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Multi-Level Evaluation of a Perinatal Health Program in Rural Southeast Georgia

Swati Raychowdhury, PhD, MPH

Jiann-Ping Hsu College of Public Health, Georgia Southern University

Stuart H. Tedders, PhD

Jiann-Ping Hsu College of Public Health, Georgia Southern University

Greta O'Steen, RN, IBCLC

Perinatal Health Program Director, Southeast Health District, Waycross, Georgia

Sarah Jones, BS

MPH Candidate, Georgia Southern University

Abstract

Problem: Infant mortality has declined steadily in the past decade, however, significant disparities associate with lack of adequate perinatal health services and barriers to access disproportionately impact women residing in rural areas. In Georgia, data suggest significant challenges with respect to birth outcomes, and this problem seems to be exacerbated in rural regions of state. The objective of this presentation is to report on the impact of a regional perinatal health care collaborative implemented in rural southeast Georgia.

Method: Analysis of pre-intervention and post-intervention birth outcomes (gestational age, birth weight and infant mortality) served as the focal point programmatic evaluation. Differences in mean gestational age and mean birth weight were analyzed using a t-test ($\alpha = 0.05$). Proportional differences in low birth weight and infant mortality were assessed using the chi-square test ($\alpha = 0.05$). Differences were investigated relative to race (white and non-white).

Results: Analysis of white participants showed no significant difference in any birth outcomes investigated. Furthermore, analysis of non-white PHP participants suggested significant improvements in all birth weight ($p < 0.001$), gestational age ($p = 0.007$), low birth weight ($p = 0.002$), and infant mortality ($p = 0.007$).

Conclusion: The perinatal health program in southeast Georgia demonstrated considerable effectiveness as measured through pre-intervention and post-intervention birth outcomes. The potential for improved health outcomes of high risk pregnant women and infants as a result of adequate perinatal care may also lead to the achievement of Healthy People 2010 within this region.

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Corresponding Author: Swati Raychowdhury, PhD, MPH, Assistant Professor, Jiann-Ping Hsu College of Public Health, Georgia Southern University, P.O. Box 8015, Statesboro, GA 30460-8015. VOX: 912-871-3359; FAX: 912-486-7553; e-Mail:

sraychowdhury@georgiasouthern.edu

Multi-Level Evaluation of a Perinatal Health Program in Rural Southeast Georgia

Despite aggressive efforts by the U.S. health care system to assure that prenatal care is effectively received by all women beginning in their first trimester of pregnancy, about 70,000 women reportedly receive no care prior to delivery each year (Taylor, Alexander, & Hepworth, 2005). Although the proportion of U.S. women beginning first trimester care has increased to more than 83% since 1999, this continues to be inadequate in terms of the Health People 2010 objectives. Healthy People 2010 strives for at least 90% of U.S. women initiating care in the first trimester (Healthy People 2000). As racial disparities in infant mortality continue to increase at an alarming rate, research suggests the discrepancy between Caucasians and African Americans, mainly concerning little change in late or no prenatal care use among the latter population (MMWR, 2000). The fact that women at greatest risk of poor pregnancy outcomes utilize access to prenatal care the least has led many U.S. states initiating regionalized perinatal care systems (McCormick, Shapiro, & Starfield, 1985; Swyer, 1993). Perinatal care at a regional level has been recognized as an effective means to reducing perinatal morbidity and mortality due to improved access to appropriate levels of maternal and neonatal care (Perkins, 1993; Gortmaker, Clark, Graven, & Sobel, 1987; Shenai, Major, Gaylord, Blake, Simmons, Oliver, et al, 1991).

In the State of Georgia, infant mortality has declined steadily in the past decade, as in the United States overall (Samuelson, Buehler, Norris, & Sadek, 2002); however, there has been no change in the proportion of preterm births over the past ten years, indicating a current lack of knowledge and effective interventions regarding the causes of preterm delivery (Grason, Hutchins, & Silver, 1999). As the number of preterm deliveries increase, the costs for the initial perinatal care can exceed \$150,000

(Brannen, Phillips, Sowell, Vickers, 2000); not including indirect costs. Social workers and hospital case managers consistently identify the psychosocial stress that families endure when they experience adverse pregnancy outcomes (Brannen, Phillips, Sowell, Vickers, 2000). Recent studies also imply a difference in academic achievement, professional attainment and weekly income levels of adults who were low birth weight (Strauss, 2000). For example, a study conducted on high school children found that compared with normal birth weight children, low birth weight children manifested deficits of 3 to 5 points in age-standardized tests of academic achievement at age 17 that had persisted with little change from age 11 (Breslau, Paneth & Lucia, 2004). The Perinatal Health Partners Program (PHP) was created to address acute and chronic issues that are associated with high-risk pregnancies in Georgia. Specifically, this program was designed in response to a regional perinatal health strategic plan and was implemented to positively impact the perinatal health in 24 southeast Georgia counties ((Greta O'Steen (personal communication, November 13, 2006). The PHP combines in-home case management with nursing assessment and care coordination for the high-risk pregnant woman and her infant with the expressed purpose of improving birth outcomes. The Center for Rural Health and Research at Georgia Southern University was contracted to provide an objective, multi-level evaluation of programmatic activities over the span of three years. The purpose of this paper is to report the key findings associated with PHP among ten Georgia counties in the Southeast Health District (9 - 2).

METHODS

Perinatal Health Partners Program (PHP)

The mission of the PHP is to develop and sustain a regional system of perinatal care that maximizes health outcomes for southeast Georgia women and infants (Greta O'Steen (personal communication, November 13, 2006)). The target area for this evaluation was restricted to 10 counties in the Southeast Health District (9 - 2), a rural health district in southern Georgia. The specific target population for this evaluation were all women served by PHP who were defined "medically high risk" (see below) for adverse outcomes based on current health status, and prior obstetric and gynecologic histories, as well as all subjects who were referred for service via their primary care physician. The success of PHP depends on a well defined network of local medical providers, regional birthing hospitals, public health and community agencies. PHP also maintains a close relationship with the regional tertiary care center, enabling PHP to access specialty care for high risk women.

A key PHP project component included an intensive, in-home medical case management approach to perinatal care. "Medically high-risk" is defined as receiving a diagnosis (with the history of with a previous pregnancy or with current pregnancy), among the following criteria (Greta O'Steen (personal communication, June 6, 2007)):

- Miscarriage (2 or more)– Second Trimester Pregnancy Loss
- Previous Fetal/Neonatal Death (If baby dies due to prenatal complications).
- Prior Premature Delivery or PROM
- Incompetent Cervix
- Diabetes – Gestational Type I or Type II
- PIH – Pre-eclampsia
- Pre-term Labor
- Multiple Gestation with Complications
- Pre-existing Medical Conditions (i.e. HTN, Lupus, Auto-Immune Disease, Cardiac Disease, Epilepsy, HIV, STC.)
- Individuals with fetal abnormality with their current pregnancy, or physician ordered bed rest, are also considered "medically high-risk" on a case-by case basis.

"Medically high-risk" women were identified early in pregnancy and offered intensive, in-home, nurse-based case management services as well as one-on-one education tailored to meet their unique medical, cultural and linguistic needs. Supports such as child care and transportation vouchers were available to help women keep their prenatal appointments. Case management was also offered to medically fragile infants discharged from tertiary care centers.

Description of Data

Data for PHP patients were tracked and maintained in a Microsoft® Access database. All data entry was handled at the public health district administrative offices according to PHP mandated protocols. Additionally, all patient records were maintained with PHP personnel and evaluators never had access to the original records. The database was transmitted electronically to the Center for Rural Health and Research at Georgia Southern University and data tables were extracted for the analysis. The electronic data file was comprehensive and included information regarding specific aspects of client demographics, client assessment profiles, referring diagnosis, pregnancy history, and birth outcomes associated with this case management effort. Extracted data were analyzed descriptively and inferentially using SPSS® for Windows. For the purpose of this paper, specific variables included birth weight, gestational age, and infant death for both the current delivery event, as well as prior delivery events.

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Data Analysis

Data analysis focused on recorded changes in birth outcomes (birth weight, gestational age, and mortality) among women “prior to” and “after” PHP enrollment. Data associated with birth outcomes prior to PHP enrollment are classified as “pre-intervention data”. Likewise, data associated with outcomes after enrollment are classified as “post-intervention data”. Data were stratified according to race, but, due to relatively small numbers, subjects were classified as either “Caucasian” or “non-Caucasian”. Proportional differences in low birth weight births and infant mortality were investigated using a chi-square test ($\alpha = 0.05$). Additionally, odds ratios and 95% confidence intervals were calculated to assess the strength of observed associations. Differences in mean birth weight and mean gestational age were also analyzed using a t-test to investigate pre-intervention and post-intervention outcomes ($\alpha = 0.05$).

RESULTS*Demographic Profile of Subjects*

From June 30, 2003 to July 31, 2006, a total of 713 women were enrolled in PHP. The majority of PHP participants were Caucasian (57.1%), and 42.9% of PHP participants were non-Caucasian. More specifically, 31.8% of subjects were black, 10.8% were Hispanic, and 0.3% were multi-racial. Over 58.0% of all PHP participants were either 20 – 24 years (30.0%) or 25 – 29 years (28.3%) old. Subjects aged 30 – 34 (17.3%) or 35 – 39 (11.9%) comprised 29.2% of all participants. The mean age of all PHP enrollees was 27.8 years. Nearly equal proportions of PHP participants reported being either married (37.3%) or single (38.3%), and the marital status for over 18.0% of subjects was not reported. Of women, 33.6% reported having less than a high school education, while 24.1% of

women reported having only a high school education. Of the remaining subjects, 10.0% had experiences at the junior college level and 9.8% of subjects had some technical college training. The educational attainment of 18.1% of participants was not reported.

Referral Profile of Subjects

Among the 713 enrollees, the most common referring diagnosis recorded was pre-existing medical conditions (23.8%) as indicated by Table 1, followed by gestational diabetes (11.4%) and pregnancy induced hypertension (10.5%).

Table 1
Referring Diagnosis of Enrolled PHP Patients

Indicator	Percent
Pre-existing Medical Conditions	23.8
Gestational Diabetes	11.4
Pregnancy Induced Hypertension	10.5
Prior Spontaneous Abortion	9.1
Premature Rupture of Membrane	8.1
Pre-Term Labor	8.1
Prior Pre-Term Labor	7.7
Prior Infant/Fetal Death	6.2

Low Birth Weight

Among Caucasians, (Table 2), no significant difference in the proportion of low birth weight births was noted ($p = 0.101$) when comparing pre-intervention outcomes to post-intervention outcomes. Additionally, the trend as indicated by the risk ratio calculation (OR: 1.5, 95%CI: 0.9 – 2.6) may suggest an improved outcome (95% confidence intervals associated with this estimate were not significant). Among non-Caucasian participants, a significant improvement in birth weight was evident as indicated by chi-square analysis ($p =$

0.002). The point estimate suggests that the odds of having a low birth weight birth were 2.3 greater among women not enrolled in the PHP (OR: 2.3, 95%CI: 1.3 – 3.8). Analysis on an aggregate indicates that PHP participants were significantly less likely to have a low birth weight birth

($p = 0.001$) as indicated by chi-square analysis. Based on risk ratio calculations, the odds of having a low birth weight birth among women not enrolled in the PHP program were 1.9 times greater as compared to women enrolled in PHP (OR: 1.9, 95%CI: 1.3 – 2.7).

Table 2

Analysis of Proportion of Birth Weight Outcomes for Pre-Intervention and Post-Intervention Subjects (Caucasian, Non-Caucasian, and All Subjects)

CAUCASIAN SUBJECTS				
	% Low Birth Weight	% Normal Birth Weight	p-Value	Odds Ratio (95% CI)
Pre-Intervention Birth Outcome	27.3% (n = 35)	72.7% (n = 93)	0.101	1.5 (0.9 – 2.6)
Post-Intervention Birth Outcome	19.6% (n = 40)	80.4% (n = 164)		
NON-CAUCASIAN SUBJECTS				
Pre-Intervention Birth Outcome	39.3% (n = 46)	60.7% (n = 71)	0.002	2.3 (1.3 – 3.8)
Post-Intervention Birth Outcome	22.2% (n = 37)	77.8% (n = 130)		
TOTAL SUBJECTS				
Pre-Intervention Birth Outcome	33.1% (n = 81)	66.9% (n = 164)	0.001	1.9 (1.3 – 2.7)
Post-Intervention Birth Outcome	20.8% (n = 77)	79.2% (n = 294)		

Mean Birth Weight

No statistically significant improvement in mean birth weight was noted among Caucasian women ($p = 0.102$) when comparing pre-intervention data to post-intervention data; however, it is important to note that the recorded average birth weight among Caucasian subjects did improve. Among non-Caucasian women, birth weight was significantly improved following PHP involvement ($p < 0.001$). Moreover, post-intervention data suggest a statistically significant improvement in

mean birth weight ($p < 0.001$) among all women included in this study.

Gestational Age

There was no significant change in mean birth weight ($p = 0.998$) in reported gestational age based on tests of significance among Caucasian subjects (Table 4). Among non-Caucasian women, data suggest a significant improvement in gestational age following PHP intervention ($p = 0.007$). When all women were aggregated and analyzed as a single cohort, mean gestational age was not

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significantly improved ($p = 0.074$). It is important to note this is a marginal p-value. It is evident that the mean gestational age among this cohort did

improve following PHP intervention, albeit not significantly.

Table 3

Analysis of Mean Birth Weight for Pre-Intervention and Post-Intervention Subjects (Caucasian, Non-Caucasian, and All Subjects)

CAUCASIAN SUBJECTS			
	Birth Weight (grams)	Std Deviation	p-Value
Pre-Intervention Birth Outcome	2917.0	917.1	0.102
Post-Intervention Birth Outcome	3079.8	772.2	
NON-CAUCASIAN SUBJECTS			
Pre-Intervention Birth Outcome	2607.2	941.7	<0.001
Post-Intervention Birth Outcome	2988.1	824.3	
TOTAL SUBJECTS			
Pre-Intervention Birth Outcome	2768.4	939.9	<0.001
Post-Intervention Birth Outcome	3033.5	796.1	

Table 4

Analysis of Mean Gestational Age for Pre-Intervention and Post-Intervention Subjects (Caucasian, Non-Caucasian, and All Subjects)

CAUCASIAN SUBJECTS			
	Gestational Age (weeks)	Std Deviation	p-Value
Pre-Intervention Birth Outcome	37.3	4.2	0.998
Post-Intervention Birth Outcome	37.3	3.0	
NON-CAUCASIAN SUBJECTS			
Pre-Intervention Birth Outcome	36.1	4.6	0.007
Post-Intervention Birth Outcome	37.4	3.0	
TOTAL SUBJECTS			
Pre-Intervention Birth Outcome	36.7	4.4	0.074
Post-Intervention Birth Outcome	37.3	3.0	

Infant Death

Although relatively few infant deaths among all women occurred over a three year period, calculated infant mortality rates for pre-intervention and post-intervention data were 52.8/1,000 and 18.6/1,000, respectively. According to Table 5, no significant difference in infant mortality was noted ($p = 1.000$) among Caucasian participants (OR: 1.2, 95%CI: 0.3 – 5.5). However, the odds ratio is trending in the correct direction thereby suggesting potential improvement in this birth outcome. Among non-Caucasian women, PHP enrollment had a significant

positive impact on infant mortality ($p = 0.007$). Non-Caucasian women not enrolled in the program have a greater likelihood of experiencing an infant death based on risk ratio calculations. Specifically, the odds of an infant death were 5.1 times more likely as compared to PHP enrollees (OR: 5.1, 95%CI: 1.4 – 19.0). Moreover, all women enrolled in the PHP program are less likely to experience an infant death ($p = 0.018$) as compared to post-intervention data. Risk ratio estimates indicate that infant deaths were 2.9 times more likely among women not enrolled in the program (OR: 2.9, 95%CI: 1.2 – 7.5).

Table 5

Analysis of Proportion of Infant Deaths for Pre-Intervention and Post-Intervention Subjects (Caucasian, Non-Caucasian, and All Subjects)

CAUCASIAN SUBJECTS				
	% Infant Death	% Survival	p-Value	Odds Ratio (95% CI)
Pre-Intervention Birth Outcome	2.3% (n = 3)	97.7% (n = 125)	1.000	1.2 (0.3 – 5.5)
Post-Intervention Birth Outcome	1.9% (n = 4)	98.1% (n = 203)		
NON-CAUCASIAN SUBJECTS				
Pre-Intervention Birth Outcome	8.5% (n = 10)	91.5% (n = 108)	0.007	5.1 (1.4 – 19.0)
Post-Intervention Birth Outcome	1.8% (n = 3)	98.2% (n = 166)		
TOTAL SUBJECTS				
Pre-Intervention Birth Outcome	5.3% (n = 13)	94.7% (n = 233)	0.018	2.9 (1.2 – 7.5)
Post-Intervention Birth Outcome	1.9% (n = 7)	98.1% (n = 369)		

DISCUSSION

Based on comprehensive and multi-level evaluation of PHP, intensive and coordinated programmatic efforts appear to be having a positive effect. Overall, PHP served 713 high-risk pregnant women from June 30, 2003 to July 31, 2006. This program was able to reach women of many socioeconomic subgroups. Most participants were Caucasian; with 42.9% of PHP participants self-identified as non-Caucasian. Among the non-Caucasian group, over 74.0% of subjects were African American. For most birth indicators examined, outcomes were significantly improved for all women enrolled in the program. Interestingly, significant improvements in birth weight, gestational age, and infant mortality were not observed for Caucasian women participating in PHP, but improvements in these indicators for African American women were prominent.

Post intervention analyses reflected a major improvement in the mean birth weight among all PHP participants. The same improvement trend was noted in the non-Caucasian population. Among the Caucasian population of participants, the data did show an improvement in the average birth weight; however, gestational age among all participants and specifically Caucasian participants showed no significant improvement. There was improvement among all participants in mean gestational age. The PHP intervention among the non-Caucasian population did show significant improvements with respect to gestational age.

When considering infant death, women not enrolled in the PHP program were 2.9 times more likely to experience infant death as compared to currently enrolled women. Data showed no significant difference among Caucasian PHP participants; however, a trend in the positive direction suggests potential improvement for this birth outcome. Non-Caucasian women not enrolled in PHP were 5.1 times more likely to experience infant death, in contrast to those enrolled in the program.

Although the failure to demonstrate significant improvements among Caucasian

women was evident, most indicators did improve from a trend perspective. The lack of statistical significance may be explained by the fact that pre-intervention birth outcomes appeared much improved as compared to their non-Caucasian counterparts. This finding would be consistent with the literature which has documented numerous racial disparities in perinatal health.

The PHP program fully addresses the perinatal needs of the ten participating counties in the Southeast Health District. The network plans to expand into the district's remaining six counties in 2007. These six counties, which do not receive Perinatal Health Partner services, have the highest number of Neonatal Intensive Care Unit admission rates to Memorial Health University Medical Center (Greta O'Steen (personal communication, November 13, 2006)). As Perinatal Health Partners expands district wide, it projects a reduction in the number of pre-term deliveries by ten percent, thus providing a healthcare savings cost of more than \$3.6 million over a three-year period. Many area residents (20.1%) are medically uninsured (US Census Bureau: Small Area Health Insurance Estimates, 2000) and 22% live in poverty (US Census Bureau, 2000), compared to 13% in Georgia (US Census Bureau, 2000). The Southeast Health District (SEHD) population of 319,128 is 70% Caucasian, 24% African American, 5% Hispanic and 1% other ethnicities (OASIS, 2000).

It is anticipated that program expansion will continue to show a reduction in pre-term deliveries within the district and will continue to provide an additional savings costs in healthcare expenditures for participants. The continuation of the Perinatal Health Partners Program within the Southeast Health District would help in improving birth outcomes among at-risk populations within the southeast region of the state as well as the entire state of Georgia. The potential for improved health outcomes of high risk pregnant women and infants as a result of adequate perinatal care may eventually lead the achievement of Healthy People 2010 in the United States.

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