Comparing Different Strategies for Offering Influenza Vaccination in the Pediatric Emergency Department

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Background and Objectives
- Primary aim: compare the cost-effectiveness of different strategies for offering influenza vaccine in the pediatric ED in terms of cost per case of influenza averted, from a societal perspective.
- Secondary aims:
  1. Estimate total societal costs and benefits of an Influenza Vaccination (IV) program in the pediatric ED
  2. Use sensitivity analyses to estimate the impact of uncertainties across variables.

Methods
- Using standard decision analysis software, a cost-effectiveness analysis was performed to compare 4 IV strategies:
  1. Offering vaccination to <2 patients
  2. Offering to patients <5 only
  3. Offering to patients <5 and high-risk patients 5+ only
  4. Offering to none
- A thorough review of the literature was performed to establish estimated values (and ranges) of variables such as baseline population influenza rates, vaccination rates, vaccine effectiveness, rates of complications of influenza, costs of illness (both direct and indirect), costs of vaccination, and QALYs lost due to illness.
- Data from a recent study within our institution (pending publication) established likelihood of parent acceptance of IV in the ED.
- High risk* for influenza complications was defined using CDC criteria: age <5 years, chronic health conditions.
- Data were analyzed using TreeAge Pro 2016 © software.

Costs and Benefits of Strategies

<table>
<thead>
<tr>
<th>Factor</th>
<th>Offer to all (95% CI)</th>
<th>Offer to age &lt;5 and high-risk (95% CI)</th>
<th>Offer to age &lt;5 only (95% CI)</th>
<th>Offer to none (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost per patient</td>
<td>$104 ($45-245)</td>
<td>$108 ($47-255)</td>
<td>$112 ($49-258)</td>
<td>$129 ($56-295)</td>
</tr>
<tr>
<td>Total influenza cases (per 1000 patients)</td>
<td>93 (31-188)</td>
<td>103 (34-202)</td>
<td>106 (35-207)</td>
<td>120 (41-230)</td>
</tr>
<tr>
<td>Cost per flu case averted</td>
<td>$114 ($55-244)</td>
<td>$120 ($55-264)</td>
<td>$126 ($51-267)</td>
<td>$148 ($73-308)</td>
</tr>
<tr>
<td>ICER (cost per additional case averted, vs. offer to all)</td>
<td>n/a ($184-2843)</td>
<td>$573 ($211-2891)</td>
<td>$1030 ($280-4696)</td>
<td></td>
</tr>
<tr>
<td>Hospitalizations (per 1000 patients)</td>
<td>0.34 (0.02-1.63)</td>
<td>0.35 (0.02-1.65)</td>
<td>0.37 (0.03-1.70)</td>
<td>0.43 (0.03-2.15)</td>
</tr>
<tr>
<td>ICER (cost per additional hospitalization averted, vs. offer to all)</td>
<td>n/a ($168-173-3,982-446)</td>
<td>$237,208 ($107,960-2,062,303)</td>
<td>$290,717 ($25,080-7,112,093)</td>
<td></td>
</tr>
<tr>
<td>Quality-adjusted life years (QALY) saved (days)</td>
<td>0.72 (0.18-1.78)</td>
<td>0.76 (0.21-1.84)</td>
<td>0.77 (0.21-1.86)</td>
<td>0.91 (0.25-2.2)</td>
</tr>
<tr>
<td>ICER (additional cost per QALY saved, vs. offer to all)</td>
<td>n/a ($5925-217,800)</td>
<td>$46,698 ($37,400-271,800)</td>
<td>$49,422 ($10,355-327,294)</td>
<td>$55,258</td>
</tr>
</tbody>
</table>

Monte Carlo Analysis: Incremental Cost-effectiveness (Additional Cost per Case Averted)

Results

Decision Tree (Simplified)

Summary of Results
- Initial analysis suggests that the average total societal cost of vaccinating a child against influenza in the pediatric ED is $104 ($45-245).
- Offering IV to all children in the pediatric ED averts a total of 93 influenza cases per 1000 patients (31-188), with a cost of $114 per case of influenza averted ($55-245).
- Offering IV to all children saves an average of $27 ($11-51) per patient compared to offering to none, and averts an additional 27 (11-40) cases of influenza.
- Routine IV in the pediatric ED could reduce influenza hospitalizations by approximately 1 (0.1-4.5) per 10,000 patients.
- Offering IV routinely results in an incremental cost-effectiveness ratio (cost per quality-adjusted life year saved) of $55,258 ($10,355-$327,294) compared to not offering vaccine, which is in keeping with accepted norms for other healthcare interventions.
- In Monte Carlo Analysis, offering vaccine to all children is the most cost-effective strategy 98% of the time.
- In sensitivity analysis, offering vaccine to all children remains the most cost-effective strategy unless the cost of vaccine was greater than $40, or the cost of administration was greater than $23.
- Offering IV to all children was of net societal monetary benefit under a variety of circumstances for influenza prevalence, vaccination rate, vaccine effectiveness, and acceptance of IV in the pediatric ED.

Conclusions
- A routine program of offering influenza vaccine in the pediatric ED is cost-effective and can result in significant reduction in societal cost and patient morbidity due to pediatric influenza illness.

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