Immunization Rates in Children Receiving Diphtheria-Tetanus-Pertussis and Measles-Mumps-Rubella Vaccines Simultaneously

Renner S. Anderson, MD, and Margaret L. Healey, PhD

- **Objective:** To assess the impact of a guideline recommending simultaneous administration of DTP4 with MMR1 on immunization rates at 24 months of age.
- **Design:** Retrospective review of medical records.
- **Patients and setting:** Children receiving primary care at a large multispecialty suburban group practice.
- **Outcome measures:** Frequency of administering DTP4 and MMR1 simultaneously and percentage of children who were fully immunized at 24 months of age.
- **Results:** The rate of simultaneous administration of DTP4 with MMR1 increased from 3% in 1991 (95% confidence interval [CI], 1% to 5%) to 75% in 1995 (95% CI, 70% to 79%). The percentage of children who were fully immunized increased from 56% in 1991 (95% CI, 51% to 61%) to 82% in 1995 (95% CI, 78% to 86%).
- **Conclusion:** Simultaneous administration of DTP4 and MMR1 may lead to higher immunization rates.

In 1986, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (ACIP) and the Committee on Infectious Diseases of the American Academy of Pediatrics modified their childhood immunization schedules to allow simultaneous administration of the fourth diphtheria-tetanus-pertussis vaccine (DTP4) and third oral polio vaccine (OPV3) with the measles, mumps, and rubella vaccine (MMR1) at 15 months of age [1,2]. This change was based on newly available data demonstrating the safety and efficacy of simultaneous administration of the DTP4 and OPV3 with the MMR1 [3]. The policy change was predicted to increase the percentage of children fully immunized at 24 months of age [1,3–6]. Completion of the full childhood series (Table 1) by age 24 months is a public health goal and a standard of good medical care for pediatric patients [7].

Providers have often failed to take advantage of the option of simultaneous administration of DTP4 and MMR1 [4–6,8–11]. In a 1994 study, Dietz et al [8] found that only 17% of 12,170 children from 21 urban sites in the United States had received DTP4 simultaneously with MMR1. The percentage of children fully immunized at age 24 months among the 21 sites varied from 10% to 52%. The researchers calculated that if DTP4 had been administered simultaneously with MMR1, the percentage of children fully immunized at 24 months of age would have been 12 to 22 percentage points higher.

In a 1991 sample of children seen in a large multispecialty group practice (Park Nicollet Clinic, Minneapolis, MN), Anderson and Kind [11] found that 56% of children were fully immunized by 24 months of age. Only 3% of the children had received DTP4 simultaneously with MMR1. Anderson and Kind estimated that if Park Nicollet physicians had routinely administered the DTP4 with the MMR1 at the 15-month health supervision visit, the percentage of children fully immunized at 24 months of age would have been 30 percentage points higher.

In 1994, a guideline was introduced at Park Nicollet Clinic to help improve childhood immunization rates. The guideline was developed by the Institute for Clinical Systems Integration, an independent, nonprofit organization that provides health care quality improvement services to medical groups affiliated with the HealthPartners health plan in central and southern Minnesota and western Wisconsin. The guideline recommended simultaneous administration of the DTP4 and the OPV3 with MMR1 and specifically discouraged deferring the DTP4 and OPV3 until 18 months of age. Although there are very few empiric data, it is thought that vaccines were deferred due to clinicians’ and parents’ concerns about pain associated with additional injections.

Following introduction of the guideline, we conducted a study to assess immunization rates and frequency of simultaneous administration of DTP4 and MMR1 and to compare these rates with rates observed in the 1991 sample [10]. The study was designed to replicate the earlier evaluation so that

Renner S. Anderson, MD, Department of Pediatrics, Park Nicollet Clinic and Health Research Center, Institute for Research and Education, HealthSystem Minnesota, Minneapolis, MN; and Margaret L. Healey, PhD, Director, Clinical Research, Health Research Center, Institute for Research and Education, HealthSystem Minnesota.
the immunization rates in the 2 samples could be directly compared. We predicted that rates would increase as a result of guideline implementation.

Methods
Setting
The study was conducted at the Park Nicollet Clinic, a large multispecialty group practice in the Minneapolis metropolitan area. Most patients receiving care at Park Nicollet Clinic are middle to upper-middle class, white, and insured with approximately 60% belonging to managed care plans.

Study Population
The study population consisted of children who received their primary care at Park Nicollet Clinic and who had their second birthday between 1 January 1995 and 30 June 1995. The population of children who received their primary care at the Park Nicollet Clinic was defined as those children who

- had within 24 months of birth made at least 1 visit to a Park Nicollet Clinic primary care physician;
- had documentation of at least 1 immunization in his or her medical record;
- did not have any documentation of transfer of care to another medical facility.

Children were excluded if they were enrolled in a research study for an experimental vaccine during the audit period.

Guideline Implementation
The pediatric immunization guideline was introduced at Park Nicollet Clinic in April 1994. A guideline coordinator was selected to lead the implementation phase. The coordinator was a pediatrician who had been a member of the guideline development team and is the first author of this paper. An implementation committee was appointed to promote dissemination of the guideline. The committee identified physician and nurse guideline champions at each clinic site providing pediatric and family practice services to facilitate guideline implementation. The guideline coordinator met with the site champions to review the guideline and baseline immunization rates. In turn, site champions trained staff at each patient care site, providing continuing education credits for completion of post-training knowledge tests. The quality improvement department collected and disseminated site-specific immunization rates every 6 months.
Sampling Technique
Clinic administrative encounter data were used to identify the study sample. All encounters from 1 January 1993 through 30 August 1995 were examined to identify children born between 1 January 1993 and 30 June 1993 and who had at least 1 encounter at the clinic within 26 months of their date of birth. A total of 2843 eligible children were identified from the encounter data. We randomly selected the medical records of 50 children on which to pretest the audit tool. From the remaining population of 2793, we used a computerized random number generator to obtain a random sample of 700 patients for the study audit; of these, 379 met the study criteria (46% excluded). Reasons for exclusion were no visit to a primary care physician (157), documentation of transfer of care (135), first visit to primary care occurred after age 24 months (10), no immunizations in record (9), enrolled in experimental vaccine study (8), duplicate medical record (1), and out of age-range (1). Immunizations from other health care systems were included if they were documented in the Park Nicollet medical record.

Chart Audit
Medical records were reviewed by 2 registered nurses and a public health professional. Information was abstracted from a centralized medical record. Chart audit rules were developed that included operational definitions of all the study variables. Children were defined as fully immunized if they had received 4 doses of DTP, 3 doses of OPV, and the MMR vaccine by age 24 months. Haemophilus influenzae type b (Hib) vaccination status was not assessed so that comparisons with the earlier study data could be made. The Hib vaccine had been excluded from the earlier study because of revisions in the Hib schedule that occurred during the study period. The varicella vaccine was excluded because it was not available to clinicians until July 1995. Hepatitis B was excluded because it was not available to clinicians until June 1995. Influenza and pneumococcal vaccines were excluded because they were not available at Park Nicollet when the study was conducted.

Results
The percentage of children fully immunized at 24 months of age increased from 56% (95% confidence interval [CI], 51% to 61%) in the 1991 sample to 82% (95% CI, 71% to 86%) in the 1995 sample (P < 0.001) (Table 2). The rate of simultaneous administration of DTP4 with MMR1 increased from 3% (95% CI, 2% to 5%) in the 1991 sample to 75% (95% CI, 80% to 88%) in the 1995 sample (P < 0.001).

Discussion
Following the introduction of a new pediatric immunization guideline in 1994, rates of simultaneous administration of DTP4 with MMR1 at Park Nicollet Clinic increased from 3% to 75%. Concurrent with this change in practice was a clinically and statistically significant increase in the rate of children fully immunized at age 24 months.

It is possible that the increase in the rate of children receiving simultaneous DTP4 and MMR1 was a result of secular trends affecting childhood immunization practices in general rather than a result of the guideline. A combined conjugated DTP/Hib vaccine became generally available to Park Nicollet practitioners just as the new immunization guideline was being introduced. By using the DTP/Hib combination vaccine, physicians could follow the guideline recommendation for simultaneous administration of DTP4 with the MMR1 at the 15-month visit without an additional injection. To what extent the observed improvement in the immunization rates of the second cohort is secondary to this technological innovation rather than to the immunization guideline is unknown. It is also unknown to what degree the higher rates of simultaneous administration of DTP4 and MMR1 contributed to improved immunization rates.

Our study suggests that early and/or accelerated administration of childhood vaccines may lead to higher childhood immunization rates. The current ACIP childhood immunization schedule allows completion of the childhood immunization series by as early as 12 months of age (Table 1). In populations of children who are at high-risk for underimmunization, completing the childhood series by 12 months of age may result in higher rates of children who are fully immunized by their second birthday. Providers should take advantage of all opportunities for early completion of childhood immunizations. Medical care systems and national vaccine advisory boards should establish guidelines recommending use of accelerated immunization schedules whenever possible.

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Table 2. Immunization Status and Frequency of Simultaneous Vaccine Administration Before and After Guideline Implementation

<table>
<thead>
<tr>
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<th>1991 Cohort (n = 449)</th>
<th>1995 Cohort (n = 379)</th>
<th>P Value</th>
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</thead>
<tbody>
<tr>
<td>Fully immunized at 24 months</td>
<td>56%</td>
<td>82%</td>
<td>&lt; 0.001</td>
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<tr>
<td>Received simultaneous DTP4 and MMR1</td>
<td>3%</td>
<td>75%</td>
<td>&lt; 0.001</td>
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IMMUNIZATION RATES

Authors’ address: Health Research Center, Institute for Research and Education, HealthSystem Minnesota, 3800 Park Nicollet Blvd., Minneapolis, MN 55416, e-mail anderr@hsmnet.com, healem@hsmnet.com.

References


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