

Orofacial Clefts and Time Traveled to Craniofacial Centers in North Carolina

Cynthia H. Cassell^{1,2} • Dianne Enright³ • Robert E. Meyer²

¹Department of Public Health Sciences, University of North Carolina at Charlotte, Charlotte, NC

²North Carolina Birth Defects Monitoring Program, State Center for Health Statistics, North Carolina Division of Public Health;

³Health and Spatial Analysis Unit, State Center for Health Statistics, North Carolina Division of Public Health

Objectives

- To determine actual time traveled to a craniofacial center or team (CFC) in North Carolina using geographic information systems (GIS)
- To examine any difference in time traveled if proposed CFC were added
- To assess any factors associated with time traveled to the CFC

Background

- To date, only one study has examined distances to health care providers among children with orofacial clefts (OFC). This study was conducted in Maryland in the late 1960's before the availability of GIS and failed to control for important demographic variables.
- Treatment of OFC traditionally relies on CFC, which provide a coordinated, interdisciplinary team approach to care for families of children with craniofacial anomalies such as OFC.
- No recent data on the effect that geographic barriers, such as distance traveled to and from specialized health care providers, have on access and utilization of services among children with birth defects such as OFC.

Methods

- Resident children with OFC born between 1995 and 2002 were identified using the North Carolina Vital Statistics, Health Services Information System, and North Carolina Birth Defects Monitoring Program (British Pediatric Association codes 749.000-749.290)
- Exclusion criteria included any adopted children or deaths in the first year of life.
- Residential addresses were located by geocoding, and GIS analysis was conducted using *ESRI ArcGIS and Network Analyst 9.2. TeleAtlas Multinet 2005 2.1* was used for the road network.
- Closest facility network analysis was used to calculate the actual time traveled to the closest CFC in the state using the maternal residential address at birth. Analysis included a five second impedance for left-handed turns.
- Two proposed CFC were located by using existing North Carolina hospitals and calculating where the maximum population would be served. See Table 2.
- Bivariate analyses was conducted using chi-square test. See Table 1.
- Any associations between time traveled and selected maternal, infant and system characteristics were examined using multivariate logistic regression analysis. See Table 3.

Results

- Of 1,252 children with OFC, 13.9% (n=174) could not be geocoded due to post office box addresses or rural routes.
- 39.2% of families traveled ≥ 61 minutes to receive services and treatment from a CFC for their child with OFC. Times traveled ranged from 1 minute to 5 hours. See Figure 1.
- If 2 additional CFC were located in Asheville and Fayetteville, where there are currently none, actual travel time would be decreased by about 16 minutes. See Figure 2.

Figure 1. Orofacial Clefts and Drive Time to Current North Carolina Craniofacial Centers, 1995 - 2002

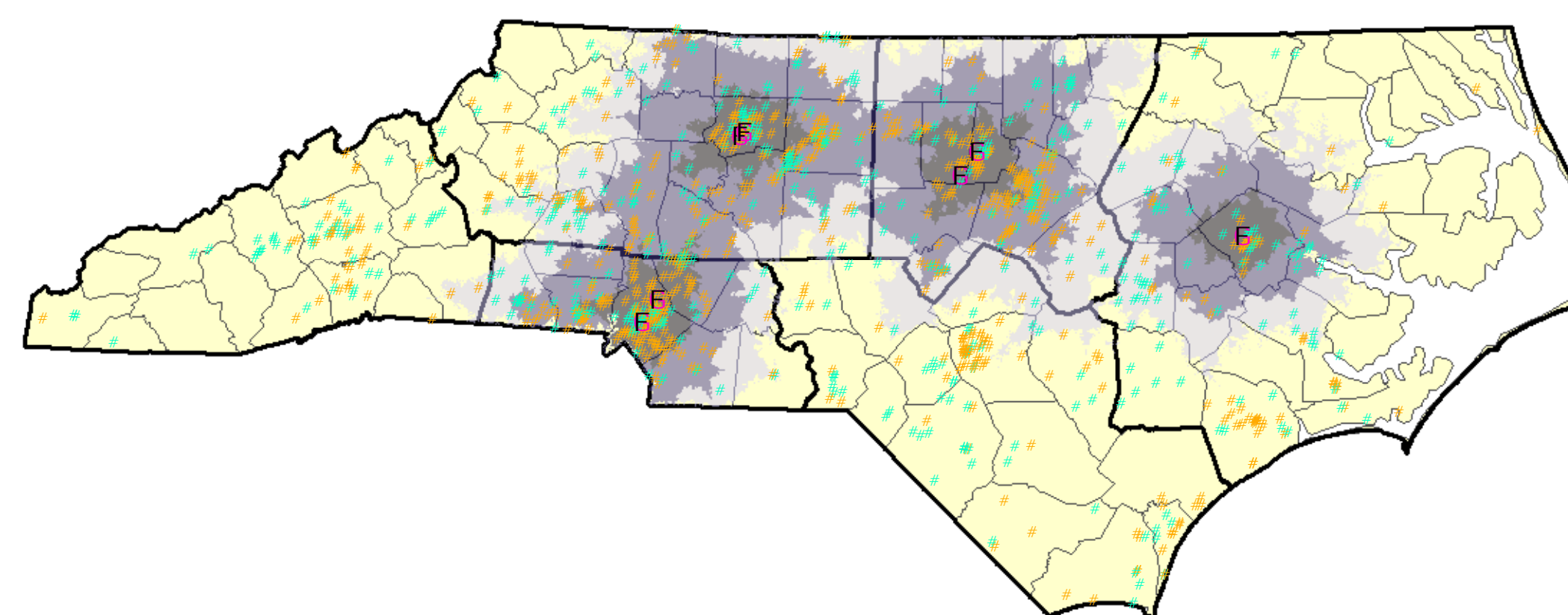
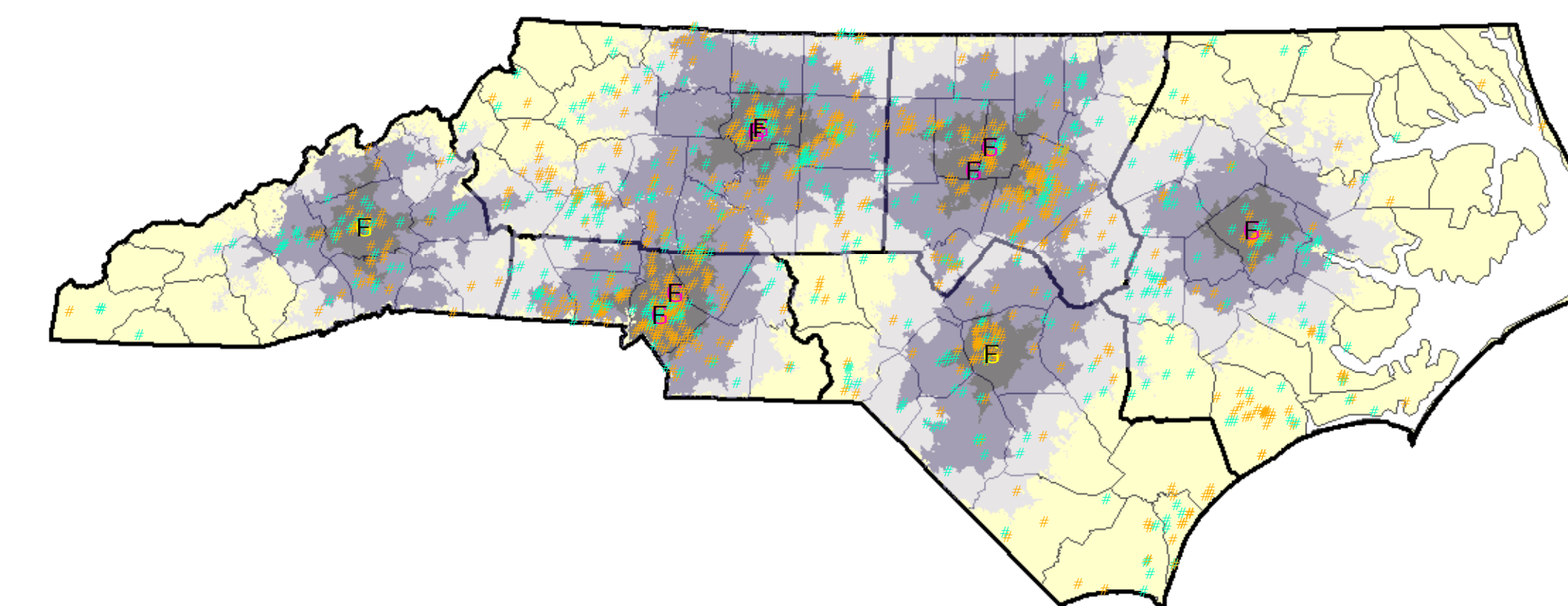


Figure 2. Orofacial Clefts and Drive Time to Current and Proposed North Carolina Craniofacial Centers, 1995 - 2002



Legend

Craniofacial Centers (CFC)

- Current CFC
- Proposed CFC

Orofacial Clefts

- Medicaid
- Not Medicaid

Drive Time

- 0-30 Minutes
- 31-60 Minutes
- 61-90 Minutes
- > 90 Minutes
- Perinatal Care Regions (PCR)

0 25 50 100 Miles

Results

Table 1. Selected Characteristics of Children with Orofacial Clefts and Actual Time Traveled to Closest Craniofacial Center or Team in North Carolina, 1995-2002

Characteristic	≤ 30 Minutes N=313 (%)	31-60 Minutes N=342 (%)	61-89 Minutes N=140 (%)	≥ 90 Minutes N=283 (%)
Maternal				
Age ^a				
≤ 20 years old	36 (11.5)	46 (13.5)	39 (27.9)	73 (25.8)
21-24 years old	58 (18.5)	78 (22.8)	35 (25.0)	61 (21.6)
25-29 years old	83 (26.5)	110 (32.2)	30 (21.4)	78 (27.6)
≥ 30 years old	136 (43.5)	108 (31.6)	36 (25.7)	71 (25.1)
Education ^b				
<High School	60 (19.2)	81 (23.7)	47 (33.6)	66 (23.3)
High School	78 (24.9)	115 (33.6)	56 (40.0)	102 (36.0)
>High School	175 (55.9)	146 (42.7)	37 (26.4)	115 (40.6)
Race/Ethnicity ^c				
White/Non-Hispanic	198 (63.3)	263 (76.9)	105 (75.0)	223 (78.8)
Black/Non-Hispanic	71 (22.7)	44 (12.9)	24 (17.1)	33 (11.7)
Hispanic	30 (9.6)	27 (7.9)	10 (7.1)	14 (5.0)
Other ^d	14 (4.5)	8 (2.3)	1 (0.7)	13 (4.6)
Number of Living Children				
0	128 (40.9)	132 (38.6)	57 (40.7)	131 (46.3)
1	112 (35.8)	130 (38.0)	54 (38.6)	81 (28.6)
≥ 2	73 (23.3)	80 (23.4)	29 (20.7)	71 (25.1)
Marital Status				
Married	211 (67.4)	249 (72.8)	83 (59.3)	198 (70.0)
Not married	102 (32.6)	93 (27.2)	57 (40.7)	85 (30.0)
Infant				
Cleft Type				
Cleft Palate	119 (38.0)	123 (36.0)	56 (40.0)	110 (38.9)
Cleft Lip	53 (16.9)	86 (25.2)	26 (18.6)	44 (15.6)
Cleft Lip with Cleft Palate	141 (45.1)	133 (38.9)	58 (41.4)	129 (45.6)
Presence of Other Birth Defects ^e				
Isolated anomaly	194 (62.0)	219 (64.0)	90 (64.3)	179 (62.3)
Multiple anomalies	119 (38.0)	123 (36.0)	50 (35.7)	104 (36.8)
Gender				
Female	129 (41.2)	156 (45.6)	62 (44.3)	129 (45.6)
Male	184 (58.8)	186 (54.4)	78 (55.7)	154 (54.4)
System				
Maternal Receipt of Medicaid ^f				
Yes	100 (32.0)	140 (40.9)	84 (60.0)	130 (45.9)
No	213 (68.1)	202 (59.1)	56 (40.0)	153 (54.1)
Source of Prenatal Care				
Health department ^g	273 (87.2)	270 (79.0)	100 (71.4)	215 (76.0)
Other	40 (12.8)	72 (21.1)	40 (28.6)	68 (24.0)
Hospital Level of Care at Birth ^h				
Level III	221 (70.6)	133 (38.9)	23 (16.4)	122 (43.1)
Community	92 (29.4)	209 (61.1)	117 (83.6)	161 (56.9)
Perinatal Care Region ⁱ				
Northwestern	80 (25.6)	122 (35.7)	67 (47.9)	23 (8.1)
Southwestern	134 (42.8)	74 (21.6)	15 (10.7)	3 (1.1)
Northeastern	75 (24.0)	122 (35.7)	19 (13.6)	11 (3.9)
Southeastern	0 (0.0)	1 (0.3)	3 (2.1)	116 (41.0)
Eastern	24 (7.7)	23 (6.7)	34 (24.3)	54 (19.1)
Western	0 (0.0)	0 (0.0)	2 (1.4)	76 (26.9)
Place of Residence ^j				
Metropolitan	301 (96.2)	212 (62.0)	93 (66.4)	174 (61.5)
Micro-politan	11 (3.5)	124 (36.3)	34 (24.3)	49 (17.3)
Noncore areas adjacent to metro area or small town	1 (0.3)	6 (1.8)	4 (2.9)	43 (15.2)
Noncore areas not adjacent to metro area or small town	0 (0.0)	0 (0.0)	9 (6.0)	17 (6.0)

Table 2. Comparison of Actual Time Traveled by Families of Children with Orofacial Clefts (N=1,078) using the Current 7 Craniofacial Centers and the Addition of 2 Proposed Craniofacial Centers in North Carolina

Number of Craniofacial Centers/Teams	≤ 30 Minutes N (%)	31-60 Minutes N (%)	61-89 Minutes N (%)	≥ 90 Minutes N (%)	Average Minutes
7 (Actual)	313 (29.0)	342 (31.7)	140 (13.0)	283 (26.3)	62.1
9 (7 + 2 Proposed)	397 (36.8)	402 (37.3)	166 (15.4)	113 (10.5)	46.2

Table 3. Adjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) for Positive Associations with Time Traveled (Travel Time Categories: ≤ 60 min and > 60 min)

Selected Covariates	OR (95% CI)
Maternal Education: High School	1.3 (0.9, 1.7)
Maternal Age: ≤ 20 Years Old	2.0 (1.3, 3.1)
≥ 2 Living Children	1.3 (0.9, 1.9)
Maternal Receipt of Medicaid	1.4 (1.0, 1.9)
Infant with Cleft Palate	1.5 (1.0, 2.2)
Infant with Cleft Lip with Cleft Palate	1.4 (0.9, 2.0)

Note: Place of residence and Perinatal Care Region were excluded in the multivariate analysis due to small cell sizes.

Discussion

- These results indicate families are traveling great distances to receive care and treatment for their children with OFC. Mothers who were younger, had a high school education, ≥ 2 living children, and received Medicaid and whose child had a cleft palate or cleft lip with cleft palate were significantly more likely to travel ≥ 61 minutes to receive services at a CFC.
- The extent to which families and children actually received services and treatment at the CFC is unknown. Children may receive services at multiple CFC. Furthermore, families may not take their child to the closest CFC, but to other CFC in the state where their health insurance is accepted. The CFC in Greenville (southeastern region) was formed during the study period, which would have resulted in families traveling much further to receive care at a CFC. Thus, these results may underestimate the true distance and time traveled to receive care.
- Despite the small decrease in time if proposed CFC were added in the state, over 140 families (13%) would be affected by being able to receive coordinated craniofacial services closer to their home. This would increase access to services, receipt of timely services, and ultimately lead to better health outcomes in this population.

Conclusions

- Geographic information systems method provide a useful tool for evaluating the role that travel distance may play as a potential barrier to accessing care among children with OFC and/or other types of birth defects.
- Future research should include GIS analysis on current contact information and location of services received to better assess whether distance and time are true barriers to care for children with OFC.

Acknowledgements

- Funding for this project was supported by the National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, Atlanta, Georgia (U50/CCU422096).

^aOther includes Native American, Asian/Pacific Islander and other Non-white; ^bIsolated anomaly is defined as orofacial cleft only and multiple anomalies are defined as orofacial clefts and another birth defect; ^cStatistically significant at p<0.05