Experience gained from Surveillance of Infectious Diseases during the Olympics. How can we extend it to real life?

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ATHENS 2004 OLYMPICS!!!
Athens 2004

• 2 events
  – Main event
    • Olympic Games: 13-29 August
  – Second event
    • Paralympic Games: 15-29 September
Public Health Issues

• Largest mass gatherings in the world
  – A lot of people in same place temporally
    • 202 Countries, 520,000 visitors
  – Huge media attention
    • 5,500 media representatives

• Early detection and response to
  – a deliberate release of BCRN agent
    • First summer Olympics after 09/11/2001
Previous experience

• 1996 OGs, Atlanta, USA

• 2000 OGs, Sydney, Australia

• 2002 Winter Olympic Games, Utah, USA
  — Gesteland PH et al. JAMIA 2003
GOALS OF SURVEILLANCE

● Recognition & response
  – outbreaks
  – BCRN events
  – single cases of infectious diseases that require measures to prevent further spread

● Evaluation of primary prevention measures
ENHANCING SURVEILLANCE

- Multiple surveillance systems in operation

- Daily reporting from health units
  - Dedicated surveillance staff
  - Zero reporting

- Daily analysis and review of data
  - Daily report
ENHANCING SURVEILLANCE

- Mandatory notification
- Laboratory reporting
- Primary care sentinel physician

New surveillance systems
  - Syndromic surveillance in
    - Hospital EDs
    - Olympic clinics
    - Cruise ships
ROUTINE SURVEILLANCE

- Major reorganization

- Reporting
  - Monthly $\Rightarrow$ weekly $\Rightarrow$ daily (OG)
### Information reported in mandatory notification reports, Greece 7/1998 - 6/2001

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting District</td>
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<td>100%</td>
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<tr>
<td>Disease</td>
<td>12211</td>
<td>100%</td>
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<tr>
<td>Reporting Hospital</td>
<td>434</td>
<td>4%</td>
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<tr>
<td>Reporting physician</td>
<td>131</td>
<td>1%</td>
</tr>
<tr>
<td>Surname</td>
<td>1850</td>
<td>15%</td>
</tr>
<tr>
<td>Name</td>
<td>1811</td>
<td>15%</td>
</tr>
<tr>
<td>Age</td>
<td>1718</td>
<td>14%</td>
</tr>
<tr>
<td>Gender</td>
<td>1795</td>
<td>15%</td>
</tr>
<tr>
<td>Place of residence - District</td>
<td>2986</td>
<td>24%</td>
</tr>
<tr>
<td>Place of residence - City / Village</td>
<td>1103</td>
<td>9%</td>
</tr>
<tr>
<td>Insurance No.</td>
<td>123</td>
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</tr>
<tr>
<td>Nationality</td>
<td>2991</td>
<td>24%</td>
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<tr>
<td>Date of disease onset</td>
<td>1001</td>
<td>8%</td>
</tr>
<tr>
<td>Type of diagnosis</td>
<td>1523</td>
<td>12%</td>
</tr>
<tr>
<td>Disease outcome</td>
<td>1001</td>
<td>8%</td>
</tr>
<tr>
<td><strong>TOTAL REPORTED</strong></td>
<td>12212</td>
<td></td>
</tr>
</tbody>
</table>
ROUTINE SURVEILLANCE

- 69 health units participated
  - 51 in Attica
  - 16 in the other Olympic prefectures
ROUTINE SURVEILLANCE

- Mandatory notification
  - EU case definitions used
  - Revised forms
  - Protocols of public health action
  - Training of healthcare staff
    - 30 courses
      - Emphasis on Olympic hospitals and district Public Health staff
Mandatory notification

Diseases to be immediately reported
- Anthrax
- Botulism
- Cholera
- Diphtheria
- Encephalitis, arbo-viral
- Haemorrhagic fever, viral
- Melioidosis/Glanders
- Plague
- Rabies
- SARS
- Smallpox
- Toulaeraemia

Diseases to be reported within 24 hours
- EHEC
- Hepatitis A
- Influenza, lab confirmed
- Legionellosis
- Measles, Rubella, Parotitis
- Meningitis / Menigococcal dis.
- Pertussis
- Salmonellosis (incl. typhoid / paratyphoid fever)
- Shigellosis
- Trichinosis
- Cluster of foodborne disease
Mandatory notification

Diseases to be reported within the first 3 days of the week following the week of diagnosis

- Brucellosis
- Chickenpox with complications
- Congenital rubella
- Congenital syphilis
- Congenital toxoplasmosis
- Echinococcosis
- Hepatitis B, acute
- HBsAg (+) in infants < 12 mo’s
- Hepatitis C, acute / confirmed anti-HCV (+), 1st diagnosis
- HIV/AIDS
- Leishmaniasis
- Leptospirosis
- Listeriosis
- Malaria
- Poliomyelitis (& AFP <15 yrs)
- Q fever, acute
- Tetanus / neonatal tetanus
- Tuberculosis
- Variant CJD (& CJD)
New reporting forms
- different for each disease or group of diseases
- 18 forms on the whole
- focus on risk factors for which intervention is necessary

Mandatory notification system reporting form
ROUTINE SURVEILLANCE

- Mandatory notification
  - Mobile health units
    - Mobile populations, immigrants and other refugees.
  - Response / outbreak investigation capacity
    - 4 teams during OGs
ROUTINE SURVEILLANCE

● **Laboratory reporting**
  – 16 Reference & satellite labs
    ● Protocols for select pathogens (n=25)
      – Collection, transportation, lab processing
    ● Link with ref labs abroad

● **Primary care sentinel physician**
  – Primary care physicians
  – 3 syndromes / 5 IDs
Laboratory notification

Stool culture results
- Salmonella
- Shigella
- E. coli: EHEC, ETEC
- Campylobacter
- Yersinia
- Clostridium difficile
- Giardia lamblia
- Cryptosporidium parvum
- Entamoeba histolytica
- Taenia

Results of serological tests *
- Adenovirus
- RSV
- Influenza virus
- Parainfluenza virus
- Echo virus
- Coxsackie virus
- Noro-virus
- Rota virus
- Haemophilus influenzae b
- S. pneumoniae
- Streptococcus, group A
- Mycoplasma pneumoniae

* Only for OGs (rom 15 hospital labs)
SYNDROMIC SURVEILLANCE
UTAH 2002

- Over 114,000 acute care encounters

- Successfully implemented & operational during Winter 2002 OGs

- No outbreaks of public health significance

- Remains operational today
SYNDROMIC SURVEILLANCE  
GREECE 2002-2004

- Major objective
  - early detection of BT event
  - detect potential disease outbreaks quickly

- 10 + 1 syndromes
SYNDROMES - HIERARCHY

1. Unexplained death with history of fever
2. Meningitis, encephalitis or unexplained acute encephalopathy or delirium
3. Sepsis or unexplained shock
4. Botulism-like syndrome
5. Febrile illness with rash
6. Bloody diarrhoea
7. Respiratory infection with fever
8. Suspected viral hepatitis (acute)
9. Lymphadenitis with fever
10. Gastroenteritis (diarrhoea and vomiting) without blood
II. Other syndrome of possible interest to public health
SYNDROMIC SURVEILLANCE
ATHENS 2002-2004

- Piloted 2002 and 2003
  - Weekly data collection retrosp analysis
    - Based upon chief complaint ED logs
  - Alert levels with specialized algorithms

- Intensification during the OG
  - Daily data collection from 31 points
  - Daily analysis & reports
    - Customized data forms
Pulsar Analysis Approach
Respiratory Infection with Fever

Illustration of original series
IN THE VENUES

- Health clinics in residence areas, stadiums and event sites
  - 220 venue clinics were in operation,
  - 30–120 of them were functioning every day

- Syndromic surveillance
  - Health clinics
  - 10 cruise ships in Piraeus
    - floating hotels for Olympic guests
CBRN

- Olympic Security Coordinating Council
- Council of Ministers with Prime Minister
- National Crisis Council
- Olympic Intelligence Centre
- Olympic Strategic Command Centre
- Expert Crisis Management Team
- Health Coordination Command Centre
- Underlying structures: Olympic hospitals
- Hellenic Police and Coast Guard
- Hellenic Fire Brigade
- Greek Atomic Energy Commission
- National Centre for Emergency Care
- Joint military team for incidents involving biological and chemical agents or radionuclear material, Ministry of National Defence
- Hellenic Centre for Infectious Diseases Control
SURVEILLANCE RESULTS
# HEALTH UNIT/PHYSICIAN PARTICIPATION

<table>
<thead>
<tr>
<th>Surveillance system</th>
<th>Mean number of units reporting daily</th>
<th>Total number of units in enhanced surveillance</th>
<th>%&lt;sup&gt;*&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory notification</td>
<td>54.5</td>
<td>69</td>
<td>79.0%&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Laboratory notification: stool cultures</td>
<td>29.5</td>
<td>69</td>
<td>NA&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Laboratory notification: serology</td>
<td>8.1</td>
<td>15</td>
<td>NA&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>Primary care sentinel physicians</td>
<td>36.5</td>
<td>49</td>
<td>74.5%</td>
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<tr>
<td>Syndromic surveillance: hospital emergency departments</td>
<td>10–17&lt;sup&gt;d&lt;/sup&gt;</td>
<td>31</td>
<td>100%</td>
</tr>
<tr>
<td>Syndromic surveillance: Olympic venues</td>
<td>30–120&lt;sup&gt;e&lt;/sup&gt;</td>
<td>220</td>
<td>100%</td>
</tr>
<tr>
<td>Syndromic surveillance: cruise ships</td>
<td>8–10&lt;sup&gt;e&lt;/sup&gt;</td>
<td>10</td>
<td>100%</td>
</tr>
</tbody>
</table>
Mandatory notification, health units reporting and cases reported, 1-31 August 2004
Surveillance results

- **Mandatory notification**
  - Salmonellosis 54%
  - Tuberculosis 17%

- **Laboratory notification**
  - Salmonella spp 67%
  - Campylobacter spp 19%
HEPATITIS !!!

- Hepatitis A: 4/443, 0.9%
- Hepatitis B: 20/443, 4.5%
- Hepatitis C: 11/443, 2.4%
<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Attica</th>
<th>Thessaloniki</th>
<th>Achaia</th>
<th>Heraklio</th>
<th>Magnesia</th>
<th>Total*</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Respiratory infection</td>
<td>3 663</td>
<td>883</td>
<td>231</td>
<td>387</td>
<td>387</td>
<td>5 551</td>
<td>4.2</td>
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<tr>
<td>Diarrhoea with blood</td>
<td>86</td>
<td>18</td>
<td>22</td>
<td>5</td>
<td>8</td>
<td>139</td>
<td>0.1</td>
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<tr>
<td>Gastroenteritis</td>
<td>3 077</td>
<td>612</td>
<td>248</td>
<td>303</td>
<td>258</td>
<td>4 498</td>
<td>3.4</td>
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<tr>
<td>Fever with rash</td>
<td>461</td>
<td>59</td>
<td>45</td>
<td>35</td>
<td>32</td>
<td>632</td>
<td>0.5</td>
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<tr>
<td>Meningitis&lt;sup&gt;b&lt;/sup&gt;</td>
<td>91</td>
<td>13</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>124</td>
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<tr>
<td>Hepatitis A&lt;sup&gt;c&lt;/sup&gt;</td>
<td>44</td>
<td>22</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>68</td>
<td>0.1</td>
</tr>
<tr>
<td>Syndrome compatible with botulism</td>
<td>17</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>Lymphadenitis and fever</td>
<td>35</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>Septic or unexplained shock</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Unexplained death</td>
<td>96</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>105</td>
<td>0.1</td>
</tr>
<tr>
<td>Total cases of syndromes reported</td>
<td>7 594</td>
<td>1 629</td>
<td>554</td>
<td>743</td>
<td>706</td>
<td>11 226</td>
<td>8.6</td>
</tr>
<tr>
<td>Total visits (all causes)</td>
<td>91 765</td>
<td>19 552</td>
<td>4 512</td>
<td>8 892</td>
<td>6 333</td>
<td>131 054</td>
<td>100</td>
</tr>
</tbody>
</table>
Syndromes of possible interest to Public Health:

- Respiratory infection with fever
- Bloody diarrhea
- Gastroenteritis (diarrhea, vomiting), without blood
- Febrile illness with rash
- Meningitis, encephalitis, or unexplained acute encephalopathy / delirium
- Suspected viral hepatitis (acute)
- Botulism - like syndrome
- Lymphadenitis with fever
- Sepsis or unexplained shock
- Unexplained death with history of fever
- Other syndrome of possible interest to Public Health
OUTBREAKS / CBRN

- 14 clusters
  - foodborne or waterborne disease
  - Small n of cases (2-5)
    - Family

- 8 larger outbreaks
  - Gastroenteritis
    - N = 6-38 cases
    - Formal intervention

- None in the venues
CBRN

- 6 “suspicious” B incidents
  - All included powder
  - 5 in olympic cities, 1 outside the venue
  - All samples neg for high risk bacteria & viruses

- 2 C incidents
Comparison:

of daily data
with previous 7 days
for each disease/syndrome
and district

using the Poisson test for counts
the binomial test for proportions

at the 99% significance level and
the 95% significance level

(Syndromic surveillance from hospital outpatients: time series analysis
taking into account data from previous years)
Statistical signals from enhanced OG surveillance, 1-31 August 2004

<table>
<thead>
<tr>
<th>Source</th>
<th>Number of Statistical Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory notification system</td>
<td>82</td>
</tr>
<tr>
<td>Primary care sentinel physicians</td>
<td>9</td>
</tr>
<tr>
<td>Laboratory reporting system</td>
<td>90</td>
</tr>
<tr>
<td>“Syndromic surveillance” from hospital outpatients</td>
<td>166</td>
</tr>
<tr>
<td>“Syndromic surveillance” from athletic venues</td>
<td>15</td>
</tr>
<tr>
<td>“Syndromic surveillance” from cruise ships</td>
<td>30</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>392</strong></td>
</tr>
</tbody>
</table>
Translating statistical significance into public health significance

The 3.00 pm daily surveillance meeting
Fig. 1. Flow chart for processing signals

Signal

Not an alert
- Related to small numbers
- Related to health system
- Delayed notification
- Change in surveillance system
- Increase in population
- Other reason for no concern

Signal to be verified
- Observation and review next meeting
- Further analysis of existing data required
- Additional information from source required

Public health alert
- Assessment
- Investigation
- Control
Operational procedures to deal with single cases

SINGLE CASES RELATED TO OGs

- All reported cases of communicable diseases related to OGs: further epidemiological investigation to establish risk of outbreak and take control measures
- Responsibility of “Olympic surveillance” team → need for numerous personnel

SINGLE CASES FROM “SYNDROMIC” SYSTEMS

- Follow-up of cases to get info on final diagnosis (to rule out the possibility of a BT event)
- KEEL staff in hospitals, cruise ships, athletic venues → very demanding in terms of personnel → reassuring that no evidence on BT related event
No major public health event in the Athens 2004 Olympic Games
LESSONS LEARNED (1)

- Surveillance systems were enhanced
- A new syndromic surveillance system was incorporated and tested
- Daily reporting was well accepted
  - Not feasible except for large scale gatherings
LESSONS LEARNED (2)

- SOPs for interpreting data and deciding on measures are necessary
  - Translating stat significance in PH action
  - Specialist capacity
  - Training & relations with regional health units
  - International cooperation
LESSONS LEARNED (3)

- The same people and systems involved in routine public health surveillance activities are being used in the surveillance systems aimed at the detection of possible bioterrorism events.
LESSONS LEARNED (4)

- Good collaboration with other systems
  - Active, integrated environmental health surveillance system
  - The Health Coordination Command Centre

- The whole experience created significant expertise among the staff of the HCDCP
Questions unanswered

- Daily surveillance report
  - Should it be in the public domain?

- Continuation of Syndromic surveillance as part of the ongoing system

- Poor to no risk assessment for CBRN events
The important thing is not to stop searching and questioning
Aknowledgments

• George Saroglou
• Takis Panagiotopoulos
• Nikoleta Mavroidi
• Agoritsa Baka
• Urania Dafni
• All the HCDCP staff…