Racial and Ethnic Disparities in Childhood Immunization Coverage in North Carolina

Kelly J. Flynn-Saldana, MPH, MPIA; Amy Kirsch, MPH, CHES; Mary Elizabeth Lister, MSPH

Abstract

Background/Objectives: *In 2000 the North Carolina Immunization Branch established the Disparities Core Team to address the issue of disparities in immunization coverage in the state. Since no existing research identified disparities in childhood immunization, the Disparities Core Team undertook a kindergarten survey to determine the existence of disparities. Childhood immunization coverage levels were measured retrospectively by race and ethnicity in North Carolina. Completion of the 4-3-1 series (4 DTaP, 3 Polio and 1 MMR) by 24 months was considered up-to-date.*

Methods: *Immunization, demographic, and healthcare information was collected from school records in the fall of 2001 for a sample of kindergarten students.*

Findings: *Disparities were found on both state and regional levels. Disparities within regions varied.*

Conclusions: *White children were more likely to be up-to-date by 24 months of age than African American children (OR=1.60, 95% CI 1.26-2.03), Latino children (OR=2.24, 95% CI 1.61-3.11), and Asian children (OR=1.88, 95% CI 1.03-3.4). Discovery of the cause of racial and ethnic disparities requires further study. Implications for interventions to eliminate disparities are discussed.*

IN 1998, AN INITIATIVE was announced committing the nation to the goal of eliminating disparities in health status among racial and ethnic minority groups by 2010. Child and adult immunizations were one of six areas that the US Department of Health and Human Services (DHHS) identified as those in which racial and ethnic minorities experience serious disparities in health access and outcomes.[1]

In 2000, the North Carolina Immunization Branch, Division of Public Health, Department of Health and Human Services, established the "Disparities Team" to focus state efforts on eliminating racial and ethnic disparities in childhood immunization status. The Disparities Team first decided to learn about the childhood populations served by the Immunization Branch so that educational efforts could be targeted appropriately to minority populations. All existing immunization coverage data available by race and ethnicity for the state were identified and reviewed.[2,3] The Disparities Team determined that recent, reliable data were not available to determine whether there was a difference in immunization coverage among various ethnic and racial groups. The team also decided that appropriate interventions could not be designed without additional data. As a result, the Disparities Team began discussing methods for establishing baseline childhood immunization coverage data.

Although public agencies have a responsibility to assess current needs and develop culturally appropriate educational strategies to eliminate disparities, such agencies are typically constrained by tight budgets. As a result, agencies may attempt to utilize existing activities and resources to meet multiple needs. In this paper, we report on an example of this strategy as employed by the Disparities Team.

As part of the Centers for Disease Control and Prevention (CDC) grant reporting requirements, regional immunization consultants throughout North Carolina are responsible for conducting school validation audits on an annual basis. In an attempt to leverage the resources of the immunization program, the Disparities Team decided to use these audits to look for evidence of racial and ethnic disparities. This approach presented a way to establish baseline immunization coverage data across racial and ethnic populations without incurring additional costs.

Ms. Flynn-Saldana and Ms. Lister are with the Division of Public Health, Women and Children's Health Section, Immunization Branch, NC DHHS. Ms. Kirsch is at CSC with the National Immunization Program, Immunization Services Division, Program Support Branch. Address correspondence to Ms. Lister at North Carolina Immunization Branch, 1917 Mail Service Center, Raleigh, NC 27699-1917. Telephone: 919/715-6761; email: marybeth.lister@ncmail.net.

Methodology

As part of the annual school audit process, this project was considered a programmatic evaluation in North Carolina, and the North Carolina Department of Health and Human Services excludes such projects from Institutional Review Board (IRB) review.

Sampling: Resources allowed for 81 North Carolina schools (5% of private and public elementary schools) to be included in the sample. Schools were sampled from each school district according to the percent of school children in the district. For example, if 10% of the school population was found in School District A, then 10% of the schools included in the sample (8 of 81) were drawn from School District A.

After the number of schools from each school district was determined, the schools were selected based on size; those with the largest population in each district were selected. Where there were schools of equivalent size, schools in urban areas were chosen over those in rural or suburban areas in order to maximize inclusion of minority racial and ethnic groups. Regional immunization consultants assigned to these urban areas also helped to identify which schools would provide a greater opportunity for including minority populations in the analysis.

For each of the 81 schools in the sample, a systematic random sample of 30 children was selected from the kindergarten class roster. If there were fewer than 30 children on the roster, the entire kindergarten class was included. Information from the birth certificate, the health assessment form, and the immunization record on file for each selected student was reviewed and recorded on a standardized data collection tool. The data collection occurred during the fall of 2001.

Survey Instrument: The following data were collected from the school records: school name, school district, urbanicity (based on metropolitan statistical area as defined by the US Office of Management and Budget), child's date of birth and gender, mother's race and ethnicity, primary site of health care (health department, private provider, etc), and dates of immunization. Although the dates for all immunizations were recorded, we analyzed the data based on the 4:3:1 series (4 doses of Diphtheria, Tetanus, and Pertussis; 3 doses of Polio; and 1 dose of Measles, Mumps, and Rubella), as this is the series most commonly used in North Carolina and in 1997 was considered the standard measurement for immunization completeness by the Immunization Branch. Eight regional immunization consultants collected this information from the 81 schools.

Data Analysis Methods: The data collection forms were sent to the Immunization Branch and entered into a Microsoft ACCESS®™ (Microsoft Corporation, 1997) database for analysis. From the ACCESS database, records were extracted based on demographic, geographic, and healthcare characteristics. The extracted data were analyzed using Clinical Assessment Software Application (CASA version 2.2, CDC, 2001) to determine the number of children who had completed the 4:3:1 series of shots by 24 months of age. The number of children up-to-date (UTD) for the 4:3:1 series in various categories was compared using the odds ratio (OR) and adjusted chi-square (or Fisher's exact) statistical tests. When both the odds ratio and the adjusted chi-square proved significant ($p<.05$), the comparison between groups was termed a "disparity."

The following racial and ethnic categories were used to analyze the data: white (non-Hispanic), African American (non-Hispanic), Hispanic (of any race), Asian, Native American, and Other/Unknown (includes children listed simply as "multiracial").

Data were first analyzed on a statewide aggregate level and then by specific geographic regions. Within the Women's and Children's Health Section of the North Carolina Department of Health and Human Services, the state has been divided into seven regions. Because of a paucity of data, two of the regions located in the westernmost part of the state (Regions 1 and 2) were combined for this analysis. Addi-

Table 1: Characteristics of kindergarten children included in the School Validation Audit

Characteristic	N	(%)
Race		
White	1432	(60)
African American	513	(21)
Hispanic/Latino	199	(8)
Native American	78	(3)
Asian	59	(2)
Unknown	142	(6)
Care		
Private Doctor	1855	(77)
Health Department	289	(12)
Military	49	(2)
Unknown	230	(9)
Gender		
Male	1231	(51)
Female	1165	(48)
Unknown	27	(1)
Metro	1899	(78)
Non-Metro	524	(22)
Region		
1 and 2 (Mountains)	237	(10)
3 (Winston-Salem Area)	536	(22)
4 (Charlotte Area)	538	(22)
5 (Raleigh-Durham Area)	569	(23)
6 (Fayetteville/Wilmington Area)	430	(18)
7 Northern Coast	113	(5)

Table 2. 4-3-1 Immunization up-to-date rates by region and category

Region	*White*		*African American*		*Hispanic/ Latino*		*Native American*		*Asian*		*Region Rates*	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
1 and 2 Mountains	146/179	(82)	14/16	(88)	8/15	(53)	N/A		N/A[a]		190/237	(80)
3 Winston-Salem Area	225/277	(81)	87/127	(68)	46/77	(60)	N/A		N/A		397/536	(74)
4 Charlotte area	298/362	(82)	55/72	(76)	16/25	(64)	N/A		N/A		430/538	(80)
5 Raleigh-Durham Area	249/311	(80)	116/173	(67)	36/53	(68)	17/22	(77)	N/A		421/569	(74)
6 Fayetteville/ Wilmington Area	161/223	(72)	72/98	(73)	18/26	(69)	N/A		49/69	(71)	310/430	(72)
Statewide	1143/1432	(80)	365/513	(71)	127/199	(64)	40/59	(68)	56/78	(72)	1841/2423	(76)

a. N/A = Less than 15 records in group
Disparity = Odds Ratio and adjusted chi-square (or Fisher's exact test) is significant between groups or regions ($p < 0.05$).
Note: In some cases the numbers were small enough that the odds ratio gave no reliable information as to the magnitude of the disparity. In that case the Yates corrected chi-square (or Fisher's exact) p-value is used.

tionally, the coastal region (Region 7) did not have enough records for a robust analysis and is not included in this report.

Results

Study Participants: Out of 2452 records collected, 14 could not be used because of transcription/data recording errors, and 15 were not used because they represented children with medical or religious exemptions to vaccination. Records from 2423 children were analyzed (Table 1).

State level analysis: Overall, the statewide 4-3-1 immunization rate at 24 months for the children included in the sample was 76% (95% CI = 75.1 - 76.9) (Table 2). White children were more likely to be up to date by 24 months of age than African American children (80% vs 71%, OR=1.60, 95% CI 1.26-2.03), Latino children (80% vs 64%, OR=2.24, 95% CI 1.61-3.11), and Asian children (80% vs 68%, OR=1.88, 95% CI 1.03-3.4). At the statewide level, there were no differences between children on the basis of urbanicity, gender, or region in the state.

Immunization coverage rates were also compared along racial/ethnic populations within the two healthcare categories. Among children identifying health departments as the regular site of healthcare, white children were more likely to be up to date than Latino children (78% vs 60%, OR=2.42, 95% CI 1.19-4.95). Among children identifying private providers as their regular site of healthcare, white children were more likely to be up to date than African American children (81% vs 74%, OR=1.48, 95% CI 1.11-1.97), Latino children (81% vs 67%, OR=1.92, 95% CI 1.16-3.17), and Native American children (81% vs 62%, OR=1.79, 95% CI 1.01-3.16).

Regional level analysis: Racial and/or ethnic disparities were found in all regions except for region 6. The Figure illustrates the range of coverage across racial and ethnic categories within each region.

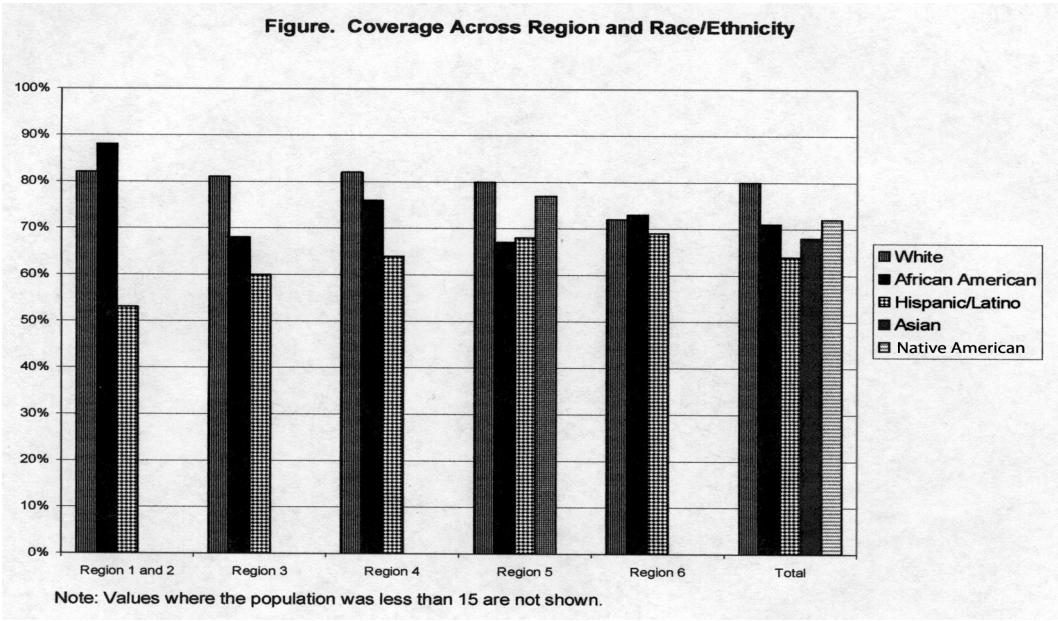
Disparities based on place of regular healthcare were found only in Region 3. In Region 3, children identified as private provider patients were 2.47 (78% vs 59%, 95% CI 1.48-4.11) times more likely to be UTD at 24 months of age than health department patients.

In Region 6, we found no disparities in immunization coverage across race/ethnicity or site of care; however, this region had the lowest coverage point estimates for white children (72%), private doctor patients (73%), and health department patients (57%).

Differences between regions: Finally, the demographic and healthcare variables were analyzed between the different regions. White children in Region 6 were less likely to be UTD than white children in all other regions. There were no disparities between regions for either African American children or Latino children.

Only one disparity was found between the private doctor patient populations in each region. Children identified as private provider patients in Region 4 were more likely to be UTD than children identified as private provider patients in region 6 (OR=1.76, 95% CI 1.22-2.56). In the public sector, the health department patient populations in Region 4 and Regions 1 and 2 were more likely to be UTD than the health department patient population in Region 3 (p-value: 0.001 and p-value: 0.03, respectively). The health department patient population in Region 4 was also more likely to be UTD than the health department population in Region 6 (p-value: 0.004).

While there were no differences based on urbanicity within any of the regions, children living in metropolitan areas in Region 4 were more likely to be UTD than children living in metropolitan areas in Region 5 (OR=1.55, 95% CI 1.13-2.12) or children living metropolitan areas in Region 3



(OR=1.44, 95% CI 1.05-1.98). Additionally, children living in rural areas in Regions 1 and 2 and Region 5 were more likely to be UTD than children living in rural areas in Region 6 (OR=1.93, 95% CI 1.10-3.39 and OR=2.08, 95% CI 1.05-4.16 respectively).

Discussion

Summary and Limitations: Using school records for a representative sample of school children across the state, we assessed immunization coverage at state and regional levels. We also assessed immunization coverage in relation to race/ethnicity and site of care. The data from this study reflect the up-to-date status of two-year-old children by racial and ethnic subgroups in 1997. Statewide coverage is similar to that found in the National Immunization Survey (NIS) in 1997, the year most of these children would have been within eligibility parameters for that survey (19-35 months).[4] The NIS findings demonstrate lower immunization coverage among Latino children as compared with white children.

This study has three limitations. The first limitation is related to sampling. Using input from the regional immunization consultants to identify particular schools to include in the sample may have introduced bias. However, we felt it was necessary to get their input as experts on these counties and to identify schools that would provide the opportunity to capture minority populations. Second, socioeconomic status information was not collected for this study, and we did not explicitly attempt to control for socioeconomic factors in our analysis. However, the nature of the immunization program in North Carolina provides implicit controls for many such variables. Since 1994, North Carolina has been a universal vaccine distribution state for state-required vaccines, which means that all required childhood vaccines are offered free in this state. Providers are allowed to charge a set administration fee for each vaccine, but are required to waive this fee if a parent indicates an inability to pay. Currently between 95% and 98% of North Carolina childhood immunization providers participate in this program, which promotes more equal access to immunization services. Finally, the school health assessment form that provided the information used in this study requests only "Place of regular healthcare." As there is no way to know how or if the current source of care relates to the child's immunization provider during their first 24 months of life, there is no way to draw solid conclusions based on this variable. It is impossible to understand through the scope of this study the importance of the difference detected along this variable in Region 3 or the lack of difference in other regions.

Immunization disparities: This study found a disparity in immunization coverage in the Latino population as compared to other population groups. The disparity between whites and Latinos exists even when using the subset of health department patients as a relative proxy for socioeconomic status. Furthermore, the disparity in Latinos coverage as compared to other groups was significant in both state-level and regional comparisons.

The recent surge in the Latino population in North Carolina provides a foundation for beginning to understand and act upon the disparity found in this study. Between 1990 and 2000, the Latino population in North Carolina grew by 400%, largely because of job opportunities for Latinos who have subsequently brought their families to live with them in North Carolina.[5] These relatively new immigrants have needed more interpreter and other services than many state programs were prepared to handle,[5] which may contribute to disparities in coverage between Latino and other children. Such information highlights the seriousness of the disparity and the need for work to be done. A comparable survey in a few years may help determine whether or not the

disparity is due to issues unique to first-generation immigrants and their families.*

There is a suggestion that more racial and ethnic disparities exist among patients served in private practices than among those served in health department clinics. Differences in coverage between these two sites likely result from differences in the implementation of recommended strategies as well as in patient mix in the two settings. Regarding patient mix, it is important to note that health department clinics in North Carolina serve more minority children than private practices. This difference in patient mix may translate into different patient-provider interactions in these two settings, which is likely to affect the uptake of health services such as immunization.

Developing Interventions: The results of this study are important to the practice of public health because they help guide program planning efforts. While it would be preferable to design an intervention that could directly target the root causes of such disparities, the results of our analysis only reveal that these disparities exist. Designing an intervention is complicated by the fact that there are probably multiple factors contributing to these disparities, and the actual disparities vary, in both magnitude and existence, regionally across the state. We therefore need additional programmatic knowledge to target and implement appropriate interventions.

The Immunization Branch and local county health departments have traditionally taken on the responsibility of ensuring high vaccination coverage levels. State-level interventions aimed at raising immunization rates in North Carolina have attempted to effect change through policy and structural changes in service delivery. The state's universal purchase policy demonstrates a willingness to assist parents in obtaining vaccinations for their children. In addition, the establishment of the universal vaccine distribution program in 1994 gave children access to a "medical home"[6] where they could receive immunization and other services from the same provider, eliminating vaccine cost barriers. [7]

North Carolina also has an Assessment, Feedback, Incentives, and eXchange (AFIX) program that attempts to improve immunization rates by focusing on provider service delivery. On an aggregate population level, these efforts do demonstrate success.[8,9,10] According to NIS data, North Carolina was ranked first in the nation in immunization of 19- to 35-month-old children in 2000. [11] As the data reported here demonstrate, however, high statewide coverage levels do not necessarily translate into equal coverage among all racial and ethnic groups. Because our findings are cross-sectional, we do not know how coverage across these subpopulations may have changed over time in response to specific interventions. We also do not know if enough time has passed to measure the impact of these interventions. As a result, we will continue to implement structural systems changes. However, the findings from this research show us that future interventions must include targeted outreach efforts to the Latino population and other minority populations.

Acknowledgments: This study was conducted by the Disparities Core Team of the North Carolina Immunization Branch, DHHS/DPH/WCH, in Raleigh, NC. The authors would like to thank Beth Rowe-West, Immunization Branch Head, Jeanne Santoli, Gary Walker, Gina Holland, Charles Philbeck, Susan Chandler, Ron Sapp, Elaine Thomas, Lisa Johns, Isabel Reynolds, Marian Scott, and Walter Council for their contributions.

*It is important to note that the Latino population in the survey is representative of the ethnic mix of Latinos in the state. For example, 65% of the Latinao population of North Carolina is Mexican and 68% of the Latinos in the sample were specifically coded as Mexican on their school health form.

REFERENCES

1 Health Systems Research, Inc. Call to Action: Eliminating Racial and Ethnic Disparities in Health. Introduction and Overview. Available at: http://raceandhealth.hhs.gov/sidebars/report.htm#I . Accessed: May 2003

2 Centers For Disease Control and Prevention. National Immunization Program. Immunization Coverage in the US. NIS. July 99-June 00 Data Tables. Vaccine Specific Coverage Levels by Race/Ethnicity and Poverty Level. 3:3:1_race_iap. [Excel File] Available at: http://www.cdc.gov/nip/coverage/NIS/99-00/toc-99-00.htm. Accessed: May 2003

3 Adams S. Center study finds minorities lagging in on-time immunizations. North Carolina Insight. North Carolina Center for Public Policy Research 1995;(March):32-43.

4 Centers For Disease Control and Prevention. National Immunization Program. Immunization Coverage in the US. NIS. 1997 Data Tables. Coverage level by Milestone and Age. 24months_iap. [Excel File] Available at: http://www.cdc.gov/nip/coverage/NIS/97/toc-97.htm. Accessed: May 2003

5 Kitchen J. The Hispanic boom. Hispanic 2002;(15):32-34.

6 American Academy of Pediatrics. The medical home. Pediatrics 2002;110:184-86.

7 Freed GL, Clark SJ, Pathman DE, et.al. Impact of a new universal purchase vaccine program in North Carolina. Arch Pediatr Adolesc Med 1997;151:1117-24.

8 Massoudi MS, Walsh J, Stokley S, et.al. Assessing immunization performance of private practioners in Maine: impact of the Assessment, Feedback, Incentives and eXchange strategy. Pediatrics 1999;103:1218-23.

9 Dietz VJ, Baughman AL, Dini EF, et.al. Vaccination practices, policies, and management factors associated with high vaccination coverage levels in Georgia public clinics. Arch Pediatr Adolesc Med 2000;154:184-89.

10 The Community Guide. Vaccine Preventable Diseases. Assessment and Feedback for Providers. Available at: http://www.thecommunityguide.org. Accessed: May 2003

11 Centers for Disease Control and Prevention. National, state and urban area vaccination coverage among children aged 19-35 months, United States, 2000. MMWR 2001;50:637-41.