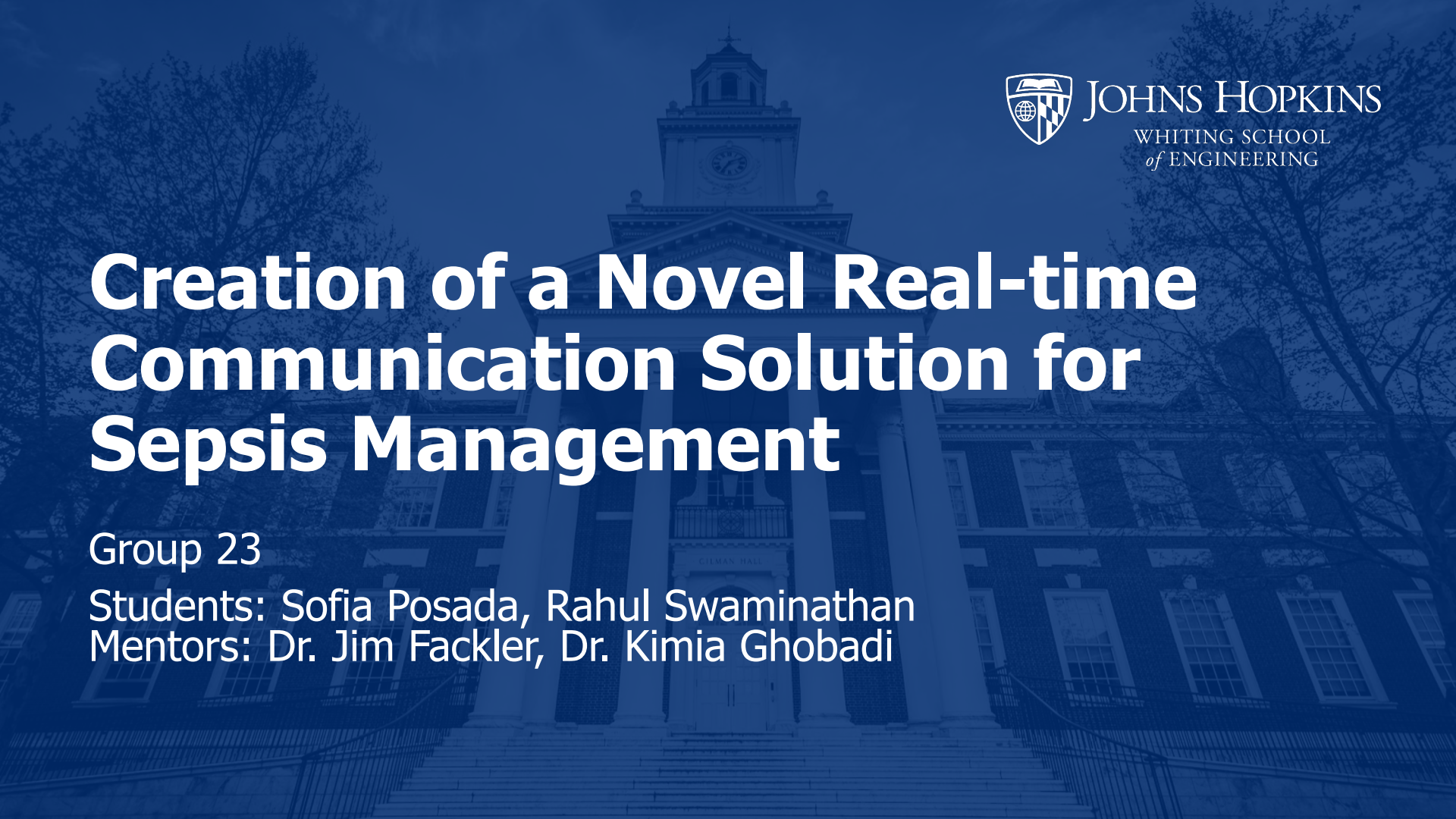

JOHNS HOPKINS
WHITING SCHOOL of ENGINEERING

Creation of a Novel Real-time Communication Solution for Sepsis Management

Group 23

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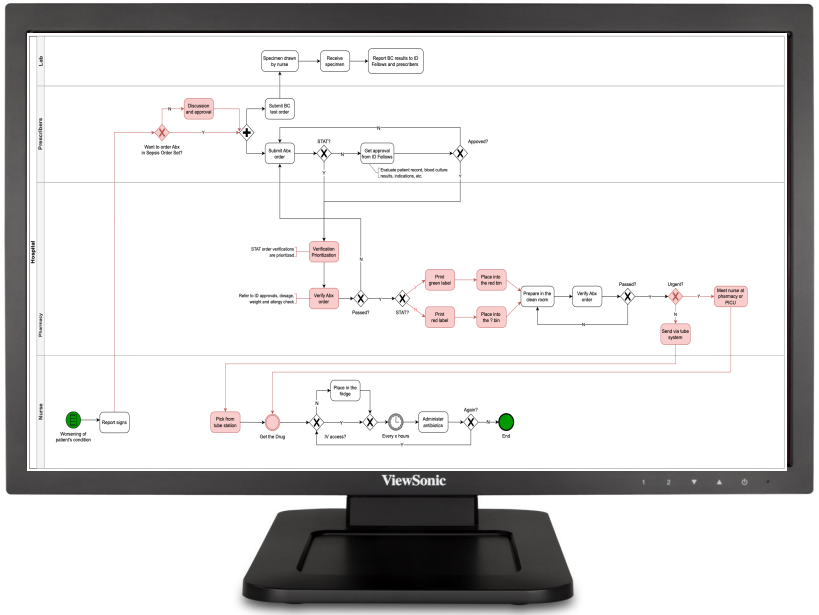
Mentors: Dr. Jim Fackler, Dr. Kimia Ghobadi

Project Summary

- **Goal**: Create a platform for sepsis management to allow antibiotics to be delivered from the pharmacy to the patient in under one hour

- **Solution:**
  - Track antibiotics
  - Visualize process map
  - Alert relevant sepsis team members



Paper Selection

- "A multifaceted intervention including sepsis electronic alert system and sepsis response team on the outcomes of patients with sepsis and septic shock" (Arabi et al, 2017)
  - Implementation and impact of using an e-alert system alongside a sepsis response team to treat sepsis.

Background information needed to understand the paper

- The management of sepsis involves a sepsis resuscitation bundle (a set of evidence-based interventions aimed at improving the outcomes of patients with sepsis)

- Relevant interventions in this paper
  - Measuring lactate levels within 6 hours of sepsis recognition
  - Obtaining blood cultures before antibiotic administration
  - Administering broad-spectrum antibiotics within 1 hour of sepsis recognition
  - Re-measuring lactate levels if initial lactate was elevated
  - …

Significance

Expected Deliverable	Associated Tasks/Milestones	Expected Date
Physical prototype of communication solution that allows providers to visualize where the antibiotics are within the hospital	Test out the Versus Information System (VIS) to see if antibiotic location can be accurately and reliably tracked and exported outside of their software. Find an alternate tracking solution if VIS is not viable	4/6
	Correlate antibiotic location with the roles of team members as described in the process map	4/20
	Set up alerts to automatically inform the relevant personnel when it is their turn	4/27

- Paper explores the possibility of implementing an e-alert system alongside an SRT
- Studies the impact of this implementation on the outcomes of septic patients
- Impact includes compliance with sepsis resuscitation bundle
  - Antibiotic administration < 1 hour = component of bundle

Summary and Key results from paper

- Problem: lack of communication impedes ability to provide efficient & effective care
  - Team members unsure when it is their turn to act - may assume someone else is taking charge or that they are not responsible for a particular task
  - Professionals from many different departments
- Solution:
  - Implement a multifaceted approach: an e-alert system alongside a sepsis response team
  - Study the effects of this approach
- Key Results:
  - Intervention demonstrated improvement in antibiotic administration as well as decreased hospital mortality rates and length-of-stays

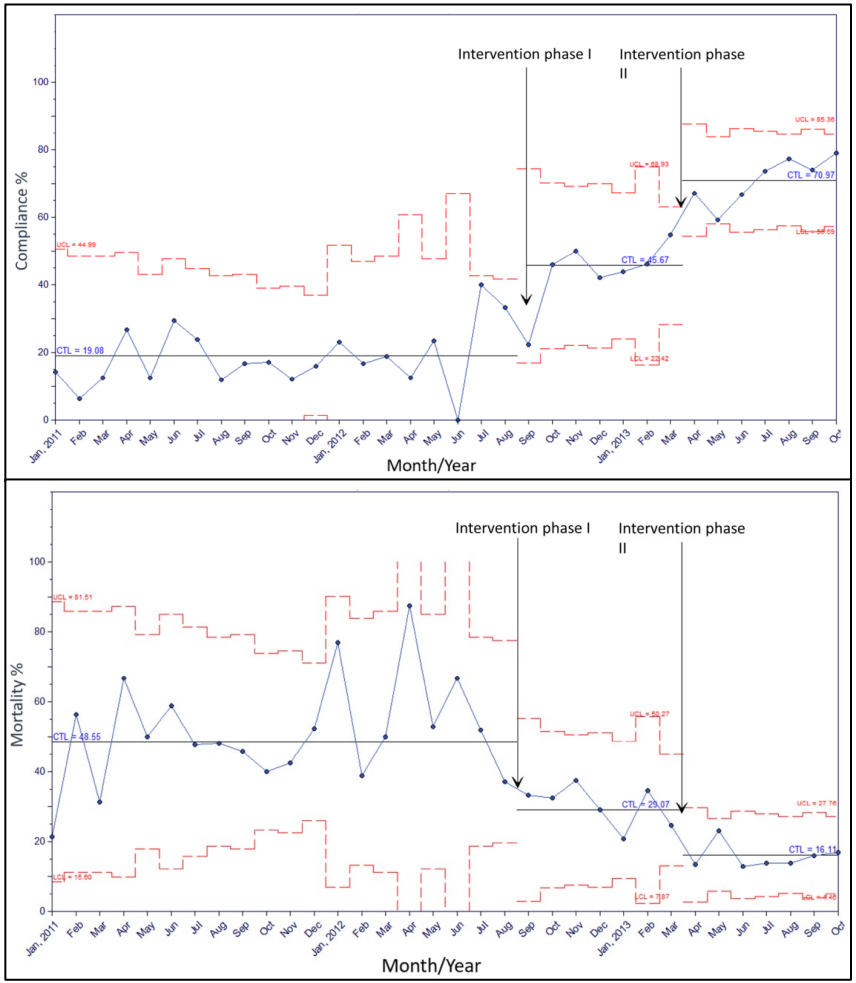
Technical Approach

Retrospective analysis of data from a tertiary care hospital in Saudi Arabia using the 2008 SSC data collection tool.

- Pre intervention phase (January 01, 2011–September 24, 2012): **baseline**
- Intervention phase I (September 25, 2012–March 03, 2013): **e-alert**
  - e-alert in EHR system QuadraMed® Computerized Patient Record System
  - alert system was triggered when a patient met 2+ SIRS criteria and would automatically notify the SRT via mobile phones and pagers
- Intervention phase II (March 04, 2013-October 30, 2013) **e-alert and SRT**
  - bedside nurse activated the SRT after being prompted by the e-alert
  - clear and structured communication pathway for healthcare providers to follow

Results

- Significant improvements in compliance with the sepsis resuscitation bundle and reductions in hospital mortality rates.
- **Compliance with the sepsis resuscitation bundle** increased from 11.8% in the pre-intervention phase to 45.3% in the intervention phase
- Hospital **mortality rates among septic patients** decreased from 29.2% in the pre-intervention phase to 23.3% in the intervention phase



Figures from "The impact of a multifaceted intervention including sepsis electronic alert system and sepsis response team on the outcomes of patients with sepsis and septic shock" (Arabi et al, 2017)

Assessment (pros and cons)

- Pros:
  - Highlights the potential benefits of a multifaceted intervention
  - The intervention is somewhat straightforward and potentially scalable
  - Study has a large sample size and control group
- Cons:
  - Study conducted at one hospital
  - Lack of technical specifications of the e-alert system
  - Paper focused more on the impact rather than implementation of intervention

Next Steps / Conclusion

- This paper provides a way to alert relevant personnel when it is their turn in the sepsis management process
- Previously we had considered using a physical device that sepsis team members would have to wear and they would be alerted by a buzz.
- Although it would have been better to know the technical specifications behind the e-alert system implemented, this study is still a valuable contribution to our project as we now know an electronic alert system is a viable way to relay information to the SRT.
- Next Step:
  - EPIC = EHR system used at JHU -> Secure chat embedded in EPIC
  - Meet with Dr. Fackler and Dave
    - Trigger alerts via secure SRT group chat?

Paper Selection, Summary, and Key Results

- "Implementation of a Web-based medication tracking system in a large academic medical center" (Calabrese and Williams, 2012)
- Problem:
  - Medications delivered from the pharmacy to hospital units are difficult to track
  - Doses are often lost or delayed --> leads to unnecessary search and re-order times
- Solution:
  - Track medications at specified points of the delivery process by scanning barcodes
- Key results:
  - Reduced medication turnaround times by 45% at the central pharmacy and 22% at the satellite locations

Significance

- Tracking was used to identify where the largest delays were occurring
- Ability to measure pharmacy delivery efficiency led to other quality-improvement initiatives
  - Same as what we aim to do with the process map and gap analysis
- Suggested tracking approach can supplement our technical approach without the need for much additional hardware

Technical Approach

- Baseline data collection
  - Medication turnaround times collected through manual recording and observation
- Workflow analysis:
  - Created a process-flow diagram for medication distribution
  - Specific barcode scan points were chosen to account for interactions between pharmacists, technicians, and nurses

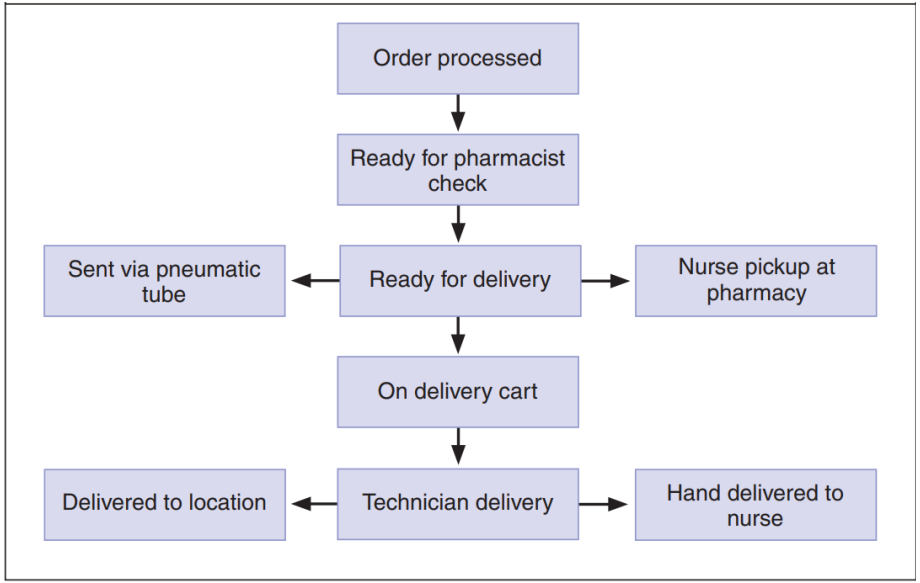
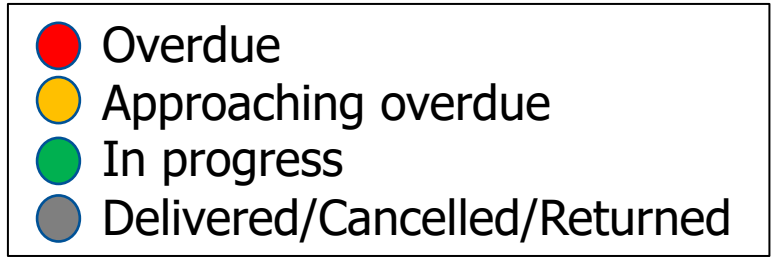


Figure 1 from "Implementation of a Web-based medication tracking system in a large academic medical center" (Calabrese and Williams, 2012)

Technical Approach

- Pharmacy OneSource's MedBoard technology was used as the web-based tracking solution
- Unique 2-D barcodes for each scan point
- Single portal to view each order's destination, delivery status, and time due
- Equipment: Bluetooth scanners, wireless hand-held personal computers, and 42-inch monitors
- Goal of 90% scan completion rate



Results

- Decrease in turnaround times for central pharmacy but increase for satellite pharmacies
- Waiting for delivery causes the longest delay, so technicians were instructed to conduct unscheduled rounds for overdue and approaching overdue medications
- Pediatrics and heart institute pharmacies met the 90% scan completion rate but the central pharmacy and ICU fell below

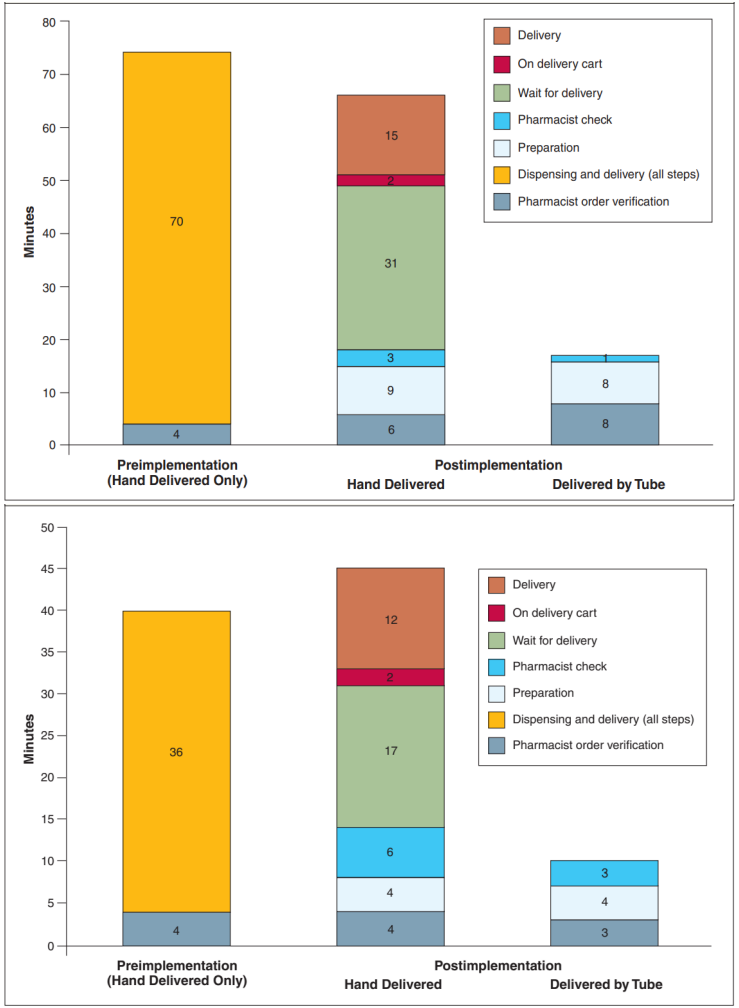


Figure 3 and 4 from "Implementation of a Web-based medication tracking system in a large academic medical center" (Calabrese and Williams, 2012)

Assessment

- Pros:
  - Technical approach is well-explained
  - Successful at least one pharmacy location
  - Scan completion rate provides insight into reliability and potential problems with implementation in large or busy pharmacies
- Cons:
  - Lack of baseline pneumatic tube delivery data
  - Misleading results - increase in hand-delivery times for satellite pharmacies is not explained

Next Steps / Conclusion

- We planned to use IR-based tracking technology, but the method suggested in this paper could be accomplished just through QR-codes and modern cell phone cameras
- PICU might have low scan completion rates due to urgency of delivery needs, so a combination of IR tracking in the PICU and barcode scanning in the pharmacy may work
- Identifying areas of delay through our gap analysis may inform procedural improvements to supplement tracking
- Need to interview pharmacy staff to see if anything like this has been tried before
- Will create a proof-of-concept prototype to verify that we can implement a smaller-scale version of this system on our own without going through a third-party provider

References

- Arabi, Y.M., Al-Dorzi, H.M., Alamry, A. et al. The impact of a multifaceted intervention including sepsis electronic alert system and sepsis response team on the outcomes of patients with sepsis and septic shock. *Ann. Intensive Care 7*, 57 (2017). https://doi.org/10.1186/s13613-017-0280-7
- Sam V. Calabrese, B.S.Pharm., M.B.A., Jonathan P. Williams, Pharm.D., M.S., Implementation of a Web-based medication tracking system in a large academic medical center, *American Journal of Health-System Pharmacy*, Volume 69, Issue 19, 1 October 2012, Pages 1651–1658, https://doi.org/10.2146/ajhp110527