Low measles vaccination caused Measles Outbreak in Kamuli District, July 2016

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Kamuli district, Eastern Uganda
Kamuli Measles Outbreak Investigation

Timelines of events

Alert to MOH-PHEOC

Investigation 17th - 22nd

5/8 samples test IgM +ve

Enhanced routine vaccination

Outbreak was contained after 1 incubation period

5th Jul 12th Jul 19th Jul 26th Jul 2nd Aug 9th Aug 16th Aug 23rd Aug
Objectives

- Establish the scope of the outbreak
- Estimate district measles vaccine effectiveness
- Estimate measles vaccine coverage
- Recommend control measure
Case definition

- **Probable case**: A resident of Kamuli with fever and generalized skin rash lasting for ≥3 days, plus ≥ 1 of the following symptoms: coryza, conjunctivitis and cough since 1\(^{st}\) June, 2016

- **Confirmed case**: A suspected case with positive measles IgM antibodies
Case finding

- Patients records review at Kamuli General Hospital, Bugeywa HClII and Butansi HClII
- Review of sickness records at schools
- Community case finding with guidance of village leaders
Cases found 8 August

- 71 probable cases
- 5 confirmed cases
## Kamuli Measles Outbreak Investigation

Children under 5 years most affected

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Population</th>
<th>AR /10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>52</td>
<td>99,032</td>
<td>5.3</td>
</tr>
<tr>
<td>5-17</td>
<td>19</td>
<td>175,512</td>
<td>1.1</td>
</tr>
<tr>
<td>18+</td>
<td>0</td>
<td>215,711</td>
<td>0</td>
</tr>
</tbody>
</table>
**Kamuli Measles Outbreak Investigation**

Males and females equally affected

<table>
<thead>
<tr>
<th>Sex</th>
<th>Frequency</th>
<th>Population</th>
<th>AR / 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>39</td>
<td>235,322</td>
<td>1.7</td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>254,933</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Butansi Sub county had highest attack rate
Epidemic curve: Propagated transmission

- **Index case**
- **Primary Case**
- **MOH notified**
- **Start Investigation**
- **Started enhanced routine vaccination**
- **Outbreak contained**

**Cases**
- Date of onset:
  - 22-May
  - 29-May
  - 5-Jun
  - 12-Jun
  - 19-Jun
  - 26-Jun
  - 3-Jul
  - 10-Jul
  - 17-Jul
  - 24-Jul
  - 31-Jul
  - 7-Aug
  - 14-Aug
  - 21-Aug
  - 28-Aug
Individually matched case control study

- Matched by age and village of residence
- Ratio 1:4
- 25 suspect cases : 100 controls
Estimation of possible exposure period

Exposure period

Rash onset

Case

Control

Max

Kamuli Measles Outbreak Investigation
### Lack of prior measles vaccination associated with outbreak

<table>
<thead>
<tr>
<th>Variable</th>
<th>% Case(s) (n=25)</th>
<th>% Controls (n=100)</th>
<th>(OR_{MH})</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccination &lt;2 years</td>
<td>16</td>
<td>51</td>
<td>6.8</td>
<td>1.8-25</td>
</tr>
</tbody>
</table>
Vaccination coverage

- The PCV = 12/71 (17%) and assumed Vaccine efficacy (VE) 85%

- \[ PPV = \frac{PCV}{1-(1-PCV)} \]

  = 58%
Not being vaccinated associated with measles outbreak

<table>
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<th>Variable</th>
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<th>% Controls (n=100)</th>
<th>OR$_{MH}$</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>Vaccination &lt;2 years</td>
<td>16</td>
<td>51</td>
<td>0.18</td>
<td>0.043-0.604</td>
</tr>
</tbody>
</table>
Vaccine effectiveness <2 years

- $VE = 1 - RR \times 100$
  \[
  \approx 1 - OR \times 100
  \]
- $VE = (1 - 0.19) \times 100 = 81$

Where: $VE =$ Vaccine effectiveness

$RR =$ Relative risk of vaccinated vs unvaccinated

$OR =$ Odds ratio (in rare disease $OR \approx RR$)
Conclusion

- Children under five years were most affected
- Lack of vaccination was associated with measles infection
- Vaccination coverage was suboptimal in the district
- Measles vaccine effectiveness was acceptable
Public Health Action

- Strengthened measles surveillance in the community and health facilities
- Quantified, requested vaccines and intensified routine vaccination amongst under fives (6-59 months)
- Intensification of routine vaccination for a week in October, November and December, 2016
Acknowledgment

- Ministry of Health
- Centers for Disease Control and Prevention
- Makerere School of Public Health
- PHFP
- Kamuli district Health Team
Vaccine efficacy

- Such vaccine efficacy trials represent the “best case scenarios” of vaccine protectiveness under controlled conditions and are commonly required before a new vaccine is licensed by the FDA and other global regulatory authorities.
proportionate reduction in disease attack rate (AR) between the unvaccinated (ARU) and vaccinated (ARV) study cohorts and can be calculated from the relative risk (RR) of disease among the vaccinated group

1-RR
Advantage

- advantages of a vaccine efficacy study include rigorous control for biases afforded by randomization, as well as prospective, active monitoring for disease attack rates and careful tracking of vaccination status; often there is, at least for a subset of the study population, laboratory confirmation of the infectious outcome of interest and a sampling of vaccine immunogenicity.
Vaccine effectiveness

- measure can assess the net balance of benefits and adverse effects of a vaccination program, not just the vaccine itself, under more natural field conditions rather than in a controlled clinical trial.

- VE is a measure of the vaccine potency (Efficacy), how well target population is vaccinated (reflecting difficulties of cold chain, access and cost of vaccine)