Informatics and Infection Control

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Patricia W Stone, RN, PhD, FAAN
Centennial Professor of Health Policy
Director Center of Health Policy
Columbia University School of Nursing
New York, NY
Why Informatic Solutions
Why Informatic Solutions
Types of Informatic Applications for Infection Prevention and Control

• Electronic Infection Surveillance Systems (ESS)
• Clinical Decision Support Tools
• Automated Monitoring of Clinician Compliance
Types of Informatic Applications for Infection Prevention and Control

- Electronic Infection Surveillance Systems (ESS)
- Clinical Decision Support Tools
- Automated Monitoring of Clinician Compliance
Shifting paradigms for infection prevention and control

• Traditional Surveillance

• Spending too much time collecting data
• Not enough time analyzing results, teaching and implementing interventions
Electronic Surveillance Systems (ESS)

- Pulls data from multiple sources
  - Laboratory, Surgery, Radiology
  - Pharmacy
  - Admission/Discharge/Transfer
- Electronic in-patient records
Deliverables

Data Mining Reports

Comprehensive Measurement

Financial Outcomes Analysis

Benchmarking

January 2003 - December 2004 (43,726 Admissions)

<table>
<thead>
<tr>
<th>Infection Type</th>
<th>Number</th>
<th>Freq</th>
<th>DRG Adj Variable Cost</th>
<th>Cumulative DRG Adj Variable Cost</th>
<th>DRG Adj Profit/Loss</th>
<th>Cumulative DRG Adj Profit/Loss</th>
<th>DRG LOS Adj</th>
<th>Cumulative DRG LOS Adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTI</td>
<td>782</td>
<td>35%</td>
<td>$2,886</td>
<td>$2,286,878</td>
<td>($2.619)</td>
<td>($2,047,931)</td>
<td>4.58</td>
<td>3.582</td>
</tr>
<tr>
<td>Bloodstream</td>
<td>270</td>
<td>12%</td>
<td>$8,479</td>
<td>$2,289,288</td>
<td>($7.205)</td>
<td>($1,945,264)</td>
<td>9.42</td>
<td>2.544</td>
</tr>
<tr>
<td>PNEU</td>
<td>212</td>
<td>10%</td>
<td>$6,991</td>
<td>$1,482,097</td>
<td>($6,973)</td>
<td>($863,414)</td>
<td>7.00</td>
<td>1.493</td>
</tr>
<tr>
<td>Surgical Site</td>
<td>174</td>
<td>8%</td>
<td>$3,901</td>
<td>$678,775</td>
<td>($1,928)</td>
<td>($355,521)</td>
<td>5.83</td>
<td>1.015</td>
</tr>
<tr>
<td>Grand Total</td>
<td>2,230</td>
<td>100%</td>
<td>$7,849</td>
<td>$17,022,195</td>
<td>($6,796)</td>
<td>($12,926,076)</td>
<td>8.95</td>
<td>19.048</td>
</tr>
</tbody>
</table>

Types of infections <10% excluded from being included in grand total.
CHAIPI: Demonstrating the impact of Electronic HAI Surveillance Technology

Launched by Blue Shield of California Foundation
CareFusion MedMined™ selected as ESS vendor
Goal: use ESS to reduce preventable HAIs

Grants awarded to 11 hospitals to support ESS adoption

Compelling clinical & economic results

605 infections prevented
4,641 hospital days avoided
$3 million in hospital savings; $9 million estimated total savings (all payors)
## Survey 2008 (n = 192) vs. Survey 2010 (n = 189)

<table>
<thead>
<tr>
<th>Hospitals that use ESS</th>
<th>Survey 2008</th>
<th>Survey 2010</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>44 (23%)</td>
<td>55 (29%)</td>
<td>0.169</td>
</tr>
</tbody>
</table>

### Hospitals that use ESS, specifically use:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Survey 1</th>
<th>Survey 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data mining (system integrated with clinical, laboratory, and pharmacy)</td>
<td>16 (36%)</td>
<td>32 (58%)</td>
<td>0.024</td>
</tr>
<tr>
<td>Automatic alerts</td>
<td>25 (57%)</td>
<td>48 (87%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Built-in templates to create reports and data summaries</td>
<td>34 (78%)</td>
<td>49 (89%)</td>
<td>0.104</td>
</tr>
<tr>
<td>Integration of infection data with CDC definitions and/or reporting requirements</td>
<td>19 (43%)</td>
<td>30 (55%)</td>
<td>0.266</td>
</tr>
</tbody>
</table>

- On average, hospitals had been using ESS for four years
- Generally, with time more functions of ESS are used
- 2012 Survey of 975 hospitals, 34% using ESS (Stone et al., 2014)
Electronic Surveillance Systems: Usability and Satisfaction

Overall Satisfaction  
Access to tech support  
Ease of use  
Surveillance features  
Effect on workflow  
Interface organization  
Reporting features

*Satisfaction measured on 5-point Likert scale, higher score was more satisfied

CHAIP Data, 2010, Stone
Satisfaction with ESS was high: staff felt ESS contributed to improved patient outcomes and added to their surveillance capabilities.

Infection prevention departments reporting high levels of administrative support were more likely to have ESS as well as report high levels of satisfaction with ESS.

### Electronic Surveillance Systems: Usability and Satisfaction

<table>
<thead>
<tr>
<th>Category</th>
<th>2008 Mean Satisfaction Score</th>
<th>2010 Mean Satisfaction Score</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Satisfaction</td>
<td>3.8</td>
<td>4.1</td>
<td>0.34</td>
</tr>
<tr>
<td>Access to tech support</td>
<td>4.1</td>
<td>4.0</td>
<td>0.43</td>
</tr>
<tr>
<td>Ease of use</td>
<td>3.9</td>
<td>4.1</td>
<td>0.37</td>
</tr>
<tr>
<td>Surveillance features</td>
<td>3.7</td>
<td>3.7</td>
<td>0.97</td>
</tr>
<tr>
<td>Effect on workflow</td>
<td>3.6</td>
<td>3.7</td>
<td>0.61</td>
</tr>
<tr>
<td>Interface organization</td>
<td>3.5</td>
<td>3.5</td>
<td>0.83</td>
</tr>
<tr>
<td>Reporting features</td>
<td>3.4</td>
<td>3.4</td>
<td>0.99</td>
</tr>
</tbody>
</table>

CHAIPi Data, 2010, Stone
“We don’t have to spend so much time doing surveillance and we can spend more time on the units” (IP)

“It’s a standardized way of acquiring data. It’s just a lot easier... better structure. You can also feed it back into long term data so we can see a much larger period of time” (Hospital Epidemiologist)

“It has become more at the forefront of the unit. Now that they’re able to see their own data and they’re able to report that back to their staff, it’s becoming more meaningful and they’re seeing the impact” (Director of Quality)

“[ESS] has helped us by bringing this information forward in a timely fashion to prevent one or two infections a month....there’s the payment price” (IC Director)
Data elements and validation methods used for electronic surveillance of health care-associated infections: A systematic review

Kenrick D. Cato PhD, RN a,*, Bevin Cohen MPH a,b, Elaine Larson PhD, FAAN, RN, CIC a,b

a School of Nursing, Columbia University, New York, NY
b Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY
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Methods

• Included ESS systems for 5 common HAIs
  • CLABSI, CAUTI, SSI, VAE, MDRO and c-diff
• Systematically audited published studies
  • Data sources
  • Internal and external validation
  • Validation of numerator and denominator
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  • Internal and external validation
  • Validation of numerator and denominator

Results

• 30 studies audited
• 83% used HAI-specific data sources (eg cultures)
• Validation
  • 33% internally validated
  • 0 externally validated
  • 80% validated numerator
  • 10% validated denominator
Methods
ESS HAI data were validated against human point prevalence surveys (PPS)

Results
ESS 88% sensitive to UTI
100% sensitive to BSI

Conclusion
Replacing PPS with ESS may provide better and more objective data
Some events lend themselves to automation easier than others: Ventilator Associated Events (VAE)

The new NHSN objective algorithm
- Based on daily PEEP and FiO2 levels
- Allows for easier automation
- Ventilator needs to be connected to hospital information system
- 3 types of events
  - Ventilator-associated condition (VAC)
  - Infection-related ventilator associated complication (IVAC)
  - Probable ventilator associated pneumonia
ESS Vendors

• In the US, the ESS vendors should link to NHSN for mandatory reporting

http://www.apic.org/Professional-Practice/Practice-Resources/Vendors-List
17 Approved ESS Vendors

- ATLAS
- CareFusion | MedMined® services
- Midas+
- EpiQuest
- TheraDoc
- ckm HEALTHCARE
- INTERSYSTEMS
- icenet
- Alere
- TRUVEN HEALTH ANALYTICS
- Cerner
- NHSN
- RL solutions
- VigiLanz
Things to think about if purchasing/developing ESS

• Understand **differences** between ESS definitions and clinical definitions

• System issues:
  
  • Interoperability with current software
    
    • Ability to pull individual patient data from multiple hospital sources (i.e., laboratory, pharmacy, ADT, electronic health record)
  
  • Ability to translate the data into actionable alerts
  
  • Ability to generate needed reports (i.e., unit managers, administration, notifiable conditions, link with NHSN)

• Interview the vendor
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Clinical Decision Support

• Provide clinicians, staff, patients, and other individuals with knowledge and person-specific information, intelligently filtered and presented at appropriate times, to enhance health and health care.

https://healthit.ahrq.gov/sites/default/files/docs/page/09-0069-EF_1.pdf
## Types of CDS for infection prevention and control

<table>
<thead>
<tr>
<th>Target Care Area</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Vaccination records</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>HAI diagnosis</td>
</tr>
<tr>
<td>Treatment</td>
<td>Evidence based guidelines, antibiotic stewardship</td>
</tr>
<tr>
<td>Follow-up management</td>
<td>Reminders about adverse events, discontinuing isolation</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Duplicate testing alerts</td>
</tr>
</tbody>
</table>
CDS for Isolation Precautions

Kathleen A. Quan, Sarah M. Cousins, Darlene D. Porter, Robert A. Puppo, Susan S. Huang, AJIC, 2015, 43:6
CDS for Isolation Precautions

- Automation saved 43 IP hours/1000 admissions
  - Also unquantifiable IP hours looking up medical histories
- Point prevalence study for isolation eligibility found 100% appropriate
A Specific CDS: “Apps”

Review and analysis of existing mobile phone applications for health care–associated infection prevention

Rebecca Schnall RN, MPH, PhD * 1, Sarah J. Iribarren RN, PhD 1

*Columbia University School of Nursing, New York, NY

American Journal of Infection Control 43 (2015) 572-6

Only 17 apps reviewed.
Limited functionality.
Problems with maintenance.
CDC: iScrub app
Issues with all CDS tools

• The CDS is only as good as the underlying evidence
• “Cookbook care” is the rallying cry against standardization
# 10 Commandments for CDS Systems

<table>
<thead>
<tr>
<th>Commandment</th>
<th>Description/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Must be fast</td>
</tr>
<tr>
<td>Simplicity</td>
<td>Too much information is a burden to all</td>
</tr>
<tr>
<td>Minimal Data Entry</td>
<td>Pre-populate when possible</td>
</tr>
<tr>
<td>Routinely Maintain and Evaluate System</td>
<td>When guidelines change-update!</td>
</tr>
<tr>
<td>Identify Latent Needs</td>
<td>e.g., therapeutic drug monitoring for antibiotic stewardship</td>
</tr>
<tr>
<td>Fit into the Existing Workflow</td>
<td>Use end user experts in development</td>
</tr>
<tr>
<td>Usability is Essential</td>
<td>Human factors understanding is essential</td>
</tr>
<tr>
<td>Do not stop and</td>
<td>Allowing end user to complete task not using CDS</td>
</tr>
<tr>
<td>Clinicians will not stop</td>
<td>Include clinically appropriate alternatives</td>
</tr>
<tr>
<td>Measure and Share Success</td>
<td>Reinforces value</td>
</tr>
</tbody>
</table>

Wright et al., 2015 from David W. Bates
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- Electronic Infection Surveillance Systems (ESS)
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Real Time Feed Back
MediHandTrace

Foot steps traced

Tag in heel of shoe

Zigbee Wireless HH system
Computerized HH compliance

• Technologies are not yet fool proof
  • Unable to assess 5 moments for HH
  • Unable to assess adequacy of HH
• Expensive, may improve with time
• Need maintenance
• Limited use at this time
Summary/Conclusions

• Electronic Surveillance Systems are here to stay!
  • Be sure to know the underlying HAI definitions
  • Use the data wisely—don’t get lost in the fancy reports

• Clinical decision support tools are being developed, improving care and saving time
  • Think about workflow to achieve maximum results when implementing

• Automated monitoring of multiple processes are possible
User Beware!

"After careful consideration of all 437 charts, graphs, and metrics, I've decided to throw up my hands, hit the liquor store, and get snookered. Who's with me?!"
Thank you!

Please contact me at ps2024@columbia.edu