Emerging Infections in Healthcare Delivery: Roles for HL7 in Applied Public Health

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- March 2003 IOM Report
  - Important 3rd release on Emerging Infections
  - Focus on capture of existing data for improved surveillance and control of infectious diseases
Factors in Emergence

- Microbial Adaptation and Change
- Human Vulnerability
- Climate and Weather
- Changing Ecosystems
- Economic Development and Land Use
- Human Demographics and Behavior

- Technology and Industry
- International Travel and Commerce
- Breakdown of Public Health Measures
- Poverty and Social Inequality
- War and Famine
- Lack of Political Will
- Intent to Harm
Factors in Emergence

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• “It’s conceivable, in fact, that in certain places microbial "perfect storms" could occur—convergences of all the factors—and unlike meteorological perfect storms, the events would not be on the order of once-in-a-century, but frequent.”
Emerging Infections

• What are some examples of emerging infections?

• What factors of emergence are associated with healthcare delivery?
West Nile Virus

Viral Encephalitis

West Nile Virus Transmission Cycle

Mosquito vector

Bird reservoir hosts

Incidental infection

West Nile virus

Incidental infection

Number Infected

Cases

Deaths

Year

1999 2000 2001 2002 2003

Cases

Deaths

0 500 1000 1500 2000 2500 3000 3500 4000 4500
Monkeypox

Prairie Dogs

Gambian Rat

Monkeypox Pustules
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Breakdown of Public Health Measures

• “The breakdown of public health measures in the United States has resulted in an increase in nosocomial infections…”

• "Hospitals are perfect breeding grounds for transferring infections among patients, health care providers, and the community."
Healthcare-Associated Infections in the U.S.

- 1.8 million hospitalized patients infected/year
- 88,000 infections contribute to death/year
- 5 pathogens associated with 50% of all infections
- Outside the US, one emerging pathogen recently had a profound impact as a healthcare-associated infection
Cases of Probable SARS – Taiwan, 2003
Cases of SARS – Toronto, 2003

*N = 361.*
SARS

Coronavirus

Budding SARSologist

Personal Protective Equipment

Disinfecting Taipei
Lessons from SARS

• Healthcare-associated transmission of SARS was the primary accelerator of disease in Toronto and Taiwan

• SARS represents the confluence of both emerging infections issues and patient safety issues

• Surveillance for healthcare-associated infections is a vital component for preventing both emerging infectious diseases and for improving patient safety
Healthcare-Associated Infections

• What systems are available to monitor healthcare-associated (nosocomial) infections?

• How is HL7 incorporated into these efforts?
CDC’s Healthcare Surveillance Activities

• Designed to help infection control, dialysis, and occupational health programs promote patient and healthcare personnel safety by providing tools to:
  – Identify the existence of problems that need to be addressed
  – Monitor the success of interventions
  – Trend data over time
  – Determine what events to target for greatest efficiency and resource management
National Healthcare Safety Network

- Comprised of three existing networks
  - NNIS: National Nosocomial Infections Surveillance System
    - Est 1970
    - Determines national baselines for hospital infections and antimicrobial resistance
  - DSN: Dialysis Surveillance Network
  - NaSH: National Surveillance System for Healthcare Workers
National Healthcare Safety Network

- Built on architecture developed for:
  - Public Health Information Network (PHIN)
  - National Electronic Disease Surveillance System (NEDSS)
- HL7 messages and models
  - Data repository modeled after V3 RIM
  - Messaging capabilities for V2.x and V3
  - Standard terminology consistent with HL7 goals
  - Utilizes V3 public health notification messages
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Exploring Innovative Systems of Surveillance

• “Advances in information technology, such as automated systems of syndromic surveillance, may also be helpful”
Syndromic Surveillance

• What efforts to facilitate syndromic surveillance have been initiated?

• How is HL7 incorporated into these efforts?
eHI Activities

• Collaboration with eHealth Initiative (eHI), CDC, and others to develop standard messages to improve reporting of syndromes potentially indicating infectious diseases of public health importance

• HL7 2.3.1 message implementation guides for connecting clinical systems to public health
  – Chief Complaint
  – Healthcare Orders
  – Microbiology Results
Messaging

Implementation Guides / XML Schemas / Standards

- **Introduction To PHIN Health Level Seven (HL7) Implementation Guides** (123 KB)
- **Bioterrorism Lab Result Implementation Guide** (770 KB)
  This implementation guide documents the use of Health Level 7 (HL7) Version 2.4 to support reporting laboratory results in the context of Bio-terrorism response messaging.
- **Disease Specific Implementation Guides - Part 1** (zip file, 4.2 MB)
  This file contains implementation guides for the following diseases: Hepatitis A, Hepatitis B (Perinatal), Hepatitis B (Acute), Hepatitis C (Chronic or Resolved), Group A Streptococcus, Group B Streptococcus, Haemophilus Influenza, CRS and a generic guide.
- **Disease Specific Implementation Guides - Part 2** (zip file, 4.1 MB)
  This file contains implementation guides for the following diseases: Other Invasive Strep Diseases and Bacterial Meningitis, Hepatitis Non-ABC and Chronic Hepatitis B, Measles, Neisseria Meningitis, Hepatitis C (Acute), Pertussis, Pubella, Streptococcus Pneumoniae, Summary Notification Message.
- **Electronic Lab Reporting v 2.3.1 Implementation Guide** (455 KB)
  This guide contains the specifications for sending laboratory-reportable findings to appropriate state, territorial and federal health agencies using Health Level 7 (HL7) messages.
- **Microbiology Implementation Guide** (370 KB)
  This implementation guide discusses how to structure microbiology result messages to be sent for public health purposes using the HL7 Version 2.3.1 standard message protocol.
- **Notification Messaging Basic Description** (604 KB)
  This document provides an overview of the Notification Messaging component of the Public Health Information Network (PHIN).
- **Transmission of Laboratory, Pharmacy and Supply Orders Guide** (267 KB)
  This guide focuses on diagnostic test or clinical observation orders, supplies and pharmacy orders.

http://www.cdc.gov/phin/messaging/
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*Microbial Adaptation and Change*

- "Antimicrobial resistance is a paramount microbial threat of the twenty-first century“
- "With the presence of antimicrobial resistance may come a corresponding increase in mortality and morbidity from untreatable disease…”
Antimicrobial Resistance

Tuberculosis

Malaria

Staphylococcus aureus

Vancomycin Resistant

Community MRSA

CDC
CDC should implement automated electronic laboratory reporting of notifiable infectious diseases from all major clinical laboratories to their state health departments as part of a national electronic infectious disease reporting system.

This would not only improve surveillance but assist in the control of antimicrobial resistance.
Electronic Laboratory Reporting

• What systems are available to automatically report laboratory data electronically?

• How is HL7 incorporated into these efforts?
Electronic Laboratory Reporting

- ELR improves timeliness and accuracy
- HL7 messaging incorporated into NEDSS Base System – available to state health departments for public health reporting
- Uses HL7 v2.3.1 ORU message and acks
- Messages from LabCorp, Quest, and others
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NHSN Medication Module
AUR Option

- Collects microbiology/antimicrobial susceptibility data from existing data source
- Utilizes V3 message for transport
- Imported into NHSN database
- Use of the AUR Option will assist hospitals in collecting data on antimicrobial resistance and/or antimicrobial use so that this information can be used for prevention purposes.
National Monitoring of Antimicrobial Use and Resistance

- Collaboration with CDC, HL7, and Theradoc
- Transmit nationally representative micro and susceptibility data from a national data repository to CDC using HL7 v3 derived messages
- Pharmacy and ADT messages to follow
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*Integrating Reporting*

- “…develop innovative strategies to improve communication between health care providers and public health authorities”
- “…implement a national electronic infectious disease reporting system”
Integrated Reporting

• What efforts are underway to integrate public health reporting?

• How is HL7 incorporated into these efforts?
Adverse Event Reporting

Public Health Reporting

MedWatch

VAERS

MAUDE
Adverse Event Reporting

- Collaboration between HL7, FDA, and CDC to build a common V3 HL7 message
- Business requirements include:
  - Device-associated adverse events
  - Food/Supplement-associated adverse events
  - Vaccine Adverse Events
  - Public Health Notifiable Diseases
  - Animal products/drugs pending
  - Tissue Allografts/Biologicals under consideration
Conclusion

• A number of factors contribute to emerging infections, those associated with healthcare delivery include:
  – Infection control lapses leading to nosocomial infections
  – Antimicrobial resistance

• Recent efforts to improve monitoring of healthcare-associated and antimicrobial-resistant infections utilize HL7 messaging and modeling in the prevention of infectious diseases
Questions - Comments

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