STRONG START FOR MOTHERS AND NEWBORNS: IMPACT ON OBSTETRIC TRIAGE VISITS

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Emily Wolfenden

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Mentor: Maria Manriquez, MD

I. Title Page

Article Title: Strong Start for Mothers and Newborns: Impact on Obstetric Triage Visits

Author Names: Emily Wolfenden¹, Ricardo Santiago², Paul Kang³, Dean Coonrod MD MPH⁴,
Maria Manriquez MD⁵

Author Information:

1. University of Arizona College of Medicine – Phoenix, BS. Medical Student
3. BS. Research Associate University of Arizona College of Medicine – Phoenix, MPH.
Academic Statistician
4. Chair, Department of Obstetrics and Gynecology, Creighton University School of
Medicine Regional Campus & Professor Obstetrics and Gynecology, University of
Arizona College of Medicine-Phoenix
5. Professor, Department of Obstetrics and Gynecology, University of Arizona College
of Medicine – Phoenix

Author Contact Information:

Emily Wolfenden
475 N 5th St Phoenix AZ 85004

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II. Abstract

Introduction: The Strong Start for Mothers and Newborns Initiative was launched in 2012 as an effort to reduce preterm birth rates, improve birth outcomes, and reduce costs of medical care for those enrolled in Medicaid or the Children's Health Insurance Program [1]. The Strong Start program modeled a maternity medical home, which includes the services of an additional project manager, registered nurse care coordinator, and two community health workers, with the aim to provide enhanced wrap around prenatal and psychosocial services. Previous studies have shown that implementation of patient-centered medical home models of care among patients with chronic diseases have led to decreases in frequency of ED visits among these patients [2,3]. However, research is lacking regarding the effectiveness of implementation of a maternity medical home model of care on reduction of Obstetric (OB) Triage visits. **Methods:** This retrospective chart review compared rates of OB Triage visits between two cohorts of women: Strong Start Maternity Medical Home participants and non-Strong Start controls within an urban county hospital network. **Results:** While the mean number of OB Triage visits among Strong Start participants (0.78; 95% CI 0.70-0.86) was higher than non-Strong Start controls (0.58; 95% CI 0.52-0.64)($P < 0.001$) the acuity was also greater. Among Strong Start participants, Odds Ratio of >1 OB Triage visits was 2.16 (1.77, 2.62) and Odds Ratio of >2 OB Triage visits was 2.50 (1.94, 3.22) compared to controls ($p < 0.001$). **Conclusions:** Triage care services increased, among participants of a maternity medical home model of care despite increased access to prenatal education and prenatal service. Further research is necessary to determine trends in OB Triage chief complaints, highlight modifiable factors that may allow a

Strong Start: OB Triage Visits

reduction in OB Triage visits, and determine the cost effectiveness of patient enrollment in a maternity medical home model of care.

Keywords: Obstetric, Triage, Maternity, Medical Home, Chief Complaint, Strong Start

III. Introduction

Historic advances made in prenatal outcomes related to care.

Preterm birth, or birth before 37 weeks gestation, is considered to be one of the most accurate indications of the overall health of a nation [4]. It is the most frequent cause of fetal death and second most frequent cause of death in children under the age of five worldwide. Preterm birth increases rates of long-term morbidity as well, with larger prevalence of neurological and developmental disabilities among infants born preterm compared to those born at full term. It is also a significant economic burden. The Institute of Medicine (IOM) estimated in 2005 that the cost of preterm birth in the United States reached \$26 billion annually, accounting for medical care costs for children up to age five, maternal delivery costs, and cost of early intervention [4].

Advances in prenatal care have been implemented in order to reduce preterm birth and low birth weight rates in the United States and worldwide. In the early 1980's, rates of low birth weight stabilized despite recent improvements in medical care [5]. In 1982, the IOM formed the Committee to Study the Prevention of Low Birthweight in order to review risk factors for low birth weights, which found that expansion of prenatal care services was an efficient, cost-effective way to reduce adverse birth outcomes such as low birth weight and preterm birth rates. The committee recommended to increase Medicaid funding and expand prenatal care services in under-resourced and underserved communities. In response to these recommendations, a number of legislative initiatives were passed in the 1980's to expand Medicaid eligibility during pregnancy to 133% of the federal poverty level. Many states also received waivers from the federal government to create Medicaid managed care programs, which are used in 28 states and have approximately 50 million beneficiaries [5].

Strong Start: OB Triage Visits

PCMH designation and implementation.

However, despite increases in prenatal care utilization among Medicaid women, low birth weight rates increased from 6.8% in 1983 to 8.0% in 2012 [5]. Although quantity of exposure to prenatal care services increased among high-risk populations during that time, it is possible that the quality of care received by these populations did not improve at a faster rate. In order to increase the quality of care received by patients, many healthcare sites have implemented a patient centered medical home (PCMH) model of care. In order to be designated by the National Committee for Quality Assurance (NCQA) as a PCMH, a facility must meet a number of elements in nine standards: (1) communication and care access, (2) tracking patients and participating in registries, (3) care management, (4) providing resources for patient self-management, (5) electronic prescribing, (6) tracking test results, (7) tracking referrals, (8) performance measurement and improvement, and (9) electronic communication with advanced technology [6]. Adoption of a PCMH model of care in clinics has been shown to improve care management, lower rates of diagnostic imaging, and reduce patient hospitalizations [7].

Strong Start Program implementation and reported outcomes.

The Strong Start for Mothers and Newborns Initiative, a collaboration between the Centers for Medicare and Medicaid Services' Innovation Center and the Center for Medicaid and CHIP Services, was launched in 2012 as an effort to reduce preterm birth rates, improve birth outcomes among newborns and pregnant women, and reduce costs of medical care during pregnancy, delivery, and over the first year of life for children born to mothers enrolled in Medicaid or CHIP [1]. Sites awarded the four-year Strong Start grant included those in areas with highest preterm

Strong Start: OB Triage Visits

birth rates in the country. The initiative has two strategies: (1) to reduce early elective deliveries through promoting awareness of risks of early elective deliveries, spreading of best practices, and promoting transparency in performance data collection and assessment, and (2) to develop and implement enhanced prenatal care models. Three evidence-based maternity care models were implemented through the Strong Start grant, including enhanced prenatal care through group visits, enhanced care at birth centers, and enhanced prenatal care at maternity care homes. Maricopa County Special Healthcare District (MCSHD), a collaboration of Maricopa Integrated Health System (MIHS) and District Medical group (DMG), is a Strong Start site and has implemented the maternity medical home model of care and collected data on birth outcomes since 2013. Data has been analyzed and has shown increases in gestational age at birth, vaginal delivery rates, and birth weight greater than 2500 grams in Strong Start participants when compared to women not enrolled in the maternity medical home [8].

Previous PCMH acute care visit analyses and their outcomes.

Analyses of patient centered medical homes (PCMH) have been completed in various populations, including pediatrics and among patients with chronic conditions, with inconclusive results. Results of these analyses have shown that adoption of a PCMH model of care reduces Emergency Department (ED) visit rates among pediatric populations and among Medicaid populations who have been enrolled in a PCMH for greater than one year [2,3]. Other studies have shown that the PCMH model of care leads to a reduction in ED visits among patients with chronic illness, but does not lead to a reduction in ED visits among those who are not chronically ill [9].

Strong Start: OB Triage Visits

Group prenatal care has been utilized as a method of increasing access to quality, reliable prenatal education for groups of women who may otherwise be reluctant to seek prenatal services. A previous study compared group prenatal care to traditional models of prenatal care at both a private obstetric clinic and a resident clinic and found that patients who attended group prenatal care classes had increased rates of patient-initiated triage visits compared to patients who attended traditional individual prenatal visits ($p = 0.0187$) [10]. This study found no differences in gestational age at delivery ($p = 0.122$) between patients who attended group prenatal care classes compared to traditional individual care. These study results suggest improvement in prenatal care delivery through a group prenatal care model. However, key differences exist between the group prenatal care model examined in this study and the maternity medical home model of care implemented at MIHS. The group prenatal care model in this study did not include the expanded care coordination integral to the Strong Start maternity medical home, thus differences may exist between these two models in regard to their impact on frequency of presentation of patients to Obstetric (OB) Triage.

Recently published research on an expanded model of prenatal care has shown reductions in preterm birth rates in a variety of residential settings. “Signature Strong Start,” a program created by physicians of Signature Medical Group, utilized a maternity medical home model of care with the aim of improving pregnancy outcomes among at-risk Medicaid beneficiaries. Through this expanded prenatal care model, patients were offered expanded care coordination through a team of a nurse navigator, social workers, and physicians. Patients received increased care services through what Signature Medical Group termed “continuous contact,” which included home visits, telephone services, and in-office encounters. They were also assessed via a

Strong Start: OB Triage Visits

biopsychosocial risk assessment tool to uncover risk factors for pregnancy. Authors of this study found a reduction in preterm birth rates of Signature Strong Start participants (7.5%) compared to historical averages (10.4%) [11]. Further sub-group analysis of these participants found that this reduced preterm birth rate was seen in all settings, including rural, urban, and suburban settings [12]. However, authors of this study did not examine impact of this maternity medical home model of care on OB Triage visits.

While the previous studies share similarities with the Strong Start maternity medical home model of care, none of these studies specifically examine the effects of this expanded prenatal care model on OB Triage visits. This study aims to elucidate the effects of a maternity medical home model of care on 1) mean number of OB Triage visits from initiation of prenatal care until delivery, 2) odds of presenting to OB Triage >1 time and >2 times, 3) gestational age(s) at presentation(s) to OB Triage, 4) gestational age at delivery, and 5) impact on delivery route.

IV. Methods Maricopa Integrated Health System IRB committee approval was obtained for this study entitled “Strong Start for Mothers and Newborns.” This retrospective chart review compared rates of OB Triage visits between two cohorts of women: Strong Start Maternity Medical Home participants (n=958) and non-Strong Start controls (n=1,223) within an urban county hospital network. The Strong Start cohort includes 958 women who were enrolled and delivered at five urban clinics. In order to participate in Strong Start, women were required to meet eligibility requirements of gestational age, health plan membership, and exhibit one or more established high-risk factors. The control group is comprised of 1,223 Medicaid enrollees at the five urban clinics listed above in addition to two urban Family Health Centers who were

Strong Start: OB Triage Visits

deemed high-risk patients during the SS implementation period (due to presence of a risk factor for preterm delivery including but not limited to age, multigestation, or race), but who did not choose to partake in the SS program. Patients and controls were enrolled in this study between 2013-2016. Pertinent charts were reviewed to determine whether or not individuals had been seen in triage during pregnancy. Data including number of OB Triage visits, gestational age at each visit, presenting chief complaints at each visit, and documented diagnoses at each visit were recorded. Discrete variables such as Strong Start status, location of clinic, gestational age at delivery, delivery route, weight, and race were also collected and are described in Table 1.

Patient demographic and baseline clinical characteristics between patients who participated in the SS program versus those who did not participate were reported as means, standard deviations for continuous variables and frequencies, percentages for categorical variables. Normally distributed continuous variables were compared using the 2-sample T-test between the two groups. The Wilcoxon Rank Sum was used for non-parametric comparisons. The Chi-squared analysis or Fisher's Exact test was used to compare categorical variables. Logistic regression was implemented to ascertain odds of one or more triage visits relative to interventional status. All baseline covariates that observed statistical significant differences between the intervention and control groups were added to the model for adjustment. All continuous covariates were assessed using the Lowess Smoother Plots to ascertain whether these covariates required categorization. All p-values were 2-sided and $p < 0.05$ was considered statistically significant. All data analyses were conducted using STATA version 14 (STATA Corp; College Station, TX).

V. Results Descriptive statistics of Strong Start participants and controls are shown in Table 1. These results show that 54.8% of participants identified as White, 21.8% as African American, 12.5% as Hispanic, and 10.9 as “other.” Previously reported patient demographics from the Maricopa Integrated Health System (MIHS) for 2013 report that, out of all patients, 86.30% identify as White, 60.80% identify as Hispanic/Latino Ethnicity, 10.60% identify as Black/African American, and 1.70% identify as Asian [13].

Mean number of OB Triage visits among Strong Start participants was 0.78 (95% CI 0.70-0.86), compared to 0.58 (95% CI 0.52-0.64) among controls ($p < 0.001$), also shown in Table 1. This illustrates that, overall, Strong Start participants visited OB Triage more frequently than controls of similar risk for preterm delivery.

Results show that odds of presenting to OB Triage ≥ 1 time were 2.16 (1.77, 2.62) among SS participants compared to controls ($p < 0.001$), and that odds of >2 OB Triage visits were 2.50 (1.94, 3.22) among Strong Start participants compared to controls ($p = <0.001$) (Table 3).

Logistic Regression was used to adjust for all variables. This suggests that women enrolled in a maternity medical home model of care not only had more OB Triage visits overall, but that they are also greater than twice as likely to present to OB Triage compared to controls. These differences persist when stratifying patients by route of delivery. Our results show that women who delivered both via vaginal delivery and via cesarean section had greater than twice the odds of presenting to OB Triage if they were enrolled in Strong Start.

Strong Start: OB Triage Visits

Our results show that patients enrolled in the Strong Start model of care were seen in clinic for an initial prenatal visit at 113.1 days gestation, compared to 119.3 days gestation in controls ($p = 0.01$). The differences in this data point between groups may suggest that women who presented to clinic for a prenatal appointment earlier in their pregnancy were more likely to enroll in an enhanced prenatal care program compared to controls. The results of this study show a significant difference in gestational age at delivery between SS participants (273.9 days gestation) and controls (270.9 days gestation) ($p < 0.001$).

Notably, our results also show a significant difference in cesarean section rates of women enrolled in SS (19.5%) compared to controls (25.0%) ($p < 0.006$). This reduction in cesarean sections among women enrolled in a maternity medical home model of care may have significant influence on costs associated with pregnancy and delivery and on maternal morbidity and mortality.

Odds of presenting to OB Triage were analyzed within the Strong Start group to elucidate factors that may prompt some women to seek acute care services more often than their peers. Our results show that no statistically significant differences existed in odds of ≥ 1 or ≥ 2 presentations to OB Triage between women under 30 years of age compared to women > 30 years old, or among women of different races. Our results do, however, show a discrepancy between odds of presentation to OB Triage between clinic locations. The Maryvale Family Clinic (FMV) location had half the odds of presentation to OB Triage compared to controls at the main clinic location, the MIHS Comprehensive Health Center (CHC) (OR 0.44, 95% CI 0.30 0.67). This suggests that discrepancies may exist between prenatal education given at clinic sites. Decreased odds of

Strong Start: OB Triage Visits

presentation to the MIHS OB Triage may also be reflective of distance from patient homes to OB Triage.

We also sought to further describe triage visits between SS participants and controls by collecting data on gestational age at each triage visit and comparing these gestational ages between groups. We found that women enrolled in the Strong Start program presented to OB Triage at a statistically significantly younger gestational age for visit 1 ($p < 0.001$), visit 2 ($p < 0.001$), and visit 3 ($p = 0.007$). This suggests that women enrolled in a maternity medical home model of care were more likely to present to OB Triage earlier in their pregnancies compared to controls. This difference between groups persisted for up to three visits to OB Triage, after which the differences became non-significant.

VI. Conclusion The aims of this study were five-fold. Multiple data points were collected from Strong Start participants and controls of similarly high risk of preterm birth to elucidate the effects of a maternity medical home model of care on 1) mean number of OB Triage visits from initiation of prenatal care until delivery, 2) odds of presenting to OB Triage >1 time and >2 times, 3) gestational age(s) at presentation(s) to OB Triage, 4) gestational age at delivery, and 5) impact on delivery route.

The results of this retrospective chart review highlight many important differences between participants enrolled in a maternity medical home model of care and controls of similar risk for preterm birth. Frequency of OB Triage visits was increased among Strong Start participants compared to controls, as was the odds of presentation to OB Triage ≥ 1 or ≥ 2 times. This is

Strong Start: OB Triage Visits

consistent with results of a previous study that compared group prenatal care to traditional models of prenatal care at both a private obstetric clinic and a resident clinic. These authors hypothesized that increased presentation to OB Triage seen among women enrolled in an expanded prenatal care model could be due in part to increased education regarding warning signs and symptoms necessitating presentation to OB Triage [10]. The content and quality of education provided to patients in an expanded prenatal care model must be assessed regularly and standardized between clinic locations in order to prevent discrepancies in care between clinic locations as seen in our results.

Descriptive statistics show a discrepancy in the racial and ethnic composition of Strong Start patients compared to the general population served by MIHS. While no statistically significant difference in frequency of acute visits existed between Hispanic and non-Hispanic women (Table 5), this discrepancy in enrollment suggests the possibility of an additional barrier experienced by patients of Hispanic or Latino ethnicity who are interested in expanded prenatal services. This barrier may be language-based, in the case of non-English-speaking patients, or culturally-based. The discrepancy between groups may also be due to additional factors such as insurance status. It is important to address these additional social and cultural barriers when designing enhanced prenatal care programs.

It is also important to highlight that our results also show a significant difference in cesarean section rates of women enrolled in SS (19.5%) compared to controls (25.0%) ($p < 0.006$). This reduction in cesarean sections among women enrolled in a maternity medical home model of

Strong Start: OB Triage Visits

care may have significant influence on costs associated with pregnancy and delivery and on maternal morbidity and mortality.

This study has many possible limitations that must be acknowledged. A primary limitation of this study is lack of descriptive statistics for participants in the control group. These statistics were purposefully excluded from analysis due to difficulty extracting specific variables from the patient chart (for example, calculation of patient age at initial prenatal visit) and for subjective nature of the interpretation of values for which multiple data entries were present in the chart (for example, many patients identified as “White” and “Hispanic”). Other unknown variables may exist, such as discrepancies in patient education at different clinic sites, patient proximity to MIHS and thus proximity to OB Triage, and patient use of the expanded prenatal care services offered to them through Strong Start. Although controls were chosen such that they were of similar risk of preterm delivery from the same clinic sites as Strong Start participants, it is possible that significant differences exist between controls and SS participants that were not accounted for in data collection and analysis. Patient outliers with a high frequency of OB Triage visits were not excluded from data analysis.

Further research is necessary to determine trends in OB Triage chief complaints, highlight modifiable factors that may allow a reduction in OB Triage visits, and determine the cost effectiveness of patient enrollment in a maternity medical home model of care.

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Strong Start: OB Triage Visits

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IX. Appendix

Table 1. Descriptive Statistics

Variables	Overall N=2181	Control N=1223	Intervention N=958	P-value
Age, Years (mean, SD)	24.1 (5.99)		24.1 (5.99)	N/A

Strong Start: OB Triage Visits

Race (n, %)				N/A
White			525 (54.8)	
African American			209 (21.8)	
Hispanic			120 (12.5)	
Other			104 (10.9)	
Clinic Type (n, %)				N/A
CHC			514 (53.7)	
FMV			220 (22.9)	
FSA			47 (4.91)	
FSC			95 (9.92)	
FSU			82 (8.56)	
Gestation Age at Initial Visit/Enrollment, Days (mean, SD)	116.5 (56.7)	119.3 (61.9)	113.1 (49.9)	0.01
Gestational Age at Delivery (mean, SD)	272.8 (14.8)	273.9 (13.9)	270.9 (15.9)	<0.001
Number of Triage Visits (mean, SD)	0.67 (1.14)	0.58 (1.01)	0.78 (1.26)	<0.001
Delivery Route (C-section, %)	428 (23.1)	298 (25.0)	130 (19.5)	0.006

Note: P-values calculated using the 2-sample T-Test or the Wilcoxon Rank Sum for continuous variables. Chi-squared / Fisher's Exact Test used to compare categorical variables.

Table 2. The association between the SS Program intervention and the likelihood of at least one triage visit.

Outcome of ≥ 1 Triage		
Variables.	OR (95% CI)	P-value ¹
Group		
Control	REF	
Intervention	2.16 (1.77, 2.62)	<0.001
Gestational Age at Initial Visit/Enrollment ≤ 100		

Strong Start: OB Triage Visits

	>100	REF 0.68 (0.56, 0.83)	<0.001
Gestational Age at Delivery			
	≤220	REF	
	>220	4.87 (1.64, 14.4)	0.004
Delivery Route			
	Vaginal	REF	
	C-Section	1.19 (0.95, 1.50)	0.11

¹Odds Ratios (95% CI) and p-values were calculated using logistic regression adjusting for all other variables within the model.

Table 3. The association between the SS Program intervention and the likelihood of at least two triage visit.

Outcome of ≥ 2 Triage Variables.		OR (95% CI)	P-value ¹
Group			
	Control	REF	
	Intervention	2.50 (1.94, 3.22)	<0.001
Gestational Age at Initial Visit/Enrollment			
	≤70	REF	
	>70	0.53 (0.41, 0.71)	<0.001
Gestational Age at Delivery			
	≤220	REF	
	>220	6.20 (0.82, 46.7)	0.08
Delivery Route			
	Vaginal	REF	
	C-Section	0.93 (0.68, 1.26)	0.65

¹Odds Ratios (95% CI) and p-values were calculated using logistic regression adjusting for all other variables within the model.

Table 4. The association between the SS Program intervention and the likelihood of triage visits stratified by vaginal/C-section birth status.

Outcome of ≥ 1 Triage		Vaginal Births		C-Section only	
Variables.		OR (95% CI)	P-value ¹	OR (95% CI)	P-value ¹
Group					
	Control	REF		REF	
	Intervention	2.13 (1.71, 2.65)	<0.001	2.27 (1.48, 3.47)	<0.001
Gestational Age at Initial Visit/Enrollment					
	≤ 100	REF		REF	
	>100	0.67 (0.54, 0.83)	<0.001	0.74 (0.50, 1.09)	0.13
Gestational Age at Delivery					
	≤ 220	REF		REF	
	>220	9.88 (1.26, 77.2)	0.03	3.14 (0.82, 11.9)	0.09
Outcome of ≥ 2 Triage		Vaginal Births		C-Section only	
Variables.		OR (95% CI)	P-value ¹	OR (95% CI)	P-value ¹
Group					
	Control	REF		REF	
	Intervention	2.46 (1.85, 3.27)	<0.001	2.88 (1.65, 5.04)	<0.001
Gestational Age at Initial Visit/Enrollment					
	≤ 70	REF		REF	
	>70	0.57 (0.42, 0.79)	0.001	0.42 (0.23, 0.75)	0.004
Gestational Age at Delivery					
	≤ 220	REF		REF	
	>220	2.95 (0.37, 23.3)	0.30	0.99 (0.56, 1.74)	0.97

¹Odds Ratios (95% CI) and p-values were calculated using logistic regression adjusting for all other variables within the model.

Table 5. The association between selected covariate and the likelihood of triage visits stratified by intervention status

Variables.	Outcome of ≥ 1 Triage		Outcome of ≥ 2 Triage	
	OR (95% CI)	P-value ¹	OR (95% CI)	P-value ¹
Age				
≤ 30	REF		REF	
>30	0.86 (0.56, 1.33)	0.52	0.89 (0.54, 1.47)	0.67
Race				
White	REF		REF	
African American	1.35 (0.91, 2.04)	0.13	0.74 (0.45, 1.19)	0.22
Hispanic	1.59 (0.95, 2.63)	0.07	1.09 (0.62, 1.90)	0.76
Other	0.66 (0.39, 1.10)	0.11	0.74 (0.41, 1.37)	0.35
Clinic Location				
CHC	REF		REF	
FMV	0.44 (0.30, 0.67)	<0.001	0.50 (0.32, 0.80)	0.004
FSA	0.91 (0.42, 1.96)	0.81	1.06 (0.45, 0.92)	0.87
FSC	0.83 (0.50, 1.38)	0.49	0.55 (0.29, 1.02)	0.06
FSU	0.73 (0.40, 1.32)	0.30	0.35 (0.15, 0.81)	0.02
Gestational Age at Initial Visit/Enrollment				
≤ 100	REF		REF	
>100	0.77 (0.56, 1.06)	0.11	0.64 (0.45, 0.92)	0.02
Gestational Age at Delivery				
≤ 220	REF		REF	
>220	7.51 (1.57, 35.9)	0.01	5.07 (0.63, 40.5)	0.12
Delivery Route				
Vaginal	REF		REF	
C-section	1.29 (0.85, 1.92)	0.22	1.05 (0.66, 1.67)	0.82

¹Odds Ratios (95% CI) and p-values were calculated using logistic regression adjusting for all other variables within the model.

Table 6. Gestation age at each triage visit

Visit	Overall Mean (SD)	Control Mean (SD)	Intervention Mean (SD)	p-value
1	229.8 (45.0)	242.9 (38.8)	216.4 (47.1)	<0.001
2	242.9 (34.5)	253.4 (29.7)	234.7 (35.7)	<0.001
3	247.6 (26.3)	253.9 (26.8)	244.1 (25.5)	0.007
4	251.9 (22.6)	257.4 (22.9)	249.0 (22.1)	0.07
5	257.6 (15.7)	259.2 (16.8)	256.9 (15.6)	0.68
6	259.9 (15.6)	254.3 (14.2)	262.8 (16.3)	0.14
7	262.1 (13.5)	258.4 (14.7)	266.8 (12.1)	0.26
8	259.8 (16.2)	247.0 (7.07)	272.5 (9.19)	0.12
9	264.3 (15.0)	256.5 (9.19)	280.0 (N/A)	0.22

P-values calculated using the Wilcoxon Rank Sum at each visit. Statistically significance set at $p < 0.006$ following the Bonferroni Adjustment for multiple comparisons correction.

Figure Caption Sheet:

Table 1. Descriptive Statistics

Table 2. The association between the SS Program intervention and the likelihood of at least one triage visit.

Table 3. The association between the SS Program intervention and the likelihood of at least two triage visit.

Strong Start: OB Triage Visits

Table 4. The association between the SS Program intervention and the likelihood of triage visits stratified by vaginal/C-section birth status.

Table 5. The association between selected covariate and the likelihood of triage visits stratified by intervention status

Table 6. Gestation age at each triage visit