Care Utilization and Birth Outcomes among Women Obtaining CenteringPregnancy Group Prenatal Care

Kiran Sigmon, MD,[a] Anna Beth Parlier, BS,[b] Katie Descieux, MA,[b] Kacey R. Scott, MLIS,[c] Shelley L. Galvin, MA[a,b]
Mountain Area Health Education Center
[a]Department of Obstetrics and Gynecology
[b]Center for Research
[c]Library and Knowledge Services

Acknowledgments: Elizabeth Scalva, MD and John Larabee, MD, Mountain Area Health Education Center, Department of Obstetrics and Gynecology

Abstract

Objective: To determine if group prenatal care reduced preterm birth rates in western North Carolina.

Methods: A retrospective, matched cohort study was conducted. Group prenatal care patients (n = 550) with delivery dates from 12/2013-2015 were matched 1:1 to deliveries at the same regional tertiary care hospital using North Carolina birth certificate data from 2011-2013. We matched deliveries on mothers' county of residence, age, parity, insurance, race/ethnicity, hypertensive disorders, gestational diabetes, prior cesarean delivery, smoking during pregnancy, and prior preterm delivery. We used McNemar's test to compare differences in rates of preterm birth, low birth weight, cesarean delivery, and adequacy of prenatal care, and calculated relative risks (95% confidence intervals) for group patients.

Results: Matching exceptions occurred for 118 (21.5%) pairs; exceptions for risk factors ensured lower risk among pre-group patients. Overall, 303 (55.1%) group patients and 296 (53.8%) pre-group patients were medically complex (≥1 risk factor). Eight fewer babies were born prematurely among group patients compared to pre-group patients (8.7% vs. 10.2%; p = 0.456; RR = 0.857; 95% CI 0.594-1.237). We found significantly fewer low birth weight babies and significantly greater adequacy of care among group patients (6.4% vs. 11.8%; p = 0.002; 88.4% vs. 79.5%; p < 0.001; respectively). There was no difference in cesarean delivery rates (group 32.4% vs. pre-group 31.6%; p = 0.822).

Conclusions: Compared to the matched, historical, pre-group cohort, the outcomes of the group patients, including medically complex patients, were as good as or better. We continue to offer group prenatal care to patients of moderate and low medical complexity.

Key Words: Birth outcomes, CenteringPregnancy, Prenatal care

Introduction

Although preterm birth rates have been declining nationally over the past decade, prematurity remains the second greatest contributor (behind congenital anomalies) to infant death rates.[1-2] Preterm babies (born < 37 weeks gestation) are at increased risk of numerous adverse short and long term consequences including respiratory distress, interventricular hemorrhage, sepsis, and neurodevelopmental disabilities.[3-4] Few perinatal interventions have been shown to significantly reduce the risk of preterm birth, especially for women with no risk factors.[5] Consequently, providers focus most of their efforts on interventions to stop preterm labor after it has started and to provide optimum neonatal care to improve outcomes.[6] Since preterm birth is not effectively

prevented within the traditional patient-to-provider model of prenatal care, Lu, et al. and others challenge healthcare providers to "re-conceptualize" prenatal care.[5,7] Novick suggests that prenatal care needs to be redesigned to incorporate education and support for pregnant women throughout their pregnancy.[8]

In an effort to address the lack of effective interventions and to modernize prenatal care, group prenatal care has emerged as a viable, alternative method of care delivery. The CenteringPregnancy model for group prenatal care, first described in 1994 by Sharon Schindler Rising, a certified nurse-midwife, provides an opportunity to focus on relationship-centered care.[9] While traditional patient-to-provider care only allows approximately two to three total hours of provider care over a typical pregnancy, group prenatal care allows for over 20 hours of provider contact with more extensive prenatal education, structured social support, and the encouragement of self-care in the prenatal process.[9-10] The CenteringPregnancy model is now used in various venues in nearly every state in the United States.[11] It has shown promise in positively affecting maternal and neonatal outcomes such as increasing healthcare compliance, breastfeeding initiation and birth weights, and decreasing preterm birth rates and neonatal intensive care unit admissions.[10,12-20]

Additionally, group prenatal care participation has been shown to improve psychological health, social support, education, and satisfaction with care, increase rates of appropriate maternal weight gain during pregnancy, attendance at postpartum visits, and contraception use, and reduce the risk of rapid repeat pregnancy.[10,12-14,16-17,21-26]

In 2014, in Buncombe County, North Carolina (NC), where the NC Perinatal Region I's tertiary care hospital is located, the preterm birth rate was 13.5%. This rate was higher than both the 2014 state and national rates (12.0% and 9.6%, respectively).[1,27-28] With the hope of reducing the preterm birth rate and improving prenatal care in our region, Mountain Area Health Education Center Obstetrics and Gynecology (OB/GYN) Specialists implemented group prenatal care (CenteringPregnancy, Cheshire, CT) in July 2013 and, in September 2014, became a Centering Health Institute approved site.[11]

Pregnant patients are invited to join a prenatal care group during their first prenatal appointment based on their estimated due dates. Each prenatal care group has approximately eight to twelve women who participate in ten, 2-hour group sessions throughout pregnancy and postpartum. Each group session includes patient physical assessments, group support, and facilitated group discussions.[8-9]

Mountain Area Health Education Center OB/GYN Specialists is the only provider of high-risk obstetric care in NC Perinatal Region I. Patients are referred to this center from the 15 outlying counties in the region that are smaller, more rural, and without a tertiary care hospital. Therefore, many patients in this clinic are medically complex.

After a consultation with the Maternal-Fetal Medicine Specialists team or an OB/GYN faculty member, an invitation to participate in group prenatal care is extended to patients with moderate medical complexities including women with complications such as controlled hypertension or a history of prior preterm birth. Exclusion from group participation includes but is not limited to women with high-risk conditions such as pre-existing diabetes, higher order multiple gestations (triplets or higher), poorly controlled chronic hypertension, lupus nephritis, sickle cell disease, newly diagnosed HIV, and history or risk of a thromboembolic event.

Implementation of group prenatal care at Mountain Area Health Education Center OB/GYN Specialists has the potential to improve prenatal care and birth outcomes throughout western NC, particularly among patients with moderately complex pregnancies. The purpose of this study was to determine if group prenatal care reduced the preterm birth rates in western NC.

Methods and Materials

We conducted a retrospective cohort study to compare outcomes for patients who participated in group prenatal care to a matched, historical, pre-group cohort. Group prenatal care patients with multiple gestation and/or no delivery record at the regional tertiary care hospital were excluded (n = 51). One patient had two pregnancies during the study period; only the first pregnancy was included. Expected dates of deliveries for patients with singleton pregnancies in group prenatal care ranged from December 22, 2013 through December 31, 2015. Five-hundred and fifty group prenatal care patients were matched to 550 historical, pre-group deliveries at the regional tertiary care hospital in Buncombe County using the most recent, available, NC birth certificate data (2011-2013).[29] This research was approved by the Mission Hospital Institutional Review Board.

Data Matching Process

Group prenatal care births were matched by year of delivery, mothers' county of residence, age, race/ethnicity, parity, insurance status, and the following diagnoses: hypertensive disorders (HTN), gestational diabetes (GDM), and/or prior cesarean delivery. We also attempted to match deliveries for smoking during pregnancy and prior preterm delivery. If more than one match was available, we randomly selected a match using the random sample function in SPSS v.21.0.1 (IBM; Chicago, IL).

Group prenatal care participants' delivery years were matched to birth certificate data from two years prior (2013 to 2011, 2014 to 2012, 2015 to 2013) to ensure we did not match a group prenatal care patient with her own data in the birth certificate database. County of residence of the mother was dichotomized as central (Buncombe) versus outlying (15 others) counties. Age was categorized as ≤19 years, 20-34 years, and ≥35 years old. Race/ethnicity was categorized as White non-Hispanic, Black non-Hispanic, Hispanic, and other. Parity was dichotomized into nulliparous and multiparous. Primary insurance status was categorized as Medicaid, private insurance, or other (none, local charity care). Medical complications during pregnancy included ≥40 years old, obesity, HTN, GDM, smoking during pregnancy, and prior preterm birth; medical complications were dichotomized as any or none. Participants in the group prenatal care cohort and in the matched cohort with ≥1 medical complication were considered medically complex. Preterm birth was coded as delivery <37 weeks gestation. Low birth weight was coded as weight <2500 grams at birth. We coded primary and repeat cesarean deliveries in the birth certificate data using the variables "route of delivery" (cesarean) and "previous cesarean delivery" (>0). Each cesarean delivery with any previous cesareans was coded as a repeat cesarean delivery; a cesarean delivery with zero previous cesareans was coded as a primary cesarean delivery.

Data for our group prenatal care patients were collected prospectively by the group facilitators and manually entered and verified by the research project manager into a group prenatal care research database. Data for the historical cohort of singleton deliveries (N = 550) were extracted manually from the NC Vital Statistics Births database by three of the authors working collaboratively.[29]

Exceptions to the matching protocol had to be made due to the small population size and limited racial and ethnic diversity in most of the outlying counties. Exceptions were made with regard to race/ethnicity to match 13 (2.4%) women. Exceptions were made for year of delivery [n = 49 (8.9%)], age [n = 3 (0.5%)], and insurance status [n = 33 (6.0%)] to ensure no exceptions were made for HTN, GDM, or prior cesarean delivery. Likewise, exceptions were made with regard to smoking status [n = 24 (4.4%)] and prior preterm birth [n = 31 (5.6%)], as the prevalence reported in the birth certificate data was very low. These necessary exceptions were made ensuring fewer

risk factors among women in the matched cohort from the birth certificate data. Overall, exceptions were made to 118 (21.5%) matches.

Data Analyses

For group prenatal care patients, we calculated adequacy of prenatal care using the Kotelchuck Adequacy of Prenatal Care Utilization Index criteria.[30] This index is based on the American College of Obstetricians and Gynecologists prenatal care recommendations and categorizes care into four levels of adequacy based on gestational age at prenatal care initiation, number of prenatal visits attended, and gestational age at delivery. The Kotelchuck Adequacy of Prenatal Care Utilization was a pre-calculated variable in the NC birth certificate data. Fifty-seven (10.4%) pre-group women were missing adequacy of prenatal care data in the NC birth certificate database and were excluded from analysis of this outcome variable. We collapsed the four levels of adequacy into adequate (adequate and adequate plus) and less than adequate (intermediate and inadequate) in order to create a dichotomous variable for analysis.

We used descriptive statistics to describe the frequencies, by cohort, of patients' socio-demographics and medical complications. We used McNemar's test to compare differences in the four outcome variables: rates of preterm birth, low birth weight, cesarean delivery (primary, repeat, combined), and adequacy of prenatal care (Kotelchuck Index). We calculated relative risks of preterm birth for participants in group prenatal care relative to those in pre-group prenatal care. We used SPSS v.21.0.1 (IBM; Chicago, IL) with a statistical threshold of $p < 0.05$.

Sensitivity analyses were conducted using McNemar's test and Pearson's X^2 test to examine any differences within and between the groups who were matched completely and those for whom matching exceptions had to be made. We divided groups for the sensitivity analyses based on matching exceptions that had potential to confound the outcome variables. Potential confounding exceptions included: age, insurance status, race/ethnicity, smoking status, and prior preterm birth. We did not include year of delivery as an exception in the sensitivity analysis because it was not a potential confounder. Ninety-three (16.9%) women had potentially confounding exceptions.

Results

Most of the patients in our study were between the ages of 20-34 years [430 (78.2%)], white non-Hispanic [442 (80.4%)], and used Medicaid as their primary health insurance [407 (74.0%); see Table 1]. The majority of mothers resided in the central (Buncombe) county [397 (72.2%)]. Patients were matched exactly for prior cesarean section [76 (13.8%)], GDM [73 (13.3%)], and HTN [112 (20.4%)]. Patients with a previous preterm delivery and smoking during pregnancy required some matching exceptions due to lower incidence rates among NC birth certificate data. Overall 303 (55.1%) participants from the group prenatal care cohort and 296 (53.8%) participants from the pre-group cohort were medically complex (≥ 1 medical complication). The median number of medical complications was 1 (1-4) for the group prenatal care cohort and 1 (1-3) for the pre-group cohort.

Table 1. Characteristics of Patients by Matched Cohort

Characteristics	Group Prenatal Care N = 550	Pre-Group Prenatal Care N = 550
	n (%)	n (%)
Delivery Year*		
2011		13 (2.4)
2012		242 (44.0)
2013	1 (0.2)	295 (53.6)
2014	247 (44.9)	
2015	302 (54.9)	
County of Residence		
Central	397 (72.2)	397 (72.2)
Outlying	153 (27.8)	153 (27.8)
Age*		
≤19	58 (10.5)	58 (10.5)
20-34	430 (78.2)	431 (78.4)
≥35	62 (11.3)	61 (11.1)
Race/Ethnicity*		
White non-Hispanic	442 (80.4)	452 (82.2)
Black non-Hispanic	78 (14.2)	77 (14.0)
Hispanic	15 (2.7)	15 (2.7)
Other	15 (2.7)	6 (1.1)
Parity		
Nulliparous	290 (52.7)	290 (52.7)
Multiparous	260 (47.3)	260 (47.3)
Health Insurance*		
Medicaid	407 (74.0)	399 (72.5)
Private	140 (25.5)	150 (27.3)
Other	3 (0.5)	1 (0.2)
Hypertensive Disorder		
Yes	112 (20.4)	112 (20.4)
No	438 (79.6)	438 (79.6)
Gestational Diabetes		
Yes	73 (13.3)	73 (13.3)
No	477 (86.7)	477 (86.7)
Prior Cesarean Section		
Yes	76 (13.8)	76 (13.8)
No	474 (86.2)	474 (86.2)
Smoking During Pregnancy*		
Yes	114 (20.7)	92 (16.7)
No	436 (79.3)	458 (83.3)
Prior Preterm Birth*		
Yes	37 (6.7)	6 (1.1)
No	513 (93.3)	544 (98.9)

*Variables for which matching exceptions were necessary.

We found 8 (15%) fewer babies born prematurely at < 37 weeks gestation among group prenatal care patients (RR = 0.857; 95% CI 0.594-1.237); this difference was not statistically significant (see Table 2). We found a significant difference in the rate of low birth weight among babies of patients in group prenatal care as compared to the pre-group cohort; there were 30 (46%) fewer babies weighing < 2500 grams (p = 0.002). There was no significant difference in the rate of cesarean deliveries (primary, repeat, or combined). Prenatal care utilization was significantly better among group prenatal care patients compared to the pre-group cohort (p = 0.0001). Among group prenatal care patients, there were 289 (58.6%) with adequate plus, 147 (29.8%) with adequate, 19 (3.9%) with intermediate, and 38 (7.7%) with inadequate prenatal care. Among the pre-group cohort, there were 189 (38.6%) with adequate plus, 203 (41.2%) with adequate, 38 (7.7%) with intermediate, and 63 (12.8%) with inadequate prenatal care.

Table 2. Cohort Comparison of Outcomes

	Group Prenatal Care N = 550	Pre-Group Prenatal Care N = 550	P Value*	RR (95% CI)
	n (%)	n (%)		
Kotelchuck Adequacy of Prenatal Care Index				
Adequate (adequate & adequate plus)	436 (88.4)	392 (79.5)	**0.0001**	**0.564 (0.418-0.762)**
< Adequate (intermediate & inadequate)	57 (11.6)	101 (20.5)		
Preterm Birth	48 (8.7)	56 (10.2)	0.456	0.857 (0.594-1.237)
Low Birth Weight	35 (6.4)	65 (11.8)	**0.002**	**0.539 (0.363-0.798)**
Cesarean Section				
Overall	178 (32.4)	174 (31.6)	0.822	1.023 (0.861-1.22)
Primary	109 (19.8)	102 (18.5)		
Repeat	69 (12.5)	71 (12.9)		

*McNemar's Test

Sensitivity analyses indicated that exceptions were made most often for women from outlying counties and those with multiple medical complications. Significant and non-significant differences in outcomes between the participants in the group prenatal care cohort and the pre-group cohort were similar for the separate subset analyses of participants with no match exceptions and those with match exceptions (see Appendix A).

Conclusions

Compared to a matched, historical, pre-group cohort of deliveries from the NC birth certificates, patients who obtained group prenatal care had eight fewer babies born premature than women in the matched, pre-group birth certificate cohort [48 (8.7%) vs. 56 (10.2%)]. The difference between rates of preterm birth was not significantly different. Similarly, no significant difference in rates of preterm delivery was reported in a meta-analysis of two multi-site randomized control trials (RCTs; n = 1,315),[13] a clustered RCT of low-resource adolescents (573 group prenatal care patients vs. 575 individual care patients),[16] a prospective matched cohort study (229 group prenatal care patients vs. 229 individual care patients),[15] or a retrospective propensity score matched study (651 group prenatal care patients vs. 5,504 individual care patients across five sites).[31]

Previous studies that did find a significantly lower rate of prematurity included the larger of two RCTs in the meta-analysis (623 group prenatal care patients vs. 370 individual care patients),[10]

and three unmatched cohort studies– one including heterogeneous women (316 group prenatal care patients vs. 3,767 individual care patients),[18] another including low-income Hispanic women (144 group prenatal care patients vs. 70 individual care patients),[19] and a third including adolescents (124 group prenatal care patients vs. 377 individual care patients).[14]

In the nine studies comparing preterm birth, rates of prematurity ranged from 5.0% to 10.5% among group prenatal care patients, whereas the rates among the comparison groups ranged from 5.5% to 24.1%. Consistently across all studies, women in group prenatal care had the same number or fewer preterm babies.[10,13-16,18-19]

Regarding low birth weight, we did find a significant difference between the group prenatal care cohort and the matched, pre-group cohort. Patients who obtained group prenatal care were significantly less likely to have low birth weight babies. Our results were consistent with some but not all of the previous studies reporting outcomes among low-risk group prenatal care participants as compared to individual prenatal care participants. Tanner-Smith, et al., Ickovics, et al., and Grandy and Bloom reported fewer low birth weight babies.[14,16,31] Tanner-Smith, et al. reported overall higher birthweights among group prenatal care patients (beneficial effect of group prenatal care = 28.6, 95% CI 4.8-52.3).[31] Ickovics, et al. found this significant difference favoring group prenatal care patients only among babies born prematurely (2398 grams vs. 1990 grams).[15]

Conversely, no significant difference in the rate of low birth weight babies among low-risk women was reported in either the meta-analysis or in the clustered RCT.[10,13,16-17] Additionally, no significant differences in the rates of low birth weight were reported in either of two unmatched cohort studies.[18-19]

There was not a significant difference in rates of cesarean delivery. Similar to our results, a RCT reported no significant differences in cesarean deliveries between group prenatal care patients and individual care patients.[17] Another cohort study reported non-significant, lower overall rates of cesarean deliveries among group prenatal care patients (13.7% vs. 15.4%).[14]

We found that patients who participated in group prenatal care were significantly more likely to have adequate prenatal care compared to the matched, pre-group cohort. Of the seven previous studies that addressed adequacy of prenatal care, all but one unmatched cohort study[14] reported better care utilization among group prenatal care patients.[10,13-15,17-18,26] Ickovics, et al. found that the greater the number of groups attended, the lower the odds of delivering a baby preterm or with a low birth weight. Further, women who attended at least five of ten (50%) group prenatal care visits were significantly less likely to have a premature or low birth weight baby.[16]

The majority of previously published research regarding group prenatal care targeted demographically and socioeconomically at-risk populations, such as adolescents and patients with low incomes.[10,14-16,18-19,26] However, few of these studies included medically complex patients with medical complications during pregnancy (i.e., HTN or prior preterm delivery). Overall, more of our patients who participated in group prenatal care were medically complex compared to the patients in previously published studies. In two matched cohort studies and three RCTs, most medical complications were exclusion criteria or the rates were not reported.[10,15-17,31] Of the studies that reported rates of smoking during pregnancy, one study reported a rate similar to our group prenatal patients (20.9%)[10]; the other two studies reported much lower rates of smoking during pregnancy (5.3% and 11%).[16,31] Only one study reported rates of HTN (4%) and GDM (2.9%).[31] Two studies reported rates of prior preterm delivery (3.1% and 4%).[10,15] These previously published rates of HTN, GDM, and prior preterm delivery among women provided group prenatal care are lower than the rates among our patients. We included many more medically complex women in group prenatal care following appropriate screening and/or consultation with providers of high-risk maternity care.

Generalizability of our results is limited by the retrospective cohort design conducted at one site. By using the NC birth certificate database, we introduced some error. Some of the variables in the birth certificate database have high degrees of reliability, while others are less reliable.[32] However, most of the variables we used in our matching process have been reported to have good to excellent validity (demographic variables, parity, insurance, concurrent illnesses, and prior pregnancy birth outcomes).[32] We were able to match most group prenatal care patients to women in the cohort from the birth certificate data on all variables. We had to make some matching exceptions; these exceptions biased data toward better outcomes in the pre-group cohort from the birth certificate data. Sensitivity analysis found similar results among those pairs for whom exceptions were made as compared to those without exceptions.

We had to match group prenatal care patients from 2013-2015 to birth certificate data from two years prior (2011-2013) because the birth certificate data was deidentified; there was no way to guarantee we would not match group prenatal care patients to themselves in the birth certificate data. This may have introduced some socio-economic confounders such as changes in unemployment rates, incomes, and insurance over the years. Overall preterm birth rates in Buncombe County and NC decreased from 2011 to 2015 (Buncombe County: 14.7 to 9.7; NC: 12.1 to 10.2). [33-35]

There are other limitations to the generalizability of these results. Due to our small sample size, we were unable to conduct sensitivity analyses comparing our high risk and low risk patients. Additionally, we had to collapse the four levels of adequacy of the Kotelchuck Adequacy of Prenatal Care Utilization calculation into two categories [adequate (adequate and adequate plus) and less than adequate (intermediate and inadequate)]. We were not able to measure all the risk factors associated with preterm birth including short inter-pregnancy interval or short cervical length.[36] Further, we did not address fidelity to the model among our groups. Mixed results across this body of literature may reflect varying degrees of fidelity to the CenteringPregnancy model.[37-38] Greater fidelity to the model has been found to be associated with lower odds of preterm birth and intensive care utilization.[37]

We did not examine costs of care delivery with our model.[10,38] A cost-effectiveness analysis was beyond the scope of this design. Comparing outcomes by level of medical complexity was also outside the scope of this study; a larger sample of medically complex group prenatal care patients would be required to conduct this type of analysis.

In conclusion, compared to a matched, historical, pre-group cohort, group prenatal care patients with low and moderate medical complexities were significantly more likely to have adequate prenatal care and significantly less likely to have low birth weight babies. When appropriate, medically complex patients should be invited to participate in group prenatal care. We plan to continue to offer this model of prenatal care to patient with low and moderate medical complexities.

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Disclosure: None

Financial Support: Implementation and evaluation of CenteringPregnancy at Mountain Area Health Education Center OB/GYN Specialists was supported, in part, by a grant from the March of Dimes Foundation North Carolina Chapter. Investigators retained full control of the evaluation and research project within.

Author's Contributions:

Kiran Sigmon, MD: Study conceptualization, interpretation of data, critical revision of article
Anna Beth Parlier, BS: Data collection, management, and analysis, interpretation of data, drafting and critical revision of article
Katie Descieux, MA: Data collection and analysis, and critical revision of article
Kacey R. Scott, MLIS: Drafting and critical revision of article
Shelley L. Galvin, MA: Study conceptualization and design, data analyses, drafting and critical revision of article, and mentoring of all aspects of the project

Previous Presentations:

Scalva E, Parlier AB, Descieux K, Galvin SL, Sigmon K. Better prenatal care and birth outcomes among women obtaining prenatal care in Centering Pregnancy group visits. Paper presented at: the 23rd Annual MAHEC Research Day; 2016 May; Asheville, NC.

Scalva E, Parlier AB, Descieux K, Galvin SL, Sigmon K. Better prenatal care and birth outcomes among women obtaining prenatal care in Centering Pregnancy group visits. Paper presented at: the 2015 Annual Meeting of the North Carolina Obstetrical and Gynecological Society; 2016 April; Greensboro, NC.

Larabee J, Parlier AB, Murphy A, Sigmon K. Birth outcomes of patients from Western North Carolina enrolled in group prenatal care. Paper presented at: Paper presented at: the 22nd Annual MAHEC Research Day; 2015 May; Asheville, NC.

Larabee J, Parlier AB, Murphy A, Sigmon K. Birth outcomes of patients from Western North Carolina enrolled in group prenatal care. Paper presented at: The 2015 Annual Meeting of the North Carolina Obstetrical and Gynecological Society; 2015 April 17-19; Kiawah, SC.

Correspondence: Shelley L. Galvin
MAHEC Center for Research
121 Hendersonville Rd. Asheville, NC 28803
Phone: 828-771-5501 Email: Shelley.galvin@mahec.net