Assessment of Missing Immunizations and Immunization-Related Barriers Among WIC Populations at the Local Level

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SYNOPSIS

Objective. Low childhood immunization rates have been a challenge in Colorado, an issue that was exacerbated by a diphtheria-tetanus-acellular pertussis (DTaP) vaccine shortage that began in 2001. To combat this shortage, the locally based Tri-County Health Department conducted a study to assess immunization-related barriers among children in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), a population at risk for undervaccination.

Methods. This study assessed characteristics and perceptions of WIC mothers in conjunction with their children's immunization status in four clinics.

Results. Results indicated poor immunization rates, which improved with assessment and referral. The uninsured were at higher risk for undervaccination. DTaP was the most commonly missing vaccine, and discrepancies existed between the children's perceived and actual immunization status, particularly regarding DTaP. Targeted interventions were initiated as a result of this study.

Conclusion. Local health departments should target immunization-related interventions by assessing their own WIC populations to identify unique vaccine-related deficiencies, misperceptions, and high-risk subpopulations.

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In the last several years, low immunization rates have been a major public health challenge in the state of Colorado. From 2002 to 2004, Colorado was among the lowest-ranked states nationwide in the National Immunization Survey for vaccine coverage among 19- to 35-month-old children.¹ This ranking may in part be related to a shortage of the diphtheria-tetanus-acellular pertussis (DTaP) vaccine, which led the Colorado Board of Health to suspend the fourth and fifth DTaP dose requirements beginning on April 21, 2001.² As a result, in 2002 and 2003 Colorado had the lowest coverage of four or more doses of DTaP than any other state in the nation.¹ The suspension was later lifted with a reinstatement deadline of September 15, 2004.²

Given this setting, Tri-County Health Department (TCHD), a local health department representing three metro-Denver counties, began focusing its immunization efforts on its most vulnerable populations. Children enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), a federal public assistance program, have consistently been identified as a high-risk group for undervaccination.³⁻⁵ Numerous studies have established that immunization status assessment and referral (A/R) can significantly improve immunization rates among WIC-enrolled children.⁶⁻¹⁰

Thus, TCHD began an A/R program in its WIC clinics in 2002. In conjunction with this program, TCHD conducted a study to assess barriers to immunization that may affect the WIC population at a local level. This study assessed characteristics and perceptions of WIC mothers in conjunction with their children's immunization status. The goal of this study was to identify and target high-risk subgroups within the WIC population.

METHODS

A cross-sectional study was conducted in four TCHD WIC clinics from 2002 to 2004. Mothers of children aged 2 months to 5 years were asked to complete surveys for each eligible child. Maternal demographic information was obtained, along with maternal perceptions of children's immunization status. At the WIC clinics, a WIC educator, trained by a public health nurse, collected each child's immunization records. A public health nurse reviewed each child's vaccine records and discussed deficiencies with the WIC educator, who then provided education to the mother on vaccine requirements.

Children were considered up-to-date (UTD) if they had met the appropriate requirements for the 4:3:1:3:3:1 series of vaccines, given their age and the

modified DTaP requirements as a result of the shortage. This series includes requirements for DTaP, *Haemophilus Influenzae* type B (Hib), measles/mumps/rubella (MMR), hepatitis B, polio, and varicella vaccines.¹ Non-UTD children were referred to either TCHD immunization clinics or to area physicians to receive missing vaccinations. In three of the four clinics, non-UTD children were then followed, and their vaccination status was reviewed again at their following WIC appointment (within one to three months).

In three clinics, random days were selected to conduct the study. On those random days, all eligible clients were asked to participate when they arrived for their appointments. In the smallest clinic, Clinic D, clients were asked to participate every day during a three-month period.

Data analysis was conducted in SAS.¹¹ Descriptive statistics on the children's immunization status were assessed and compared with maternal perceptions. Maternal demographic variables were then assessed as predictors of their children's vaccination status using multiple logistic regression modeling. Four regression models were created, one for each clinic. The regression models each included insurance status, race/ethnicity, maternal age, number of children, and education levels.

RESULTS

Data were obtained on a total of 1,571 mother-child pairs. Mothers with multiple children and, hence, multiple surveys, were de-duplicated for the regression analysis of maternal characteristics, leaving a total of 1,232 mothers. Mothers in all four clinics were similar in mean age, education, and mean number of children (Table 1). With regard to racial and ethnic distribution, in all clinics the predominant groups were Hispanic and non-Hispanic white people, which was consistent with the ethnic distribution of the clinics' geographic locations. Clinic B had the highest percentage of Hispanic white respondents (63%), while clinic D had the highest group of non-Hispanic white respondents (60%). Insurance coverage was also similar in all four clinics. The majority of clients at each clinic had some form of public insurance, while 10% to 17% had no form of insurance at all (Table 1).

On vaccine record review, 64% to 74% of children were UTD. Mother-reported UTD rates were much higher, ranging from 85% to 94%. In the three clinics in which follow-up was conducted, UTD rates improved after the A/R intervention (Table 2). In the three clinics in which missing vaccine types were assessed, a wide range of vaccines was found to be missing

Table 1. Maternal demographic characteristics by clinic site

Clinic	A	B	C	D
Mean age	26.4	26.7	26.6	27.4
Mean number of children	2.4	2.3	2.1	2.2
Completed high school (percent)	43	43	38	38
Race (percent)				
Hispanic white	45	63	44	33
Non-Hispanic white	42	27	40	60
Other	13	10	12	7
Insurance (percent)				
Public	62	71	66	62
Private	28	18	17	28
None	10	11	17	10

among non-UTD children (Figure). The majority of non-UTD children (68% to 87%) were missing the DTaP vaccine (Figure). Of children whose mothers reported they were UTD, 22% to 31% were actually lacking vaccinations. Among these children, DTaP was the most common vaccine missing, with 65% to 85% of non-UTD children lacking the vaccine.

On logistic regression analysis, prior to adjustment for other variables, insurance status was significantly associated with UTD status in three clinics. Education and number of children were also significantly associated with UTD status prior to adjustment, but only in one out of four clinics. After controlling for maternal age, race, education, and number of children, those with public insurance were significantly more likely to be UTD than the uninsured, in three of the four clinics. Significant odds ratios ranged from 2.5 to 7.1 (Table 3). After adjustment, no other variables were significantly associated with UTD status in more than one clinic.

DISCUSSION

The 2002–2004 period was a challenging time in Colorado with regard to immunizations. Given the circumstances, TCHD chose to explore barriers to immunization among high-risk groups, such as the WIC population. In TCHD's study, baseline UTD rates for its WIC population were substantially below the national, *Healthy People 2010* target of 90%, confirming the undervaccination of this group.¹² Moreover, in the TCHD study, as in numerous other studies, A/R interventions improved these UTD rates.^{6–10}

In this study, numerous vaccine types were found to be missing among non-UTD children. However, an important finding for TCHD was the poor DTaP coverage among its WIC population, along with the discrepancies between mother-reported and actual UTD status with regard to DTaP. This discrepancy may have occurred due to confusion related to the DTaP vaccine shortage. This finding illustrated the need for local health departments to conduct their own assessments on vaccine coverage within their WIC populations, rather than simply rely on national data, as missing vaccines may vary based on location or unique regional circumstances.

This finding also highlights the need for TCHD to target DTaP specifically in educational messages for WIC mothers, particularly now that the shortage has ended, as it may add further confusion about DTaP dose requirements. With a 116% rise in reported pertussis cases in the TCHD jurisdiction in 2004, it is important to educate WIC mothers about pertussis as well, thereby further emphasizing the importance of vaccination.

The findings regarding DTaP may also affect future A/R strategies employed at TCHD WIC clinics. Research has suggested assessing DTaP coverage alone in WIC clinics as a proxy for assessing overall UTD rates, thereby reducing workload.^{13,14} While this strategy may be valuable in some locales, it may be less useful in the

Table 2. Response rates and UTD rates by clinic site

Clinic	When data collected	N	Response rate (percent)	Mother-reported UTD rate (percent)	Actual UTD rate (percent)	Post-A/R UTD rate (percent)
A	January–February 2002	271	78	86	68	No follow-up
B	October–November 2002	387	80	88	74	84
C	May–June 2003	366	83	85	64	79
D	March–May 2004	547	88	94	68	80

A/R = assessment and referral

UTD = up-to-date

Figure. Percentage of non-UTD children missing specific vaccines^a

^aThis information was not collected in Clinic A.

MMR = measles/mumps/rubella

Hib = Haemophilus Influenzae Type B

DTaP = diphtheria-tetanus-acellular-pertussis

UTD = up-to-date

TCHD setting. In Clinic D, for example, while DTaP was the most commonly missing vaccine among non-UTD children (68%), counting only these children as non-UTD would have missed 32% of non-UTD children. This strategy would have artificially inflated the baseline UTD rate in Clinic D from 68% to 78%.

Assessing DTaP alone in TCHD WIC clinics may thus be less effective in identifying non-UTD children. In some WIC settings, missing non-UTD children may be less important as compared to workload. However, given the immunization-related challenges in Colorado, TCHD's goal was to identify as many non-UTD children as possible, making this work-reducing strategy less viable. Local public health agencies should consider assessing their own goals, along with DTaP coverage in their own WIC populations, prior to applying this method.

This study also helped identify immunization-related barriers specific to the TCHD WIC population. Other studies have shown higher risks of undervaccination based on factors such as maternal race, education, number of children, and insurance status.^{5,15,16} In TCHD's WIC population, it appears that lack of insurance is an important risk factor. These clients represent a

vulnerable subpopulation that should be targeted in future interventions.

This study had several limitations. Differences in sampling methods at one of the clinics prevented merging of the data from all four sites. Merging would have given greater power to the analysis, and may have

Table 3. Odds of being UTD with public insurance vs. no insurance by clinic^a

Clinic	Percent of UTD children with public insurance	Percent of UTD children with no insurance	AOR (95% CI)
A	62	38	7.1 (2.2, 23.0) ^b
B	78	59	2.7 (1.2, 6.1) ^b
C	67	48	2.5 (1.3, 5.0) ^b
D	65	63	1.1 (0.5, 2.2)

^aControlling for maternal age, race, education, and number of children

^bStatistically significant values

UTD = up-to-date

AOR = adjusted odds ratio

CI = confidence interval

elucidated other significant associations. Another limitation was that no follow-up assessment or review of missing vaccines was done in Clinic A, which limited our analysis of that site.

As a result of this study, several actions have been taken. TCHD is now conducting A/R interventions at all of its WIC clinics. Moreover, TCHD's WIC immunization programs are increasing educational efforts regarding DTaP as well as pertussis. Efforts are also being made to identify and educate uninsured WIC mothers about low-cost or free vaccination programs available at TCHD and throughout the community.

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