Respiratory Viruses

2015-2016

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University of Washington
Disclosures:

Consult for the Washington State Hospitalization Association on HAIs and antimicrobial stewardship
A/Fujian/411/2002 (H3N2)
Global circulation of influenza viruses

Number of specimens positive for influenza by subtype

- B (Lineage not determined)
- A (Not subtyped)
- A(H1)
- A(H3)
- A(H5)
- A(H1N1)pdm09

Weeks

2014

2015
Figure 1: WHO/NREVSS Laboratory Data, Washington, 2014–2015
Percentage of respiratory specimens that tested positive for influenza
By influenza transmission zone

Status as of 6 August 2015

Note: The available country data were joined in larger geographical areas with similar influenza transmission patterns to be able to give an overview (www.who.int/influenza/surveillance_monitoring/updates/EN_GIP_Influenza_Transmission_zones.pdf). The displayed data reflect reports of the week from 13 to 26 July 2015, or up to two weeks before if not sufficient data were available for that area.

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not be full agreement.

Data Source: Global Influenza Surveillance and Response System (GISRS), FLURID (www.who.int/flurid).
Annual Impact of Influenza

- Infects 5-20% of US population annually
  - Attack rates highest in young
  - Mortality highest among older adults
- 3 lost days of work or school
- 226,000 hospitalizations per year 1979-2001
- 36,000 deaths annually
  - Post influenza MRSA pneumonia

## Pandemic Impact in King County

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>MODERATE (1957/1968 -like)</th>
<th>SEVERE (1918 -like)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U.S.</td>
<td>King County</td>
</tr>
<tr>
<td>Illness</td>
<td>90 million</td>
<td>540,000</td>
</tr>
<tr>
<td>Outpatient care</td>
<td>45 million</td>
<td>270,000</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>865,000</td>
<td>5,190</td>
</tr>
<tr>
<td>ICU care</td>
<td>128,750</td>
<td>773</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>64,875</td>
<td>389</td>
</tr>
<tr>
<td>Deaths</td>
<td>209,000</td>
<td>1,254</td>
</tr>
</tbody>
</table>

Adapted from Pandemic Influenza Response Plan, Public Health – Seattle & King County, available @ [http://www.metrokc.gov/health/pandemicflu/plan/index.htm](http://www.metrokc.gov/health/pandemicflu/plan/index.htm)
Sav[es] Lives
Who should get vaccinated?

• children aged 6 through 59 months
• all persons aged 50 years and older;
• adults and children who have chronic pulmonary (including asthma) or cardiovascular (except isolated hypertension), renal, hepatic, neurologic, hematologic, or metabolic disorders (including diabetes mellitus)
• persons who have immunosuppression (including immunosuppression caused by medications or by HIV infection)
• women who are or will be pregnant during the influenza season
• children and adolescents (aged 6 months through 18 years) who are receiving long-term aspirin therapy and who might be at risk for experiencing Reye’s syndrome after influenza virus infection
• residents of nursing homes and other long-term care facilities
• American Indians/Alaska Natives
• persons who are morbidly obese (body mass index of 40 or greater)
• health-care personnel
• household contacts (including children) and caregivers of children aged 59 months and older (i.e., aged younger than 5 years) and adults aged 50 years and older, with particular emphasis on vaccinating contacts of children aged younger than 6 months
• household contacts (including children) and caregivers of persons with medical conditions that put them at high risk for severe complications from influenza
## Effectiveness of the Flu Vaccine

<table>
<thead>
<tr>
<th>Age group (yrs)</th>
<th>Averted hospitalizations</th>
<th></th>
<th>Averted, medically attended cases</th>
<th></th>
<th>Averted cases</th>
<th></th>
<th>Fraction prevented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (95% CI)</td>
<td>No. (95% CI)</td>
<td>No. (95% CI)</td>
<td>No. (95% CI)</td>
<td>% (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–4</td>
<td>10,216 (5,594–16,502)</td>
<td>981,851 (575,222–1,591,166)</td>
<td>1,465,450 (859,735–2,367,044)</td>
<td>29.6 (28.0–30.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5–19</td>
<td>4,770 (2,869–7,722)</td>
<td>887,256 (529,333–1,437,481)</td>
<td>1,739,717 (1,046,532–2,816,363)</td>
<td>17.3 (16.8–17.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–64</td>
<td>19,813 (12,887–30,107)</td>
<td>1,086,409 (698,241–1,666,804)</td>
<td>2,936,241 (1,909,887–4,461,808)</td>
<td>14.3 (14.0–14.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥65</td>
<td>44,460 (17,779–82,413)</td>
<td>273,876 (108,797–511,422)</td>
<td>489,065 (195,570–906,541)</td>
<td>17.1 (10.5–21.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All ages</td>
<td>79,260 (39,530–136,744)</td>
<td>3,229,393 (1,911,592–5,206,874)</td>
<td>6,630,473 (4,011,725–10,551,756)</td>
<td>17.3 (16.2–18.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 6.6 fewer illnesses
- 3.2 million fewer medically attended illnesses
- 80,000 fewer hospitalizations
What happened last year?

• Vaccine effectiveness (VE) = real world decrease in clinic visits
• Overall VE last year was 18%
• Flu vaccine did not protect against drifted H3N2 (vaccine effectiveness = 18%)
  • 60-80% of circulating H3N2 was drifted
• But did protect against vaccine-like H3N2 and influenza B strains (flu B VE = 45%)
February 6, 2015 –Despite declines in some key indicators, flu remains widespread across most of the country and severity indicators are still high, according to this week’s FluView. Another eight pediatric deaths have been reported this week, bringing the total for the season to 69. Flu activity has been elevated for 11 consecutive weeks nationally and is expected to continue for several more weeks, especially in parts of the country where activity started later.

Mismatched H3N2 flu viruses continue to predominate across the country, hitting older people hard. The flu-associated hospitalization rate among people 65 and older this week is the highest rate recorded since CDC began tracking that data in 2005. Overall nearly 60 percent of flu-associated hospitalizations have been among people 65 years and older. At the current rate of hospitalization, more than 92,000 people 65 and older would have been hospitalized in the US so far this season. Nearly 94 percent of all adults hospitalized for flu this season have had at least one reported underlying medical condition; the most commonly reported conditions are heart disease, metabolic disorders including diabetes, and obesity.
Influenza Vaccine

2014-2015
• A/California/7/2009 (H1N1)-like virus;
• (H3N2) virus antigenically like the cell-propagated prototype virus A/Victoria/361/2011;
• B/Massachusetts/2/2012-like virus.
• B/Brisbane/60/2008-like virus

2015-2016
• A/California/7/2009 (H1N1)-like virus
• A/Switzerland/9715293/2013 (H3N2)-like virus
• B/Phuket/3073/2013-like virus
• B/Brisbane/60/2008-like virus
2015-2016 Influenza Vaccines

- Inactivated influenza vaccine, quadrivalent (IIV4), standard dose, IM/ID
- Inactivated influenza vaccine, trivalent (IIV3), standard dose, IM
- Inactivated influenza vaccine, cell-culture-based (ccIIV3), standard dose, IM
- Inactivated influenza vaccine, trivalent (IIV3), high dose, IM
- Recombinant influenza vaccine, trivalent (RIV3), standard dose, IM*
- Live attenuated influenza vaccine, quadrivalent (LAIV4), IN**

*Severe egg allergy is not a contraindication
**Should not be admin to pregnant women, children with asthma, immunosuppressed or recent flu tx
Effect of Influenza Vaccination on Mothers and Infants (HIV+ and HIV-)

A HIV-Uninfected Cohort, Mothers

B HIV-Uninfected Cohort, Infants

C HIV-Infected Cohort, Mothers

D HIV-Infected Cohort, Infants

No. at Risk

HIV3 Placebo

Months since Vaccination

No. at Risk

HIV3 Placebo

Age (mo)

No. at Risk

HIV3 Placebo

Proportion of Mothers with Confirmed Influenza

Proportion of Infants with Confirmed Influenza

P=0.01

P=0.01

P=0.03

P=0.59
Effect of High Dose Influenza Vaccine in People >65 years of age

Table 3. Efficacy of High-Dose Vaccine Relative to Standard-Dose Vaccine against Confirmed Influenza Caused by Strains Similar to the Vaccine Components.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Laboratory-Confirmed Influenza*</th>
<th>Culture-Confirmed Influenza†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relative Efficacy (95% CI)</td>
<td>Relative Efficacy (95% CI)</td>
</tr>
<tr>
<td></td>
<td>IIV3-HD (N=15,990)</td>
<td>IIV3-SD (N=15,993)</td>
</tr>
<tr>
<td></td>
<td>no. (%)</td>
<td>%</td>
</tr>
<tr>
<td>Protocol-defined influenza-like illness</td>
<td>73 (0.5)</td>
<td>35.4 (12.5 to 52.5)</td>
</tr>
<tr>
<td>Influenza A</td>
<td>56 (0.4)</td>
<td>31.7 (2.9 to 52.3)</td>
</tr>
<tr>
<td>A/H1N1</td>
<td>7 (&lt;0.1)</td>
<td>12.5 (-176.2 to 73.0)</td>
</tr>
<tr>
<td>A/H3N2</td>
<td>49 (0.3)</td>
<td>33.8 (3.7 to 54.8)</td>
</tr>
<tr>
<td>Influenza B</td>
<td>17 (0.1)</td>
<td>45.2 (-2.2 to 71.5)</td>
</tr>
<tr>
<td>Modified CDC-defined influenza-like illness</td>
<td>26 (0.2)</td>
<td>49.0 (16.7 to 69.5)</td>
</tr>
<tr>
<td>Influenza A</td>
<td>21 (0.1)</td>
<td>41.7 (-2.7 to 67.6)</td>
</tr>
<tr>
<td>A/H1N1</td>
<td>2 (&lt;0.1)</td>
<td>0.0 (&lt;1280.0 to 92.8)</td>
</tr>
<tr>
<td>A/H3N2</td>
<td>19 (0.1)</td>
<td>44.1 (-8.8 to 69.9)</td>
</tr>
<tr>
<td>Influenza B</td>
<td>5 (&lt;0.1)</td>
<td>66.7 (3.5 to 90.5)</td>
</tr>
<tr>
<td>Respiratory illness</td>
<td>106 (0.7)</td>
<td>27.4 (6.1 to 44.0)</td>
</tr>
<tr>
<td>Influenza A</td>
<td>82 (0.5)</td>
<td>18.8 (-9.8 to 40.1)</td>
</tr>
<tr>
<td>A/H1N1</td>
<td>12 (0.1)</td>
<td>-33.4 (-258.4 to 48.4)</td>
</tr>
<tr>
<td>A/H3N2</td>
<td>70 (0.4)</td>
<td>23.9 (-5.0 to 45.0)</td>
</tr>
<tr>
<td>Influenza B</td>
<td>24 (0.2)</td>
<td>46.7 (10.6 to 68.9)</td>
</tr>
</tbody>
</table>
Hemagglutinin-stem nanoparticles generate heterosubtypic influenza protection

Hadi M Yassine1,6, Jeffrey C Boyington1,6, Patrick M McTamney1,3,6, Chih-Jen Wei1,5,6, Masaru Kanekiyo1, Wing-Pui Kong1, John R Gallagher2, Lingshu Wang1, Yi Zhang1, M Gordon Joyce1, Daniel Lingwood1,5, Syed M Moin1, Hanne Andersen3, Yoshinobu Okuno4, Srinivas S Rao4,5, Audray K Harris2, Peter D Kwong1, John R Mascola1, Gary J Nabel1,5 & Barney S Graham1
Serum from humans immunized with seasonal influenza vaccine protects mice against vaccine homologous H1 and heterosubtypic H5 influenza challenge.


http://127.0.0.1:8081/plosone/article?id=info:doi/10.1371/journal.pone.0103550
Influenza Virus Treatment

• Supportive treatment
• Neuraminidase inhibitors
• Combination therapy?
  • Steroids
  • INF
  • Ig
  • CTM
Neuraminidase Inhibitors

- Oseltamivir – Oral, BID x 5 days
- Zanamivir – Inhaled, BID x 5 days
- Peramivir – Intravenous, single dose
  - Infants
  - Poor absorption
# Antivirals and Resistance

<table>
<thead>
<tr>
<th>Influenza type</th>
<th>Osteltamivir (Tamiflu®)</th>
<th>Zanamivir (Relenza®)</th>
<th>Amantadine/Rimantadine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal H3N2</td>
<td>Yes</td>
<td>Yes</td>
<td>No*</td>
</tr>
<tr>
<td>Seasonal H1N1</td>
<td>No#</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2009 H1N1</td>
<td>Yes – for now&amp;</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

*2005-2006 91% amantadine/rimantadine resistance among H3N2

#2007-2008 11% oseltamivir resistance among seasonal H1N1

2008-2009 99% oseltamivir resistance among seasonal H1N1

When Seasonal AND 2009 H1N1 circulating, zanamivir OR (oseltamivir and rimantadine)

42 cases of 2009 H1N1 resistant to oseltamivir in US
Treatment modalities other than neuraminidase inhibitors for influenza

<table>
<thead>
<tr>
<th>Therapeutic agent(s)</th>
<th>Mechanisms of actions</th>
<th>General comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oseltamivir (Tamiflu)</td>
<td>A phase 2 RCT showed that oseltamivir reduced the risk of hospitalization in patients with influenza compared to placebo.</td>
<td>The effectiveness of oseltamivir in reducing the risk of hospitalization highlights its importance in the management of influenza.</td>
</tr>
<tr>
<td>Peramivir (Rimantadine)</td>
<td>A randomized, double-blind, placebo-controlled trial demonstrated the efficacy of peramivir in reducing the duration of influenza symptoms.</td>
<td>Peramivir's rapid onset of action makes it a valuable addition to antiviral therapy.</td>
</tr>
<tr>
<td>Zanamivir (Relenza)</td>
<td>A placebo-controlled trial showed that zanamivir reduced the duration of influenza symptoms in patients treated within 12 hours of symptom onset.</td>
<td>Zanamivir's ease of administration via the respiratory route offers a practical option for influenza management.</td>
</tr>
</tbody>
</table>

Emerging respiratory tract viral infections.
Hui, David; Zumla, Alimuddin
Testing and Treatment

• Testing linked to intent to treat
• Influenza A PCR Panel
  • NP swab for influenza A PCR testing
  • Reflexive subtyping and potential oseltamivir resistance
• Hospitalized with suspected or confirmed influenza
• Suspected or confirmed severe influenza illness, including signs of lower tract infection (pneumonia)
• Patients at high risk for influenza complications
  ➢ ALL pregnant women (through 2 weeks postpartum)

Recommend not testing or treating patients with mild illness without risk factors for influenza complications
Importance of Early Recognition and Clinical Judgment

- Early treatment associated with better outcomes
- 15 deaths in King County
  - Time from symptom onset to treatment
    - Mean 5.8 days (2-12 days)
  - 5 patients with predisposing risk factors presented with ILI and were not treated initially
- Testing challenges
  - Rapid point of care tests 10-50% sensitive
  - FA and “inconclusive results”
  - Movement towards PCR testing
  - Upper vs. lower tract testing

Epi-Log Dec 2009: Public Health Seattle & King County
Critical Care 2009;13:R148
J Infect Dis 2011;203;1739-47
Modes of Transmission

Droplets
Thought to be primary mode of transmission
Coughing, sneezing, and talking
Heavy; settle within 6 feet of the source

Airborne
Related to procedures → aerosolized particles

Contact
Direct: skin-to-skin contact
Indirect: contact with virus in the environment
Viral Shedding in Hospitalized Patients

147 inpatients with H3N2 during 2007

Table 5. Factors Associated with Persistent Viral RNA Detection at 1 Week and Persistent Virus Isolation after 4 Days of Illness, in Patients Hospitalized with Influenza A Infection

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients with viral RNA detected at symptom day 7, %</th>
<th>Patients with virus isolated on symptom day ≥4, %</th>
<th>P</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza virus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>32.7</td>
<td>17.2</td>
<td>.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>B</td>
<td>69.6</td>
<td>56.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;65 years</td>
<td>39.0</td>
<td>17.0</td>
<td>.011</td>
<td>.921</td>
</tr>
<tr>
<td>=65 years</td>
<td>9.5</td>
<td>17.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comorbidity, major</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45.7</td>
<td>22.7</td>
<td>.040</td>
<td>.221</td>
</tr>
<tr>
<td>No</td>
<td>25.4</td>
<td>13.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systemic corticosteroid use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>53.8</td>
<td>24.1</td>
<td>.007</td>
<td>.256</td>
</tr>
<tr>
<td>No</td>
<td>25.0</td>
<td>14.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oseltamivir initiation time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1–2</td>
<td>14.3</td>
<td>2.3</td>
<td>.004</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Day 3–4</td>
<td>35.3</td>
<td>18.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not received</td>
<td>57.1</td>
<td>38.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2009 H1N1

Table 3. Duration of Viral Shedding and Day of Illness at Initiation of Oseltamivir Treatment

<table>
<thead>
<tr>
<th>Day of illness</th>
<th>Median duration of viral shedding, days</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>Ref</td>
</tr>
<tr>
<td>2</td>
<td>5.0</td>
<td>.665</td>
</tr>
<tr>
<td>3</td>
<td>5.0</td>
<td>.747</td>
</tr>
<tr>
<td>4</td>
<td>7.0</td>
<td>.021</td>
</tr>
<tr>
<td>≥5</td>
<td>8.5</td>
<td>.003</td>
</tr>
</tbody>
</table>
### Surgical Mask vs. N95 Respirator Randomized Study

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Surgical Mask N=212</th>
<th>N95 Respirator N=210</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccinated</td>
<td>68 (30.2%)</td>
<td>62 (28.1%)</td>
<td></td>
</tr>
<tr>
<td>Lab-confirmed*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT-PCR</td>
<td>50 (23.6%)</td>
<td>48 (22.9%)</td>
<td>0.86</td>
</tr>
<tr>
<td>H1N1 serology</td>
<td>6 (2.8%)</td>
<td>4 (1.8%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Serology without symptoms</td>
<td>17 (8.0%)</td>
<td>25 (11.9%)</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>29/44 (65.9%)</td>
<td>31/44 (70.5%)</td>
<td></td>
</tr>
<tr>
<td>Physician visits</td>
<td>13 (6.1%)</td>
<td>13 (6.2%)</td>
<td>0.98</td>
</tr>
<tr>
<td>Influenza-like illness, Fever and cough</td>
<td>9 (4.2%)</td>
<td>2 (1.0)</td>
<td>0.06</td>
</tr>
<tr>
<td>Work-related absenteeism</td>
<td>42 (19.8%)</td>
<td>39 (18.6)</td>
<td>0.75</td>
</tr>
</tbody>
</table>

*RT-PCR or serology

JAMA 2009;302:E1-7
Influenza Containment Strategies

- Eliminating potential exposures
  - Keep sick from non-sick
- Engineering controls
  - Patient placement
  - Air exchanges
  - Close suctioning systems
- Administrative controls
  - Vaccination
  - Stay at home when ill
  - Patient triage
  - Respiratory Hygiene/"Cough Etiquette"
- Personal protective equipment
Genetic Evolution of H7N9 Virus in China, 2013

The eight genes of the H7N9 virus are closely related to avian influenza viruses found in domestic ducks, wild birds and domestic poultry in Asia. The virus likely emerged from "reassortment," a process in which two or more influenza viruses co-infect a single host and exchange genes. This can result in the creation of a new influenza virus. Experts think multiple reassortment events led to the creation of the H7N9 virus. These events may have occurred in habitats shared by wild and domestic birds and/or in live bird/poultry markets, where different species of birds are bought and sold for food. As the above diagram shows, the H7N9 virus likely obtained its HA (hemagglutinin) gene from domestic ducks, its NA (neuraminidase) gene from wild birds, and its six remaining genes from multiple related H9N2 influenza viruses in domestic poultry.
Cumulative influenza A(H7N9) virus detections

Plotted by month of illness onset if available, otherwise hospitalization or reporting

Number of detections
- TOTAL deaths
- TOTAL cases

Value

Date of onset/reporting
Areas reporting confirmed human cases for influenza A(H7N9) to WHO from 2013-06-01 *

Number of cases by reporting area

- 1 - 4
- 5 - 9
- 10 - 19
- 20 - 49
- 50 - 99
- 100 - 149

*All dates refer to onset of illness
Data as of 09/24/2014
Source: WHO
H5N1 Arrives in the United States

Jan 30, 2015 | Colleen Nguyen | Outbreak News

by CDC PHIL
- H5N1 more common in younger men and women without co-morbid illnesses and is associated with higher mortality

- H7N9 is more common older men with co-morbidities and appears to be less lethal

- Both infections are associated with poultry exposure
Consult a health worker if you have fever (38 °C or higher), cough or difficulty breathing. Inform them of your recent travel history.

Wash your hands regularly with soap and water and maintain good personal hygiene.

Avoid close contact with people if you are sick.

Cover your mouth and nose with a tissue or your sleeve when coughing or sneezing.

Current outbreak situation in the Republic of Korea and China as of 24 August 2015

News on the current situation

The last case of MERS-CoV infection in the Republic of Korea as reported to WHO was laboratory confirmed on 4 July 2015.
MERS-CoV detection around the world

Map purchased from maps.com

25 countries have had an imported detection
13 have supported local transmission

251-1000
51-250
11-50
1-10
0

Local transmission
Positive camels
Figure 1
Cases of MERS-CoV infection by date, Hospital B, Pyeongtaek, South Korea, May–June 2015 (n=37)
Kaplan-Meier curve for days to laboratory confirmation after suspected MERS-CoV symptom onset, Hospital B, Pyeongtaek, South Korea, May–June 2015 (n=37)

- Median number of days between suspected symptom onset and laboratory confirmation in tertiary infection (4 days)
- Median number of days between suspected symptom onset and laboratory confirmation for all 37 cases (6.5 days)
- Median number of days between suspected symptom onset and laboratory confirmation in secondary infection (9 days)

MERS: Middle East respiratory syndrome.
All other countries reporting cases to date: Egypt, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, United Arab Emirates, Yemen, Algeria, Tunisia, Austria, France, Germany, Greece, Italy, the Netherlands, Turkey, United Kingdom, Malaysia, Philippines, Thailand, and United States of America.
Researchers today [16 Dec 2013] reported that dromedary camels on a farm in Qatar were infected with a strain of Middle East respiratory syndrome coronavirus (MERS-CoV) nearly identical to that found in 2 people associated with the farm. The findings point to an outbreak that involved both camels and humans, but they don’t answer the key question of whether camels infected humans or the other way around.

Qatari health officials announced on 27 Nov 2013 that the virus had been found in camels on the farm. Today's [16 Dec 2013] report in the Lancet Infectious Diseases spells out the science behind the announcement and says the findings mark the 1st definitive confirmation of the virus in camels.

The research team, involving Dutch, Qatari, and British scientists, said the nucleotide sequences of 2 genomic fragments from the camel and human viruses were very similar but not identical. The similarity is close enough so that researchers couldn't tell whether the camels or the humans were infected first. "We cannot conclude whether the people on the farm were infected by the camels or vice versa, or if a third source was responsible," the report says.
Final note:

Healthcare facilities need to be prepared to perform travel screening wherever patients enter into the system.

Can be challenging to implement, but can become a simple routine.