

# Center Study Finds Minorities Lagging in On-Time Immunizations

by Steve Adams

**N**orth Carolina—armed with free vaccines and a forthcoming computerized tracking system—aims to greatly improve its performance in immunizing preschool children when the shots are due. But how good a job are health departments doing now in immunizing minorities at the local level? And how can the state improve its chances of reaching its Year 2000 goal of having 90 percent of children ages two-and-under age-appropriately immunized?

To address these questions, the Center analyzed immunization records at nine North Carolina health departments—all with significant minority populations. Its findings? Only 60.6 percent of the children being served had received immunizations on time. And for minorities, the problem appears even worse—an indication that minority children may not be receiving the well-child care they need to get a healthy start in life. Only 54.1 percent of minorities were up to date, compared with 66.4 percent of whites.

These findings reflect a state and national problem. North Carolina and the rest of the country do an excellent job of making sure school children are fully vaccinated for common childhood diseases. More than 95 percent of North Carolina children are fully immunized by the time they reach school. This is not surprising; state law requires parents to provide immunization records when children enroll.<sup>1</sup> Nationally, the percentage of school-age children immunized is a point or two higher.<sup>2</sup>

Among younger children, the numbers aren't so encouraging. A retrospective, school-based immunization survey, conducted by the department of epidemiology in the University of North Carolina at Chapel Hill School of Public Health, examined records of 990 first-grade children enrolled during the 1993–94 school year. Of these children, only 58.8 percent (581) were

up-to-date with all recommended vaccines by age 2.<sup>3</sup>

That figure approximates the national average of 57 percent. But the United States lags behind even many less developed countries, according to Gary Freed of the Cecil G. Sheps Center for Health Research at the University of North Carolina at Chapel Hill. Indeed, the United States ranked 17th in immunization rates in 1988–89, trailing Bulgaria, Hungary, Greece, Brazil, China, Mexico, North Korea, Chile and Romania, among others. Even during the civil war in El Salvador, the warring factions called cease-fires to allow childhood immunization teams safe passage.<sup>4</sup>

In North Carolina and the United States as a whole, the most expensive health-care system in the world simply isn't doing its job in delivering immunizations. And minorities bear a disproportionate share of the problem.

## The Health Departments' Role

**I**n the fall of 1992, the state initiated an ambitious "Immunization Action Plan" to raise the proportion of children ages 2 and under who got their shots on time to 90 percent by the year 2000. The plan was updated in November 1993 to satisfy legislative mandates and add a universal distribution program using vaccines purchased with state and federal tax dollars. The action plan's tactics include expanding the state's program of distributing vaccines free to all providers and establishing a statewide computer data base to monitor all children's immunizations from birth.<sup>5</sup>

About 45 percent of North Carolina preschool children rely on health departments for their immunizations.<sup>6</sup> Although the departments continue efforts to increase the number of immunizations they give and to keep their young patients on schedule, the action plan may require them to play a greater role in keeping track of

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immunizations for all children, including those who get their vaccinations privately. "Local health departments will immunize less children [proportionately], but will need to accept the quality assurance role for vaccines administered in physicians' offices," Annette Byrd, head of the Immunization Section, wrote to local health directors in May 1994.<sup>7</sup>

How well prepared are health departments to handle this expanded role? They have a long way to go.

In the spring and summer of 1994, the Center examined the immunization records of 4,866 children, ages 1.5 months to slightly over 2 years, at nine health departments, urban and rural, east and west. The counties surveyed were Buncombe, Halifax, Hertford, Johnston, Mecklenburg, New Hanover, Pender, Robeson, and Swain.

While these counties are not intended to be representative of the state as a whole, the survey's findings generally track earlier state and national surveys. And, indeed, they support the key elements of the action plan.

The survey found:

- Overall, 60.6 percent of the children surveyed were "on time." Immunizations are scheduled at 2, 4, 6, and 12 to 15 months. Children were counted as *on time* if they were no more than a month overdue for the latest appropriate round. (See "How the Immunization Survey Worked," pp. 42-43.)

- Minorities rely on health departments for immunizations more heavily than whites, but they are less likely to be on schedule. The 1990 census reported that minorities make up 29.9 percent of the population in the counties surveyed, but 49.1 percent of the children in the Center's survey were non-white. The compliance rate was 66.4 percent for whites, compared with 54.1 percent for others.
- Success rates vary considerably among departments. The proportion of children who were on schedule ranged from 42.7 percent in Hertford to 79.1 percent in Swain.
- The health departments and other government agencies often don't screen children for immunizations when they visit for another purpose. There were no immunization records for nearly 14 percent of the children, even though they had received some other service. The survey excludes these children in calculating compliance rates. But with no records, health departments have no way of knowing whether these children are receiving their immunizations or not.
- Record-keeping methods are inconsistent from county to county, even though most use standardized paper cards. Some counties were able to summarize their records from computer data bases, while others were not.

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- Although all of the departments surveyed had some system of tracking children who are due or overdue for immunizations, the systems varied widely in scope.

A picture emerges of a system in transition. At the time of the Center's survey, the Immunization Action Plan had been in place for only a few months, and its effects were only beginning to appear. Many of the issues raised by the survey are addressed by the plan, but at this point, there is much opportunity for improvement.

### The Immunization Action Plan

**T**he Immunization Action Plan is designed to build a more structured system for making sure that preschoolers receive vaccinations on time. For the first time, there will be a central system for distributing vaccines and maintaining records for private providers, health departments, and other agencies with an interest in maintaining child health.

The relationship between the N.C. Department of Environment, Health, and Natural Resources and local health departments is similar to that of the public school system. Local departments are responsible to boards of health, which in return report to county commissioners. The departments get "direction and quality assurance from the state, but for the

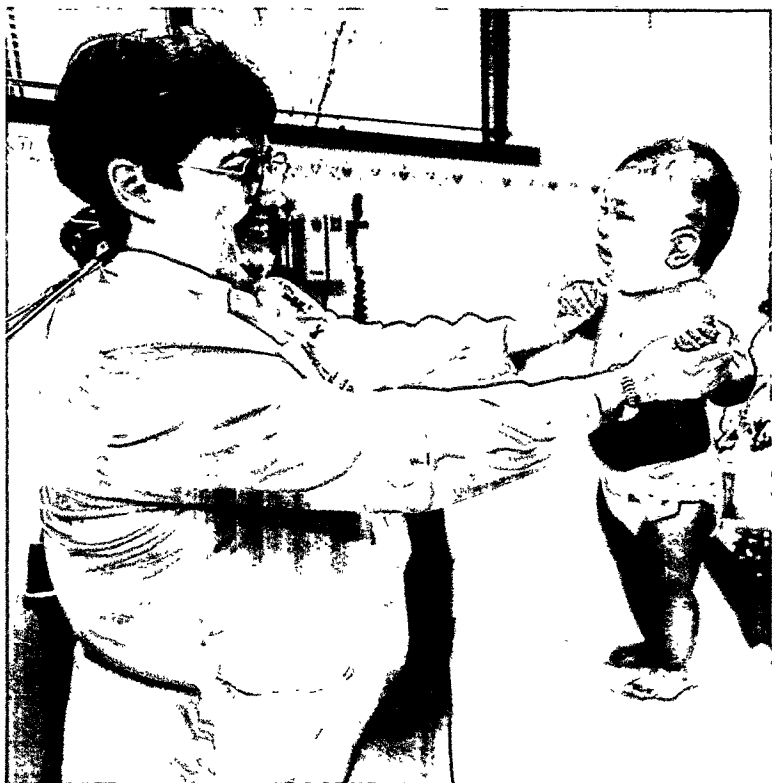
most part they structure programs to meet the needs of their vastly different populations," as DEHNR put it in the action plan.<sup>8</sup>

Now health departments will be responsible for monitoring immunizations for all children born in their counties. Private providers, who traditionally have been left on their own to monitor vaccinations, will be required to participate in the statewide immunization registry if they accept vaccines from the state.

The action plan—begun in earnest in 1993 with increased funding to local health departments to expand capacity to deliver services—contains several important components. It proposes to:

- Establish a statewide immunization registry, a computer data base with a goal of 90 percent participation from all immunization providers by 1996. Data for all children born in the state will be automatically loaded into the system electronically using birth certificate data.
- Expand the state program of providing state-purchased vaccine for private, as well as public providers, as it has for health de-

**Tiffany Montalvo,  
9 months, with  
nurse Shirley Moser  
at the Wake County  
Health Department**



Karen Tam

partments since the 1950s. The program, begun in 1994, is a key to the success of the registry, because all providers who receive vaccines will be required to participate. The plan calls for increasing purchases of vaccines from 1 million doses in 1993–94 to 2 million in 1994–95. These figures include vaccines for both the departments and for private providers.

- Extend clinic hours to make them more convenient for working parents.
- Coordinate tracking and follow-up with other agencies, such as Medicaid and the Supplemental Food Program for Women, Infants, and Children (WIC).
- Increase educational efforts to emphasize the importance of immunizations.

The plan will increase the cost of administering the immunization program by nearly a third in a single year. The state provides a little over half the funds. Most of the rest is federally funded. The budget for DEHNR's Immuniza-

tion Section increased from \$15.5 million in 1993–94 to \$20.3 million in 1994–95. Most of the increase is attributable to purchasing vaccines (\$9.4 million to \$14.2 million).

The cost of setting up the registry is comparatively small—\$600,000 in the first year and \$1.2 million in the second. However, in the fall of 1994, the registry, originally scheduled for “roll out” to all health departments by July, was months behind schedule, as the Immunization Section was still working to get the first departments on line on a pilot basis.<sup>9</sup>

### Race and Immunization

**I**n deciding which local health departments to include in its study, the Center sought a mix of rural and urban counties with significant minority populations. The Center also wanted some geographic balance. The result is a good cross-section of North Carolina counties, although not a representative sample. Success

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**Table 6. Percentage of Children 2 and Under Age-Appropriately Immunized in Nine North Carolina Counties**

County	Number of Children with Immunization Records	Number Up-to-date on Shots*	Percent Up-to-date
BUNCOMBE	598	385	64.4
HALIFAX	615	373	60.7
HERTFORD	316	135	42.7
JOHNSTON	306	190	62.1
MECKLENBURG	446	246	55.2
NEW HANOVER	493	361	73.2
PENDER	609	377	61.9
ROBESON	624	328	52.6
SWAIN	187	148	79.1
<b>Total</b>	<b>4,194</b>	<b>2,543</b>	<b>60.6</b>

\* Children were counted up to date if they had received immunization shots on the following schedule: Age 1.5–5 months, first diphtheria, pertussis, tetanus (DPT1), first oral polio (OPV1); age 5–7 months, DPT2, OPV2; age 7–16 months, DPT3, OPV2; over 16 months, DPT4, OPV3, measles, mumps, rubella (MMR1).

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rates vary significantly by county, as shown in Table 6 on page 35. At 79.1 percent, Swain County's compliance rate was nearly double Hertford's rate of 42.7 percent.

Local administration and resources may account for part of this discrepancy. However, preschool immunization patterns in North Carolina resemble national trends. In the United States, 97 percent to 98 percent of children are fully immunized when they enter school, yet only 60 percent are fully immunized by age 2.<sup>10</sup>

Particularly at risk are children in rural areas and inner cities, poor children, children whose parents have little education, and children of young, single mothers. Immunization rates for minority children are some 30 percent lower than for whites, according to the Centers for

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## Immunization Index

**Percentage of U.S. children fully immunized on entering school in 1991:** 97 to 98 percent.

**Percentage of N.C. children fully immunized on entering school in 1991:** 95 percent.

**Percentage of U.S. children not fully immunized at age 2 in 1991:** up to 40 percent.

**Percentage of N.C. children not fully immunized at age 2 in 1991:** 41.3 percent.

**Number of countries with higher immunization rates than the U.S. for children under 1 year in 1988–89:** 16, including Brazil, Bulgaria, Chile, China, Greece, Hungary, Mexico, North Korea, and Romania.

**Number of measles cases in the U.S. in 1983:** 1,497.

**Number of measles cases in the U.S. in 1990:** 27,672.

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Source: Gary L. Freed, W. Clayton Bordley and Gordon H. DeFries, "Childhood Immunization Programs," *The Milbank Quarterly*, Vol. 71, No. 1, 1993, pp. 65 ff.

Disease Control in Atlanta, Ga. There are also indications that children who receive vaccinations at health departments are less likely to be on schedule than those who receive immunizations privately. Success rates may be even lower for children who switch back and forth.<sup>11</sup>

In the Center's survey, race was the only one of these risk factors that could be identified consistently. Minority parents tend to rely more heavily than whites on health departments for their children's immunizations, but they are less likely than whites to be on schedule for immunizations, according to the health department records.

According to the 1990 Census, 70.1% of the people in the nine counties surveyed were white, yet the sample of children with health department immunization records was almost evenly divided (53.1 percent vs. 46.9 percent). Only in Swain, where many Cherokee Indians use the federal Indian Health Service for their immunizations, did minorities account for a smaller percentage of health department patients than they do in the overall population. In Buncombe County, the two figures were the same. (See Table 7, p. 37.)

A large majority of minority patients are African American—1,485 of 1,967 minority children in the survey (75 percent). Another 292 are Native American (15 percent of minority children in the survey); most of these—264—were in Robeson County. No county had more than a handful of Hispanic patients. The remaining children are members of other minorities or classified in health department records as "Other."

In Swain, more than a quarter of the population is Native American, but Native Americans there are more likely to use the Indian Health Service on the Cherokee Qualla Boundary Reservation than the health department, says health director R.D. Childers, Jr. There is no federal health service in Robeson, where the Lumbees have long sought federal recognition as a tribe.

As shown in Table 8, p. 38, the overall success rate for the nine counties was 60.6 percent—66.4 percent for whites and 54.1 percent for minorities. Success rates among minority groups varied little—from a low of 52.7 percent (58 of 110) among Asians and others to a high of 58.8 percent (47 of 80) among Hispanics. Table 9, p. 39, shows that the pattern of lower success

rates for minorities occurs in seven of the nine counties. In Buncombe, minorities actually had a higher success rate than whites. However, minorities make up less than 10 percent of the children surveyed there.

### Missed Opportunities

**T**oo often, health departments fail to screen children for immunizations when they visit for some other reason. Public health workers call these "missed opportunities." In three of the counties surveyed, the Center detected this problem for children in the Special Supplemental Food Program for Women, Infants and Children (WIC).

Overall, there were no immunization records for 13.8 percent of the children who had visited health departments. Again, the percentage was higher for minorities than for whites—17.7 percent vs. 10 percent.

Six departments had at least some immunization records for more than 97 percent of their patients. But Hertford and Johnston had vaccination records for only slightly over half of their patients. New Hanover had records for 86.9 percent of its patients. The majority of the children without immunization records in those counties had visited the health department for WIC reviews.

WIC is a federal nutrition program administered by DEHNR. The program requires semiannual eligibility reviews. Children are tested for anemia, but "there's nothing you would call a regular checkup," says Alice Lenihan, head of the department's WIC section. As for immunization screening, "They haven't been asked to do that," she says.

Nevertheless, health departments in Hertford, Johnston, and New Hanover routinely set up an immunization master card when a child

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**Table 7. Percentage of Minorities in Nine North Carolina Counties and Percentage of Children Ages 2 and Under Who Get Immunization Shots at Health Department**

County	Percentage of Minorities in County	Percent Minorities 2 and Under Immunized at Health Dept.
BUNCOMBE	9.6%	9.7%
HALIFAX	53.3	61.8
HERTFORD	59.3	72.8
JOHNSTON	19.6	38.2
MECKLENBURG	29.5	56.1
NEW HANOVER	21.6	33.5
PENDER	31.6	43.5
ROBESON	64.0	77.2
SWAIN	31.8	10.7*
<b>Total</b>	<b>29.9</b>	<b>46.9</b>

\* Swain County has a large population of Native Americans who get immunizations at the Indian Health Service on the Cherokee reservation.

Sources: 1990 U.S. Census and N.C. Center for Public Policy Research field audits of immunization records in nine North Carolina counties.

**Table 8. Number and Percentage of Whites and Minorities Up-To-Date on Immunizations**

Racial or Ethnic Group	Number of Records Examined	Number Up-To-Date on Shots	Percent Up-To-Date on Shots
WHITE	2,227	1,478	66.4%
AFRICAN AMERICAN	1,485	801	53.9
NATIVE AMERICAN	292	159	54.5
HISPANIC	80	47	58.8
OTHER	110	58	52.7
Total Minority	1,967	1,065	54.1
Overall Total	4,194	2,543	60.6

\* Children were counted up-to-date if they had received immunization shots on the following schedule: Age 1.5–5 months, first diphtheria, pertussis, tetanus (DPT1), first oral polio (OPV1); age 5–7 months, DPT2, OPV2; age 7–16 months, DPT3, OPV2; over 16 months, DPT4, OPV3, measles, mumps, rubella (MMR1).

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visits for a WIC review. They do not, however, systematically check immunizations. In Johnston and New Hanover, children in WIC made up exactly half of the sample, but accounted for more than three-quarters of the children with no immunization records. WIC children also accounted for a majority of those with no vaccination records in Hertford. It was not possible to identify WIC children from the records available in the other six counties.

A large proportion of children in the WIC program are also on Medicaid, which will pay for immunizations from a private provider. Thus, many of these children may be receiving vaccinations elsewhere. Nevertheless, the health departments see these children periodically, and it is clear that at least the three departments for which WIC records were available had not consistently screened for vaccinations during WIC visits.

To address this problem, DEHNR has launched demonstration projects in five North Carolina counties to provide immunization nurses at WIC sites. The aim is to see if this approach will have an impact on raising on-time

immunization rates. Their duties will be to screen children enrolled in WIC for their immunization status; immunize children as needed or counsel parents to obtain immunizations from private providers; follow up with children who are behind or who are at risk of falling behind in their immunization status; and work with private providers who immunize WIC enrollees to ensure that these children are getting their shots on time. If these pilots are successful, they could be replicated in other counties.

A new Medicaid program called Health Check also may ultimately help with assuring that children receiving Medicaid benefits get their immunizations on time. It requires that young children have regular health checkups that include immunization shots. Health Check outreach workers follow up when children are not brought in for appointments.

WIC visits are merely one example of missed opportunities to screen for immunizations and lack of coordination among child services. In 1992, the Immunization Section held a series of focus groups involving health department officials, private doctors, and others. Participants listed "fragmentation" of efforts as one of the key barriers to raising immunization levels for preschoolers.<sup>12</sup>

The Immunization Registry should help make immunization information available, but it may not answer the question of who is responsible for making sure children keep on schedule. Meanwhile, health departments are supposed to be responsible for keeping track of their patients and private doctors for theirs. Many children get health care only when they are sick, often at emergency rooms or urgent care centers.

Local health departments are the logical choice for monitoring immunizations at the county level. But they don't have the resources to do it.

### Following Through

**L**ack of staff and facilities was another barrier to immunizations identified in the Immunization Section's 1992 focus groups. Health officials called for extended clinic hours, additional clinic locations, and more staff to administer

vaccinations and to follow up with the parents of children who were due or late.

That was before the idea of universal immunization fully took hold. Of the nine departments the Center surveyed, three—Buncombe, Mecklenburg, and Robeson—maintain fairly sophisticated computer data bases. That alone does not solve the problem. Those counties' rates of on-time immunization ranged from 52.6 percent to 64.4 percent.

Particularly in poorer counties, health departments continue to struggle with cramped facilities and limited numbers of staff to follow up on children who are late or disappear from the record-keeping system.

In Pender County, Sandra Rivenbark brought her own typewriter to work in mid-1994 when the health department hired her part-time to track down children due for immunizations. Even though the department's records are stored

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**Table 9. Percentage of Minority Children Up-To-Date on Their Immunizations Compared to Whites in the Nine Counties Surveyed**

County	Percent of White Children Up-To-Date*	Percent of Minority Children Up-To-Date	Overall Total
BUNCOMBE	64.3%	65.5%	64.4%
HALIFAX	70.6	54.5	60.7
HERTFORD	41.9	43.0	42.7
JOHNSTON	65.6	56.4	62.1
MECKLENBURG	54.6	55.6	55.2
NEW HANOVER	77.4	64.8	73.2
PENDER	65.4	57.4	61.9
ROBESON	59.9	50.4	52.6
SWAIN	80.2	70.2	79.1
<b>Total</b>	66.4	54.1	60.6

\* Children were counted up-to-date if they had received immunization shots on the following schedule: Age 1.5–5 months, first diphtheria, pertussis, tetanus (DPT1), first oral polio (OPV1); age 5–7 months, DPT2, OPV2; age 7–16 months, DPT3, OPV2; over 16 months, DPT4, OPV3, measles, mumps, rubella (MMR1).



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on computer, she had to go to another office to use one. By October, she had transferred to a receptionist's position at the department because she needed a full-time job. "The county doesn't pay anything," says health director Irma Simpson. "That's why we have a hard time getting anybody."

In New Hanover, Kim Sykes makes 60 to 80 calls a week to track down children who are overdue for immunizations. She also visits pediatricians' offices and clinics to collect immunization records. Although she has access to computer records at her desk, she uses a paper-card "tickler" system to keep track of which children she needs to contact. She was hired in November 1993 with a \$35,000-a-year grant from the Immunization Section. A year later, she was still working her way through the department's card file.

Sykes' job requires the skills of a record researcher and the tactics of a bill collector. "There are still people due in January who still haven't come in," she said in October. "They're the ones that are really delinquent. . . . We'd have to hire three more people to do it thoroughly."

Sykes' efforts provide some indication of the scale of the problem. In her first six months on the job, she single-handedly cut the number of blank immunization records in New Hanover by more than 50 percent. By searching the records of local pediatricians and other providers, she located records for 80 children included in the Center's survey, 63 of whom were in the WIC program.

Since the survey in New Hanover randomly selected one record in five, it appears that she had located records for about 400 children, about three-quarters of whom were in the WIC program. After this effort, the health department still had no records for 13.1 percent of all children surveyed and for 24.3 percent of those in the WIC program. Without Sykes' research, however, the figures would have been 27.3 percent and 47.8 percent, respectively.

Ironically, Sykes' research actually lowered the survey's estimate of New Hanover's compliance rate. The Center's survey, like state compliance surveys, doesn't count children who have

no immunization records in determining the percentage who are on schedule. Of the records she located, 65 percent were up to date, compared with 73.2 percent for the county sample as a whole.

However, Sykes also actively recruits parents to have their children immunized. From the records available, there was no way to determine how effective that effort had been because someone in the clinic enters the records when the children actually get their vaccinations.

Nevertheless, it seems reasonable to conclude that personal contact is more effective than less direct outreach efforts, such as post-cards, community education programs, and recruiting civic groups to promote immunizations. "To be honest with you, people [parents] just don't care," says Hertford's Jim Boehm. "They're just not concerned."

## Conclusion

There is fairly general agreement on the obstacles to increasing immunization rates in North Carolina:

- lack of a centralized record system;
- parents—and even some doctors—who don't know the required immunization schedule;
- long waits at clinics;
- cost at private clinics, although the cost of vaccine is free to patients and the administration fee has been greatly reduced (health department vaccinations are free);
- transient families;
- health departments that don't provide convenient enough clinic schedules;
- difficulty getting off work, particularly for parents with more than one child;
- lack of transportation; and
- lack of coordination between programs such as WIC, Medicaid, and health departments.<sup>13</sup>

Health departments have tried various promotional tactics to encourage immunizations. They give away T-shirts when children come in. They have shot days at shopping centers. They enlist civic groups, such as the Kiwanis Clubs. They provide brochures and pamphlets. In some counties, such as Swain, a staff nurse makes

home visits. Some hire people like Kim Sykes in New Hanover to pester the parents of children who are late. There has been some success with auto-dialed reminders and sending post-cards to parents. Some have set up their own computer databases.

But these tactics alone will inevitably leave a significant number of children unserved, and minorities will continue to suffer a disproportionate share of the problem. The backbone of the Immunization Action Plan is clearly the vaccine distribution program and the immunization registry.

Public and private schools are effective in enforcing immunization laws because they have access to nearly all school-age children and they have the means to enforce the law. There is no such central authority for preschoolers. Instead, there is a hodgepodge of programs that monitor preschoolers' health. Although the action plan calls for more coordination (words like "cooperate" and "collaborate" appear frequently), no one is clearly accountable for making sure that all children receive vaccinations. Buncombe County Health Director James Tenney puts it bluntly: "It's not our responsibility to look after the ones who attended private practices. . . . The responsibility for administering vaccine rests with the provider of care." There should be a centralized monitoring system for tracking immunizations, he says, but the information should come from providers. Those two ideas, he admits, "may be incompatible."

The action plan addresses this problem in several ways. The immunization registry may provide a commonly accessible data base for government agencies and private providers. The plan suggests that free vaccine provided by the state may reduce private referrals to health departments by as much as 30 percent, thereby freeing health department workers to take a stronger role in compliance. The Immunization Section has set a goal of increasing immunizations, *in raw numbers*, by 5 percent per year.

Education campaigns may increase compliance rates. The plan also calls on health departments to increase their emphasis on immunizations—but proposes funding of only \$1.6 million a year for that purpose. That's an average of \$16,000 per county for 100 counties.

But who *is* responsible? The state can maintain a central data base, but it can't track down children who need shots from Raleigh. Programs such as WIC can try to coordinate their efforts, but it doesn't make sense to duplicate efforts. And it doesn't make sense to deny a child nutritional supplements because its parent does not comply with the immunization law. Most private doctors are responsible individuals, but who will check up on them?

That leaves the health departments, and they clearly don't have the resources to take on a much greater responsibility for tracking immunizations. The action plan calls for \$11.1 million in state funding for 1994-95, more than 90 percent of which is for buying vaccines. Still, it's clear that health departments must take a stronger role if the state is to have a hope of meeting its goal of having 90 percent of children ages two-and-under age-appropriately immunized by the year 2000.

#### FOOTNOTES

<sup>1</sup> G.S. 130A-155(a), which reads in part, "No child shall attend a school (K-12), whether public, private, or religious, or a day-care facility as defined in G.S. 110-86(3), unless a certificate of immunization indicating that the child has received the immunizations required by G.S. 130A-152 is presented to the school or facility."

<sup>2</sup> Gary L. Freed, *et al.*, "Childhood Immunization Programs: An Analysis of Policy Issues," *The Milbank Quarterly*, Vol. 71, No. 1, 1993, p. 66.

<sup>3</sup> *Immunization Action Plan*, Immunization Section, Department of Environment, Health, and Natural Resources, Raleigh, N.C., November 1993, p. 1.

<sup>4</sup> Freed, *et al.*, pp. 67-68.

<sup>5</sup> *Immunization Action Plan*, p. 2.

<sup>6</sup> Telephone interview with Norma Allred, immunization epidemiologist, Immunization Section, Division of Health Services, N.C. Dept. of Environment, Health, and Natural Resources, Sept. 2, 1994.

<sup>7</sup> Letter from Annette Byrd, head of Immunization Section, to local health directors, May 16, 1994.

<sup>8</sup> "The State of North Carolina Presents the Infant Immunization Initiative Action Plan: Get the Ticket to Board a Healthy Year 2000," DEHNR proposal to the federal government for funding of the state's immunization action plan, June 23, 1992, p. 6.

<sup>9</sup> *Immunization Action Plan*, pp. 2-3, 34, and 51-52.

<sup>10</sup> Freed, *et al.*, p. 66.

<sup>11</sup> "The State of North Carolina Presents the Infant Immunization Action Plan: Get the Ticket to Board a Healthy Year 2000," Appendix 3.

<sup>12</sup> *Ibid.*, unnumbered appendix.

<sup>13</sup> *Ibid.* and Freed, *et al.*, pp. 80-90.