Sociotechnical Evaluation of the Safety and Effectiveness of Point-of-Care Mobile Computing Devices: A Case Study Conducted in India

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Health Care Reform in India

- Countries are investing in HIT at unprecedented rates
- Reform in India will affect over 1 billion people
- Goal is to get to a resilient “IT-enabled health system”
  - Better health care quality, safety and efficiency
- More than 2/3 of the population lives in rural areas
  - Limited health care access
  - Technology penetration low
  - Physicians scarce
- Challenges to successful HIT implementation
  - Patient safety concerns
  - Provider productivity/workflow issues

Sittig, Kahol, & Singh 2013; Singh & Sittig 2013
Swasthya Slate (Health Tablet)

- Mobile computing device for affordable point-of-care diagnostics in rural settings
  - Developed by Public Health Foundation of India (PHFI)

- Front-line, non-physician health care workers can use it to collect and interpret basic clinical data

Sittig, Kahol, & Singh 2013
Swasthya Slate

- Point of care mobile computing device;
- Cost-effective “open-source” operating system; easy data collection and storage
- Electrodes and sensors to capture BP, glucose, hemoglobin, EKG, temperature, heart rate, and water quality
- Data captured by a non-physician synced with an online server
  - Can be accessed by a qualified physician for additional decision-making

Sittig, Kahol, & Singh 2013
Small (3.5 inch) box connecting via Bluetooth to a 16 GB Android tablet that has the Swasthya application.

Sittig, Kahol, & Singh 2013
Information Technology

- Necessary?
- Only solution?
- Technology use must be accompanied by a strategic approach accounting for the context of the environment where implemented
- Both technical and non-technical factors need to be addressed
8-dimensional Socio-Technical Model of Safe & Effective EHR Use

Hardware & Software
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Organizational Policies, Procedures, & Culture

Workflow & Communication

Personnel

Content

Hardware & Software

User Interface
8-dimensional Socio-Technical Model of Safe & Effective EHR Use

Organizational Policies, Procedures, & Culture

Workflow & Communication

Personnel

External Rules & Regulations

Hardware & Software

Content

User Interface
8-dimensional Socio-Technical Model of Safe & Effective EHR Use

Organizational Policies, Procedures, & Culture

Workflow & Communication

Personnel

Measurement & Monitoring

Content

Hardware & Software

User Interface

External Rules & Regulations
Project Aims

- Develop a sociotechnical assessment guide organized by 8 dimensions of sociotechnical model to evaluate the Swasthya Slate

- Evaluate the Swasthya Slate
  - Design
  - Development
  - Usability

- Ensure the device’s safe and effective large-scale use in rural India

Sittig, Kahol, & Singh 2013
Assessment Guide

- Developed an itemized assessment guide to identify risks or challenges to safe and effective tablet use

- Content derived from
  - Literature reviews
  - Interviews with experts and potential users
  - Documenting/observing user acceptance
  - Field observations

Sittig, Kahol, & Singh 2013
Examples from the Guide...

- The tablet will run the required software applications for at least 4 hours on battery power.
- Clinical content can be updated remotely.
- The required software applications can be used with a finger (no gloves) or a stylus.
- Centralized IT support personnel are accessible via cellphone or Voice-over-IP to health care workers.
Examples from the Guide...

- Indications for referral are clearly specified and sent to the referring provider either via paper, fax, email, etc.
- Procedures for maintenance and technical problem-solving are clearly delineated.
- Regulations create mechanisms to strictly reinforce the delivery of expedited clinical care and referrals for patients who are found to need urgent medical attention.
- 5% of data collected are validated for accuracy.
Evaluation

- Surveyed 100 community health workers: 50 midwives, and 50 health workers

- Mean usability rating was 8.9/10 (SD = 0.6)
  - Lowest score for user customization (mean 7.8/10, SD 1.1), customization was limited to avoid interference with Best Practices
  - Highest domain score for suitability for the task (mean 9.2/10, SD 0.6).

- Average learning time to first correct execution of the software was 10 minutes,
  - by 45 minutes users were able to use the apps with less than 1% “slip” errors (e.g., accidental pressing of buttons, etc.).

- Assessment revealed and addressed both technical (functionality, content, usability, user interface) and non-technical (workflow, processes and policies etc.) areas of improvement
Results and Improvements

- Product enhancements resulting from our evaluation:
  - Tablet case redesigned so that the device is better protected from environmental factors
  - Software reliability improved
  - User Interface improved
    - Large text on buttons
  - Workflow modified: upfront diagnostics performed before checkup, fit user’s workflow, minimizing time kit needed to be turned on, maximizing battery life.

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Results and Improvements

- Developed reporting system to be in line with the reporting requirements of the government

- Decision Support System designed to limit interventions by frontline health workers to those that are non-pharmacological

- Identified skill sets of types of personnel using the device

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Future Plans...

- Pilot tests of Swasthya Slate continue
- Stakeholders must assemble multidisciplinary assessment teams to conduct these evaluations
- Data from these tablets must be used successfully to improve clinical care
  - Quality
  - Safety
  - Efficiency
- Devices must be integrated within the social context of the health system

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Conclusions...

- Swasthya Slate effective
  - Used by trained health care workers
  - Collect data
  - Assist with primary health care needs

- HIT changing the way we deliver health care

- Can be used to reform and improve health care, especially in developing countries

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Thank You

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