1. Presenting Problems

**Human factors/limitations:**
- human factors analysis documents cognitive limitation & errors *per* fatal sentinel event root cause analysis reported in The Joint Commission (TJC) *The Source* (April 2015, 13:4)
- failure to monitor blood at correct intervals to prevent heparin-induced thrombocytopenia, owing to erroneous order set entry
- causative factors include staffing ratio & cognitive overload

**Medical mistakes:**
- 220,000 – 440,000 preventable patient deaths annually in USA
- 4,800,000 annual patient deaths globally.
- chronic underreporting from failure to record, no codes

**Physician burnout:**
- Causes: pressure of time, electronic health record (EHR) system use, chaotic environment, family responsibilities & little schedule/pace control *per* Agency for Health Research & Quality
- Burnout greater than 50% in some venues & $4.6B annual cost impact on USA healthcare *per* Annals of Internal Medicine
2. Root Cause Exacerbation

Concurrent & complex personal health domains:
- womb-to-tomb duration of individual health management
- multiple/mixed medical practice & healthcare delivery venues
- continual knowledge accrual/update & integration with practice

Time criticality:
- micro, e.g. – bio-physiological mechanisms such as homeostasis
- macro, e.g. – person-specific pathology detection & management
- constant monitoring needed to mitigate illness & failure-to-rescue

Information intensity:
- high volume, velocity & variety
- impedes information management: acquire, assess, apply & adopt
- forces use of heuristics & rules-of-thumb for memory & activity

Venue chaos:
- concurrent complex process/activity execution
- ambient system & staff randomly occurring distractions, e.g. – staff clinical/social conversation & alarm fatigue
- marginal/inadequate patient-staff ratios

EHR system design and operating/use factors:
- exacerbates non-clinical workload, e.g. – pajama-time charting
- impedes patient-provider relationship development
- little/no workflow-compatible provider benefit, e.g. – “push” functionality, clinical decision support

These conditions and factors exacerbate the medical mistake root cause: cognitive overload.
3. Mitigation Methods

As Is:
- Patient safety organization programs & publications focused on human, leadership & other factors subject to behavioral control
- Reliance on heuristics, rules-of-thumb & training identified by TJC’s Robust Process Improvement (RPI)™
- Current tools & methods
  - raise complex knowledge & clinical process execution to a high level of abstraction to reduce cognitive demand
  - abstraction may obfuscate essential/significant detail
  - typically exacerbate cognitive overload because of need to memorize/recall

To Be:
- Information technology (IT) real-time cognitive support in mobile application/app form/format
- Mobile apps created & operated by healthcare provider clinical & administrative subject matter experts in do-it-yourself mode
- Mobile apps leverage automated processes designed & developed as digital knowledge artifacts using Object Management Group (OMG) standard process & decision notation
- Mobile apps memorialize knowledge as information in operating context to
  - ensure replicable execution with no new medical mistakes
  - facilitate knowledge accrual & continuous process improvement with versioning/archiving
- Steps to create & operate mobile apps using DIY SaaS:
  1. provider applies for SaaS subscription via contact form
  2. approved subscriber receives login credentials via email
  3. subscriber uses assigned ID &PW to login via secure portal
  4. subscriber uses OMG-/HIPAA-compliant features to design & deploy automated processes as mobile applications
  5. subscriber accesses mobile app instance for conditional, continuous, or on-demand clinical & administrative uses
4. Expected Results

**Presenting problem (re step 1, top left of poster)**

Post-operative heparin-induced thrombocytopenia (Type 1 HIT), *per TJC’s The Source* (April 2015, 13:4)

- patient started heparin infusion post-op on orthopedic unit & then was later transferred to a cardiac unit
- infusion order entered incorrectly omitting blood test every 6H
- blood test not performed for 24 hours until error was discovered
- Computerized tomography (CT) scan showed intracerebral hemorrhage & patient’s mental status deteriorated comorbidities
- family chose against mitigating surgery & patient died 3 days later

**As Is:**

- manual EHR order input/recording error of commission
- nursing shift hand-off cognitive/communication error of omission
- no reliable failure-to-rescue detective/corrective controls in place
- care/treatment requirements exceed staff ratios & clinical needs

**To Be:**

- DIY provider automation of customized process as mobile app
- continuous EHR system monitoring for order-result conformation
- condition-based notification of responsible care team member(s)
- mobile device delivers notification and requires acknowledgment