42)	(0.24)	(0.44)	(0.37)	(0.67)	(0.21)	(0.38)
South	1.68	1.63	0.82	0.44	0.76	1.21	1.08
	(1.21)	(0.55)	(0.25)	(0.13)	(0.30)	(0.43)	(0.37)
West	1.30	1.30	2.41	1.69	0.62	1.39	0.76
	(1.01)	(0.39)	(0.90)	(0.73)	(0.33)	(0.62)	(0.30)
Poverty status (ref: Above FPL)							
Below FPL	1.97	1.17	0.87	0.87	0.94	0.74	1.04
	(0.66)	(0.25)	(0.11)	(0.11)	(0.15)	(0.15)	(0.15)
Missing	0.03*	0.58	0.53	0.49	0.90	0.75	0.86
	(0.01)	(0.19)	(0.14)	(0.15)	(0.22)	(0.22)	(0.21)
Educational attainment (ref: Less than high school)							
High school or GED	1.05	1.11	1.44*	1.54	1.13	1.00	1.33
	(0.20)	(0.22)	(0.14)	(0.27)	(0.15)	(0.19)	(0.21)
Some college/ vocational school	1.22	1.12	2.91*	1.67	0.95	0.98	1.38
	(0.30)	(0.21)	(0.45)	(0.41)	(0.17)	(0.22)	(0.24)
College or more	0.52	0.97	2.89*	2.66*	0.78	0.85	1.78
	(0.21)	(0.27)	(0.65)	(0.86)	(0.18)	(0.26)	(0.40)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)							
Hispanic/ Latina	0.41	1.09	0.77	0.99	0.75	0.82	1.34
	(0.17)	(0.37)	(0.19)	(0.32)	(0.22)	(0.29)	(0.31)
Race (ref: Black or African-American)							
White	1.05	0.73	1.47	0.98	2.00*	1.57	0.99
	(0.37)	(0.13)	(0.29)	(0.23)	(0.43)	(0.43)	(0.19)
Other/more than one race	1.13	0.88	1.35	1.20	1.49	0.98	0.98
	(0.48)	(0.26)	(0.30)	(0.34)	(0.39)	(0.44)	(0.26)
Other language than English spoken at home (ref: No)							
Yes	2.22	1.05	4.46*	2.52*	1.05	1.48	0.94
	(0.85)	(0.20)	(1.19)	(0.59)	(0.21)	(0.51)	(0.16)
Mother's age	0.99	1.01	0.99	1.02	1.02	0.99	1.01
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Child's age	0.92	0.97	1.00	1.16*	0.88	0.98	0.98
	(0.03)	(0.03)	(0.02)	(0.03)	(0.05)	(0.03)	(0.02)
Constant	51.45*	5.22	1.85	0.02*	2.56	11.5*	1.67
	(41.42)	(3.43)	(0.57)	(0.01)	(1.66)	(7.15)	(0.79)
Observations	2,419	2,116	2,405	1,906	1,661	1,346	2,187
Clusters	79	78	79	78	60	57	77

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99.62% confidence level (*$p < 0.0038$) confidence level.

Supplemental Analyses

VRO – HS Women

A2 Table 5. Maternal Descriptive Statistics of VRO HS Women

	HS Women	
	N	%
Age		
Under 18 years old	434	5.5
18 to 24 years old	3,216	40.5
25 to 34 years old	3,526	44.5
35 years or older	757	9.5
Race		
Black or African-American	4,935	62.2
White	1,734	21.9
Other/more than one race	1,264	15.9
Hispanic/Latina ethnicity		
No	6,546	82.5
Yes	1,387	17.5
Educational attainment		
Less than high school	1,573	19.8
High school graduate or GED	2,192	27.6
Some college or Associate degree	1,650	20.8
Bachelor's degree or higher	379	4.8
Unknown/missing	2,139	27.0
Marital status		
Not married	6,209	78.3
Married	1,404	17.7
Unknown/missing	320	4.0
Health care coverage at delivery (recoded)		
Medicaid or other government funded insurance	6,602	83.2
Private insurance, including TRICARE	1,036	13.1
Self-pay, Indian, other, unknown	295	3.7
Receipt of WIC during pregnancy		
No	1,631	20.6
Yes	6,228	78.5
Unknown/missing	74	0.9

A2 Table 6. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using VRO

	Had Health Insurance	Tobacco Use During Pregnancy	Breastfeeding at time of report	Maternal Morbidity	Infant Death
Region (ref: Northeast)					
Midwest	1.90	1.19	0.22*	0.91	1.02
	(0.62)	(0.41)	(0.08)	(0.73)	(0.42)
South	1.41	0.86	0.33*	1.67	0.72
	(0.45)	(0.34)	(0.10)	(1.04)	(0.33)
West	0.80	0.83	1.20	8.78	-
	(0.31)	(0.38)	(0.60)	(6.32)	
Receipt of WIC during pregnancy (ref: No)					
Yes	2.03*	1.07	1.19	1.19	0.41
	(0.37)	(0.11)	(0.09)	(0.34)	(0.12)
Unknown/missing	0.54	1.28	1.10	0.61	3.98
	(0.31)	(0.45)	(0.37)	(0.58)	(2.57)
Educational attainment (ref: Less than high school)					
High school or GED	1.12	0.70*	1.38*	0.56	0.64
	(0.29)	(0.07)	(0.13)	(0.20)	(0.28)
Some college/vocational school	1.27	0.52*	2.20*	0.79	0.64
	(0.40)	(0.08)	(0.25)	(0.38)	(0.30)
College or more	0.88	0.14*	3.66*	1.01	-
	(0.32)	(0.04)	(0.72)	(0.45)	
Unknown/missing	0.70	0.90	0.72	1.87	0.75
	(0.24)	(0.17)	(0.25)	(1.50)	(0.33)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)					
Hispanic/Latina	0.34*	0.30	1.18	0.61	1.05
	(0.10)	(0.16)	(0.25)	(0.27)	(0.43)
Race (ref: Black or African-American)					
White	0.76	3.50*	1.23	1.43	0.95
	(0.20)	(0.67)	(0.17)	(0.64)	(0.35)
Other/more than one race	0.64	1.91	2.17*	1.44	0.63
	(0.16)	(0.43)	(0.37)	(1.35)	(0.32)
Marital status (ref: Not married)					
Married	0.90	0.41*	1.62	0.81	0.95
	(0.16)	(0.06)	(0.14)	(0.20)	(0.36)
Unknown/missing	4.80	0.08*	-	8.76	-
	(2.60)	(0.06)		(10.76)	
Maternal age	0.99	1.07*	0.99*	0.98	1.01
	(0.02)	(0.01)	(0.01)	(0.02)	(0.04)
Constant	36.86*	0.03*	3.40*	0.03*	0.01*
	(21.19)	(0.01)	(1.23)	(0.02)	(0.01)
Observations	7,849	7,302	7,499	7,228	6,874
Clusters	71	67	66	60	61

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

- Indicates the omission of level due to low cell count.

A2 Table 7. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using VRO

	Had Hypertension	Had Gestational Diabetes	No Preterm Birth Outcome	Had Low Birth Weight
Region (ref: Northeast)				
Midwest	1.25	1.40	0.63*	1.23
	(0.32)	(0.20)	(0.07)	(0.15)
South	1.26	1.03	0.64*	1.40
	(0.31)	(0.19)	(0.07)	(0.18)
West	1.14	1.81	0.60	1.57
	(0.34)	(0.71)	(0.14)	(0.28)
Receipt of WIC during pregnancy (ref: No)				
Yes	1.22	1.15	1.28	0.85
	(0.13)	(0.15)	(0.12)	(0.07)
Unknown/missing	0.87	0.49	1.02	1.06
	(0.34)	(0.37)	(0.39)	(0.33)
Educational attainment (ref: Less than high school)				
High school or GED	0.83	1.08	1.25	0.81
	(0.10)	(0.14)	(0.12)	(0.09)
Some college/vocational school	1.05	1.05	1.30*	0.77
	(0.12)	(0.18)	(0.11)	(0.09)
College or more	0.70	0.84	1.58	0.63
	(0.12)	(0.16)	(0.27)	(0.16)
Unknown/missing	0.68	0.80	1.37*	0.85
	(0.16)	(0.15)	(0.14)	(0.11)
Ethnicity (ref: Non-Hispanic/Latina)				
Hispanic/Latina	0.91	1.29	1.02	0.83
	(0.12)	(0.20)	(0.09)	(0.11)
Race (ref: Black or African-American)				
White	0.70	1.04	1.45	0.53*
	(0.08)	(0.20)	(0.19)	(0.07)
Other/more than one race	0.61	1.01	1.31	0.61*
	(0.13)	(0.19)	(0.15)	(0.07)
Marital status (ref: Not married)				
Married	0.96	1.60*	1.05	0.87
	(0.08)	(0.16)	(0.10)	(0.09)
Unknown/missing	0.74	0.64	1.40	0.56
	(0.22)	(0.26)	(0.40)	(0.24)
Maternal age	1.06*	1.09*	0.96*	1.02*
	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.03*	0.00*	20.11*	0.09*
	(0.01)	(0.00)	(4.19)	(0.02)
Observations	7,847	7,847	7,848	7,932
Clusters	71	71	70	71

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

A2 Table 8. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using VRO

	First Prenatal Care Visit	Weight Gain During Pregnancy	Total Prenatal Care Visits
Region (ref: Northeast)			
Midwest	-0.34	-6.90	-0.06
	(0.65)	(3.00)	(0.05)
South	-1.63	-0.20	0.03
	(0.72)	(2.25)	(0.06)
West	-1.93	4.71	0.06
	(0.80)	(3.38)	(0.05)
Receipt of WIC during pregnancy (ref: No)			
Yes	-1.38*	0.55	0.10*
	(0.26)	(0.62)	(0.02)
Unknown/missing	-0.57	-5.16	0.03
	(0.97)	(2.21)	(0.06)
Educational attainment (ref: Less than high school)			
High school or GED	-0.88*	-0.63	0.06
	(0.28)	(0.61)	(0.02)
Some college/vocational school	-1.58*	1.05	0.13*
	(0.33)	(0.96)	(0.03)
College or more	-0.66	-0.84	0.07
	(0.47)	(1.04)	(0.04)
Unknown/missing	-0.60	-10.69*	0.11
	(0.52)	(3.36)	(0.05)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)			
Hispanic/Latina	0.50	-2.33	-0.03
	(0.36)	(1.22)	(0.03)
Race (ref: Black or African-American)			
White	-0.41	0.18	0.07*
	(0.34)	(1.20)	(0.02)
Other/more than one race	0.25	1.18	-0.03
	(0.68)	(1.78)	(0.04)
Marital status (ref: Not married)			
Married	0.05	-1.64	0.07*
	(0.29)	(0.64)	(0.01)
Unknown/missing	-1.60	-5.78	0.10
	(0.76)	(3.53)	(0.06)
Maternal age	-0.05	-0.14*	0.00*
	(0.02)	(0.044)	(0.00)
Constant	16.82*	33.93*	2.12*
	(0.85)	(2.54)	(0.06)
Observations	6,965	7,444	7,754
Clusters	70	71	71

Parameters expressed as regression coefficients.

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0038 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

PRAMS – HS Women

A2 Table 9. Maternal Descriptive Statistics of 2017 and 2018 PRAMS HS Women

	HS Women	
	N	%
Age		
Under 18 years old	19	2.9
18 to 24 years old	270	40.9
25 to 34 years old	309	46.8
35 years or older	63	9.5
Race		
Black or African-American	394	59.6
White	175	26.5
Other/more than one race	92	13.9
Hispanic/Latina ethnicity		
No	564	85.3
Yes	97	14.7
Educational attainment		
Less than high school	124	18.8
High school graduate or GED	241	36.5
Some college or Associate degree	192	29.1
Bachelor's degree or higher	33	5.0
Unknown/missing	71	10.7
Marital status		
Not married	533	80.6
Married	128	19.4
Health care coverage at delivery (recoded)		
Medicaid or other government funded insurance	502	76.0
Private insurance, including TRICARE	91	13.8
Self-pay, Indian, other, unknown	68	10.3
Receipt of WIC during pregnancy		
No	83	12.6
Yes	568	85.9
Unknown/missing	10	1.5
Poverty status		
Above FPL	209	31.6
Below FPL	361	54.6
Unknown/missing	91	13.8

A2 Table 10. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using PRAMS

	Screened for IPV		Screened for Depression		
	Preconception	Prenatal	Preconception	Prenatal	Postpartum
Region (ref: Northeast)					
Midwest	0.87	0.96	0.91	0.72	0.83
	(0.23)	(0.33)	(0.19)	(0.27)	(0.19)
South	0.53*	0.39	0.61*	0.45	0.49
	(0.07)	(0.18)	(0.07)	(0.21)	(0.17)
West	1.51	0.69	1.75	0.94	2.14
	(0.53)	(0.24)	(0.31)	(0.42)	(1.21)
Poverty status (ref: Above FPL)					
Below FPL	0.90	0.56	0.96	0.55	0.91
	(0.13)	(0.16)	(0.15)	(0.15)	(0.23)
Missing	0.83	0.48	0.78	1.07	0.61
	(0.24)	(0.14)	(0.24)	(0.75)	(0.27)
Educational attainment (ref: Less than high school)					
High school or GED	1.30	1.12	1.15	1.41	1.44
	(0.22)	(0.21)	(0.27)	(0.43)	(0.38)
Some college/vocational school	1.56	1.65	1.24	1.67	2.30*
	(0.31)	(0.59)	(0.23)	(0.60)	(0.55)
College or more	1.44	1.09	1.03	0.70	1.71
	(0.54)	(0.31)	(0.33)	(0.19)	(0.70)
Unknown/missing	0.89	0.97	0.85	1.09	0.90
	(0.15)	(0.31)	(0.16)	(0.63)	(0.23)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)					
Hispanic/Latina	1.18	2.93	0.89	4.89	3.12
	(0.23)	(1.39)	(0.23)	(5.58)	(1.61)
Race (ref: Black or African-American)					
White	0.63	0.40	0.81	0.64	0.64
	(0.13)	(0.14)	(0.13)	(0.29)	(0.26)
Other/more than one race	0.72	0.48	1.14	1.25	0.91
	(0.19)	(0.19)	(0.27)	(0.42)	(0.30)
Marital status (ref: Not married)					
Married	1.27	0.67	1.07	0.49	1.12
	(0.25)	(0.19)	(0.11)	(0.15)	(0.28)
Maternal age	0.99	0.97	0.99	0.97	0.98
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Constant	1.00	39.59*	0.95	36.61*	5.68*
	(0.42)	(21.75)	(0.48)	(23.64)	(2.74)
Observations	648	646	650	644	639
Clusters	16	16	16	16	16

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0022 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

A2 Table 11. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using PRAMS

	Well Visit (Preconception)	Postpartum Visit	Has Health Insurance	Intended Pregnancy	IPI <18 Months
Region (ref: Northeast)					
Midwest	1.02	0.79	5.38	0.86	1.62
	(0.32)	(0.26)	(6.79)	(0.28)	(0.52)
South	0.87	1.15	1.06	0.60	1.27
	(0.23)	(0.20)	(0.66)	(0.15)	(0.22)
West	1.13	1.24	-	0.69	1.61
	(0.36)	(0.78)		(0.28)	(0.28)
Poverty status (ref: Above FPL)					
Below FPL	0.88	0.80	0.42	1.07	1.57
	(0.11)	(0.28)	(0.19)	(0.20)	(0.63)
Missing	0.68	0.62	0.25	1.57	1.91
	(0.21)	(0.34)	(0.18)	(0.51)	(0.57)
Educational attainment (ref: Less than high school)					
High school or GED	1.46	1.77	1.72	0.76	0.94
	(0.37)	(0.54)	(0.70)	(0.13)	(0.22)
Some college/vocational school	1.72	3.44*	5.90	0.63	0.86
	(0.49)	(1.22)	(4.90)	(0.16)	(0.28)
College or more	1.82	3.61	-	1.34	0.86
	(0.59)	(3.70)		(0.54)	(0.68)
Unknown/missing	1.11	1.10	3.48	0.66	0.80
	(0.28)	(0.28)	(2.34)	(0.15)	(0.22)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)					
Hispanic/Latina	0.80	2.12	0.17	0.59	0.58
	(0.22)	(0.94)	(0.20)	(0.22)	(0.21)
Race (ref: Black or African-American)					
White	1.10	0.63	0.63	1.20	1.21
	(0.21)	(0.29)	(0.49)	(0.28)	(0.25)
Other/more than one race	0.99	0.80	1.10	1.81	1.02
	(0.19)	(0.38)	(1.12)	(0.53)	(0.37)
Marital status (ref: Not married)					
Married	1.40	3.14	0.28*	2.09	1.17
	(0.31)	(1.20)	(0.11)	(0.51)	(0.46)
Maternal age	1.01	0.98	0.94	1.03	0.94
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Child age		1.00			
		(0.00)			
Constant	0.71	4.52	304.40*	0.68	1.51
	(0.35)	(3.16)	(275.20)	(0.37)	(0.92)
Observations	648	639	546	477	337
Clusters	16	16	13	15	14

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0022 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).
- Indicates the omission of level due to low cell count.

A2 Table 12. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using PRAMS

	Tobacco Use During Pregnancy	Ever Breastfed	Still Breastfeeding	Safe Sleep
Region (ref: Northeast)				
Midwest	0.63	0.80	0.99	1.08
	(0.18)	(0.42)	(0.35)	(0.34)
South	1.21	0.66	0.56	0.80
	(0.67)	(0.18)	(0.11)	(0.20)
West	0.63	1.20	1.67	0.41
	(0.21)	(0.44)	(0.66)	(0.27)
Poverty status (ref: Above FPL)				
Below FPL	2.93*	0.74	0.61	1.41
	(0.99)	(0.20)	(0.15)	(0.24)
Missing	1.98	0.61	0.60	1.84
	(0.86)	(0.23)	(0.16)	(0.51)
Educational attainment (ref: Less than high school)				
High school or GED	0.70	1.71	0.69	0.94
	(0.20)	(0.46)	(0.27)	(0.19)
Some college/vocational school	0.66	3.69*	1.34	1.13
	(0.26)	(0.87)	(0.48)	(0.17)
College or more	1.15	8.62*	2.09	0.84
	(0.70)	(5.71)	(1.06)	(0.38)
Unknown/missing	0.53	2.60*	1.09	1.02
	(0.16)	(0.53)	(0.42)	(0.25)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)				
Hispanic/Latina	0.06*	2.05*	1.19	1.17
	(0.04)	(0.46)	(0.35)	(0.31)
Race (ref: Black or African-American)				
White	6.69*	1.42	1.16	1.58
	(2.68)	(0.35)	(0.34)	(0.49)
Other/more than one race	2.12	1.85	1.22	1.48
	(1.34)	(0.77)	(0.26)	(0.42)
Marital status (ref: Not married)				
Married	0.52	1.22	1.88	1.63
	(0.30)	(0.29)	(0.40)	(0.31)
Maternal age	1.05	0.97*	1.03	0.99
	(0.03)	(0.01)	(0.03)	(0.01)
Child age			1.00	0.99
			(0.00)	(0.00)
Constant	0.02*	4.91*	0.48	1.34
	(0.02)	(1.92)	(0.52)	(0.80)
Observations	652	634	480	626
Clusters	16	16	14	16

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0022 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

A2 Table 13. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using PRAMS

	Had Hypertension	Has Gestational Diabetes	No Preterm Birth Outcome	Had Low Birth Weight	Adequate/Adequate Plus on Kotelchuck Index	Maternal Morbidity
Region (ref: Northeast)						
Midwest	0.88	1.40	0.45	7.07	1.27	-
	(0.46)	(0.98)	(0.23)	(5.45)	(0.53)	
South	1.02	1.38	0.47	5.49	0.63	1.71
	(0.44)	(0.97)	(0.22)	(4.28)	(0.18)	(1.56)
West	0.71	1.60	0.74	4.76	2.10	-
	(0.91)	(1.32)	(0.33)	(4.53)	(0.72)	
Poverty status (ref: Above FPL)						
Below FPL	0.92	1.86	0.51	1.28	0.62	1.90
	(0.16)	(0.50)	(0.18)	(0.31)	(0.13)	(1.28)
Missing	0.85	1.07	1.09	0.85	0.46	6.05*
	(0.19)	(0.86)	(0.65)	(0.56)	(0.12)	(1.26)
Educational attainment (ref: Less than high school)						
High school or GED	1.18	1.55	1.18	0.69	0.99	0.71
	(0.45)	(1.15)	(0.89)	(0.23)	(0.19)	(0.99)
Some college/ vocational school	1.89	1.71	0.94	0.36	0.87	0.79
	(0.80)	(0.81)	(0.53)	(0.14)	(0.18)	(0.23)
College or more	1.27	1.93	3.45	-	0.83	-
	(1.08)	(1.80)	(1.35)		(0.58)	
Unknown/missing	0.77	1.49	0.79	1.74	1.17	6.38*
	(0.30)	(1.83)	(0.67)	(1.49)	(0.40)	(3.32)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)						
Hispanic/Latina	1.02	0.36	7.96	0.42	1.13	1.72
	(0.65)	(0.30)	(5.58)	(0.28)	(0.35)	(0.55)
Race (ref: Black or African-American)						
White	0.51	1.12	1.07	0.86	0.54	0.37
	(0.23)	(0.43)	(0.18)	(0.44)	(0.14)	(0.19)
Other/more than one race	0.49	3.84	0.56	0.56	0.82	0.67
	(0.22)	(1.67)	(0.17)	(0.45)	(0.44)	(0.12)
Marital status (ref: Not married)						
Married	1.84	1.04	1.14	0.63	0.93	1.01
	(0.58)	(0.46)	(0.58)	(0.20)	(0.29)	(0.72)
Maternal age	1.07*	1.14*	0.96	1.05	1.05	1.13
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.06)
Constant	0.02*	0.00*	83.48*	0.01	2.00	0.00*
	(0.02)	(0.00)	(82.22)	(0.02)	(1.17)	(0.00)
Observations	620	624	660	628	645	468
Clusters	15	15	16	16	16	9

Parameters expressed as odds ratios (OR).

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0022 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

- Indicates the omission of level due to low cell count.

A2 Table 14. Multivariable Analysis of HS Women Characteristics on Maternal and Infant Outcomes Using PRAMS

	First Prenatal Care Visit	Weight Gain During Pregnancy	Total Prenatal Care Visits
Region (ref: Northeast)			
Midwest	0.66	-6.61	-0.14*
	(0.75)	(1.97)	(0.04)
South	0.07	-3.47	0.03
	(0.97)	(1.70)	(0.08)
West	-0.66	-1.84	-0.01
	(0.92)	(1.49)	(0.05)
Poverty status (ref: Above FPL)			
Below FPL	0.39	-1.07	-0.05
	(0.51)	(1.38)	(0.03)
Missing	2.26	-3.61	-0.08
	(0.84)	(2.26)	(0.03)
Educational attainment (ref: Less than high school)			
High school or GED	-0.28	3.65	0.03
	(0.49)	(2.35)	(0.03)
Some college/ vocational school	-1.09	2.88	0.05
	(0.75)	(2.75)	(0.03)
College or more	-2.34	-0.78	0.03
	(0.66)	(2.93)	(0.04)
Unknown/missing	-0.69	4.43	0.05
	(0.71)	(2.65)	(0.05)
Hispanic/Latina ethnicity (ref: Non-Hispanic/Latina)			
Hispanic/Latina	1.42	-7.46*	0.02
	(0.88)	(1.47)	(0.05)
Race (ref: Black or African-American)			
White	-0.36	2.10	0.04
	(0.58)	(1.35)	(0.06)
Other/more than one race	0.44	0.73	0.04
	(0.91)	(2.86)	(0.07)
Marital status (ref: Not married)			
Married	0.04	1.19	0.07
	(0.62)	(1.78)	(0.03)
Maternal age	-0.11	-0.32*	0.01*
	(0.035)	(0.074)	(0.00)
Constant	13.87*	38.94*	2.32*
	(1.13)	(2.68)	(0.07)
Observations	610	622	644
Clusters	15	15	16

Parameters expressed as regression coefficients.

Standard errors (in parentheses) clustered on Healthy Start site ID.

Alpha set to 0.0022 using Bonferroni correction.

* Indicates parameter was statistically significant at the 99% confidence level (*p<0.01).

Appendix Three

Vital Records

Descriptive

A3 Table 1. Maternal Descriptive Statistics of VRO Participants Before Application of Propensity Score (PS) Weights

	Non-HS Women		HS Women	
	N	%	N	%
Age* **				
Under 18 years old	7,751	1.7	434	5.5
18 to 24 years old	127,331	27.1	3,216	40.5
25 to 34 years old	255,845	54.5	3,526	44.5
35 years or older	78,700	16.8	757	9.5
Race* **				
Black or African-American	144,748	30.8	4,935	62.2
White	225,512	48.0	1,734	21.9
Other/more than one race	99,367	21.2	1,264	15.9
Hispanic/Latina ethnicity* **				
No	323,403	68.9	6,546	82.5
Yes	146,224	31.1	1,387	17.5
Educational attainment* **				
Less than high school	67,186	14.3	1,573	19.8
High school graduate or GED	104,275	22.2	2,192	27.6
Some college or associate degree	97,950	20.9	1,650	20.8
Bachelor's degree or higher	85,273	18.2	379	4.8
Unknown/missing	114,943	24.5	2,139	27.0
Marital status* **				
Not married	198,493	42.3	6,209	78.3
Married	160,159	34.1	1,404	17.7
Unknown/missing	110,975	23.6	320	4.0
Health care coverage at delivery* **				
Medicaid or other government funded insurance	277,485	59.1	6,602	83.2
Private insurance, including TRICARE	172,558	36.7	1,036	13.1
Self-pay, Indian, other, unknown	19,584	4.2	295	3.7
Receipt of WIC during pregnancy* **				
No	228,477	48.7	1,631	20.6
Yes	236,605	50.4	6,228	78.5
Unknown/missing	4,545	1.0	74	0.9

$^{*}p<0.05$, $^{**}p<0.01$, $^{**}p<0.001$

A3 Table 2. Maternal and Infant Health Indicators: VRO Participants Before Application of PS Weights

	Non-HS Women		HS Women	
	N	%	N	%
Hypertension* **				
No	426,215	90.8	6,929	87.3
Yes	39,156	8.3	918	11.6
Unknown/missing	4,256	0.9	86	1.1
Tobacco use during pregnancy* **				
No	401,944	85.6	6,322	79.7
Yes	27,803	5.9	980	12.4
Unknown/missing	39,880	8.5	631	8.0
Cigarette Use Before Pregnancy* **				
No	431,829	92.0	6,732	84.9
Yes	33,646	7.2	1,123	14.2
Unknown/missing	4,152	0.9	78	1.0
Maternal Morbidity* **				
No	323,100	68.8	6,965	87.8
Yes	15,087	3.2	263	3.3
Unknown/missing	131,440	28.0	705	8.9
**Gestational Diabetes* **				
No	437,102	93.1	7,421	93.6
Yes	28,269	6.0	426	5.4
Unknown/missing	4,256	0.9	86	1.1
Preterm Birth* **				
Yes	42,439	9.0	850	10.7
No	424,530	90.4	6,998	88.2
Unknown/missing	2,658	0.6	85	1.1
Infant Mortality				
No	466,995	99.4	7,884	99.4
Yes	2,632	0.6	49	0.6
Low Birth Weight **				
No	432,028	92.0	7,068	89.1
Yes	37,412	8.0	864	10.9
Unknown/missing	187	0.0	1	0.0
Breastfed* **				
No	109,323	23.3	2,952	37.2
Yes	246,278	52.4	4,552	57.4
Unknown/missing	114,026	24.3	429	5.4

$^{*}p<0.05$, $^{**}p<0.01$, $^{**}p<0.001$

A3 Table 3. Maternal Descriptive Statistics of VRO Participants after Application of PS Weights

	Non-HS Women		HS Women	
	N	%	N	%
Age* **				
Under 18 years old	7,751	1.7	433	5.5
18 to 24 years old	127,331	27.7	3,216	40.5
25 to 34 years old	250,057	54.5	3,526	44.5
35 years or older	74,057	16.1	757	9.5
Race* **				
Black or African-American	144,748	31.5	4,934	62.2
White	216,231	47.1	1,734	21.9
Other/more than one race	98,217	21.4	1,264	15.9
Hispanic/Latina ethnicity* **				
No	316,150	68.9	6,545	82.5
Yes	143,046	31.2	1,387	17.5
Educational attainment* **				
Less than high school	67,186	14.6	1,572	19.8
High school graduate or GED	104,273	22.7	2,192	27.6
Some college or associate degree	97,947	21.3	1,650	20.8
Bachelor's degree or higher	74,848	16.3	379	4.8
Unknown/missing	114,942	25.0	2,139	27.0
Marital status* **				
Not married	198,493	43.2	6,208	78.3
Married	160,159	34.9	1,404	17.7
Unknown/missing	100,544	21.9	320	4.0
Health care coverage at delivery* **				
Medicaid or other government funded insurance	277,485	60.4	6,601	83.2
Private insurance, including TRICARE	162,132	35.3	1,036	13.1
Self-pay, Indian, other, unknown	19,579	4.3	295	3.7
Receipt of WIC during pregnancy* **				
No	218,823	47.7	1,631	20.6
Yes	235,844	51.4	6,227	78.5
Unknown/missing	4,529	1.0	74	0.9

*$p<0.05$, **$p<0.01$, ***$p<0.001$

A3 Table 4. Maternal and Infant Health Indicators: VRO Participants after Application of PS Weights

	Non-HS Women		HS Women	
	N	%	N	%
Hypertension* **				
No	416,456	90.7	6,928	87.3
Yes	38,484	8.4	918	11.6
Unknown/missing	4,256	0.9	86	1.1
Tobacco use during pregnancy* **				
No	391,531	85.3	6,321	79.7
Yes	27,786	6.1	980	12.4
Unknown/missing	39,879	8.7	631	8.0
Cigarette use before pregnancy* **				
No	421,438	91.8	6,731	84.9
Yes	33,607	7.3	1,123	14.2
Unknown/missing	4,151	0.9	78	1.0
Maternal morbidity* **				
No	323,095	70.4	6,964	87.8
Yes	15,084	3.3	263	3.3
Unknown/missing	121,017	26.4	705	8.9
**Gestational diabetes* **				
No	427,351	93.1	7,420	93.6
Yes	27,589	6.0	426	5.4
Unknown/missing	4,256	0.9	86	1.1
Preterm birth* **				
Yes	41,737	9.1	850	10.7
No	414,803	90.3	6,997	88.2
Unknown/missing	2,656	0.6	85	1.1
Infant mortality				
No	456,574	99.4	7,883	99.4
Yes	2,622	0.6	49	0.6
Low birth weight **				
No	422,079	91.9	7,067	89.1
Yes	36,930	8.0	864	10.9
Unknown/missing	187	0.0	1	0.0
Breastfed* **				
No	109,321	23.8	2,951	37.2
Yes	246,275	53.6	4,552	57.4
Unknown/missing	103,600	22.6	429	5.4

$^{*}p<0.05$, $^{**}p<0.01$, $^{**}p<0.001$

Multivariable

A3 Table 5. Characteristics of HS and Non-HS Women on Maternal and Infant Outcomes Using Vital Records data

	Had Hypertension	Had Gestational Diabetes	Maternal Morbidity	No Preterm Birth Outcome	Had Low Birth Weight	Infant Being Breastfed	Infant Mortality
Healthy Start	1.25*	1.13	0.97	1.00	1.03	0.95	0.75
	(0.05)	(0.06)	(0.06)	(0.04)	(0.04)	(0.02)	(0.11)
Maternal age	1.04*	1.10*	0.99*	0.97*	1.02*	1.00	1.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Race (ref: Black or African-American)							
White	0.79*	1.32*	2.48*	1.34*	0.62*	1.17*	0.62*
	(0.01)	(0.03)	(0.07)	(0.02)	(0.01)	(0.01)	(0.04)
Other/More than one race	0.79*	1.51*	1.97*	1.31*	0.75*	2.08*	0.80*
	(0.02)	(0.03)	(0.06)	(0.03)	(0.02)	(0.03)	(0.06)
Ethnicity (ref: Non-Hispanic/Latina)							
Hispanic/Latina	0.89*	1.05	1.12*	1.11*	0.79*	1.78*	0.72*
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.05)
Educational Attainment (ref: Less than high school)							
High school or GED	1.02	1.00	0.95	1.11*	0.90*	1.32*	0.90
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.07)
Some college/vocational school	1.05	1.03	0.89	1.19*	0.82*	1.89*	0.73*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.06)
College or more	0.83*	0.83	0.73*	1.48*	0.68*	3.83*	0.62*
	(0.02)	(0.03)	(0.03)	(0.04)	(0.02)	(0.09)	(0.07)
Unknown/missing	0.76*	0.81*	0.87*	1.03	0.95	0.63*	1.15
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)	(0.09)
Marital Status (ref: Not married)							
Married	0.81*	1.28*	1.16*	1.38*	0.68*	1.97*	0.74*
	(0.01)	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.04)
Unknown/missing	0.54*	0.84*	2.13	1.24*	0.74*	0.61*	0.46*
	(0.01)	(0.02)	(0.61)	(0.02)	(0.01)	(0.09)	(0.04)
Health Care Coverage Payment at Delivery (ref: Medicaid or other government-funded insurance)							
Private, including TRICARE	1.08*	0.88*	0.96	1.10*	0.88*	1.14*	0.82*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.05)
Self-pay, Indian, other, unknown	0.88*	0.77*	1.13	0.85*	1.13*	1.08*	1.33
	(0.03)	(0.03)	(0.05)	(0.03)	(0.04)	(0.02)	(0.13)
Constant	0.05*	0.00*	0.04*	12.50*	0.12*	0.97	0.01*
	(0.00)	(0.00)	(0.00)	(0.47)	(0.00)	(0.02)	(0.00)
Observations	462,786	462,786	345,406	464,387	466,940	363,099	467,128

Parameters expressed as odds ratios (OR).
Alpha set to 0.0045 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.55% confidence level (*p<0.0045) confidence level.

A3 Table 6. Characteristics of HS and Non-HS Women on Tobacco Use during Pregnancy Using Vital Records data (Sequential models)

	Tobacco Use During Pregnancy	
	Model I	Model II
Healthy Start	1.43*	1.18
	(0.05)	(0.09)
Maternal Age	1.06*	1.05*
	(0.00)	(0.00)
Race (ref: Black or African-American)		
White	3.95*	1.68*
	(0.07)	(0.05)
Other/More than one race	1.63*	0.95
	(0.04)	(0.04)
Ethnicity (ref: Non-Hispanic/Latina)		
Hispanic/Latina	0.18*	0.46*
	(0.01)	(0.02)
Educational Attainment (ref: Less than high school)		
High school or GED	0.61*	0.63*
	(0.02)	(0.03)
Some college/vocational school	0.48*	0.47*
	(0.01)	(0.02)
College or more	0.10*	0.22*
	(0.01)	(0.02)
Unknown/missing	1.19*	2.61*
	(0.03)	(0.13)
Marital Status (ref: Not married)		
Married	0.26*	0.55*
	(0.01)	(0.02)
Unknown/missing	0.12*	0.45*
	(0.00)	(0.02)
Health Care Coverage Payment at Delivery (ref: Medicaid or other government-funded insurance)		
Private, including TRICARE	0.44*	0.51*
	(0.01)	(0.02)
Self-pay, Indian, other, unknown	0.83*	0.88*
	(0.03)	(0.07)
Cigarette Use Prior to Pregnancy (ref: No)		
Yes		682.30*
		(24.11)
Unknown/missing		3,089.00*
		(759.00)
Constant	0.03*	0.00*
	(0.00)	(0.00)
Observations	426,618	426,618

Parameters expressed as odds ratios (OR).
Alpha set to 0.0045 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.55% confidence level (*p<0.0045) confidence level.

A3 Table 7. Characteristics of HS and Non-HS Women on Maternal and Infant Outcomes Using Vital Records

	First Prenatal Care Visit	Weight Gain During Pregnancy	Total Prenatal Care Visits
Healthy Start	-0.48*	0.36	0.07*
	(0.09)	(0.21)	(0.01)
Maternal age	-0.06*	-0.17*	0.00*
	(0.00)	(0.01)	(0.00)
Race (ref: Black or African-American)			
White	-0.75*	1.72*	0.09*
	(0.04)	(0.08)	(0.00)
Other/More than one race	-0.16*	3.54*	0.02*
	(0.05)	(0.10)	(0.00)
Ethnicity (ref: Non-Hispanic/Latina)			
Hispanic/Latina	-0.28*	-0.64*	0.00
	(0.04)	(0.09)	(0.00)
Educational Attainment (ref: Less than high school)			
High school or GED	-0.94*	1.44*	0.08*
	(0.06)	(0.12)	(0.00)
Some college/vocational school	-1.40*	1.93*	0.14*
	(0.06)	(0.12)	(0.00)
College or more	-0.99*	3.09*	0.13*
	(0.07)	(0.13)	(0.00)
Unknown/missing	-0.94*	-13.21*	0.15*
	(0.06)	(0.11)	(0.00)
Marital Status (ref: Not married)			
Married	-0.28*	-0.47*	0.05*
	(0.04)	(0.08)	(0.00)
Unknown/missing	-2.77*	-1.41*	0.27*
	(0.04)	(0.08)	(0.01)
Health care coverage payment at delivery (ref: Medicaid or other government-funded insurance)			
Private, including TRICARE	-1.43*	0.91*	0.07*
	(0.04)	(0.08)	(0.00)
Self-pay, Indian, other, unknown	1.84*	1.20*	-0.17*
	(0.10)	(0.17)	(0.01)
Maternal medical risk factors (ref: No risk)			
Risk			0.01*
			(0.00)
Unknown/missing			-0.04*
			(0.00)
Constant	16.08*	30.41*	2.08*
	(0.10)	(0.19)	(0.01)
Observations	413,813	436,282	453,456

Parameters expressed as regression coefficients.
Alpha set to 0.0045 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.55% confidence level (*p<0.0045) confidence level.

PRAMS

Descriptive

A3 Table 8. Maternal Descriptive Statistics of 2017 and 2018 PRAMS Participants Before Application of PSM Weights

	Non-HS Participant		HS Participant	
	N	%	N	%
Age* **				
Under 18 years old	18	1.2	19	2.9
18 to 24 years old	338	22.7	270	40.9
25 to 34 years old	883	59.4	309	46.8
35 years or older	248	16.7	63	9.5
Race* **				
Black or African-American	682	45.9	394	59.6
White	504	33.9	175	26.5
Other/more than one race	301	20.2	92	13.9
Hispanic/Latina Ethnicity **				
No	1,196	80.4	564	85.3
Yes	291	19.6	97	14.7
Educational Attainment* **				
Less than high school	246	16.5	124	18.8
High school graduate or GED	393	26.4	241	36.5
Some college or associate degree	393	26.4	192	29.1
Bachelor's degree or higher	321	21.6	33	5.0
Unknown/missing	134	9.0	71	10.7
Marital Status* **				
Not married	828	55.7	533	80.6
Married	659	44.3	128	19.4
Health Care Coverage at Delivery* **				
Medicaid or other government-funded insurance	849	57.1	502	76.0
Private insurance, including TRICARE	527	35.4	91	13.8
Self-pay, Indian, other, unknown	111	7.5	68	10.3
Receipt of WIC During Pregnancy* **				
No	662	44.5	83	12.6
Yes	798	53.7	568	85.9
Missing	27	1.8	10	1.5
Pregnancy Intention* **				
Later, or not at all	429	28.9	232	35.1
Yes, or sooner	747	50.2	245	37.1
Unsure or Unknown/missing	311	20.9	184	27.8

$^{*}p<0.05$, $^{**}p<0.01$, $^{**}p<0.001$

A3 Table 9. Maternal and Infant Health Indicators for 2017 and 2018 PRAMS Participants before Application of PSM Weights

	Non-HS Participant		HS Participant	
	N	%	N	%
Hypertension* **				
No	1,299	87.4	540	81.7
Yes	157	10.6	80	12.1
Unknown/missing	31	2.1	41	6.2
Did Mom Smoke During Pregnancy* **				
No	1,359	91.4	538	81.4
Yes	117	7.9	114	17.3
Unknown/missing	11	0.7	9	1.4
Cigarette Use Before Pregnancy* **				
No	1,345	90.5	554	83.8
Yes	122	8.2	98	14.8
Unknown/missing	20	1.3	9	1.4
Maternal Morbidity				
No	1,464	98.5	654	98.9
Yes	20	1.3	6	0.9
Unknown/missing	3	0.2	1	0.2
Gestational Diabetes* **				
No	1,354	91.1	587	88.8
Yes	105	7.1	37	5.6
Unknown/missing	28	1.9	37	5.6
Preterm Birth				
Yes	172	11.6	57	8.6
No	1,314	88.4	603	91.2
Unknown/missing	1	0.1	1	0.2
Infant Mortality				
No	1,239	99.0	543	99.3
Yes	13	1.0	4	0.7
Low Birth Weight **				
No	1,291	86.8	600	90.8
Yes	196	13.2	61	9.2
Kotelchuck Index - Adequacy of Prenatal Care Utilization				
Inadequate	202	13.6	103	15.6
Intermediate	157	10.6	55	8.3
Adequate	569	38.3	239	36.2
Adequate plus	518	34.8	248	37.5
Unknown/missing	41	2.8	16	2.4
Woman Screened for IPV 12 Months Before Pregnancy				
Not screened	946	63.6	415	62.8
Screened	522	35.1	233	35.3
Unknown/missing	19	1.3	13	2.0
Woman Screened for IPV During Pregnancy* **				
Not screened	318	21.4	88	13.3
Screened	1,135	76.3	558	84.4
Unknown/missing	34	2.3	15	2.3
Woman Screened for Depression 12 Months Before Pregnancy				
Not screened	927	62.3	398	60.2
Screened	537	36.1	252	38.1
Missing	23	1.6	11	1.7
Woman Screened for Depression During Pregnancy* **				

	Non-HS Participant		HS Participant	
	N	%	N	%
Not screened	264	17.8	73	11.0
Screened	1,190	80.0	571	86.4
Unknown/missing	33	2.2	17	2.6
Woman Screened for Depression After Pregnancy (postpartum)				
Not screened	332	22.3	155	23.5
Screened	1,108	74.5	484	73.2
Unknown/missing	47	3.2	22	3.3
Infant Safe Sleep (alone in own crib/bed on back)				
No	839	56.4	348	52.7
Yes	572	38.5	278	42.1
Unknown/missing	76	5.1	35	5.3
Ever Breastfed* **				
No	231	15.5	152	23.0
Yes	1,197	80.5	482	72.9
Unknown/missing	59	4.0	27	4.1
Still Breastfeeding* **				
No	534	35.9	296	44.8
Yes	665	44.7	184	27.8
Unknown/missing	288	19.4	181	27.4
Woman Well Visit (Preconception)* **				
No	549	36.9	303	45.8
Yes	925	62.2	345	52.2
Unknown/missing	13	0.9	13	2.0
Postpartum Visit Occurred				
No	172	11.6	82	12.4
Yes	1,275	85.7	557	84.3
Unknown/missing	40	2.7	22	3.3
Interpregnancy Interval of Less than 18 Months				
No	578	38.9	234	35.4
Yes	241	16.2	103	15.6
Unknown/missing	668	44.9	324	49.0

$^{*}p<0.05$, $^{**}p<0.01$, $^{**}p<0.001$

A3 Table 10. Maternal Descriptive Statistics of 2017 and 2018 PRAMS Participants After Application of PSM Weights

	Non-HS Participant		HS Participant	
	N	%	N	%
Age* **				
Under 18 years old	17	1.2	18	2.7
18 to 24 years old	338	23.0	268	40.7
25 to 34 years old	883	60.1	309	47.0
35 years or older	231	15.7	63	9.6
Race* **				
Black or African-American	681	46.4	391	59.4
White	497	33.8	175	26.6
Other/more than one race	291	19.8	92	14.0
Hispanic/Latina Ethnicity **				
No	1,179	80.3	561	85.3
Yes	290	19.7	97	14.7
Educational Attainment* **				
Less than high school	245	16.7	124	18.8
High school graduate or GED	393	26.8	239	36.3
Some college or associate degree	393	26.8	192	29.2
Bachelor's degree or higher	304	20.7	33	5.0
Unknown/missing	134	9.1	70	10.6
Marital Status* **				
Not married	823	56.0	530	80.6
Married	646	44.0	128	19.5
Health Care Coverage at Delivery* **				
Medicaid or other government-funded insurance	848	57.7	500	76.0
Private insurance, including TRICARE	510	34.7	91	13.8
Self-pay, Indian, other, unknown	111	7.6	67	10.2
Receipt of WIC During Pregnancy* **				
No	645	43.9	82	12.5
Yes	797	54.3	566	86.0
Missing	27	1.8	10	1.5
Pregnancy Intention* **				
Later, or not at all	428	29.1	231	35.1
Yes, or sooner	731	49.8	245	37.2
Unsure or Unknown/missing	310	21.1	182	27.7

*$p<0.05$, **$p<0.01$, ***$p<0.001$

A3 Table 11. Maternal and Infant Health Indicators for 2017 and 2018 PRAMS Participants After Application of PSM Weights

	Non-HS Participant		HS Participant	
	N	%	N	%
Hypertension* **				
No	1,284	87.4	538	81.8
Yes	154	10.5	80	12.2
Unknown/missing	31	2.1	40	6.1
Did Mom Smoke During Pregnancy* **				
No	1,341	91.3	536	81.5
Yes	117	8.0	113	17.2
Unknown/missing	11	0.8	9	1.4
Cigarette Use Before Pregnancy* **				
No	1,327	90.3	551	83.7
Yes	122	8.3	98	14.9
Unknown/missing	20	1.4	9	1.4
Maternal Morbidity				
No	1,447	98.5	651	98.9
Yes	19	1.3	6	0.9
Unknown/missing	3	0.2	1	0.2
Gestational Diabetes* **				
No	1,339	91.2	585	88.9
Yes	102	6.9	37	5.6
Unknown/missing	28	1.9	36	5.5
Preterm Birth				
Yes	170	11.6	57	8.7
No	1,298	88.4	600	91.2
Unknown/missing	1	0.1	1	0.2
Infant Mortality				
No	1,223	99.0	541	99.3
Yes	13	1.1	4	0.7
Low Birth Weight **				
No	1,275	86.8	599	91.0
Yes	194	13.2	59	9.0
Kotelchuck Index - Adequacy of Prenatal Care Utilization				
Inadequate	201	13.7	102	15.5
Intermediate	156	10.6	54	8.2
Adequate	560	38.1	238	36.2
Adequate plus	512	34.9	248	37.7
Unknown/missing	40	2.7	16	2.4
Woman Screened for IPV 12 Months Before Pregnancy				
Not screened	936	63.7	414	62.9
Screened	514	35.0	231	35.1
Unknown/missing	19	1.3	13	2.0
Woman Screened for IPV During Pregnancy* **				
Not screened	311	21.2	88	13.4
Screened	1126	76.7	555	84.4
Unknown/missing	32	2.2	15	2.3
Woman Screened for Depression 12 Months Before Pregnancy				
Not screened	916	62.4	397	60.3
Screened	530	36.1	250	38.0
Missing	23	1.6	11	1.7
Woman Screened for Depression During Pregnancy* **				

	Non-HS Participant		HS Participant	
	N	%	N	%
Not screened	258	17.6	73	11.1
Screened	1,181	80.4	568	86.3
Unknown/missing	30	2.0	17	2.6
Woman Screened for Depression After Pregnancy (postpartum)				
Not screened	330	22.5	155	23.6
Screened	1,093	74.4	481	73.1
Unknown/missing	46	3.1	22	3.3
Infant Safe Sleep (alone in own crib/bed on back)				
No	829	56.4	346	52.6
Yes	565	38.5	277	42.1
Unknown/missing	75	5.1	35	5.3
Ever Breastfed* **				
No	231	15.7	151	23.0
Yes	1,180	80.3	480	73.0
Unknown/missing	58	4.0	27	4.1
Still Breastfeeding* **				
No	531	36.2	294	44.7
Yes	651	44.3	184	28.0
Unknown/missing	287	19.5	180	27.4
Woman Well Visit (Preconception)* **				
No	547	37.2	302	45.9
Yes	909	61.9	343	52.1
Unknown/missing	13	0.9	13	2.0
Postpartum Visit Occurred				
No	171	11.6	82	12.5
Yes	1,259	85.7	554	84.2
Unknown/missing	39	2.7	22	3.3
Interpregnancy Interval of Less than 18 Months				
No	571	38.9	234	35.6
Yes	240	16.3	103	15.7
Unknown/missing	658	44.8	321	48.8

$^{*}p<0.05$, $^{**}p<0.01$, $^{**}p<0.001$

Multivariable

A3 Table 12. Characteristics of Healthy Start Participants and Non-Healthy Start Participants on Screenings Using PRAMS

	Screened for IPV		Screened for Depression		
	Preconception	Prenatal	Preconception	Prenatal	Postpartum
Healthy Start	1.06	1.41	1.14	1.47	1.13
	(0.12)	(0.20)	(0.12)	(0.23)	(0.14)
Maternal age	1.00	0.98	1.00	0.98	1.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Race (ref: Black or African-American)					
White	0.74	0.47*	0.93	0.68	0.84
	(0.10)	(0.08)	(0.13)	(0.13)	(0.13)
Other/More than one race	0.85	1.02	1.12	1.02	1.10
	(0.13)	(0.21)	(0.17)	(0.22)	(0.20)
Ethnicity (ref: Non-Hispanic/Latina)					
Hispanic/Latina	0.79	1.61	0.69	1.89	1.85*
	(0.13)	(0.35)	(0.12)	(0.45)	(0.37)
Educational Attainment (ref: Less than high school)					
High school or GED	0.89	1.23	0.89	1.62	1.63
	(0.14)	(0.24)	(0.14)	(0.34)	(0.27)
Some college/vocational school	1.16	1.51	1.08	1.62	1.94*
	(0.19)	(0.31)	(0.17)	(0.35)	(0.34)
College or more	0.91	1.15	0.83	1.29	2.29*
	(0.20)	(0.28)	(0.18)	(0.34)	(0.59)
Unknown/missing	0.89	1.23	0.80	1.01	1.82
	(0.19)	(0.34)	(0.17)	(0.27)	(0.43)
Marital Status (ref: Not married)					
Married	1.15	0.82	1.09	0.91	1.13
	(0.15)	(0.13)	(0.14)	(0.15)	(0.16)
Pregnancy Intention (ref: Later or not at all)					
Yes or sooner	0.74	0.77	0.88	0.98	1.06
	(0.09)	(0.13)	(0.11)	(0.17)	(0.15)
Unsure or Unknown/missing	0.70	0.88	0.98	1.22	1.13
	(0.10)	(0.16)	(0.14)	(0.25)	(0.18)
Health Care Coverage Payment at Delivery (ref: Medicaid or other government-funded insurance)					
Private, including TRICARE	1.33	0.82	1.20	0.76	1.26
	(0.18)	(0.13)	(0.16)	(0.13)	(0.20)
Self-pay, Indian, other, unknown	1.15	0.55	1.09	0.49	0.73
	(0.22)	(0.12)	(0.21)	(0.12)	(0.15)
Constant	0.70	8.80*	0.60	8.16*	1.47
	(0.22)	(3.44)	(0.19)	(3.49)	(0.49)
Observations	2,095	2,080	2,093	2,080	2,059

Parameters expressed as odds ratios (OR).
Alpha set to 0.0025 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.75% confidence level (*p<0.0025) confidence level.

A3 Table 13. Characteristics of Healthy Start Participants and Non-Healthy Start Participants on Maternal and Infant Outcomes Using PRAMS

	Preconception Well Woman Visit	Postpartum Visit	IPI <18 Months	Ever Breastfed	Safe Sleep	Tobacco Use During Pregnancy
Healthy Start	0.92	1.27	0.94	0.91	1.47*	1.60
	(0.10)	(0.19)	(0.14)	(0.12)	(0.16)	(0.44)
Maternal age	1.02	1.00	0.92*	0.98	1.01	1.01
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Race (ref: Black or African-American)						
White	1.23	0.66	0.93	1.45	1.30	1.52
	(0.17)	(0.13)	(0.19)	(0.25)	(0.18)	(0.50)
Other/More than one race	0.92	0.82	1.06	2.26*	1.02	0.54
	(0.14)	(0.20)	(0.25)	(0.50)	(0.16)	(0.21)
Ethnicity (ref: Non-Hispanic/Latina)						
Hispanic/Latina	0.59	1.25	0.62	2.71*	1.27	0.11*
	(0.09)	(0.29)	(0.16)	(0.68)	(0.21)	(0.05)
Educational Attainment (ref: Less than high school)						
High school or GED	1.06	1.84*	0.84	1.31	0.96	0.95
	(0.16)	(0.36)	(0.17)	(0.23)	(0.15)	(0.36)
Some college/vocational school	1.54	2.67*	0.88	3.34*	0.88	0.80
	(0.24)	(0.58)	(0.20)	(0.65)	(0.14)	(0.35)
College or more	1.97	6.36*	1.30	5.51*	0.90	1.87
	(0.46)	(3.18)	(0.42)	(1.97)	(0.19)	(0.89)
Unknown/missing	1.06	2.69*	0.72	1.87	0.84	0.21
	(0.21)	(0.80)	(0.24)	(0.51)	(0.18)	(0.12)
Marital Status (ref: Not married)						
Married	1.29	1.83*	1.34	1.28	1.24	0.81
	(0.16)	(0.36)	(0.24)	(0.21)	(0.15)	(0.25)
Pregnancy Intent (ref: Later or not at all)						
Yes or sooner	0.87	1.59	0.50*	1.08	1.15	0.55
	(0.11)	(0.29)	(0.09)	(0.17)	(0.14)	(0.16)
Unsure or Unknown/missing	0.75	1.01	0.82	0.76	1.01	0.78
	(0.10)	(0.19)	(0.15)	(0.13)	(0.14)	(0.27)
Health Care Coverage Payment at Delivery (ref: Medicaid or other government-funded insurance)						
Private, including TRICARE	1.54*	1.27	0.81	1.26	1.19	0.31
	(0.21)	(0.27)	(0.16)	(0.23)	(0.16)	(0.15)
Self-pay, Indian, other, unknown	1.31	1.04	0.58	1.03	1.24	141.30*
	(0.23)	(0.29)	(0.17)	(0.27)	(0.23)	(84.57)
Tobacco Use Prior to Pregnancy (ref: No)						
Yes						799.80*
						(447.70)
Unknown/missing						16.72
						(25.83)
Child age					0.98	
					(0.01)	
Constant	0.69	2.15	8.36*	2.31	0.31	0.01*
	(0.21)	(0.88)	(4.48)	(0.87)	(0.10)	(0.01)
Observations	2,101	2,066	1,148	2,042	2,007	2,107

Parameters expressed as odds ratios (OR).
Alpha set to 0.0025 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.75% confidence level (*p<0.0025) confidence level.

A3 Table 14. Characteristics of Healthy Start Participants and Non-Healthy Start Participants on Maternal and Infant Outcomes Using PRAMS

	Had Hypertension	Had Gestational Diabetes	No Preterm Birth Outcome	Had Low Birth Weight	Adequate/ Adequate Plus on Kotelchuck Index	Infant Death
Healthy Start	1.37	1.06	1.35	0.56*	1.43	0.76
	(0.23)	(0.23)	(0.23)	(0.10)	(0.17)	(0.50)
Maternal age	1.07*	1.11*	0.97	1.00	1.04*	0.91
	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.08)
Race (ref: Black or African-American)						
White	0.66	1.04	0.67	0.94	1.11	0.51
	(0.15)	(0.28)	(0.15)	(0.20)	(0.17)	(0.43)
Other/More than one race	0.55	1.49	1.04	0.66	1.05	0.79
	(0.15)	(0.42)	(0.28)	(0.17)	(0.20)	(0.88)
Ethnicity (ref: Non-Hispanic/Latina)						
Hispanic/Latina	0.95	0.77	2.05	0.42	1.87*	-
	(0.28)	(0.26)	(0.60)	(0.13)	(0.39)	
Educational Attainment (ref: Less than high school)						
High school or GED	1.09	1.49	1.36	1.02	1.19	2.94
	(0.28)	(0.50)	(0.32)	(0.24)	(0.20)	(2.72)
Some college/vocational school	1.26	1.54	1.45	0.74	1.46	0.81
	(0.32)	(0.49)	(0.34)	(0.18)	(0.26)	(0.96)
College or more	1.03	0.87	1.89	1.00	1.25	1.52
	(0.33)	(0.39)	(0.60)	(0.30)	(0.29)	(1.61)
Unknown/missing	0.94	0.97	2.70	0.55	1.53	10.57
	(0.33)	(0.42)	(1.19)	(0.21)	(0.38)	(15.05)
Marital Status (ref: Not married)						
Married	1.12	1.17	1.00	0.68	0.99	4.77
	(0.22)	(0.26)	(0.20)	(0.14)	(0.14)	(3.88)
Pregnancy Intent (ref: Later or not at all)						
Yes or sooner	0.75	1.83	1.01	1.23	1.28	2.13
	(0.14)	(0.48)	(0.19)	(0.23)	(0.18)	(1.71)
Unsure or Unknown/missing	0.70	1.22	1.33	1.16	1.05	1.46
	(0.15)	(0.39)	(0.30)	(0.25)	(0.16)	(1.22)
Health Care Coverage Payment at Delivery (ref: Medicaid or other government-funded insurance)						
Private, including TRICARE	1.07	1.03	1.14	0.84	1.30	0.68
	(0.20)	(0.25)	(0.24)	(0.17)	(0.21)	(0.39)
Self-pay, Indian, other, unknown	0.18	2.15	1.69	0.69	0.30*	1.77
	(0.13)	(0.75)	(0.57)	(0.23)	(0.06)	(1.74)
Maternal Medical Risk Factors (ref: No risk)						
Risk				2.61*		
				(0.46)		
Unknown/missing				1.99		
				(1.44)		
Constant	0.02*	0.00*	12.12*	0.20*	0.58	0.03
	(0.01)	(0.00)	(6.20)	(0.10)	(0.20)	(0.06)
Observations	2,056	2,063	2,125	2,127	2,071	1,500

Parameters expressed as odds ratios (OR).
Alpha set to 0.0025 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.75% confidence level (*p<0.0025) confidence level.
- Indicates the omission of level due to low cell count.

A3 Table 15. Characteristics of Healthy Start Participants and Non-Healthy Start Participants on Maternal and Infant Outcomes Using PRAMS

	First Prenatal Care Visit	Weight Gain During Pregnancy	Total Prenatal Care Visits
Healthy Start	-0.98	0.97	0.10*
	(0.33)	(0.89)	(0.02)
Maternal age	-0.06	-0.30*	0.00
	(0.03)	(0.08)	(0.00)
Race (ref: Black or African-American)			
White	-0.76	2.63	0.00
	(0.42)	(1.12)	(0.03)
Other/More than one race	0.19	0.63	-0.01
	(0.51)	(1.25)	(0.03)
Ethnicity (ref: Non-Hispanic/Latina)			
Hispanic/Latina	1.04	-1.78	0.04
	(0.50)	(1.27)	(0.03)
Educational Attainment (ref: Less than high school)			
High school or GED	-0.59	1.28	0.05
	(0.50)	(1.22)	(0.03)
Some college/vocational school	-1.57	1.58	0.11*
	(0.48)	(1.32)	(0.03)
College or more	-1.90*	0.23	0.09
	(0.53)	(1.61)	(0.04)
Unknown/missing	-0.24	0.92	0.11
	(0.61)	(1.63)	(0.04)
Marital Status (ref: Not married)			
Married	0.27	-0.31	0.03
	(0.40)	(0.99)	(0.02)
Pregnancy Intent (ref: Later or not at all)			
Yes or sooner	-1.05	1.41	0.05
	(0.41)	(1.01)	(0.02)
Unsure or Unknown/missing	-0.64	3.62	0.00
	(0.50)	(1.26)	(1.26)
Health Care Coverage Payment at Delivery (ref: Medicaid or other government-funded insurance)			
Private, including TRICARE	-0.45	1.14	0.00
	(0.40)	(1.10)	(0.02)
Self-pay, Indian, other, unknown	0.25	-2.54	0.07
	(0.57)	(1.39)	(0.04)
Maternal Medical Risk Factors (ref: No risk)			
Risk			0.04
			(0.02)
Unknown/missing			-0.10
			(0.09)
Constant	15.26*	33.16*	2.21*
	(0.97)	(2.60)	(0.05)
Observations	1,934	1,997	2,065

Parameters expressed as regression coefficients.
Alpha set to 0.0025 using Bonferroni correction.
* Indicates parameter was statistically significant at the 99.75% confidence level (*p<0.0025) confidence level.

Methodological Appendix

Bonferroni Corrections

We used a Bonferroni correction to determine the appropriate alpha level for models within each analysis. For each Bonferroni correction, we divided a *p*-value of 0.05 by the number of models (based on outcome measures) to calculate a corrected significance threshold to avoid a "false positive" result, or Type I error (see Table M1 and M2).

Table M1. Corrected Significance Thresholds from Bonferroni Correction for Each Set of Reproductive Phase-based Analyses Using the HSMED

Reproductive Phase	Total Multivariable Models	Bonferroni Correction	Corrected Significance Threshold
Preconception	5	0.05/5	0.01
Prenatal	6	0.05/6	0.0083
Postpartum	13	0.05/13	0.0038
Interconception/Parenting	13	0.05/13	0.0038

Table M2. Corrected Significance Thresholds from Bonferroni Corrections for Each Set of Analyses Using VRO and PRAMS

Data Source	Total Multivariable Models	Bonferroni Correction	Corrected Significance Threshold
VRO	11	0.05/11	0.0045
PRAMS	20	0.05/20	0.0025

Propensity Score Methodology

We used multivariable regression to model the association between HS participation and selected outcomes by incorporating propensity score methods. Propensity scores are often used in observational studies when random assignment to treatment or control groups is not possible (Rubin, 2001). This methodology creates balance between treatment and control group participants, which improves our ability to make group comparisons.

For the present study, we incorporated propensity score weighting. The propensity scores reflect the likelihood a woman has for participating in the HS program given her demographic and socioeconomic characteristics, such as age, race, ethnicity, and education. We used the propensity scores to construct a comparison group with similar characteristics as the HS women, and therefore minimized selection bias to allow for the estimation and interpretation of treatment effects of the HS program on selected outcomes.

Before constructing the propensity weights, we conducted a balance check to assess which characteristics significantly differed between HS women and the comparison group of non-participants. These significantly different factors helped to inform[28] the selection of the matching variables that were included in a logistic regression model to predict the propensity score associated with program participation.

We constructed two different propensity weights based on the calculated propensity scores in order to assess which weight was better at balancing the two groups: 1) inverse probability of treatment (IPT) weights and 2) standardized mortality ratio (SMR) weights. After constructing both weights, we identified

[28] We do not want too many match variables; we also do not want to include highly correlated match variables (e.g., race and ethnicity).

common support, or the overlap between the range of propensity scores (see Exhibit 1 and 2). For common support, we assessed the minimum and maximum of the distribution of propensity scores for each group. Our goal was to identify the overlap of values in order to enforce a shared range of propensity scores in both groups. By constricting the range, we created common support to create balance in terms of participant characteristics between HS women and non-participants.

We then incorporated the weights and common support restriction into the logistic regression analysis to recheck the balance. Refer to Exhibit 3 and 4 for the distribution of propensity scores before and after IPT and SMR weighting in the VRO sample, and Exhibit 5 and 6 for the PRAMS sample.

The propensity scores were more balanced using the SMR weights in both the VRO and PRAMS samples. We conducted all multivariable analyses using the shared range of propensity scores (identified through common support) and SMR weights to assess the association between HS program participation and maternal and infant outcomes.

Exhibit 1: Identifying Common Support between HS and Comparison Group Using VRO

```
-> hs_partic = 0

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        prop |    469,627    .016349    .0161822   .0003287    .081622

-> hs_partic = 1

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        prop |      7,933   .0321555    .0177017   .0007608   .0838987
```

Exhibit 2: Identifying Common Support between HS and Comparison Group Using PRAMS

```
-> hs_partic = Non-participant

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        prop |      1,487    .279396    .1425066   .0266243   .5823479

-> hs_partic = HS participant

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        prop |        661   .3714646    .1151541   .0424476   .6133611
```

Exhibit 3: Distribution of Propensity Scores after IPT Weighting Using VRO

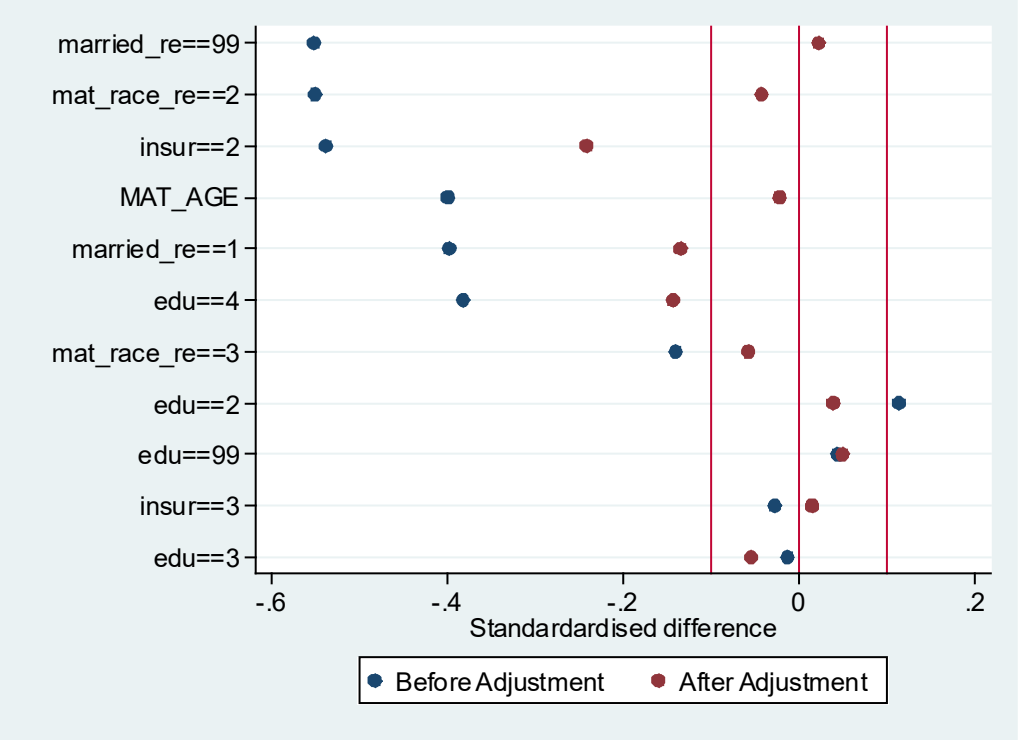

Exhibit 4: Distribution of Propensity Scores after SMR Weighting Using VRO

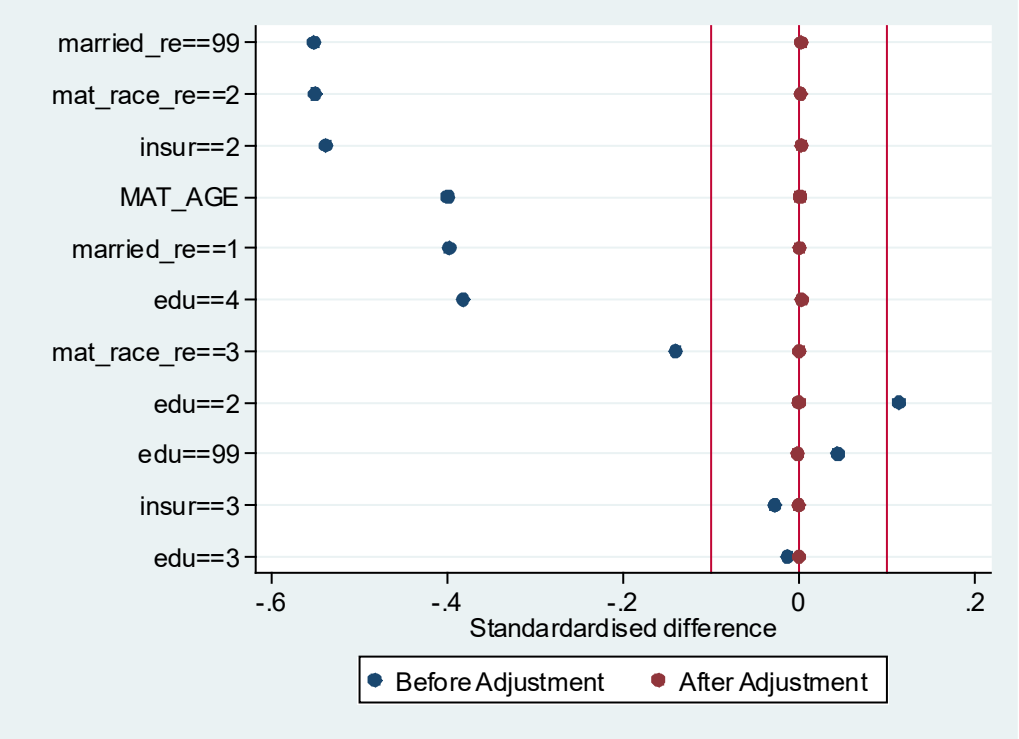

Exhibit 5: Distribution of Propensity Scores after IPT Weighting Using PRAMS

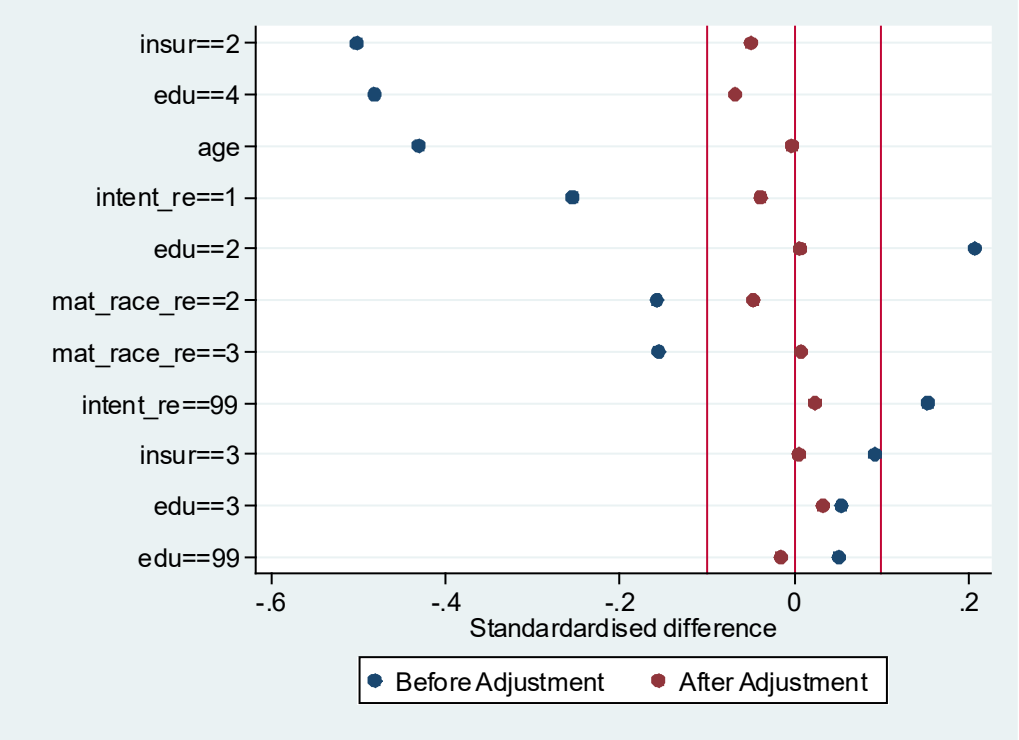

Exhibit 6: Distribution of Propensity Scores after SMR Weighting Using PRAMS