
The Effect of Patient Education on Pediatric Immunization Rates

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Background. Over the last decade, the immunization rate among preschool children has decreased, especially in the lower socioeconomic population. During this period, reports of outbreaks of immunizable diseases, especially pertussis and measles, have correspondingly increased. This study was designed to evaluate the effect of a brief patient education encounter with new mothers on pediatric immunization rates.

Methods. Two hundred thirty-eight mothers and infants were assigned to an intervention or control group. On the first day postpartum, the mothers in the intervention group participated in a 10- to 15-minute discussion on the importance of immunizations and were given a patient education handout. A reminder letter was mailed to the intervention group at 2 months postpartum. The control group received no special intervention. Infants were followed for their 2- and 4-month immunizations for diphtheria, pertussis, and tetanus and oral polio vaccine (DPT/OPV). At 1 year of age, the infants' immunization records were as-

essed for the completion of their first three DPT/OPV immunizations.

Results. There was no statistically significant difference, by chi-square analysis, in the immunization rates of the control and intervention groups at 2, 4, or 12 months of age. At 1 year of age, 29 of 122 (24%) of the control group had received all three DPT/OPV immunizations, compared with 33 (28%) of 116 infants in the intervention group.

Conclusions. Concordant with similar studies, the immunization rate among infants of parents of lower socioeconomic status (26%) is low. An educational intervention presented to mothers in the postpartum period did not improve the rate of immunization by the age of 12 months. There are undoubtedly several reasons for this failure. Other means to improve immunization rates of infants should be developed and tested.

Key words. Immunizations, vaccinations; patient education; children. *J Fam Pract* 1992; 35:288-293.

Over the last few decades, the American public has benefited greatly from an aggressive immunization program. Since the development of the pertussis vaccine in the 1930s and the subsequent addition of other vaccines, the incidence of eight major diseases has been significantly reduced.^{1,2} A disturbing trend is being reported across the United States, however: the immunization rate of the preschool population is decreasing, especially in lower socioeconomic populations.³⁻⁷

During the 1980s, there were several outbreaks of pertussis in the United States.⁸⁻¹⁰ In 1983, 330 cases

were reported in Oklahoma. Of the children aged 3 months to 6 years (136) who were diagnosed with pertussis, only 36% were up to date with their immunization schedules. In a subsequent survey of 5300 children who received immunizations at the Oklahoma County clinic (serving the indigent population), only 27% were up to date.⁹ In a recent report by the Centers for Disease Control (CDC),³ a 33% increase in the national incidence of pertussis was noted from 1982-1983 to 1984-1985. A survey of 1504 children, ages 7 months through 6 years of age, who had acquired pertussis between 1984 and 1985, showed that 70% had not been properly immunized. The number of measles cases has increased dramatically in recent years; there were as many as 25,000 cases in 1990. The epidemic has disproportionately affected preschool children. Nearly one half of the reported cases occurred in preschool children, three fourths of whom had not been vaccinated.^{6,7} After a

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recent outbreak of measles in California (1799 cases), it was reported that only 29% of the affected individuals were adequately immunized.⁴

Similar to this national trend, the number of indigent children adequately immunized in Waco, Texas, was noted to be decreasing. A preliminary retrospective survey was conducted in 1987 of 50 patients, ages 6 months to 3 years, who were admitted to the family practice inpatient service (McLennan County Family Practice Residency Program) for evaluation of their immunization status. Of the 50 records examined, 41 included sufficient information for analysis. Only 34% of the children were adequately immunized, and 43% were behind schedule by at least two immunizations.

An important factor in the low rates of immunization may be the lack of parental education and understanding concerning the risks and benefits of immunizations. Patient education has long been touted by family physicians as a technique for positive modification of patients' behavior.¹¹⁻¹³ The hypothesis of this study was that patient education could improve the immunization rate of children by modifying the behavior of mothers. If successful, this would provide an initial cost-effective means of improving the immunization rate. Though a few studies have incorporated immunizations as a marker of general health, there are no recent prospective studies that specifically evaluate the effect of patient education on the pediatric immunization rate.¹⁴⁻¹⁶

Methods

Subjects

A prospective study was designed to evaluate the effect of a brief patient education encounter on the immunization rate. The subjects of this study were mothers and their newborn infants delivered by family practice residents at the McLennan County family practice residency. Two hundred thirty-eight postpartum mothers were assigned to either the intervention or the control group according to delivery date. Two schedules were used: one schedule (Sunday, Tuesday, Thursday) was randomly assigned to the intervention group, while the other schedule (Saturday, Monday, Wednesday) was assigned to the control group. Any child with a serious neonatal illness (eg, extreme prematurity) that would necessitate a different immunization schedule or follow-up was excluded from the study. Any child who lived outside the county was also excluded, owing to a greater difficulty in confirming immunizations.

Study Design

Three occasions seemed most logical for patient education of new mothers: in the hospital immediately postpartum, at the scheduled 2-week follow-up visit, or by home visitation. Several descriptive studies have suggested that the immediate postpartum period is a very "teachable" time.¹⁷⁻²⁰ Mothers are often excited about their new child and open to discussing the child's health. They are a captive audience with adequate time and relatively few distractions while in the hospital. Another possible opportunity for intervention is during the first checkup 2 weeks after hospital discharge. This appointment, however, tends to be a time of hurried medical care because of the volume of patients in a county clinic. Mothers typically bring their other children, and there is rarely an opportunity to sit down and educate them in a quiet environment. A third potential time for the teaching encounter is through a postpartum home visit. Because our intent was to investigate a cost-effective method, the immediate postpartum period was selected as the time for the teaching encounter.

The mothers in the intervention group (116) participated in a 10- to 15-minute discussion concerning immunizations. The risks and benefits of immunizations were discussed, and any questions the mother might have on the subject were answered. The teaching was done on the first day postpartum. Two thirds of the teaching sessions were done by a nurse (P.K.O.) with experience in patient education, while the remainder of the sessions were conducted by a physician (K.C.O.). A translator was used when the preferred language of the mother was Spanish. After the discussion, the mother was given a 1-page handout that summarized the points covered in the session. The handout was written on a sixth- or seventh-grade reading level (SMOG formula)¹³ and was available in English and Spanish. Mothers in the intervention group also received a reminder letter 2 months postdelivery. Although there was no effort to prevent physicians, nurses, or health department workers from giving informal advice, mothers in the control group (122) received no special patient education intervention.

Measurement

Immunizations were administered either at the county public health department or the family practice clinic. The children were followed for their 2- and 4-month DPT/OPV immunizations and were defined as being "on time" if they occurred within 3 months and 5 months of delivery, respectively (guidelines from the Advisory Committee on Immunization Practices, US Public Health Service, 1987). At 1 year of age, the infants'

Table 1. Demographics of 238 Mothers Who Participated in the Study (in percent)

Characteristic	Intervention (n = 116)	Control (n = 122)
Race/Ethnicity		
White	31	24
African-American	33	47
Mexican-American	36	28
Oriental	0	1
Prenatal care		
Yes	93	92
No	7	8
Age (y)		
12-15	6	11
16-19	29	28
20-29	61	48
≥30	4	13
Number of previous children		
0	39	38
1-2	47	41
3-4	10	16
≥5	4	5

immunization records were assessed for completion of the first three DPT/OPV immunizations. To make sure that a large number of patients did not receive their immunizations at private physicians' offices, several physicians were contacted. Because of the cost of the immunizations, few county patients receive their immunizations in the private setting. However, one private physician administers immunizations through Medicaid, the Early and Periodic Screening, Diagnosis and Treatment program. His charts were reviewed for any of the patients in the study and those identified were included in the results.

Analysis

The mean number of immunizations received "on time" were tabulated for the intervention and control group and compared using chi-square analysis. Also, the percentages of children with inadequate immunizations in both groups were recorded for comparison with previous publications.

Results

Two hundred thirty-eight patients were followed in the study: 116 in the intervention group and 122 in the control group. There was no significant difference in the two groups with respect to age, race, previous number of children, and prenatal care (Table 1).

Table 2. Percentage of Children On Time for 2-Month and 4-Month DPT/OPV Immunizations* and Completing All Three DPT/OPV Immunizations by 12 Months of Age

Immunizations	Control (n = 122)	Intervention (n = 116)	P Value
2-month DPT/OPV	33	31	.772
4-month DPT/OPV	20	27	.197
12-months completion	24	28	.411

*Advisory Committee on Immunization Practices. Guidelines for on-time: 3 months of age for 2-month DPT/OPV, and 5 months of age for 4-month DPT/OPV immunization.

DPT/OPV denotes diphtheria, pertussis, tetanus, and oral polio vaccine.

The results of the comparison of the intervention group with the control group are shown in Table 2. There were no significant differences between the two groups, when comparing the immunization rate by chi-square analysis, for the 2- and 4-month DPT/OPV or at 12 months of age. Of the 116 patients in the intervention group, 36 (31%) received the 2-month immunization on time, whereas 40 (33%) of the 122 patients in the control group received the immunization on time. Twenty-seven percent of the intervention group were on time for their first and second immunizations, compared with 20% of the control group. At 1 year of age, 33 (28%) of the 116 patients in the intervention group had received all three DPT/OPV immunizations, compared with 29 (24%) of the 122 patients in the control group. The overall immunization rate for the control and intervention groups was 26%.

Of the total group (238), there were no differences in the immunization rates among the various ethnic groups, age groups of the mothers, or the number of previous children. One group did show a significant difference in the immunization rate. Of the 18 children of mothers who received no prenatal care, regardless of intervention, only one infant had received all three DPT/OPV immunizations by 1 year of age ($\chi^2 = 4.24$; $P < .05$).

Discussion

Several major findings emerged from this study. First, the immunization rate did not significantly improve with a brief postpartum educational encounter. Second, the overall immunization rate of this population of preschool, lower socioeconomic children was alarmingly low. Additionally, infants of mothers without prenatal care had a significantly lower immunization rate than those in other groups. Finally, several significant barriers to adequate immunization were identified.

A brief patient education session may be ineffective in changing the immunization rate for several reasons,

including the timing of the encounter and our understanding of the patient's agenda. The timing of the educational encounter may be critical. Although there are several descriptive reports of the value of postpartum education on the long-term health of mother and infant, there is a paucity of prospective studies. A recent prospective study by Serwint et al¹⁶ compared the effect of early initiation of communication (consisting of general infant-care topics) between the mother and clinician at 1 to 2 days postpartum with initiation of communication at the first clinic visit. They found that early communication improved the first clinic visit rate, but did not affect the subsequent health maintenance visits, maternal knowledge of infant care, maternal anxiety, or the infant immunization rate at 90 days. As suggested by Serwint and co-workers, the mother may experience an information overload in the immediate postpartum period, making it difficult to retain health maintenance concepts. In a study from Canada, Larson¹⁵ compared the effect of timing of the health communication in three settings: prenatal and early antenatal home visits, late antenatal (after 6 weeks) home visits, and no home visits. The infants of mothers who experienced prenatal and early antenatal home visits were found to have reduced accident rates and higher immunization rates, and these mothers scored higher on assessments of home environment and maternal behavior. Interestingly, their reported immunization rate was 88% up to date at 18 months of age, possibly reflecting a difference between Canada and the United States in access to health care by lower socioeconomic groups. Nevertheless, there are still too few data concerning the timing of postpartum education to understand its impact.

Although timing seems important, another variable may be the mother's agenda. Brief patient education encounters seem most effective when the health educator and the patient not only agree that a problem exists but also agree on its relative importance, as in smoking cessation²¹ or management of otitis media.¹² However, the agenda of the health educator and the patient may differ. Other more basic problems such as food, transportation, and child care may be more immediate, and thus the mother places immunizations (a long-term health maintenance issue) lower on her agenda, rationalizing that she will have her child "catch up" before being enrolled in school.

Regardless of the results of the patient education encounters, the disturbing national decline in immunization rates in preschool children is reflected in this study. At 1 year of age, the immunization rate in this study of 238 children (intervention plus control), regardless of race, maternal age, or parity, was 26%. This immunization rate is comparable to other recent reports in similar popula-

tions.^{3,6,7,9} A study from California reports that the immunization rate of children receiving their care at public clinics is approximately half that of children receiving care from private physicians.⁴ The immunization rates are even lower in special subsets of the indigent population, such as the homeless or children of migrant workers.^{22,23} In our study, infants of mothers who received no prenatal care were at particular risk for lack of immunization.

Two limitations that likely affected the overall immunization rate in this study are: (1) the dual system for indigent health care in this area, and (2) the restricted hours that the immunization clinic is open. In the study population, routine pediatric health care for the lower socioeconomic group is performed at the family practice center (FPC), but most immunizations are administered at the public health department during two periods each week (Tuesday and Thursday from 2:00 PM until 4:30 PM). The clinic is often crowded during these periods, and this may dissuade mothers from bringing their children for immunization. As we became aware of the importance of these barriers during our own study, the recent national measles epidemic increased nationwide awareness of the many barriers to obtaining health care services for indigent children.²⁴

Other potential barriers have been suggested by previous reports. Markland and Durand²⁵ suggest that risk factors for inadequate immunization include low perception of disease seriousness, low perception of risk of disease, inadequate knowledge of efficacy of vaccine, inadequate knowledge of length of protection afforded by vaccine, younger age levels of parents, lower education levels of parents, larger families, less media exposure, and race other than white. A 1975 survey of 1147 parents in Ohio reported that paternal education, maternal education, family size, and socioeconomic status were important factors in children being adequately immunized.²⁶ However, 82% of the children in the study received their immunizations from a private physician, making generalization of these risk factors to a lower socioeconomic group difficult. In contrast to these surveys, our current study did not show any differences in immunization rates among ethnic groups, maternal age groups, or family sizes. As noted earlier, lack of prenatal care was significantly related to failure to comply with immunization.

A recent survey of 601 parents of children who were inadequately immunized was completed in Utah.²⁷ Sixty-six percent of the parents stated that their children were ill at the time of planned immunization. Eighteen percent either were worried that the vaccinations would cause problems or did not think that the vaccinations were important. This survey was designed to discover barriers specific to Utah. Yet, since questionnaires were not sent to unwed mothers and since the socioeconomic status of

Table 3. Potential Barriers to Adequate Immunization

Financial barriers	
Lower socioeconomic status	
Cost of vaccine	
Limited resources of public health clinic	
Delivery system barriers	
Location and accessibility of public health clinic	
Transportation to public health clinic	
Inadequate hours of immunization clinic	
Insufficient staffing of immunization clinic	
Overcrowding of public health department	
Cultural and language barriers between local clinic workers and population they serve	
Inadequate tracking systems in public health clinics	
Policy barriers	
Requirement for physical examination prior to immunization	
Need for physician referral in order to be vaccinated	
Requirements for enrollment in well-baby clinics in order to be vaccinated	
Information barriers	
Lower paternal/maternal education levels	
Perceived seriousness of disease	
Perceived seriousness of vaccine	
Myth of not giving immunization with colds, runny nose	
Lack of assessment of immunization status by health care providers	
Missed opportunities by health care providers (office, hospital, etc)	

the family was not reported, little can be generalized to the indigent population. A summary of potential barriers for lower socioeconomic families seeking immunizations is found in Table 3.^{6,7,24-27} Although surveys of immunization program managers have been conducted,²⁴ there is not a current survey that explores the indigent family's perspectives on barriers to obtaining immunizations.

The National Vaccine Advisory Committee has recently made several excellent recommendations to improve the availability and management of immunization delivery, including enhanced surveillance efforts and increased media-based awareness programs.^{6,7} Other efforts to encourage immunization should be reinforced, including educating health care workers and parents that colds, minor illnesses, and concurrent use of antibiotics are not contraindications to receiving immunizations. Children who are seen in a clinic setting for follow-up appointments (eg, recheck of otitis media) should be evaluated for their immunization status and vaccinated accordingly.⁵ Likewise, children who are being discharged from the hospital can often be updated on their vaccinations.^{28,29}

Conclusions

In summary, a brief patient education encounter did not affect the pediatric immunization rate in this study. The

overall immunization rate in this indigent population is very low, and further studies to understand and subsequently improve the rate will be pursued. Follow-up studies will include a survey of the mothers who did not have their children immunized on time. This should provide some insight into the mothers' perceptions of immunization and give some direction for further methods of intervention.

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