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Additional Information:

- This is a conference paper.

Metadata Record: https://dspace.lboro.ac.uk/2134/32211

Version: Accepted for publication

Publisher: © Association of Canadian Ergonomists (ACE)

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Please cite the published version.
SEPSIS: A WORK SYSTEMS ANALYSIS OF 30 SURVIVOR AND TRIBUTE STORIES

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KEYWORDS  
Sepsis, SEIPS, Patient Safety, Systems approach, Healthcare

SUMMATIVE STATEMENT  
Often reported incidents involving sepsis state opportunities were missed. This raises the question of where in the system these opportunities are present. Through a qualitative document analysis of tribute and survivor stories, work system elements that may provide an opportunity for the successful treatment or those that may hinder effective treatment of sepsis were identified.

INTRODUCTION  
Sepsis is a complex clinical syndrome (Kent and Fields, 2012) that is a major healthcare issue worldwide (Angus et al., 2001; Lang and Tasker, 2017; Namas et al., 2012; Vincent et al., 2006). The most recent view of this syndrome is that it is characterized by multiple systems within the body responding to a microbial pathogen including biochemical, cellular and organ-organ interactions and involves a complex chain of events involving numerous systems within the human body (Namas et al., 2012).

Due to the complexity of sepsis and despite individual mechanisms of this syndrome having been extensively studied, challenges in diagnosing and treating it successfully remain (Kent and Fields, 2012; Namas et al., 2012). And despite medication available to treat sepsis, mortality rates are as high of 25% to 50% (Chege and Cronin, 2007; Wolf, 2012). One effective approach for the treatment of sepsis that has been identified includes receiving aggressive treatment early, particularly within the first hour, and can influence severity, survival, morbidity and mortality (Chege and Cronin, 2007; Jones et al., 2007).

Despite evidence of the time critical nature of this syndrome, often delays in diagnosing and treating of sepsis occur. Aspects that cause delays in the identification and treatment of sepsis that have been identified include delays in diagnosis, lack of availability of beds and delays in nursing care (Burney et al., 2012). Current interventions aimed at identifying and treating sepsis include clinical guidelines for the treatment and management of sepsis (Chege and Cronin, 2007; Kent and Fields, 2012) as well as increasing awareness regarding the signs and symptoms of sepsis through campaigns (e.g. Surviving sepsis campaign) (Chege and Cronin, 2007).

To better understand and develop treatments for sepsis, recently a systems approach has been adopted to expand the biological understanding of the mechanisms of sepsis (Namas et al., 2012). Furthermore, it has been suggested that to bring about successful change with regards to the treatment of sepsis, a system-wide approach needs to be developed that includes all the healthcare staff, and even family and carers that come in contact with the patient (Lang and Tasker, 2017). Examples of current system approaches for the identification and triage of sepsis in young children include at the level of public health and
prehospital public awareness generated by the UK Sepsis Trust, at the primary healthcare level support materials for professionals, and at the hospital or emergency department level the Manchester Triage system or ‘NICE Red Traffic Lights’ in acutely ill children (Lang and Tasker, 2017).

From a human factors and ergonomics perspective, a systems approach has not only been used to understand healthcare processes better to improve patient safety (Rivera et al., 2008; Gurses et al., 2012) but also to understand infection outbreaks within acute care settings to identify the larger system contributing factors of the outbreaks (Waterson, 2009). This raises the question if a systems approach, from a human factors and ergonomics perspective, could not be adopted to better understand the influencing system factors regarding the current identification and treatment protocols for sepsis as this is such a time sensitive syndrome whereby the patient will come in contact with numerous healthcare subsystems.

This research aimed to identify potential system elements that may assist or hinder the identification and treatment of sepsis. The research objective was to analyse documents relating both to tribute as well as survivor stories to identify possible opportunities, that were either missed or utilised, in the treatment and diagnosis of sepsis from a human factors systems approach.

**METHODOLOGY**

A sample of 30 survivor and tribute stories were qualitatively analysed from the perspective of system ergonomics to identify opportunities and system elements that aid or hinder in the identification and treatment of sepsis. The survivor and tribute stories were downloaded from the UK Sepsis Trust website (www.sepsistrust.org) on the 8th of February 2017.

Of the 30 stories analysed, 15 were tribute stories and 15 were survivor stories. The stories were selected so that an equal number of stories per age group were analysed. A total of four stories, two survivor and two tribute for analysed for the age groups 0-10, 11-20, 31-40, 41-50, 51-60, 61-70. A total of six stories, three survivor and three tribute stories for analysed for the age group 21-30. The distribution of the stories per age group and per type is graphically represented in Figure 1.

![Figure 1: The number of stories analysed per age group for the survivor and tribute stories in the sample.](image-url)
All data were analysed using NVivo 10 (QSR International, 2014) using thematic analysis (Braun & Clarke, 2006). The analysis was based on the SEIPS 2.0 model (Holden et al., 2013) as this model incorporates a systems approach, is healthcare-specific yet still general enough to be applicable to various healthcare scenarios (Carayon et al., 2006, 2014). Initial data reduction was done by using pre-set codes, and all data was categorised according to the sociotechnical work system components and the outcomes as described in the SEIPS 2.0 model. The sociotechnical work system components included the person, task, tools and technology, organization, internal and external environment components. The person component consisted of the elements family, patient and staff. The outcomes included of the patient, professional and organization outcomes. Finally, emergent codes were developed for the SEIPS 2.0 elements using focused coding. Common themes across the examples were collated and mapped onto the SEIPS 2.0 model. Additionally, examples of aspects where the system worked well were identified.

RESULTS
Contributing factors were found to originate from four of the six work system components. These included person, task, organisation and external environment components. With some of the identified examples, it was possible to classify the contributing factor as positive or negative. A summary of the results for the work system aspects has been graphically represented in Figure 2. No elements were identified for the tool and technology or internal environment components in the 30 stories analysed. Example excerpts from the stories for each work system aspect have been included in the results below.

The person component of the work system influencing the treatment of sepsis included patient-related, family-related and staff-related elements. Majority of the patient-related elements identified in the stories were found in both the survivor and tribute stories. The patient-related elements identified as influencing the treatment of sepsis included the patient’s history, general health, their behaviour (e.g. refusing help), the underlying infection, and the physical and physiological signs and symptoms they experience (e.g. pain, fever, breathing problems, confusion, feeling unwell). Additional patient-related elements identified in only the survivor stories included the patient recognising the symptoms of sepsis themselves due to previous experience and the patient pleading for treatment, which is highlighted in the following excerpt: “It was there that I collapsed after trying to convince the GP that there was something terribly, terribly wrong with me”.

The family-related elements identified in both survivor and tribute stories included either rationalising away the symptoms (e.g. “all… girls caught chickenpox consecutively”) or intercepting and seeking medical attention on behalf of the patient (e.g. “…my wife wanted to call 999”). A family-related element identified in the survivor stories included advocating for the patient. This is highlighted in the following excerpt: “my fiancé turned and said to the doctor – ’but he can’t even walk, this can’t be right’”. Another example of this is highlighted in the following quote from one of the survivor stories: “Her Mum’s insistence on the attendance of a senior doctor probably saved her life”.

Similarly, to the family-related element, a staff-related element identified in both survivor and tribute stories included medical staff advocating for the patient. This is highlighted in the following excerpt: “I was so fortunate that the Junior Doctor pushed and pushed for me to be taken to the ICU in spite of others who wanted me to stay put”. Unfortunately, as this element was identified in both stories, this alone is not enough to ensure the successful treatment of sepsis and the timing of this in the development of sepsis appears to be crucial. An additional staff-related element that has a negative effect identified in the tribute stories included not recognising the urgency of the patient’s situation. Positive elements identified from the survivor stories included staff trying to ensure shorter waiting times at the emergency department as they knew the severity of the patient’s condition, staff being aware
of sepsis, and quick reactions of staff (e.g. immediate surgery, antibiotics being administered by paramedics).

Figure 2: A Summary of the key contributing factors, negative factors (-) and positive factors (+) identified for each of the work system aspects. No elements were identified for the tool and technology or internal environment components in the 30 stories analysed.

In both story types, the task components identified as hindering the treatment of sepsis included an incomplete diagnosis with a fixation on the preliminary diagnosis. This is highlighted in the following excerpt from one of the survivor stories “the GP put down to being muscular. I kept returning with the pain and was just given stronger painkillers and told to rest”. The negative task components identified in the tribute stories included delays in receiving scans, administration of antibiotics, services (e.g. GP) and being diagnosed. Additional negative task components identified included being misdiagnosed (e.g. Viral versus bacterial infection), antibiotics not being prescribed and being inappropriately triaged either by A&E or by the GP. The positive task components identified in the survivor stories included receiving scans early and in a timely manner, early administration of antibiotics specifically IV antibiotics, and immediate medical treatment such as surgery. This is highlighted in the following excerpt: “whilst I apparently didn’t initially score too high for sepsis they treated me with IV fluids and antibiotics, painkillers and various X-rays and scans”. The negative task components identified in the survivor stories included not monitoring the patient’s vital signs and despite the need for antibiotics being identified early, they were not administered for several hours.
Majority of the stories analysed highlighted that numerous services and wards were involved in the treatment as well as in the diagnosis of sepsis (e.g. GP, Emergency medics, NHS helpline, emergency numbers such as 111 and 999). Negative organisational work system components identified across both the survivor and tribute stories included a lack of availability of services, and poor response times (e.g. GP appointments). Organisational elements identified in the tribute stories included miscommunication between services due to a lack of understanding of the severity of the condition. In the survivor stories, quick response time by ambulance staff, liaising between systems to reduce waiting times for the patient to receive medical care, and an organisational awareness were the organisational elements identified that aided the treatment of sepsis. An example of the different systems liaising with each other to reduce waiting times is highlighted in the following excerpt: “The nurse liaised with … Hospital and arranged for me to … get to A&E – armed with a letter saying I wasn’t to wait in reception to be seen, and had to go straight through”. A negative organisational element identified in one of the survivor stories included the patient leaving the hospital early due to a bad experience.

External environment elements identified in the tribute stories included assigning the symptoms to flu due to flu season. This and the resulting effect is highlighted in the following quote: “This was the height of the flu epidemic of 2010/2011 and her symptoms were quickly assessed to be another case of seasonal flu. She was immediately dismissed, receiving no treatment, and with the standard advice to rest and take plenty of fluids”. The external environment elements identified in the survivor stories included the negative effects of the holiday season on access and availability to healthcare services and the misconceptions and concern regarding seeking healthcare treatment whilst in a foreign country.

The outcomes identified across the 30 stories could be categorised as organisational outcomes or patient outcomes. No examples of professional outcomes were described in the texts. The patient outcomes described in all 15 tribute stories was death, the patient outcomes described in the survivor stories included the negative side effects of suffering from sepsis such as both physical and mental health complications as well as emotional distress. The organisational outcomes identified in both survivor and tribute stories included a lack of trust in the healthcare systems due to negative experiences and negative effects on the healthcare system’s reputation. An additional organisational outcome identified in the survivor stories included the increased costs of additional hospital stays.

DISCUSSION AND CONCLUSION
All the stories highlighted that a patient suffering from sepsis will come into contact with numerous sub-systems such as the emergency paramedics, GP’s and telephone helplines as well as numerous wards within one hospital stay. The delays identified both in survivor and tribute stories could be categorised as predominantly originating from either the patient or the healthcare system. Patient delays included rationalization of the severity of the symptoms away, whereas delays as a result of the healthcare system included delays in diagnosis, prescription and administration of antibiotics, as well as delays in diagnostic scans. Positive system elements identified, which occurred predominantly in the survivor stories include either family members or specific members of staff advocating the seriousness of the condition of the patient, department awareness of sepsis and quick reactions of medical staff with regards to treatment.

From the results, the prompt administration of antibiotics was identified as a key factor, which has been highlighted in the literature regarding current treatment plans (Chege and Cronin, 2007; Kent and Fields, 2012). Additionally, the results highlighted that the early administration of antibiotics was often due to specific individuals advocating for the patient. This raises several questions relating to antibiotic prescription and use. What causes the delay in prescription and administration of antibiotics? Specifically, which system elements need to be addressed to ensure timely administration of antibiotics? Is the culture associated
with the overprescription of antibiotics negatively affecting sepsis treatment plans? Adopting a system’s approach, from a human factors perspective, to the analysis of sepsis treatment and diagnosis can aid in the identification of potential bottlenecks, specifically those related to work structure and organisational factors, that may have detrimental effects for this time-sensitive condition.

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