

Improving cardiac surgical care: A work systems approach

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ABSTRACT

Over the past 50 years, significant improvements in cardiac surgical care have been achieved. Nevertheless, surgical errors that significantly impact patient safety continue to occur. In order to further improve surgical outcomes, patient safety programs must focus on rectifying work system factors in the operating room (OR) that negatively impact the delivery of reliable surgical care. The goal of this paper is to provide an integrative review of specific work system factors in the OR that may directly impact surgical care processes, as well as the subsequent recommendations that have been put forth to improve surgical outcomes and patient safety. The important role that surgeons can play in facilitating work system changes in the OR is also discussed. The paper concludes with a discussion of the challenges involved in assessing the impact that interventions have on improving surgical care. Opportunities for future research are also highlighted throughout the paper.

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There is something compelling about open-heart surgery, something fantastic and fabulous, a mixture of dream and nightmare, all come true.

–Michael Crichton

Significant reductions in patient morbidity and mortality following cardiac surgery have occurred since the inception of the surgical subspecialty over 50 years ago. Despite these dramatic improvements in outcomes, however, surgical errors with serious consequences continue to occur (Kohn et al., 1999). It is now estimated that one-third of all bypass deaths are preventable (Guru et al., 2008). Historically, surgical outcomes have been attributed primarily to the technical skills of the surgeon. For example, within most surgical specialties, the primacy of technical skill is the underlying assumption driving rankings of surgical performance across institutions or among one's surgical colleagues. In general, "once patient outcomes (usually mortality) have been adjusted for patient risk factors, the remaining variance is presumed to be explained by individual surgical skill" (Vincent et al., 2004). Hence, when things go wrong or surgical errors are made, it is logical from this "human-centered" perspective to naturally question the particular surgeon's competency or aptitude.

In contrast, a systems safety approach suggests that human error is often caused by a combination of work system factors rather than solely the ability of the individual surgeon. Specifically, the Systems Engineering Initiative to Patient Safety (SEIPS) model (Carayon et al., 2006) indicates that in addition to surgical skill (person factors), performance and outcomes are also impacted by such factors as teamwork and communication, the physical working environment, technology/tool design, task and workload factors, and organizational variables (see Fig. 1). According to this perspective, errors are the natural consequences, not causes, of the systemic breakdown among the myriad work systems factors impacting performance (ElBardissi et al., 2007). Consequently, patient safety programs are likely to be most effective when they intervene at specific failure points within the system rather than focusing exclusively on the competency of the individual who committed the error (Carthey et al., 2001).

Although the work systems approach is relatively new to many surgical specialties, there is an increasing awareness of the impact that systemic factors can have on shaping surgical performance, as illustrated by the following quote:

To put it crudely, good surgical skills coupled with basic team performance and the basic equipment may enable a surgeon to achieve a 90% success rate in a high-risk operation. However, refinements in surgical skill may be a relatively small element in the drive to reduce mortality from 10% to 1%. Optimizing the

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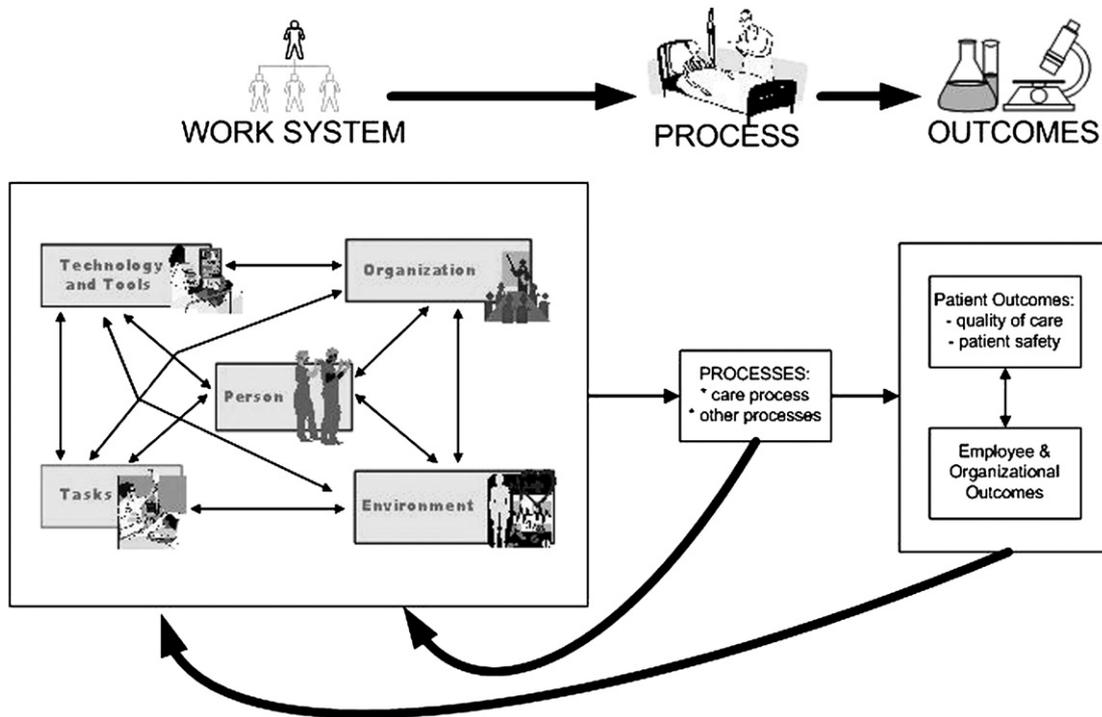


Fig. 1. The Systems Engineering Initiative to Patient Safety (SEIPS) model (Carayon et al., 2006).

surgical environment, attention to ergonomics and equipment design, understanding the subtleties of decision making in a dynamic environment, enhancing communication and team performance may be more important than skill when reaching for truly high performance (Vincent et al., 2004, p. 481).

Historically, the majority of data concerning systemic factors that impact patient safety in the OR have come from anecdotal and sentinel event reports, which often lack details concerning the specific nature of the systemic problems that impact surgical performance (Carthey et al., 2001). However, in recent years, there have been a growing number of published studies that have used prospective data collection methods, such as ethnographic and direct observation to identify empirically the real-time dynamics of work system factors in the OR and their impact on patient safety (Healey et al., 2007; Wiegmann et al., 2007). While research still needs to be done to fully understand the complexities of cardiac surgical care, the results of these prospective studies have begun to identify opportunities and interventions for improving surgical performance and patient outcomes. Albeit, the efficacy of only a few of these interventions have actually been tested and it is unlikely that any single intervention alone will have a major impact on surgical care. Nevertheless, the majority of recommendations emerging from this body of research are grounded in empirical data. When considered together they provide an opportunity to develop comprehensive intervention strategies for addressing a wide variety of work system factors that impact surgical performance and patient safety in the OR.

The purpose of the present paper is to provide a review of previous research on the impact that work system factors have on cardiac surgical care and the subsequent recommendations that have been put forth to improve surgical performance and outcomes. A summary of some of the key references and their recommendations can be found in Table 1. While the majority of this research has been conducted in the United States and the United Kingdom, the results should be readily generalizable to

cardiac surgery in general. We will frame our discussion using the SEIPS model, highlighting research and recommendations pertaining to the various component of the model including (1) the physical OR environment, (2) teamwork and communication, (3) tools and technology, (4) tasks and workload, and (5) organizational processes. We should note, however, that our goal is NOT to comprehensively review all pertinent data for each SEIPS component as they relate to every surgical subspecialty in the OR (e.g., anesthesiology, nursing, perfusion, etc.). To do so would result in a document of encyclopedic form. Rather, for each SEIPS component, we will detail two key issues and associated recommendations that we feel show significant potential for improving

Table 1
Work system factors summary.

Work system factor	Potential interventions	Key references
Physical environment	<ul style="list-style-type: none"> Standardized OR layout "Sterile Cockpit" Rule 	Brogmus et al., 2007 Ofek et al., 2006 Healey et al., 2007 Lingard et al., 2004 Carthey et al., 2003 Wiegmann et al., 2007 DeFontes and Surbida, 2004
Teamwork and communication	<ul style="list-style-type: none"> Foster team familiarity Pre-operative briefings 	Morrow et al., 2006 Cook and Woods, 1996 Karsh and Holden, 2007 Degani and Wiener, 1993 Hales et al., 2007
Tools and technology	<ul style="list-style-type: none"> Usability testing Anticipate unintended consequences 	Thomas et al., 2005 Keroack et al., 2007 Pronovost et al., 2005 Reason, 1990 Eiff, 1999
Task and workload factors	<ul style="list-style-type: none"> Develop standardized procedures/checklists Incorporate breaks to reduce fatigue 	Bann et al., 2005 Carthey et al., 2003
Organizational influences	<ul style="list-style-type: none"> Improve leadership engagement Establish accountability for safety 	
Role of surgeon	<ul style="list-style-type: none"> Error management Adapting surgical and communication styles 	

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