

Final Report

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Executive Summary

A critical challenge in today's healthcare community is the management and care of patients with the diagnosis of sepsis. Clinicians, patients and their families face challenges in sepsis care within the adult acute care population. This life-threatening condition demands swift, precise, and coordinated care, yet navigating its complexities often results in fragmented treatment and prolonged recovery times. Through our research, we have discovered that there are many different ways to treat and manage sepsis and that the needs of sepsis patients and their families are not being met through traditional methods. Therefore, we recognized the urgent need to improve sepsis care, not only for healthcare providers but for patients and their families who are oftentimes left out of the decision making process. Sepsis has varying scales of severity, from mild sepsis up to septic shock. Sepsis can lead to septic shock if the patient is not cared for quickly enough, and/or if the infection spreads quickly. Septic shock is the most severe form of sepsis and is fatal.

Recognizing the differing degrees of severity of sepsis and that the management of this condition varies, we aimed to provide more thorough guidance and clinical care tools. Therefore, we formed a group of four members specializing in Health Informatics, called the Sepsis Solutions Team, that has dedicated its efforts to develop an innovative prototype that aims to improve how sepsis is managed. We created a Sepsis Action Plan as a prototype and final solution. This solution is a three-part prototype consisting of an improved electronic health record (EHR) sepsis navigator tab, an adept sepsis committee, and a comprehensive educational framework. Our proposed Health Informatics (HI) solution stands as a transformative change, aiming to streamline sepsis management and care with clinicians while providing patients and their families with the necessary support needed to guide them throughout this difficult process. By embracing this comprehensive approach, we envision a future where our concerted efforts pave the way for a notable reduction in sepsis rates, bringing us closer to improved patient outcomes and increased healthcare effectiveness.

At its core, the problem we confront is the inadequate and disparate management of sepsis cases within the adult care setting. Clinicians grapple with data isolation, uncoordinated interventions, and varying degrees of sepsis awareness among staff members. Patients and their families thrust into the challenges of sepsis are often left confused due to the limited access to clear information and guidance. It is this intricate web of challenges that our HI solution strives to untangle.

The following sections describe our project through the design thinking process that began with the team performing literature reviews and interviewing patients, their families, and interviewing members of the acute care healthcare clinical team. This is so that we could better understand the problem and begin empathizing with all the effects of sepsis. Current sepsis management protocols can vary from hospital to hospital, but many contain the same themes and concepts. Two examples of current management protocols implemented are sepsis bundles and better education on sepsis. Some pitfalls and limitations with the sepsis bundles are that it should be timed when lab work is able to be performed, however, if there is any interruption in that time, the bundle can not be completed with the time constraints. Conversely, we discovered that regular continuous professional nursing education on sepsis was needed to significantly improve patient outcomes.

During our empathizing stage, we were able to further define and focus our problem. We created personas based on all those people affected by sepsis, that included: a nurse,

clinician, patient, and a patient family member. During this process, we were able to define each of their needs and challenges, identify their resources, and learn their goals for sepsis care. We also were able to perform a COM-B analysis in order for us to understand their motivational factors. By examining their capabilities, motivation and opportunities, we were able to assess the behavioral changes to determine intervention functions for each sepsis community member. By creating the personas and examining the data collected from the survey and interviews, we came to the collective agreement that an improvement in the electronic health record (EHR) was needed as a first step.

The EHR program was labeled the Sepsis Action Plan, which included the design of a well-built monitoring system in the EHR that would screen patients with early signs of sepsis. The EHR would include an organized way to see interventions, orders, and educational materials for both patients and clinicians. Furthermore, the team decided there should be an action committee that could create a continuous educational training plan for clinicians and staff. This committee would also be responsible for filtering through data collected from the electronic medical records on sepsis management in order to develop any improvements that need to be made to sepsis care and the Sepsis Action Plan.

Within the EHR, the Sepsis Solutions team designed a sepsis navigator for tracking sepsis orders, interventions, education, and other necessary documentation that can also be analyzed later for further improvements by the sepsis committee. A prototype of the EHR sepsis navigator can be observed in the results of digital wireframing. The Sepsis Solutions team felt that building this into the EHR is feasible and simple as it is a straightforward endeavor and most healthcare facilities nowadays already have an existing EHR system already built into their organizations. By leveraging the flexibility and adaptability of modern EHR systems, the team is confident that incorporating a new and easy sepsis navigation tab would be achieved without extensive overhauls.

Feedback was gathered by three interviewees who had been part of the initial interviews, and it was assessed whether they saw any problems with the prototype. Furthermore, the interviewees were asked whether they believed there was any need for improvements or adjustments. All three people interviewed stated that this was a positive direction in sepsis management, but they also had different feedback. Based on the recommended feedback, changes were assessed and the prototype was adjusted. The Sepsis Solutions team made modifications to the prototype's EHR sepsis navigator tab. Another modification was to add a diagnosis option as shown in the digital wireframing illustration.

In pursuit of enhancing healthcare outcomes, the Sepsis Solutions team created a prototype with three different parts addressing the most critical challenges and concerns with sepsis management as stated by clinicians and patients. This includes an EHR navigator, education, and collaboration between different healthcare professionals to promote the best of care for countless patients and healthcare providers worldwide. Recognizing the urgent need for improved sepsis care, the team has put its efforts into developing these promising solutions in hopes of decreasing sepsis rates and providing a significant stride forward towards better care for patients and better health outcomes overall. The Sepsis Solutions team hopes to demonstrate a potential way to streamline sepsis care while providing real-time information to improve care in the future. With this in mind, the Sepsis Solutions team hopes to revolutionize and transform sepsis care with the prototype with the overall goal of reducing the threat sepsis has on patients and the global healthcare community.

Background and Context

Our team used a Canva whiteboard to document the breakdown of tasks, data collection, and organization of findings. Tasks were divided among team members, including literature reviews, data collection from forums and social media, interviews, and survey development. The literature review highlighted the severity and impact of sepsis on patients, with mortality rates ranging from 10-40% depending on septic shock presence. The cost of sepsis management is substantial, and it remains a critical problem for the healthcare community. The review also discussed current sepsis management protocols, such as sepsis bundles and educational interventions, to improve patient outcomes.

Based on the literature review, the team began by creating and collecting results from a 12-question survey through Qualtrics, personal interviews, and interest groups found on online forums of Facebook and Reddit. For the survey questions and interviews, the team collected data from respondents through our personal network. Subjects recruited were from acute care settings such as hospitals and inpatient rehabilitation healthcare facilities in the Philadelphia area and included clinicians, family members, and patients. For the Qualtrics survey, methods used to fill out the survey include email and text and respondents were given one week for completion.

A total of 50 respondents answered the survey. Personal interviews were conducted in-person, over the phone, and through meetings online. For the personal interviews, a total of 5 interviews were conducted among the recruited subject population. This included one patient and four clinicians. Additionally, data was collected from a total of twenty social media posts from forums and interest groups. Interest groups and forums were chosen if they were run and/or moderated by individuals that were hospitalized by sepsis, or by organizations focused on sepsis awareness or education. The Sepsis Alliance Facebook group and the Sepsis subreddit on Reddit were selected because they focused on patient's experiences with sepsis.

The survey results showed that many clinicians felt confident in handling sepsis cases. However, they also expressed a need for more training and education, particularly for new staff members. Challenges with sepsis management included issues with sepsis screening tools, lack of knowledge in identifying sepsis signs, and delays in physician response. Social media posts from sepsis survivors emphasized the importance of early diagnosis and better communication and education during the acute stage of illness. Surprisingly, staff shortages hindering septic patient care was a theme among all of the interviews. The needs assessment concluded with identifying key areas of improvement in sepsis management, such as enhancing education and training for clinicians, refining sepsis screening tools, and engaging patients and their families in early recognition of sepsis signs. Based on the information gathered in the needs assessment, the team moved on to design personas, representing different stakeholders in the sepsis care process.

Lastly, the team designed the following five personas: a nurse, two doctors, a patient, and a family member. The results can be observed in Appendix A. With the personas in hand, the team was able to identify characteristics of our target user groups and recurring themes that substantiated the challenges associated with sepsis care. With the scenarios, point of view (POV), and how might we (HMW) statements, it was revealed that three areas in sepsis care that needed improvement. First, many behaviors focused on a lack of education of sepsis personally or with other staff. This overarching theme could be observed with all of the personas. Another behavior was limited ability and knowledge of creating a simple and better sepsis navigator in the EHR. This was predominantly associated with Personas #1: the nurse and Persona #4: the doctor of osteopathic medicine. Finally, the third behavior was the lack of support from

clinicians to either other healthcare workers, patients, or their family members. This was also observed with all personas as well. Finally, a COM-B analysis was conducted on each persona to elaborate and understand what is driving current behaviors and what might be changed to facilitate user behaviors in our final solution. This is discussed further in the Health Informatics section of this paper.

Health Informatics Solution

Before a solution could be determined, the team used a COM-B model on each persona. This included the physical and psychological capabilities, opportunities, and motivations were analyzed, as well as the utilizing the behavior change wheel. Based on this analysis, the team generated potential solutions for each persona to improve sepsis care. This aided in exploring different intervention functions.

Based on all the data collected and analyzed, a brainstorming session was held among the team. One idea that stood out to the team included having a comprehensive sepsis management program that can be used by healthcare facilities called the Sepsis Action Plan. The solution consists of three parts: an EHR sepsis navigator tab, a sepsis committee, and educational training and materials. It is important to note that building the educational training and materials are addressed together with the sepsis navigator tab and the committee.

Within the EHR, the Sepsis Solutions team designed a sepsis navigator for tracking sepsis orders, interventions, education, and other necessary documentation that can also be analyzed later for further improvements by the sepsis committee. A prototype of the EHR sepsis navigator can be observed in the results of digital wireframing in the Appendix B. One major issue observed during collecting data was the necessity for educational resources for clinicians, easy access to sepsis care workflows to manage patients better, and documentation on whether clinicians educated patients and family members on sepsis. The Sepsis Solutions team believed that integrating this into the EHR would be easy and simple, considering that many healthcare facilities possess an established EHR system within their organization. By leveraging the flexibility and adaptability of modern EHR systems, the team is confident that incorporating a new and easy sepsis navigation tab would be achieved without extensive overhauls. However, technical specifications would clearly be that the organization would already need a successful and running EHR system with developers that can adapt their models to include the newly designed navigator. Furthermore, the team believes there will be a largely positive impact on sepsis care and management as it aligns with the user goals and needs, addressing concerns found during the team's data collection such as difficult to use EHR navigators and lack of education on sepsis care with the stakeholders. Based on these results, the team created a mock-up of the wireframing results which is demonstrated in Appendix B. It shows the EHR navigation tab that would be created to follow sepsis patients and their plan of care. The icons in this example would allow clinicians to streamline the sepsis action model and promote positive health outcomes.

The second part of the action plan includes the sepsis committee. They would ultimately be responsible for maintaining the Sepsis Action Plan at their healthcare facility, including analyzing data collected from EHR, building educational resources, and developing the action plan further if adjustments are needed. The committee would meet frequently, establish target goals for clinicians, and create quality improvement initiatives to address sepsis rates organization-wide. They would also facilitate implementation of best practices. The committees would consist of multidisciplinary teams of healthcare professionals who already work at the organization such as nurse leaders from various units, physicians of different practices that have patients with a high risk of developing sepsis, clinical educators who can determine the necessary and up-to-date information on sepsis, and health IT staff that can address EHR issues

and changes. By drawing on the collective expertise and knowledge of committee members, guidelines can be established for the organization to follow.

The third part includes addressing educational concerns of all stakeholders. This would be developed by the sepsis committee. First, staff would have continuous mandatory training sessions developed by the committee where clinical staff would need to watch educational videos and go to in-person training sessions to feel comfortable with the process of caring for a patient going septic. Secondly, the EHR would have education material and resources for clinicians to understand the workflow of sepsis management. Thirdly, the EHR would have resources to give to patients and their family members on sepsis care. Finally, clinical staff would need to document that education was given to the patient and family members so that this can be tracked for quality improvement purposes. All information developed and given would reflect current evidence based research and interventions as assessed by the sepsis committee. With these three parts in mind, the next section of this paper describes the testing phase of our solution as well as the evaluation of the mockup digital wireframe solution with end-users.

Implementation and Evaluation

For the testing phase, three interviews about the final prototype were conducted in-person with two nurses and one patient who had previously gone into septic shock. This was to determine the usability of and any thoughts on the prototype as well as whether they thought the action plan would be effective. Feedback was gathered, and it was assessed whether they saw any problems with the prototype. Furthermore, the interviewees were asked whether they believed there was any need for improvements or adjustments.

All three people interviewed stated that this was a positive direction in sepsis management, but they also had different feedback. The patient interviewed felt that this prototype would be a helpful addition to sepsis care. The patient is a sepsis survivor. He thought that the prototype would be a helpful tool and it could positively impact the care provided. He did mention that his sepsis started during surgery, so that should be considered. From that observation, a code alert was added to the prototype to allow for staff to immediately alert the hospital's rapid response team. This team would immediately draw labs, monitor the patient more closely than regular staff, and put the patient in intensive care quickly. With this addition, he felt strongly that the prototype would be effective.

The two nurses that were interviewed will be described as Nurse 1 and Nurse 2. Nurse 1 is a BSN nurse with more than 20 years of experience while Nurse 2 is also a BSN nurse with a little more than five years of experience. Additionally, both nurses have taken care of sepsis patients. While most of the feedback from both nurses was primarily positive, the two staff nurses had different conclusions to the prototype design. One key observation is that they were in agreement that the action plan is necessary to reduce sepsis rates. In addition, they both felt that the usability of the EHR sepsis navigator shown in the digital wireframing results was user-friendly to clinicians and that the design interface would allow providers to navigate through and utilize the sepsis bundle orders effectively. Nurse 1 described the navigator as "simple and to the point." Nurse 2 also felt that the navigator would be "easy to use" but was concerned about the EHR criteria for sepsis alert. Based on her personal experience, Nurse 2 stated she felt that there were "needed areas of improvement when it came to the EHR initiation of sepsis bundle orders." She discussed how a quick change in vital signs alerts the clinicians on potential sepsis regardless of why the vitals have changed. She suggested diagnosis and clinical presentation should be factors taken into consideration when the EHR fires sepsis alerts and orders as that is how practice works in the real world. She states, "adding this to the EHR navigator would be very helpful." She also suggested there should be an option to remove the sepsis tab if that patient is found to not have a condition of sepsis.

Furthermore, both nurses believe a sepsis committee would be beneficial to quality improvement projects on sepsis. Nurse 1 however was concerned with staffing for the sepsis committee and when committee meetings would take place. Nurse 1 was worried as it was already difficult for units to have adequate nursing staff. She stated, "removing a nurse from the floor would affect patient safety." She suggested that the sepsis committee nurse leaders could be an assigned nurse that goes to meetings on days off from work. She also suggested meetings can be done through video chats such as zoom meetings. She believed it would be feasible and that it would work with the personal schedules of staff. She did, however, feel that it would take some adjustment for staff to take on more responsibilities with these committees.

Finally, both nurses felt that, if the EHR navigator and sepsis committees were built properly, the educational component to the prototype would work. Their assessments of the

prototype both included the importance of education for clinicians and patients. They have personally witnessed the crucial need and positive effects of health education during patient care for both staff and patients. One of the biggest problems both of these clinicians have observed with staff is finding proper resources on sepsis care and management during a busy shift. Both nurses stated that having an easily navigable EHR with links to educational materials for patients and resources for clinicians while using a sepsis committee to create educational training sessions would be beneficial in the long-term for sepsis management.

As a result of the testing phase and feedback from interviews, the Sepsis Solutions team made modifications to the prototype's EHR sepsis navigator tab. One modification included a code alert option to notify the rapid response team for declining septic patients as explained in the responses of testing the prototype on a sepsis survivor patient. Another modification was to add a diagnosis option as shown in the digital wireframing illustration. This is so that practicing clinicians can take into consideration other clinical factors affecting patients and rule out sepsis. The result wireframing also allows data to be collected so that the sepsis criterion can be adjusted for sepsis alerts within the EHR by health IT professionals. In addition, the sepsis bundle orders can be added or removed quickly based on clinician's observations of a patient. Clinical presentation would help to drive health interventions for sepsis instead of using data without any context as that could lead to errors and/or misinterpretations.

A summative evaluation of our finished product was evaluated using the popular framework of Technology Acceptance Model (TAM). We felt the prototype best represented a TAM1 model, which included two key factors: perceived usefulness (PU) and perceived ease of use (PEOU). The team felt that our prototype needed to have both PU and PEOU, as well as the intention to use a technology in the acceptance model. We felt it would be important to not exclude PU and PEOU in our acceptance models, therefore the TAM1 model felt most representative.

Unfortunately due to time constraints, we were unable to evaluate whether our prototype would fit in the acceptable model. Therefore, during a subsequent next phase, we had planned to ask interviewees to think about how well the technology could improve their tasks, how easy they found the technology, if they felt pressured to use it, and how much support they felt they needed. We would take into consideration the role of moderating factors, including the interviewees age, gender, and experience level. This would help us complete a summative evaluation in the future.

APPENDIX A: PERSONAS

Persona 1:

Jackie Robinson, RN, BSN

**Demographics:**

Age: 37 years old

Gender: Female

Occupation: ICU BSN Nurse

Education: Bachelor's Degree

Needs:

- More Resources
- Added Support
- Better Management

Challenges:

- Limited information on how to add sepsis bundles to unit

Goals:

- To manage multiple patients (5+) at the same time, over a 12-hour shift
- To add sepsis bundles to unit

**Resources:**

- Has strong knowledge on how to use smartphones, the internet, and computers; is able to make calls, send text messages, and check email.
- Has strong knowledge on sepsis
- Has access to EHR clinical specialists to develop sepsis bundles and materials

Persona 2:

Sandy Hoover- Patient

**Demographics:**

Age: 74 years old

Gender: Female

Occupation: Retired

Education: High School Diploma

Needs:

- Better management of her conditions
- Constant support

Goals:

- To manage her diagnosis of sepsis, and maintain her health and independence
- To stay active and engaged with her family and friends


**Challenges:**

- Has a low health literacy level and limited information on sepsis
- Has limited ability and knowledge of how to use smartphones, the internet, and computers; struggled with basic functions, such as making calls, sending text messages, and checking email
- Has limited mobility, due to arthritis, making it difficult to get to doctor's office
- Struggles to read small print, such as with emails and text messages


Resources:

- Has a strong family network and friend support group


Persona 3:




Dr. Devi Hadish, M.D.
Demographics:
Age: 40 years old
Gender: Male
Occupation: Physician
Education: Medical Degree
Needs:
-Support in sepsis management
-Better trainings on handling septic shock
Challenges:
-Limited preparation on handling septic shock
Resources:
-Has strong knowledge on how to use smartphones, the internet, and computers; is able to make calls, send text messages, and check email
-Has strong knowledge on sepsis
-Has access to hospital administration to develop sepsis training and educational materials


Goals:
-To create educational and training tools to better manage sepsis

Persona 4:



Dr. Hannah Burner, D.O.
Demographics:
Age: 28 years old
Gender: Female
Occupation: Doctor of Osteopathic Medicine
Education: Medical Degree
Needs:
-More guidance on how to use sepsis bundles
Challenges:
-Helping other staff members with sepsis management
Resources:
-Has strong knowledge on how to use smartphones, the internet, and computers; is able to make calls, send text messages, and check email.
-Has strong knowledge on sepsis


Goals:
-To better utilize sepsis bundles in the ER

Persona 5:

Debbie Pepperidge- Family Member of Patient

Demographics:

Age: 52 years old
Gender: Female
Occupation: Secretary
Education: High School Diploma

Needs:

-Support groups / systems to help her deal with her son's diagnosis and progress
-Better communication and explanations from clinical staff about son's sepsis management

Goals:

-To understand son's plan of care and health needs

Challenges:

-Difficulty understanding sepsis information

**Resources:**

-Has basic knowledge on how to use smartphones, the internet, and computers; is able to make calls, send text messages, and check email

APPENDIX B: DIGITAL WIREFRAMING/PROTOTYPE

