



Cost of Vaccinating Refugees Overseas Versus After Arrival in the United States, 2005

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3 tables omitted

SINCE 2000, APPROXIMATELY 50,000 refugees have entered the United States each year from various regions of the world.¹ Although persons with immigrant status are legally required to be vaccinated before entering the United States, this requirement does not extend to U.S.-bound persons with refugee status.* After 1 year in the United States, refugees can apply for a change of status to that of legal permanent resident, at which time they are required to be fully vaccinated in accordance with recommendations of the Advisory Committee on Immunization Practices (ACIP).^{2,3} A potentially less costly alternative might be to vaccinate U.S.-bound refugees overseas routinely, before they depart from refugee camps. To compare the cost of vaccinating refugees overseas versus after their arrival in the United States, CDC analyzed 2005 data on the number of refugees, cost of vaccine, and cost of vaccine administration. This report summarizes the results of that analysis, which suggested that, in 2005, vaccinating 50,787 refugees overseas would have cost an estimated \$7.7 million, less than one third of the estimated \$26.0 million cost of vaccinating in the United States. Costs were calculated from the perspective of the U.S. health-care system. To achieve public health cost savings, routine overseas vaccination of U.S.-bound refugees should be considered.

To facilitate the cost analysis, refugees who were U.S. bound in 2005 were

divided into age groups, using the CDC Information on Migrant Populations (IMP) database.† For 2005, IMP contained demographic information on 50,787 refugees.‡ Two assumptions were made in the cost analysis: (1) that 100% of refugees would receive vaccinations and (2) that all refugees would be vaccinated in accordance with the ACIP schedule§ within either 180 days of departure or 180 days of their arrival in the United States. All costs were estimated in 2005 dollars; because all costs were incurred in less than 1 year, no future costs or discounts to current values were calculated. The following equation was used to calculate the cost of vaccinations overseas and in the United States:

$$\begin{aligned} \text{Cost of vaccination} = & \\ & (\text{cost of vaccine/dose} \times \text{doses/} \\ & \text{person} \times \text{persons}) + \\ & (\text{cost of administration/dose} \times \text{doses/} \\ & \text{person} \times \text{persons}). \end{aligned}$$

The cost of purchasing each of the 10 vaccines recommended by ACIP in 2005|| in the United States was assumed to be in accordance with the CDC vaccine contract price list.⁴ The cost of administering vaccines in the United States for persons aged ≤18 years was established as \$14.95 per child vaccination¶; this assumption was based on the average of maximum allowable regional charges in the federal Vaccines for Children program.⁵ The cost of administering vaccine to adults was established at \$18.81 per adult vaccination; this assumption was based on the average of maximum allowable state charges in the 2005-2006 Medicare Administration and Vaccine Reimbursement Rates.⁶

The costs of obtaining each of the 10 vaccines overseas were based on the 2005 United Nations Children's Fund (UNICEF) vaccine price list⁷ or in-country purchase prices where UNICEF prices were not available.# The total cost of administering all vaccine doses to all refugees overseas was

estimated from vaccination program budget estimates (CDC, unpublished data, 2005) and costs previously billed by the International Organization for Migration (IOM). Overseas administration costs then were calculated as \$48.17 per refugee, regardless of the number of vaccinations.

By age group, the estimated cost of vaccinating all refugees in the United States ranged from \$64,945 for infants aged 0-3 months to \$11,669,263 for persons aged 19-64 years. The estimated cost of vaccinating all refugees overseas ranged from \$48,706 to \$2,685,146 for the same respective age groups. Total cost of vaccinating 50,787 refugees in 2005 would have been \$25,990,579 in the United States, compared with \$7,706,026 overseas.

When costs were analyzed by vaccine type, nine of the 10 recommended vaccines were less costly when administered overseas than in the United States. Only pneumococcal vaccine cost less to administer in the United States (\$1,085,320) than overseas (\$1,490,493).

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CDC Editorial Note: The results of the analysis described in this report suggest that vaccinating refugees overseas would be less costly than after their arrival in the United States. The cost of vaccination, both overseas and in the United States, has two components: the cost of the vaccine and the cost of its administration. The findings indicate that most of the cost savings would result from savings in administration costs. For 2005, vaccine administration costs overseas were estimated at approximately one sixth of vaccine administration costs in the United States.

Refugee vaccinations in the United States are paid for by various domestic agencies, including state and local

health departments, Medicaid, the federal Vaccines for Children Program, and the Refugee Medical Assistance program of the U.S. Department of Health and Human Services' Office of Refugee Resettlement. Unknown proportions of refugees have acquired immunity to vaccine-preventable diseases or have received routine vaccinations overseas. However, record-keeping for vaccinations often is unreliable, and the majority of refugees arrive in the United States with vaccinations undocumented. In the event of an outbreak in an overseas camp of U.S.-bound refugees, the U.S. Department of State or other U.S. agencies usually will bear the cost of emergency vaccinations. If U.S.-bound refugees were vaccinated overseas routinely, the Department of State or other U.S. agencies likely also would bear those costs.

In addition to cost savings, vaccination of refugees overseas has the potential to reduce importation of diseases into the United States and reduce costs associated with response to outbreaks. Refugees often come from areas where vaccine-preventable diseases are endemic (e.g., measles in Africa). During 2004-2007, CDC responded to 19 outbreaks of vaccine-preventable diseases that occurred in overseas camps housing U.S.-bound refugees.

The findings in this report are subject to at least two limitations. First, assumptions regarding overseas prices of vaccines were based on the UNICEF price list or from in-country purchase prices. However, purchase prices of vaccines might differ from one region of a country to another, which might result in overestimates or underestimates of the actual cost of vaccinating overseas. Second, this analysis does not include potential direct and indirect savings (e.g., medical costs and lost productivity) resulting from any reduction in the number of treated cases of vaccine-preventable disease and their sequelae. Also not included are any savings resulting from the potential reduction in costs of responding to outbreaks of vaccine-preventable diseases

among refugees and the communities in which they settle. In October 2006, two cases of poliomyelitis in the Dadaab refugee camp in Kenya resulted in U.S. containment measures that cost \$309,283.⁸ In 2004, the cost of containing one case of imported measles in Iowa was \$142,452⁹; in 2005, the cost of controlling a measles outbreak that resulted from a case of imported measles in Indiana was \$167,685.¹⁰

This analysis suggests that substantial cost savings can be realized by vaccinating U.S.-bound refugees overseas, before they depart for the United States. In addition, vaccinating refugees overseas might help to reduce importation of vaccine-preventable diseases, reducing the costs of responding to and containing outbreaks that result from imported disease.

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REFERENCES

1. US Department of Homeland Security. *Yearbook of immigration statistics: 2005*. Washington, DC: US Department of Homeland Security, Office of Immigration Statistics; 2006.
2. CDC. Recommended childhood and adolescent immunization schedule—United States 2006. *MMWR*. 2006;54(52):Q1-Q4.
3. CDC. Recommended adult immunization schedule—United States, October 2006–September 2007. *MMWR*. 2006;55(40):Q1-Q4.
4. CDC. CDC vaccine price list 2006. Atlanta, GA: US Department of Health and Human Services, CDC; 2006.
5. CDC. Vaccines for Children (VFC) maximum regional charges for vaccine administration by state. Atlanta, GA: US Department of Health and Human Services, CDC; 2004. Available at <http://www.cdc.gov/vaccines/programs/vfc/fee-fedreg.htm#table>.
6. Centers for Medicare and Medicaid. 2005-2006 immunizers' question and answer guide to Medicare coverage of influenza and pneumococcal vaccination benefits. Dallas, TX: Centers for Medicare and Medicaid; 2005. Available at <http://www.cms.hhs.gov/adultimmunizations/downloads/0506qanda033006.pdf>.
7. United Nations International Children's Fund (UNICEF). 2005 vaccine projections: quantities and pricing. New York, NY: UNICEF; 2005. Available at http://www.who.int/immunization_delivery/new_vaccines/1.Projections_Vaccines_2005.pdf.
8. CDC. U.S.-incurred costs of wild poliovirus infections in a camp with U.S.-bound refugees—Kenya, 2006. *MMWR Morb Mortal Wkly Rep*. 2008; 57(9):232-235.
9. Dayan GH, Ortega-Sanchez IR, LeBaron CW, Quinlisk MP; The Iowa Measles Response Team. The

cost of containing one case of measles: the economic impact on the public health infrastructure—Iowa 2004. *Pediatrics*. 2005;116(1):e1-e4.

10. Parker AA, Staggs W, Dayan GH, et al. Implications of a 2005 measles outbreak in Indiana for sustained elimination of measles in the United States. *N Engl J Med*. 2006;355(5):447-455.

*Immigration and Nationality Act section 212 (8 U.S.C. 1182)(a)(1)(A)(ii) as amended by section 341 of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996.

†IMP is an internal CDC database maintained by the Division of Global Migration and Quarantine that contains information on refugees, including date of birth, date of arrival in the United States, overseas medical screening, and follow-up for certain medical conditions.

‡The total number of refugees in 2005 was 53,738. However, the IMP database did not include information on 2,951 refugees.

§The ACIP schedule includes catch-up immunizations. Refugees do not generally have proof of previous immunizations; therefore, they generally receive all the vaccinations in the schedule.

||Diphtheria-tetanus-acellular pertussis/tetanus-diphtheria; *Haemophilus influenzae* type b; hepatitis A; hepatitis B; inactivated poliovirus; influenza; measles, mumps, and rubella; meningococcal; pneumococcal; and varicella.

¶The administration fee was charged for each vaccination performed, regardless of whether one vaccine was administered in one visit or many vaccines in one visit.

#UNICEF prices were not available for hepatitis A, *Haemophilus influenzae* type B, meningococcal, pneumococcal, and varicella vaccines.

Interim Within-Season Estimate of the Effectiveness of Trivalent Inactivated Influenza Vaccine—Marshfield, Wisconsin, 2007-08 Influenza Season

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DURING CLINICAL TRIALS, THE EFFICACY of vaccination with inactivated influenza vaccines for the prevention of serologically confirmed influenza infection has been estimated as high as 70%-90% among healthier adults. However, the effectiveness of annual influenza vaccination typically is lower during those influenza seasons when a suboptimal match between the vac-