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A Methodological Approach for Evaluating the Enterprise Community Healthy Start Program in Rural Georgia: An Analysis Using Linked PRAMS, Birth Records and Program Data

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Abstract

Introduction—Community Healthy Start program evaluations are often limited by a lack of robust data and rigorous study designs. This study describes an enhanced methodological approach using local program data linked with existing population-level datasets for external comparison to evaluate the Enterprise Community Healthy Start (ECHS) program in two rural Georgia counties and presents results from the evaluation.

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Conflict of interest The authors report no conflicts of interest.

Code Availability Available upon request.

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Ethical Approval PRAMS data collection was approved by the GDPH Institutional Review Board (IRB) (Project #950601). This study was approved by the Augusta University IRB (Project #611346).

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Methods—ECHS program data were linked to birth records and the Pregnancy Risk Assessment Monitoring System (PRAMS) for 869 women who delivered a live birth in Burke and McDuffie counties from 2010 to 2011. Multivariate logistic regressions with and without propensity score methods modeled the association between ECHS participation and maternal health indicators and pregnancy outcomes.

Results—107 ECHS participants and 726 non-participants responded to PRAMS and met eligibility criteria. Compared with non-participants, ECHS participants were younger, completed fewer years of education, and were more likely to be non-His-panic Black, unmarried, insured with Medicaid, participating in WIC, and having an unintended pregnancy. Models with and without propensity score weighting derived similar results: there was a positive association between ECHS participation and receiving adequate or adequate plus prenatal care ($p < 0.05$); no statistically significant associations were observed between ECHS participation and any other health behaviors, health care access and utilization measures or pregnancy outcomes.

Discussion—Rigorous evaluation of a local Healthy Start program using linked PRAMS and birth records with a population-based external comparison group and propensity score methods is an enhanced and feasible approach that can be applied in other local and state jurisdictions.

Keywords

Data linkage; Healthy start; PRAMS; Rural; Georgia

Introduction

Infant mortality rates (IMR) are an important indicator of health and well-being in the United States as well as markers of health in individual states. In 2019, the U.S. IMR was 5.6 per 1000 live births (Kochanek et al., 2020). Although the overall U.S. IMR has declined over the past decade (Mathews & Driscoll, 2017), rates remain disproportionately high in the southern states (CDC, 2021). Healthy Start is one of the nation's earliest programs focused on reducing infant mortality in communities across the U.S. with high rates of infant mortality and other adverse pregnancy outcomes. It aims to improve health outcomes before, during and after pregnancy and reduce racial/ethnic differences in rates of adverse perinatal outcomes by improving access to quality health care and services; strengthening the health workforce; building healthy communities; and promoting health equity. Since 1991, the Healthy Start program has grown from a demonstration project in 15 communities to 101 programs in 35 states, the District of Columbia, and Puerto Rico.

Community program evaluations have indicated that establishing the impact of Healthy Start is difficult. A randomized trial design is often not feasible for community programs, and program participants differ from non-participants both within the same community and across multiple jurisdictions. Many programs are unable to collect data from an external comparison group. Thus, methodological approaches in Healthy Start evaluations vary with some lacking an external comparison group and others limited by inadequate methods to ensure comparability between participants and non-participants (Thomas et al., 2015). Linking public data systems with program data is an important way to enable rigorous assessment of Healthy Start program impacts by defining meaningful comparison

groups and providing rich data to control for differences between program participants and nonparticipants. Recent evaluations used administrative data linked with program data, an external comparison group, and propensity score methods (PSM) and noted significant associations between Healthy Start participation and positive health outcomes (August et al., 2015; Bill et al., 2009; Cooper et al., 2013; Hussaini et al., 2011; Kothari et al., 2014; Salihu et al., 2009, 2014). Overall, while the methodology in these evaluations improved over time, more rigorous and comprehensive evaluations are needed using robust statistical techniques with appropriate comparison groups adjusting for participation selection bias and a more comprehensive set of risk factors often lacking in administrative databases (Meghea et al., 2014).

The Enterprise Community Healthy Start (ECHS) program was established to improve infant health outcomes in Georgia by addressing factors that contribute to the high IMR among minority groups. An initial evaluation of ECHS participation on maternal health literacy was limited by a small study population with no external comparison group and a lack of information on key outcomes (Mobley et al., 2014). ECHS leadership, in collaboration with the Centers for Disease Control and Prevention (CDC), and the Georgia Department of Public Health (GDPH), conceptualized a rigorous research methodology to address gaps from prior evaluations and used linked data to evaluate outcomes of this rural Healthy Start program.

The objective of the current study was twofold: (1) to describe an enhanced methodological approach for evaluating a local Healthy Start program using local program data linked with birth records and rich and robust data from the Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based external comparison group, and two analytical approaches with and without PSM; and (2) to present results from the most recent evaluation of the ECHS program that used these methods to examine the association between program participation and selected indicators of maternal and infant health. Prior evaluations have not linked program data to PRAMS which offers robust data on maternal health behaviors and experiences. This approach and the resulting information serve to inform other Healthy Start evaluations (Banks et al., 2017).

Methods

Data Sources

Data were from three sources: ECHS program, live birth records, and PRAMS Phase 6 (2009–2011) (Fig. 1). The three datasets complemented each other and together provided comprehensive data which made a rigorous study design for the ECHS evaluation possible.

The ECHS program developed a web-based database to monitor the services received by the participants. All unique identifiers were extracted for inclusion in this analysis. Live birth records were provided by the GDPH and included all live births in Georgia between 1/1/2010, and 12/31/2011, with demographic, geographic, medical and health information. The Georgia PRAMS collects information annually on maternal attitudes, behaviors, and experiences before, during, and shortly after pregnancy. Each year, a stratified random sample of women with a recent live birth in the Georgia birth certificate registry are chosen

to participate and are sent questionnaires with telephone follow-up for non-responders 2–6 months after delivery. For this study, all eligible residents in the ECHS service area (Burke and McDuffie counties) were sent PRAMS surveys during 2010 and 2011. PRAMS data collection was approved by the GDPH Institutional Review Board (IRB) (Project #950601).

The ECHS database administrator provided identifiable information on ECHS participants to the GDPH staff. They worked with CDC to conduct the record linkage. The three data sets were deterministically linked using the following match fields: social security number, mother's first and last name, mother's birth date, race, delivery date, residential address, and delivery hospital, as necessary. While the linked dataset included all women who delivered a live birth in Georgia from 2010 to 2011, the study population was restricted to those residing in Burke and McDuffie counties to allow for comparison of ECHS participants to an external comparison group of non-participants in the same counties. For this analysis, we excluded those with multiple gestations. We also excluded ECHS participants who had no antenatal ECHS visits, which suggests they enrolled into ECHS postnatally and did not receive prenatal ECHS services that we would expect to impact maternal and infant outcomes.

ECHS Program

The ECHS program aimed to reduce racial and ethnic disparities through improvement of infant health and women's health before, during, and ≤ 2 years following pregnancy. From 2005 to 2019 ECHS served two rural counties with high rates of adverse pregnancy outcomes and health professional shortages. Recruitment was voluntary and women enrolled before or after delivery. ECHS staff assessed potential risk factors for participating women upon enrollment and subsequently provided intensive nursing case management in home and community settings (Thomas et al., 2018).

Measures

There were 17 maternal health factors and pregnancy outcomes selected because of their association with infant outcomes, including 12 measuring maternal health behaviors during pregnancy, postpartum health behaviors and characteristics, infant-related maternal health behaviors, and health care access and utilization measures from PRAMS and 5 measuring prenatal care and pregnancy outcomes from birth records (Fig. 1).There were several sociodemographic and pregnancy characteristics and maternal medical risk factors included as covariates.

Statistical Analysis

Descriptive analyses were conducted to assess sociodemographic and pregnancy characteristics, health behaviors, and health care characteristics of the study population by ECHS participation. Fisher's exact tests were used to compare all characteristics.

We applied two methods to minimize confounding by accounting for the differences in characteristics between the ECHS participants (treatment group) and non-participants (external comparison group). Multivariate regression models are traditional methods used to reduce bias from confounding by adjusting for covariates in the model. PSM are

increasingly used as an alternative to multivariate regression models and balance the covariates between the treatment and control groups based on a single propensity score. For this study, we demonstrated the use of both methods since resources are often limited for evaluations of local programs which may preclude the use of advanced techniques like PSM. Multivariate regression models are easier to perform than PSM, and in many cases, these two approaches produce similar results (Elze et al., 2017).

Multivariate logistic regression modeled 12 maternal health behaviors, health care access and utilization measures, and pregnancy outcomes by ECHS participation adjusting for five covariates, including maternal age, race, education, pregnancy intention, and method of payment at delivery. These covariates differed by ECHS participation, were significantly correlated with ≥ 1 outcome variable in the binary analysis, and were not highly correlated with each other. For PSM, we used standardized mortality ratio (SMR) weighting to match the treatment and external comparison groups by a propensity score (Brookhart et al., 2013; Kurth et al., 2006). Success of the PSM was informed by a balance check calculating the standardized difference for all model covariates; values < 10% were considered balanced. Detailed PSM steps are in Appendix A.

Sampling weights for PRAMS were not applied because all eligible women in the two counties were surveyed and we did not intend to generalize the results to Georgia. All analyses were conducted using Stata 14 (StataCorp LP, College Station, TX) and SAS 9.4 (SAS Institute Inc., Cary, NC). We considered p-values < 0.05 statistically significant. This study was approved by the Augusta University IRB (Project #611346).

Results

Deterministic record linkage of ECHS program data to live birth records and PRAMS yielded a linkage rate of 100%. From 2010 to 2011, there were 265,907 live births in Georgia; 1230 were delivered in Burke and McDuffie counties. Among these infants, 184 were born to ECHS participants and 1046 to non-participants (Fig. 2). The PRAMS response rate was 69% among ECHS participants and 71% among non-ECHS participants. The final sample included 833 women: 107 ECHS participants and 726 non-ECHS participants. A comparison of selected characteristics of PRAMS respondents and non-respondents by ECHS participation is in Appendix B. Only among non-participants, PRAMS respondents and non-respondents differed by several characteristics.

In the study sample, higher proportions of ECHS participants were < 25 years old, non-Hispanic Black, completed < 12 years of education, were unmarried, insured with Medicaid at delivery, participated in WIC during pregnancy, and had an unintended index pregnancy, compared with non-participants (Table 1). Lower proportions of ECHS participants breastfed their infants for ≥ 12 weeks and initiated prenatal care in the first trimester (Table 2). No differences were observed between ECHS participation and any other indicators of maternal and infant health. After PSM, all standardized differences among the covariates were < 10% (Appendix C).

In the multivariate logistic regression model without PSM, ECHS participation was positively associated with adequate/adequate plus prenatal care (coefficient = 0.09; p = 0.02; Table 3). There were no statistically significant associations between ECHS participation and selected health behaviors, other health care access and utilization measures, low birthweight, or preterm birth. Results were similar after utilizing the PSM. There was a positive association between ECHS participation and adequate/adequate plus prenatal care (coefficient = 0.11; p = 0.02).

Discussion

This population-based study in rural Georgia demonstrates the utility and feasibility of an enhanced methodological approach to evaluate a local Healthy Start program using program data linked with robust data from existing population-level datasets and a population-based external comparison group. Similar results from the two analytical approaches reinforces the use of multivariate logistic regression which is more accessible for communities that may lack staff and resources to conduct more advanced analyses such as PSM.

ECHS participation was positively associated with adequate/adequate plus prenatal care. The findings are consistent with a previous national Healthy Start evaluation using vital records which found a positive association with adequate prenatal care in 8 of 15 sites (Moreno et al., 2000). While our results should be interpreted with caution, potential explanations of these findings may include ECHS program activities facilitated access to recommended prenatal care for participants through support and advocacy from Registered Nurse Case Managers who connected participants to the health care system, made referrals to specialized health care, arranged transportation to the regional perinatal center, and assisted them to access health insurance (Thomas et al., 2018). The lack of significant associations between ECHS participation and other indicators of maternal and infant health may be due to the small sample size and inability to control for unmeasured factors, such as food insecurity or inadequate housing. A larger multi-year sample and broader measures of social determinants of health may be needed to make more conclusive statements about the impact of ECHS participation on these key indicators. Future evaluations should also consider the impact of the source of care and quality of services on these outcomes.

Our study expands on previous Healthy Start evaluations by using local program data linked to PRAMS and live birth records. PRAMS provides rich data on preconception, prenatal and postnatal health behaviors and experiences that can be used for local, state, and federal program development and evaluation (Shulman et al., 2018), which allowed for the comparison of important health indicators. Additionally, the inclusion of an external comparison group of all women delivering a live birth in the two counties strengthened our ability to draw conclusions about the impact of ECHS. Evaluations of public health programs are often hindered by limited data collected within the program and lack of data from a comparison group. This study provided new ideas and opportunities for programs to use data from existing surveillance systems, such as PRAMS, for more rigorous evaluations of maternal and child health (MCH) programs. Lessons learned included the importance of leveraging existing partnerships, building upon sound local data collection systems,

communicating locally to promote PRAMS awareness, and having realistic expectations about the time and resources needed for this effort.

Limitations

While population-based, this study was restricted to two rural Georgia counties, which limits the generalizability of the findings. With only 107 participants, the power to detect statistically significant associations between ECHS participation and outcomes may be limited. However, a post-hoc power calculation for selected outcomes indicated the study had enough power to detect meaningful effect sizes (Appendix D). We were unable to obtain information on maternal or infant deaths and could not examine the impact of the ECHS program on these important outcomes.

PSM allowed us to increase comparability between ECHS participants and non-participants on selected maternal and pregnancy characteristics. However, there may still be unmeasured factors associated with program participation and thereby causality could not be determined (Thomas et al., 2018).

Our analysis demonstrated a positive association between ECHS participation and adequate prenatal care, however, data were missing for 13% of women for this variable. PRAMS data are self-reported and subject to errors in recall and social desirability bias. However, prior studies found high reliability and validity for selected measures in our study, including WIC participation, method of payment at delivery, and breastfeeding initiation (Ahluwalia et al., 2013; Dietz et al., 2014). Furthermore, in the analysis, 12 outcome measures were tested. With an alpha level of 0.05, there was a 46% probability of type 1 error.

In addition, there is the potential for bias due to differences between PRAMS respondents and non-respondents. However, significant differences were only observed among non-ECHS participants, and thus the potential bias should be minimal due to the nature of the SMR weighting methods. Future studies are needed that include longitudinal cohorts of participants and non-participants and pre-intervention data on both groups, which would allow for a more rigorous quasi-experimental study and would provide important information on baseline characteristics of women before program participation.

Conclusion

An evaluation of a local Healthy Start program using linked program data, birth records, and PRAMS with a population-based external comparison group and PSM provided an enhanced methodological approach for assessing the association between program participation and several important indicators of maternal and infant health. This study demonstrates the feasibility of this approach, which can be replicated in other local and state jurisdictions. It also served as a pilot for the national Healthy Start evaluation that assessed the impact of the program using prospectively collected data from local programs, state vital records, and PRAMS (Banks et al., 2017). Innovative methodologies for assessing the impact of the Healthy Start program on the health and well-being of women and infants in the U.S., including assessments of specific program components, will identify opportunities to improve outcomes and reduce disparities in MCH.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data Availability

Available upon request.

References

Ahluwalia IB, Helms K, & Morrow B (2013). Assessing the validity and reliability of three indicators self-reported on the Pregnancy Risk Assessment Monitoring System survey. Public Health Reports, 128(6), 527–536. 10.1177/003335491312800612 [PubMed: 24179264]

August EM, Salihu HM, de la Cruz CZ, Mbah AK, Alio AP, & Lo Berry E (2015). A quasi-experimental design to assess the effectiveness of the federal healthy start in reducing preterm birth among obese mothers. Journal of Primary Prevention, 36(3), 205–212. 10.1007/s10935-015-0389-0 [PubMed: 25762508]

Banks JE, Dwyer M, Hirai A, Ghandour RM, & Atrash HK (2017). Design and operation of the transformed national Healthy Start evaluation. Maternal and Child Health Journal, 21(Suppl), 40–48. 10.1007/s10995-017-2381-1 [PubMed: 29210021]

Bill DE, Hock-Long L, Mesure M, Bryer P, & Zambrano N (2009). Healthy Start Programa Madrina: A promotora home visiting outreach and education program to improve perinatal health among Latina pregnant women. Health Educator: Journal of Eta Sigma Gamma, 41, 68–76.

Brookhart MA, Wyss R, Layton JB, & Sturmer T (2013). Propensity score methods for confounding control in nonexperimental research. Circulation: Cardiovascular Quality and Outcomes, 6(5), 604–611. 10.1161/circoutcomes.113.000359 [PubMed: 24021692]

Centers for Disease Control and Prevention. (2021). Infant mortality rates by state (Table). Centers for Disease Control and Prevention.

Cooper BP, Scharff DP, Elliott M, & Rotter B (2013). The impact of SLHS program on perinatal indicators. Maternal and Child Health Journal, 17(6), 1158–1165. 10.1007/s10995-012-1101-0 [PubMed: 22903303]

Dietz P, Bombard J, Mulready-Ward C, Gauthier J, Sackoff J, Brozicevic P, … Taylor A (2014). Validation of self-reported maternal and infant health indicators in the Pregnancy Risk Assessment Monitoring System. Maternal and Child Health Journal, 18(10), 2489–2498.10.1007/s10995-014-1487-y [PubMed: 24770954]

Elze MC, Gregson J, Baber U, Williamson E, Sartori S, Mehran R, … Pocock SJ (2017). Comparison of propensity score methods and covariate adjustment: Evaluation in 4 cardiovascular studies. Journal of the American College of Cardiology, 69(3), 345–357. [PubMed: 28104076]

Hussaini SK, Holley P, & Ritenour D (2011). Reducing low birth weight infancy: Assessing the effectiveness of the Healthy Start program in Arizona. Maternal and Child Health Journal, 15(2), 225–233. 10.1007/s10995-009-0556-0 [PubMed: 20054627]

Kochanek KD, Xu J, Arias E (2020). Mortality in the United States, 2019. (NCHS data brief, no. 395). Retrieved from National Center for Health Statistics website: https://www.cdc.gov/nchs/products/databriefs/db395.htm

Kotelchuck M (1994). An evaluation of the Kessner Adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index. American Journal of Public Health, 84(9), 1414–1422. 10.2105/AJPH.84.9.1414 [PubMed: 8092364]

Kothari CL, Zielinski R, James A, Charoth RM, & Carmen Sweezy LD (2014). Improved birth weight for Black infants: Outcomes of a Healthy Start program. American Journal of Public Health, 104(Suppl 1), S96–S104. 10.2105/ajph.2013.301359 [PubMed: 24354844]

Kurth T, Walker AM, Glynn RJ, Chan KA, Gaziano JM, Berger K, & Robins JM (2006). Results of multivariable logistic regression, propensity matching, propensity adjustment, and propensity-based weighting under conditions of nonuniform effect. American Journal of Epidemiology, 163(3), 262–270. 10.1093/aje/kwj047 [PubMed: 16371515]

Mathews TJ, & Driscoll AK (2017). Trends in infant mortality in the United States, 2005–2014 (NCHS data brief, no. 279). Retrieved from National Center for Health Statistics website: https://www.cdc.gov/nchs/products/databriefs/db279.htm

Meghea CI, Raffo JE, VanderMeulen P, & Roman LA (2014). Moving toward evidence-based federal Healthy Start program evaluations: Accounting for bias in birth outcomes studies. American Journal of Public Health, 104(Suppl 1), S25–S27. 10.2105/ajph.2013.301276 [PubMed: 24354826]

Mobley SC, Thomas SD, Sutherland DE, Hudgins J, Ange BL, & Johnson MH (2014). Maternal health literacy progression among rural perinatal women. Maternal and Child Health Journal, 18(8), 1881–1892. 10.1007/s10995-014-1432-0 [PubMed: 24469358]

Moreno L, Devaney B, Chu D, & Seeley M (2000). Effect of healthy start on infant mortality and birth outcomes. Mathematica Policy Research, Inc.

Rasmussen KM, Catalano PM, & Yaktine AL (2009). New guidelines for weight gain during pregnancy: What obstetrician/gynecologists should know. Current Opinion in Obstetrics and Gynecology, 21(6), 521–526. 10.1097/GCO.0b013e328332d24e [PubMed: 19809317]

Salihu HM, August EM, Mbah AK, Alio AP, Berry EL, & Aliyu MH (2014). Impact of a federal healthy start program on feto-infant morbidity associated with absent fathers: A quasi-experimental study. Maternal and Child Health Journal, 18(9), 2054–2060. 10.1007/s10995-014-1451-x [PubMed: 24549651]

Salihu HM, Mbah AK, Jeffers D, Alio AP, & Berry L (2009). Healthy start program and feto-infant morbidity outcomes: Evaluation of program effectiveness. Maternal and Child Health Journal, 13(1), 56–65. 10.1007/s10995-008-0400-y [PubMed: 18690524]

Shulman HB, D'Angelo DV, Harrison L, Smith RA, & Warner L (2018). The pregnancy risk assessment monitoring system: Overview of design and methodology. American Journal of Public Health, 108(10), 1305–1313. 10.2105/ajph.2018.304563 [PubMed: 30138070]

Thomas SD, Hudgins JL, Sutherland DE, Ange BL, & Mobley SC (2015). Perinatal program evaluations: Methods, impacts, and future goals. Maternal and Child Health Journal, 19(7), 1440–1446. 10.1007/s10995-015-1677-2 [PubMed: 25636650]

Thomas SD, Mobley SC, Hudgins JL, Sutherland DE, Inglett SB, & Ange BL (2018). Conditions and dynamics that impact maternal health literacy among high risk prenatal-interconceptional women. International Journal of Environmental Research and Public Health, 15(7), 1383. 10.3390/ijerph15071383 [PubMed: 30004397]

Significance

What is already known?

Previous local Healthy Start program evaluations were limited by less rigorous designs without a population-based comparison group and a lack of rich data on maternal health behaviors, experiences and outcomes.

What this study adds?

This study describes an enhanced methodological approach for evaluating a community Healthy Start program in Georgia using linked PRAMS, birth records, and program data, an external comparison group, and methods to adjust for bias. Results indicate a positive association between program participation and adequate or adequate plus prenatal care. The enhanced methodological approach can be applied in other community Healthy Start evaluations.

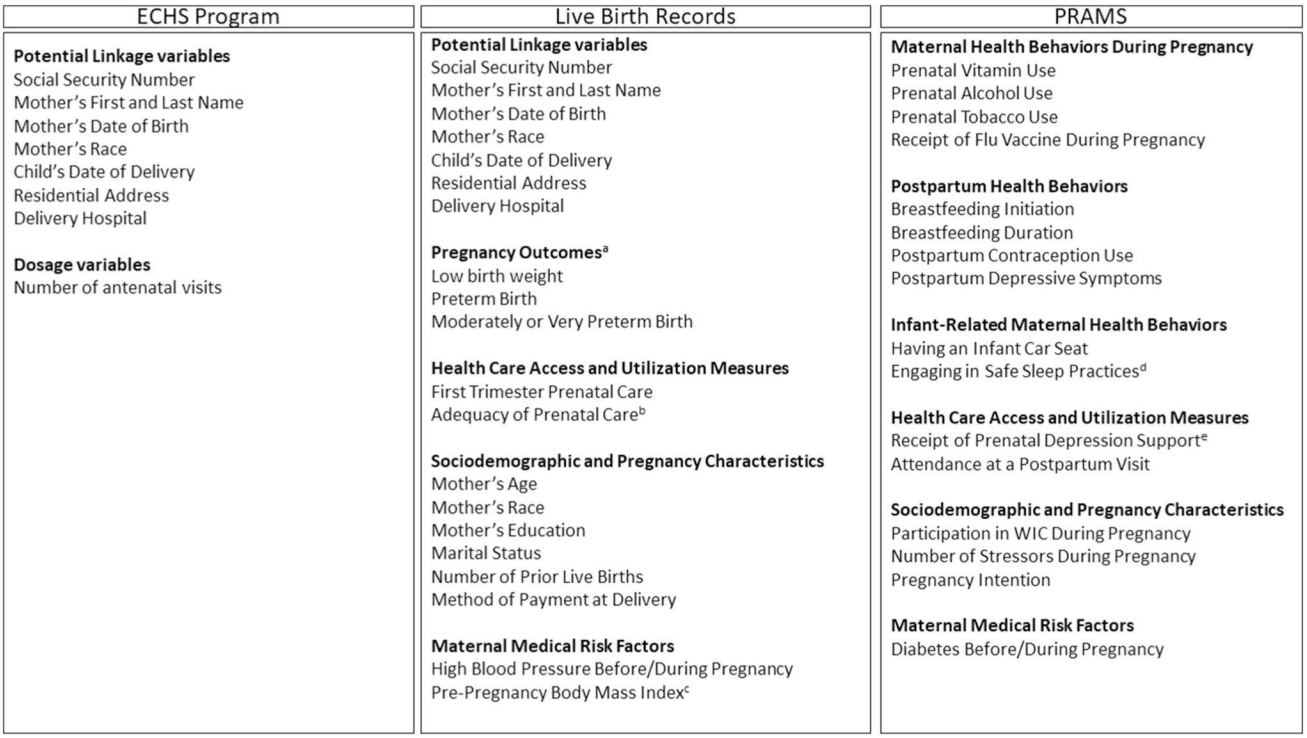

Fig. 1.

Data sources and data elements used in the evaluation of the ECHS program. *ECHS* Enterprise Community Healthy Start, *PRAMS* Pregnancy Risk Assessment and Monitoring System, *WIC* Women, Infants, and Children. **a** Low birth weight (< 2500 g), preterm birth (< 37 weeks of gestation), and moderately or very preterm birth (< 34 weeks of gestation) based on the obstetric estimate of gestational age. **b** Classified according to the Kotelchuck Index (Kotelchuck, 1994) and collapsed into a binary indicator (adequate/adequate plus versus inadequate/intermediate) due to small sample sizes. **c** Categorized according to the Institute of Medicine's 2009 recommendations (Rasmussen et al., 2009). **d** Defined as supine sleep position and non-bed sharing. **e** Defined as health care worker talked about baby blues during pregnancy

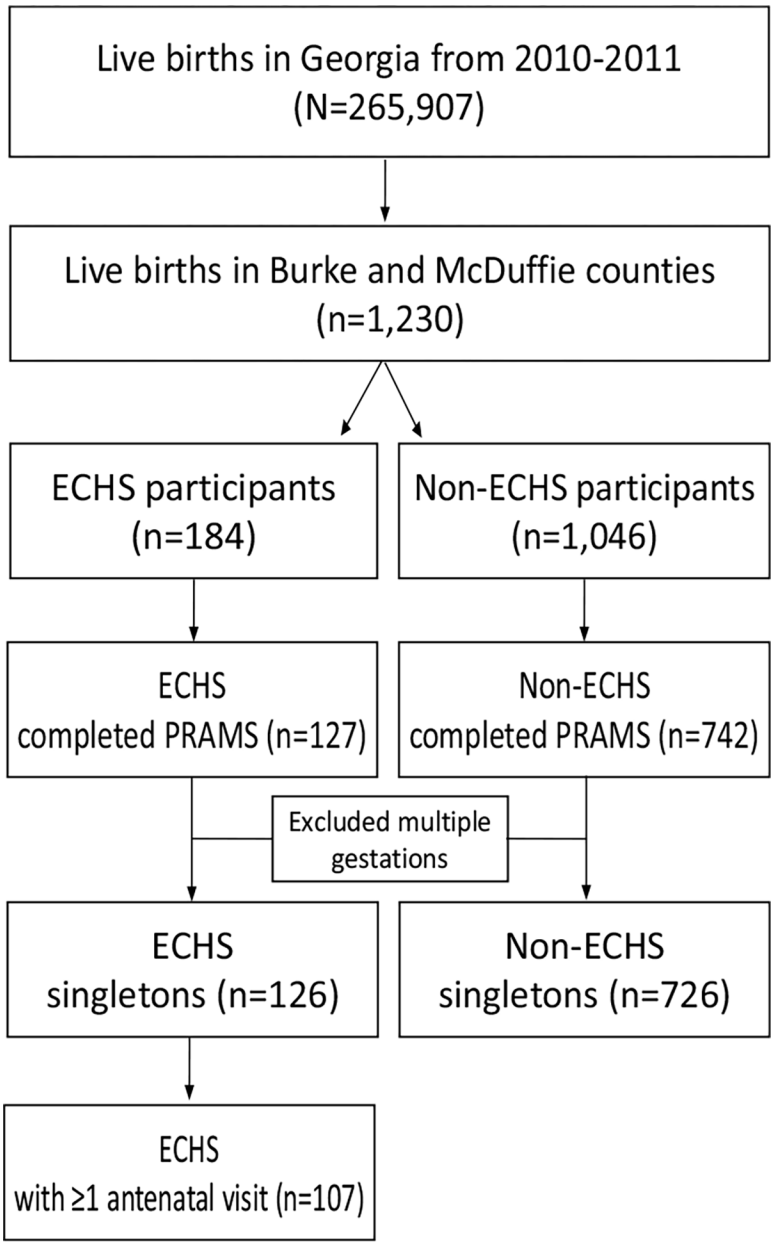

Fig. 2.

Flow chart to identify the final sample of ECHS participants and non-participants in Burke and McDuffie Counties from 2010 to 2011. *ECHS* Enterprise Community Healthy Start

Table 1

Sociodemographic and health characteristics of ECHS participants and non-participants in Burke and McDuffie Counties, 2010–2011 (N = 833)

	Non-participants (N = 726)		ECHS participants (N = 107)		*p*-value
	n (%)[a]		n (%)[a]		
Socio-demographics					
Maternal age, years					**0.01**
≤ 17	31	(4.3)	8	(7.5)	
18–24	297	(40.9)	58	(54.2)	
25–34	330	(45.5)	32	(29.9)	
35 +	68	(9.4)	9	(8.4)	
Maternal race[b]					< **0.001**
White	369	(51.3)	20	(18.7)	
Black	330	(45.8)	85	(79.4)	
Other race	21	(2.9)	2	(1.9)	
Number of missing observations	6		0		
Maternal education					**0.02**
< 12 years	149	(20.8)	35	(32.7)	
12 years	241	(33.6)	35	(32.7)	
≥ 12 years	327	(45.6)	37	(34.6)	
Number of missing observations	9		0		
Unmarried mothers	422	(58.1)	90	(84.1)	< **0.001**
Number of prior live births					0.94
None	291	(40.4)	41	(38.7)	
1	196	(27.2)	29	(27.4)	
2	126	(17.5)	21	(19.8)	
≥ 3	107	(14.9)	15	(14.2)	
Number of missing observations	6		1		
Method of payment at delivery					< **0.001**
Medicaid	460	(63.4)	99	(92.5)	
Private insurance	193	(26.6)	7	(6.5)	
Other	73	(10.1)	1	(0.9)	

	Non-participants (N = 726)		ECHS participants (N = 107)		*p*-value
	n (%)[a]		n (%)[a]		
WIC participation during pregnancy	485	(67.3)	95	(89.6)	< **0.001**
Number of missing observations	5		1		
Total No. of stressors[c]					0.07
None	337	(46.7)	40	(37.4)	
1–2	232	(32.1)	33	(30.8)	
3–5	129	(17.9)	27	(25.2)	
6–18	24	(3.3)	7	(6.5)	
Number of missing observations	4		0		
Intended pregnancy[d]	288	(40.2)	27	(25.5)	**0.004**
Number of missing observations	10		1		
Medical Risk					
Diabetes before or during pregnancy[e]	91	(12.5)	20	(18.7)	0.09
High blood pressure before or during pregnancy[e]	47	(6.6)	8	(7.7)	0.67
Number of missing observations	11		3		
Pre-pregnancy maternal body mass index					0.63
Underweight (< 18.5 kg/m^2)	29	(4.2)	6	(5.9)	
Healthy Weight (18.5–24.9 kg/m^2)	297	(43.4)	39	(38.6)	
Overweight (25.0–29.9 kg/m^2)	188	(27.5)	27	(26.7)	
Obese (≥ 30.0 kg/m^2)	171	(25.0)	29	(28.7)	
Number of missing observations	41		6		

ECHS Enterprise Community Healthy Start, *WIC* Women's Infants, Children (Special Supplemental Nutrition Program)

[a] Column percentage calculated using non-missing observations for each variable

[b] Given a data quality issue associated with the Hispanic ethnicity measure available in our data, only race was included in this analysis

[c] Defined according to 18 stressful life events occurring within 12 months before delivery

[d] Defined as wanting pregnancy then or sooner (versus wanting pregnancy later or not wanting pregnancy then or anytime in the future)

[e] Including both chronic and gestational combined

All estimates are unweighted. Bold p-values indicate statistical significance (p < 0.05)

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Most sociodemographic data were obtained from live birth records; WIC participation, number of stressors, and pregnancy intention were obtained from PRAMS. Data for medical risk factors were obtained from PRAMS, with the exception of high blood pressure which was obtained from live birth records since the PRAMS questionnaire only assessed whether a woman visited a health care worker to be checked or treated for high blood pressure

Table 2

Health behaviors and pregnancy outcomes of ECHS participants and non-participants in Burke and McDuffie Counties, 2010–2011 (N = 833)

	Non-participants (N = 726)		ECHS participants (N = 107)		*p*-value
	n (%)[a]		n (%)[a]		
Maternal health behaviors during pregnancy					
Prenatal vitamin use (last trimester)	450	(62.5)	58	(54.2)	0.11
Number of missing observations	6		0		
Prenatal alcohol use (last trimester), among those who drank before pregnancy[b]	23	(10.6)	3	(12.5)	0.73
Number of missing observations	1		1		
Prenatal tobacco use (last trimester), among those who smoked before pregnancy[c]	66	(45.2)	6	(35.3)	0.61
Number of missing observations	0		1		
Receipt of flu vaccine during pregnancy	223	(31.2)	32	(31.7)	0.91
Number of missing observations	10		6		
Maternal health behaviors after pregnancy					
Breastfeeding initiation	386	(54.4)	50	(47.2)	0.18
Number of missing observations	16		1		
Breastfeeding duration ≥ 12 weeks	190	(27.0)	17	(16.0)	**0.02**
Number of missing observations	23		1		
Postpartum contraception use	605	(84.0)	88	(83.0)	0.78
Number of missing observations	6		1		
Postpartum depressive symptoms	100	(13.9)	12	(11.5)	0.65
Number of missing observations	6		3		
Maternal health behaviors pertaining to the infant					
Had infant car seat	704	(99.3)	102	(97.1)	0.07
Number of missing observations	17		2		
Safe sleep practices					
Baby sleep position was supine	357	(50.3)	47	(44.3)	0.30
Non-bed sharing with baby (versus any bed sharing)	222	(31.3)	29	(27.4)	0.50
Number of missing observations	16		1		
Health care access and utilization					

	Non-participants (N = 726)		ECHS participants (N = 107)		*p*-value
	n (%)[a]		n (%)[a]		
First trimester prenatal care	597	(83.7)	78	(74.3)	**0.03**
Number of missing observations	13		2		
Adequate or adequate plus prenatal care (versus inadequate or intermediate)	464	(73.5)	77	(80.2)	0.21
Number of missing observations	95		11		
Received prenatal depression support	468	(66.3)	74	(73.3)	0.18
Number of missing observations	20		6		
Had a postpartum visit	664	(92.4)	93	(88.6)	0.18
Number of missing observations	7		2		
Pregnancy outcomes					
Low birth weight (< 2500 g)	66	(9.2)	14	(13.2)	0.22
Number of missing observations	11		1		
Preterm birth (< 37 weeks)	59	(8.1)	9	(8.4)	0.85
Moderately or very preterm birth (< 34 weeks)	15	(2.1)	4	(3.7)	0.29
Number of missing observations	1		0		

ECHS Enterprise Community Healthy Start

[a]Column percentage calculated using non-missing observations for each variable

[b]n = 243 (including 25 ECHS participants and 218 non-participants)

[c]n = 164 (including 18 ECHS participants and 146 non-participants)

All estimates are unweighted. Bold p-values indicate statistical significance (p < 0.05)

Data for health behaviors and selected measures of health care utilization (postpartum visit and depression support) were obtained from PRAMS; data for prenatal care were obtained from live birth records

Table 3

Multivariable regression for selected health behaviors, health care characteristics, and pregnancy outcomes among ECHS participants and non-participants in Burke and McDuffie Counties, 2010–2011

	N[b]	Logistic Regression without Weighting		Logistic Regression with Propensity Score Weighting[a]	
		Marginal Effects of ECHS participation	(*p*-value)	Marginal Effects of ECHS participation	(*p*-value)
Maternal health behaviors					
Breastfeeding initiation	795	0.05	0.36	0.05	0.37
Postpartum contraception use	804	− 0.01	0.85	− 0.01	0.85
Had infant car seat	793	− 0.02	0.12	− 0.02	0.33
Safe sleep practices					
Baby sleep position was supine	794	0.02	0.73	0.01	0.83
Non-bed sharing with baby (versus any bed share)	794	0.08	0.14	0.07	0.13
Health care access and utilization					
First trimester prenatal care	804	− 0.03	0.47	− 0.02	0.63
Received prenatal depression support	786	0.08	0.09	0.08	0.13
Adequate or adequate plus prenatal care (versus inadequate or intermediate)	715	0.09	**0.02**	0.11	**0.02**
Had a postpartum visit	802	− 0.04	0.26	− 0.03	0.32
Pregnancy outcomes					
Low birth weight (< 2,500 g)	800	0.01	0.70	0.02	0.68
Preterm birth (< 37 weeks)	810	− 0.0004	0.99	− 0.0002	1.00
Moderately or very preterm birth (< 34 weeks)	810	0.02	0.44	0.02	0.32

In multivariable regression analysis we selected outcomes that align with Healthy Start Benchmarks and are associated with infant mortality. All regression models were controlling for key covariates regarding women's socio-economic status and medical risks that were statistically significantly different at alpha = 0.05 level between ECHS participants and non-participants, as shown in Table 1, including maternal age, maternal race, maternal education, pregnancy intention, and method of payment at delivery. Due to the small sample size, we minimized the number of covariates in the model. If two covariates were highly correlated (correlation coefficient > 0.4), we only selected one for inclusion in the analysis. For example, WIC participation was significantly correlated with method of payment at delivery and was not included in the final model

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[a]We used propensity score method (PSM) with standardized mortality ratio (SMR) weighting, using the five model covariates as the matching variables (i.e., maternal age, maternal race, maternal education, pregnancy intention, and method of payment at delivery)

[b] Number of observations used in the regression model that had non-missing values for all model covariates and the outcome All estimates were produced without the sampling weights for PRAMS. Bold p-value indicates statistical significance ($p < 0.05$)