Comprehensive Evaluation of the Infectious Disease Bio-Surveillance System in a County Public Health Department

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Introduction
1 Who We Are

Human Computer Interaction Institute

Carnegie Mellon University

Center for Advanced Study of Informatics in Public Health
Brief Summary of HCI

- Computer Science
- Behavioral Science
- Design
What an HCI perspective offers

- Gives us an accurate understanding of the current work process with a focus on technology
- An examination of the usability and efficiency of software systems to identify breakdowns and areas of improvement
- A human-centered approach allows us to familiarize ourselves with the actual people that need to use the system and be able to design for them
Scope
4 Scope

• Understand the practices of surveillance units
• Identify the breakdowns and workarounds in the work process
• Look for opportunities for improving these practices
• Create new designs, validate them with real users, and develop prototypes
• Evaluate and validate the new designs in terms of usability and efficiency
Research
Research Conducted

- “Contextual Inquiry”
  - Observing work processes in context
  - Spending 2-4 hours observing participants
  - Pseudo-Apprentice Role
Research Conducted

- “Diary Studies”
  - Leaving forms with practitioners to see whom the correspond with and how during times we were not able to observe directly
- Interviews
Who We Talked To

- Director of Health Department
  - Head of Epidemiology
    - Epidemiologist
    - Epidemiologist
  - Chief of Infectious Diseases
    - Supervisor Nurse
    - 5 Secretaries
    - Clerk
      - Maintaining Attendance
    - Administrator (Public Health Education)
      - Travel Consultant
    - QA Nurse
      - (Orders, Stores, Monitors Vaccines)
    - Coalition Nurse
      - (Spreads Awareness)
    - 2 Nurses
      - Flu Clinic
    - 4 Nurses
      - (Dog Bites, Vaccines, Measles, Meningitis, Auditing)
    - Nurse
      - (Hepatitis B)
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Findings
Life Cycle of a Case

- Patient
  - Reporting Authority
    - Lab Database
Life Cycle of a Case

- County HD
  - Epidemiology Dept.
  - Dept. of Infectious Diseases
- NEDSS
- Reporting Authority
- Lab Database

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Introduction | Scope | Research | Findings | Conclusion | Future Work
Life Cycle of a Case

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- **Patient**
- **Reporting Authority**
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- **NEDSS**

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Life Cycle of a Case

Diagram:
- County HD
  - Epidemiology Dept.
  - Dept. of Infectious Diseases
- Patient
- State
- NEDSS
- Reporting Authority
- Lab Database

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Life Cycle of a Case: Annotated
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Cases cannot be submitted electronically due to formatting issues
Life Cycle of a Case: Annotated

- County HD
  - Epidemiology Dept.
  - Dept. of Infectious Diseases
- Patient
  - Reporting Authority
  - Lab Database

Faxes sent can be illegible
Cases can be sent multiple times by accident
Life Cycle of a Case: Annotated

The state cannot see all of the information they would like and must follow-up with HD directly.
The county has to send request to the state to see activity in surrounding area.
Life Cycle of a Case: Annotated

NEDSS does not support all of the types of cases the county tracks (Ex: MRSA)

Slow server response causes frustration, delays entry of information

Forms are redundant, do not help to prevent errors, and do not make it easy to “undo”
Life Cycle of a Case: Annotated

- County HD
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The Unsimpplier Version...

County HD

- Epidemiology Department: Analyze reports, detect/handle epidemics
- Infectious Diseases Department: Investigate cases

Findings

- Reporting Authorities
- Patients: Relatives (family/work)
- Concerned Residents
- Medical Authorities: Hospitals, Clinics, Laboratories, Quest

Lab Database

Introduction | Scope | Research | Findings | Conclusion | Future Work

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Major Findings: Limitations and Workarounds

Users do not have a way of going back to intermediate steps of generating a report once it is created.
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Major Findings: Limitations and Workarounds

There is no way to pull out detailed information from the IDE (Infectious Disease) reports in NEDSS

NEDSS Generated Report

Workaround: Excel Report
Major Findings: Limitations and Workarounds

• MRSA - This version of NEDSS does not support investigations of cases not meeting state criteria, thus they must create their own systems to support monitoring these instances

• Hepatitis - A nurse worked 45 minutes on a case only to find out that it had already been reported by the department... in 2005
Major Findings: Duplication of Work

- Nurses have to check existing cases before entering a new case in NEDSS to ensure that it is not a duplicate... but sometimes this is not always in effective in preventing duplicate investigations.
- Labs are received via fax that leads to legibility problems.
- Same patient assigned to different nurses because of a spelling mistake in the name.
Major Findings: Duplication of Work

- Large amounts of valuable information is gathered during an investigation, but it is not reported.
- Nurses print screens from NEDSS, annotate on them and then enter the information back into NEDSS.
Major Findings: Duplication of Work

- Nurses have to fill in the same information multiple times while creating a case.
  
  - Lab Codes: “I only use one lab and every time I have to search it up from the hundred labs that come up here.”
  
  - Server Delay: “It’s frustrating to use because it takes such a long time to enter everything”
Major Findings: NEDSS in Decision Making Process

Role of NEDSS in the decision making process:

- NEDSS is used to generate reports on cases
- NEDSS is used to get the questionnaire data related to a case, on a case by case basis
- NEDSS tells about the risk factors, but not about the people who came into contact with the infected people
- NEDSS can help by providing contact information, dates of onset, and care site outcome
Conclusion
Conclusion

- Localized NEDSS system does not make easy enough for different users to get the information they need - and so they have developed parallel systems to help compensate.

- Provide incentive for staff to put in information promptly through improved feedback and tools support (i.e., VOIP, decision making support tools).

- Help staff better handle large amounts of contact information and actually assist with the investigation process and provide incentive to use.
Future Work
Future Work

✓ Duplicate research methods with a different county, different population type, and different NEDSS-based system

✓ Run design workshops with epidemiologists and nurse investigators to brainstorm design solutions and identify promising ones

✓ Wireframe initial design schemas and walk through them with epidemiologists and staff to ensure validity
Future Work

- Prototype and develop new software support:
  - Integration investigation support tools:
    - Ex: Case Management Assistance, Automized Duplication Checks, Contact Management
  - Improved usability with changes to interface and selection menus (less codes)
- Evaluate changes to work process and evaluate efficiency post-implementation of prototype
Thank You

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Thank You

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