Immunization Status of Refugee Children after Resettlement

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Introduction

Refugees arriving in the United States are a heterogeneous group and their medical needs vary based on their country of origin and transit, length of time as a refugee, and quality of health care prior to arrival. Refugee children are at risk for vaccine preventable diseases due to under-vaccination, which can have individual as well as public health implications. In recent years, importation of infectious diseases has been of concern. For example, 89% of measles cases in the United States in the first half of 2008 were attributable to importations of disease.[1] Three percent of imported measles between 1997 and 2001 occurred specifically in refugees.[2] In 2006 there was an outbreak of wild poliovirus infection in Kenyan refugee camps where US-bound refugees were residing, highlighting the need for continued high rates of vaccination.[3] Newly arrived refugees usually resettle near other recent arrivals within a city, increasing their potential exposure.

Unlike other immigrants, many refugees arrive with no documentation of immunization. Meropol found that only 39% of a predominantly Vietnamese refugee population had evidence of adequate immunization at their initial visit.[4] More recently, a study of adult and pediatric refugees in Minnesota found that most refugees lacked adequate vaccination at arrival.[5] Although many refugees lack documentation, some may have natural immunity to these diseases or they may have received vaccination for which no documentation exists.[6] However, with the exception of varicella, it is cost effective to re-start immigrant and refugee children on the catch-up immunization schedule if they lack documentation, rather than serotesting.[6-8]

Although studies have examined immunization status upon arrival, less is known about the adequacy of catch-up vaccination after resettlement. Adequate vaccination after resettlement is important for protection against the spread of vaccine preventable diseases, as well as for the individual child who requires these vaccines for school entry and change of immigration status to that of a legal permanent resident. Our primary objective for this study was to determine the percent of children up-to-date on vaccines after one year in the United States. Our secondary objective was to identify risk factors including age and primary care follow-up that predict under-immunization one year after resettlement.

Methods

We performed a retrospective chart review of refugee children at Rhode Island Hospital/Hasbro Children's Hospital, the only children's hospital in the state. Refugee children were identified by obtaining a list from the International Institute of Rhode Island of all refugees who arrived in Providence between November 2003 and November 2006. The International Institute is one of two volunteer organizations in Rhode Island that helps with the resettlement of refugees. Most refugees arriving in Providence are resettled through this organization. The list included names of refugees with their date of birth, date of arrival, and country of origin. Refugees 0-18 years of age were extracted and hospital electronic records were accessed to determine who was seen at the Hasbro Children's Hospital clinics. Inclusion criteria were: Age 0-18 years and at least one physician visit at one of the Hasbro Children's Hospital clinics (Adolescent Medicine, Hasbro Primary Care, or Medicine/Pediatrics). This time frame was chosen to ensure that all children had been in the United States for at least 15 months at time of chart review. This study was reviewed and approved by the Rhode Island Hospital and Rhode Island Department of Health Institutional Review Boards.

Age, sex, date of arrival to the United States, country of origin, and any prior immunizations were recorded from the initial visit. Immunizations and number of **primary care provider** (**PCP**) visits were extracted for the first 15 months after arrival. PCP visits included well child, follow-up, and sick visits to the clinics. In order to capture children who may have changed primary care providers, immunizations were also extracted from the Rhode Island Department of Health KIDSNET Database, which is the state's immunization registry. KIDSNET captures most children in the state, with 152 out of 176 pediatric providers participating in the program and over 200,000 children in the database as of April 2007.[9] Only vaccines administered in Rhode Island are included. Information was gathered for the first 15 months after arrival in order to allow up to 90 days for an initial medical screening to occur and still have at least 12 months of primary care follow-up to receive necessary vaccines.

Up-to-date immunization status was determined using the Red Book recommendations for catch-up immunization.[10] A child was considered up-to-date for a specific vaccine if they received the age-based recommended number of doses that could be given, according to minimum intervals, in one year from the time of first clinic visit. Although information

Table 1. Sample Characteristics (N=198)

Variable	N (%)
Sex	
Male	98 (49)
Female	102 (51)
Country of Origin	
Liberia	140 (71)
Somalia	29 (14)
Burundi	16 (8)
Ethiopia	4 (2)
Other	10 (5)
Age at arrival	
0-35 months	16 (8)
36-83 months	50 (25)
7 years and older	132 (67)

was recorded for the first 15 months *after arrival*, children were up-to-date as long as they had the number of vaccines that could be given in 12 months *from the first clinic visit*. Up-to-date was defined in this way to give children a window of time to schedule the initial visit as well as a yearly physical one year later. For scheduling reasons, children may not have their initial visit immediately after arrival or their yearly physical scheduled exactly 12 months from their first visit.

HepB vaccination was up-to-date if evidence of immunity or three doses of vaccine. Tetanus-containing vaccination was up-to-date if three doses of DTaP or **diphtheria, tetanus toxoids and pertussis (DTP)** for 0-18 month olds, four doses of DTaP or DTP for 19-83 month olds, and three doses of **tetanus and diphtheria toxoids (Td)** or **tetanus, diphtheria toxoids and acellular pertussis (Tdap)** for children seven years and older. Polio vaccination was up-to-date if four doses of **inactivated polio vaccine (IPV)** for children less than four years, three doses of IPV for children four years and older, and four doses of IPV or **oral polio vaccine (OPV)** for children who received at least one dose of OPV. MMR or measles vaccination was up-to-date if one dose of vaccine for children less than seven years old and two doses if seven years or older. Varicella was up-to-date if evidence of immunity or if 1 dose of vaccine for children less than 13 years and two doses for children 13 years and older. **Pneumococcal vaccine (PCV)** was up-to-date if three doses for 0-12 month olds, two doses for 13-23 month olds, one dose for two-to-four year olds, and zero doses for children five years and older. **Haemophilus influenzae type b conjugate vaccine (Hib)** vaccination was up-to-date if two doses for 0-15 month olds, one dose for 16-59 month olds, and zero doses for children five years and older. Children were considered up-to-date overall if they were up-to-date for all seven vaccines.

Only half of recently arrived refugee children initially seen at a primary care clinic were up-to-date on all vaccines 15 months after arrival in the United States.

Age was divided into categories based on the requirements of the catch-up immunization schedule. Overall up-to-date status was calculated for 0-35 month olds to allow comparisons with **National Immunization Survey (NIS)** immunization rates, which are routinely done for 19-35 month olds. We included the 0-18 month olds due to small numbers.

Results

Sample characteristics

Between November 2003 and November 2006, 254 refugee children arrived through the International Institute of Rhode Island and 218 (86%) were seen at the Hasbro Children's Hospital clinics. Of these, 204 charts were available for review and five of the 204 patients were excluded because they received one-time immunizations, without a physician visit. Another patient was excluded because she originally resettled in another state. All patients had been in the United States for at least 15 months. The majority of refugees (71%) were Liberian and the mean age at arrival was 8.8 years with a range of four months to 18.7 years (Table 1). The mean time from arrival to the first primary care appointment was 27 days (SD=20). The mean length of primary care follow-up during the first 15 months after arrival was nine months (SD=5). 51% of patients continued primary care follow-up for at least one year with visits recorded at 12 months or longer after their initial clinic visit. Nine percent of patients never returned after the initial visit.

Immunizations status

Only 4% of patients had any immunizations documented prior to arrival. Within the first 15 months after arrival, 51% were up-to-date for all seven vaccines (Figure 1). Eighty-nine percent (176/198) were tested for hepatitis B and 5.7% (10/176) were immune and required no further vaccination. Seventy percent of children who continued to receive primary care in the clinics one year after their initial visit were up-to-date for all vaccines.

Fifty percent of children 0-35 months of age at arrival were up-to-date for all vaccines 15 months after arrival. Compared to children seven years of age and older, 36-83 month olds were significantly less likely to be completely immunized after 1 year of primary care, and children with a greater number of PCP visits were more likely to be up-to-date when adjusted for age (Table 2).

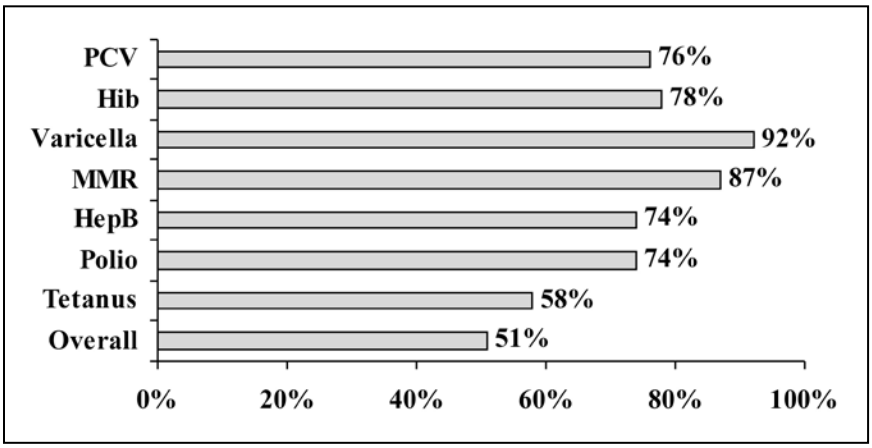

Figure 1. Up-to-date immunization rates after one year.

Discussion

Only half of recently arrived refugee children initially seen at a primary care clinic were up-to-date on all vaccines 15 months after arrival in the United States. Vaccination rates for most individual vaccines were higher (74-92%) with the exception of tetanus-containing vaccines, which had a completion rate of 58%. This is not surprising given the larger number of tetanus-containing vaccines required compared to many of the other vaccines. In addition, a six month minimum interval is needed prior to administra-

Table 2.The association of age and number of primary care (PCP) visits with overall up-to-date immunization

		Unadjusted		Adjusted for age and # of visits	
		OR (95% CI)	P value	OR(95% CI)	P value
Age	0-35 months	0.78 (0.28-2.21)	0.65	0.42 (0.13-1.36)	0.15
	36-83 months	0.48 (0.25-0.94)	0.03*	0.36 (0.17-0.77)	0.008*
	7 years and up	Reference group	0.10	Reference group	0.02
Number of PCP visits		1.32 (1.18-1.49)	0.00*	1.37 (1.20-1.56)	0.00*

* P < 0.05

tion of the final vaccine in the series and several visits over a longer period of time are required to achieve full vaccination.[10] Consistent with this finding, PCP visits in the first 15 months of resettlement were associated with increased rates of complete vaccination.

The overall vaccination rate found in this population of refugees is much lower than the national and Rhode Island rates of vaccine coverage of 77% and 80% found in 19-35 month olds in the 2006 **National Immunization Survey (NIS)**.[11] In order to make comparisons with national and state immunization coverage rates, the overall completion rate specifically for 0-35 month olds was calculated and was also low at 50%. With the exception of tetanus-containing vaccines, rates of completion for individual vaccines for refugees were more comparable to NIS rates. Rates were derived from the entire sample of 198 refugees. Immunization status for individual vaccines was not calculated specifically for 0-35 month olds because of the small size of the group. Rates of MMR or measles vaccination were 87% and 92% for refugees in this study and in the NIS sample, respectively. Eighty-seven percent were up-to-date for PCV in our sample as well as in the NIS. Refugees had a higher rate of varicella vaccination (92%) than the NIS (89%).

Vivier et al (2001) examined immunization status for Rhode Island children aged 19-35 months enrolled in a Medicaid managed care program.[12] The study included only active patients and did not specifically address refugees. However the sample was more comparable to the current study because it included patients from the same hospital-based clinic practices. The authors found an overall immunization coverage rate of 79%, similar to the NIS rate.

Methodological differences between the current study and the NIS and Rhode Island Medicaid study discussed above limit direct comparison. These include differences in the sample (refugees 18 years and under versus 19-35 month olds in the general population) and definition of up-to-date (catch-up versus primary immunization schedule). The catch-up schedule requires refugees to receive nearly the same number of vaccines in a much shorter time period than children born here who start on the regular immunization schedule. This is particularly true for this refugee sample, which was essentially unvaccinated at arrival, with only 4% having documentation of any vaccines. The low rate of *any* vaccination prior to arrival differs from previous studies, which found higher rates of *adequate* vaccination at arrival.[4, 5] Differences in country of origin and health care access prior to arrival likely explain this.

Our finding of 51% complete vaccination is within the range of 33-60% found in a study of 19-35 month old refugees and immigrants in San Diego county.[13] However, the sample and methods used differed from the current study. The San Diego county study derived immunization information from interviews with immigrant and refugee families with children, some of whom were born in the United States, while we examined immunization records from clinic medical charts and a web-based statewide immunization registry only for newly arrived refugee children starting over on a catch-up schedule.

Another key finding was that refugees who followed up for an entire year after their initial medical visit were more likely to be completely vaccinated, with an overall completion rate of 70%. In order to achieve up-to-date status, adequate follow-up is needed. The association found in this study between number of PCP visits and increased vaccination status is consistent with other studies of the association between immunization status and a medical home. Adequate primary care follow-up and the concept of medical home have been defined in a variety of ways. In the study of preschool children in Rhode Island mentioned above, Vivier et al. found that children who were up-to-date on vaccines had more primary care visits (17.3 versus 12.3 visits).[12] Using NIS data, Smith et al (2005) found that 19-35 month olds eligible for the Vaccines for Children program were more likely to be up-to-date if their parents reported a primary care provider who provided ongoing care for the child (72.3% versus 63.5%).[14] Irigoyen et al (2004) examined immunization status in association with length of follow-up at the initial source of care for children under three years of age in New York City.[15] The authors found that children were 17.5 times more likely to be up-to-date at 18 months of age if they had continuity of care at the initial source of primary care for 12-14 months.

A major strength of this study was the ability to capture most of the refugee children in the state. The International Institute resettles most refugees arriving in Rhode Island and largely refers to the Hasbro Children's Hospital clinics. In addition, the state's immunization registry was accessed to capture any children who may have had vaccines at another practice within the state. Finally, this is the first study to our knowledge to address immunization rates in newly arrived refugee children after a year of resettlement using physician and health department records.

Limitations of this study include a relatively homogenous sample of mostly Liberian children at one institution, which may limit generalizability to different countries of origin and clinical settings. In addition, 9% of patients were lost to follow-up after their initial physician visit. They may have received vaccinations elsewhere, in an out-of-state practice or with a Rhode Island provider not participating in the state registry. If

these patients were vaccinated elsewhere, immunization rates found by our methods would be an underestimate of actual immunization coverage.

It should also be noted that this study utilized stringent criteria to define up-to-date status. This was based on minimum intervals on the catch-up vaccination schedule. Though fewer vaccinations likely confer some protection, multiple doses of vaccine are required to ensure complete protection.[10] Stringent criteria were chosen to obtain conservative estimates of vaccination especially given the need for these vaccinations for school and change of status to that of legal permanent resident, which refugees can apply for one year after arrival.

In conclusion, this is one of few studies to evaluate vaccination status in refugee children after resettlement. The implications of our findings are that although refugee children have low overall rates of immunization, improved primary care follow-up after arrival may increase immunization coverage.

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