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Major Article

Exploring leadership within a systems approach to reduce health care–associated infections: A scoping review of one work system model

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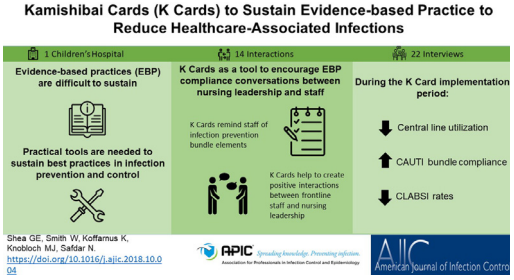

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Background: Despite efforts to prevent health care–associated infections (HAIs), these infections continue to challenge health care systems. The Centers for Disease Control and Prevention emphasizes implementation of evidence-based practices. Within the complex health care environment, sustained implementation calls for work systems that harness expertise of interprofessional teams, which, in turn, calls for suitable executive, mid-level, and local leadership. The purpose of this review is to highlight the need to study leadership when using a systems approach to reduce HAIs.

Methods: This is a scoping review of HAI studies that used a systems engineering model called the Systems Engineering Initiative for Patient Safety model. We examined if and how leadership was addressed within 1 systems approach.

Results: We found 15 studies using the Systems Engineering Initiative for Patient Safety model and, of these, leadership was directly mentioned in 3 studies. In the remaining studies, reference to leadership may be inferred by use of terms such as teamwork, managerial oversight, climate and culture, staffing support, and institutional/administrative support.

Conclusions: Research is needed to bring recognition of the role of leadership within a work systems approach to reducing HAIs. We need further examination of leadership attributes and communication behaviors that allow staff to diffuse and sustain best practices to prevent HAIs.

Health care–associated infections (HAIs) continue to pose a major challenge to patients and to health care systems.[1] There are evidence and adequate tools such as guidelines, checklists, toolkits, and algorithms to prevent and control HAIs.[2,3] However, moving evidence into routine practice remains a formidable task because of the complex nature of hospitals and health care systems. Researchers are now emphasizing "the how" of moving evidence into practice, studying the complexity in which implementation takes place, including who is leading the process and how leadership may affect moving evidence into routine practice.

Evidence supports the importance of studying leadership to propel implementation forward.[4-8] However, a recent systematic review of leadership in evidence-based practice revealed that, although acknowledged as an important contextual factor, the study of leadership in the field of implementation science is rather new.[9] A recent

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study calls out the influential nature of leadership on translating best practices into routine care, and highlights the need for health care leaders to recognize the impact their leadership style can have on the process of implementation.[10] Another study found that attention to top-level leader behaviors is 1 factor influencing adherence to new implementation guidelines and policies to reduce HAIs.[11]

Leaders who foster clinical excellence, encourage cross-disciplinary teams, and can think strategically while acting locally are the type of leaders who impact the reduction of HAIs. Sinkowitz-Cochran et al[12] examined organizational culture related to a national Veterans Affairs methicillin-resistant *Staphylococcus aureus* prevention initiative, and found that hospital leadership was significantly associated with staff knowledge, attitudes, and practices related to methicillin-resistant *S aureus* prevention.[12] A recent study by Welsh et al[13] funded by the Agency for Healthcare Research and Quality Hospital-Acquired Infections Collaborative, listed "convincing administration to provide leadership" as 1 of 7 important themes for reducing HAIs.

The Centers for Disease Control and Prevention calls for leadership commitment as 1 of the core implementation elements of antibiotic stewardship programs.[14] Leadership within a systems engineering approach has been recommended. An Institute of Medicine report proposed using engineering models and concepts to solve system problems and promote safety in health care in the late 1990s and early 2000s.[15] In 1988, Donabedian[16] was 1 of the first investigators to propose a categorical model based on structure, processes, and outcomes of care, putting a framework in place to understand and assess the quality of health care.[16] Donabedian's lasting framework was a precursor to the Systems Engineering Initiative for Patient Safety (SEIPS), developed at the University of Wisconsin-Madison.[17] SEIPS is a multidisciplinary initiative, applying systems engineering, human factors engineering, and quality engineering approaches. This model employs a work system approach comprised of 5 elements: the *individual* who performs the *tasks* using *tools* within a physical *environment* and within an *organizational* infrastructure (Fig 1). The model has been used extensively in the field of patient safety to describe elements of the work system that can either facilitate or hinder improvements in processes.[17,18] The SEIPS model also appears to be an appropriate framework to explore how leadership impacts the success of HAI reduction activities because of the potential to emphasize leadership within all 5 elements of the work system model. We also chose this model because it has already been used extensively within the patient safety literature,[19-23] and leadership has been mentioned to some extent as a component of the "organization" element in previous patient safety literature.[24] Figure 1 depicts the SEIPS model, which is based on the balance theory of job design.[25,26]

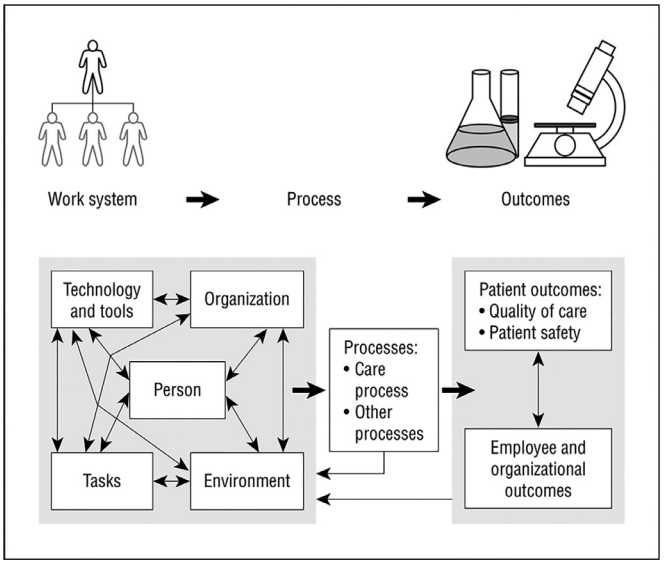

Fig 1. SEIPS model of work system and patient safety. The SEIPS model is based on the balance theory of job design (Smith and Carayon, 1989, 1995; Carayon and Smith, 2000[25]). *SEIPS*, Systems Engineering Initiative for Patient Safety.[27,28]

METHODS

Using the SEIPS model, we performed a scoping review of research to study HAIs. We looked specifically at if and how leadership was addressed as part of the study, particularly within the SEIPS framework, and if recent literature indicates any trend toward an increase in researchers addressing leadership within the model. This review followed the scoping review framework developed by Arksey and O'Malley,[29] and mapped the literature by using these 6 steps: (1) identifying the research question, (2) identifying relevant SEIPS and HAI literature, (3) selecting only those studies using SEIPS related to HAIs, (4) charting mention of leadership in the article, (5) collating, summarizing, and reporting results, and (6) consulting with primary stakeholders. This framework provides an overview without synthesis of evidence or appraisal and is meant to be used, in this case, to encourage further inquiry into leadership within the use of systems models.

Research question

Is leadership addressed (and to what extent) within peer-reviewed literature, in which the SEIPS model was used for HAI-related interventions or evaluations?

Relevant literature

The PubMed, Compendex, ABI Inform, Web of Science, and Scopus databases were used to conduct the literature search. The primary terms used for the literature search were HAIs, leadership, and SEIPS, keeping the search focused on 1 systems model as an example. The ancillary terms used include "human factors," "systems engineering," "patient care" and "quality of care," and "leader or leaders."

Study selection

We reviewed only those studies related to HAIs that used the SEIPS model for implementation or evaluation.

Charting data

Once inclusion was determined (based on use of the SEIPS model and related to HAIs), we reviewed the article to find any reference to leadership within the systems approach used for the study. Three outcomes were recorded: (1) leadership addressed (the article clearly states and defines leadership in the article), (2) leadership not addressed (no mention of leadership or its role when using a systems approach, and (3) leadership developing (the article describes some aspect of leadership, such as management style in the context of teamwork, champions within the team, or when leadership is described as an essential component but with no definition of the role or significance of leadership).

Summarizing

We summarized the 3 articles found that directly mentioned leadership and provided a table depicting all other studies (Table 1).

Table 1
How leadership is addressed

Citation	How leadership is addressed
Yanke et al. Translating evidence into practice using a systems engineering framework for infection prevention. Infect Control Hosp Epidemiol 2014;35:1176-82.[30]	Leadership developing. Organizational management style was identified as a key component of the organization element of SEIPS.
Yanke et al. Understanding the current state of infection prevention to prevent *Clostridium difficile* infection: a human factors and systems engineering approach. Am J Infect Control 2015;43:241-7.[31]	Leadership developing. Work schedules were identified as a component of the organization element of SEIPS.
Caya et al. Using a systems engineering initiative for patient safety to evaluate a hospital-wide daily chlorhexidine bathing intervention. J Nurs Care Qual 2015;30:337-44.[32]	Leadership not addressed.
Safdar et al. Management of ventilator-associated pneumonia in intensive care units: a mixed methods study assessing barriers and facilitators to guideline adherence. BMC Infect Dis 2016;16:349.[33]	Leadership not addressed.
Rock C et al. Using human factors engineering approach to improve patient room cleaning and disinfection. Infect Control Hosp Epidemiol 2016;37:1502-6.[34]	Leadership addressed. The SEIPS organization component lists organizational culture and the hierarchy with power difference between frontline workers and leadership and between EVS workers and other health care professionals. Lack of appreciation of EVS workers, no long-term recognition of good work, staffing, and work schedule are also mentioned.
Wilson et al. Applying human factors and ergonomics to the misuse of nonsterile clinical gloves in acute care. Am J Infect Control 2017;45:779-86.[35]	Leadership addressed. The SEIPS organization component section mentions the "strong influence of cultural norms and lack of leadership" as contributing to results of the study.
Barker et al. Barriers and facilitators to infection control at a hospital in northern India: a qualitative study. Antimicrob Resist Infect Control 2017;6:35.[36]	Leadership addressed. In the discussion, this article mentions that hospital leadership should prioritize the allocation of resources, and the highest level of leadership needs to address staffing and implementation of policies that help with recruitment and retention of nurses.
Mitchell et al. Infection control at an urban hospital in Manila, Philippines: a systems engineering assessment of barriers and facilitators. Antimicrob Resist Infect Control 2017;6:90.[37]	Leadership developing. Authors report that the organization prioritized funding and staffing for laboratory facilities, which were vital to perform necessary tests.
Musuuza et al. Assessing the sustainability of daily chlorhexidine bathing in the intensive care unit of a Veteran's Hospital by examining nurses' perspectives and experiences. *BMC Infect Dis* 2017;17:75.[38]	Leadership developing. Results indicate that most barriers were related to perceived workload and scheduling.
Ngam et al. Barriers and facilitators to *Clostridium difficile* infection prevention: a nursing perspective. Am J Infect Control 2017;45:1363-8.[39]	Leadership developing. Authors mention varying official organizational policies related to ordering diagnostic tests.
Schwartz et al. Adherence to surgical hand antisepsis: barriers and facilitators in a tertiary care hospital. Am J Infect Control 2017;46:714-6.[40]	Leadership developing. One barrier mentioned was lack of managerial oversight.
Redwood et al. Reducing unnecessary culturing: a systems approach to evaluating urine culture ordering and collection practices among nurses in two acute care settings. Antimicrob Resist Infect Control 2018;7:4.[41]	Leadership not addressed.
Seibert et al. What do visitors know and how do they feel about contact precautions? Am J Infect Control 2018;46:115-7.[42]	Leadership not addressed.
Barker et al. Screening for asymptomatic *Clostridium difficile* among bone marrow transplant patients: a mixed-methods study of intervention effectiveness and feasibility. Infect Control Hosp Epidemiol 2018;39:177-85.[43]	Leadership not addressed.
Krein et al. Identification and characterization of failures in infectious agent transmission precaution practices in hospitals: a qualitative study. JAMA Intern Med 2018;178:1051-1057.[44]	Leadership not addressed.

EVS, environmental service; *SEIPS*, Systems Engineering Initiative for Patient Safety.

Consultation

We incorporated the last step of a scoping review (consultation) to better understand our results in the context of current and future systems engineering work related to reduction of HAIs.

RESULTS

Fifteen relevant studies were found, with only 3 studies including direct mention of leadership. All studies found were published between 2014 and 2018. Table 1 lists all the studies, along with the citations and the information found related to leadership. The following is a synopsis of each of the 3 studies that addressed leadership directly.

In 2016, the use of a systems approach to room cleaning and disinfection was studied by Rock et al.[34] A table within this article identifies challenges to patient room cleaning and lists culture and the hierarchy aspect of the organization as a challenge, with mention of the power differential between frontline staff and leadership and between environmental service associates and other health care workers.[34] This article highlights the complexity of constructing a safe environment for patients (improved room cleaning), calling for integrating human factors with infection prevention.

Barker et al[36] used the SEIPS model in 2017 to examine implementation of infection control practices in a large tertiary center in northern India. Person, task, and organizational level factors were critical to infection control at this hospital. Major barriers included a high rate of nursing staff turnover, time spent training new health care workers, and heavy clinical workloads. A well-developed infection control team and an institutional climate that prioritizes infection control were major facilitators. This study concluded that institutional support, including prioritizing resources to properly train nursing staff, was paramount.[36] Leadership was mentioned as part of the discussion section of this study.

In 2017, the use of nonsterile clinical gloves in acute care was investigated by Wilson et al[35] using the SEIPS model to place the process in the context of the work system.[35] The SEIPS model helped to map themes and to consider strategies that could be used to improve processes and outcomes to reduce high-risk nonsterile clinical glove use behavior. Nonsterile clinical glove use has been associated with potential for cross-contamination and HAI transmission. Cultural norms and leadership were identified as contributing to the results of this study, the predominant use of nonsterile clinical gloves in clinical practice.[35]

Among those studies not directly mentioning leadership (n = 12), 6 studies were labeled "leadership developing" in which the article describes some aspect of leadership but uses different terms such as

management style in the context of teamwork, champions within the team, or when leadership is described as an essential component but with no definition of the role or significance of leadership.[30,31,37-40]

DISCUSSION

We found that only 3 of 15 studies directly mentioned leadership. In 2013, a discussion article was published jointly by the Institute of Medicine and the National Academy of Engineering titled, "Bringing a systems approach to health."[45] This article highlights organizational leadership as 1 of 5 prerequisites for implementing systems approaches in health care and indicates that the spread of a systems approach depends on technology, leadership, culture, and greater learning. The importance of leadership for diffusion of best practice throughout the organization was recently emphasized by Greilich et al.[46] The authors stated a necessary and sufficient condition for diffusion of best practice is "executive leadership, a conducive culture, and capacity for robust quality improvement." This article highlights leadership as 1 of 7 conditions for implementation success.[46]

Although not strictly HAI-related, a recent systematic review of ambulatory antibiotic stewardship interventions using SEIPS found a limited number of studies focused on the actual roles of those individuals who make up an organization.[47] Our results concur with this finding and indicate a need for HAI researchers who use a systems model to openly study the role of individuals in leadership positions (eg, executive, mid-level, or local) when moving evidence to practice. Another study by Wong[48] connects systems thinking and leadership to address dialysis safety to prevent infections. This article emphasizes the need for executive-level leaders to see themselves as change agents with a commitment to leadership training to sustain best practices.[48]

It appears that recent SEIPS publications lean toward unpacking several elements of the SEIPS model, including the organization element. The SEIPS 2.0 is an extended model that incorporates the concepts of configuration, engagement, and adaptation, all capturing human factors that add to the complexity of the work system.[49] Within human factors and systems approaches, leadership appears to fit the model in a broader sense, such as the relationship between worker outcomes and patient outcomes. Examining all system factors, including person satisfaction, stress, and burnout among staff and personal development is emerging and identified as key to reducing safety hazards and improving quality, all factors that may be enhanced by good leadership.[18,50,51]

Exploring how health care leadership facilitates or hinders implementation of HAI evidence-based practice needs further exploration. Further research is needed to (1) identify health care leadership actions, competencies, and communication behaviors needed to create system change, (2) explore leadership as a vital link in systems or policy change needed to move evidence to practice, (3) delineate roles within implementation, and (4) explore the feasibility of training our future health care leaders, whether executive, mid-level, or local, in specific communication skills that are needed to move research into routine practice.

LIMITATIONS

Conducting a scoping review focused primarily on HAI research using only the SEIPS model is a major limitation. We wanted to stay narrow in our first attempt to address leadership within a systems model. What we found by examining only 1 systems model is not representative of other systems models, and our findings and recommendations cannot be generalized to all systems models and frameworks. Also, the studies found were not assessed for quality. Because of the nature of a scoping review, our findings are meant to encourage further inquiry into leadership when using a systems approach to implementation of best practices.

CONCLUSIONS

Examining how leadership fits within the SEIPS model or other systems approaches may assist in alleviating ambiguities related to large and complicated initiatives to reduce HAIs. Considering that leadership can set the tone for an entire organization, leadership behaviors and communication may mean the difference between a supportive health care culture and a culture that undermines the work of so many well-intentioned employees. Poor or ineffective leadership can result in ineffective and inefficient roll-outs of infectious disease directives. Future studies on HAI prevention should include assessment of leadership (at all levels) and include the effect of leadership can have on HAI prevention-related outcomes. Systems approaches may be necessary but not sufficient unless the role of health care leadership is accentuated within the systems approach. HAI researchers may want to consider how leaders impact communication issues, workplace culture, organizational learning climate, and implementation and sustainment of best practice guidelines.

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