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# The Delayed Immunization of Children of Migrant Farm Workers in South Carolina

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## Synopsis .....

*A study was conducted to evaluate the immunization status of migrant farm worker children in South Car-*

*olina. Results of this study indicate that the children receive their immunizations at times which are significantly later than the recommended schedule. The first, second, third, and fourth oral poliomyelitis vaccine (OPV) doses are being given approximately 10, 15, 23, and 32 months late, respectively. Diphtheria, pertussis, tetanus vaccine (DPT) is likewise late with the first, second, third, and fourth doses occurring 9, 14, 20, and 26 months late. The fifth booster dose in both series was timed properly. The mumps, measles, rubella vaccine (MMR) is approximately 28 months late, on average. An evaluation of antibody status of 41 migrant farm worker children (5-10 years old) revealed that, even with aberrant patterns of administration, all children had adequate antibody titers. These data indicate that, although adequate levels of protection are reached with the pattern of immunization that migrant farm worker children have, there are large groups of children that are unprotected early in life when they are most susceptible to these diseases.*

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**A**S A COMPONENT OF A SOUTH CAROLINA Migrant Farm Worker Health Study, the immunization status of migrant children traveling through the State during the 1986 and 1987 crop seasons was examined. The majority of migrants are Hispanic American family groups (usually Mexican American) with the remainder a mixture of American blacks and whites. The South Carolina Employment Security Commission registered 10,760 migrants during 1986. This count obviously underestimated the number of migrants in the State, because those avoiding the immigration service tend to avoid registration.

The system of health services available to migrants is a combination of general social and health services, with special programs targeted for migrant populations. Of the four areas of South Carolina having large numbers of migrants, three are served by federally supported rural health initiative clinics. The South Carolina Department of Health and Environmental Control Migrant Program provides health care services in cooperation with the county health department in the fourth area.

Health care workers have expressed concern about the immunization status of the migrants' children.

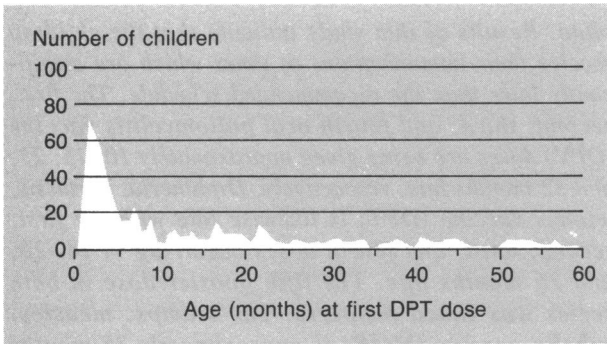
These concerns address both over immunization and under immunization.

## Methods and Study Population

In South Carolina there is a summer education program for migrant farm workers' children, a program of the South Carolina Department of Education. It consists of 6 weeks of education and support services designed to meet the needs of both intrastate and interstate migratory students. Approximately 8 percent of the students served are enrolled in programs operated during the regular school year (September through May), and 92 percent are enrolled in programs operated during the summer (June through September) in South Carolina. Approximately 2,000 children between the ages of 6 weeks and 18 years are served each year. Children who are less than 3 years old are provided day care service. A prekindergarten program is provided for 3- and 4-year-olds. The school age children are placed in their appropriate grade level. The program is supplementary to regular school year education.

As a component of this program, migrant student health records are completed and submitted to the

**Age at first dose of diphtheria pertussis tetanus (DPT) vaccine**



Migrant Education–Interstate and Intrastate Coordination Program. A repository for these records is the Arkansas Department of Education in Little Rock. These records contain screening data and laboratory test results, immunization data, and a list of unresolved health problems.

The South Carolina Department of Education has on file a complete set of the records of migrant farm worker children attending their summer program. The unduplicated records of 1,022 children attending the South Carolina school programs in 1985 were analyzed. This year was selected to accommodate the lag time required to complete the record keeping system. For a variety of reasons, 409 records had no immunization information. These children were dropped from the analysis, since the assumption could not be made that they were not immunized. A random sample of 40 records, from the remaining 613, were reviewed against clinic and family records and were found to be accurate. All records with any immunization data were analyzed.

A serum survey of level of antibody protection was conducted to supplement data collected from the records. Consent forms, to allow the drawing of blood, were sent home with children between the ages of 5 and 13 attending school in Johns Island and Spartanburg. Although a large number of parents consented to participation, only 41 blood specimens were drawn, a consequence of the movement of the farm workers and the inconsistent attendance at the schools.

Serum samples, of a minimum of 3.0 ml serum per child, were sent to St. Christopher’s Hospital for Children in Philadelphia, PA, for analysis. The assays (Centers for Disease Control approved standardized procedures) used to determine antibody status were

1. Diphtheria-toxin neutralization in VERO cells
2. Tetanus-modified passive hemagglutination
3. Pertussis-direct whole cell agglutination
4. Measles-enzyme linked immunoassay (ELISA)
5. Mumps-enzyme linked immunoassay (ELISA)

6. Rubella-enzyme linked immunoassay (ELISA)
7. Poliovirus type 1-virus neutralization in VERO cells
8. Poliovirus type 2-virus neutralization in VERO cells
9. Poliovirus type 3-virus neutralization in VERO cells

**Results**

Analysis of the 613 records to determine the level of completed series showed that only 35 percent of students had a completed series of immunizations by the age of 10 years. A complete series consisted of four doses of diphtheria, pertussis, tetanus vaccine (DPT), three or more doses of oral poliomyelitis vaccine (OPV), and one dose of mumps, measles, rubella vaccine (MMR). Only 10 percent of the 2-year-olds had completed this level of immunizations (table 1).

The timing of administration of each dose of vaccine was examined for each series. Current recommendations for OPV administration call for the vaccine to be given at 2 months, 4 months, 15 months, and 4–6 years. For the South Carolina migrant children studied, OPV was given at an average age of 12 months for the first oral polio dose, 18 months for the second, and 30 months for the third. The range for the series is notably wider for the last dose and less variable for the first two doses, as shown in the following table:

<i>OPV dose</i>	<i>Mean age (months)</i>	<i>Standard deviation</i>	<i>Variance</i>
1st . . . . .	12.4	15.9	253.3
2nd . . . . .	19.0	18.3	355.9
3rd . . . . .	28.9	23.5	550.0
4th . . . . .	47.0	27.9	776.3
5th . . . . .	65.2	29.0	842.2

As with OPV, the data from the school program shows a pattern of late starts for the first dose of DPT but with wide variance. It is recommended that DPT immunizations be given by 2, 4, 6, and 18 months, and 6 years. The variance increases for the second through the fifth dose with the variance being quite high for the fourth and fifth doses, as follows:

<i>DPT dose</i>	<i>Mean age (months)</i>	<i>Standard deviation</i>	<i>Variance</i>
1st . . . . .	11.5	15.5	240.0
2nd . . . . .	17.9	17.8	318.5
3rd . . . . .	26.4	21.5	460.1
4th . . . . .	41.5	23.5	532.9
5th . . . . .	64.4	31.2	971.7

The recommendation for a change in the timing of the MMR from 12 to 15 months was based on four

Table 1. Immunization status of South Carolina migrant farm worker children, 1985

School	Total students	Immunization data from school records		Complete series <sup>1</sup> by age 10		Complete series by age 5		Complete series by age 2	
		Number	Percent	Number <sup>2</sup>	Percent	Number <sup>2</sup>	Percent	Number <sup>2</sup>	Percent
Monetta .....	190	99	52	57	58	45	45	19	19
Daniel Morgan .....	48	28	58	11	39	10	36	3	11
Haut Gap .....	268	169	63	7	4	6	4	1	.006
Oconee .....	18	10	56	0	0	0	0	0	0
Lady's Island .....	159	98	62	34	35	26	27	11	11
E.B. Ellington .....	220	148	67	71	48	53	36	19	13
Holly Spring .....	83	31	37	2	6	1	3	0	0
St. James .....	36	30	83	29	97	23	83	10	33
<b>Total .....</b>	<b>1,022</b>	<b>613</b>	<b>60</b>	<b>211</b>	<b>35</b>	<b>164</b>	<b>27</b>	<b>63</b>	<b>10</b>

<sup>1</sup>Complete series: 4 DPT, 3 or more OPV, MMR. Complete series were calculated on children with immunization data, not number of children in program.

<sup>2</sup>Categories are not mutually exclusive.

studies that showed that antibody prevalence in children vaccinated at 12 months ranged from 80–85 percent, but it was 95 percent in children immunized after 13 months (1–4). In these migrant children, the average age when it was administered was 3.6 years. None of these children had been immunized before 12 months of age. Data on timing of MMR was as follows:

MMR dose	Months
Mean .....	43.1
Standard deviation .....	35.7
Variance .....	1,273.9

Further analysis of the timing of the onset of initiation of the DPT series was carried out to identify factors contributing to the delay. More than 86 percent of these children had initiated the series by age 5 years (see chart).

The group of children receiving their first DPT before 12 months was examined to determine if the month of birth had influenced the onset of immunization. Those born in the 6 months from January to June would reach age 2 months around the time that the family began the migration, while those born from July to December would be at their home base when they reached the age for the first dose of DPT. There was no difference in the rate of immunization between the two groups and in the number of children receiving the vaccine before the age of 12 months (table 2).

To determine the effect of aberrant patterns of immunization on levels of antibodies, a small serum survey of 41 samples was examined. The 41 children were between 5 and 13 years and had their completed series of immunizations. The serum was measured for antibodies to pertussis, tetanus, rubella, and poliomyelitis. All 41 children had adequate titers for pertussis, poliomyelitis, and tetanus. Two of the samples had no

Table 2. Relationship of birth month to timing of first dose of diphtheria, pertussis, tetanus vaccine

Birth month	Number of births	First DPT under 1 year	Percent
January .....	38	25	68
February .....	58	30	52
March .....	49	21	43
April .....	38	19	50
May .....	44	21	48
June .....	46	21	46
<b>6 months .....</b>	<b>273</b>	<b>137</b>	<b>50</b>
July .....	46	24	52
August .....	47	25	53
September .....	44	17	16
October .....	46	22	48
November .....	52	25	48
December .....	61	38	62
<b>6 months .....</b>	<b>296</b>	<b>151</b>	<b>51</b>

antibodies against rubella. When these two samples were analyzed for antibodies to mumps and measles, both had adequate titers to measles. One child had no antibodies to mumps as well as rubella.

## Discussion

Although studies on the timing of immunizations are difficult to locate, it appears likely that migrant children differ markedly from the rest of the population. In a 1979 Ohio study, 72.5 percent of 2-year-old children had completed a basic series of immunizations, defined as three DPT, three OPV, and one measles and rubella vaccination (5).

A survey by the South Carolina Department of Health and Environmental Control indicated that 72 percent of white children and 67 percent of nonwhite

children had “completed” their series of immunizations by age 2. (“The Health Status of South Carolina’s Children,” unpublished report by W.C. Derrick, Jr., and D.H. Bryan, University of South Carolina, School of Medicine, Department of Pediatrics, 1987). In contrast, only 10 percent of migrant children were “series complete” by age 2 and only 35 percent by age 10. A study by Michael and Salend of health needs in migrant farm worker children cited immunization problems occurring in only 5.5 percent of children less than 18 years of age using the Mid-Hudson Migrant Education Center (6). This study did not define what was classified as an immunization problem, so it is difficult to determine the reason for the difference in rates from this study.

Migrant children lag behind the rest of the population in the initiation of the DPT series. A 1981 study of Louisiana children found that 64 percent had received their first DPT by age 2 months and 96 percent by 11 months (7). The mean age of migrant children in South Carolina at their first DPT was 12.4 months, and only 47 percent had received the immunization by 11 months. Migrant farm worker children also lag behind other Mexican American children in initiating their DPT series. A study of data from the Mexican American portion of the Hispanic Health and Nutrition Examination Survey showed 95.3 percent had received the first DPT immunization by 12 months, and 98.1 percent of children had one or more DPT immunizations by age 6 years (8). This proportion compared with 86 percent of migrant farm worker children immunized by 5 years. This reservoir of unprotected children at risk for infectious disease is compounded by their lifestyle, which involves yearly travel and interaction with many other groups.

The delay in the administration of the MMR is significant. It can cause problems because outbreaks have occurred even in populations with high rates of vaccinations (4, 9). In a 1986 outbreak of measles in Dade County, FL, 88 percent of reported cases, which occurred in the 16-month to 4-year age group, were preventable (10). In another outbreak of measles in a Florida migrant worker neighborhood in 1983, 47.3 percent of cases occurred in children under 12 months, below the recommended age of immunization. A survey indicated that only 65.9 percent of the total migrant population in the area had documented histories of vaccination or were older than 20 years (11). These findings indicate the need for *timely* immunization, particularly in populations where immunization rates are likely to be low.

The rate of timely immunization with the first DPT dose did not differ according to the child’s birth month; therefore, the family’s travel did not seem to be a risk factor for failure to receive vaccine on time.

The serum samples of 41 children, ages 5–13 years old, showed that all received a complete series of immunization. These series demonstrated a markedly aberrant pattern of immunization with periods between doses ranging from 2 days to 1½ years. Despite these unusual patterns, these children all had adequate antibody levels for DPT and OPV. Thus, the major concern is the long delay in infancy before starting the immunization series. This delay leaves large numbers of infants and toddlers susceptible to these communicable diseases. Our record review indicated that only 35 percent of older children had a completed series and, thus, like those included in the serum survey, could be considered protected.

This study suggests migrant farm worker children represent a large percentage of persons who are susceptible to communicable diseases that can have severe and longlasting sequelae. A national sample of migrant children would have to be studied to determine if these results can be generalized to the children of our large labor force of migrant farm workers.

**References** .....

1. Krugman, R. D., et al.: Further attenuated measles vaccines: the need for revised recommendations. *J Pediatrics* 91: 766–767 (1977).
2. Albrecht, P., Ennis, F. H., Sattzman, E. J., and Krugman, S.: Persistence of maternal antibodies in infants beyond 12 months: mechanism of measles vaccine failure. *J. Pediatr* 91: 715 (1977).
3. Yeager, A. S., Davis, J. H., Ross, L. A., and Harvey, B.: Measles immunization: successes and failures. *JAMA* 237: 347–351 (1977).
4. Shasby, D. M., Shope, T. C., Downs, H., Hermanne, K. L., and Polkowski, J.: Epidemic measles in a highly vaccinated population. *N Engl J Med* 296: 585–589, Mar. 17, 1977.
5. Marks, J., et al.: Risk factors associated with failure to receive vaccinations: *Pediatrics* 64: 304–309 (1979).
6. Michael, R. J., and Salend, S. J.: Health problems of migrant children. *J Sch Health* 55: 411 (1985).
7. Cherry, F., et al.: Immunization and health care patterns of Louisiana two year olds: *Pediatrics* 137: 48–56 (1985).
8. Gergen, P. J., Ezzati, T., and Russell, H.: DTP immunization status and tetanus antitoxin titers of Mexican-American children ages six months through eleven years. *Am J Public Health* 78: 1446–1450 (1988).
9. Gustafson, T. L., et al.: Measles outbreak in a fully immunized secondary school population. *N Engl J Med* 316: 771–774, Mar. 26, 1987.
10. Measles-Dade County, Florida, *MMWR* 36: 45–49, Feb. 6, 1987.
11. Measles among children of migrant workers—Florida. *MMWR* 32: 471–475, Sept. 16, 1983.