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A comparative cost analysis of the Vaccination Program for US-bound Refugees ☆

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ABSTRACT

Background: Vaccination Program for US-bound Refugees (VPR) currently provides one or two doses of some age-specific Advisory Committee on Immunization Practices (ACIP)-recommended vaccines to US-bound refugees prior to departure.
Methods: We quantified and compared the full vaccination costs for refugees using two scenarios: (1) the baseline of no VPR and (2) the current situation with VPR. Under the first scenario, refugees would be fully vaccinated after arrival in the United States. For the second scenario, refugees would receive one or two doses of selected vaccines before departure and complete the recommended vaccination schedule after arrival in the United States. We evaluated costs for the full vaccination schedule and for the subset of vaccines provided by VPR by four age-stratified groups; all costs were reported in 2015 US dollars. We performed one-way and probabilistic sensitivity analyses and break-even analyses to evaluate the robustness of results.
Results: Vaccination costs with the VPR scenario were lower than costs of the scenario without the VPR for refugees in all examined age groups. Net cost savings per person associated with the VPR were ranged from $225.93 with estimated Refugee Medical Assistance (RMA) or Medicaid payments for domestic costs to $498.42 with estimated private sector payments. Limiting the analyses to only the vaccines included in VPR, the average costs per person were 56% less for the VPR scenario with RMA/Medicaid payments. Net cost savings with the VPR scenario were sensitive to inputs for vaccination costs, domestic vaccine coverage rates, and revaccination rates, but the VPR scenario was cost savings across a range of plausible parameter estimates.
Conclusions: VPR is a cost-saving program that would also reduce the risk of refugees arriving while infected with a vaccine preventable disease.

1. Introduction

In fiscal year (FY) 2015, about 70,000 refugees resettle in the United States [1]. Unlike other immigrants, refugees are not required to have any vaccinations before US arrival. Lack of immunity among refugees may cause outbreaks of vaccine-preventable diseases (VPDs) in US communities and lead to significant public health-response costs [2]. To improve the health of US-bound refugees and reduce costs, the US Centers for Disease Control and Prevention (CDC) initiated the overseas Vaccination Program for US-bound Refugees (VPR) in December 2012 [3]. VPR is a collaboration between the US CDC's Division of Global Migration and Quarantine and the US Department of State's Bureau of Population, Refugees, and Migration. The program is implemented mainly by the International Organization for Migration (IOM). For 2012 through 2015, IOM administered vaccines in six countries—Ethiopia, Kenya, Malaysia, Nepal, Thailand, and Uganda. IOM and CDC are expanding VPR to 21 countries for FY 2017 [3]. In addition to administering the recommended vaccines, IOM transcribes valid vaccination records into official documents to share with health departments after refugees arrive.

☆ The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the institutions with which the authors are affiliated.

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After arrival in the United States, refugees are covered by either Medicaid or federally funded Refugee Medical Assistance (RMA) for at least 8 months [4]. During this period, vaccines for refugees would be primarily reimbursed through direct or indirect federal payments [4]. The US CDC recommends that refugees undergo a comprehensive medical exam within 90 days after arrival. Vaccines may be delivered at the comprehensive exam or follow-up appointments.

Relative to the baseline scenario, in which all vaccines are delivered after arrival in the United States, VPR is expected to decrease vaccination costs per fully vaccinated individual because vaccination costs are lower overseas compared to costs in the United States. We conducted a comparative cost analysis of fully vaccinating a US-bound refugee according to the Advisory Committee on Immunization Practices (ACIP) recommendations for age, with and without VPR, to estimate cost savings.

2. Data and methods

We estimated the costs for refugees to complete the relevant age-appropriate, ACIP-recommended vaccination schedule, according to two scenarios: (1) the pre-2012 baseline with no VPR, in which all refugee vaccinations would occur after US arrival ('No VPR' scenario) and (2) the current situation with VPR, and US follow-up to complete recommended vaccination schedules ('VPR' scenario). Under the 'VPR' scenario, refugees received one or two doses of selected vaccines prior to departure and additional vaccines to complete their age-appropriate schedule after resettlement in the United States. All costs were estimated in 2015 US dollars from the US payers perspective [5]. Costs were not discounted because we assumed refugees would complete age-specific, recommended catch-up schedules [6,7] within a 1-year time horizon.

We included all age-specific, ACIP-recommended vaccines except influenza in the catch-up schedule in the analyses [6,7]. To facilitate the analyses, US bound-refugees were divided into four age groups based on the age they were able to start immunization: (1) infant to 4.9 years old, (2) 5–10.9 years old, (3) 11–18.9 years old, and (4) ≥19 years old. VPR provides one to two doses of the following vaccines: hepatitis B (HepB); diphtheria, tetanus, and pertussis (DTP); tetanus, diphtheria (Td); *Haemophilus influenzae* type b (Hib); Pentavalent (HepB-Hib-DTP); oral poliovirus (OPV); and measles, mumps, and rubella (MMR).

2.1. Domestic vaccination costs for refugees

We used Medicaid reimbursement rates as the base case since RMA reimbursement rates are similar to Medicaid rates. Because Medicaid beneficiaries aged 0 through 18 years are eligible for the Vaccines for Children (VFC) program [8], base case and lower-bound costs of pediatric vaccines were estimated using the US CDC purchasing costs for the VFC from the 2015 *Pediatric/VFC Vaccine Price List* [9].

Base case costs of adult vaccines were estimated using 2014 MarketScan Medicaid multi-state data, which was adjusted to 2015 prices by using the average change in private sector prices between 2014 and 2015 [9]. The lower-bound estimates were government purchasing rates for the Section 317 Immunization Program for uninsured or underinsured adults [10], and the upper-bound estimates were private sector prices from the 2015 *Adult Vaccine Price List* [9].

We used Current Procedural Terminology (CPT) codes 90460 and 90461 to estimate vaccine administration fees for refugees younger than 19 years old. For adults, CPT codes 90471 and 90472 were used. Estimated vaccine administration fees for Medicaid beneficiaries in 2015 were used for the base case and lower-bound estimates. The upper-bound cost estimate was the midpoint of private sector fee ranges from Healthcare Solutions' *2015 Physicians' Fee & Coding Guide* [11].

2.2. Overseas vaccination costs for US-bound refugees

For vaccine costs, we used the weighted average cost per dose by vaccine, using FY 2017 country-specific budgets weighted by the expected number of US-bound refugees from each country and the expected numbers of pediatric and adult vaccines purchased. For program administration costs, we assumed that there were fixed and variable costs. The fixed cost per refugee, which is independent of the numbers of doses given to each refugee, included the office, office overhead, and HepB surface antigen (HBsAg) test costs. The variable costs were estimated per dose delivered, and included staff, staff overhead, and non-vaccine operational costs. The lower-bounds are the first quartile of vaccine and program costs across the budgets of the VPR-implementing countries, while the upper-bounds are the third quartile of budgeted costs. We assumed that per dose and per person costs in FY 2017 budget were equivalent to those costs in 2015.

2.3. Estimation of per person costs by scenario

For the 'No VPR' scenario, the number of doses per refugee to achieve full vaccination by age was multiplied by the domestic vaccination cost per dose to estimate domestic vaccination costs per person by vaccine. Per-person vaccination costs by vaccine for each age group were summed to estimate costs of vaccination per refugee.

For the 'VPR' scenario, overseas and domestic vaccination costs were included. For each vaccine provided by VPR, we multiplied the number of doses given per person by the sum of the overseas vaccine and variable program costs per dose. We added estimates for all vaccines required by age group, and added the overseas fixed program cost per person to estimate the total overseas vaccination costs per person. The remaining numbers of doses after arrival were estimated by subtracting the numbers of doses provided by the VPR from the numbers of doses to fulfill the ACIP-recommended schedule by age for each vaccine. Then, we followed the same steps used to estimate domestic vaccination costs under the 'No VPR' scenario to estimate domestic vaccination costs under the 'VPR' scenario.

Because vaccines that are not currently included in VPR incurred the same costs under both scenarios, we separately examined the costs for VPR vaccines (i.e., DTaP/DTP/Tdap/Td, HepB, Hib, IPV/OPV, and MMR) to focus more directly on the relative costs of pre-departure versus post-arrival vaccination costs for US-bound refugees.

2.4. Sensitivity analyses

We conducted sensitivity analyses to evaluate the robustness of our results. We performed one-way sensitivity analyses by setting one cost parameter at the lower- and upper-bound estimates while keeping all other parameters fixed at base case values. In addition, we conducted break-even analyses for domestic coverage rates and domestic revaccination rates. For the base case analysis, we assumed all refugees completed ACIP-recommended vaccination schedules after arrival in the United States. However, some refugees might not complete the vaccination schedule after arrival. Also, some refugees might be unnecessarily revaccinated after arrival because some healthcare providers might not consider overseas doses to be valid.

For break-even analysis, we varied the domestic coverage rates between 0% (no domestic vaccination) and 100% (complete domes-

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