The Outbreak Database – A Tool for Hospital Epidemiologists
Prof. Ralf-Peter Vonberg, University of Hannover
A Webber Training Teleclass

The ´Outbreak Database´
– A tool for hospital epidemiologists

Definition of „Nosocomial Outbreak“

… is a sudden increase in the incidence rate of nosocomial infections to a value above normal, affecting large numbers of people or spread over a wide area.

PART #1
Nosocomial Outbreaks in Medical Literature

Prevalence of nosocomial infections


• February 2006 - May 2006
• number of hospitals: 270
  ▪ England (190)
  ▪ Wales (20)
  ▪ Northern Ireland (15)
  ▪ Republic of Ireland (45)
• number of patients: 75,694
• surgical procedures: 19,984
• HCAI prevalence: 7.59 %

Prevalence of nosocomial infections from outbreaks

About 5 to 10 % of all nosocomial infections are acquired during an outbreak.
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PART #2
Learning from Nosocomial Outbreaks

Nosocomial outbreaks ...
... represent an extraordinary situation
... are frightening for staff
... cause morbidity, mortality and costs
... may contain unknown variables
... may start anytime
... may occur anywhere
... may draw public attention

Learning from nosocomial outbreaks
Outbreaks of nosocomial infections: lessons learned and perspectives
Penta Gastmeier and Ralf-Peter Vonberg

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What do we need?

A single outbreak description is most likely not representative for the situation in other hospital settings.

Generalization of findings requires a systematic analysis of a large number of reports of similar nosocomial outbreaks.

What do we get?

may be used

will hardly be used

The problem of retrieving data

Outbreak recognition

Outbreak reporting

Outbreak obtainment

Outbreak recognition

no … … yes

awarement of staff

“usual ward”

“high risk patients”

number of patients

small

large

type of pathogen

physiological flora

rare species

severity of illness

colonization only

infection / lethal outcome

Outbreak reporting

Disinfectant contaminated with Klebsiella oxytoca as a source of sepsis in babies

Research methods and results showed that contaminated disinfectant was introduced to a neonatal and pediatric intensive care unit. All babies were infected with Klebsiella oxytoca and further transmission occurred to other babies. The resistance of K. oxytoca against the disinfectant was probably mediated by specific enzymes, which were required for its survival.

CORRESPONDENCE

Consequences of scientific reporting of complications

So far, the publication of scientific reports of complications has been reported to be rare. An influence of the number of patients or the severity of illness on the public scrutiny of the results is not described. The research methods and results of this study have been published in a local, perhaps less visible journal, and therefore have not been propagated in medical and research networks.


Outbreak obtainment

Content

complete vs. lacking

Understanding

English vs. other languages

Retrieving

limited subscription vs. open access

Identifying

locally-read journal only vs. option for an internet-based search

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The problem of evidence

- randomized controlled trials cannot be carried out
  - approach to outbreaks is retrospective (by definition)
    - loss of time = loss of information
  - ethical dilemma of putting persons at risk on purpose
    - determining dose of infection, e.g. in the immuno-compromized
    - tolerating potential risks of nosocomial infections in patient care
    - judging the use of infection control measures by intentional breaks
  - standardized manner of outbreak reporting lacking
    - data often missing that is required for risk factor analysis

ORION may improve quality


Need for standardized reporting


PART #3
Introducing the Outbreak Database

Data collection is time consuming

There is a need for a tool for ...
... hospital epidemiologists
... infection control personnel
... infectious diseases specialists
... health care workers on the ward
... staff in microbiology & virology
... many others

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The Outbreak Database

Welcome to Outbreak Database, the world-wide database for nosocomial outbreaks!

www.outbreak-database.com

Ralf-Peter Vonberg
Institute for Medical Microbiology and Hospital Epidemiology
Hannover Medical School

- only “real” nosocomial outbreaks are included
- web-based application ⇒ available world wide & 24/7
- user registration ⇒ advanced search mode possible
- relevant outbreak characteristics filed separately
- use free text and / or given search terms
- run by university hospital staff (non-profit organization)
- may be assessed absolutely free of charge

Characteristics

- articles (new files get added regularly) 2,500
- setting countries 87
  medical departments 25
- pathogen possible or proven sources 7
  modes of transmission 4
  causative species > 250
- patients risk factors 11
  types of infection 52
- staff infection control measures 14

Characteristics (continued)
- year of the outbreak
- type of facility
- year of publication
- total # of cases
- type of study report
- # of fatal cases
- outbreak duration
- age groups
- # of outbreak phases
- typing methods

Search the Outbreak Database

combine parameters

search terms vs. free text

get PubMed URL

export to MS Excel®

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Use the “Group-By” function

Part #4
Application of the Outbreak Database

Prevention of infections by outbreaks
1. Support during an investigation of an outbreak
2. Education of medical staff
3. New insights in the role of pathogens and potential routes of transmission
4. Preparing infection control guidelines
5. Ideas for future applications

Support in an outbreak investigation

Support in an outbreak investigation

Support in an outbreak investigation

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Support in an outbreak investigation
191 MRSA outbreaks in total

- 26 outbreaks
MRSA-positive staff may have been the source of the outbreak
- 13 outbreaks
Epidemiological and microbiological findings including genotyping of MRSA strains:
Staff was most likely not the outbreak’s source.
- 8 outbreaks
Staff was infected.
- 3 outbreaks
Staff was colonized.

Support in an outbreak investigation
As total closure of a ward is expensive:

1. What are the most critical patients?
2. What are the most transmissible pathogens?

Support in an outbreak investigation

<table>
<thead>
<tr>
<th>Medical Department</th>
<th>No. Outbreaks</th>
<th>No. Outbreaks with Closure (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>246</td>
<td>44 (12.7%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Neurology</td>
<td>307</td>
<td>44 (14.3%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Internal Medicine</td>
<td>132</td>
<td>8 (6.1%)</td>
<td>0.032</td>
</tr>
<tr>
<td>Hematology/Oncology</td>
<td>285</td>
<td>12 (4.2%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Genetics</td>
<td>24</td>
<td>24 (100%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>General Medicine</td>
<td>24</td>
<td>3 (12.5%)</td>
<td>0.032</td>
</tr>
<tr>
<td>Dialysis</td>
<td>30</td>
<td>5 (16.7%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Medical Imaging/Neurology</td>
<td>44</td>
<td>7 (16.3%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Transplantation</td>
<td>26</td>
<td>5 (19.2%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>52</td>
<td>9 (17.3%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Urology</td>
<td>41</td>
<td>5 (12.2%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Total</td>
<td>1,561</td>
<td>194 (12.4%)</td>
<td>-</td>
</tr>
</tbody>
</table>

Support in an outbreak investigation

<table>
<thead>
<tr>
<th>Species</th>
<th>No. Outbreaks</th>
<th>No. Outbreaks with Closure (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus spp.</td>
<td>188</td>
<td>12 (10%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Pseudomonas spp.</td>
<td>130</td>
<td>10 (7.7%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>115</td>
<td>10 (8.7%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Acinetobacter spp.</td>
<td>105</td>
<td>24 (22.9%)</td>
<td>0.020</td>
</tr>
<tr>
<td>Serratia spp.</td>
<td>94</td>
<td>14 (14.9%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>67</td>
<td>8 (11.9%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>66</td>
<td>10 (15.2%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Streptococcus spp.</td>
<td>63</td>
<td>18 (28.6%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Salmonella spp.</td>
<td>56</td>
<td>4 (7.1%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Legionella spp.</td>
<td>48</td>
<td>2 (4.2%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Norovirus</td>
<td>34</td>
<td>15 (44.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Clostridium spp.</td>
<td>34</td>
<td>4 (11.8%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>27</td>
<td>7 (25.9%)</td>
<td>0.050</td>
</tr>
<tr>
<td>Aspergillus spp.</td>
<td>25</td>
<td>5 (20.0%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Influenza virus / Parainfluenza virus</td>
<td>26</td>
<td>10 (38.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Citrobacter spp.</td>
<td>12</td>
<td>3 (25.0%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Adenovirus</td>
<td>11</td>
<td>3 (27.3%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>11</td>
<td>4 (36.4%)</td>
<td>0.040</td>
</tr>
<tr>
<td>Total</td>
<td>1,561</td>
<td>194 (12.4%)</td>
<td>-</td>
</tr>
</tbody>
</table>

Support in an outbreak investigation

Education of staff

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INFECTION CONTROL, AND HOSPITAL EPIDEMIOLOGY
301

How Outbreaks Can Contribute to Prevention of Nosocomial Infection: Analysis of 1,022 Outbreaks
Peter Gustafsson, HR, Sander Rasmussen, MSc; Ingrid Bjerregaard, MSc; Ita Brouwer, MSc; Lars Lassen, MSc; Karin Graubner, MSc; Thomas Buus, MSc

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May some mold species be considered less virulent than others?

What are the most important mold sources in the hospital area?

Who are typical types of patients at risk for an invasive mold infection?
**Education of staff**

1. What are the most risky substances?
2. What pathogens cause the outbreak?
3. At what occasion does contamination usually take place?
4. What are the clinical consequences?

**Type of substance**

<table>
<thead>
<tr>
<th>Substance</th>
<th>No. outbreaks</th>
<th>No. patients</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparin and/or NaCl solutions</td>
<td>30</td>
<td>451</td>
<td>4.3</td>
</tr>
<tr>
<td>Erythrocyte concentrates</td>
<td>14</td>
<td>39</td>
<td>86.4</td>
</tr>
<tr>
<td>Thrombocyte concentrates</td>
<td>10</td>
<td>173</td>
<td>1.5</td>
</tr>
<tr>
<td>Other types of blood products</td>
<td>10</td>
<td>121</td>
<td>4.7</td>
</tr>
<tr>
<td>Total parenteral nutrition</td>
<td>7</td>
<td>622</td>
<td>4.3</td>
</tr>
<tr>
<td>Propofol</td>
<td>6</td>
<td>53</td>
<td>13.8</td>
</tr>
<tr>
<td>Sulbutanol</td>
<td>4</td>
<td>143</td>
<td>0.0</td>
</tr>
<tr>
<td>Ultra sound gel</td>
<td>4</td>
<td>36</td>
<td>0.0</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>3</td>
<td>15</td>
<td>0.0</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>2</td>
<td>50</td>
<td>0.0</td>
</tr>
<tr>
<td>Others</td>
<td>25</td>
<td>413</td>
<td>23.2</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
<td>25</td>
<td>44.0</td>
</tr>
</tbody>
</table>

**New insights**

Outbreaks in neonatal intensive care units—They are not like others

Helm Gastmeier, MD; J. Andrea Leon, MD; S. Sathmier; R. M. Audrain-Callender, MPH; K. L. Kase, MD; S. J. Wood, MD; J. A. F. de Carvalho, MD; R. C. Azevedo, MD; R. J. F. de Carvalho, MD; R. A. J. F. de Carvalho, MD; H. W. Hubner, MD; and B. Z. F. de Carvalho, MD.

University of Medicine and Dentistry of Philadelphia, Perelman School of Medicine, Philadelphia, Pennsylvania, USA; and Hospital de Clinicas de Ribeirao Preto, Faculdade de Medicina, Universidade de Sao Paulo, Ribeirao Preto, Sao Paulo, Brazil.

Background: Information on neonatal infections monitored in neonatal intensive care units (NICUs) has been recently described and have led to a better understanding of the role of infections in the NICU setting. The objective of this study was to evaluate the pattern of infections in NICUs and to compare them with other ICUs.

Methods: Data were collected from a prospective study of 12 NICUs in Brazil and 16 NICUs in the United States. The NICUs were selected to represent the spectrum of care settings for preterm infants in the United States and Brazil. The study was conducted from April 1, 2003, to March 31, 2004.

Results: The NICUs had a total of 642 infants admitted during the study period. The NICU had a higher rate of bloodstream infections (18.8 per 1,000 patient-days) compared with the ICU (14.0 per 1,000 patient-days). The NICU also had a higher rate of respiratory infections (9.7 per 1,000 patient-days) compared with the ICU (6.0 per 1,000 patient-days).

Conclusion: neonatal intensive care units have a different profile of infections compared with other ICUs, with a higher rate of bloodstream infections and respiratory infections.

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New insights

What are the differences in NICU outbreaks compared to other ICUs in terms of …

① … causing pathogens?
② … type of infection?
③ … sources of the outbreak?
④ … infection control measures?

Infection control measures to limit the spread of *C. difficile*:

- Patient screening
- Hand hygiene
- Isolation / cohorting
- Protective clothing

Models on outbreaks

Statistical epidemic modeling with hospital outbreak data

- M. Wolverson, M. Dertouzos, D. Bonsor, M. Schmacher, and J. Heuchan
- Institute of Medical Biometry and Medical Informatics, University Medical Center Göttingen, Germany
- Department of Internal Medicine 1. Hematology/Oncology, University Medical Center Göttingen, Germany
- Department of Internal Medicine 1. Hematology/Oncology, University Medical Center Göttingen, Germany
- Department of Internal Medicine 1. Hematology/Oncology, University Medical Center Göttingen, Germany

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Modeling on outbreaks

assumption  estimation  expectation


Summary

Nosocomial outbreaks have always occurred and (most probably) always will.

Nosocomial outbreaks may have severe clinical and economical consequences.

Be aware of nosocomial outbreaks and publish findings for the benefit of future patients.

The Outbreak Database is an extremely valuable tool in outbreak research.

Suggested reading


SCIENTIFIC AND EPIDEMIOLOGICAL STUDY

Worldwide Outbreak Database: the largest collection of nosocomial outbreaks
Ralf-Peter Vonberg, Ralf-Peter von Berg, Malte T., T. Malte

www.webbertraining.com/schedulep1.php

COMING SOON ...

12 Apr. 11 (Free British Teleclass) Voices of the IPS
Speaker: Infection Prevention Society Board

13 Apr. 11 (South Pacific Teleclass) Prevention of Surgical Site Infections
Speaker: Dr. Matthias Melnitz, KK Women’s and Children’s Hospital, Singapore

14 Apr. 11 Healthcare-Associated Infection Prevention Bundles – Preventing The Preventable
Speaker: Dr. William Jarvis, Jason & Jarvis Associates

28 Apr. 11 (Free British Teleclass – A. Denver Russell Memorial Teleclass)
The Spaulding Classification for Disinfection and Sterilization
Is it Time to Reconsider?
Speaker: Dr. Gerry McDonnell, Steris Inc.

05 May 11 (Free WHO Teleclass) The Importance of Worldwide Hand Hygiene
Events and Activities
Speaker: Prof. Didier Pittet, University of Geneva Hospitals
Sponsored by WHO Patient Safety Challenge (www.who.int/gpsc/en)

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