
Failure to Vaccinate Children Against Measles During the Second Year of Life

An analysis of immunization practices in two Tennessee county health departments

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THE PROGRAM TO ERADICATE MEASLES in the United States was predicated in 1967 on four basic premises: that a highly effective, live measles vaccine would be administered routinely to 1-year-old children; that measles vaccine would be given to any remaining susceptible children before they entered school; that active surveillance for measles cases would be established; and that outbreaks would be controlled through

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appropriately designed immunization programs (1). By 1971, it was clear that the failure to eradicate measles hinged on one crucial point: "immunization of all children at 1 year of age, regardless of their geographic or sociologic location" (2). Conrad and co-authors (2) also alluded to the difficulty in delivery of vaccine to rural populations as an aspect of the inadequate distribution of health services. Schreier recently argued that "measles remains a problem today chiefly because children have not been adequately vaccinated against the disease" (3). His analysis focused on the failure of the measles eradication effort as an aspect of national and State spending policy.

In Tennessee, where a majority of children are vaccinated against measles by their local health departments, we have examined vaccination practices as a facet of the delivery of preventive health services and have identified specific practices that lead to failure to vaccinate children against measles during the second year of life.

Background

In Tennessee, measles vaccine is given free by the 95 health departments to any child under 12 years old. Single-dose, combined measles-rubella vaccine is administered at 1 year of age as part of a schedule of immunizations recommended in the Tennessee Child Health Standards of the Tennessee Department of Public Health (4). In 1973, the health departments alone administered 29,604 doses of measles vaccine to the State's estimated population of 68,772 children 1



year of age. As of January 1, 1974, 58.8 percent of the State's nearly 400,000 children 1 to 6 years old had been vaccinated against measles by the health departments, according to vaccine distribution figures. These figures do not include vaccinations given by private physicians (5).

Immunization levels have been determined in Tennessee by random sample surveys of 2-year-olds. In 1973, 16,169 of 68,632 age 2 children were sampled, and 80 percent had a history of measles vaccination. Measles vaccination levels for 2-year-olds ranged by county from 49 to 88 percent (6).

Measles vaccination through local health departments is part of a child health program that includes routine immunizations, screening for phenylketonuria (PKU), hematocrit determinations, tuberculin skin testing, well-baby physical examinations by public health nurses, and general counseling. Although guidelines for this care and vaccination are established by the Tennessee Child Health Standards, the quality and level of care vary widely among counties, and vaccination practices are not uniform.

Local health departments are not only the major providers of vaccination to young children in Tennessee; they are also often the sole providers of preventive health services to poor urban and rural children. Thus,

the effectiveness of local health department vaccination programs in reaching target populations affects important groups at high risk for measles.

Measles vaccine should be given, ideally, at 12 months of age. Therefore, by surveying children at 24 months of age, we have observed a critical 12-month period during which this marker of health care delivery should have been received.

Although parental noncompliance surely plays a role in the failure to have children vaccinated, it is our hypothesis that administrative problems in local health department clinics account for a significant proportion of the failure to vaccinate children. That is, even when parents bring their children to health departments at the appropriate age, there is a possibility that through defects in the delivery of immunization services the child will depart unvaccinated.

Methods

Of the counties where immunization surveys of 2-year-olds had previously been carried out, two were chosen for the study: county R with a high level of measles vaccination and county O with a low level. Both are rural farming counties in middle Tennessee; estimated populations in 1971 were 29,594 and 15,117, respectively. In each county, a health department is located at the county seat; scheduled immunization clinics are held five times a week in county R and twice a week in county O.

The sample of 2-year-olds was drawn from records of 468 births that occurred in calendar year 1969 in county R and 248 births from July 1970 to June 1971 in county O. Children who had died, moved, or obtained any childhood immunizations outside the county were excluded. Also excluded were those children who had received any vaccinations from private physicians, even if they had received some immunizations from the health department. However, children who had not received any of the standard childhood vaccines and those who had had measles were included. The resulting sample, broken down into the following figures, was considered to be the entire target population for health department immunization services.

Target sample	County	
	R	O
2-year-olds still in county who had attended the health department -----	294	133
Completely unimmunized 2-year-olds with no health department records -----	12	19
Total -----	306	152

Demographic data were obtained from birth certificates. Immunization histories were obtained from health department records or through interviews with parents when such records were incomplete or absent. Further, the health department files were audited to determine dates of all well-child services, including PKU testing,

hematocrit determinations, tuberculin skin testing, infant examinations, home visits, counseling, and special clinic attendance. Records for each child were audited through his or her second birthday. Parents of children without health department records were contacted personally.

The following definitions were used in classifying immunization histories:

Measles vaccinated—vaccinated before 24 months of age.

Measles unvaccinated—not vaccinated by 24 months of age.

Measles vaccination delayed because of illness—vaccination delayed until after 14 months of age because of a concurrent febrile illness in a susceptible child who came to the health department at appropriate age.

Measles vaccination delayed because of tuberculin testing—vaccination delayed until after 14 months of age so that child could first receive a tuberculin skin test. Measles vaccination was considered to be delayed because of testing if the child failed to return for his vaccination within 1 month after the skin test.

Prolonged primary DTP series—primary series of three injections of diphtheria-tetanus-pertussis vaccine extended over 6 or more months, regardless of age at commencement.

Lost to followup—failed to return to the health department for any required childhood vaccinations before 24 months of age and did not obtain vaccinations from another source.

Results

The results of the survey of measles vaccination in relation to attendance at health department clinics are given in table 1. Of the target group of 306 children in county R, 96.1 percent had been to the health department at least once, and 78.6 percent of these were vaccinated against measles. In county O, 87.5 percent of the target population of 152 children had been to the health department, and only 42.1 percent of these were given measles vaccine.

In each county, more than half of the children who had not had a measles vaccination were lost from the

well-child program before their first birthday. The remainder, 49.2 percent in county R and 42.1 percent in county O, had failed to receive a measles vaccination even though they attended a health department clinic during their second year. The records of these groups were examined more closely to see why they had not been vaccinated.

In county R, 45.2 percent and in county O, 37.5 percent of the unvaccinated 2-year-olds who had attended the clinic had had their measles vaccination deferred so that they could be given a tuberculin skin test. These children did not return to have their skin tests read, nor did they return to receive their measles vaccine. Only a few children were not given a measles vaccination because of illness. There remained a large group of children in each county, 51.6 percent in county R and 56.2 percent in county O, for whom no reason was recorded for their not receiving a measles vaccination.

Tuberculin skin testing contributed to delays in vaccination, even among children who eventually received measles vaccine. Vaccination was delayed for more than 1 month because of tuberculin testing in 25.5 percent of the measles-vaccinated children in county R and in 35.7 percent in county O. A small number of children in each county, 9 and 5, respectively, received measles immunizations without being tuberculin tested.

Because immunization schedules are determined by age, it might be expected that children who entered the health department program at an early age and attended the clinic frequently would be more likely to receive a measles vaccination. However, there was no significant difference between the age of the child at first health department contact in the measles-vaccinated group and the age in the measles-unvaccinated group in either county.

Table 1. Attendance at health department clinics and measles vaccination history for 2-year-old children in two Tennessee counties

Clinic attendance and vaccination history	County R		County O	
	Number	Percent	Number	Percent
Total births in selected year	468	248
Total sample	306	100.0	152	100.0
No health department records	12	3.9	19	12.5
Attended health department clinic at least once	294	96.1	¹ 133	87.5
Measles vaccinated	231	78.6	56	42.1
Measles unvaccinated	63	21.5	76	57.1
Lost to followup before first birthday	32	50.8	44	57.9
Attended at least once during second year	31	49.2	32	42.1
Vaccination delayed for tuberculin testing	14	45.2	12	37.5
Vaccination delayed by illness	1	3.2	2	6.2
Reason not recorded	16	51.6	18	56.2

¹ One record incomplete.

In county O, children who began their DTP series at an age earlier than 3 months were more likely to receive a measles vaccination ($X^2 = 9.74, P < 0.025$). In county R, the relationship between the age at time of first DTP vaccination and measles immunization was not significant. Further examination of the pattern of administration of DTP in county R, however, revealed an important problem in its health department. The Child Health Standards recommend that the primary DTP series be given over a 3-month period, beginning at 2 to 3 months of age. When this primary series was interrupted or was prolonged over 6 months or more, the likelihood of a child's receiving a measles vaccination was significantly reduced.

Of the 79 children whose DTP series was given over 6 months or more, 26 (32.9 percent) remained unvaccinated for measles. Only 12 (6.9 percent) of the children who received their DTP series over a period of less than 6 months were not measles vaccinated ($X^2 = 28.58, P < 0.01$).

Finally, the measles-vaccinated and measles-unvaccinated 2-year-olds in each county were compared for demographic variables. Data available from birth certificates, although frequently incomplete, revealed no significant differences between these groups with respect to maternal education, race, the trimester in which prenatal care began, or number of prenatal visits.

Discussion

Two local health departments often failed to vaccinate children against measles even when these children had been entered into the well-child program some time during their first 2 years of life. Attrition from the well-child program before their first birthday accounted for 50.8 and 57.9 percent of these children; however, an audit of health department records did not explain the attrition. Attrition will need to be followed up in other studies that include surveys of parental attitudes toward immunization and the interactions of clinic staffs with parents.

In this study, we focused on the 49.2 and 42.1 percent of unvaccinated children who had attended the clinic at an appropriate age, and we identified several important factors in the failure to vaccinate them against measles.

First, the practice of giving priority to tuberculin skin testing led to children being sent away from the health department at 1 year of age with skin test antigen in place but without measles vaccination. Although the American Academy of Pediatrics recommends that "tuberculin testing ideally precedes or accompanies the administration of measles vaccine," it clearly emphasizes that "this is desirable as part of an ideal health program, but should not be a routine prerequisite for community programs where the risk from natural measles far outweighs any theoretical hazards of possible exacerbation of undiagnosed tuberculosis" (7). In Tennessee in

1972, only 34 (0.1 percent) of the 29,267 children under 5 years of age tested by county health departments had positive reactions, and some of these were detected by screening tuberculosis case contacts rather than by routine skin testing (8). Routine tuberculin testing should not be a barrier to measles vaccination. The practice of emphasizing tuberculin testing in health departments reflects old priorities that need to be changed.

Second, the relation between delay in the administration of the basic series of three DTP immunizations and subsequent failure to vaccinate against measles reflects confusion on the part of some clinic staffs about procedures for vaccinating children who have become delinquent or who have interrupted their basic DTP vaccination series. Measles vaccination should be given priority for these children when they are over 1 year of age (7). Further, some local health department personnel are not aware that it is appropriate to administer two or more live-virus vaccines simultaneously.

Third, a large group of 1-year-olds who attended the health department clinic were not vaccinated against measles for reasons that could not be determined from their records. Only anecdotal data and personal observations are available to explain these failures. Haphazard record checks and careless secretarial procedures played a part in the nonvaccination of this group. Of more importance, however, is the compartmentalization of services and rigidity of staff in health departments. If children arrived on days that immunization clinics were not being held, they were refused vaccination even though they had traveled long distances or were in a high-risk group and it was unlikely that they would return at the specified time. Clearly, measles vaccination should be available whenever susceptible, especially high-risk, children are at the health department.

As shown in table 2, a considerable impact could be made on vaccination levels if all the loopholes cited in vaccination practice were closed so that every child between 1 and 2 years old who comes to the health department is vaccinated and if health departments made a concerted effort to reduce attrition of children before their first birthday. Procedural changes within the health departments could thus bring vaccination levels well within the acceptable range. Outreach programs, while time consuming and expensive, may be needed to reach the remaining unvaccinated children and also to reduce attrition.

We wish to re-emphasize that measles vaccination was used in this study as a marker for the delivery of preventive health care services. In fact, with current methods of vaccine administration and with the use of multiple-antigen vaccines, such as measles-rubella and measles-mumps-rubella, the failure to vaccinate children could adversely affect their immune status in respect to several childhood diseases.

Table 2. Hypothetical impact of improved health department procedures on measles vaccination levels

Procedure	County R			County O		
	Number of children	Additional percent vaccinated	Cumulative percent vaccinated	Number of children	Additional percent vaccinated	Cumulative percent vaccinated
Target population of 2-year-olds	306	152
Currently measles vaccinated	231	...	75.5	56	...	36.8
<i>Corrective procedures:</i>						
Assure vaccination of all 1-year-olds who attend clinic	31	10.1	85.6	32	21.1	57.9
Eliminate attrition before first birthday	32	10.5	96.1	44	28.9	86.8
Outreach to children who did not receive health department services	12	3.9	100.0	19	12.5	99.3

Conclusion

The current resurgence of measles has been attributed to a failure to vaccinate children. This failure, in turn, has been attributed by some investigators to two causes: inadequate Federal and State financing and inadequate methods for delivering immunizations to "hard-to-reach" populations. Our study findings for two rural Tennessee counties suggest that in addition to these limiting factors, faulty procedures within health department clinics are allowing children to remain unvaccinated despite their having attended the clinic at some time.

Our analysis suggests that health departments can improve their vaccination services by auditing immunization records; reviewing their clinic practices, recordkeeping methods, and convenience of vaccination clinic hours; and re-educating clinic staff concerning tuberculin testing, simultaneous administration of live-virus vaccines, methods for correcting immunization delinquency, the realities of vaccination complications, and the im-

portance of reaching groups at risk for measles.

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SYNOPSIS

GUYER, BERNARD (Center for Disease Control, Atlanta), BARID, STEVEN J., HUTCHESON, ROBERT H., Jr., and STRAIN, ROSE S.: *Failure to vaccinate children against measles during the second year of life. An analysis of immunization practices in two Tennessee county health departments. Public Health Reports, Vol. 91, March-April 1976, pp. 133-137.*

In many Tennessee counties, children under the care of health departments have low measles vaccination levels. An immunization survey and a health department record audit of 2-year-olds were under-

taken in two counties to determine the reasons for this situation.

The results indicated that faulty clinic procedures played a large part in the failure to vaccinate against measles. Nearly half of the unvaccinated 2-year-olds with health department records had been present in the health department clinic at the appropriate age for measles vaccination; the remainder had dropped out of the well-child program before their first birthday. Emphasis on tuberculin skin testing and delay in the administration of the basic series of DTP immunizations correlated with the failure to

vaccinate against measles. For more than half of the children who attended the clinic after their first birthday, no reason was recorded for the failure to vaccinate them against measles.

Improved clinic procedures could bring measles vaccination levels within the acceptable range. These procedures would include new methods for correcting immunization delinquency, simultaneous tuberculin skin testing and measles vaccination of children without a history of tuberculosis exposure, emphasis on vaccinating at-risk groups, and more convenient vaccination clinic hours.