Influenza Vaccine Use In the Americas

Current public health efforts to measure vaccine effectiveness

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Outline

I. Background of seasonal influenza vaccination in LAC
II. Cooperative agreement CDC/PAHO
IV. Multicenter program evaluation in Central America
V. Next steps
Countries and Territories in the Americas with Policies for Seasonal Influenza Vaccination

Out of 45 countries and territories reporting in the Americas

Pending introduction:

- Guyana
- Haiti
- St Kitts
- St Maarten

Source: Country Reports to PAHO, MOH web pages, PAHO/WHO Surveys

Note: Data was not collected from the French Departments (French Guiana, Guadeloupe, Martinique)
Countries and territories in the Americas identified several criteria used to justify seasonal influenza vaccine introduction:

- PAHO’s TAG, WHO and ACIP recommendations
- Morbidity and mortality
- Political decisions
- Cost-effectiveness studies
- As part of the preparation for H5N1 influenza pandemic

Source: Country Reports to PAHO, MOH web pages, PAHO/WHO Surveys
### Countries and territories in the Americas with policies for seasonal influenza vaccination

<table>
<thead>
<tr>
<th>Number of countries with:</th>
<th>2004</th>
<th>2008</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Policies for influenza vaccination</td>
<td>13</td>
<td>35</td>
<td>41</td>
</tr>
<tr>
<td>- Vaccination of children*</td>
<td>6</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>- Vaccination of elderly</td>
<td>12</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>- Vaccination of persons with chronic diseases</td>
<td>9</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>- Vaccination of health workers</td>
<td>3</td>
<td>32</td>
<td>37</td>
</tr>
<tr>
<td>- Vaccination of pregnant women</td>
<td>3</td>
<td>7</td>
<td>22</td>
</tr>
</tbody>
</table>

* This category does not include countries vaccinating only children with chronic diseases

Source: Country Reports to PAHO, MOH web pages, PAHO/WHO Surveys

Note: Data was not collected from the French Departments (French Guiana, Guadeloupe, Martinique)
Use of Seasonal Influenza vaccine and formulations in the Americas 2011

Source: Country and territory reports to PAHO, MOH websites, WHO survey
Percentage of positivity for influenza, National Reference Laboratories Costa-Rica and Panama. 2006-2010
Seasonal influenza vaccination coverage among elderly in Central America, Mexico, and Dominican Republic. 2007-2011

Source: Country reports to PAHO
Seasonal influenza vaccination coverage among children in Central America, Mexico, and Dominican Republic. 2007-2011

Source: Country reports to PAHO
Influenza coverage in pregnant women, in selected countries in LAC, 2011

Seasonal influenza vaccination

Persistent challenges

• Quality of information systems
  – Coverage rates for all targeted populations groups are not routinely available – absence of reliable denominators and inconsistent definitions of high risk groups
  – WHO/UNICEF joint reporting form did not capture vaccine coverage among pregnant women before 2011
• Despite national policies, there is a low vaccine uptake among
  – Pregnant women
  – Health care workers
• Seasonality in tropical countries: questions regarding timeliness of vaccination and formulation
• Two-dose schedule for children <9y vaccinated for the first time
  – Challenges to complete schedules
  – Challenges to calculate vaccine coverage
PAHO/CDC Cooperation on Influenza

- PAHO/CDC have existing CoAG in flu pandemic preparedness (FY2006-2010)
  - Preparedness & Communication
  - Surveillance & Detection
  - Response & Containment
- In FY 2010, interest in expanding scope of CoAg by including influenza vaccination activities
  - Impact evaluation pandemic vaccination
  - Seasonal vaccine effectiveness
Current public health efforts to measure vaccine effectiveness in LAC

Inter-Institutional Collaboration between:

The Centers for Disease Control and Prevention,

Regional Office for Central America—Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET), influenza program and,

The Pan American Health Organization
Objective:
This program evaluation aims to measure the effectiveness of the inactivated trivalent seasonal influenza vaccine against laboratory-confirmed influenza illness using RT-PCR, among vaccination target groups (children and elderly) in Central America: Costa-Rica, El Salvador, Honduras, and Panama.)
Multicenter program evaluation to measure the effectiveness of seasonal influenza vaccine in Central America, April-September 2011 -2013

<table>
<thead>
<tr>
<th>Country</th>
<th>Influenza vaccination target groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>6 months – 10 years with chronic diseases</td>
</tr>
<tr>
<td>El Salvador</td>
<td>6–59 months</td>
</tr>
<tr>
<td>Honduras</td>
<td>6–35 months with chronic diseases</td>
</tr>
<tr>
<td>Panama</td>
<td>6–59 months</td>
</tr>
</tbody>
</table>
Participants, case-definitions, vaccination, and pre-existing conditions status identification

- Design: case-test-negative control

- 1 Case: 3 Controls: identified through sentinel surveillance during April-October, 2011-2013, Central America influenza seasons

- **Cases** = severe acute respiratory infection (SARI) case-patients PCR-confirmed influenza

- **Controls** = SARI case-patients who are PCR-negative for influenza

- Frequency matched by
  - Age-group (aged < 5 or ≥ 60 years)
  - Epidemiologic week of SARI onset

- Vaccination status: abstracted from surveillance and verified by EPI

- Pre-existing medical conditions status: abstracted from surveillance records and hospital charts


Analytical plan a priori

- Calculated proportion of vaccinated and unvaccinated case-patients and influenza negative controls
  - Crude OR = odds of cases and controls being vaccinated
  - VE = (1-RR) * 100
- Explore univariate analysis, collinearity, propensity scoring
- Explored interactions with logistic regression model
  - stratified by age-group (a = child vs. adult) and year (y):

For example:

\[ \text{Case status (0/1)}_{a,y} = \beta_0 + \beta_1 A + \beta_2 S + \beta_3 P + \beta_4 PP + \beta_5 \text{IV}_y + \beta_6 (t_{\text{sari}} - t_{\text{influenza vaccine}}) + \beta_7 \text{PV} + \beta_8 \text{HV} + \beta_9 O \]

Where
- A = Participant's age in years
- S = Sex
- P = Preexisting medical condition (0/1) and/or as the total number of diagnoses
- PP = Proportion of samples testing time for influenza during time (t)
- IV = Influenza vaccine status during year (y)
- PV = Pneumococcus vaccine status up to date
- HV = Haemophilus influenzae vaccine up to date
- O = Oseltamivir treatment within 48 hours of SARI symptom onset
Influenza vaccine effectiveness participants in Central America during 2012

<table>
<thead>
<tr>
<th>Country</th>
<th>Children (N)</th>
<th>Adults (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Salvador</td>
<td>310</td>
<td>54</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>68</td>
<td>101</td>
</tr>
<tr>
<td>Honduras</td>
<td>56</td>
<td>33</td>
</tr>
<tr>
<td>Panama</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>462</td>
<td>192</td>
</tr>
</tbody>
</table>
## Characteristics of participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Cases (N=126)</th>
<th>Controls (511)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age median (IQR)</td>
<td>Children 2 (1-2) Adult 76 (73-81)</td>
<td>Children 1 (1-2) Adult 76 (70-81)</td>
</tr>
<tr>
<td>Males (%)</td>
<td>61 (48)</td>
<td>281 (55)</td>
</tr>
<tr>
<td>Pre-existing conditions</td>
<td>56 (45)</td>
<td>246 (48)</td>
</tr>
<tr>
<td><strong>Influenza vaccine</strong></td>
<td><strong>39 (28)</strong></td>
<td><strong>202 (39)</strong>*</td>
</tr>
<tr>
<td>Pneumococcus vaccine</td>
<td>40 (46)</td>
<td>113 (48)</td>
</tr>
<tr>
<td>Haemophilus vaccine</td>
<td>54 (81)</td>
<td>202 (85)</td>
</tr>
<tr>
<td><strong>Oseltamivir use</strong></td>
<td>5 (5)</td>
<td><strong>132 (25)</strong>**</td>
</tr>
</tbody>
</table>

* p=0.01 in Pearson X² comparing the proportion of cases and controls vaccinated for influenza

** p<0.001 in Pearson X² comparing the proportion treated with oseltamivir
<table>
<thead>
<tr>
<th>Country</th>
<th>Number of participants</th>
<th>Female (%)</th>
<th>Diagnosed pre-existing medical conditions</th>
<th>Influenza vaccine status</th>
<th>Pneumovax status</th>
<th>Influenza Haemophilus influenzae vaccine</th>
<th>Oseltamivir treatment within 48 hours of SARI onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Salvador</td>
<td>Children=310</td>
<td>126 (42%)</td>
<td>42 (14%)</td>
<td>90 (29%)</td>
<td>146 (56%)</td>
<td>249 (95%)</td>
<td>19 (6%)</td>
</tr>
<tr>
<td></td>
<td>Adults=54</td>
<td>22 (54%)</td>
<td>30 (73%)</td>
<td>8 (15%)</td>
<td>3 (8%)</td>
<td>7 (18%)</td>
<td>2 (5%)</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>Children=68</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>10 (15%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
</tr>
<tr>
<td></td>
<td>Adults=101</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
</tr>
<tr>
<td>Honduras</td>
<td>Children=56</td>
<td>X (y%)</td>
<td>12 (21%)</td>
<td>22 (39%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
</tr>
<tr>
<td></td>
<td>Adults=33</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>8 (34%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
</tr>
<tr>
<td>Panama</td>
<td>Children=28</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
</tr>
<tr>
<td></td>
<td>Adults=4</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
<td>X (y%)</td>
</tr>
<tr>
<td>Total</td>
<td>Children=462</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adults=192</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Next steps

- Continue case-patient identification, corroboration of vaccine status and pre-existing conditions
- Prepare interim analyses for the first Vaccine Effectiveness Latin America (VELAS) network meeting during February, 2013
- Invite Argentina, Brazil, Chile, Colombia, Mexico, and other Latin American countries’ participation in VELAs network and 2011-2013 data collection
- Explore adopting a standardized VE analytical plan so that data may be better shared across regions
- Continue strengthening flu surveillance and influenza vaccination programs in LAC
!Thanks!

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Thank you
Interim analyses of influenza vaccine effectiveness among 758 Central America participants during 2012

<table>
<thead>
<tr>
<th></th>
<th>Cases</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinated</td>
<td>32</td>
<td>121</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td>100</td>
<td>327</td>
</tr>
<tr>
<td><strong>Adults</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinated</td>
<td>19</td>
<td>40</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td>40</td>
<td>79</td>
</tr>
</tbody>
</table>

\[
OR_{\text{crude}} = 0.86 \\
VE_{\text{crude}} = 14\%
\]

\[
OR_{\text{crude}} = 0.94 \\
VE_{\text{crude}} = 6\%
\]