Foodborne viruses in Europe:

Web-based technologies for investigation of transnational outbreaks of viral gastroenteritis

Ben Lopman,

for:

The Foodborne Viruses in Europe Consortium

M Koopmans, H Vennema, M Reacher, J Carrique-Mas, Y van Duynhoven, F-X Hanon and DWG Brown
Background

- Foodborne viral infections are increasingly recognised as a public health concern
- Norwalk-like viruses (NLV) are the most common cause of enteric disease
  - Large human reservoir
  - Stable outside the host
  - Small infectious dose (10-100 particles)
  - Cause outbreaks among all age groups
- Multiple genetic variants of NLV co-circulate in the community
Virus leads to second hospital closure

The Victoria Infirmary remains closed
Health Officials Pinpoint Disease in Oscar Illness

Los Angeles — A disease that spreads through food infected with sewage pollution likely is responsible for a mystery illness that overcame at least 100 guests at a pre-Oscar ceremony earlier this month, public health officials said.

The March 2 event at the Regent Beverly Wilshire hotel in Beverly Hills honored scientific and technical achievement in cinema. About 500 people attended the dinner and awards presentation.

Days afterward, dozens of guests began complaining of vomiting, diarrhea and nausea. The illness lasted several days in most cases.
<table>
<thead>
<tr>
<th>Agents</th>
<th>Total Illnesses</th>
<th>Foodborne Illnesses</th>
<th>% of all foodborne illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Bacteria</td>
<td>5,204,934</td>
<td>4,175,565</td>
<td>30.2</td>
</tr>
<tr>
<td>All Parasites</td>
<td>2,541,316</td>
<td>357,190</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Norwalk-like viruses</strong></td>
<td><strong>23,000,000</strong></td>
<td><strong>9,200,000</strong></td>
<td><strong>66.6</strong></td>
</tr>
</tbody>
</table>

Source: Mead et al, EID, 2000
Foodborne Viruses in Europe

National Institute for Public Health and the Environment Koopmans et al.

PHLS Colindale Brown et al.

IFREMER LeGuyader et al
University Dijon Pothier et al

Central Public Health Institute, Madrid Sanchez et al

University of Barcelona Bosch et al

University of Helsinki von Bonsdorff et al

Swedish Institute Infectious Disease Control; Svensson et al

Statens Serum institute Bottiger et al

Robert Koch Institute Schreier et al

Central Public Health Institute Rome, Ruggeri et al
Objectives of the network

1) study the epidemiology of enteric viruses across Europe
2) determine high risk foods & transmission routes
3) identify novel strains at the onset and trace their spread.
4) investigate mechanisms of emergence of these novel strains
Harmonisation of European Surveillance

Epidemiological Data  Virological Data

Harmonisation of methods

Development of web-accessible database
Harmonisation of European Surveillance

Epidemiological Data  Virological Data

Harmonisation of methods

Development of web-accessible database
Epidemiological Data I

• Harmonised clinical definitions
  – **CASE** of viral gastroenteritis
  – **OUTBREAK** of viral gastroenteritis

• Standard Outbreak Questionnaire
  – Etiology
  – Transmission
  – Setting
  – Case Information
  – Diagnostic Results
  – Food Vehicles
Epidemiological Data II

- Web-Based outbreak report form
- Active Server Pages technology
- Microsoft Access Database

http://www.eufoodborneviruses.net
Viral Gastroenteritis Outbreak Report Form

Fields with a * must be entered

Reporting Institute: Please select *

Outbreak Reference: *(your unique reference number)

Be sure to retain your outbreak reference. You will need it to update the record.

Reporter's Name: * (First Last)

Today's date: * dd/mm/yyyy

submit ONLY virological data

Transmission

Mode of transmission: Please select one

If foodborne, "PREPARED" takes precedence over "SERVED".
If person-to-person "SERVED" takes precedence over "PREPARED".

Place where transmission of infection occurred: Please select one

Was the outbreak the result of a point source exposure? *(e.g., aztec theme?)
Viral Gastroenteritis Outbreak UPDATE Form

Reporting Institute: NL-National Institute for Public Health and the Environment
Outbreak Number: EP2002040 *(your unique reference number)*
Reporter's Name: Yvonne van Duynhoven *(First Last)*
Today's date: 14/03/2002 *(dd/mm/yyyy)*

Transmission

If foodborne, "PREPARED" takes precedence over "SERVED". If person-to-person "SERVED" takes precedence over "PREPARED".

Mode of transmission: PERSON TO PERSON
if "other", specify

Place where transmission of infection occurred:
Residential institution
Specify:

Was the outbreak the result of a point source exposure?(e.g. at a function?)
No
Viral Gastroenteritis Outbreak Search Page

Search by reporting institute:

Please select  
Search

Search by mode of transmission:

Please select one  
Search

Search by setting:

Please select one  
Search
<table>
<thead>
<tr>
<th>Institute</th>
<th>Outbreak Reference</th>
<th>Reporter Name</th>
<th>Report Date</th>
<th>Organism</th>
<th>Mode of transmission</th>
<th>Setting</th>
<th>First date of onset</th>
<th>Characterisation data entered?</th>
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<td>18/03/2002</td>
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<td>PERSON TO PERSON</td>
<td>Hotel/Guest House</td>
<td>25/12/2001</td>
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</table>
Short Outbreak report

Reporting Institute: NL - National Institute for Public Health and the Environment

Outbreak reference: EP2002040

Reporter’s name: Yvonne van Duynhoven

Report date: 14/03/2002

Mode of transmission/ setting

Mode of transmission: PERSON TO PERSON
Setting of outbreak: Residential institution
Details of setting: nursing home
Was the outbreak the result of a point source exposure?: No
Date of point source exposure:

Aetiology

Was the organism identified?: Yes
Organism name: Norwalk-like virus

Case information

Number at risk: 422
Harmonisation of European Surveillance

- Epidemiological Data
- Virological Data

Harmonisation of methods

Development of web-accessible database
Virological Data: Sequencing of NLV

1. Diagnostic PCR fragment

2C  3C  RNA pol  capsid

5  5358  5371  6947  6950  7585  7654

GLPSG  YGDD
Virological Data II

- Web-based genetic bank

Please select an experiment for identification:

<table>
<thead>
<tr>
<th>Sequence types</th>
<th>Fingerprint types</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLV-Polymerase</td>
<td>NLV-RLB (bands)</td>
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<tr>
<td>NLV-Capsid</td>
<td></td>
</tr>
<tr>
<td>HepA-Vp1_P2a</td>
<td></td>
</tr>
<tr>
<td>SLV-Polymerase</td>
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<tr>
<td>SLV-Capsid</td>
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<tr>
<td>ASV-Capsid</td>
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<tr>
<td>NLV-long sequences</td>
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</table>

Applied Maths, Ghent, Belgium
Database
- Login: calici
- Password: 
- Experiment: NLV-Polymerase

Identification
- Display up to: 10

Sequence data

Back to the main menu page
The databases are relational.

Epidemiological Database

Sequence Database

Searchable

Food vehicles

Cross-Reference

Linked Outbreaks

Sequences
A group of linked outbreaks
Phylogenetic inference of emerging variant NLV Iib Hilversum:

Polymerase gene
Emerging variant
Emerging variant detected in eight countries
A group of linked outbreaks
Phylogenetic inference of emerging variant NLV IIb Hilversum:

2001-17
2001-14
2001-07
2001-29
2001-19
2000-48
2000-44
2000-00
2001-06

Hawaii
Girlington
Wortley
Lordsdale
Grimsby
SnowMounta
Mexico
OTH
Melksham
Hillingdon
Arg320
GGIIc Den Haag

Polymerase gene

IIb Hilversum
Summary

• We have identified linked outbreaks on an international scale

• Transnational outbreaks may be common
  – Introduce new genetic variant to an area

• The Foodborne Viruses in Europe group has developed a model for the detection of transnational outbreaks
  – Web accessible password protected database
  – Open to all participants
  – Links can be recognised from epidemiological OR virological characteristics of outbreaks
Conclusions

- Recognition of international outbreaks relies on both molecular typing and epidemiological data

- Preliminary results from our network show the value of standardised international databases for the recognition of transnational outbreaks
Acknowledgements

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