The Mobile Emergency Triage (MET) Project

Developing Ubiquitous Clinical Decision Support for Pediatric ED Problems

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Emergency
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April 15, 2005
Outline

• Clinical Decision Support
  – what is it?
  – how can it help?
• Ubiquitous Computing
  – You Bick Quit WHAT?
  – how does this work with MET?
• MET-AP validation trial results
• Other modules
Rapid pulse, sweating, shallow breathing. According to the computer, you’ve got gallstones.
Clinical Decision Support

• Multiple definitions/applications
  – capturing/analysing clinical data on which to base
    • program/operational decisions
      – financial data (cost of doing business)
      – increasingly tied to clinical outcomes
    • point-of-care clinical decisions
      – for individual patients
      – may include tools for the patient
Potentials for CDSS

• Increase health care quality
  – change clinician behaviors by promoting EBM
    • literature or expert-based evidence (Expert Driven)
    • local practice-based evidence (Knowledge Driven)
  – Reduce medical errors
    • built-in safety net
• Increase health care efficiency
  – standardize care/reduce variation
Examples of CDSS

• Alerts
  – highlighting out-of-range lab values
  – patient ready for R/A
• Reminders
  – patient due for next vaccination
• Critiquing
  – screening in CPOE for drug interactions
• Interpretation
  – ECG
Examples of CDSS

• Predicting
  – risk of mortality from a severity-of-illness score

• Diagnosis
  – listing a differential diagnosis based on the patient’s symptoms and findings

• Assisting
  – calculating adjusted drug dosages for renal function

• Suggestions
  – analyse recent PTT results and make suggestions for heparin dosing to keep PTT in therapeutic range
MET Approach to CDSS

- a definitive diagnosis is not always possible
- the goal of ED care is to efficiently “triage” patients to the most appropriate disposition path
  - discharge home
  - observe/investigate for possible pathology
  - refer to another specialist for definitive assessment/management of probable pathology
- “triage” extends beyond the initial assessment and categorization performed by the triage nurse
MET Approach to CDSS

• choose ED problems
  – common patient complaint
  – have multiple possible outcomes to consider
  – MD decisions hindered by uncertainty
    • necessary information not readily available
    • information not consistently organized or recognized
    • patients rarely “fit” the textbook description
  – efficiencies in care could be found with better decision-making
MET CDSS Goals

• Developed with the following goals
  – improved data collection
    • ensure that the MD is considering all important features in an organized fashion
  – assist physician decision-making
  – promote earlier, more accurate triage/disposition decisions
  – NOT a diagnostic test
Helper NOT Enforcer

• provide a weighted recommendation for all possible outcomes
• allow the physician to combine recommendations with their own clinical judgments
Requirements for CDSS in ED

• Emergency = Orchestrated CHAOS
  – patients coming and going
  – staff coming and going
  – multiple distractions
    • sick patients
    • worried parents
    • learners
    • pager
Requirements for CDSS in ED

• Any acceptable system MUST conform to the workflow
  – portable
  – reliable
  – intuitive
  – simultaneously available to multiple users
  – scalable to the needs of specific users
Ubiquitous Computing

- *ubiq·ui·tous*
- Function: *adjective*
  - existing or being everywhere at the same time
Ubiquitous Computing

- Clinical Decision Support
  - customized
    - clinical problem
    - user (staff, trainee, nurse)
  - available
    - anywhere it is required (wirelessly at the bedside)
    - on any digital device (irrespective of operating system or programming language)
MET-AP Validation Trial

- Prospective validation trial (July 2003 – Feb 2004)
  - patients 1-16y
  - acute abdominal pain <10 days duration
  - assessed in the usual fashion
  - staff and residents recorded data electronically and entered their prediction
    - discharge
    - consult surgery for appendicitis
    - observe/investigate for other pathology
  - chart & telephone follow-up to determine the patient’s final outcome
MET-AP Validation Trial

• Integration with hospital IS
  – data recipient
  – EPIC registration data populated our patient database
  – registration used customized research field to flag most patients with abdominal pain
    • these patients displayed to select from
Objectives

• to determine the accuracy of MET-AP in recommending the correct triage category
• to determine the accuracy of staff/resident in predicting the correct triage category
• to determine the inter-observer agreements between staff and residents for evaluating patient attributes
Enrollment

34,527 Patient Visits

2255 Visits with AP

1098 Eligible Visits

631 Approached

593 Enrolled

574 Analyzed

38 Refused Consent

12 Later Excluded

7 Lost to Follow-up

235 Assessed by Staff Only

222 Assessed by Staff & Residents

117 Assessed by Residents Only

457 Staff Assessments

339 Resident Assessments
# Characteristics of Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Analyzed (n = 574)</th>
<th>Not Approached (n = 476)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (SD)</td>
<td>9.13 (3.92)</td>
<td>9.49 (4.42)</td>
<td>0.170</td>
</tr>
<tr>
<td>Male n (%)</td>
<td>284 (49.5)</td>
<td>222 (47.5)</td>
<td>0.575</td>
</tr>
<tr>
<td>Final Triage Category n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge</td>
<td>443 (77.2)</td>
<td>335 (71.7)</td>
<td>0.130</td>
</tr>
<tr>
<td>Investigate/Observe</td>
<td>73 (12.7)</td>
<td>72 (15.4)</td>
<td></td>
</tr>
<tr>
<td>Consult Surgery</td>
<td>58 (10.1)</td>
<td>60 (12.8)</td>
<td></td>
</tr>
</tbody>
</table>
## Overall Accuracies

<table>
<thead>
<tr>
<th></th>
<th>Staff Physician Assessments (n=457)</th>
<th>Resident Assessments (n=339)</th>
<th>Difference Between Physician Type for Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MET-AP Triage Accuracy</strong></td>
<td>72.2% (67.9, 76.1)</td>
<td>69.3% (64.2, 74.0)</td>
<td>2.9% p=0.755</td>
</tr>
<tr>
<td><strong>MD Prediction Accuracy</strong></td>
<td>70.2% (65.9, 74.2)</td>
<td>62.8% (57.6, 67.8)</td>
<td>7.4% p=1.000</td>
</tr>
<tr>
<td><strong>Difference Between Methods for Physician Type</strong></td>
<td>2.0% p=0.518</td>
<td>6.5% p=0.836</td>
<td></td>
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</tbody>
</table>
## Breakdown of Performance

<table>
<thead>
<tr>
<th>Final Outcome Category</th>
<th>MET Recommendation</th>
<th>Physician Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D/C</td>
<td>Obs/Inv</td>
</tr>
<tr>
<td>Benign</td>
<td>279</td>
<td>39</td>
</tr>
<tr>
<td>Other</td>
<td>38</td>
<td>18</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

April 15, 2005
The Future . . .

• How to improve performance accuracy?
  – consider additional attributes or weight current attributes differently
  – larger prospective database with better representation of “Other” group
  – new techniques to limit imbalance bias of “Benign” group
MET-AP CIHR Proposal

• Expert Opinion Panel
  – identify tacit knowledge used by experts and discover latent attributes used by them

• Two-centre Prospective Data Collection
  – CHEO & HSC, 2000 patients over 12 months
  – 1500 to mine, 500 to test

• Clinical Judgement Analysis
  – examine variations in the ways different groups of physicians utilize attributes to make their clinical judgements

• New Data Mining Methods
  – imbalance bias
Other MET Modules

- Scrotal pain (MET-AS)
- Hip pain/limp (MET-HP)
  - inadequate (+) cases at CHEO -> multicentre
    - septic hip, osteomyelitis
    - SCFE, LCP, etc.
- Asthma (MET-AE)
  - decision for short-stay, long-stay or admit
  - reduce time to admit decision
  - avoid repeat visits for inadequate treatment
  - electronic clinical pathway documentation by nurses and physicians
- Syncope
Thank you

- Please visit us at:

www.mobiledss.uottawa.ca