



Mobile Clinical Decision Support Systems for Acute Pediatric Emergency Complaints: The MET Project



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BACKGROUND

- ED physicians must efficiently triage undifferentiated patients
 - Serious pathology > consult other specialists
 - Benign problems > discharge to community
 - Unknown/other > investigate/observe further
- Process hampered by incomplete and ambiguous information
- Junior physicians (learners) may not obtain complete information or recognize patterns to differentiate "sick" from "not sick"
- May result in inappropriate discharge, unnecessary tests, delays to definitive care, increased patient/parental anxiety
- Advances in medical informatics allow computerized Clinical Decision Support Systems (CDSS) to assist
 - Prompt the physician to get the important information
 - Evaluate the current presentation against a clinical model
 - Present recommendations for the physician to consider/act on
- CDSS tools must be available to the physician at the point-of-care
- Mobile technology allows complex CDSS at the bedside (m-health)

OBJECTIVES

To develop the Mobile Emergency Triage (MET) CDSS for common acute pediatric emergency complaints with the end goal that these tools will assist physician decision-making and promote earlier disposition decisions

METHODS

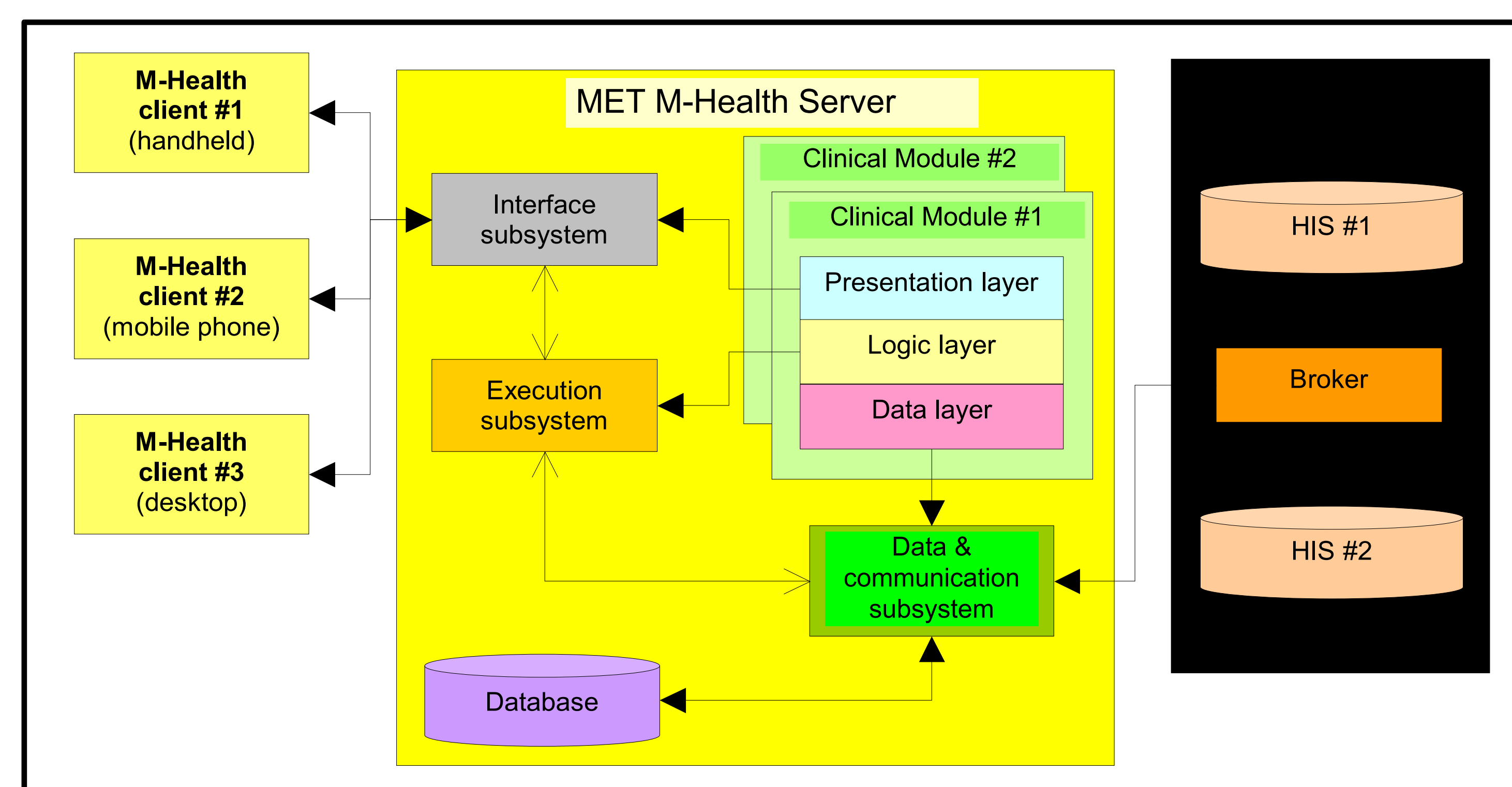
- Multidisciplinary project team with members representing
 - Clinical care
 - Decision support & data mining
 - Computer Science
- Multiple streams of innovative research and development
 - Clinical algorithms (modules) for various complaints
 - New data mining techniques for knowledge discovery
 - Ubiquitous computer systems allowing the system to be used on any digital device (PDA, tablet, smart cell phone)
 - Integration with existing Health Information Services (HIS) and Electronic Health Records (EHR)

STEPS IN DEVELOPING A CLINICAL MODULE

- Identify common clinical presentations where the physician must choose from several possible disposition paths in a timely fashion
- Conduct a literature review to identify all possible attributes that may be used to describe/differentiate patients with the complaint
- Complete a retrospective chart review to create a database of known patients with their attribute values and final outcome
- Analyze the retrospective data using mining techniques to identify patterns that differentiate patient groups
- Prospectively validate the accuracy of the algorithm
- Revise/redevelop the algorithm if performance is less than clinically acceptable
- Implement and evaluate the impact of the CDSS on patient care and efficiencies in different environments

RESULTS TO DATE

- Development of a functional architecture for our m-health system
 - Intelligently deliver each component, as necessary, to various lean mobile clients
 - Integrate with HIS and HER
 - Operational in wireless laboratory



ABDOMINAL PAIN (MET-AP)

- Prototype module based on 650 retrospective patient charts
- 13 common clinical attributes selected from analysis
- Decision support to differentiate 3 groups with acute AP
 - Consult surgery for probable appendicitis
 - Discharge for benign or resolving causes
 - Investigate/observe for other serious causes
- Prospective validation trial of 574 patients over 8 months
 - Patients enrolled on PDA 24/7 by over 150 different physicians
 - Physicians blinded to MET recommendation and patient managed in usual fashion
 - Compared MET recommendation and physician prediction to gold standard established through extensive follow-up
 - Overall accuracies similar (MET 67%, physicians 70%)
 - Excellent inter-observer agreements for most attributes
- ISSUES:
 - "Other" group very diverse, therefore more data required
 - MET not as conservative as physicians, resulting in unacceptable number of "appendicitis" patients discharged
- NEXT STEP:
 - Multi-centre prospective data collection trial to capture more "Other" patients and other clinical attributes, including those describing the patient's general appearance
 - Assess physician acceptance, how they would combine their clinical impression with divergent MET recommendation



SCROTAL PAIN (MET-AS)

- Module based on 400 retrospective patient charts
- Decision support for 3 disposition groups for acute scrotal pain
 - Consult urology for probable testicular torsion
 - Discharge benign or resolving causes
 - Outpatient clinic for torsion of appendix testis, hydrocele, etc.
- NEXT STEP:
 - Analysis continues to develop the clinical algorithm

HIP PAIN (MET-HP)

- Module based on 350 retrospective patient charts
- Decision support to differentiate 3 groups with hip pain/limp
 - Discharge for benign or resolving causes
 - X-ray & consult orthopedics for possible SCFE, LCPD, occult #
 - Lab, bone scan for possible septic joint, osteomyelitis
- ISSUES:
 - Poor pilot test accuracy for X-ray and bone scan groups due to small numbers in the dataset
- NEXT STEP:
 - Multi-centre prospective data collection trial to capture more patients with serious but rare outcomes

ASTHMA EXACERBATIONS (MET-AE)

- Data collected for 800 patient visits
- Decision support to differentiate 3 groups with asthma exac.
 - Short-stay in ED <4hrs, no return visits
 - Long-stay in ED 4-16 hrs, no return visits
 - Admit to hospital (proxy ED>16 hrs)
- ISSUES:
 - Unlikely able to predict solely on 1st assessment, therefore temporal dimension added to analysis to consider subsequent assessments and treatments over time
- NEXT STEP:
 - Analysis continues to develop a two-stage clinical algorithm

GLOBAL ISSUES TO SOLVE

- No system will perfectly predict every patient
 - What is an acceptable level of accuracy to allow safe integration into current practice?
- Few if any CDSS are in use or have undergone rigorous evaluation
 - What are the methodological standards for evaluating CDSS?
 - What is the best method of assessing physician acceptance and success of integration into current practice?
- Wireless communication is the ideal solution for m-health
 - How can data security concerns be overcome?
 - How much electronic interference will be generated once everyone is carrying a wireless device?
- Integration with EHR
 - Can the system automatically "learn" from new patients' data?