

Underimmunization in Chicago Children Who Dropped Out of WIC

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Background: The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) serves a large proportion of Chicago infants, but some discontinue participation before age 1 year. To determine if children who remained active at WIC immunization-linked sites after their first birthday were more likely to be immunized by ages 19 and 25 months than those who dropped out, a retrospective cohort study was conducted.

Methods: Four Chicago WIC sites that used monthly voucher pick-up were chosen. Children born from July 1, 1997 to September 30, 1997 who attended these sites were eligible (N=1142). The cohort was divided into two groups: (1) active group (46%), who had a WIC visit on or after their first birthday; and (2) inactive group (54%), who had their last WIC visit before their first birthday. Children were enrolled through home visits.

Results: The records for 200 children were analyzed. By age 19 months, 65 (84%) of 77 active children had received one dose of measles-mumps-rubella vaccine (MMR), compared to 82 (67%) of 123 inactive children (risk ratio [RR]=1.3; 95% confidence interval [CI], 1.1–1.5). By age 25 months, 64 (83%) active children had received four doses of diphtheria-tetanus-pertussis vaccine (DTP), one MMR, and three doses of *Haemophilus influenzae* type b vaccine (Hib), compared with 64 (52%) inactive children (RR=1.6; 95% CI, 1.3–2.0).

Conclusions: In this cohort, children active in WIC after their first birthday were more likely to be immunized by ages 19 and 25 months, compared with those who were no longer active. Chicago children who drop out of WIC may represent those at highest risk for underimmunization and may require special strategies to improve coverage.

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Introduction

Although overall immunization rates among pre-school-aged children in the United States have reached unprecedented highs, immunization rates among children in some urban areas are below national levels. For example, the 2000 National Immunization Survey (NIS) showed that coverage for children in Chicago aged 19 to 35 months with four doses of diphtheria-tetanus-pertussis vaccine (DTP), three doses of polio vaccine, one dose of measles-mumps-rubella vaccine (MMR), and three doses of *Haemophilus influenzae* type b vaccine (Hib) was 65.1% (± 6.4), compared with the national coverage estimate of 76.2%

(± 0.9).¹ Improvements are necessary to reach the *Healthy People 2010*² goals of 90% coverage for each recommended vaccine and 80% coverage with all recommended vaccines. Within a city, the risk for underimmunization is not uniform. “Pockets of need” exist, most often in areas that are crowded, poor, and with lower use of healthcare services; additional resources and strategies are needed to identify and ultimately improve coverage of those children at highest risk.³

Initiatives that link immunization activities with the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) have become an important strategy to improve immunization coverage among high-risk children.^{4–9} One approach is the use of monthly voucher pick-up (MVP), whereby a 1-month supply of WIC food vouchers is administered instead of the usual 2- or 3-month supply for children who are delayed in immunizations, until immunizations are brought up to date. In a 1997 study, Chicago WIC sites that combined immunization assessment and referral with MVP had higher immunization coverage among participants, compared with sites that performed only

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immunization assessment and referral.⁴ Studies at WIC sites in other cities also documented the benefit of WIC linkages that used MVP.⁵⁻⁷ Because the 1997 evaluation demonstrated the potential impact on immunization rates for the large proportion of Chicago children enrolled in WIC (approximately 44% of the Chicago birth cohort enrolled in WIC in 1999; Illinois Department of Human Services [IDHS], unpublished observations, 2000), the use of MVP has since been instituted at most Chicago WIC sites.

The greatest benefit from WIC-immunization linkages would be expected to occur among children enrolled throughout the first 2 years of life. However, many children discontinue participation in WIC before or near age 12 months.¹⁰ One reason for discontinuation is that infant formula, relatively costly for families and provided through WIC, is no longer a covered benefit after age 12 months. The purpose of this retrospective cohort study was to determine if children who left Chicago WIC sites before age 12 months were less likely to receive immunizations on time, particularly in the second year of life. If so, additional immunization strategies may need to be directed to these children to optimally protect them and the community from vaccine-preventable diseases.

Methods

This study was approved by the Institutional Review Board of the Chicago Department of Public Health (CDPH).

WIC Clinics

Four WIC clinics were chosen to provide the study sample. At the time of the study, CDPH operated 23 of the 41 Chicago WIC clinics, and 21 of CDPH-administered sites used MVP. Four CDPH-administered clinics that reported having adequate staff and used MVP from July 1997 through October 1999 were selected for the study. The clinics were in different regions of the city, and their catchment areas included economically disadvantaged children at high risk for under-immunization based on CDPH data. At that time, protocol directed that immunization records for enrolled children be brought in by parents/guardians and reviewed by WIC staff at each visit. The parents/guardians of children whose immunizations were up to date at the WIC visits received a 3-month supply of vouchers. Those who were not up to date (or who did not have a valid reason for lacking an immunization record) received a 1-month supply of vouchers until immunizations were brought up to date, and then the 3-month supply was reinstated. To continue in WIC beyond the first year of life, recertification visits were required at age 12 months and every 6 months thereafter.

Study Sample

The eligible population consisted of infants who met four criteria: (1) enrolled in WIC at one of the four selected clinics; (2) born on or between July 1, 1997 and September 30, 1997; (3) brought in for a WIC visit by age 2 months; and

(4) stayed within those four sites for all WIC visits through December 1999. Only one twin from each twin set was eligible. Data from IDHS were used to identify children who met the selection criteria, and children who did were grouped by the clinic of their initial WIC enrollment. Each child was then categorized by the second-year WIC status as "active" if the child had a WIC recertification visit on or after the first birthday, or "inactive" if the child's last WIC certification visit was before the first birthday. A randomly ordered list of children was created for each of the eight subgroups (four clinics, active/inactive).

Procedures for Collection of Immunization Data

Following the order on the eight lists, an attempt was made to determine each child's immunization status until the sample size was reached or funds were exhausted. First, a child's immunization status was determined from available records. The records were considered sufficient to verify immunization status if they showed receipt of DTP1 and Hib1 by age 4 months, no longer than 4 months between each of the first three doses of DTP and Hib vaccines, MMR at age 12 to 17 months, Hib3 or 4 at age 12 to 17 months, and DTP4 by age 24 months. Polio immunization was not assessed because it was believed to track well with receipt of other vaccines. Records from IDHS data management system, WIC charts, CDPH clinic data management system, and CDPH medical charts were reviewed.

If the immunization records from these sources were not sufficient, an attempt was made to contact parents/guardians, following a protocol of telephone calls and home visits to maximize the chances of successful contact. Home visits were conducted from September 2000 through April 2001. Consistent efforts were made to locate an accurate address and telephone number for each child, including those who had moved out of the area. When a parent/guardian was reached, informed consent to copy the home immunization record and obtain an immunization record from all the child's providers was requested. Parents who participated received a \$10 gift certificate for a local supermarket. Parents of children with delayed immunizations were encouraged to promptly visit their provider or the local CDPH clinic to obtain the necessary immunizations. Home records were considered to be sufficient for use without provider verification if the immunizations met the timing requirements described earlier. We attempted to verify all other home records with providers.

Data Analysis

The outcome variables of interest were receipt of MMR by age 19 and 25 months, and receipt DTP4, MMR, and Hib3 by age 25 months. A sample size of 151 children was needed in each of the two WIC-status groups (active, inactive) to detect a difference of at least 15% in coverage for a single immunization, if coverage in the active group was at least 80% ($\alpha=0.05$, two-sided; $\beta=0.20$). The study was designed so that each clinic would contribute children to the study sample in approximately the same proportion that it contributed to the original cohort.

Data were analyzed using Epi Info 6.04b (CDC, Atlanta GA, 1996), using a two-tailed chi-square test and calculating 95%

confidence intervals (CIs) for risk ratios (RRs). No adjustments were made for multiple comparisons. When the data were stratified by clinic, the crude and Mantel-Haenzel-adjusted RRs differed by 1%; the crude RRs are presented. Unless otherwise stated, immunizations given before the recommended age were counted in the coverage calculations.

The immunization coverage between the active and inactive groups was compared twice. First, the two groups were compared using the records of only those children who participated in the study through home visits. Many more children in the active group versus the inactive group had a complete, on-time immunization record available from other sources and, therefore, did not receive a home visit. By comparing only children who participated through home visits, the opportunity for children from either group to contribute an on-time immunization record to the analysis was more equitable. However, excluding children with an available on-time immunization record and no home visit biases to a lower estimate of immunization coverage in the active group more so than in the inactive group (since more children in the active group had such a record). Therefore, the active and inactive groups were compared a second time, including a sample of the children with a complete record and no home visit. For this second comparison, we estimated the number of children who would have been expected to participate in the study if home visits had been attempted (based on the study participation rate for that WIC clinic and WIC status group), and then randomly selected that number of children's records to add to those used in the first comparison.

Results

Study Participation

A total of 1159 children met the original eligibility criteria; 17 of these were subsequently excluded from study participation (16 had no address available, and 1 was known to be deceased). This left 1142 children on the selection lists (614 inactive, 528 active). Table 1 shows characteristics of the groups. Only eight children in the inactive group were coded as WIC ineligible at their last assessment.

Home visits were attempted for 483 inactive and 178 active children. The final study participation rate for children for whom home visits were attempted was 26% (123/483) for inactive children (22% to 29%, depending on the clinic) and 43% (77/178) for active children (41% to 44%, depending on the clinic). Many children, especially from the inactive group, could not be located because of address changes. Few parents/guardians who had home visits attempted actively refused to participate (15/661, 2.3%; 12 inactive, 3 active). An additional 15 children (13 inactive, 2 active) whose parents consented to participate were ultimately excluded from analysis because they had either no home immunization record or only an incomplete record, and the immunization record could not be adequately provider verified. The proportion of the final sample that came from each clinic was within 5% of the

Table 1. Study cohort by WIC status, home visit enrollment, and clinic

Participant group	Cohort n (%)	Home visits attempted	Study participants from home visits
WIC active	528 (46)	178	77
WIC inactive	614 (54)	483	123
Total	1142	661	200
Clinic ^a	Contribution to original cohort (%)	Contribution to cohort enrolled by home visits (%)	
A	44	48	
B	21	24	
C	19	14	
D	16	16	

^aPercent of participants of black race (ethnicity Hispanic or non-Hispanic) by clinic: A = 99%, B = 98%, C = 83%, and D = 98%. WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

proportion that each clinic contributed to the initial cohort (Table 1).

Immunization Coverage

Table 2 shows immunization coverage for the inactive and active groups, and RRs for receiving those immunizations. The first analysis compared the 123 inactive and 77 active children who participated through home visits. Compared with inactive children, active children were more likely to have received MMR by ages 19 and 25 months, Hib3 by 25 months, and DTP4 by 25 months. Active children were therefore more likely to have received DTP4, MMR, and Hib3 by age 25 months (RR for the combination by age 25 months in active vs inactive children was 1.6 [95% CI, 1.3–2.0]) due in large part to the difference in DTP4 coverage.

By age 37 months, all of the active children and 94% of the inactive children had received MMR. Active children were still significantly more likely than inactive children to have received DTP4, MMR, and Hib3 by age 37 months.

For the second analysis, a sample of the complete immunization records obtained without home visits was combined with those obtained through home visits. These additional records (24 from active group, 1 from inactive group) increased the immunization coverage estimates of the active group, resulting in slightly higher relative risks compared with those obtained in the first analysis. The active children in this analysis were more likely to have received DTP3 and Hib2 by age 12 months, thereby increasing the probability of finishing the series on time in the second year of life.

When timing of vaccines in the series was considered (DTP3 before age 12 months and DTP4 between age 12 and 24 months, MMR by age 25 months, Hib2 before

Table 2. Comparison of proportion of children immunized in WIC active and inactive groups, by vaccine dose and age

Vaccine(s)	Receipt by age (months)	Home visit participants only			Home visit participants + sample of complete records		
		Active ^a (n=77)	Inactive ^a (n=123)	RR (95% CI)	Active ^a (n=101)	Inactive ^a (n=124)	RR (95% CI)
MMR	19	84	67	1.3 (1.1–1.5)	88	67	1.3 (1.1–1.5)
	25	97	80	1.2 (1.1–1.4)	98	80	1.2 (1.1–1.4)
	37	100	94	1.1 (1.0–1.1)	100	94	1.1 (1.0–1.1)
DTP4	25	86	54	1.6 (1.3–1.9)	89	54	1.6 (1.4–2.0)
	37	95	79	1.2 (1.1–1.4)	96	79	1.2 (1.1–1.3)
Hib3	25	94	78	1.2 (1.1–1.4)	98	78	1.2 (1.1–1.4)
DTP4, MMR, Hib3	25	83	52	1.6 (1.3–2.0)	87	52	1.7 (1.4–2.0)
	37	92	75	1.2 (1.1–1.4)	94	75	1.2 (1.1–1.4)
	37, with timing ^b	61	48	1.2 (1.0–1.6)	70	48	1.4 (1.2–1.8)
DTP3, Hib2	12	81	68	1.2 (1.0–1.4)	85	69	1.2 (1.1–1.4)

^aValues are percentage of children in group who were immunized.

^bDTP3 at age <12 months and DTP4 or 5 at age 12 to 24 months, MMR by age 25 months, Hib2 at age <12 months, and Hib3 or 4 at age 12 to 24 months.

CI, confidence interval; DTP, diphtheria–tetanus–pertussis vaccine; Hib, *Haemophilus influenzae* type b vaccine; MMR, measles–mumps–rubella vaccine; RR, risk ratio; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

age 12 months, and Hib3 or 4 between age 12 and 24 months), the estimates for coverage with DTP4, MMR, and Hib3 by 25 months decreased in both the active and inactive groups.

Home Records and Providers

Among children who participated by home visit, 60% of inactive and 66% of active children had an immunization record available at home. The majority of children who participated through home visits were reported to have only one vaccine provider (72% of inactive, 78% of active). A minority of children was reported to have received immunizations at a CDPH clinic (16% of inactive, 5% of active).

Discussion

In this cohort of children from WIC sites that used MVP, study participants who were active in WIC at age ≥12 months were more likely to have received appropriate immunizations by ages 19 and 25 months, compared to those who dropped out of WIC before age 12 months. Although it is encouraging that 100% of the active children and 94% of the inactive children enrolled in this study received MMR by age 37 months, many inactive children were unprotected for a substantial part of the second year of life. Protecting infants at the earliest age possible should continue to be the goal of immunization programs. In the second analysis, children who continued in WIC were also better immunized by age 12 months.

While other studies have documented the important benefits of WIC-immunization linkage for children who stay enrolled in WIC, few have specifically addressed the status of children who dropped out early from WIC.

In the 1997 Chicago study, for example, age-appropriate immunization rates were assessed among cross-sections of children of various ages <24 months who were active in WIC at the time of assessment.⁴ The findings from the current field study were consistent overall with those of a recent evaluation in which the NIS database was used to examine national and state-specific coverage for 7785 children who participated in WIC.¹⁰ Of those children who, by parent report, were receiving WIC benefits at the time of the survey (age 24 to 35 months), 75% (±2.1) were up to date with immunizations at age 24 months (DTP4, polio3, MMR, Hib3). These results compared with 69% (±2.5) coverage among those children who were no longer receiving WIC benefits. Coverage at age 12 months (DTP3, polio2, Hib2), however, was not significantly different in these two groups. One of the earliest studies of WIC interventions, conducted in Chicago from 1991 to 1993, found that the effect of WIC-immunization linkage in improving immunization coverage of 2-year-olds was greatest in active WIC participants, compared with the improvement in coverage for all WIC-enrolled children (active and terminated).¹¹

The overall impact of lower rates of immunization among inactive children depends on the rates of WIC disenrollment and coverage levels. For the cohort that met all the eligibility requirements for this study, about half did not recertify. In the NIS study, the WIC dropout rate between ages 1 and 2 years was reported to be 28%, and 60% of those who dropped out between ages 1 and 3 years were still income eligible.¹⁰ Although the coverage for MMR by age 19 months and DTP4 by age 24 months was low among the inactive children enrolled in the current study, coverage increased by age 37 months. Additional strategies for these children

should be geared to improving on-time receipt of vaccines. The active group also demonstrated a need for improvement in receiving vaccines on schedule. As evidenced by the inability to locate many children eligible for this study, any reminder/recall or outreach intervention would need to identify children relatively soon after WIC inactivity, or at least have other methods of determining current residence.

This study had limitations. WIC activity was categorized by certification visit at age ≥ 12 months. It was therefore not possible to look for a dose-response relationship between duration of WIC enrollment and immunization coverage. Because a certification visit is required to continue in WIC after the first birthday, this visit was thought to be a useful marker for WIC activity in the second year of life. The study participation rate for the inactive children was low, due primarily to inability to locate the children, and this greatly increased the effort needed to complete the study. How well these participants represent the entire inactive group is not known. However, those children who could not be located may have been at even higher risk for underimmunization than the ones who participated if, in this population, moving early in life indicates a less reliable environment for regular healthcare services. This study may not be generalizable to WIC sites with MVP in other areas of Chicago, or outside of Chicago, because the clinics chosen were in areas known to be at high risk for underimmunization, and the use of MVP at these clinics was not formally assessed.

It cannot be determined from this study if staying enrolled in WIC was responsible for the higher immunization coverage, or if continuing in WIC was a marker for families who are more likely or more able to keep their child's immunizations current for reasons independent of the WIC-immunization linkage. Therefore, it is not known if retaining the inactive children at these WIC sites would necessarily have improved their immunization coverage. Such efforts, however, would allow children continued access to other WIC services and potential benefits. In Milwaukee, for example, children active at MVP sites not only had higher immunization coverage compared with children at sites without MVP, but also had more well-child visits and lead and anemia screenings.¹² In the current retrospective study, information was not collected on why families discontinued WIC. The reasons may be program specific. Focus groups with mothers of WIC children in Milwaukee, however, did not identify WIC-immunization activities as possible reasons for discontinuing WIC, and studies have shown that WIC dropout rates are not significantly greater at sites employing MVP compared to sites without MVP.^{4,5,11-13} Prospective studies can provide a better understanding of why families discontinue WIC early. Additional studies can also help identify the

differences between families who continue in WIC and those who do not. This information would help determine the feasibility of improving WIC retention and may highlight other potential methods to better reach these children.

WIC-immunization linkages continue to benefit thousands of high-risk children. Children who drop out of WIC may be at highest risk for underimmunization, and strategies directed to this group, including improving WIC retention, may be important for programs to consider.

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