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

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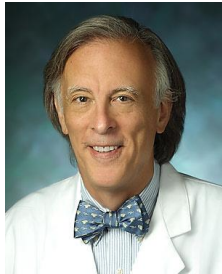
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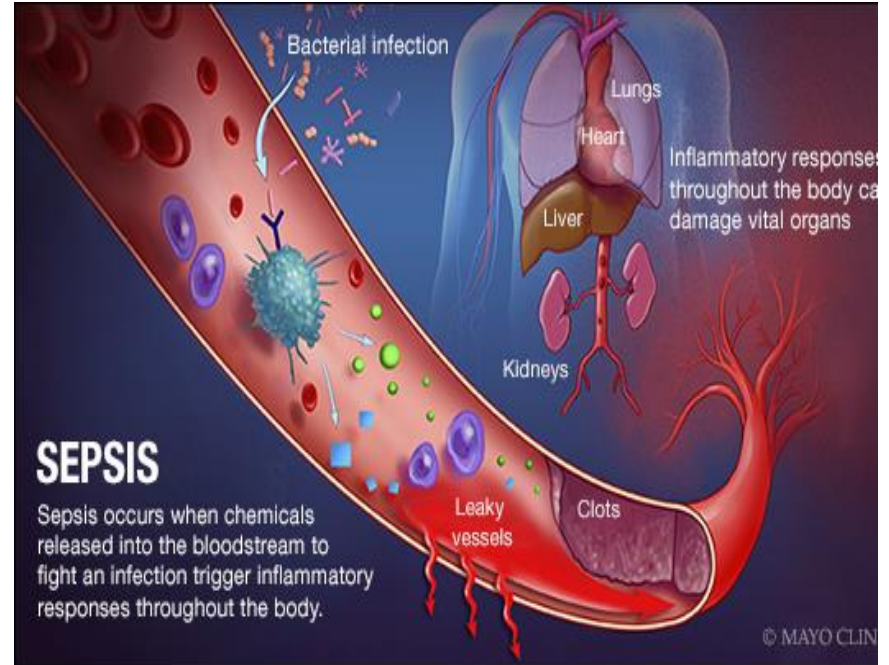
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Background

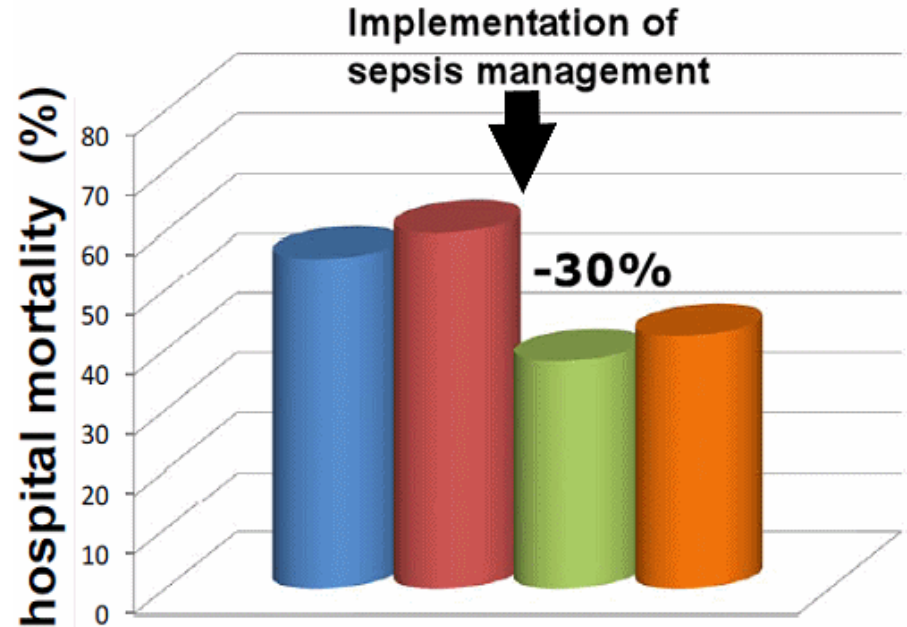
- Sepsis is a life-threatening medical emergency caused by the body's overwhelming response to an infection
- Can progress to septic shock
- Age is a significant risk factor – immune system not fully developed in infants
- If someone begins to experience sepsis symptoms, treatment needed right away!



<https://newsnetwork.mayoclinic.org/discussion/mayo-clinic-q-and-a-understanding-sepsis-and-septic-shock/>

Background cont.

- Sepsis requires hospitalization and medical care urgently
- Prompt treatment decreases mortality rate
- Delivery of antibiotics within **one hour** leads to better results – decreased mortality rates, shorter length of stay at hospital
- Multiple research articles explain the importance of delivering antibiotics within one hour.

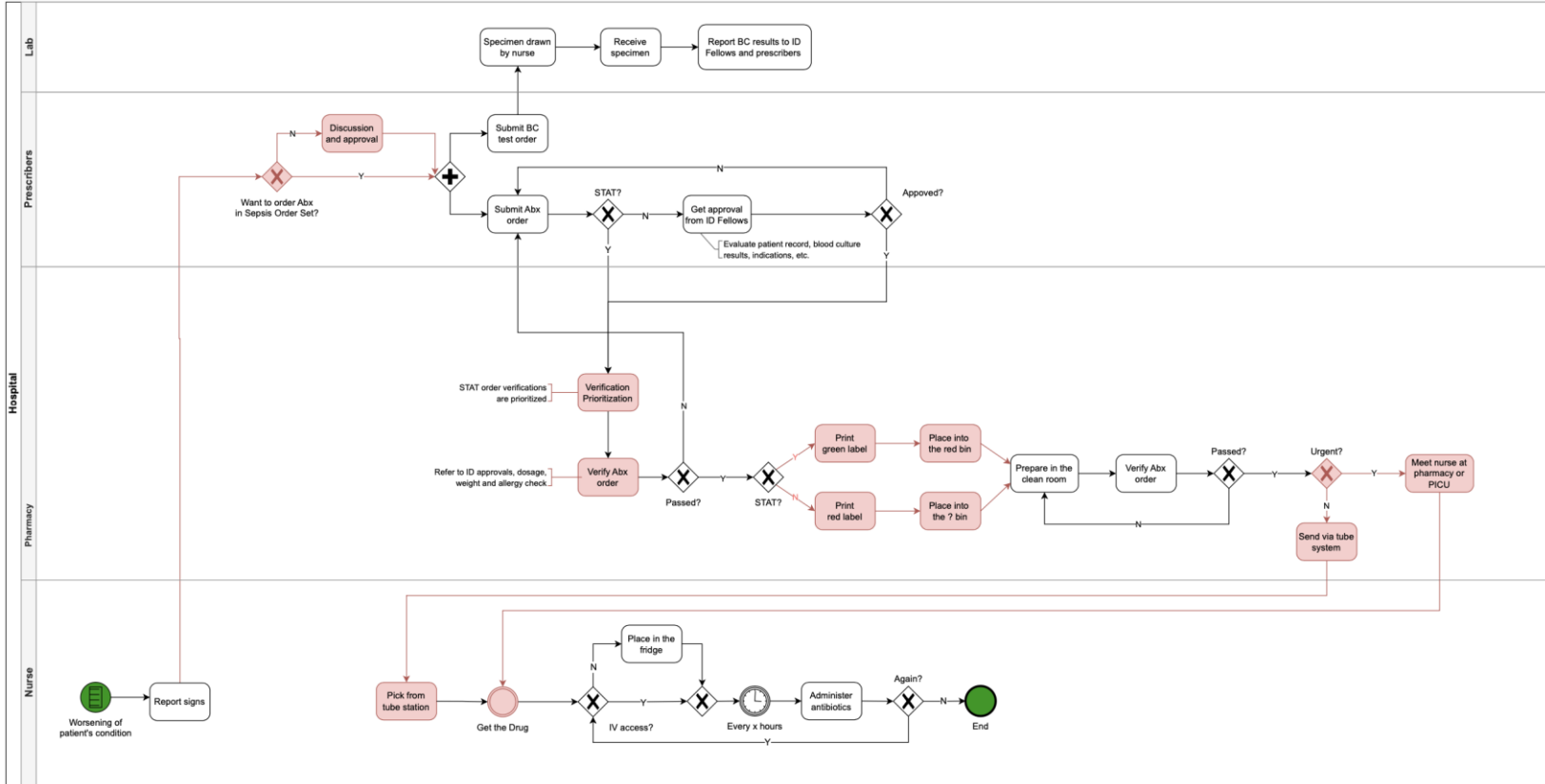


Michael Christ: How to manage sepsis in the Emergency Department leading to a decreased mortality ...

Our Goal this Semester

- “The specific task is delivery of IV antibiotics within an hour to children diagnosed with a serious bacterial infection.” – Dr. Fackler
- But how?
- Rahul and I want to develop a Hopkins-viable solution to allow the sepsis management team to see each step of the process and to allow each person to know when they “have the ball”
- We will begin with a process map currently being built by another student for his Master’s Thesis

Prior Work – Chen Wang's Process Map



Technical Approach Overview

- Finalize process map
 - Interviewing providers
 - Collecting timestamps regarding where the antibiotics are
- Perform gap analysis
 - Identify where the biggest lack of communication is
- Physical prototype
 - Tracking device to locate where antibiotic is at all times
 - Software to visualize this information on a monitor
- Test efficiency
 - Collect timestamps to ensure faster IV delivery

Technical Approach (Process Map Finalization)

- Go to the PICU and meet with Dr. Fackler
- Identify those involved in the sepsis management team
- Conduct clinician interviews
- Walk throughout the PICU and identify the different locations where the antibiotic will be at



Technical Approach (Gap Analysis)

- Gather timestamps regarding location of antibiotics and time spent at each location
- VIS – tracking technology in the hospital
- Tracks staff but we want to track antibiotics
- Identify delays throughout the antibiotic delivery process

PRECISE LOCATING IN TWO DISTINCT SIZES.

The Asset Tag and Mini Asset Tag offer reliable IR RTLS technology for room-level (or better) accuracy.



ASSET TAG

- Size: 1.38"H x 2.38"W x 0.52"D
- Weight: 0.9 oz with battery
- Ingress Protection: IP53 water/dust sealed
- RF Frequency: 433 MHz; IR Wavelength: 875 nm, 455 kHz
- Battery: CR2477 lithium coin cell, sold separately
- Battery Life: Up to 2 years depending on time in motion



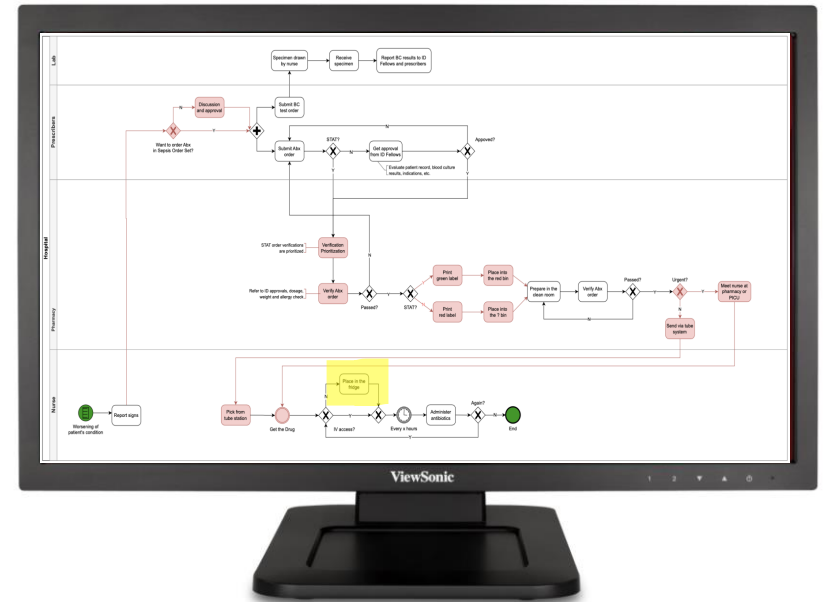
MINI ASSET TAG

- Size: 1.22"H x 1.76"W x 0.72"D
- Weight: 0.8 oz with battery
- Ingress Protection: IPX6 moisture resistance
- RF Frequency: 433 MHz; IR Wavelength: 875 nm, 455 kHz
- Battery: CR2477 lithium coin cell, sold separately
- Battery Life: Up to 2 years depending on time in motion

Technical Approach (Physical Prototype)

- Track antibiotic location and correlate with process map roles
- Contact relevant personnel using VIS's internal alert system or Epic's secure chat
- Display the augmented process map on a monitor in the hospital with certain areas highlighted to show where the antibiotic is currently located

Dr. Fackler: Antibiotics are ready for pick-up in Rm. 708



Technical Approach (Efficiency Testing)

- Track the antibiotics from the pharmacy to the patient using the VIS tags to create a dataset of locations and timestamps as done in the original data collection step
- Compare the antibiotic delivery time before and after implementation of our solution

Deliverables

- Minimum (by 3/17/2023):
 - Finalized process map of sepsis management workflow
 - Complete dataset of timestamps and locations for antibiotic delivery
 - Short report of gap analysis showing where a communication solution is most needed
- Expected (by 4/28/2023):
 - Physical prototype of communication solution that allows providers to visualize where the antibiotics are within the hospital
- Maximum (by 5/18/2023):
 - Implemented prototype of communication solution that uses a monitor to display the location of the antibiotics and whose turn it is within the process map
 - Dataset of timestamps and locations for antibiotic delivery after the solution is implemented

Minimum Deliverables

Minimum Deliverable	Associated Tasks/Milestones	Expected Date
Finalized process map of sepsis management workflow	Shadow Dr. Fackler in the PICU to observe the steps of antibiotic delivery during sepsis management	2/21
	Identify all team members involved in sepsis management at a role-level	3/2
	Conduct clinician/provider interviews to augment the existing process map and identify commonly used communication platforms	3/7
Complete dataset of timestamps and locations for antibiotic delivery	Place a locator tag inside the bag containing the antibiotics to track its location and time throughout the delivery process and fill in the gaps in the existing timestamp data	3/9
*Documentation: Short report of gap analysis showing where a communication solution is most needed	Analyze the complete timestamp data and see where the antibiotics are held up for the longest periods of time in order to cross-reference that with the process map to see where a solution would be most useful	3/16

Expected Deliverables

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

Maximum Deliverables

Maximum Deliverable	Associated Tasks/Milestones	Expected Date
Implemented prototype of communication solution that uses a monitor to display the location of the antibiotics and whose turn it is within the process map	Set up an additional monitor in the PICU's huddle room that displays the location of the antibiotics as well as the process map	5/4
	Program the process map to light up in the relevant sections when the antibiotics have reached that part of the workflow	5/11
Dataset of timestamps and locations for antibiotic delivery after the solution is implemented	As done earlier, place a locator tag inside the bag containing the antibiotics to track its location and time throughout the delivery process in order to see how the efficiency of antibiotic delivery has changed as a result of the implemented solution	5/18

Dependencies

Dependency	Need	Status	Planned Deadline	Hard Deadline	Contingency Plan
IRB Approval	Tracking location of antibiotics from the pharmacy	No approval needed for sticking a locator tag in the antibiotics bag because someone from the pharmacy is on the existing IRB	2/16	2/28	N/A
Access to Versus Information System technology	Tracking location of antibiotics from the pharmacy	Currently working with the pharmacy to understand more about this technology and its use cases	2/28	3/7	Use our own tracking device like an Apple AirTag and find out how to export that location data
Access to existing timestamp data	Gap analysis for identifying solution space	The person in charge of this data had a family emergency and had to leave, so it is unclear when this will be resolved	2/20	3/7	Conduct gap analysis using our own limited data from antibiotic tracking
HIPAA Training	Access to certain datasets and Epic Secure Chat	Most trainings should be completed – currently checking with Dr. Fackler	2/28	4/13	May be able to use anonymized data for all analysis purposes

Management Plan

- Meetings:
 - Weekly check-in with mentors: Thursdays 4 pm - 5 pm
 - Weekly group work sessions: Mondays, Wednesdays, Fridays 11 am - 12 pm
- Other platforms:
 - **Communication:** Formal communication and document sharing will occur over email, whereas informal or time-sensitive communication will occur over text.
 - **Code:** All code will be stored in a private GitHub repository that will be made public at the discretion of Dr. Fackler and Dr. Ghobadi.
 - **Documentation Storage:** All working documents will be written and stored on Google Drive for ease of collaboration, with final reports being compiled using OverLeaf. All final documents, presentations, and deliverables will be uploaded to the CIIS Wiki page for this project.

References

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Reading List

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