Controlling Vaccine Preventable Diseases in the US and Global Immunization Efforts

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National Vaccine Advisory Committee Meeting, Washington DC
February 8, 2012
Estimated Vaccination Coverage, Children 19-35 Months and 13 – 15 years, 1991-2010*

* Target is 80 percent for Rotavirus, Tdap (1+), MCV4 (1+), HPV (3+) and 90% for varicella (2+)
† Full series Hib (≥3 or ≥4 doses, depending on product type received). Brand of Hib vaccine received was not collected on the NIS prior to 2009.
¶ Among females

Comparison of 20th Century Annual Morbidity and Current Morbidity: Vaccine-Preventable Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>20th Century Annual Morbidity†</th>
<th>2011 Reported Cases † †</th>
<th>Percent Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallpox</td>
<td>29,005</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>21,053</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Measles</td>
<td>530,217</td>
<td>212</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Mumps</td>
<td>162,344</td>
<td>370</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Pertussis</td>
<td>200,752</td>
<td>15,216</td>
<td>92%</td>
</tr>
<tr>
<td>Polio (paralytic)</td>
<td>16,316</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Rubella</td>
<td>47,745</td>
<td>4</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Congenital Rubella Syndrome</td>
<td>152</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Tetanus</td>
<td>580</td>
<td>9</td>
<td>98%</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em></td>
<td>20,000</td>
<td>8*</td>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>

†Source: JAMA. 2007;298(18):2155-2163
† †Source: CDC. MMWR January 6, 2012;60(51):1762-1775. (provisional 2011 data)
*Haemophilus influenzae* type b (Hib) < 5 years of age. An additional 14 cases of Hib are estimated to have occurred among the 237 reports of Hi (< 5 years of age) with unknown serotype.
## Comparison of Pre-Vaccine Era Estimated Annual Morbidity with Current Estimate: Vaccine-Preventable Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Pre-Vaccine Era Annual Estimate</th>
<th>2010 Estimate</th>
<th>Percent Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A</td>
<td>117,333 †</td>
<td>7,138</td>
<td>94%</td>
</tr>
<tr>
<td>Hepatitis B (acute)</td>
<td>66,232 †</td>
<td>9,428</td>
<td>86%</td>
</tr>
<tr>
<td>Pneumococcus (invasive)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>all ages</td>
<td>63,067 †</td>
<td>39,500 #</td>
<td>37%</td>
</tr>
<tr>
<td>&lt; 5 years of age</td>
<td>16,069 †</td>
<td>4,400##</td>
<td>73%</td>
</tr>
<tr>
<td>Rotavirus (hospitalizations, &lt; 3 years of age)</td>
<td>62,500 † †</td>
<td>2,500###</td>
<td>96%</td>
</tr>
<tr>
<td>Varicella</td>
<td>4,085,120 †</td>
<td>281,873</td>
<td>93%</td>
</tr>
</tbody>
</table>

† JAMA. 2007;298(18):2155-2163

†† CDC. MMWR. February 6, 2009 / 58(RR02);1-25


## 2010 (provisional) Active Bacterial Core surveillance

### New Vaccine Surveillance Network (unpublished)
Measles, United States, 1985-1999

Importations by WHO Region

- **Unknown**
- **Western Pacific**
- **South East Asian**
- **European**
- **Eastern Mediterranean**
- **African**
- **American**

<table>
<thead>
<tr>
<th>Year</th>
<th>Imported cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
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<tr>
<td>91</td>
<td></td>
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<td>92</td>
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<td>93</td>
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<tr>
<td>96</td>
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</tr>
<tr>
<td>97</td>
<td></td>
</tr>
<tr>
<td>98</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td></td>
</tr>
</tbody>
</table>
Measles Elimination, the Americas, 1980-2011*

A total of 3.2 million measles cases and 16,000 deaths would have occurred between 2000-2020 if PAHO strategies were not implemented. This resulted in a savings of US$ 208 million in treatment costs.¹

Source: Country reports to PAHO/WHO.
*Data until EW 35/2011; coverage data not available for 2010.
¹Ibidem Acharya et. al.
Measles, United States, 1996-Present
Measles, United States, 2011
Geographic Distribution of Cases (n=222)

= 1 case
<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Total no. of cases</th>
<th>Countries</th>
<th>Genotype identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>African</td>
<td>4</td>
<td>Ethiopia (1), Kenya (2), Nigeria (1)</td>
<td>B3 (4)</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>3</td>
<td>Jordan (1), Pakistan (2)</td>
<td>D4 (1)</td>
</tr>
<tr>
<td>European</td>
<td>33</td>
<td>Bulgaria (1), <strong>France (13)</strong>, Italy (4), Poland (1), Romania (1), Spain (1), United Kingdom (5), France/Germany/Italy/Spain* (1), France/Germany/Spain* (1), France/Italy* (1), France/Spain/United Kingdom* (1), France/United Kingdom* (1), Hungary/Romania* (2)</td>
<td>D4 (16), G3 (1)</td>
</tr>
<tr>
<td>Americas</td>
<td>2</td>
<td>Canada (1), Dominican Republic† (1)</td>
<td>D4 (1)</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>19</td>
<td>Bangladesh (1), <strong>India (16)</strong>, Indonesia (2)</td>
<td>D8 (5), D4 (1)</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>11</td>
<td>China (2), Malaysia (2), Philippines (6), Malaysia/Philippines/Singapore/Vietnam* (1)</td>
<td>H1 (1), D9 (6)</td>
</tr>
</tbody>
</table>

72% of importations were among U.S. residents traveling abroad

*Patient visited more than 1 country during the incubation period
† Likely acquired disease from French tourist
2009 Imported Measles, U.S., as of 12/31/2009

71 cases
21 importations
12 imported virus cases
Measles Outbreaks*, United States, 2011

- 112/222 (50%) annual cases were outbreak-associated
- 17 total outbreaks
- Median outbreak size was 6 (range: 3 – 21)
- 44% of outbreak-associated cases were unvaccinated philosophical belief exemptors

*Outbreak = 3 or more epidemiologically linked cases
Personal Belief Exemptions in Kindergarteners, San Diego County, 2008

*Courtesy of D. Sugerman et al.*
# Implications for Disease Control

Hospital-associated measles outbreak, PA, Mar-Apr 2009, MMWR, January 20, 2012 / 61(02);30-32

## TABLE. Locations visited by six measles patients while contagious — Pennsylvania, March–April 2009

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Locations visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Index patient)</td>
<td>23 mos</td>
<td>Hospital ED and otolaryngology clinic, community hospital ED, doctor’s office</td>
</tr>
<tr>
<td>B</td>
<td>4 yrs</td>
<td>Hospital ED and otolaryngology clinic, community hospital ED, doctor’s office</td>
</tr>
<tr>
<td>C</td>
<td>33 yrs</td>
<td>Doctor’s office, construction worksite</td>
</tr>
<tr>
<td>D (ED physician)</td>
<td>NA</td>
<td>Hospital ED, medical conference, child-care center</td>
</tr>
<tr>
<td>E</td>
<td>11 mos</td>
<td>Hospital primary-care clinic, city buses, children’s play center</td>
</tr>
<tr>
<td>F (Source patient)</td>
<td>10 yrs</td>
<td>International flight, hotel, doctor’s office, hospital ED</td>
</tr>
</tbody>
</table>

Abbreviations: ED = emergency department; NA = not available.
Keys to Maintaining Measles Elimination in the U.S.

- High 2-dose MMR vaccination coverage
- High quality surveillance system
- Rapid identification of and response to measles cases
- Measles is reportable within 24 hours per Council of State and Territorial Epidemiologists guidelines
- Aggressive outbreak control measures
- Access to reliable laboratory testing capabilities
- Genotyping can give clues to source in some instances
- Information sharing tools (Epi-X, HAN)
Distribution of Confirmed Measles Cases Following the Interruption of Endemic Transmission, the Americas, 2003-2011*

*Data as of EW 35/2011

Source: Country reports to PAHO/WHO.
Measles is Epidemic in France

Measles cases per month - Mandatory reporting, France, January 2008-June 2011 (provisional data for June) / Number of measles boxes per month - Mandatory notification, France, January 2008 - June 2011 (provisional data for June)

nb de cas

4000
3500
3000
2500
2000
1500
1000
500
0

J FMAMJ JASONDJ FMAMJ JASONDA

2008 2009 2010 2011

Année-mois (date de début d'éruption)
Vaccination of U.S.-Bound Refugees

- 70,000 refugees resettled (70 nationalities from 100 countries) to 49 states annually
- Refugees not legally required to get vaccinations before U.S. resettlement
  - ~ 1/3 of refugees arrive in U.S. with no documented vaccinations
- > 40 VPD outbreaks in last 5 years
  - 1 recent imported measles case in Burmese refugee from Malaysia led to 8 cases in U.S., costly state/local PH response, and delayed resettlement of refugees
- Missed opportunity to vaccinate refugees between required overseas health assessment & arrival in U.S. (4-6 months)
Impact of Global Measles Mortality Reduction Efforts, 2000 - 2008

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Estimated deaths 2000</th>
<th>Estimated deaths 2008</th>
<th>Percent reduction in deaths</th>
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<tbody>
<tr>
<td>Africa</td>
<td>371,000</td>
<td>28,000</td>
<td>92%</td>
</tr>
<tr>
<td>Americas</td>
<td>&lt;1,000</td>
<td>&lt;1,000</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>101,000</td>
<td>7,000</td>
<td>93%</td>
</tr>
<tr>
<td>European</td>
<td>&lt;1,000</td>
<td>&lt;1,000</td>
<td>-</td>
</tr>
<tr>
<td>SE Asia</td>
<td>234,000</td>
<td>126,000</td>
<td>46%</td>
</tr>
<tr>
<td>W. Pacific</td>
<td>25,000</td>
<td>2,000</td>
<td>92%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>733,000</td>
<td>164,000</td>
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Source: MMWR 2009; 58(47):1321-1326
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<td>TOTAL</td>
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<td>164,000</td>
<td>78%</td>
</tr>
</tbody>
</table>

**Deaths Averted:** 12.7 million

Source: MMWR 2009, 58(47):1321-1326
Measles Resurgence in Africa

4-fold increase in cases since 2008
Outbreaks in 28 countries with large outbreaks in Burkina Faso (2009), S. Africa (2010), and DRC (2011)
Outbreaks in drought affected Horn of Africa
High case-fatality
In October 2003, the Pennsylvania Dept of Health and CDC were notified of a suspected case of respiratory diphtheria in a previously healthy Pennsylvania man aged 63 years who reported that he had never been vaccinated against diphtheria. He and seven other men from NY, PA, and W. VA. had returned from a week-long trip to rural Haiti, where they helped build a church.
Haiti’s National Immunization Program
2012 Partnership Plans

Measles-Rubella & Polio Campaign (April 2012)
- vaccine supply, logistics
- social mobilization
- supervision and microplanning
- capacity building

Introduce New Vaccines (June 2012)
- introduce pentavalent vaccine “catch up”
- increase operational capacity of cold chain
- social mobilization

Rotavirus & Pneumococcal

Strengthen Routine Immunization
- strategies to reach every child
- improve surveillance
- cold chain improvement
- vaccine supply & logistics

US Mumps Outbreak, 2009-2011
US Mumps Outbreak, 2009-2011

- 97% of cases within an Orthodox Jewish community
- Unique schools, large households conducive to transmission
- Prolonged, intense exposures likely overcame protection afforded by the vaccine
- Source - 11 y.o. M returning from UK where outbreak was ongoing
- US outbreak likely source of a subsequent outbreak in Israel
Summary

• Sustaining elimination and/or control of vaccine-preventable diseases in the US requires substantial public health and clinician efforts
• Infectious diseases know no borders
• Improving immunization in other countries protects all of us
• Reduced public and social support for immunization in other countries threatens all of us
• Global immunization efforts - ‘best buy’ for health and foreign aid investments
  – support security, diplomacy and humanitarian USG goals
  – embody our nation’s values
Acknowledgments

• Stephanie Bialek
• Martin Cetron
• Margaret Cortese
• John Fitzsimmons
• Dan Payne
• Sandy Roush
• Jane Seward
• Abbie Shefer
• Greg Wallace
Measles, United States, 2001-2011
Importations by WHO Region

Number of Cases

Year


Unknown
South East Asian
Eastern Mediterranean
American
Western Pacific
European
African
Confirmed measles cases in the Americas, 2011*

**Note:** Cases were imported, import-related or unknown.

*Data as of EW 35/2011

Source: MESS and country report to PAHO/WHO
Measles Europe, 2011*

- 26,236 reported cases
- 7 deaths
- France: 14,040
- Italy: 4,000
- Spain: 2,407
- Romania: 2,072
- Germany 1,361

* Jan 1 – July 31