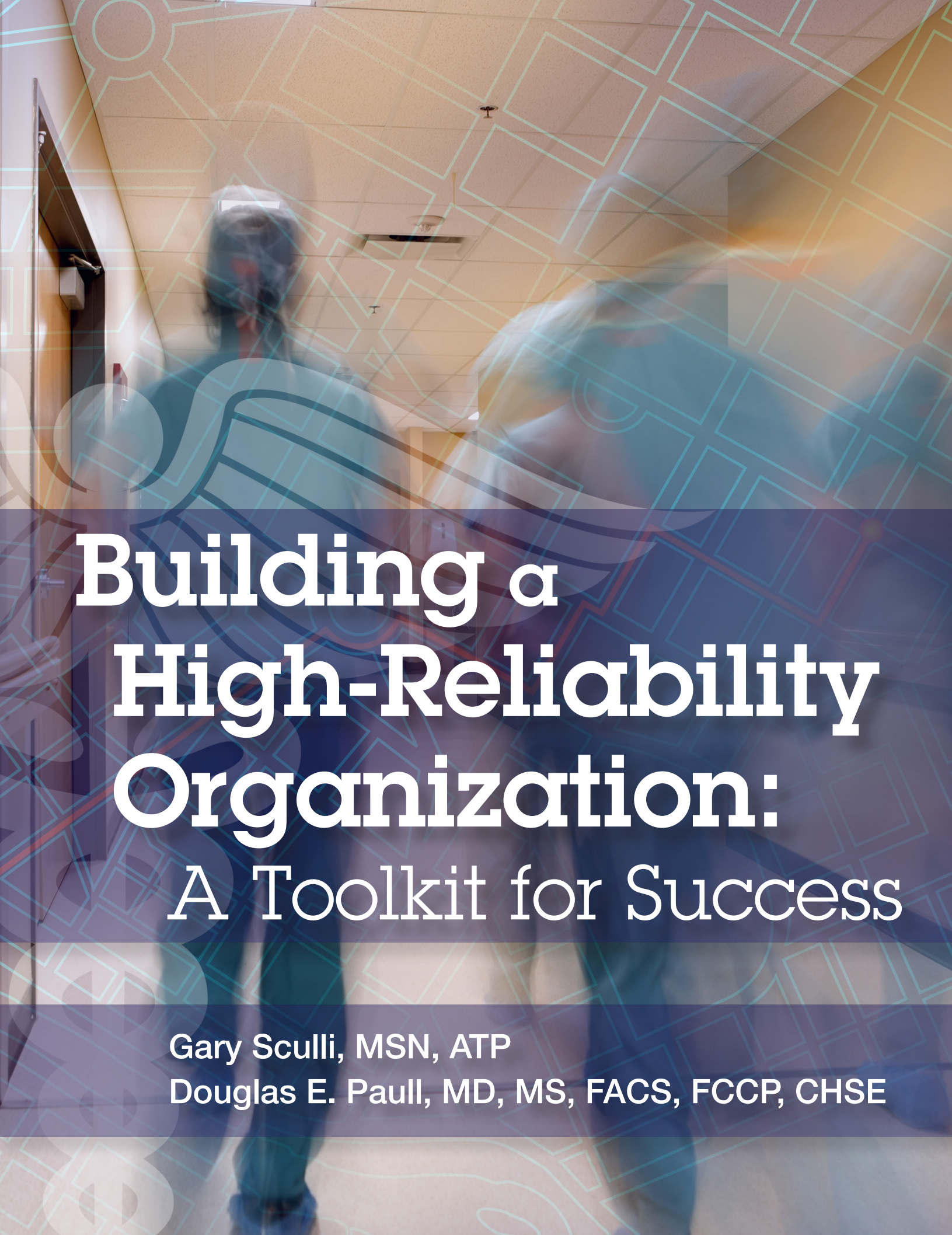

Building a High-Reliability Organization:

A Toolkit for Success

Gary Sculli, MSN, ATP
Douglas E. Paull, MD, MS, FACS, FCCP, CHSE

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About the Authors

Gary L. Sculli, MSN, ATP, brings a unique and diverse perspective to patient safety. He has been a registered nurse for more than 29 years and has worked in multiple clinical specialties. In addition to serving as an officer in the United States Air Force Nurse Corps, Sculli is also a former airline pilot for a major U.S. airline. He has developed and taught Crew Resource Management (CRM) programs in both aviation and healthcare and continues to work as a patient safety consultant. Sculli currently works at the National Center for Patient Safety in Ann Arbor, Michigan, serving as the director of clinical training, where he leads programs that implement CRM, team training, and human factors concepts in clinical practice to create and sustain high-reliability care. He is also the author of the HCPro book *Soaring to Success: Taking Crew Resource Management From the Cockpit to the Nursing Unit*.

Douglas E. Paull, MD, MS, FACS, FCCP, CHSE, graduated from Duke University with degrees in zoology and medicine. He completed his general surgical training at the New York Hospital-Cornell Medical Center and his cardiothoracic surgical fellowship at the University of North Carolina at Chapel Hill. He obtained a master's degree in patient safety from the University of Illinois at Chicago. He has more than 20 years of clinical experience. Prior to joining the Veterans Health Administration's National Center for Patient Safety (NCPS), Paull was associate professor of surgery at the Boonshoft School of Medicine at Wright State University in Dayton, Ohio. He is currently director of patient safety curriculum and medical simulation at NCPS and has authored multiple publications on surgery, team training, and patient safety.

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Gary L. Sculli, MSN, ATP

I would like to acknowledge my friend and colleague Dr. Doug Paull; a great mind and a true gentleman in every way. I have learned so much from you over the years, and I am forever in your debt. Thanks to Dr. David Sine for your guidance and mentorship. You helped me see that there was in fact a contribution to be made and saw it long before I ever did; thank you, friend. Thank you, Dawn M. Sillars, MPH, for all of the help and assistance you gave finding references, constructing tables, and just being a sounding board for ideas. Many thanks also to Amanda M. Fore, RN, MS, PhD(c) for your help and support while completing this project.

Most of all, I want to sincerely thank you, the reader. If you are reading this, you are most certainly dedicated to the unique discipline that is patient safety and have devoted a part of your professional life trying to improve the system for the benefit of patients. The road to high reliability is daunting; what it takes to achieve it in many cases does not mesh well with traditional and well-established methods used to deliver healthcare. But you embrace the idea and forge ahead anyway because you know that to "get there," your steadfast leadership is required. It is my hope that what you read here can serve you well on your journey.

Douglas E. Paull, MD, MS, FACS, FCCP, CHSE

I would like to acknowledge the guidance and wisdom of my mentors in patient safety, both past and present: Dr. Jim Bagian, Dr. Robin Hemphill, Caryl Lee, Linda Williams, and my co-author Gary Sculli. They have taught me, and countless others, about the foundations of patient safety for a modern healthcare system and have served as excellent role models in patient safety leadership. I would also like to thank my many colleagues who have dedicated their professional lives to improving patient safety and helped me throughout my career.

Words cannot express my gratitude for my wife Lisa and her understanding and patience in support of the writing of this book. Further inspiration came from my daughter Sara and grandchildren Elena Jane and John.

Foreword

To the reader:

I am very pleased to have been asked to write a foreword for this new book, *Building a High-Reliability Organization: A Toolkit for Success,* by Gary Sculli and Douglas Paull. As a consultant physician working for the National Health Service in the United Kingdom, I did my pre-clinical studies at Worcester College, Oxford University, and my clinical training at King's College Hospital Medical School, London University. The emphasis throughout that training and in my post- graduate years was very much on "getting it right for the patients and reducing iatrogenic harm." In simple terms, this meant establishing the right diagnoses in the context of the patient's comorbidities, making and implementing wise plans for treatments, monitoring the patient's clinical status, reviewing progress regularly, and being careful to reduce avoidable harm. Quality and safety in the care of the individual patient was drummed into us! But ensuring quality and safety requires much more than simply emphasizing the importance of "wise" plans or being "careful." In my opinion, most senior doctors and administrators have not realized how much healthcare delivery has changed over the last 70 years. In the past, a senior doctor (consultant or attending) was very much like an individual craftsman running his own business, like a carpenter, plumber, or goldsmith. As Sir William Osler stated, "Physicians as a rule have less appreciation of the value of an organization than members of other professions." Today, healthcare is highly complex and fast moving, and it requires high-risk decision making by teams whose membership can change rapidly. Reliable outcomes depend on well-organized standard operating procedures, clear and efficient communication, high-functioning interdisciplinary teams, resilient processes, the use and sustainment of safety tools such as checklists and briefings, the firm presence of a culture of safety, and ongoing training in crew resource management. These elements are at least as important as the intellectual or technical brilliance of any individual clinician and require an unwavering commitment from the highest levels in an organization.

In April 2013, I happened serendipitously to sit next to David Sine, a colleague of both Gary Sculli and Douglas Paull, at the International Forum on Quality and Safety in Healthcare in London. We soon got to talking about the use of checklists in healthcare, a topic with which I am quite familiar. David was very enthusiastic about Sculli's work and encouraged me to obtain a copy of *Soaring to Success: Taking Crew Resource Management for the Cockpit to the Nursing Unit*. I devoured that book because it echoed my belief that we could dramatically improve patient safety

not only by changing what we say, and how we say it; but also by adopting the tools used in high-reliability industries.

This book takes that idea to a new level. How can top leaders and managers in healthcare organizations really know if they have what it takes to create and sustain high-reliability care? How can top leaders ensure that frontline staff possess the knowledge, skill, and resources needed to make their work processes consistent, safe, and reproducible? In 10 chapters, Sculli and Paull provide a road map that answers these questions directly. Clearly laid out for the reader in narrative and checklist form are what the authors term *"high-reliability markers,"* which, if present, indicate that an organization has the necessary elements in place to trap human error, anticipate and safely manage failure, and avoid catastrophic events. Sculli and Paull intuitively write that top leaders must be present *in* the workplace, have a deep rich understanding of the frontline experience and exert their efforts to transform the clinical setting into a venue where it's easy to "get it right" and hard to "get it wrong." The authors explicate topics key to high reliability, such as human factors, strategies to support individual and team situational awareness, a preoccupation with the possibilities for failure, reducing variability through adherence to standard operating procedures, creating readily accessible usable workplace checklists, creating and nurturing a just culture and a safety culture, and much more. Sculli and Paull's use of the word "mandate" throughout the book along with an almost religious adherence to investing in and sustaining a perpetual training program for all clinicians will certainly challenge leaders to depart from "business as usual" approaches. The authors make it clear that high reliability is not a passing fad or quick fix, but rather a way of life that requires bold decisions and transformational leadership.

The good news is that moving toward high reliability will reduce the long-term financial and emotional cost burden for any healthcare organization. It will substantially increase the chances that your organization will consistently "get things right" with less avoidable harm for patients. The road map for that high-reliability journey is before you.

Read on!

Gordon

Dr. Gordon Caldwell, FRCP

Consultant Physician and Clinical Tutor

National Health Service—United Kingdom

An Important Note to the Reader

This book is formatted with outlines, titles, and subtitles in each chapter. Our intent and focus with regard to content should, we hope, be clear. Throughout the book, we use case studies liberally; we did this intentionally. It is important to us that concepts are developed within the context of the clinical environment. We believe that case studies from various disciplines and settings are a good way to achieve that goal. The chapters are for the most part self-contained and stand on their own; therefore, it is perfectly acceptable to read the book out of chapter order if you so choose.

A take-home feature of the book for healthcare leaders is found in the checklist that concludes all but one of the chapters. The checklist lays out what we call **"high-reliability markers."** The markers are presented on the left side of the checklist and methods to implement presented on the right. The checklists provide a concise summary of what has been developed in the chapter text. Note also that the checklists are administrative summaries, not the type of checklists one would see in a safety sensitive operational setting. Therefore, they do not follow the design principles discussed in Chapter 4.

Lastly, it is important for you to know that Chapter 1—*Situational Awareness is Fundamental to High Reliability*—is **mostly a theoretical chapter and does not follow the standard format seen in the rest of the book**. Why? Well, the chapter title says it all. Situational Awareness is a topic from which many things descend. It crosses the boundaries of all other high-reliability markers and in this sense is truly fundamental to the rest of the book. A critical step in the movement toward high reliability occurs when leaders commit to measures that facilitate the development of both individual and team situational awareness at the front line of care. For this reason, we devote two chapters to the topic.

CHAPTER 1

Situational Awareness is Fundamental to High Reliability

In this chapter:

- Situational awareness case study
- Background
- Leadership, situational awareness, and high reliability
- Developing situational awareness
- Situational awareness derailed
- Cognitive resources of situational awareness
- Environmental threats to situational awareness
- What's next?

Case study

A 75-year-old male patient is on a cardiac medical surgical unit with tachycardia and worsening angina. After being admitted and placed on telemetry, the patient is scheduled for a cardiac catheterization. The unit has a central nurse's station monitor, but it is not manned and is there only as a back-up to remote monitoring. In a remote location, all of the unit's telemetry-capable beds are monitored by a certified cardiac monitor technician. At 11 a.m., the monitor technician notices that the patient is not registering a readable rhythm and immediately calls the unit. A medical assistant answers the phone and, after receiving the information from the technician, summons the nurse taking care of the patient. Going to the bedside, the nurse notices that the patient seems restless and has accidentally ripped off one of the electrodes. She settles the patient down and reattaches the electrode. After attaching the electrode and verifying a readable rhythm at the central station, the nurse—who was already behind with the 10 a.m. medication pass—returns to her work. Approximately 10 minutes pass, and the patient, now unattended, again pulls off his electrodes. Shortly after, he develops ventricular fibrillation and then cardiac arrest. The telemetry technician notices the absence of a rhythm and thinks that what he sees is related to the initial situation he called about earlier. He thinks the nurse knows what is going on and does not feel the need to call. No one at the central station notices this either, because all alarms are silenced and nurses rarely look at the monitor during hours of high task load. When the medical team comes by for rounds, the patient is found pulseless, cyanotic, and without

respirations. A "code blue" is initiated, but the patient does not respond to interventions and is pronounced dead. Staffing on the unit calls for six nurses and two medical assistants for 30 patients. On this day, two nurses were pulled to another unit, leaving the unit understaffed.

Background

In this modified but true case, the clinicians involved, and the team as a whole, were not aware of critical pieces of information that if known would have helped form a more accurate understanding about what was actually happening with this patient. Nor, it seems, was there an attitude of vigilance, which might have prompted the staff to anticipate impending failures. In other words, what was formulated in the mind did not align with the truth or actual reality of the situation. While there are many possible reasons for this dissonance between what a team thinks is happening and what is really happening, the result is the same: low situational awareness (SA).

This case raises multiple questions:

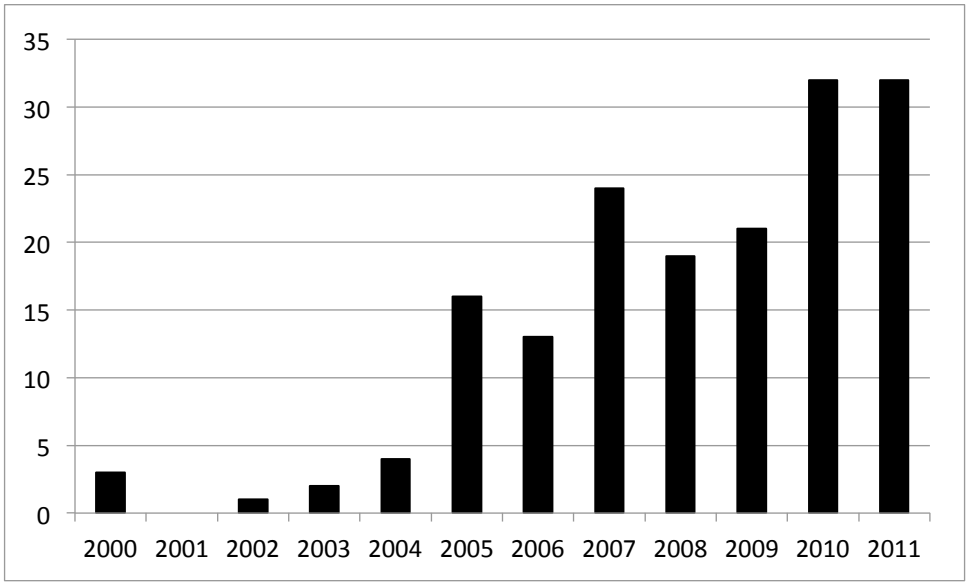
- Why was the unit so profoundly understaffed?
- Was this a regular occurrence?
- What is the standard operating procedure (SOP) for communication between the monitor technician and nursing staff for resolving rhythm irregularities?
- Did the staff trust the functionality of the telemetry equipment? Why was the alarm turned down at the central station?
- What was the task load of the monitor technician, and what made him believe that a second rhythm irregularity was related to the first and known by the nursing staff?
- Did the nurse anticipate a possible problem with the patient since he had become anxious?

The answer to each of these questions plays a central role in the development of SA, a state of being that profoundly affects patient safety.

High-reliability industries and organizations are very familiar with the term SA. In such industries, the term is not a passing fad embraced for a few short years only to be replaced by the next buzzword or catchy movement. SA is a foundational concept, and its importance in operational decision-making at the front line is recognized and categorically supported by leadership. In healthcare, save for pockets of very safe and reliable care delivery, this is generally not the case. SA is not a term that is fluently defined or discussed by frontline clinicians, clinical managers, and healthcare executives. For example, Fore and Sculli (2013) published a concept analysis on the term "situational awareness" in nursing practice.[1] What they discovered was interesting: An

overwhelming majority of these articles were unrelated to healthcare and came from other disciplines, such as aviation, nuclear power, and military operations. Limiting the search to use of the term in nursing returned almost nothing, so they expanded to healthcare in general. While this increased the number of studies that discussed the definition, use of, or measurement of SA, and while the number has increased over the last decade or so (**see Figure 1.1**), healthcare continues to be under-represented when it comes to understanding and supporting SA.

Figure 1.1: Abstracts on PubMed and CINAHL 2000–2011



Leadership, Situational Awareness, and High Reliability

What is meant by the phrase "supporting situational awareness"? It's simple: Healthcare leaders must understand the critical link between situational awareness and clinical decision-making. They need to understand how teams develop situational awareness and must be prepared to clear any and all obstacles that impede that process. Executive leaders and service line leaders close to the bedside must scrutinize models of care delivery currently in use and must be sure that these models enhance a clinician's ability to capture patient information, process the information, easily communicate that information to other team members, and use an engaged and functional team to manage clinical situations likely to occur. The importance of the previous sentence cannot be underestimated.

If you approached the everyday line pilot for a major airline and asked the question, "What is meant by the term situational awareness, and what are specific behaviors you and your team

practice on a regular basis to maintain it?" you would receive a cogent answer with specifics. Yet if you approached a nurse or physician or any other healthcare worker and asked the same question, chances are the answer would not come as easily. It is exponentially harder for clinicians to maintain adequate levels of SA than it is for an airline pilot. When you consider staffing shortfalls, hostile work environments, distractions, unmanageable task loads, inadequate training, and poor human-centered designs that persist in many patient care environments, the ability to develop and maintain adequate levels of SA can be profoundly compromised.[2] I also assert that if healthcare organizations from the top down and bottom up were committed to making it easier for clinicians to develop SA at the front line of care, where hands touch patients, many of the adverse events described above would not happen. There can be no discussion of achieving high reliability in healthcare without a commitment to developing high levels of situational awareness among clinical teams.

Developing Situational Awareness

In healthcare, SA is defined as the perception of the elements within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.[3, 4] To further explain, SA is divided into three levels (**see Figure 1.2**):

Level 1: Perception of elements. A clinician is aware of things, meaning certain elements have reached his or her attention. For example, an Emergency Room (ER) physician assesses a patient and learns that the patient is 66 years old, lives with his daughter who is gone most of the day, has a history of congestive heart failure (CHF), recently had the flu, has not been in the hospital recently but was treated as an outpatient for "walking pneumonia" a few months ago, and has a productive cough, decreased breath sounds in the left chest, a temperature of 99° F, respiratory rate of 22/min, mild pleuritic chest pain, decreased appetite, and occasional confusion but is presently quite lucid. The patient's lab work is unremarkable. A chest X-ray taken immediately after triage shows a "left lower lobe infiltrate." These are simply elements or facts of which the physician is aware. By themselves, these pieces of information mean nothing. Again, level 1 is simply the perception of specific elements in the environment, meaning that these items have captured one's attention. That's all.

Level 2: Comprehension of meaning. The ER physician will now put all of these disjointed elements together, find relationships between them, and assign meaning to the scenario. It's like taking individual trees and putting them together to create a patch of forest. One can say it's an ability to see the "big picture." Using the elements so far, the physician's big-picture view suggests community-acquired pneumonia (CAP) with a marginal Pneumonia Severity Index (a tool used to numerically calculate the chance of mortality and the need for admission as an inpatient).

Level 3: Projection. Now the physician will project into the very near or immediate future. From this projection, he or she knows that if interventions and therapies are not promptly initiated, the patient may very well continue to deteriorate and develop a profound pneumonia with continued failure to thrive. Serious illness and mortality can occur, especially if the patient is sent home with minimal monitoring and assistance from family throughout the day.

Figure 1.2: SA = situational awareness

Level 1 SA Perception	66 yo male Lives with daughter Productive cough Low-grade fever Weakness and poor appetite Occasional confusion Mild pleuritic pain Chest X-ray = LLL infiltrate Respirations 22 Recent bout with flu Hx of CHF; and "Walking Pneumonia" Decreased breath sounds No recent hospitaliztion
Level 2 SA Comprehension	Community acquired Pneumonia PSI indicates possible admission
Level 3 SA Projection	Patient will continue to deteriorate from infection Respiratory distress Mortality
Decisions/Actions	Obtain sputum culture Oxygen Pulse oximetry Treat empirically with antibiotics Admit to hospital for IV antibiotic therapy

Moving through these levels, the physician can then make decisions and take actions. In this case, sputum cultures, pulse oximetry, oxygen, and prompt antibiotic therapy are ordered, and a plan to admit as an inpatient is formulated.[5] The physician moves through these levels subconsciously, and it occurs within a circumscribed period of time and space—taking place in the ER during the time the patient is triaged and evaluated, and a decision to treat and admit is made. You can say then that the development of SA is the precursor to decision-making.

Situational Awareness Derailed

In our model of SA, the end points (i.e., decisions) can be compromised by failures at any level. For example, in the case of our ER physician, if he or she is distracted, fatigued, or task-saturated due

to poor staffing or high patient load, key elements in the patient's presentation, such as weakness and a recent history of confusion, may not be known. They fail to reach the physician's attention, which creates a level 1 SA failure. The consequence is that the subsequent "big picture," short-term projections, and, ultimately, the end-point decision to admit as an inpatient for treatment may not occur even though it is indicated based on the patient's true condition.

The same compromise to clinical decision-making can occur at level 2 SA. Consider, for example, the case of a nurse on a medical-surgical unit caring for a middle-aged, female patient with a severe kidney infection. The patient is exhibiting signs and symptoms of sepsis (infection in the bloodstream), which, if not treated promptly, can be fatal. The nurse has perceived all of the necessary elements by way of handoff report and patient assessment: hypotension, tachycardia, altered mental status, decreased urine output, low grade fever, and decreased oxygen saturation. However, if this nurse is unable to put these elements together and form the correct big picture—if the relationships among the individual elements are not processed and recognized—then what is comprehended is not reflective of the patient's true state. The decisions and actions of this nurse will be less than optimal for the patient. Potential causes for this inability to recognize the patient's true state may be fatigue or the presence of distractions; however, we can also imagine a lack of continual training on the clinical manifestations of sepsis to allow pattern recognition as causal in this level 2 SA failure (we'll discuss the relationship between high reliability and training in Chapter 10). If the nurse thought the patient might be septic but wasn't sure and failed to confirm with another team member, then the absence of continual training on nontechnical skills such as crew resource management (CRM), which emphasizes vigilance, communication, and using other team members to solve problems, may be causal. Whatever the reason, if the actual state of the patient is not comprehended, the level 2 SA failure can lead to flawed decision-making.

Continuing with the same case, if the nurse perceives all necessary elements (level 1 SA), forms the appropriate relationships between them, and recognizes the big picture as sepsis (level 2 SA) but near future projections (level 3 SA) fail to paint the very real picture of septic shock, multi-system organ failure, and death, then, again, the appropriate end-point decision may not occur. This patient requires transfer to a higher level of care, vasopressors and intravenous fluids for blood pressure support, and aggressive antibiotic therapy. Perhaps the nurse does not possess the requisite experience to know what the near future can look like for a septic patient. Or the simple human factor issues previously mentioned, such as fatigue or high task load, might derail the process. As with all levels of SA, a level 3 SA failure can compromise the integrity of the clinical decision that is made, ultimately placing the patient at greater risk.

Cognitive Resources of Situational Awareness

Human beings are not stellar when it comes to multitasking. We can do one task well. We can do two tasks relatively well; however, when a third task is added, error rates increase sharply, and we are prone to omission errors—meaning we forget things.[6] **Human attention and working memory** (the short-term memory, where we process real-time information) are imperfect resources in the best of circumstances, yet they are crucial to the development of SA. When you add the multitude of threats existing in many clinical environments, these tenuous resources are further strained to the point where key elements in the patient's assessment are not known, not processed, or perhaps detected then forgotten.

SA is highly dependent on human **attention**. As we discussed, a starting point in developing SA and making decisions is simply being aware of something in the environment; a piece of information first has to capture our attention. This is problematic in that attention is a limited resource; we only have so much of it to go around. Suppose a radiology technician is reviewing instructions with an elderly, frail patient prior to a procedure. The patient is relaying a concern, and the technician is focused and listening. Suddenly a coworker calls the technician's name from the central station, relaying a question from a physician who is on the phone. Now the technician's attention is refocused for a moment and then divided between the patient and the physician's question. With attention divided, the technician fails to see the patient stand up quickly and lose his balance. He reaches out but is unable to stop the patient's fall. The patient hits the floor head first.

In simple terms, the human attention span can be thought of as a bucket. As more things vie for our attention, the bucket fills and our attention is divided. At some point, when too many things in the environment demand our attention, the bucket overflows and we can pay attention to nothing more. Clinical environments are replete with stimuli relentlessly competing for our limited attentional resources. This makes medical and nursing care a risky proposition for patients and is a source of great stress and dissatisfaction for nurses, physicians, and ancillary staff alike. Many times there is simply too much coming at clinical staff, yet we as leaders expect them to deliver highly reliable and safe care, exacting formal discipline upon them when they fail. (The relationship between high reliability and creating a "just culture" will be discussed in Chapter 8.) The risk is even more profound when attentional resources are taxed during the performance of critical, safety-sensitive work, such as titrating a high-risk medication in an intensive care unit or mixing intravenous medications in the pharmacy. Attention buckets overflow, and a failure to acquire salient clinical information occurs.

The same holds true for a clinician's **working memory**. Formally, working memory can be defined as the limited number of ideas, sounds, or images that we can maintain and manipulate mentally at any point in time. The key word in this definition again is "limited." The working memory is a cognitive resource with finite capacity, like a bucket.[7] We can maintain about five to seven items,

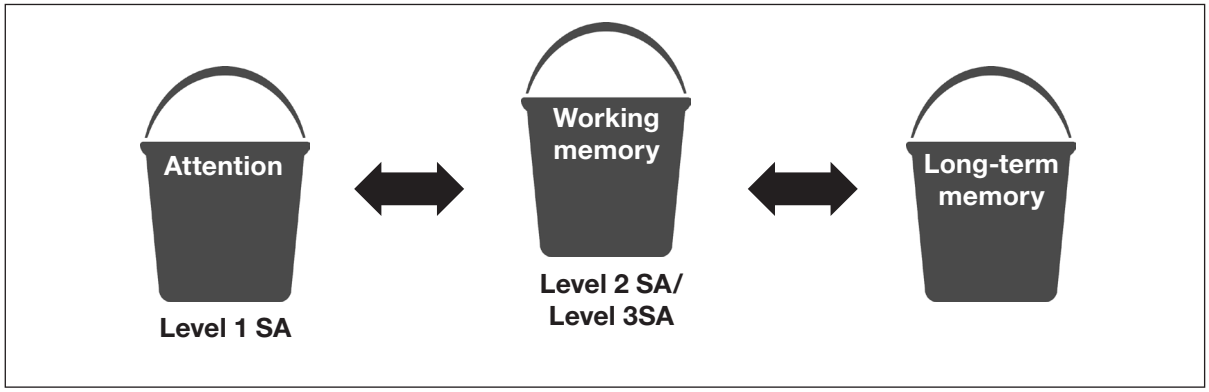
or "chunks," of information in the working memory at any one time; after that, the bucket overflows and the information is lost (forgotten). Even if the working memory bucket is not filled to capacity, but rather the information within is not used, rehearsed, or promptly unloaded by writing it down or typing into an electronic charting system, it can decay (in as little as 20 seconds) and be quickly forgotten. An example of the limitations of the working memory can be seen in the simple memorization of a seven-digit phone number. Trying to keep the number fresh and usable in the working memory requires that it be rehearsed over and over again; we've all experienced this. This works relatively well if we can use the number in short order; however, if we can't call the number right away or we are distracted during its rehearsal by external or internal stimuli, chances are good that we'll forget it.

Working memory is a critical cognitive resource for clinicians because this is the place where patient assessment data is temporarily stored and then processed so they can make sense of what is happening. It is the mental place where they comprehend a patient's current state (level 2 SA) and project a patient's likely future state (level 3 SA). Distinguished psychologist James Reason explains that the working memory is closely linked to what he calls the "conscious workspace, the experiential here and now."[8] To describe the conscious workspace, he asks you to picture yourself on a bank watching a stream go by. The stream curves around a sharp bend as it moves toward you and again curves around another bend as it moves away. You can't see upstream or downstream; all you can see is the part that swiftly passes in front of you. The clinical information processing occurring in real time in any setting—the operating room, step-down unit, intensive care unit, medical-surgical unit, or outpatient clinic—represents the part of the stream that you can see. Reason's metaphor is an excellent way to describe the "here and now" aspect associated with working memory.

In **Figure 1.3,** we see three buckets representing our cognitive resources. The **attention bucket** on the left represents the resource that receives patient information from the environment. The **working memory bucket** represents the place where we store and analyze the information in the here and now so we can comprehend it. Also included is the **long-term memory bucket**. This cognitive resource represents information that we have learned and stored over time, either in the classroom, in training, or in real-life experiences. It represents a more permanent storage of patterns and models that help us recognize the "big picture" views we create via working memory. Recall the patient we discussed earlier who exhibited multiple elements that, when related and combined, represented the big picture called CAP. How did the physician know this? She knew it in part because she has learned the pattern of this condition. She has most likely read case studies in texts and journals, has discussed it in medical school and with colleagues, has seen it in the ER before, and has learned to recognize it. This information is burned in the long-term memory. When real-time clinical data is processed in the working memory, part of that process includes a comparison with models, rules, schematics, and past experiences that live in our long-term memory stores.

This mental exchange, represented by the second two-way arrow in Figure 1.3, is how we define and comprehend a situation. We've also learned what to do once we recognize CAP, what clinical progression to expect, and the most appropriate course of action to take. This is the knowledge that gives us the predictions and projections characteristic of Level 3 SA, where we are again accessing mental models filed away in our long-term memory.

Figure 1.3: The cognitive resources of situational awareness



Information in the long-term memory can also direct our attention resource represented by the first two-way arrow in Figure 1.3. As a clinician recognizes a pattern, that pattern can reveal where to search for additional information, which allows the perception of additional facts that can make a patient's actual state much clearer. For example, if CAP is suspected, a focus on specific laboratory studies or specific parts of radiographic images will help determine disease severity. In other words, the long-term memory can tell the clinician where to direct attention and look for things that matter.

What is the main point of the previous theoretical discussion? It is to highlight the complexity involved in developing SA. Clinicians move through this process subconsciously, and even as they utilize their limited cognitive resources, the world around them is not static. They are actively exposed to new data while holding on to existing pieces of information. This is a tall order in the friendliest of environmental conditions. Unfortunately, many patient care units can be anything but friendly to cognitive processing. As healthcare leaders, it is important to know and accept that attention and working memory are critical to the development of SA, and these resources are fragile in the best of circumstances. If this is internalized, then you can begin to view *all* clinical environments through a new lens. This is imperative and representative of a paradigm shift toward high reliability. Why? Because in the wake of an adverse event, we often blame practitioners for lack of vigilance or create hasty action plans that place more burden on human cognition. However, if we first ask the question **"How could we have better supported SA?"**, then a first

step in developing strategies and countermeasures to reduce attention and processing errors has been taken.

Environmental Threats to Situational Awareness

Fatigue

SA is dynamic, constantly changing and updating, and is subject to a number of threats from the environment in which healthcare teams work, including fatigue, hierarchy, and distractions. Fatigue has been defined as "an overwhelming sense of tiredness, lack of energy, and feeling of exhaustion associated with impaired physical and cognitive functioning."[9] Provider fatigue is a contributing factor to preventable adverse events in healthcare.[10] Fatigue directly threatens SA by causing lapses in attention and memory and decreasing both the speed and accuracy in which the human brain processes information.[11] Nurses working more than 12.5 hours in a shift are three times more likely to make an error. Residents working 24-hour shifts are five times more likely to make a diagnostic error and 61% more likely to suffer a needlestick injury. Despite ample evidence, healthcare leaders are largely unaware of the threat that fatigue represents to patient and employee safety.

Culture

The culture of an organization, or for that matter the patient care unit, serves as a strong modulator of SA. Nurse-physician interactions—often characterized by poor communication, conflict, and dissatisfaction—can lead to preventable patient-adverse events. It is not so much what is said but rather what is not said: "Silence kills" in healthcare.[12] Healthcare workers observe important safety violations, errors, incompetence, and/or disrespectful behavior but fail to "speak up" because of the intimidating environment often passively condoned by local supervisors.[13] This lack of information sharing inhibits level 1 SA development.

SA depends on teamwork and communication. A culture that facilitates communication leads to improved SA, better decision-making, and better outcomes for patients. Perhaps Leape et al. (2012) best summarize the relationship between culture, the organization, and leadership: "Without mutual respect and a sense of common purpose, people cannot and will not work effectively together … these characteristics are embodied in so-called 'high-reliability organizations' … The responsibility for creating a culture of respect falls on the organization's leader because only he or she can set the tone and initiate the processes that will lead to change."[14] In subsequent chapters, we will examine some of these processes in more detail.

Automation and technology

Automation and technology help improve patient safety and SA in many ways, including alerting providers to important information (e.g., change in a patient's vital signs), improving the legibility of written orders (e.g., computerized physician order entry), or ensuring the correct medication is given to the right patient (bar code medication administration). Unfortunately, at times, the very same automation can lead to unintended errors. Physiologic monitoring systems analyze multiple parameters simultaneously and can product many distinct audible alarm sounds. When taking into account the assortment of audible sounds, the number of parameters monitored at a given time, and the number of patients being monitored in a single clinical area, the potential for clinicians to be inundated with audible information is high. Add to the mix the fact that many audible alarms are spurious, or represent little to no risk to the patient, and the stage is perfectly set for clinicians to experience "alarm fatigue." This phenomenon occurs when staff experience sensory overload due to an excessive amount of audible alarms. Over time they become desensitized, responding in a delayed manner or not at all. This is exacerbated by the belief that physiologic monitoring systems generate mostly "false alarms." Consider that in one study it was determined that while anesthesia workstations can monitor an array of parameters and can have 20 or more distinct alarms, 75% of audible warnings were false while only about 3% actually signaled a risk to the patient.[15] The complancency associated with alarm fatigue can be profound; staff may actually turn monitoring systems off altogether, or change parameter limits to reduce noise levels and nuisance alarms. This can be a perilous situation for patients as changes in condition that represent real risks go undetected. Automation-induced alarm fatigue is not a hypothetical. Patients have died as a result of alarm-related errors.[16]

The Joint Commission has made several recommendations to address the problem with alarms, including development of an organizational process for safe alarm management, inventory of all devices with alarms, guidelines for alarm settings, and inspection and maintenance of devices and alarms. The take-home message is that healthy organizations consider the unintended consequences of automation and take action to prevent and mitigate the threats that automation poses to SA.

Distractions

The healthcare arena is replete with multiple, frequent distractions that can profoundly strain the cognitive resources discussed earlier. Interruptions occur up to 23 times per hour in acute care settings.[17] Distractions are the root cause of 11% to 45% of medication errors. Moreover, 19% of interrupted tasks are never completed. By its very occurrence, a distraction adds working memory burden to a provider, as he or she must remember to return to the task they were originally performing. The timing and type of interruption, as well as the similarity of the interruption to the primary task, all have a varying effect on memory and SA.[18]

What's Next

In this chapter, we have defined and described the various levels of SA and how humans move through each as a precursor to clinical decision-making. We also explored the cognitive resources involved in the development of SA and the fact that these resources are fragile and limited in the best of circumstances. Lastly, we reviewed specific threats to the development and maintenance of SA existing in the healthcare environment. The next chapter is, in a sense, the second part of our discussion of SA and high reliability. Chapter 2 will discuss specific countermeasures that leaders should embrace and implement to manage the identified threats to SA. In addition, a leadership checklist will be provided for use in assessing the presence of markers that indicate an organization's commitment to helping frontline staff and teams develop higher levels of SA.

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Building a High-Reliability Organization: A Toolkit for Success

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Building a High-Reliability Organization: A Toolkit for Success is a practical guide to becoming a high-reliability organization (HRO). HROs practice the highest standards of patient quality and focus sharply on managing error and preventing failure. In this first-of-its-kind book, written for real-world healthcare professionals on the front lines of patient safety, authors Gary L. Sculli, MSN, ATP, and Douglas E. Paull, MD, MS, FACS, FCCP, CHSE, take the concept of an HRO and break down what it means at the point of care. Through step-by-step instructions and a practical, straightforward approach, they demonstrate how your organization can ensure safe patient care, every day, for every patient. Each chapter includes case study analysis and valuable leadership checklists.

After reading this book, you will:

- Possess a clear understanding of what constitutes high-reliability healthcare
- Understand which elements and behaviors must be included in an overall plan to achieve high reliability at the front lines of care
- Be able to promote evidence-based, reliable methods to improve safety, including team training, standardization, and investment in patient safety infrastructure
- Become a transformational leader in your healthcare organization
- Be able to apply the principles of a fair and just culture to promote the reporting, discussion, and disclosure of adverse events

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