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Impact of a Federal Healthy Start Program on feto-infant morbidity associated with absent fathers: a quasi-experimental study

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Abstract

Objectives—The absence of fathers during pregnancy increases the risk of feto-infant morbidities, including low birth weight (LBW), preterm birth (PTB), and small-for-gestational age (SGA). Previous research has shown that the Central Hillsborough Healthy Start project (CHHS) – a federally funded initiative in Tampa, Florida – has effectively improved birth outcomes. This study explores the effectiveness of the CHHS project in ameliorating the adverse effects of fathers’ absence during pregnancy.

Methods—This retrospective cohort study used CHHS records linked to vital statistics and hospital discharge data (1998–2007). The study population consisted of women who had a singleton birth with an absent father during pregnancy. Women were categorized based on residence in the CHHS service area. Propensity score matching was used to match cases (CHHS) to controls (rest of Florida). Conditional logistic regression was employed to generate odds ratios (OR) and 95% confidence intervals (CI) for matched observations.

Results—Women residing in the CHHS service area were more likely to be high school graduates, black, younger (<35 years), and to have adequate prenatal care compared to controls ($p < 0.01$). These differences disappeared after propensity score matching. Mothers with absent fathers in the CHHS service area had a reduced likelihood of LBW (OR=0.76, 95% CI=0.65–

0.89), PTB (OR=0.72, 95% CI=0.62–0.84), very low birth weight (OR=0.50, 95% CI= 0.35–0.72) and very preterm birth (OR=0.48, 95% CI=0.34–0.69) compared to their counterparts in the rest of the state.

Conclusions—This study demonstrates that a Federal Healthy Start project contributed to a significant reduction in adverse fetal birth outcomes in families with absent fathers.

Keywords

Paternal involvement; Healthy Start; Florida; preterm birth; small-for-gestational age; singletons

Introduction

A growing body of research has revealed that paternal involvement significantly impacts child health and development [1–3]. Furthermore, recent studies have determined that a father's support in the prenatal period may play an important role in preventing infant mortality [4, 5], preterm birth [6–8], low birth weight [6, 8, 9], and small size for gestational age [6, 8]. Similarly, previous research has determined that obstetric complications, such as anemia, eclampsia, and placental abruption, are more prevalent among women whose babies' fathers were absent during pregnancy [5, 8].

In this study, we utilize an ecological approach to assess the impact of a Federally-funded Healthy Start program, the Central Hillsborough Healthy Start Project (CHHS), on fetal-infant morbidities among families with absent fathers. CHHS is implemented by REACHUP, a community-based nonprofit organization, and funded through the Maternal and Child Health Bureau's Healthy Start Initiative to improve maternal and infant outcomes in the socioeconomically challenged community of East Tampa (zip codes: 33602, 33603, 33605, 33607, and 33610) within Hillsborough county of Florida [10].

The Central Hillsborough Healthy Start Project (CHHS) is a federally-funded, community-based intervention program that works towards the reduction of racial/ ethnic disparities in adverse maternal and infant health outcomes within socioeconomically challenged neighborhoods in Tampa, Florida [10, 11]. Previous research has demonstrated that CHHS successfully reduced adverse birth outcomes such as very low birth weight and preterm birth among program participants by approximately one-third, as compared to other women in the community [10]. However, there are no known studies that assess the effectiveness of Healthy Start programs in ameliorating the adverse effects of fathers' absence during pregnancy. This study, therefore sought to address this investigative gap.

Methods

The Federal Healthy Start program as implemented by the CHHS consists of a home visit and referral to a care group for further education on social and mental health. The CHHS offers risk reduction services during and outside of pregnancy and since the purpose of this manuscript is the impact of absent fathers on pregnancy outcomes, we will focus on the services provided by the prenatal group of the CHHS program. The prenatal group focuses on pregnant women who have risk factors that are associated with adverse pregnancy

outcomes. CHHS services are provided to these women by the project. Unique to Florida, all pregnant women and newborns are offered risk screens to identify those who would benefit most from risk reduction services. In the majority of cases, the reason for receipt of services was due to prenatal screening scores that were at or above the 4.0 screening score recommended as the cut-off point for delivery of risk reduction services. Florida's universal screening of pregnant women and infants includes a series of questions that focus on medical, environmental, and psychosocial factors that identify a patient as at-risk. The score is determined by summing the contributing items, each worth one point except for race, which contributes two points. The following 15 variables comprise the components of the screening score: Black race; maternal age below 18 or above 39; unmarried; less than high school education; low maternal weight (<110 pounds); problems keeping appointments; moving more than 3 times in the past year; feeling unsafe; going to bed hungry; tobacco use in the past 2 months; use of drug or alcohol in the past 2 months; unwanted pregnancy; current maternal illness; seeking prenatal care in the second trimester; and history of poor outcomes or no previous pregnancy experience.

The CHHS services are provided according to needs identified through screening and further assessment which includes: 1) case management/care coordination including home visits; 2) health education; 3) perinatal depression screening, referrals, and community interventions; 4) interconception continuity of care; 5) doula support during pregnancy, labor, birth, and early postpartum period. In addition to direct services the project builds internal and community capacity through 1) community engagement and mobilization through a community consortium; 2) program participant outreach, recruitment, and retention; 3) recruiting and retaining staff from the community; and 4) continuous service quality assurance and improvement.

The prenatal group meets monthly to assist pregnant women with an absent father to prepare for childbirth and parenting through the implementation of education and awareness-focused intervention plans that aim to promote a healthy pregnancy to full term, reduce stress and increase self-awareness. The prenatal group provides single mothers with the opportunity to interact with other parents and receive support during this crucial period of life change. The preconception/inter-conception care group provides the single mothers with education on improving maternal/infant attachment; information and training on life styles and social interactions to mitigate the likelihood of perinatal depression; and family health literacy through a curriculum with an emphasis on four focus areas: 1) health education, 2) family/community involvement, 3) counseling and mental health services, and 4) health services. An emphasis on health, nutrition, and physical activity also provides the opportunity for a healthier pregnancy in the absence of the father. These services are provided by staff, subcontractors, and local providers as a one-on-one intervention.

For this study, CHHS program data, vital statistics records from the Florida Department of Health for the years 1998 through 2007 and records from Florida's Agency for Health Care Administration (AHCA) Hospital Inpatient Discharge (HID) dataset were linked over the same period using unique identifiers. Diagnoses and procedures within the HID dataset were recorded using standard codes from the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). We restricted our analysis to women who had

a singleton, viable live birth (20 weeks of gestation and 44 weeks of gestation) with an absent father during pregnancy. The resulting study population totaled 170,159 across the state of Florida. We restricted our analysis to women with absent fathers during pregnancy and compared fetal birth outcomes among women within the CHHS service areas (exposed group) versus their counterparts in the rest of the State (unexposed). Although not all women in the CHHS service areas (exposed group) received services, our primary purpose is to estimate the overall impact of the CHHS project at the population/ecological level. Restricting the unexposed group to women within the catchment areas that did not come into contact with the CHHS program may be biased by contamination since some of the unexposed women might benefit from the broad-based education offered to enrolled women they have come into contact with. Also, the goal of the CHHS program is to induce community-level rather than only individual-level change in health outcomes. This explains our rationale for using the rest of the state as the comparator. The fetto-infant outcome variables of interest were the following: preterm birth (PTB: <37 weeks of gestation), very preterm birth (VPTB: <32 weeks of gestation), low birth weight (LBW: birth weight <2500g), very low birth weight (VLBW: birth weight <1500g), and small-for-gestational age (SGA: birth weight < 10th percentile for gestational age).

Maternal socio-demographic variables were abstracted from vital statistics data and included race/ethnicity, age, educational level, marital status, parity, smoking status, and adequacy of prenatal care. Race/ethnicity was grouped into four categories: white, black, Hispanic, and other. The Hispanic category was defined as an ethnic group regardless of racial origin. The “other” category refers to individuals that could not be identified as white, black or Hispanic. Marital status was dichotomized into married or unmarried, with all persons divorced, widowed, or of unknown marital status classified as unmarried. We categorized maternal age into two groups: <35 years and 35 years. Educational level was classified as either <12 years of education or 12 years of education. Parity was dichotomized as either nulliparous (those with no children) or parous (those with children). Maternal prenatal smoking was dichotomized as either a yes or no response. Adequacy of prenatal care was assessed using the Revised Graduated Index algorithm (R-GINDEX). The R-GINDEX examines the adequacy of care based on the trimester when prenatal care began, the number of visits, and the gestational age of the infant at birth [12]. Prenatal care was dichotomized as either adequate or inadequate, with inadequate prenatal care utilization referring to women who either had missing prenatal care information, had prenatal care but the level was considered sub-optimal (i.e., fewer prenatal care visits as compared to the length of pregnancy), or had no prenatal care at all.

Statistical Analysis

Baseline characteristics among women in the study were compared by exposure to the CHHS program (i.e., women within the CHHS service area [exposed] vs. those within the rest of Florida [unexposed]) using the Chi-square test. Since the test results showed that the two groups of women were significantly different from each other with respect to baseline characteristics, propensity score matching was performed to match women in CHHS service area to the rest of Florida in order to balance the two groups and provide unbiased estimates of treatment effects. This matching procedure was defined as the probability of a woman

being assigned to the exposed group, given a set of baseline characteristics [13]. This approach identified neighborhoods that were identical to each other with respect to the likelihood of being in the exposed group [13]. For each computed propensity score, women were selected from the comparison group based on the closest absolute propensity score -the “nearest neighbor” [14]. We conducted the selection process without replacement and matched women from the CHHS service area and the rest of Florida on a ratio of 1:1 [14, 15]. After propensity score matching, the distribution of the covariates between women in the exposed and those in the unexposed group were expected to be the same, leading to non-significant differences in the covariates across these groups of women [14]. After matching, we compared the socio-demographic characteristics of mothers within the CHHS service area with those in the rest of the state of Florida using the Chi-square test.

A crude frequency comparison for the presence of common obstetric and medical complications was also performed. The variables examined included anemia, insulin-dependent diabetes mellitus; gestational diabetes; pregnancy-induced hypertension; hypertension complicating pregnancy, childbirth and the puerperium; pre-existing hypertension; preeclampsia; eclampsia; placental abruption; and placenta previa. Alcohol and drug use during pregnancy were also assessed. Pregnancy-related complications for mothers with absent fathers within the CHHS service area were compared with the rest of the state of Florida before and after propensity score matching using the Chi-square test.

Using matched data, the risk for fetο-infant outcomes of interest among mothers with absent fathers within the CHHS service area was compared to the risk among mothers within the rest of Florida. Since the dataset included matched cases and controls, we performed conditional logistic regression to generate adjusted odds ratios and 95% confidence intervals [16]. Using this method, regression parameters were estimated by taking into account the presence of intra-cluster correlation. Variables included in the logistic regression analysis were based on a review of the literature and biologic plausibility. All tests were two-tailed with a type 1 error rate fixed at 5%.,SAS version 9.2 (SAS Institute, Cary, NC, USA) was used to perform all analyses. This study was approved by the Institutional Review Board of the University of South Florida.

Results

Table 1 shows the frequency comparison of selected socio-demographic characteristics among mothers with absent fathers during pregnancy in the CHHS service area and the rest of the state of Florida before and after propensity score matching. In Table 2, we present the comparison of selected medical and pregnancy-related complications within the study population before and after propensity score matching. Prior to matching, mothers in the CHHS area were more likely to be black, younger (<35 years) with at least a high school degree and adequate prenatal care, whereas mothers in Florida were more likely to be white, older (≥ 35 years), nulliparous, and to report that they smoke cigarettes during pregnancy ($p<0.01$, Table 1). After matching, all differences in socio-demographic characteristics between mothers in the CHHS service area and the rest of the state of Florida disappeared. Before matching, the following pregnancy-related complications were more prevalent among mothers in the CHHS service area than among mothers in the rest of Florida:

hypertension complicating pregnancy, pregnancy-induced hypertension, alcohol abuse, and drug abuse. However, after matching, no significant differences in the selected pregnancy-related complications were observed between the groups (Table 2).

Adjusted estimates for the relationship between selected fetoinfant morbidity outcomes and mothers with absent fathers during pregnancy within the CHHS service area are presented in Table 3. Compared to mothers in the rest of Florida, mothers in the CHHS service area had a 52% reduced likelihood of having a VPTB infant (AOR=0.48, 95% CI=0.34–0.69), while the odds of having a VLBW infant were reduced by 50% (AOR=0.50, 95% CI=0.35–0.72). Furthermore, in comparison to mothers in the rest of Florida, mothers in the CHHS service area had a 28% reduced likelihood of having a PTB infant (AOR=0.72, 95% CI=0.62–0.84), and 24% reduced likelihood of having a LBW infant (AOR=0.76, 95% CI=0.65–0.89). However, there were no significant differences in the odds of SGA (AOR=0.94, 95% CI=0.82–1.09). Since mothers with missing prenatal care information were few, we decided to re-run the analyses with and without these mothers. The estimates for the analyses remained unchanged.

Discussion

We found that mothers with absent fathers during pregnancy and living in the catchment area served by the Central Hillsborough Health Start program were less likely than their matched peers residing in other parts of Florida to experience preterm and very preterm delivery and to have low birth weight babies. Despite a dearth of studies on this topic, our findings are broadly consistent with other published studies [6–8]. A study of psychosocial predictors of birth outcomes in low-income women reported that 9% of the variance in gestation among black mothers could be attributed to spousal or partner support [17]. Similarly, a registry-based study found that mothers whose partner's information was missing from vital records are at higher risk of adverse pregnant outcomes, including preterm birth and low birth weight [6]. Tan et al.'s registry-based study validated earlier reports of a protective effect of paternal involvement (as measured by the listing of the father's name on the birth certificate) on low birth weight [4]. An analysis of data from the Fragile Families study also documented a two-fold likelihood of low birth weight among children born to mothers not living with fathers than among children born to married mothers [7]. Using the presence of father's information on the birth certificate as proxy for paternal involvement, we showed in an earlier study that the association between level of paternal involvement and occurrence of certain fetal morbidity outcomes (preterm birth and low birth weight) remains valid for younger mothers, especially African American teens [8].

The mechanism by which paternal involvement impacts the occurrence of preterm birth and low birth weight is likely multifactorial. It is a recognized fact that married mothers are less likely to smoke cigarettes during their pregnancy and are more likely to utilize early prenatal care [5, 7, 18]. Women who reside with their partners are also more likely to abstain from alcohol use during pregnancy [19]. Paternal involvement in the prenatal period may, therefore, be considered to positively influence healthy maternal behaviors, including regular attendance at prenatal care and decreased adoption of adverse lifestyle choices, including smoking and alcohol use. Paternal support in pregnancy may also exert a

beneficial effect on length of gestation and fetal growth via a stress-relieving effect. For instance, Ghosh et al. [20] found that paternal support during pregnancy moderated the effects of chronic stress on preterm birth among women living in Los Angeles County. Chronic stress causes hypothalamo-pituitary axis and sympathetic nervous system dysregulation, thereby altering production of stress hormones, including cortisol and corticotrophin releasing hormone. Elevated stress hormone levels are documented triggers for preterm birth and fetal growth restriction [21–23]. We are, however unable to comment if this was the case in this study, as our database did not include information on measures of maternal stress.

There is considerable variation in the constructs used to describe paternal involvement across studies. Teitler has characterized as many as six typologies for parental involvement, ranging from mother's marital status, cohabitation, father's presence at birth and financial support to whether or not the father's name is documented on the birth certificate, etc [7]. The level of paternal involvement has also been analyzed in terms of engagement, accessibility and responsibility [24, 25]. In this study we were not able to specifically examine the type, quality and intensity of paternal involvement. However, our proxy for paternal involvement [presence of paternal information on vital records] can be considered to be fairly accurate, as it has been shown to be closely correlated to actual paternal prenatal involvement [7]. Another limitation in this study is our use of the last menstrual period (LMP) method to compute gestational age instead of clinical estimate. The LMP method is imperfect and prone to misclassification bias because of errors in recall and miscalculation associated with bleeding in early pregnancy [26].

A strength of this study is the population-based design, which increases the generalizability of our findings. We also adjusted for marital status in our analyses, thereby enabling assessment of the effect of paternal involvement independent of marital status. Finally, prior to analysis we matched the two population groups (CHHS and non-CHHS service areas) on the basis of important sociodemographic characteristics and maternal complications in pregnancy, thereby yielding unbiased estimates of treatment effects.

In summary, we report significant benefits of a Federal Healthy Start project in reducing preterm birth and low birth weight outcomes among mothers of infants whose fathers were absent during pregnancy. A public health approach to tackling preterm delivery and low birth weight must address the role of supportive paternal involvement during pregnancy. Findings from this study can inform policy and guide priority setting, especially when designing and implementing interventions geared to addressing the intractable crisis of preterm delivery in our communities.

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Crude frequencies of selected maternal socio-demographic characteristics for absent fathers within the Central Hillsborough Healthy Start service area (zip codes: 33601, 33602, 33605, 33607, 33610) and the rest of Florida before and after matching (1998–2007)

Socio-demographic Characteristics	Before matching			After matching		
	Healthy Start (n=3,242) %	Florida a (n=166,917) %	p-value b	Healthy Start (n=3,194) %	Florida a (n=3,240) %	p-value b
Race			<0.01			0.93
White	10.52	33.12		10.68	10.83	
Black	75.46	47.67		75.11	75.43	
Hispanic	10.52	14.41		10.68	10.46	
Other	3.49	4.80		3.54	3.27	
Older mothers (35 years old)	5.62	7.11	<0.01	5.42	5.22	0.72
Education (12 years)	51.85	37.53	<0.01	51.22	51.88	0.60
Smokers	9.51	15.28	<0.01	9.33	9.66	0.74
Adequate prenatal care	52.99	32.16	<0.01	52.72	53.30	0.64
Unmarried	92.07	91.39	0.34	92.08	92.07	1.00
Nulliparous	29.35	36.72	<0.01	29.68	29.26	0.37

¹The “Florida” group excludes the Healthy Start service area.

Significant values in bold font. P-values <0.05 considered significant.

Table 2

Crude frequencies of selected pregnancy complications for absent fathers within the Central Hillsborough Healthy Start service area (zip codes: 33601, 33602, 33605, 33607, 33610) and the rest of Florida before and after matching (1998–2007)

Pregnancy Complications	Before matching			After matching		
	Healthy Start (n=3,242) %	Florida ^a (n=166,917) %	p-value ^b	Healthy Start (n=3,194) %	Florida ^a (n=3,240) %	p-value ^b
Anemia	17.28	9.59	<0.01	16.66	17.25	0.52
Gestational diabetes	2.65	2.28	0.16	2.63	2.53	0.80
Diabetes mellitus	0.80	0.70	0.49	0.78	0.77	0.96
Pregnancy-induced hypertension	4.26	2.82	<0.01	4.23	4.04	0.71
Hypertension complicating pregnancy	11.94	9.88	<0.01	11.77	11.98	0.80
Pre-existing hypertension	1.85	1.53	0.14	1.88	1.91	0.92
Preeclampsia	4.41	3.73	0.04	4.29	4.29	1.00
Eclampsia	0.19	0.16	0.67	0.13	0.22	0.38
Placental abruption	1.23	1.08	0.42	1.25	1.36	0.71
Placenta previa	0.49	0.38	0.32	0.44	0.40	0.82
Alcohol abuse	0.49	0.15	<0.01	0.44	0.34	0.52
Drug abuse	3.80	1.84	<0.01	3.32	3.92	0.20

^aThe “Florida” group excludes the Healthy Start service area.

^bSignificant values in bold font. P-values <0.05 considered significant.

Table 3

Conditional odds ratio for the association between absent fathers and feto-infant morbidity outcomes among mothers within the Central Hillsborough Healthy Start service area (zip codes: 33601, 33602, 33605, 33607, 33610) after propensity score matching (Florida, 1998–2007)^a

Outcomes	Florida ^b (n=3,240) AOR (95% CI)	Healthy Start (n=3,194) AOR (95% CI)
Low birth weight (n=1,158)	1.00 (---)	0.76 (0.65–0.89)
Very low birth weight (n=204)	1.00 (---)	0.50 (0.35–0.72)
Preterm birth (n=1,306)	1.00 (---)	0.72 (0.62–0.84)
Very preterm birth (n=224)	1.00 (---)	0.48 (0.34–0.69)
Small for gestational age (n=1,447)	1.00 (---)	0.94 (0.82–1.09)

Abbreviations: AOR=Adjusted Odds Ratio; 95% CI=95% Confidence Intervals

^a Matching was done by conducting a logistic regression of the exposure variable as dependent variables and the following maternal characteristics as independent variables: maternal age, parity, race, smoking, education, marital status, adequacy of prenatal care, anemia, Gestational diabetes, placenta accreta, diabetes mellitus, pregnancy-induced hypertension, hypertension complicating pregnancy, childbirth, and the puerperium, preexisting hypertension, preeclampsia, eclampsia, placental abruption, placenta previa, alcohol abuse, and drug abuse.

^b The “Florida” group excludes the Healthy Start service area.