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Optimizing Crisis Resource Management to Improve Patient Safety and Team Performance

A handbook for all acute care health professionals

Peter G. Brindley, Pierre Cardinal
Editors

Praise for Optimizing Crisis Resource Management to Improve Patient Safety and Team Performance

"CRM, perhaps the most important issue in airway management today; and by world leaders in the field!"— Michael F. Murphy MD. Chief Medical Officer, Adult Critical Care and Anesthesiology, MEDNAX

"Investigations, drugs, and procedures don't save lives in a crisis... People do. Clear concise, yet still comprehensive - this is the one-stop introduction for clinical teams striving to thrive in the chaos of a medical emergency."— Dr Chris Nickson MBChB. Co-creator of Lifeinthefastlane.com and the SMACC conference

"The concepts in this book are now an indispensable part of the skill set needed by any team looking after people who are experiencing critical illness. These concepts save lives. This comprehensive and well written book is core curriculum."— Andrew Baker MD. Professor and Chief of Critical Care at St. Michael's Hospital, and the University of Toronto

"There's immense value in this book. It includes highly respected authors and is full of practical information. It helps readers train their fast brain while facilitating communication and task management during crisis"— C. Martin. Professor and Chair, Western University Critical Care Medicine. Past President Canadian Critical Care Society. ICU World Congress, Vancouver 2021

"This book is a terrific easy and digestible review of key concepts relating to effective team-based care in the resuscitation of the critically ill. A great resource for every trainee and practitioner in the field of critical care. Bravo to the authors!"— Derek C. Angus MD. Professor and Chair, Critical Care Medicine, University of Pittsburgh School of Medicine and UPMC Healthcare System

"If you take care of sick patients as part of a team, this book is essential reading. The editors have created a no-fluff compilation of crucial, usable information."— Scott D. Weingart MD. EMCrit.org

"An important topic and a useful book for all in acute care medicine."— Simon Finfer MD. Professor, The George Institute for Global Health, University of Sydney, University of New South Wales and Royal North Hospital

"25 years ago, what should have been a near miss was, I regret, a miss. Last week a near miss ended well. How things have changed. Today we communicate more as a team, we work together, and we expect clear leadership and responsiveness. All of these personal and team behavioural traits seem so obvious today, but weren't always so, and I learnt the hard way. This text will help many find an easier, safer way".— Gary Masterson. MBChB President of the Intensive Care Society, UK. Medical Lead, Cheshire & Mersey Critical Care Network, UK

"While technology to aid and abet critical illness has been integral to our specialty, optimal practice requires understanding how humans interact interdependently when cognitively challenged, time pressured and under emotional stress. This book is highly relevant for all those

who care for vulnerable patients in the ICU."— Deborah J Cook MD OC. Canada Research Chair and Professor of Critical Care Medicine, McMaster University

"Highly readable, practical, concise".— Mervyn Singer MD. Professor, University College London, UK. Editor-in-Chief of Intensive Care Medicine Experimental.

"Whether you work in the most resource intensive or resource limited environment these human skills and teamwork save lives. If you want to safely treat the acutely ill then this book is worth your time".— Kathryn Maitland MD. Professor of Paediatric Tropical Infectious Diseases. Imperial College, London and KEMRI/Wellcome Trust Research Programme, Kenya.

"Regardless of where you work in the world, if you treat the acutely ill then this book is a useful resource"— Flavia Machado MD. Professor of Intensive Care Medicine. Sao Paulo, Brazil.

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Editors
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The editors and authors wish to fully and publicly thank our wives, husbands, kids and grandkids. You make it all happen; you put up with our nonsense, and you make it all so worthwhile.

Contents

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This photo is the aftermath of a 90 minute complex team resuscitation and is intended for reflection. Despite what looks like chaos, the patient survived and ONLY because great team work complemented great equipment and great training. This resuscitation required mastery of all of the topics discussed in this book: awareness and attention, decision-making, communication, task management, leadership and followership, and teamwork. The patient is alive and the team remained strong in large part because Crisis Resource Management was optimized.

Foreword

WHILE I WAS A NEUROSURGERY RESIDENT an adverse event caused a child's death at a neighboring hospital. That incident has stuck with me and has influenced my career. That incident also served as a catalyst and helped define the emerging field of patient and system safety in Canada.

Previously, when errors occurred we had a tendency to look for individuals to blame. This was partly because we did not understand the science or language of human error in medicine. It was also because our curricula rarely addressed how individuals and teams can learn to keep patients safe. Fortunately, an exciting (and challenging) educational transition is underway, and The Royal College of Physicians and Surgeons of Canada is proud to help lead the way.

Competency-based medical education deliberately integrates safety competencies into its framework. In everyday language, this means that it is now an explicit requirement that Canadian medical trainees demonstrate care and commitment to patients and colleagues.

This book is part of that initiative and focuses on crisis resource management and human factors. The challenge is to take those concepts, which are typically borrowed from other industries, and disseminate them as practical actions for the healthcare team. With a range of chapters rich in the themes of attentiveness, decision-making and followership, the editors have succeeded.

If you have had the pleasure of being a student of either Dr. Peter Brindley or Dr. Pierre Cardinal, then you will know why I am so excited about this book. These two Canadian clinician-educators, along with numerous experts from the clinical and behavioural sciences, have produced an engaging, succinct and practical discussion. The goal is to deepen our scope as team members and to expand our resilience for the sake of our patients.

Grab this book and share it like a meal with your teams.

Dr. Susan Brien MD FRCSC M.Ed. CPE
Director, Practice and Systems Innovation
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THE OVERRIDING AIM of this book is simple, yet essential: to improve patient safety. More specifically, it aims to enhance performance during medical crises and to create (and maintain) resilient healthcare professionals. It is written for all acute care clinicians, whether generalist or specialist, trainee or experienced professional, doctor or nurse, rural or urban. It also includes both theoretical underpinnings and practical insights. This book is deliberately modest in size, but is — just as deliberately — ambitious in intent.

We greatly appreciate you accessing this resource, whether via paper or screen, and whether you consume it in one sitting or as distinct chapters. Because we are clinicians and academics, we know that you are very busy and that other resources and distractions are always competing for your time. Accordingly, we have worked hard to produce a handbook that is not only practical, but also engaging, up to date, portable, unique and authored by multidisciplinary experts.

Clearly, factual recall still matters, and procedural skills still matter. However, evidence is increasingly showing that nontechnical skills matter just as much. This means that delivering optimal care requires myriad deliberate skills, many of which were not traditionally addressed. This book focuses on nontechnical skills. We have divided that discussion into six chapters based around the pillars of crisis resource management (CRM). We owe the pioneers of CRM our ongoing gratitude. However, knowledge is never static, and much has evolved. This is because researchers, educators and front-line clinicians have continued to perfect and expand these CRM principles. Accordingly, this book covers both basic and advanced CRM, but hopes to encourage still more reflection, discussion and discovery. After all, clinicians should remain open to all pertinent insights, no matter their source. Moreover, no single person or profession has all the answers.

By its very nature, acute care routinely requires that practitioners forge ahead despite limited information, competing priorities, distracting stress and (potentially) paralyzing uncertainty. Individual and team performance is simply too perilous, too important and too complex to be left to chance. Fortunately practical insights can be readily translated to our clinical reality. Although acute care should be individualized, there are also common cognitive road maps. No matter the pathophysiology, cues need to be identified, decisions need to be made, priorities need to be communicated, tasks need to be managed, leaders need to lead, and followers need to follow. Each of these subskills is addressed in its own chapter. We conclude by discussing how to enable life-saving teamwork where otherwise there could be chaos. My good friend, Dr. Pierre Cardinal, further summarizes specific chapter details immediately below.

Acute care medicine requires both art and science and a curriculum that is "fit for task." This is because we need practitioners who can thrive despite being pressured by time, buffeted by uncertainty and challenged by resources. This means that we

need to bolster our core competencies by including CRM and human factors training. The nuanced and fascinating challenge lies in developing individuals and teams that are robust but adaptable, predictable but bespoke and fast but not haphazard. This book aims to take on that daunting but worthwhile challenge. On behalf of all the authors, we are very grateful for this opportunity to protect deserving patients and valued colleagues.

Peter Brindley MD FRCPCUniversity of Alberta, Canada.

DOING THE RIGHT THING at the right time requires proficiency in dynamic decision-making, communication and team management. Multiple tasks must be prioritized and coordinated in order to keep the patient alive until sufficient information becomes available, at which point we can pinpoint a diagnosis and begin definitive therapy. Healthcare teams must also understand that their actions (or inactions) carry potentially disastrous consequences. Furthermore, during crises, the perceptual and cognitive resources of each team member are more likely to become overstretched, especially when situations are unfamiliar or resources are inadequate. Stress is a double-edged sword; sometimes it enhances alertness and focus, but sometimes it delays thoughts and actions.

Working as a team not only lends more hands, but also more eyes, ears and grey matter. Moreover, teamwork training can translate into improved bedside performance, better decision-making and fewer medical errors. Interestingly, teamwork training likely enhances teamwork-related skills (e.g., performance of teamwork-related skills, such as initiating a team debrief) as well as clinical task performance (e.g., performance of task-related duties, such as administering a medication on time). Furthermore, improved performance can translate into both improved organizational outcomes (e.g., safety climate, length of stay) and patient outcomes (e.g., patient satisfaction and survival).

There is more to teamwork than merely "calling by name" or "closing the loop." Studies have identified that higher-performing teams adopt more sophisticated patterns of communication, coordination and leadership and that they can better adapt their teamwork. The challenge facing acute care teams is knowing what is the preferred style of leadership/followership, the optimal form of coordination, the most suitable communication, or the best decision-making. Two words aptly summarize the chapters that follow: "It depends." In every chapter, authors present different options describing not only how best to apply crisis resource management (CRM) principles, but also under what conditions to apply them.

The first chapter reviews basic theories and practices of attention and awareness. It outlines how situational awareness helps make sense of a situation, focuses atten-

tion on the most relevant cues and enables clinicians to make predictions. It also discusses how situational awareness can change, depending on our experience, expectations, expertise, distractions, stress and biases. The chapter expands on ways for clinicians (and teams) to leverage their limited attentional resources. The goal of the second chapter is to better understand decision-making habits and how they impact CRM in everyday clinical practice. The chapter explains two important models (the Recognition-primed Decision Model and the Dual Process Model) and reviews how expertise and cognitive load influence clinical decision-making.

The goal of the third chapter is to disseminate practical communication strategies and expand our understanding beyond models that have dominated to date. Four relevant communication models are presented (the mechanistic, rhetorical, systems and sociomaterial approaches), along with a discussion of their benefits and constraints, and complemented by examples and tips. The fourth chapter describes how teams manage resources and organize tasks. We examine how tasks are used to either collect information (in an attempt to increase understanding) or improve team coordination (prioritizing, allocating, delegating and mobilizing resources). Theories that influence task management are also reviewed. The chapter also discusses the shared mental model, the use of implicit or explicit coordination and the development of interpositional knowledge.

The fifth chapter centres on leadership and followership. It reviews different styles of leadership and followership, emphasizing that the preferred style should be based on the patient needs, on the clinical situation and on the problem-solvers (i.e., the clinical team). This sixth and final chapter is on teamwork and shared cognition. The authors review the benefits of mastering CRM skills to improve teamwork, but caution us that not all teamwork is necessarily good: "We do not just need more teamwork; we need better teamwork."

We have gone beyond a one-size-fits-all model. In so doing, CRM skills are presented in a more sophisticated manner. This is because under some conditions, a certain CRM skill (or CRM skill style) might be greatly beneficial and lead to both better performance and better outcomes. Under different conditions, however, the same skill might be deadly. It just depends!

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Attention and Awareness in Acute Care Medicine

Authors: Peter G. Brindley, Jordan R. Schoenherr, Daniel Howes
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"Data! Data! Data!" he cried impatiently. 'I can't make bricks without clay.'"

Sherlock Holmes, in The Adventure of the Copper Beeches

Introduction

When discussing the science and practice of acute care medicine, terms like "attention" and "awareness" should never be mere buzzwords. Instead, these are essential practical skills required by all competent practitioners. To understand the science behind these skills we need to dig deeper and review the psychology of how humans identify threats, manage distraction and maintain vigilance. As with most aspects of crisis management, these skills are rarely innate. Instead they take humility to accept, experience to master and discipline to maintain. The effort is worthwhile given that attention and awareness are central to clinical judgment, medical decision-making, and resuscitative success. Without basic skills (and basic understanding) we increase the likelihood of patient peril and decrease the likelihood of patient rescue.[1] While these complex skills are not always easy to quantify, they can be, quite literally, life-saving.

Attention is a precious resource. Accordingly, it should be allocated judiciously and wisely. We should understand that the demands of acute care medicine mean that attention is usually — for both good and bad — divided, focused, or shifted among stimuli.[2] For instance, we can remain appropriately focused on one piece of critical information, but in doing so we risk fixation

errors. Alternatively we can transfer our attention among relevant stimuli, but risk cognitive overload. As outlined below, good practitioners (and good teams) ensure they possess both the ability to focus and to scan.

Healthcare practitioners also shift and share their attention between the patient and the team, or from direct patient attention (using vital signs at the bedside) to indirect patient interrogation (using blood work or radiological tests). Because of its importance we need to sustain attention through vigilance[3] in order not to exhaust (also known as vigilance decrement).[4] The "adrenaline rush" of acute care helps us maintain our attention and vigilance somewhat. However, even the most resilient practitioner can be challenged by the common need to manage more than one complex patient and to work in ever-changing teams.

Cognitive processes shift between deliberative thinking (which requires deliberate attention) and automatic responses (typically primed through experience). Prior experience increases the likelihood of automaticity because the situation may match a prototype that has been encountered before. This allows the expert to identify, synthesize and predict without time-consuming deliberation. The expert should also be able not only to rapidly focus, but also to expeditiously shift their attention, even in the absence of conscious awareness. However, the danger is that we may all see patterns where they do not exist and that we routinely fail to challenge our assumptions. If we are unaware of how we arrived at a conclusion, then presumably it is harder to teach others how to gain expertise.

Junior practitioners more often piece together a solution, or cycle through different possibilities. Accordingly, they must apply sustained attention and self-awareness or risk recognizing only certain aspects of a situation.[5,6] This more labour-intensive approach can result in dangerous delays, unpredictable application and exhaustion. In contrast, automaticity means that experts should be able to increase focus, expedite attention shift, lessen response time and reduce variability. The downside is that without extra effort the expert may not slow down to engage others.

This chapter reviews the basic theory and practice of attention and situational awareness. It also discusses how situational awareness can change, depending on our experience, expectations, expertise, distractions, stress and biases.[7-12] The goal is for clinicians (and teams) to better leverage their limited attentional resources for the at-risk patient. Accordingly, these insights should help us better define expertise and competence by the ability of a practitioner (and a team) to juggle the myriad of challenges required for acute care medicine. Our patients need practitioners who can not only expedite the appropriate response, but also remain open to clues and do not become overwhelmed or fixed.

Situational Awareness

Awareness is closely related to attention. For instance, certain features of our clinical environment can seem to "pop out" and dominate over other clinical clues. Examples

Table 1: The Three Levels of Situational Awareness

Level	Benefits	Risks
One: Perception		
Scanning Attention	• Sample many stimuli • Avoid fixing on one stimulus	• Stimulus overload • Lack of prioritization
Focused Attention	• Prioritize • Eliminate" unimportant" cues	• Fixation error • Miss "important" cues
Two: Synthesis		
Cognitive Modeling	• Recognize patterns (heuristics) • Reduce workload • Predictable response	• See patterns where they do not exist • Premature closure/ confirmation bias • Resistant to new ideas
Three: Projection		
Anticipation	• Predict future events	• Incorrect assumptions
Sharing	• Increased resources (cognitive/physical)	• Need to coordinate a team

might include when the patient "doesn't look right," or when the lactate is elevated even if the patient does not yet appear to be in distress. In theoretical terms this reflects the fact that attention is guided by our current expectations and prior experiences. As mentioned, this prioritization is often automatic; it can occur without our awareness.[13]

Successful use of awareness requires "metacognition," namely an understanding of how we think and how this informs our actions. More specifically, we require the ability

to monitor and regulate in real time what information we use to complete a task and which mental facilities are emphasized or de-emphasized. During medical emergencies, we are prone to rely on information that immediately comes to mind.[5,6] Accordingly, our experience bank is critically important and is mirrored by the assumption that we often do not rise to the occasion, but rather fall back on familiarity and training.[14] Metacongition also helps us understand the "expert" as someone with enough experience to recognize critical features. However, the expert combines their experience with enough dexterity to transition among responses that are rapid and routine and to leverage thinking that is both deliberative and individualized.[15,16]

A healthcare worker's awareness depends on the extent to which they recognize features of the current situation. In medicine we refer specifically to situational awareness. Endsley[7] proposed a three-step model based on how information is processed. Specifically, situational awareness is defined in terms of 1) our ability to identify relevant cues, 2) the way we synthesize these cues based on prior knowledge and 3) the extent to which we can predict future outcomes. Each of these levels requires the information gained from the preceding level. Understanding features of situational awareness should not only help us understand how we and our learners make contextual judgments, but also allow us to identify thinking that makes errors more or less likely.

Level One Situational Awareness: Recognition of Cues

The first level of situational awareness (Table 1) requires the detection and identification of relevant diagnostic cues.[7] These reflect the building blocks of understanding (e.g., chest pain, ST segment elevation and dyspnea are initial cues that raise the possibility that we may ultimately diagnose myocardial ischemia). However, more data do not necessarily mean more usable information. For any given situation, some features will be relevant (information) and other features might be irrelevant (noise).

The definition of expertise or competence includes assessing when the practitioner has learned which cues are most important and which can be relatively ignored. As outlined previously, this is also how prior experience allows for the rapid focus of our attention on relevant features, which in turn should facilitate more efficient decision-making.[14] Although it is difficult to teach awareness, by focusing the attention of trainees on those cues with the most relevance (i.e., "hard" signs or symptoms) we can mold their learning and responses. Considering the earlier example of chest pain, pain that radiates to the neck or arm would take precedence over pain that occurs only after movement or breathing.

However, there is an important drawback to this approach. Reliance on high-value cues alone can also lead to attentional blindness and fixation errors (e.g., when our attention is grabbed by some cues, to the exclusion of others). Clinically, this means we can overlook other relevant cues (e.g., a symptom that does not fit the classical description), causing the diagnosis to be missed.[17,18] Expressed another way, by looking "here" we can easily miss "there."

A classic demonstration of attentional blindness was presented by Chabris and Simons.[19] Participants were presented with a video of basketball players wearing either white or black T-shirts. The task required that participants count the number of passes between team members wearing white. Due to focus on the basketball players, most viewers missed an actor dressed in a black gorilla suit who walked across the screen for six seconds. More recently, Drew and colleagues[17] duplicated this finding by studying radiologists instructed to look for cancerous nodules. A matchbox-sized image of a gorilla was placed within one of the images, but radiologists were not informed of its presence. More than 80% did not see the gorilla during an average of six seconds of viewing time. In other words, the effects of fixation, or other distracting influences, can cause us to look without seeing (or hear without listening, or act without reflecting).[25-27]

There are other ways in which clinicians can be misguided and distracted and in which fixation errors can occur. These include certain features of patient histories,[20,21] the presence of previous diagnoses,[22,23] and initial diagnoses combined with contradictory or disconfirming evidence.[24] In other words, our assumptions and prior knowledge can result in blind spots when left unchallenged. This premature cognitive closure can result in failure to consider alternative diagnoses, to accept that we may be wrong, or to accept that patients may have more than one problem.

Level Two Situational Awareness:Synthesis of Cues

The second level of situational awareness (Table 1) requires synthesis.[7-12] Once we have identified relevant cues (level one situational awareness), we then use past experiences and prior knowledge to integrate these cues into a better understanding of the overall situation (level two situational awareness). In the medical context this typically means combining signs, symptoms and the results of laboratory investigations into a diagnosis, which in turn could be physiologic (e.g., pregnancy), pathophysiologic (e.g., myocardial infarction), a disease (i.e., a condition with a clear etiology, such as pneumonia), or a syndrome (i.e., a common cluster of signs and symptoms, such as acute respiratory distress syndrome).

In the psychological context, Klein's Recognition-primed Decision (RPD) Model[5,6] outlines that experts are more likely than non-experts to be able to combine all cues (complete recognition). Expressed another way, part of being an expert is performing quicker synthesis. In contrast, novices might recognize only some features (partial recognition). As outlined, this latter situation results in more time and effort required to piece the parts together. The novice might also be capable of identifying and remembering critical cues, but might not be able to fit them together.[1] As practitioners mature, they learn to bring together disparate cues into a recognizable whole.[7-12]

Even experts make mistakes. After all, given that level two (synthesis) builds on the products of level one (identification), false recognition of cues (level one) could result in misdiagnosis (level two). This is one reason why a targeted history and physical examination is still essential in acute care medicine. It is also why distractions

are so concerning. For example, stress, noise, fatigue and competing priorities can all result in both the misidentification of cues and the failure to access knowledge. This is why we teach expert teams to minimize distractions at critical junctures. It is also why many training sessions include noise in an attempt to show how easy it is to become distracted. Hopefully, these deliberately noisy training sessions also inoculate practitioners against the chaotic reality of acute care medicine. As previously noted, atypical presentations can also lead to errors (e.g., the diabetic patient without chest pain, or the immunocompromised patient without a fever). This is why experts learn both the rules and the exceptions, and this is why novices need to be exposed to more than one case.

Compounding the likelihood of error in identification and synthesis, acute care medicine commonly requires concurrent diagnosis and treatment (e.g., capturing the obstructed airway at the same time as stimulating the low blood pressure). This issue of concurrence versus sequential management is covered in detail in the decision-making chapter; however, in brief, the concomitant approach is somewhat at odds with the sequential approach taught in early medical training. Accordingly, it requires considerable attention and routine exposure.

Rather than the luxury of receiving one cue at a time, the demands of critical care often require practitioners to simultaneously recognize and integrate multiple cues. We are more likely to look for easy patterns (multiple cues that we convince ourselves fit together) than challenge ourselves one cue at a time. Accordingly, we have a tendency to favour a common and easily retrievable pattern from memory rather than the discipline that would be required to compare a myriad of less common options.[5,6]

The assumption that "common things are common" is supported by Occam's razor and, importantly, is often correct. However, given that "often correct" is not good enough, part of what defines competence is the willingness to put in the extra work. Easily recognizable patterns can also be wrong or incomplete, and the assumption these patterns are correct is associated with overconfidence and incomplete effort.[28-30] Premature diagnostic closure can mean we 1) miss dual diagnoses (e.g., the tension pneumothorax in a patient with asthma), 2) miss the over-arching diagnosis (e.g., Addison disease as the cause of shock and hyperkalaemia), or 3) make false assumptions because we fixate on a single cue and then misinterpret or "twist" other cues to fit what we fixed on (e.g., we assume low blood pressure is from myocardial infarction because we see electrocardiogram [ECG] changes, and we miss the septic shock). Accordingly, another aspect of what separates experts from novices is accepting that bias is ubiquitous and has the potential to afflict all practitioners, regardless of seniority.

Level Three Situational Awareness: Prediction

The third level of situation awareness (Table 1) builds on the previous two and requires that we predict future concerns. Following the detection of cues (level one), which prompt a diagnosis (level two), we now consider what is likely to happen next (level three). Consider the following clinical example. A patient presented with chest

pain, ECG changes and elevated troponin. We subsequently diagnosed myocardial ischemia. We now anticipate and plan accordingly. Next steps could include stabilizing the patient with aspirin and oxygen, transferring the patient before his condition worsens, or administering in situ thrombolysis. Obviously these decisions are contextual. Regardless of the particular intervention, being proactive rather than reactive is informed by this third level of situational awareness.[7-12,31] Consider an additional example. You receive a call from a rural site regarding a patient who is unresponsive following a head injury. Without seeing the patient and knowing no more than his vital signs or Glasgow Coma Scale score, you can make a reasonable prediction regarding whether he will need airway control. Even if the patient is not fully comatose, you might recommend his physician intubate now to protect him during a potentially perilous transport. Similarly, you can assume that the injured brain will swell further, necessitating hemodynamic intervention or surgical drainage. In either event, without any cerebral imaging, you have predicted the patient needs transfer to a facility where additional resources, experienced staff and advanced monitoring are available. The need for anticipation and preparation also dictates that the charge nurse is informed of their impending arrival.

Errors in prediction can result in either under- or over-cautious responses. What help separates experts from novices is the ability to predict, which is gained from both prior knowledge (e.g., "I have seen many of these cases; they all deteriorate.") and the ability to dynamically respond (e.g., "The situation is not as bad as we expected; hold that treatment for now."). The ability to predict also requires composure, which in turn means being able to retain awareness and measure despite stress and uncertainty.

Stress and Response Strategies

Situational factors can adversely affect situational awareness. Stress is commonly understood as a heightened state of physiological and psychological arousal.[25,31] Stress is often understood to be on a continuum, wherein low and high levels of arousal result in a lack of engagement or over-stimulation.[32,33] The understanding of stress has expanded to include the level of task engagement, distress and worry. Moreover, attaining an optimal level of arousal differs depending on experience. In the absence of experience, we are more likely to be over-stressed. As outlined, with greater experience we are more likely to anticipate (level three). This anticipation in turn reduces processing demands and lessens stress. The danger for the expert is that everything becomes routine to the point of tedium.

As mentioned, decision-making can benefit from stress. In the short term, adrenaline can increase our focus. However, this focus can result in greater fixation on certain situational cues and the relative neglect of others (i.e., tunnel vision). Over the longer term, adrenaline-fueled tachycardia is also associated with exhaustion and impaired decision-making,[31] Specifically, adrenaline-fueled tachycardia can result in task myopia, whereby one task, such as obtaining intravenous access, reduces our ability to consider

other options, such as intraosseous access. It can also result in task saturation, where an individual becomes overwhelmed by the task, or "winds down" near its end (e.g., the tendency to want to hand off care of the resuscitated patient, even in the face of new deterioration).[31] This is why, especially in complex environments, we need to develop techniques to divide tasks into manageable pieces. This division can be accomplished through task delegation and by mentally breaking the procedure down into manageable steps.[25]

We need to learn when to step back, both literally and figuratively.[15,16] While expertise means rapid detection of diagnostic cues, the expert also identifies which aspects are associated with greater uncertainty and risk. This reflects a shift from automatic responses to more controlled deliberation. This approach, typically credited to Moulton, is referred to as "slowing down when you should." This means stopping, or fine-tuning, at critical junctions of diagnosis and treatment. Accordingly, some emergency treatment algorithms even incorporate this into a "stop and think" or "go back and re-examine" phase.

Moulton and colleagues[34] observed that surgeons often "drift." In other words, they respond automatically when slowing down would be better. This increases the likelihood of proceeding with a singular plan no matter what. It means you have missed an opportunity to contemplate other cues. It also means you are unlikely to explore other diagnoses or engage other practitioners. We need to learn that acute care medicine is as much cerebral as procedural and that it can benefit greatly from the investment of metacognitive strategies and brief delays.[35,36] While individual action is often required, we should make time for deliberation and for ensuring that we are all "on the same page" and "on the same team."

Team Situational Awareness and Collective Competence

Resuscitation commonly requires the coordination of numerous team members.[1] This, in turn, means that we need to maximize the situational awareness in individuals, in sub-teams and in the team as a whole.[37] The extent to which a team can act together effectively can be understood as team cohesion,[38] which, in turn, is an essential feature of collective competence.[39] As each team member develops their own understanding, that understanding is shared with others. This can be understood as the team's horizontal cohesion. Team members should also ensure that the team leader is fully apprised of the situation. This is understood as vertical cohesion within a team.

While highly cohesive teams can be extremely effective, efficacy and definitive action also require leadership. Other chapters will focus on teamwork, leadership and communication. Regardless, an open and supportive leadership style wherein team members can communicate with their team leader is the typical goal in the complex acute care environment[40,41] because this structure can also augment the team's situational awareness. More specifically, the team leader synthesizes and integrates individual models, then communicates understanding while also encouraging members to speak

up. The goal is to provide the team with a shared mental model as well as the most widely applicable situational awareness. Consistent with the model of individual situational awareness, teamwork and team communication should include key findings (level one), the patient's current state (level two) and the likely trajectory (level three).

In order for team members to perform in a unified situation they must understand each other's strengths, weaknesses and awareness.[42,43] It is not reasonable to assume that all members share the same understanding, attention or awareness.[44] Each individual needs to not only hone their own situational awareness, but also appreciate that of others. Like a Venn diagram, individuals' situational awareness must overlap in relevant ways in order to function effectively together.[5-10] This is why during medical crises cues should not only be identified, but also explicitly declared.[45]

By declaring diagnostic concerns and therapeutic priorities to all team members we hopefully bolster everybody's ability to detect, understand and predict. Increased team situational awareness should help each member not only complete their individual task, but also assist others when complex resuscitation forces them to break off (e.g., anticipating the need for additional equipment or resources). Situational awareness is not only potentially life-saving, it is also everybody's business.

Summary

Understanding attention and awareness in acute medical care means dissecting how we recognize cues, achieve meaning and make predictions. The process of converting patient peril into patient safety is complex, nuanced and individual. Regardless, situational awareness is a key attribute for both individuals and teams in virtually all acute care crises. It requires everybody's discipline and humility to minimize cognitive overload, premature closure and bias. Optimal situational awareness means that we are more likely to strike the right balance between expeditious rescue and prudent deliberation.

Without deliberate strategies, a momentary loss of situational awareness can spiral into a runaway crisis. Fortunately, critical reflection can turn a vicious cycle into a virtuous cycle. Metacognition means being aware of how we think and of how our thinking affects our actions. This understanding also highlights why expertise requires a career-long commitment and volume-based competence. Our patients deserve practitioners who undergo regular practice and debriefing and who are open to internal reflection and external criticism. Awareness, attention and the discipline they require are at least as important as traditional medical "cleverness."

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Decision Making in Acute Care Medicine

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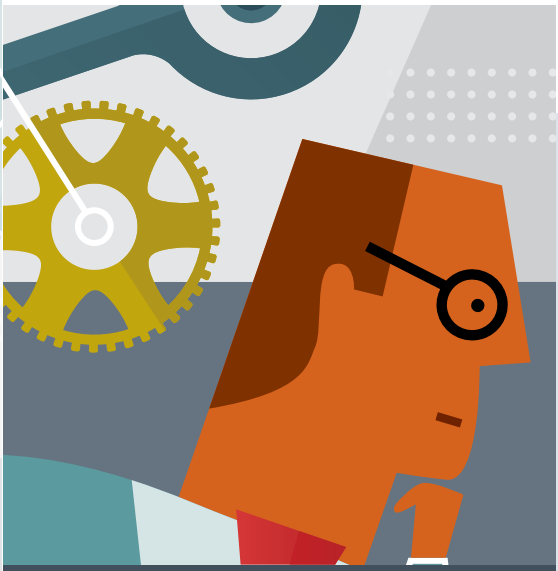

"All Life is Problem Solving."

Sir Karl Popper

Introduction

Decision-making is fundamental to the provision of effective medical care. Early in training, health care practitioners (HCPs) are taught a linear, analytical approach to decision-making that works well for the majority of stable patients. This follows an ordered structure: obtaining a patient's history, performing a physical examination, developing a differential diagnosis, ordering investigations and, finally, instituting therapy. For stable patients, this approach maximizes information-gathering and provides time for contemplation. In contrast, during medical crises this strategy is impractical and potentially dangerous. This is especially true if we postpone urgent resuscitation. Accordingly, the provision of emergency care can be challenging for HCPs and perilous for patients.

The goal of this chapter is to allow HCPs to better understand their own decision-making habits and how those habits impact crisis resource management (CRM) in everyday clinical practice. Moreover, in understanding our own decision-making processes we as HCPs may become better able to pass on successful techniques to the next generation of decision-makers.

During a medical crisis, the goal is to maximize patient stability and minimize delays. Diagnosis and therapy should occur concurrently, often at the

expense of diagnostic precision. Data-gathering focuses more on what is immediately available (i.e., vital signs and point-of-care analysis) and less on waiting for diagnostic tests (computed tomography [CT] scans, laboratory results). Similarly, consultations are limited to specific interventions (e.g., intubation, surgery, help with resuscitation) rather than diagnostic opinions. To manage the patient in peril, the team needs to rapidly convert available data (e.g., an increasing heart rate) into usable information (e.g., the patient's condition is worsening) and follow with a logical, expedited response (e.g., bolus fluids). The art of acute care medicine is ensuring that while we do not intervene without sufficient thought, we do not allow uncertainty to cause potentially harmful delays.

As outlined, the concurrent approach used during crises downplays the need to establish an immediate etiologic diagnosis (e.g., streptococcal septicemia). Instead, we often redefine uncertainty by providing broader temporary physiologic or pathophysiologic diagnoses (e.g., hypotension or septic shock). Missing diagnostic details and treatment gaps are filled in later when the medical crisis has abated and when traditional sequential decision-making strategies can be safely used again. The concurrent approach increases the chance that the physician-leader and medical team can stay ahead of a rapidly evolving situation and can simultaneously manage competing priorities.

Beyond the challenges of time-sensitive decision-making, the effective physician-leader must also maximize the effectiveness of the whole team, regardless of high stimulus density and high clinical stakes.[1] This can be done by using well-established CRM principles. These CRM skills are reviewed elsewhere, but include leadership and followership, situational awareness, communication skills, resource utilization and teamwork. Specifically, in this chapter we focus on the theory and practice of effective decision-making as well as the effect that experience, cognitive load and working memory have on decision-making.

The Fundamentals of Medical Decision-making

Although decision-making in one form or another is important for all HCPs, it is central to clinical doctors, who make the majority of high-stakes decisions. Despite its importance, decision-making is rarely deliberately addressed in traditional medical curricula. Instead, doctors typically gain most of their experience on the job during clinical work. With experience, most eventually become capable decision-makers; however, the process of decision-making — and deliberate strategies to optimize that process — are often not fully appreciated by the decision-makers themselves.[2-4] In other words, clinicians often become unconsciously competent decision-makers.

Over a career, medical decision-makers should commit to honing their intuition and clinical reflexes. However, it may be difficult for HCPs to articulate how or why they make particular decisions.[2] For example, an experienced physician can quickly identify the deteriorating asthma patient, decide to intubate and begin appropriate therapy. When asked later what made them intervene so quickly, answers might include

"the patient was fatiguing," or "if I hadn't, then the patient was going to arrest." Though true, these judgments are intuitive (or intrinsically tacit) and difficult to relate to for novices. This often makes decision-making difficult to teach.

Understanding decision-making during crises involves addressing the limits of human working memory. We can reliably manage only a finite number of discrete elements of information (approximately seven), and an even smaller number when information-processing is required.[3,4] For example, for the novice who is managing a patient with congestive heart failure (CHF), these information elements may be as basic as "hypoxemia," "hypertension," "crackles," "volume overload," "diuretic" and "positive-pressure ventilation." These six items approach the novice's working memory capacity. In contrast, for the expert, multiple elements can be integrated into information units or chunks (e.g., "CHF presentation" and "CHF management"). This leaves a larger proportion of working memory available for other tasks. Figure 1 summarizes this important concept.

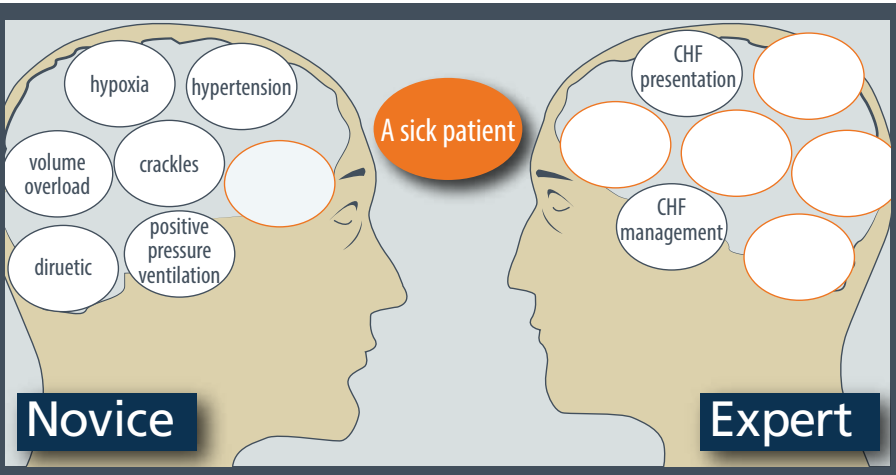

Figure 1: Working Memory Use in Novices and Experts when Encountering a Clinical Situation

Educating decision-makers in the art of subconsciously grouping symptoms may facilitate their ability to efficiently recognize the "sick" patient. Of note, the ability to simply recognize a sick patient is every bit as important as acquiring knowledge or mastering manual skills. Accordingly, this subconscious group of symptoms should be central to what is taught to learners during their acute care education.

Models of Decision-making

Decision-making (also called problem-solving in some CRM models) is a complex topic. However, it has been summarized using theoretical models from several professional domains. Two of these models, Gary Klein's Recognition-primed Decision (RPD) Model[5] and Daniel Kahneman's Dual Process Model (DPM),[6] provide a foundational understanding of the cognitive processes used by experts.

Recognition-primed Decision-making Model (RPD)

The RPD model[3] helps explain how successful decision-making can occur in complex, ever-changing, medical environments despite the constraints of human working memory. As outlined, most experienced doctors, when faced with a crisis, do not consciously compare a multitude of options prior to acting. They recognize a clinical situation as typical, which immediately brings to mind a set of expectations, suitable goals and typical courses of action. For example, an experienced physician managing an intubated trauma patient with hypotension and hypoxemia might expedite a lung ultrasound, be confident enough that the patient has a pneumothorax and rapidly decompress the chest. This occurs rapidly not because that physician possesses special knowledge, but rather because he/she is "attuned." In other words, the physician accepts the possibility of tension pneumothorax in all patients with chest trauma and understands the danger of undertreating (more so than over-treating) this diagnosis. The experienced clinician also pattern-recognizes the association between tension pneumothorax, positive-pressure ventilation, hypoxemia and hypotension.

Understanding how, why and what we decide helps to define what makes an effective acute care doctor. Accordingly, they can usually focus quickly on high-yield diagnostic clues (often called "hard signs" or "red flags"), rapidly confirm/refute suspicions, address key dangers, act expeditiously and avoid wasting cognitive resources on extraneous details.[7] Moreover, they are able to recognize when their initial course of action is flawed and modify their response because they are cognitively dexterous and sufficiently confident. If the plan cannot be easily modified, then the next most plausible course of action is rapidly pursued. This process is then repeated until an acceptable way forward is found.[8] This sequence of steps forms the basis for the RPD model. Once again, it is in contrast to the traditional analytical approach of linear information-gathering and exhaustive hypothesis generation.

The recognition displayed by the expert physician is analogous to intuition and is central to RPD. A junior doctor may not immediately recognize the previously described cluster of signs and symptoms as a tension pneumothorax. As a result, the novice's decision-making is more analytical and, hence, time-consuming. Despite every good intention, patients can suffer the consequences of delayed decision-making in time-sensitive situations.

Dual-process Model (DPM)

An alternative to the RPD model is the DPM described by Daniel Kahneman. This model conceptualizes thinking and decision-making into System I and System II. System I is involved in intuitive judgments that are fast and automatic. These judgments are relatively effortless and lack a sense of voluntary control.[9] For example, the experienced clinician who enters a ward and declares within seconds that a patient is "sick" or "not sick" is using System I. These are familiar situations and therefore the physician recognizes a pattern. As such, adept decision-making requires a learner who commits to repeated and regular exposure.

System II is slower and more logical. It is activated when a situation is unfamiliar and therefore deviates from a System I construct. System II replaces fast and relatively effortless intuition with concerted logical reasoning.[9] For example, the patient with resistant hypotension eventually found to have adrenal insufficiency is likely to have induced a physician's System II processing. The ability to step back from a crisis and use System II reasoning during the stress of resuscitation is another hallmark of the experienced and effective HCP. Again, this requires regular and repeated exposure — but this behavior can be taught and encouraged. For example, when teaching novices how to make decisions, it is often stressed that it is a dynamic/empiric process: if intuition fails, go back to a more structured approach (e.g., if a patient deteriorates or fails to respond and the problem is not easily identified, go back to "ABC").

Complementary models

The DPM is supported by psychological literature regarding cognitive errors and biases, whereas the RPD model is supported by expert intuition and decision-making theory. However, these approaches overlap and are better thought of as complementary rather than oppositional. For example, the intuition that informs the RPD model is similar to System I processing within the DPM. Recognition (i.e., intuition, or System I processing) is relatively accurate in experts' hands, but potentially problematic for novices. The danger of inexperience in the novice or fatigue in the expert is that both could oversimplify (or morph) complex medical problems in order to fit a pattern learned from previous (different) encounters. This cognitive bias is referred to as the simplifying heuristic.[7]

In Situ Decision-makingRecognition, Expertise and Cognitive Load

Recognition is key to clinical decision-making. What is less clear is how HCPs develop expertise in recognition. Research suggests that the practice environment needs to provide sufficient valid cues as well as the opportunity to identify such cues.[7] Accordingly, chaos, distraction and unhelpful team-mates can affect the likelihood of timely

recognition. Also, as previously outlined, for HCPs to become skilled in resuscitation medicine and to make effective decisions during crises, they need to have sufficient exposure and experience. This can be gained through clinical encounters or well-crafted medical simulations. Alternatively, we need to accept that clinical competence might never be gained. Regardless, it is unfair and illogical to expect HCPs rarely exposed to crisis decision-making to perform at a high level when disaster finally strikes.

Experiments based around operating room emergencies and cases managed by anesthesiology residents suggest that physicians at the resident level exhibit one of four problem-solving approaches.[10] Residents who are "stalled" find it difficult to generate diagnostic possibilities or coordinate their responses. Others are "fixated" and quickly generate a plausible but incorrect diagnosis and have trouble deviating despite alternate cues (so-called "premature closure"). "Diagnostic vagabonds" produce a large number of possibilities but fail to rule them in or out. The "adaptive" group is the most effective. These residents generate a number of plausible diagnoses, rule certain ones out and respond appropriately.

As HCPs gain experience they should become more likely to recognize immediate threats and, therefore, more likely to rapidly intervene. They are also likely to become more comfortable thinking and reacting despite diagnostic uncertainty. In other words, how HCPs process clinical information and make decisions should naturally mature over time. Moreover, the way in which a practitioner solves problems is a prime way by which we can determine whether they are "fit for task," or in need of further intervention.[11]

HCPs will mature (or fail to mature) at different rates. The beneficial effect of learning through experience is that it should decrease cognitive load and thereby free up both working memory and higher-level thinking. In contrast,

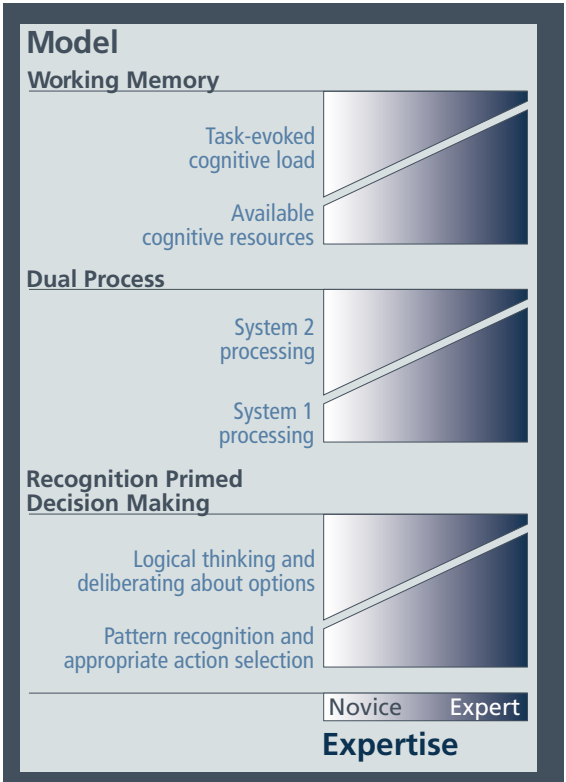

Figure 2: Decision-Making Model, Methods and Relationship to Expertise.

inexperienced acute care HCPs facing challenging medical crises may be too cognitively overloaded to recognize or respond. This results in an inability to consider alternate approaches, clinical exceptions, rare diagnoses, or pre-emptive interventions. It also results in novices being unable to stop and think, unable to perform dexterous procedures and unable to leverage CRM skills, such as communication and leadership (Figure 2). In short, critical decision-making is not innate and therefore should not be left to chance.

Teaching Decision-making

If we accept that experienced physicians, bolstered by regular clinical exposure, are effective crisis decision-makers, then it makes sense to teach the RPD model. Accordingly, Cohen and Freeman[12] have used this model to address critical thinking using clinical cases. In order for teaching to be realistic, clinical information should be presented in an unpredictable sequence (also known as random practice schedule). This method not only mirrors acute care, but also forces learners to critically compare and contrast new data with whatever came before.[13] For novices, it might be necessary to simplify the cases and provide guidance (or cognitive nudges) that help them recognize what is most relevant and what is most distracting.[14]

During instruction, learners should focus on four beneficial activities: creating a story (where all existing evidence is incorporated and explained, and where reasonable assumptions are made despite uncertainty); testing a story (where inconsistencies and uncertainties are identified and the story refined through deliberate testing); evaluating a story (where plausibility is questioned by playing the devil's advocate); and quick testing (where the time available and the consequences of actions are predetermined, thereby encouraging more immediate action if delays are unacceptable).[15]

Effective instruction in critical decision-making requires a pre-brief to describe a cognitive-strategy that can steer the decision-making process. It also requires a skilled facilitator who can prompt the learner to self-reflect on his/her developing strategy, with the collegial goal that it be further refined. Prompts should help learners prevent mistakes, challenge their biases and ensure they remain open to other explanations. When learning situations are presented in an unpredictable sequence, the use of retrospective prompts (e.g., were there any similarities between the last two situations?) are more effective than proactive prompts (e.g., are there any similarities between the following two situations?). The combination of random practice schedule and retrospective prompts increases the likelihood that skills are transferred from one situation to the next.[15] In this way, education around decision-making can benefit both practitioners and patients.

Summary

For those responsible for treating acutely ill patients, effective decision-making is a complex, but essential skill. It can take a career to truly master expert decision-making

and should not be left to chance. Despite a substantial body of knowledge about decision-making in non-medical domains, it is rarely taught or coached in medical training programs. Fortunately, there is emerging evidence surrounding decision-making that can be readily adapted to acute care medicine.

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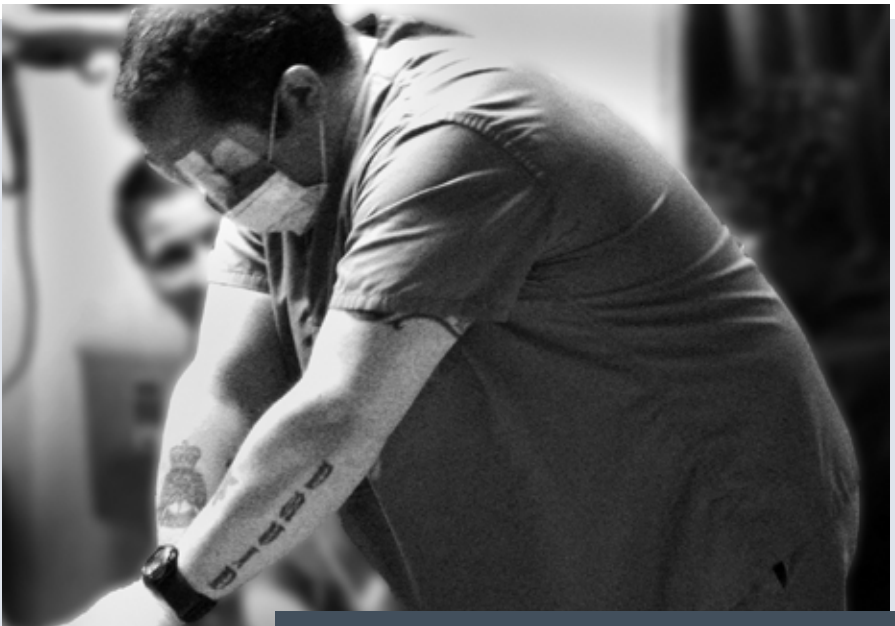

Photo: ©Dr. Robert Arntfeld,
Subject: Ken Parker

This picture is for reflection. How is this healthcare worker feeling: energized or exhausted,terrified or excited? If this was you, would you know when and how to ask for help or relief? Would you be lost in this individual pursuit from everything else or open to engagingwith the team? Would you be able to lead, would you be prepared to follow?

Verbal Communication in Acute Care Medicine

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"The single biggest problem in communication is the illusion that it has taken place."

George Bernard Shaw

Introduction

Communication Is a Core Medical Skill

Communication is increasingly being recognized as central to the delivery of high-quality acute medical care.[1-4] "Good communication" is a recurring feature when clinical care goes well, and "bad communication" is a common suspect when clinical care goes wrong. Therefore, like other high-risk sectors, such as aviation, nuclear engineering and the military, many medical specialties have embraced the need to provide practical training and regular practice.[5-8] The goal is for all practitioners to possess sufficient communication competence to manage daily medical challenges.

If we compare communication to a drug, as a metaphorical illustration, it would be understood to be one of our most potent "therapies." Similarly, like a drug, communication is neither one-size-fits-all, nor a panacea. It should be used in the right "dosage" at the right time and should be tailored to the needs of the particular situation. It can function as a "placebo" (i.e., good communication makes things better) or as a "nocebo" (i.e., bad communication makes things worse).[2,3] Better communication might also decrease risk of litigation and maintain hospital reputation. In sum, communication is everybody's core business; it should be taught

to trainees, expected from practitioners and supported by administration.[2-4]

Along with a growing understanding of the importance of communication, there is growing acceptance of the need to support and disseminate the theory and practice of acute medical communication.[2-4] This chapter will outline both scientific models and practical applications of communication theory. In addition to the traditional focus on the sender–message–receiver model, this chapter will explore communication from three additional dimensions: as social relations, as negotiation among perspectives and as networks of human and nonhuman elements. This chapter will also emphasize that these theoretical insights can extend beyond the conventional focus of the acute medical crisis. Lessons learned can also be applied to more common, ongoing communication challenges, such as the dynamics of changing team memberships, evolving patient statuses and increasing shared decision-making. This chapter draws on a broad array of disciplines. Our goal is to treat communication with the respect that it deserves, while avoiding clichés and platitudes. More specifically, we hope to disseminate practical strategies while expanding the understanding of communication beyond the models that have dominated to date.

Communication is More Than Just What is Said

Good communication is more than just talking. It acts like a key therapy that improves (or impairs) task execution, bolsters (or stalls) information exchange and helps (or hinders) relationship-building.[2-4] Communication operates as more than just what is said; it includes how something is said and how it is understood.[2]

Given these insights, nonverbal communication (which includes posture, facial expressions, gestures and eye contact) and para-verbal communication (which includes pacing, tone, volume and emphasis) are at least as important as verbal communication.[2,3] Consider the following thought experiment involving times when there is incongruence between the words used and the facial expression or the tone.[2-4] If a colleague says to us, "I don't need your help" in a tone that suggests otherwise, we are likely to downplay the verbal in favour of the nonverbal. Alternatively, we might base our response on prior interactions we have had with the speaker (e.g., "Sue never wants help from anyone…no matter what she says"). In both cases, we would likely endeavour to help our colleague, but at what cost? At best, incongruence can increase misinterpretation; at worst, it erodes teamwork.[2-4] Our interpretation of our colleague's position involves interceding in their decision-making, however minor, potentially causing negativity, anger, resentment, or a breakdown in collegiality. As such, we need to "say what we mean and mean what we say."

In addition, practitioners should understand that "not communicating" is not really possible; failing to say anything can also send its own unintended message. Silence, for example, can be misinterpreted as agreement or disagreement, support or disinterest, cooperation or contempt.[9] The safety literature has tended to treat silence as problematic and to encourage – indeed, to obligate – all team members to speak up, and to do

so clearly, regardless of rank.[5] This is appropriate given that disasters in both the medical and aviation world have been associated with excessive deference and timidity. However, just as commercial pilots emphasize the need to control communication when the plane is below 10,000 feet, clinical resuscitators should ensure that verbal communication is limited to that which is focused and goal-directed.

On some occasions — for example, when a team member needs to think or perform a complex procedure — temporary silence is exactly what is required. As such, we must also recognize that the relationship between focused talking and active listening is nuanced and fluid. Moreover, an understanding of when people should speak up and when they should listen becomes even more complex if we acknowledge the influence of power imbalance, hierarchy and past experience. As a result, these considerations are relevant not just to physicians, but also to all members of the medical team and to patients/surrogates.[10] For these reasons we delve into the practice and theory that underpins medical communication.

Theoretical Approaches to Communication

As outlined, the science and practice of communication is complex, and communications scholars have formulated four dominant communication approaches: a mechanistic approach, a rhetorical approach, a systems approach and a sociomaterial approach. Particular affordances and constraints are considered for each, and practical examples and tips are given.

A Mechanistic Approach to Communication

A mechanistic approach describes communication by breaking into three component parts: sender, message and receiver. An example is Shannon and Weaver's communication model, which was derived from telecommunications and has been applied previously to medical communication.[2] In their model, transmitters (i.e., speakers) encode messages, and receivers (i.e., listeners) decode them (Figure 1). Challenges to communication highlighted by this model include "interference on the transmission channel" and "channel overload" caused by overly complicated messages. To avoid overload, which can result in indecision, the receiver must be able to decode the message into usable information. For example, in the acute care clinical realm, a skilled practitioner will receive "data" (e.g., "his saturation is dropping

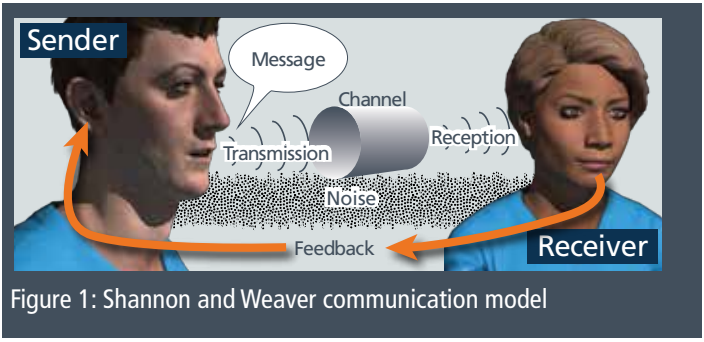

Figure 1: Shannon and Weaver communication model

despite bag-mask ventilation [BMV]"), but will be able to convert it into "information" (e.g., "we need a different approach: add a PEEP valve; try two-handed BMV; prepare for intubation").[2]

Such mechanistic approaches, like the Shannon and Weaver model, draw attention to individual parts of a communication event. Thus, they can be valuable when we consider roles and responsibilities in acute care communications. For example, the SBAR (situation–background–assessment–recommendation) model considers common sources of noise or interference and encourages practices that strengthen the encoding and decoding of messages.[2-4] SBAR emphasizes that acute care communicators must clearly understand that an essential part of their role is to be both heard and understood; if not, then they should reframe what they are trying to say. Similarly, for professionals working as acute care collaborators, it is essential to ensure a clear understanding of a given message and to request clarification as required.

As useful as these insights are, mechanistic approaches are insufficient to tackle the full gamut of acute medical care communication. First, the emphasis on "parts" (transmitter, receiver) rather than on the "connections between parts" means that mechanistic approaches do not fully account for relational factors, such as interdisciplinary hierarchy.[2-4] Second, the characterization of communication as linear and unidirectional (from transmitter to receiver) oversimplifies the multi-directionality of clinical communication, especially within resuscitation teams or in chaotic clinical situations. The mechanistic approach also focuses on "data" and "information" as the encoded and decoded message, respectively, but does not address the role of meaning. Acute care professionals do not passively compute data and information, they derive meaning from them. Importantly, this is why team members cannot assume that co-workers share their conclusions about a patient's condition or the clinical priorities for the day.[2]

Notwithstanding these limitations, the mechanistic approach offers useful clinical tips. For example, we should pay attention to situational factors that may produce channel interference. This includes the noise level in the resuscitation bay, or the loss of nonverbal cues when team members are wearing surgical masks. It also highlights "transmitter oriented" communication, where it is the speaker's responsibility to be understood, rather than "receiver oriented" communication, where it is the listener's responsibility to unravel what was meant.[2,5]

The mechanistic approach highlights the benefits from implementing mechanisms that encourage accurate message transmission, such as the "Cs of communication": cite names (to avoid diffusion of responsibility), be clear and concise (to avoid confusion) and close the loop (to confirm that it has been done).[2-4,8] This last strategy (closed-loop communication) explicitly introduces a feedback loop into the mechanics of communication. Examples include telling a specific resident to intubate and to report back when it is done (or to report the end-tidal CO_2), or asking a specific nurse to increase to 100% oxygen and to call out the saturation every minute. In other words, there are many ways to close the loop, but as a strategy it confirms that the instruction was heard, understood and performed.

Communication guides or mnemonics can also provide structure and reliability to complex communication. Table 1 summarizes five popular guides for medical communication.

Table 1: Five popular guides for medical communication

Guide	Strategy	
Calgary-Cambridge Guide	1. Initiate 2. Gather information 3. Provide structure	4. Build relationships 5. Explain and plan 6. Close the session
GREAT	1. Greetings/goals 2. Rapport 3. Evaluation/ expectation/ examination/ explanation	4. Ask/answer acknowledge 5. Tacit agreement/thanks
LAURS	1. Listening 2. Acceptance 3. Utilization(of appropriate words)	4. Reframing and 5. Suggestion
VALUE	1. Value statements from family 2. Acknowledge emotions 3. Listen	4. Understand the patient as a person 5. Elicit questions
SPIKES	1. Settings 2. Patient perception 3. Invite to share	4. Knowledge transmission 5. Emotions and empathy 6. Summarize and strategize

While such systems are helpful, they should be considered strategies, not recipes; users should guard against automating their communications to the point where nuance or dialogue is suppressed.

A Rhetorical Approach to Communication

Whereas acute care medicine previously focused on scientific discovery and technological advance, medicine can be increasingly understood as a complex social system.[2,9,11] The rhetorical approach to communication is based on the premise that rhetoric, the art of persuasion, underpins all communication. Communication is social and therefore takes place in the context of relationships between individuals whose goals, perspectives and values are partly shared and partly opposed. Communication, according to the rhetorical model, involves a speaker who aims to persuade an audience to join a temporary or permanent space of shared goals, perspectives and values. For example, in an acute clinical scenario an anesthesiologist may try to persuade team members to prioritize intubation over other aspects of resuscitation. If the team members disagree, a rhetorical approach would argue that the anesthesiologist's failure to persuade the team resides not only in the manner of delivery, but also in the ability to frame communication around the competing goals, perspectives and values of the team.

A rhetorical model characterizes communication as having not only the transmitter–message–receiver components seen in the mechanistic model (though usually called speaker–content–audience in a rhetorical model; Figure 2), but also having two additional key components: purpose and context.[11] Messages are not constructed neutrally; they are constructed to achieve a purpose in a social context. In a rhetorical approach, it is the relationships between these parts that determine the effectiveness of the communication.

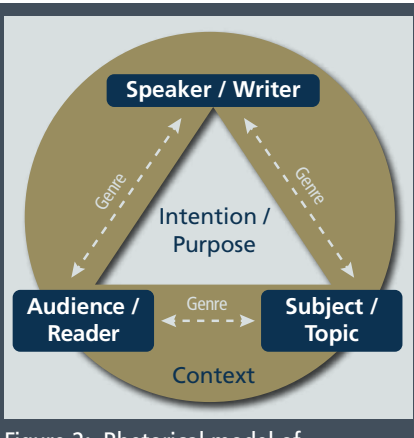

Figure 2: Rhetorical model of communication

Whereas a mechanistic approach works helps us understand how to give and take orders during an acute medical crisis, the rhetorical approach is well suited to help us grapple with more socially complex communication. For example, after a particular hemodynamic or airway crisis has abated, other priorities arise. For example, there is now the need to establish what would be an acceptable quality of life, or when it might be better to de-emphasize life support in order to focus on patient comfort and family visitation. A rhetorical approach highlights how communication could be impacted by the competing purposes of the acute care

team, the patient and various family members in such nuanced and evolving clinical situations.

A rhetorical approach to communication also considers the role of genres —standardized and sanctioned forms of communication. Genres are recognizable responses that are familiar and acceptable to a community. Genres can be powerful communication tools, because they carry social meaning relevant to the context, over and above the content itself. For instance, SBAR is a genre that originated in military and aviation contexts, but has been adopted into healthcare.[3,4,12] The goal is to organize exchanges such that one team member can quickly orient another to a clinical situation for the purpose of obtaining their assistance.

If SBAR is clinically recognized and sanctioned, then its use is more likely to help new or junior team members achieve their communicative purpose, especially when compared to a nonsanctioned genre.[13] Consider the following SBAR example:

Situation: "This is Dr. X, I need your help now."

Background: "I cannot oxygenate or ventilate this patient."

Assessment: "We have a failed airway."

Recommendation: "Bring me the surgical airway kit."

The content is important, of course, but as soon as the audience recognizes the SBAR genre, they can start to infer the speaker's communicative purpose and even predict what they might need from others.

A rhetorical approach reminds us, though, that genres are neither permanent nor neutral. They are dynamic, socially constructed and sometimes fiercely disputed. Efforts to introduce new genres, such as a surgical checklist, may meet with stubborn resistance or yield mixed results that are difficult to interpret.[10] This may not be based on concerns with the content, but rather the social purposes (e.g., suspicion that administration is dictating, standardizing, or regimenting that clinicians communicate a particular way within their teams). Thus, a rhetorical approach acknowledges the power of genres to contain ideas and to shape ideas as well as the practices that follow. To teach genres, therefore, is to shape what practitioners think and do, and therefore their relations, not just the words they use.

The P.A.C.E. (probing–alerting–challenging–emergency communication) model

offers an instance of using generic structure to reshape traditional social relations. This model progresses from probing to alerting to challenging to emergency communication (i.e., from least to most direct). Without this structure, junior team members may only hint (e.g., "Perhaps it's time to try a different approach."), whereas senior team members may unnecessarily favour blunt commands (e.g., "I'm taking over now.").[14]

The P.A.C.E. genre is an attempt to engineer the content of communication, from tentative to directive. It is also an attempt to engineer conventional social relations that could threaten safe communication during crises.

A Systems Approach to Communication

Systems engineering is an interdisciplinary approach concerned with customer needs and concept development. In a broader sense, while "hard systems engineering helps us identify the technical solutions to customer needs, soft systems engineering (SSE) attends to understanding what those needs are and how they relate as multiple people interact. In SSE, the relations between participants in a given situation are referred to as interactions, and the vantage points assumed by participants are referred to as perspectives.[15-17] Accordingly, because there are different interactions and perspectives, there are also different understandings, viewpoints and priorities (Figure 3).[13,18] While differences are to be expected, these differences are also complementary and supplementary. The SSE approach to dealing with communication is called "design as a dialogue." During acute crises this approach helps us understand the need for strategies related to negotiating roles and boundaries.

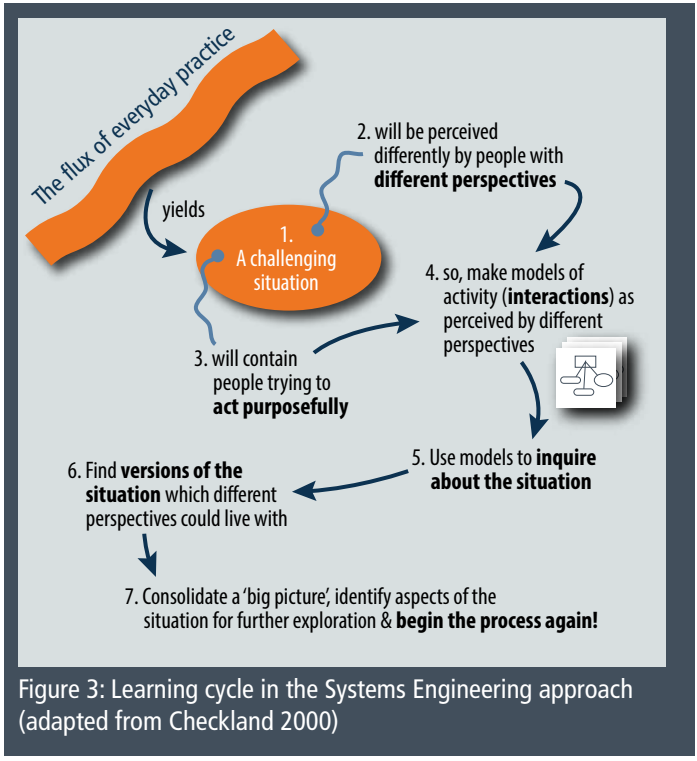

Figure 3: Learning cycle in the Systems Engineering approach (adapted from Checkland 2000)

Applying a clinical example, such as cardiac arrest, allows us to understand that the success or failure of communication depends on integrating many perspectives. These might include the nurses' perspectives about how to ensure constant and effective chest compressions,

the anesthesiology resident's perspective about how to perform intubation while chest compressions are still underway, the intensive care unit (ICU) resident's perspective on the need to establish central venous access while others are crowding the bed, or the attending physician's perspective on the need to transfer the patient expeditiously.

We might interpret differing perspectives Just as merely a set of individual problems. In fact, the interactions among multiple perspectives will collectively shape and reshape the communication that takes place within the team. In theory, the patient benefits if the different perspectives result simultaneously in complementary resuscitation. Alternatively, the patient suffers if those different perspectives result in interpersonal squabbles or the inability to empathize with others' concerns.

Regarding acute care medical communication, the SSE approach is most useful for the purpose of coordinating activities and achieving a shared mental model. While SSE does not prescribe a specific communication method, there are strategies that exemplify SSE principles. For instance, the "call out" strategy[2-4,19] may be used to allow team members to voice changes as the situation evolves (e.g., "He's now desaturating."). Similarly, the "step back method" may assist team members in creating "time-outs" to confirm that the multiple perspectives continue to converge regarding the current diagnosis or how the priorities have evolved. This approach compels the team to reassess assumptions (e.g., "Are we sure the endotracheal tube passed through the cords?").

The "repeat back method" [2-4,20] may help confirm mutual understanding amongst the multiple perspectives (e.g., "So, is our next attempt to rescue this airway with an extraglottic airway or surgical airway?"). It may also allow team members to ensure that interactions that are about to occur are properly understood by others before processing (e.g., "Okay, so first you want the difficult airway kit in the room, then you want the video laryngoscope in your left hand.").

The focus on interactions and perspectives also makes SSE useful for understanding critical care communication in less acute but no less important situations and whenever the individual and the system intersect. This approach emphasizes that decision-making requires more than just data transmission. Patients are validated as people with their own perspectives and values (not just diseases) and as part of a complex "life support system" that includes family, friends and even the larger community.[20,21]

A Sociomaterial Approach to Communication

The sociomaterial approach to communication (Figure 4) draws attention to the fact that communication does not just happen among humans; other objects also play a role.

For example, the Internet is a piece of technology that facilitates, but also shapes, the human practice of seeking help from others. In a similar vein, during resuscitation, our machines, lines and tubes also influence how we communicate. This means that to understand how medical teams communicate we need to understand not only the peo-

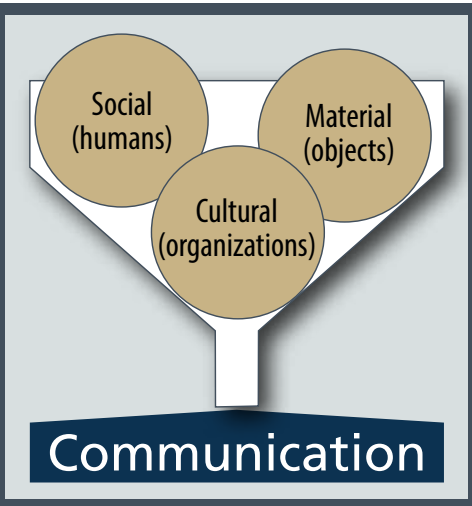

Figure 4: Sociomaterial Approach to Communication

ple, but also the objects we use to do our work.[22] An example in medicine is the electronic medical record (EMR) — an object that radically changes (either hindering or helping, depending on your point of view) the communication among medical team members.

While the EMR facilitates exchange of information among healthcare providers, it can impose challenges when different team members value the information and its quality differently. This in turn can make it difficult to agree on how to prioritize information. Recognizing and understanding the influence of objects/technology on how team members interact could then be used to adjust communication behaviours. A partial solution is to better appreciate that the EMR should supplement but not replace face-to-face or phone conversations among providers.

Modern medicine has seen an explosion of standardized order sets and computer entry. When used appropriately, these approaches can mitigate cognitive overload, inattention, bias and unpredictability. However, over-reliance on technology and checklists can mean that the patient no longer receives the same amount of face-to-face attention and verbal communication or the same sense of human connection. Checking boxes and clicking icons may suggest that we are delivering comprehensive cutting-edge care. Unfortunately it can also become a justification for not putting as much energy into providing individualized and empathetic care.

Over-reliance on technological answers means we might be tempted to avoid emotionally draining conversations about what is right and wrong rather than what is technologically possible. We must be wary of creating a system where it is easier to "nurse" the computer rather than the patient and where it is easier to communicate with a screen rather than with a human being in need.

Summary

Communication is likely the most important nontechnical skill in medicine. This is especially true in acute care medicine, where teamwork among diverse groups of health professionals and patients/families is required and where teamwork mandates communication. Given its importance, "verbal dexterity" should not be assumed to be innate, nor should it be left to chance. To date, discussions of acute care communication have

tended to focus on acute events (e.g., resuscitations), but this focus is unnecessarily narrow. Equally and perhaps more challenging are communications that might extend over days and require negotiation among competing purposes and include diverse opinions.

The four communications approaches discussed in this chapter — mechanistic, rhetorical, systems and sociomaterial — draw attention to different aspects of communication. The mechanistic approach offers a means to focus on three individual components (sender, message, receiver), the rhetorical approach emphasizes social relations, the SSE considers negotiation among perspectives and the sociomaterial considers material elements often overlooked in human-centric considerations of communication. Each approach is insufficient in isolation, but taken together they help explain the complexity of healthcare communication and offer practical insights.

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Task Management in Acute Care Medicine

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Reviewer: John Kim

"Never tell people how to do things. Tell them what to do and they will surprise you with thier ingenuity."

George S. Patton

Introduction

Being able to complete tasks and leverage resources is central to productivity, no matter the field of endeavour. Therefore, it should be no surprise that these skills are also key to the practice of acute care medicine and to the pursuit of patient rescue. Accordingly, the topics of "task management" and/or "coordination" are often (though not always) included in any crisis resource management (CRM) curriculum.

However, these topics are also the most infrequently researched among the CRM concepts covered in this book. Therefore, although it is relatively easy to convince healthcare professionals that task management and coordination matter, it is a bigger challenge to produce a practical primer. We start with definitions and a basic framework. We then strive to move from the theoretical to the practical. As with each of our chapters, the goal is simple but profound: to save lives and strengthen teams.

Terminology

Task management can be broadly defined as "managing resources and organizing tasks to achieve goals."[1] A basic understanding begins by appreciating that task management often works via dynamic feedback loops at both the individual and team levels (Figure 1). Expressed another way, this means that

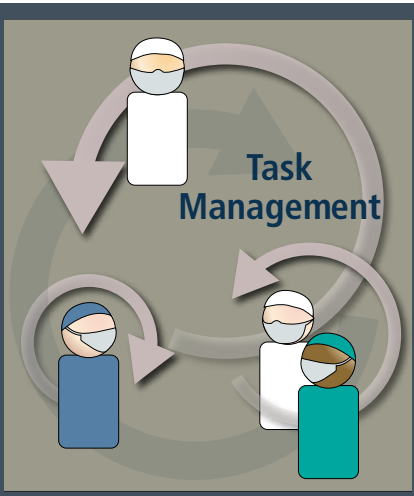

Figure 1: Task management is a dynamic feedback loop and functions on the individual and team level.

outputs affect inputs and vice versa. This is why acute care medicine can easily suffer from vicious cycles (bad information can result in bad decision after bad decision), or why teams that are highly drilled and highly skilled can rescue patients using virtuous cycles (good coordination leads to one good action after another). Some medical tasks (e.g., taking a history, doing a physical examination, interpreting a scan) focus more on managing information, which helps to make sense of the situation. Other tasks (e.g., prioritization, allocation, delegation, resource mobilization) are intended to improve team coordination and to spur action.

Information-related tasks help develop a "shared mental model," which in turn greatly facilitates coordination.[2-5] This is because the shared mental model provides acute care team members with a common knowledge and a common structure that helps them predict what other team members are likely to do.[6] Shared mental models have been discussed elsewhere in this book. Regardless, they bolster coordination because they "help people describe, explain, and predict problems in their environment."[7] The shared mental model is discussed further below.

Coordination can be defined as "the process by which team resources, activities, and responses are organized, so that tasks are integrated, synchronized, and completed within existing constraints."[8] Team coordination is either explicit or implicit. Explicit coordination refers to using deliberate communication to coordinate actions. Implicit coordination relies less on verbal communication and more on team members possessing a shared understanding. This implicit understanding has usually been established before engaging in the actual task[9] and comes from shared training, experience and regular exposure. Team coordination usually becomes more implicit as teams mature: they know what to do with progressively less and less verbal prompting. If there is any doubt, then coordination should be made more explicit.

Toward a Fuller Understanding of Task Management

When there are more discrete steps, complexity, or unfamiliarity, task management is more likely to go wrong. Similarly, there is a greater need for coordination in order for things to go right.[1,10-15] Regardless, psychology has codified what may seem self-evident to some acute care clinicians. What follows is a short discussion of pertinent frameworks

and models. The goal is to help clinicians gain a deeper understanding, while accepting that there is no substitute for common sense and volume-based competence.

The input–process–outcome (IPO) framework states that the input (often thought of as available resources) either facilitates or hinders team processes (e.g., coordination, leadership, communication) and thus impacts outcome (e.g., patient mortality, length of hospital stay).[16] The input or resources are not just pieces of equipment or available drugs. They also include personnel and anything else that can be leveraged from the local environment.[12] In other words, we can better define our resources as not just staff, stuff and space, but also skills and systems (Table 1).[17]

Table 1: Examples of resources

	Resources
Stuff	Equipment, supplies, medications...
Staff	Nurses, specialists, technicians..
Space	360º access, bed availability...
Bandwidth	Mental capacity
Organizational Processes	Codes, escalation processes...

The cognitive task load (CTL) model (Figure 2) identifies three key factors that affect team performance: percentage of time occupied, task-set switching and level of information processing.[18] To be optimal, it is believed that approximately 70%–80% of a person's time should be consumed by tasks. If tasks occupy substantially more time, people become overloaded or cognitively locked; when they occupy substantially less, people become underloaded or bored. Interestingly, effective workers probably have a natural inclination to compensate for percentage of time occupied. In other words, we may unconsciously speed up or slow down to approximate being "three-quarters busy."[18]

The second component of the CTL model, task-set switching, refers to our cognitive flexibility, our ability to switch between different tasks. Performing different tasks is disruptive and usually means slower performance and decreased accuracy on the second task. The difference between repeating the same task (i.e., task A, then task A again) versus switching tasks (i.e., task A then task B) is defined as the "switch cost." It is one reason why leaders should assign team members one task at a time, or why sequential tasks should ideally be related.

The third component of the CTL model, the level of information processing, can be understood using the skill–rule–knowledge (SRK) framework. This helps predict errors in different tasks, or within the same task when different skills are required. In the knowledge-based mode, humans complete tasks by thinking their way through,

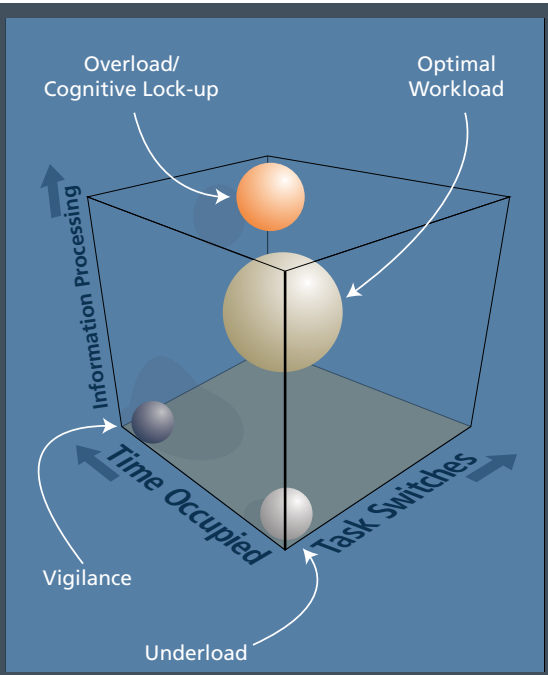

Figure 2: Task performance is affected by time occupied, task switches, and the level of information processing. A balance of each of these factors creates an area where optimal performance is more likely. Adapted from: Grootjen et al.[18]

rather than by reacting automatically. This occurs when a beginner performs any task, or when experienced individuals face novel situations. The practitioner applies considerable conscious effort, therefore responses are slower. After each action, the practitioner needs to review its effect before proceeding, which creates further delay. Practitioners can also become cognitively exhausted, or because of novelty they may not be able to predict how the situation will progress.

Skill-based performance refers to frequently practised, largely physical and typically automatic actions. Because there is minimal conscious monitoring, the task is performed faster; however, the danger is that the task is performed without contemplation.

Between these two poles of knowledge-based and skill-based performance is rules-based performance. These rules have usually been learned in training, or by mimicking others. Rules include varying degrees of understanding and habit. Scarce resources are obviously a major challenge; however, excessive resources can be similarly challenging.[19]

Most practitioners have conducted resuscitations during which they wished others were available. However, most have also conducted resuscitations during which they were relieved that others were not present. During the day, the increased staff response can be welcome, or it can be overwhelming. At night, the lack of personnel can be scary or liberating. The "goldilocks team" means having just the right number of people with just the right skills. It is not merely a number; it is a group of people who collectively possess all the necessary manual and cognitive skills. It is also the people who possess "the right stuff," namely, the ability to coordinate information transfer and complete tasks, regardless of adversity.

Improving Task Management

Improving coordination during crises means understanding and applying three key concepts: an accurate shared mental model, implicit coordination and task standardization, and interpositional knowledge (IPK).

The Shared Mental Model

The development of accurate mental models — namely, models that realistically portray what is happening and what is needed — is associated with improved team performance.[2-5] It may seem self-evident that tasks are better managed when teams possess greater understanding. If so, then it follows that team coordination means dedicating the right amount of time (not too little; not too much) to establishing and sharing those models. This is not always done, especially in the midst of stress, distraction and chaos. Communication lapses are a common during medical emergencies.[20-23] Moreover, although sharing an accurate mental model is very important, it is what you do with your mental model that matters most. As can the wish for diagnostic certainty, excessive analysis can result in task paralysis. It is a key characteristic of acute care medicine that our mental models centre on action and that we rarely want information for information's sake.

Mental models are not static; they evolve during a crisis as information is gathered and interpreted. Furthermore, information is not collected randomly. Instead, as outlined in the chapter on situational awareness, our attention is activated if we recognize environmental cues. Early on, our mental models are usually primitive because they are based on scarce information. Again, this does not mean they are unimportant; after all, these early mental models may be all we have in order to rescue the patient in extremis.

In critical care, our primary survey (airway–breathing–circulation [ABC]) informs much of the early mental model. Even though this is rapidly established, this incomplete and poorly differentiated model will inform early and potentially dangerous interventions, such as intubation and use of chest tubes and vasopressors. When the patient stabilizes, the team's effort can progress to collecting additional information and expanding the mental model. This progression provides a more nuanced model and a more comprehensive understanding, which leads to more targeted treatment. Again, the specifics of the situation — namely, how stable the patient is and what resources are available — inform how much time and effort should be spent on information management versus task management.

As outlined, there is little benefit and some risk if we focus excessively on collecting information. For example, if postextubation stridor and respiratory distress develop in a long-standing intensive care unit patient, then little additional information is required. Instead, efforts should focus on re-establishing airway access and minimizing delays. The mental model should therefore reflect this reintubation priority and the importance of avoiding other distractions. In contrast, if we have a patient in mild circulatory shock, it is quite appropriate to invest time in establishing the etiology and expanding

the differential, otherwise we might continue to resuscitate blindly.

Much of the art of task management rests with understanding the need to act and think and to avoid letting either of these acts cloud the other. While we have stressed the importance of action, this must be balanced against an understanding of our perceptual and cognitive biases. These biases have a tendency to lead us to prematurely close our minds and hold on to the first diagnosis that came to mind. This propensity toward premature closure means that we must be disciplined enough not to neglect other possibilities and dedicated enough to put in the extra effort.[24] Once the crisis has abated (i.e., relative stability with the A-B-C's)- the team should redouble their efforts to re-examine available data and search for additional clues. This includes both positive and negative pertinent clinical findings.

Medical teams faced with complexity and unfamiliarity will typically spend more time discussing, developing and sharing their mental models because input from various team members enriches the model and the likelihood that all team members are on the same page. Accordingly, the greater the overlap between the individual mental models (i.e., the more similar the shared mental model), the better the team's performance should be.[2,3,5] In contrast, if an activity is urgent, simple, or standardized, then action should be streamlined without delay.

Implicit Coordination and Task Standardization

As previously outlined, implicit coordination refers to team members recognizing a situation for which there is a familiar action plan and coordinating each other's actions with minimal discussion or debate.[9] This coordination is considered implicit because in many situations team members know what to do and what sequence in which to do it without being told. The team already knows what the priorities are, who does what (i.e., they have predetermined the process of care) and whether additional human or physical resources are required (i.e., whether to modify the existing team structure).

Implicit coordination is exemplified by the team that appears to assemble out of nowhere. For example, the nurse knows to start charting while another starts intravenous access and another premixes infusions, and simultaneously the respiratory therapist sets up for possible intubation. These tasks occur rapidly and relatively silently. Actions are automatic, proficient and reassuring. Clearly, standardized responses can be very helpful. However, despite appearances, these teams may still have an imperfect understanding of each other's abilities, their environment and the patient's peculiarities. In other words, appropriate task allocation is relatively simple, but only if our assumptions are correct. If we are faced with unfamiliarity or surprise, task allocation is far more complex.[12]

Fortunately, subordinate team members can also successfully distribute tasks amongst themselves. Experienced teams members may even be able to do this efficiently and quietly without directed leadership. Implicit coordination frees the leader to devote more energy to overview and contemplation rather than to instruction and delegation.

Leaders need to resort to explicit coordination whenever the action plan falls outside of the team comfort zone. For example, the leader would be more explicit about task sequencing and allocation if the team was using an unfamiliar piece of equipment or facing an unusual diagnosis. The need for explicit coordination is also affected by resources, experience, training, fatigue, competing patients and more. As outlined, more experienced teams usually rely more on implicit coordination, and less experienced teams need more explicit coordination. Regardless, good team members are insightful and flexible enough to match the strategy to the problem.

Standardized action plans — namely, plans that are known by most but are often not formalized — develop over time and typically through experience. People may learn that "this is the way things are done" in a particular ICU or emergency department. In other words, standardization reflects the culture of a particular group or hospital. These shared knowledge structures may be "battle-tested" and completely appropriate; however, just because they are familiar does not mean they are ideal. They may not have been sufficiently challenged and may not incorporate the latest evidence. They may reflect policy worship rather than patient needs. Action plans can also vary within an organization because of individual preferences. For example, most nurses can tell you that "Dr. A likes to preoxygenate his patients in this way, Dr. B always preoxygenates in this way, but we never really know what Dr. C is going to do!"

Studies demonstrate that increased standardization is usually associated with more implicit coordination and less overt leadership. Therefore, standardization is common in high-performing teams. Regardless, impressive standardization usually requires planning. To appreciate what planning can achieve, take a few seconds to watch how a team changes four tires during a Formula One race (ow.ly/LBTM309lrob). These videos illustrate many aspects of successful task management and coordination. All pieces of equipment, including the car, are specifically designed; all team members knew their role and the roles of others; all knew the proper sequence; and all had practised exhaustively. Notably, during initial training the team might have required explicit coordination. Clearly, they have become proficient and familiar enough that all coordination is now implicit.

Critics might argue, quite rightly, that Formula One levels of performance are not always possible in medicine. For example, it is far easier to standardize changing tires than managing heterogeneous patients with undifferentiated shock. Moreover, standardization can encourage intellectual laziness and rigidity. However, standardization has been beneficial in some areas of medicine. For example, Ontario paramedics have been trained in a way that approximates Formula One in the setting of out-of-hospital cardiac arrest. Their equipment is designed to provide instantaneous feedback on the depth and frequency of chest compressions, and crews have been drilled to understand that job one is to perform uninterrupted, high-quality chest compressions. They know how to perform with a two-provider crew and how roles change if a third and then a fourth provider arrive. Between 2004 and 2016, survival to hospital admission following witnessed ventricular fibrillation increased from 8% to 34%.[26] This example shows

how the proper input (equipment, action plan design, training) improves process (more effective chest compression) and can be associated with better patient outcome (more than a four-fold increase in survival). As in car races, not all elements of medical crises can be standardized, but some can and should be.

Interpositional Knowledge

Superior performance rarely happens by accident; instead, it requires training and familiarity. IPK[27] represents a shared understanding of the tasks, roles and appropriate behaviour required by all. Cross-training and feedback may improve IPK.[15-27-29] The intent of cross-training is not to fully duplicate the same knowledge and skills in each team member. In other words, we are not trying to turn nurses into doctors or vice versa. Instead, it is as much about team empathy and building anticipatory skills. Studies of World War II aircrew concluded that the most successful crews had the highest levels of IPK. Moreover, they used their downtime to bolster this knowledge.[27] Expressed another way, to manage a task we should first (ideally) coordinate a relationship.

Proficiency in task management needs more than simplistic protocols or ad hoc clinical exposure. In fact, if left to change, our skills may even plateau within the first years of residency training.[30] The situation is further complicated by the absence of any single well-validated assessment tool. Regardless, we all need to commit to lifelong skills development.[30,31] "Good enough" is, frankly, not good enough.

Conclusion

As with all aspects of CRM, the important part of task management and coordination is not about remembering psychological models or quoting research findings. Rather, it is about understanding scientific basics in order to leverage the best practical insights, no matter their source. We care about these topics because we want meaningful outcomes for vulnerable patients. We need to practise and perfect because these skills rarely come naturally.

In an effort to understand complex acute care medicine, parallels have been made to high-stakes industries, most notably aviation. However, coordinating a team could be understood in comparison to a symphony orchestra. After all, skilled practitioners (whether musicians or healthcare workers) dedicate their working lives to becoming technically proficient and stress-averse. Ideally, each medical team member (or musician) has an excellent understanding of the situation (i.e., the mental model or the musical score), which informs their actions and helps them anticipate future events. Continuing this analogy, the medical leader (or musical conductor) directs and redirects each component to create a recognizable, though still unique, whole (i.e., resuscitation or music). The degree to which this must be conducted depends on the complexity of the patient (or the music) and the familiarity/skills of the practitioners. Sometimes this means directing individual performers (or groups of performers), sometimes it means

directing the team as one, and sometimes it means allowing people to just get on with it. Both leaders and followers perform better if they are aware of the dynamic interplay, the overall goal and how tasks align. At the risk of over-stretching this analogy, the outcome can be transcendent or cacophonous.

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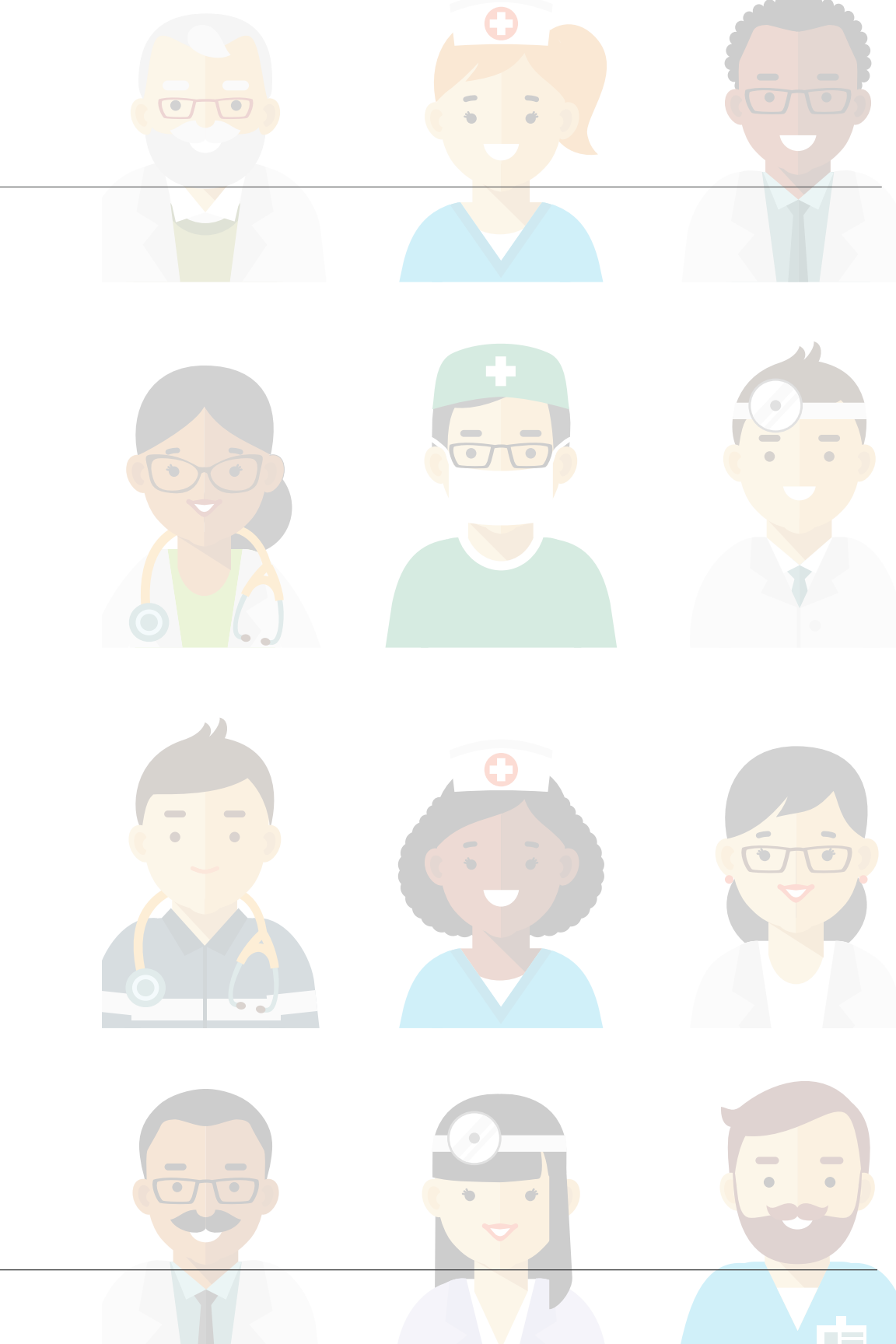
Photo: ©Dr. Robert Arntfeld
Subject: Dr. Brian Buchanan

This picture is for reflection. Ultrasound/echocardiography is an incredible tool that is increasingly common in resuscitation. However, how do we ensure that the team is not overly distracted by technology? How do we ensure that cardiac ultrasound is minimally intrusive to the resuscitative efforts? How would you ensure that sonographer's data is converted into information and then into action?



Leadership and Followership Skills in Acute Care Medicine

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"A Leader is one who knows the way, goes the way, and shows the way."

John C. Maxwell

Introduction

In the 1960s, during an obscenity trial, the US Supreme Court Justice Potter Stewart became famous for stating that while he could not define pornography, he "knew it when he saw it." Good leadership and good followership are clearly less titillating topics, but similarly, most of us can learn to recognize their presence, or lament their absence.[1] Despite a trend toward flatter hierarchies, there is still the need for leaders and followers. On the other hand, anyone who enters medicine believing it is still a binary case of doctors giving blunt orders and nurses meekly carrying them out is in for a shock.

Most professionals — not just healthcare workers — need a basic understanding of leadership and followership principles. However, in the case of acute care resuscitation, understanding these roles and responsibilities is central to how we create a cognitive roadmap and an action plan. In other words, ideas about leadership and followership underpin our attempts to rescue perilously ill patients and combat heightened stress, chaos and complexity. Our collective beliefs about who leads and who follows also help explain how decisions are made and priorities are formed throughout the medical system.

Modern medicine is complex. This is true in the therapeutic realm and in terms of power dynamics. As outlined,

this is partly because ideas around authority and subservience are changing throughout society. As such, we should not be surprised that there is pressure on traditional medical hierarchies to mirror that larger shift. Obviously, we must be open to the best ideas, no matter their age or their source. As such, this chapter offers broad perspectives and practical insights as well as some cautions. To oversimplify this topic could have grave consequences for the safety of patients and the resilience of practitioners.

Recognizing the Importance of Leadership

Around the world and across medical disciplines, the need for strong leadership has been identified, encouraged and codified. Efforts include the Royal College of Physicians and Surgeons of Canada CanMeds Framework,[2] the Canadian Nurses Association Position Statement on Nursing Leadership (2009),[3] the Swiss Catalogue of Learning Objectives,[4] the learning objectives of Britain's General Medical Council,[5] the United States' Learning Objectives for Medical Student Education[6] and the World Federation of Medical Education global standards.[7]

While not all healthcare workers will take on official leadership roles, many still lead in their day-to-day jobs. This ranges from the clinical realm (e.g., running ad hoc resuscitation teams) to education (e.g., guiding efforts to revamp curricula) to administration (e.g., spearheading initiatives to deliver safer care). In other words, leadership is required to advance medicine, and teamwork (which requires leaders) is required to get everyday hospital work done. Until recently, the art and science of followership has not been given similar attention. This chapter aims to fill a relative void.

In contrast to leadership courses, there are very few courses positioned as courses in followership. Fortunately, all healthcare workers have spent all of their training and at least some of their practices/careers in some form of followership role. In career terms, even senior physicians and surgeons, who may lead in their specialty realms, still need to function in clinical teams; within practice groups; and within departments, universities and health authorities. As such, nobody is really ever always a leader or always a follower. Moreover, good leaders and good followers are not usually born; instead they can be made, or destroyed.

Toward a Better Definition of Leadership and Followership

In broad strokes, leadership means that an individual (or a small group) exerts disproportionate noncoercive influence over others. Followership, in turn, requires a degree of deference and acceptance.[8] In the modern context, rather than one group dominating and the other serving, leaders are more likely to be the first among equals (primus inter pares), and followers are more likely to be highly valued if they possess important complementary skills. Modern followers are authorized — in fact, they are expected — to speak up, and modern leadership no longer comes with tacit permission to steamroll or ignore others. To quote Steven Covey, "leadership is the ability to communicate others' worth and potential so clearly that they are inspired to see it in

themselves."[9] To quote Augustine Agho, "followership is the ability to competently and proactively follow instructions, and support efforts to achieve organizational goals."[10]

There is a danger when discussing leadership and followership to rely on ideas that are either popular because they are politically correct, or on ideas that are not ideally suited to the rigours of acute care resuscitation. As mentioned, hierarchies have flattened, and the differences between leaders and followers have blurred. However, we should also temper aspirations with reality. Hierarchy is still (appropriately) a prime means by which we get things done, especially during situations that could otherwise descend into chaos. Therefore, it is not anachronistic or reactionary to maintain situational hierarchy. Moreover, while the importance of followership is gaining appreciation, we should accept that there are different attitudes and varying interpretations.

In 2010, Carsten and colleagues[11] concluded that some people define followership through passivity, deference and obedience. In 2011, Kean and colleagues[12] promoted the idea that leadership and followership roles are co-constructed and vary depending on the situation. Regardless, there appears to be growing agreement that the two roles are interdependent and fluid. Leadership is difficult to define without referencing followership, and without followers it is impossible to identify leaders; to understand leadership we need to understand followership. In a functioning system the relationship is likely to be symbiotic, and in a failing system it is likely to be antagonistic.

High-stakes fields, such as acute care medicine, still need to maintain a correlation between power and responsibility. In other words, because the leader has greater power they also bear greater responsibility. Accordingly, this is still one of the key ways by which we define leaders versus followers. Leaders need to not only answer for the team's performance, but also be held accountable and empowered to implement change. Because we still attribute disproportionate responsibility to leaders, it is still appropriate that followers do not have the final say. The corollary is that because modern followers have more power, they have a greater sense of responsibility.

As outlined, the subordinate view of followership is less common and less extreme in modern, complex healthcare because we assume that people who feel valued are more likely to share their abilities. As such, leaders increasingly treat followers as equals and this encourages leaders and followers to co-produce outcomes.[13] This dynamic can also require leaders and followers to move into, out of and within these roles. If this structure fails, then the leader needs to have the option of returning, albeit reluctantly and briefly, to command and control structures. In other words, the best team structure is that which gets the job done, and it can change minute by minute.

The more traditional role theory[14] defines a follower based on their preappointed "role" or "rank" within a hierarchical system. Traditionally, leadership and followership were defined a priori by profession and seniority (i.e., mature doctors were more likely to assume leadership roles and junior nurses were more likely to assume followership roles). As a result, the identity of the leader and follower was more obvious, but also less flexible. The more recent constructionist approach[15] defines followership by "relational interactions."[8] As a result, leaders and followers are increasingly self- and situationally

defined. It means that each individual needs to decide whether to step forward or hold back. In other words, the modern model is more flexible, but also more complex.

If leadership and followership are apportioned properly, it can result in more dexterous and stress-resistant teams that are better equipped to combat the complexity of modern high-stakes healthcare. When done wrong, we erode role clarity and invite chaos. Ultimately, it is patients who will benefit or suffer. If all team members share the same understanding of leadership and followership, then the team is more likely to be on the same page, whereas if ideas are different, then teams are more likely to be at odds. We have long known that team roles should be earned and regularly practised. Regardless, we should apportion leadership and followership based on delivering what the patient needs, not based on rank or a wish to feel important. Leadership and followership are not one-size-fits-all. Instead, they should be individualized to the problem (the clinical scenario) and to the problem-solvers (the clinical team).

Leadership in Acute Care Medicine

Leadership can be broadly categorized as either task-oriented or relationship-oriented.[16,17] Task-oriented leadership is more straightforward because it focuses on goals and procedures. It relies on followers doing the right thing because of rewards and punishments (i.e., a transactional relationship) or because of their training and self-motivation. Regardless, task-oriented leadership relies more on hierarchy, deference and obedience.[16] Relational leadership is more complex, but potentially more meaningful, because it focuses on people and relationships.[18]

Relationship-oriented leadership relies on motivation and engagement. Transformational leadership (a form of relational leadership)[19-22] promotes the idea of a shared vision and collective ownership. Accordingly, it is widely promoted in modern medicine and comes with a flatter authority gradient. There are many putative benefits, but the risk is that followers could reject the vision or feel immune to punishments and rewards. It also takes a lot of (usually pre-emptive) work to inspire people, which in turn demands a personal connection. Task-oriented leaders can distance themselves psychologically from their followers. In contrast, transformational leaders get closer to followers in order to garner trust and respect.[19-22]

A 2013 systemic review examined nursing management leadership styles in different health care settings. It concluded that a relational/transformational leadership style was associated with more positive clinical outcomes, including greater patient satisfaction, lower patient mortality, fewer medication errors, less restraint use and fewer hospital-acquired infections.[18] However, such encouraging results do not mean that the transformational leadership style is automatically preferable in all situations. Indeed, studies conducted in academic trauma centres have demonstrated that a transformational leadership style is rarely used in the resuscitation of trauma patients.[23]

When resuscitating acutely ill patients, we need a structure that helps highly trained and appropriately motivated professionals rescue a fellow human at risk of imminent

death. Fortunately, there should be minimal need to negotiate with true professionals. In other words, we do not always need transformational leadership to get simple finite tasks completed. However, we likely do need a transformational leadership style whenever we wish to address larger, long-term issues, such as team culture.[24] Notwithstanding extreme aggressive (or passive) behaviour, we should evolve past assuming that a particular style is either always good or always bad.[25]

Excessive delegation can be associated with decreased productivity,[16] presumably because of poor decision-making, which in turn relates to diffused responsibility and inadequate role clarity. Notably, this excessive delegation style may be tacitly encouraged among practitioners who teach in academic centres, because while they are responsible for treating patients, they are also expected to train future colleagues. These senior practitioners often adopt a delegating style of leadership to enable residents and fellows to manage the crisis. Delegation is absolutely appropriate, otherwise the followers will not gain their own leadership experience.[23] However, this important task must be juggled alongside the ability to monitor the situation and the dexterity to change roles. Ideally the educational leader empowers the follower. However, should the situation overwhelm the leadership capabilities of less experienced follower, the senior leader should switch to a more directive and hands-on role.

Kunzle and colleagues[26] conducted a study with 12 nurse/anesthesiology resident teams exposed to a simulated crisis (asystole in a patient requiring intubation). The authors concluded that high-performing teams were characterized by residents and nurses who would still share leadership as stress and task burdens increased. In contrast, in low-performing teams, leadership was inadequately shared, and residents assumed an increasingly greater proportion of leadership behaviour. The authors assumed, sensibly enough, that by sharing leadership the high-performing teams could still function when the task burden was too high for a single individual — especially if that individual was trying to both perform a manual skill (intubation) and coordinate a team. In the midst of an acute care crisis, the challenge is to determine whether you have a higher-functioning team or a lower-functioning team. In the former, sharing leadership increases cognitive and manual capacity, whereas in the latter it invites further chaos.

Klein and colleagues[27] studied "extreme action teams," which were characterized as having members who performed urgent, unpredictable, interdependent and consequential tasks while simultaneously experiencing changes in team composition and having to deliver education. They found that teams were certainly hierarchical and de-individualised, but typically maintained shared leadership. They characterized the approach as "dynamic delegation," where senior leaders rapidly and repeatedly gave and withdrew leadership roles to and from their juniors.[27] Again, this emphasizes the fluid nature of leadership and followership and the need to give and take power during a complex resuscitation.

While there can be as many leadership styles as there are leaders, Klein and colleagues[27] concluded that effective leaders performed at least four key functions: strategic direction, monitoring the progression of clinical care, providing hands-on treatment

and teaching other team members (not only pertinent facts and procedures, but also leadership attributes). Yukl,[16] based on Lewin, Lippit and White's 1939 work, outlined three archetypal leadership styles: autocratic, democratic and laissez-faire. The autocratic, or authoritarian, leadership style exemplifies clear expectations and an obvious division between leader and follower. For reasons similar to those discussed previously, Yukl concluded that the autocratic leadership style is efficient, especially for routine tasks. The downside is that the autocrat seeks little input, does not foster creativity within the larger group and, therefore, is unlikely to be suited to more complex problems requiring individualized solutions.

Democratic leaders participate within the group and acknowledge input from members. Despite less productivity from the democratic group than the autocratic group, Yukl found that the contributions were of higher quality;[16] therefore, the democratic leadership style was believed to be the most effective when the problem exceeded the cognitive abilities of an individual. However, hierarchy still matters, and democracy can go too far. The laissez-faire style was associated with excessive delegation and the lowest productivity. Decades later, it is noteworthy that three archetypal leadership styles are easily recognizable to modern healthcare workers.

The acuity of medical crises can make it hard to find time for the tact and engagement required for transformational relationships. However, this emphasizes the importance of anticipatory team-building (including that gained from regular simulation) and the dexterity that is expected of modern leaders. Clearly transformational leadership,[16,17] also known as visionary or inspirational leadership, requires more proactive effort. However, the extra effort could be rewarded with engaged followers and greater cognitive and procedural capacity.

Followership in Acute Care Medicine

As mentioned previously, compared to leadership, followership has been relatively ignored, and there is a dearth of hard evidence, possibly owing to negative connotations — especially in a society more likely to celebrate individual achievement — and to downplaying the importance of the team. For example, followers might be perceived as passive or uncreative, or they may be considered to have lower status or to be incapable of making independent judgments.[28] Many may assume that being a follower means merely doing as you are told. If so, then following is less of an acquired skill and more akin to obedience. However, attitudes have changed over the last two decades, beginning in corporate management literature. As outlined, good leaders and good followers share many traits, and choosing to lead or follow is highly context-dependent.[11] Moreover, it has been suggested that individuals who develop strong followership skills are more likely to translate into better leaders (i.e. there are presumed benefits to working your way up from the bottom).[29,30] What follows is the work of researchers who attempted to define what makes a good or bad follower. The main purpose is to offer the reader a chance to reflect on their own personality and that of their institution.

A 2009 survey by Agho and colleagues[10] of senior-level executives ranked the five most important characteristics of effective followers as:

1. honesty/integrity,
2. competence,
3. dependability,
4. loyalty and
5. supportiveness.

Meanwhile, a 1990 nursing article suggested that free-thinking and self-motivation were needed in followers in order to foster their capacity to "possess initiative, manage themselves, and succeed without a strong leader."[31] Similarly, in 2009 Chaleff[32] defined the traits of a good follower based on the courage to assume responsibility, serve, challenge, participate in transformation and take moral actions.

Sy[33] concluded through a series of surveys that individuals with a followership prototype possess traits of industry (i.e., they are hardworking, productive and go "above and beyond"), enthusiasm (i.e., they are excited, outgoing and happy) and citizenship (i.e., they are loyal, reliable team players). Just as importantly, he reported that individuals with a followership anti-prototype possesses traits of conformity (i.e., they are easily influenced, follow trends, and are soft-spoken), incompetence (i.e., they are uneducated, slow and inexperienced) and insubordination (i.e., they are arrogant, rude and bad-tempered).

Much of the followership literature currently comes from nursing, and the most defined example of a formal followership initiative is the Effective Followership Algorithm (EFA).[34] This standardized algorithm outlines a way for clinicians to challenge authority using a 3W approach: what I see, what I'm concerned about and what I want. Clinicians then assert themselves using a four-step tool: get attention, state concern, offer a solution and pose a question. The authors concluded that using the EFA was associated with statistically significant improvements in team communication.

Kelley[30] defined five distinct followership styles based on a 2 x 2 matrix that compares the follower's initiative (active versus passive) with their ability to think independently and critically. We can relate these followership styles to acute care medicine.[30]

Passive Followers

Passive followers do not take initiative, nor do they think critically. They are sometimes thought of as "sheep," as they follow the herd mentality, offering little input and rarely questioning authority. In acute care medicine, passive followers do as they are told and perform tasks or actions only as instructed.

Conformist Followers

Often referred to as "yes people," conformist followers have high levels of motivation/initiative, but lack critical thinking or appraisal. They have high levels of energy,

but are completely dependent on a leader for higher-level thinking. For example, conformist followers might plan a hospital discharge efficiently, but could fail to consider whether discharge is best for the patient.

Alienated Followers

Unlike passive and conformist followers, alienated followers do have the capacity to recognize errors in judgment or decision-making. However, because they lack motivation and initiative, they may be reluctant to speak up and bring forth concerns. Hence, they may still contribute to group think. This group could include those who have been chastised for speaking up previously and are fearful of further negative attention.

Pragmatist Followers

Pragmatist followers can think and act independently, but are reluctant to cause turmoil or conflict. Often considered "fence sitters," [31] they have the ability to act, but do so only when they deem it absolutely necessary. This may include new team members who lack confidence before they are firmly established within the group.

Effective/Exemplary Followers

Effective or exemplary followers have both the capacity to recognize errors and the motivation/initiative to speak up. In this way, they are best able to contribute to a mature team and are best able to move fluidly between the roles of follower and leader. As the name implies, this is considered the best follower archetype. Since effective/exemplary followers are able to think for themselves, they will critically evaluate the situation. However, it is not enough just to criticize; teams need members who engage. Great followers should also take ownership for team decisions, and see team failures and successes as their own.[34]

Summary

As outlined, modern, effective leaders and followers are increasingly active participants and are expected to speak up. We should be cognizant that listening is as important as speaking, and doing is as important as criticizing. Good team members can see past their own needs in order to keep the focus on the patient. They are also unafraid to assert and engage themselves when the team deviates, and they are confident enough to keep quiet and follow when that is what is required.

Attitudes in both junior doctors and student nurses are likely established early in training.[35] This includes ideas of leadership and followership as well as professional identity, personal identity and relationship to power. As such, educational efforts should occur before ideas are entrenched. Efforts should be targeted toward breaking

down silos among professions, specialties, genders and generations. Fortunately, crisis resource management (CRM) principles and regular simulation exercises increasingly emphasize the importance of multidisciplinary training, team empathy, flattened hierarchies, open communication and an acceptance that leaders and followers can have different and complementary skills.

While the need for better leadership has been well recognized, there remains a dearth of practical strategies. Until recently, the concept of followership has been relatively ignored, even though it is essential for high-functioning teams and safe patient care. Because the science is not yet developed, our best current approach may be to simply identify, reflect, promote and disseminate the best narrative examples of leadership and followership. Moreover, instead of presenting these skill sets as separate, we can teach "a third way," creating clinicians who move seamlessly from leader to follower and back, and who accept that teams succeed or fail together. Regardless of the leadership or followership style, the goal remains the same: to serve the patient in need.

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Teamwork in Acute Care Medicine

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"If you want to go fast, go alone. If you want to go far, go together"

African Proverb

Introduction

Teamwork Matters

In the 1970s, two Boeing 747s collided on the runway of Los Rodeos Airport, Tenerife. The infamous collision of KLM 4805 and Pan Am 1736 resulted in 583 deaths, making it the deadliest crash in aviation history. Root cause analysis concluded that a lack of teamwork was at least partially responsible, just as it has been in many critical aviation incidents.[1] In the clinical arena, teamwork appears to be just as vital and just as fragile. While the other chapters in this book have focused largely on individual nontechnical skills, this chapter focuses on the team.

The importance of the team becomes obvious if we consider that the modern single critical care patient is estimated to require approximately 180 steps per day.[1] Regardless of the exact number, such clinical complexity means that the needs of the modern patient will exceed the capacity of even the most capable healthcare provider. In short, delivering even rudimentary healthcare means that we need teamwork. The increasing complexity of the modern patient and the requirement for safety, reliability and predictability mean that we also need teams that "work."

Aviation data suggest that fewer

planes crash when the co-pilot, rather than the senior pilot, is at the controls.[2] Psychologists and human factor experts have debated the reason why, but part of the explanation is presumed to be because this creates an ad hoc team. In this aviation team, the subordinate is engaged, the senior is freed up to offer oversight, and both have clear roles. Regardless, by creating a functioning team — even a small one — they are more likely to leverage a larger mental range, a greater physical capacity, and broader psychological reserves than they were able to leverage previously.[2] If instead we create a dysfunctional team, then we increase the likelihood of confusion and disruption. Accordingly, time invested in improving or maintaining the team is not time wasted.

Teamwork, both good and bad, is often easier for clinicians to identify than to define. Psychologists have defined functional teamwork as "cooperative efforts to achieve a common goal," and have emphasized that teamwork usually means more than just subordinates doing as the leader tells them.[3] Additionally, team scientists have highlighted the team's social constructs and the interdependence of members.[4,5] In complex, unpredictable systems, a psychological approach to teamwork is about more than just task completion; it is about maximizing problem-solving capabilities, such that the sum exceeds the parts.[3]

Just as in aviation and psychology, the medical literature is increasingly suggesting that inadequate teamwork is among the most common reasons for preventable medical error.[1,3,6-9] In addition, there is no single overarching medical team skill; there are many. Accordingly, our discussion will intersect and overlap with the other crisis resource management attributes discussed in this book. By highlighting common failings in teamwork just as our other chapters have highlighted common failings in decision-making or in situational awareness it becomes impossible to hide from an "inconvenient truth": despite impressive advances in what we can deliver for patients (i.e., our technology), we have a long way to go in terms of how we deliver care to our patients (i.e., our nontechnical abilities). Because medicine has focused on traditional scientific advancement, it has also been a laggard in terms of understanding how teams perform at the bedside.[1,3]

In addition to discussing common failings, we can also identify, dissect and learn from high performers. Fortunately, both psychology and aviation already offer applicable language and strategies regarding how we can make a "science of team performance" and a "science of managing complexity" (Summary Table 1). Much of our efforts will start, or stall, with acute care medicine accepting what psychology has long understood: a team of experts is not automatically an expert team, and the future workplace is likely to focus more on "we" and less on "me."[3] It is time for our medical teams to modernize for the same reason that aviation did: too many preventable deaths.[1,3,6-9]

Creating Healthcare Teams That Work

Before being accused of offering simple solutions to complex problems, we need to offer a caution: the idea that teamwork in acute care medicine merely has to mir-

Table 1: Summary of practical strategies to improvemedical team work

Team Factor	Recommendation
Culture	• More "we"; less "me" • Mutual respect • "What" is right; not "who" is right • Foster team empathy
Establish Structure	• Assign roles • Assign responsibilities • Establish priorities • Communicate throughout
Shared Mental Model	• Ensure all are on the same page • Invite input whenever possible • Outline priorities • Set team emotions
Cross-Monitor	• Monitor performance • Monitor workload • Build team empathy • Encourage feedback
Maintain Resilience	• Routine practice sessions • Request feedback • Encourage debrief • Provide time for casual interaction

Adapted from St. Pierre, et al; 2008.

ror that in other high-stakes professions can be oversimplified and overstated, because healthcare delivery has its own subtleties, pressures and requirements. While we should certainly embrace the best "off-the-shelf" ideas that others have to offer, we should not underestimate or oversimplify our medical challenges. Medical teams need their own rigorous study and bespoke structure. Moreover, while healthcare teams share common problems and common needs, training suitable for emergency medicine may not be

suitable for obstetricians. This means that training goals should also be set according to local and domain-specific needs.[10]

To maximize the chance of patient rescue we must also tailor a team's mission for the individual patient. This is not always in line with the optimal team structure that prioritizes academic output or helps junior practitioners acquire and maintain skills. Presumably, if we are going to measure whether medical teams "work," we should start by defining our primary goal and the supplementary or competing goals.[11] Helmreich[12] has argued that the central goal of team training should be the reduction of consequential medical error. It is not an insurmountable problem to have more than one mission, but it does mean resisting the temptation to rush to simple conclusions.

Reassuringly, studies have demonstrated that global teamwork measures can improve after deliberate team training.[4] Studies have also shown improvements following team training in less obvious metrics: patient satisfaction, hospital length of stay, complications and even mortality.[13] As such, we need to move beyond thinking of teamwork as a "soft" skill. Instead, teamwork acquired through deliberate training coincides with the central goals of acute care medicine: saving lives and protecting vulnerable patients.[13] It also means taking practitioners on a deeper dive in order to understand what it means to nurture high performing teams.

A More Comprehensive Understanding of Medical Teamwork

Planes can remain grounded during inclement weather, and psychologists have the luxury of contemplation time. In contrast, health teams have to intervene despite greater uncertainty and alongside greater time pressure. Ad hoc medical teams need to be formed rapidly, often without their members having prior experience of each other's abilities and working styles.[13] The lifespan of any ad hoc medical team is also relatively short; after all most medical interventions are shorter than aviation flights. Medical team composition is also fluid given the huge number of random combinations of doctors and nurses assigned to work a shift together.[13,14] Despite, or perhaps because, we typically perform together only in the short-term and intermittently, it makes sense that our roles are usually predictable and predefined based on specialty. To offer a simple example, doctors are generally responsible for in-hospital airway management, and nurses are generally responsible for in-hospital chest compressions.

Leadership in acute clinical care can also be negotiated, rotated and shared.[13] For example, during a cardiac arrest, the code team leader may pause to allow another doctor, such as an anesthesiologist, to intubate the patient. During this time the anesthesiologist may briefly lead the team by asking for sedation or asking to be handed equipment. Following successful intubation, leadership reverts to the code team leader, chest compressions resume, and the anesthesiologist may even leave the room. Similarly, subteams may be created and dismantled during the course of a resuscitation, which is an example of divisional rather than functional team structure. A divisional team

structure may involve subteams responsible for intubation and fluid resuscitation that operate in semiautonomous fashion for a set period of time toward the completion of a specific task. All of these team permutations can be practised and perfected prior to exposing the susceptible patient to unnecessary risk.

No matter the task, teamwork is underpinned by cultural values. In other words, culture influences teamwork, even if it can also be difficult to define, measure or quantify. Culture is commonly understood to be a complex whole that reflects the knowledge, beliefs, customs and habits possessed by a group. Culture is also a series of values that are accepted, generally without question, and are passed along by communication and imitation.[15] Culture usually cannot be dictated, but can be encouraged. Culture affects teamwork because it affects team members' individual and collective behaviour, attitudes and actions. Culture is so powerful that it can even overpower education or the sense of right and wrong.[3,16] Attempting to understand local teamwork culture — both good and bad — is key to effective team training and targeted improvement.

Medical Teams, Old and New

Traditionally, medicine has had a laudable culture based on patient ownership and self-reliance ("the bucks stops here"). The downside of this culture was that we typically focused on the individual agenda more than on team cohesion.[3] As a result of the dominant culture of individualism, we presume that success results from individual efforts and that failure results from individual shortcomings. Quality care has been historically linked to how the solo practitioner performs, and remedies have focused on individual competence.[3,6-9,17] This is not surprising; after all, medical culture mirrors the western culture from which it originated. Similarly, just as western culture is changing, so is medical culture. Therefore, to work in a modern medical team means understanding when our culture helps and when it hinders.[17] A high-functioning team will preserve the best of the old (i.e., dependability, role definition) and safely integrate the best of the new (i.e., inclusion, engagement).

Healthcare teams function within larger organizations and healthcare systems. This is why systems and resources should now be in place that facilitate — or at the very least do not impair — bedside teamwork. Team training should align with organizational goals and should receive meaningful support from all levels of leadership.[11,14] Otherwise, even the best teams will function in isolation or even in opposition. Broad, system-wide support also means that team training can be key to implementing hospital-wide change (e.g., practising handover tools, or introducing a rapid response team). Organizational buy-in can also ensure that team training can carry these skills throughout the health system and that performance is less reliant on individual personalities.[11,18] Engaging leadership in the development and implementation of training not only builds institutional support, but also means that training is more likely to align with that organization's high-level priorities.

Modern acute care is as much about developing team empathy as it is about maximizing individual knowledge or procedural finesse. This is because team members typically fully share their abilities only when they feel it is "safe" to do so and when they understand what is going on. Team members participate in two types of work within teams. The first type is task work, which consists of individual technical processes (e.g., placement of an intravenous line). Task work is complemented by teamwork, which refers to the skills and behaviours that allow teams to work toward a shared common goal.[19] In complex, dynamic systems, individuals are unlikely to have sufficient cognitive resources to resolve a crisis. The team offers shared cognition, mutual support and cross-monitoring. In this way, effective teamwork helps to integrate team- and task-based processes; one without the other is usually insufficient.[20]

We also need to nourish team dexterity or resilience. This means developing norms of interaction strong enough to withstand changing circumstances, locations, stress and fatigue. Resilience in complex systems involves the ability to understand what to expect (understanding of roles, task assignment, integrating cultural norms), what to look for (how and when to declare a crisis), how to respond (the team- and task-based work of medical teams) and how to reflect (by way of debriefing and focused incident review).[21] More specifically, this means the best teams preserve their ability to exchange information, prioritize efforts, coordinate tasks, compensate for each other's weaknesses, and give and receive usable feedback.[5,14,18,22] Accordingly, we should not be surprised that psychologists have identified the most common team failings as deficiencies in assigning roles and responsibilities, holding team members accountable, using check-backs and sharing useable information.[3]

The best medical teams understand what psychologists have known for a long time: good teamwork rarely happens by chance. Furthermore, we often get the teams that we deserve, and afferent effort often explains efferent quality. The best teams are deliberate and are maintained by sustained efforts on many fronts.[11,14] Fortunately, bad teams can be made good; unfortunately, good teams can turn bad. Like most things in medicine, you get out what you put in.

Just as we need to guide team interactions during a crisis, we also need to loosen the reigns once the crisis has abated. For example, it is important to allow the team to relax and have fun together. This is how the team relieves stress, reinforces its camaraderie and maintains its sense of shared mission. Allowing the team to laugh together is not frivolous; it keeps that team resilient heading into the next crisis.[23] There is a real danger that modern healthcare is becoming a humour-free zone. Just as rudeness can be iatrogenic, excessive seriousness and political correctness, however well intentioned, can adversely affect the team.

Practical team skills are discussed further in the leadership, communication, and shared cognition and cross-monitoring sections that follow. Several of these skills are so important that they are covered in detail in other chapters. These attributes can also be difficult to parse. Regardless, they are further outlined here to illustrate how and why we should redouble our efforts to ensure the team is "fit for the task."

Teamwork Competencies

Leadership

Good team leadership can be loosely defined by the degree to which it helps to combat chaos by providing order, structure and oversight.[16] In order to lead effectively, the leader usually takes a central role in communicating priorities and delegating tasks.[18] Both task-focused behaviours (e.g., rescuing the patient) and person-focused behaviours (e.g., maintaining socioemotional aspects of the team) have to be managed and balanced in order to create an effective team environment.[3,16,24]

Task-focused instructions ensure that task work is completed and that roles are defined.[24] However, task assignment is usually determined by profession (e.g., anesthesiologists intubate and surgeons operate).[3] Therefore, these tasks and roles do not usually need to be negotiated. However, if there is the potential for confusion (e.g., both the anesthesiologist and surgeon can insert central lines), effective team leaders will predict and pre-empt (e.g., "Dr. Smith, you intubate; Dr. Jones, you do lines."). Similarly, effective team leaders will provide a cognitive roadmap that includes task priorities (e.g., "Dr. Smith, please wait for Dr. Jones to intubate before you focus on central venous access.").

Because we humans are "social animals," we prefer to have a relationship, however cursory, before we complete a task. Obviously, the time pressures of delivering acute care medicine make this idea of "relationship before task" challenging. As a result, we can identify good team members as those who can still function effectively despite a lack of familiarity. However, as has been emphasized previously, acute care medicine requires more than just bold action. Good leaders also manage the team and any interpersonal crises. This means that, in the short term, good leaders rescue the patient and defuse the interpersonal crisis. Later they take time to understand and heal the team.

Leaders who are "person-focused" promote social relationships, empowerment and a creative exchange with the goal of shaping the team toward a desired common goal. Person-focused leadership behaviours appear to be more effective in increasing team productivity in complex environments. This contrasts with task-focused leadership, which works better in simple environments.[24] Task-focused behaviours are helpful when we need to get simple things done quickly. Person-focused behaviours are helpful in moving beyond the "leader" and "follower" roles and evolving the team into a synchronized thinking machine. Person-focused leadership is appropriate when we need to increase engagement and communication.

Communication

Verbal communication is vital to optimizing high-level teamwork. However, in the face of a crisis, silence is commonplace.[6] During surgery, silence may be "golden," but it rarely is during a team resuscitation. Just as pilots are taught to avoid "black-box silence" during crises, healthcare team members can be taught to routinely announce their intentions, or recap the situation and ask for further input.[6] Once a flow of verbal communication has been established, graded assertiveness and framing of the situa-

tion helps to ensure that verbal communication is heard and understood.[6] Once verbal communication is understood, task completion can be confirmed by closed loop communication, and feedback can be sought.[6] The team leader and members must balance excessive verbal communication with appropriate noise control. This means that we should be quieter during critical events, such as intubation, and we should not take offense if asked to be quiet.

How something is said is as important as what is said. Therefore, the use of mitigating language that "sugar-coats" should be avoided. Communication should be clear and decisive. Furthermore, the onus should be on the speaker to transmit the information rather than on the recipients to decipher it.[6] A 2015 study published in Pediatrics[25] highlighted how profoundly rudeness could worsen teamwork. Neonatal intensive care unit staff undertook resuscitation simulations, but were secretly randomized to receive neutral versus rude feedback from an "external expert" midway through the resuscitation. The rude comments were actually relatively mild given that they did not occur face to face, did not come from someone familiar, were nonsustained and were free of overt aggression or vulgarity. This single alteration (rudeness) was estimated to affect performance more than chronic sleep deprivation. The authors went further and proposed a psychological mechanism for rudeness-induced iatrogenesis. They concluded that rudeness worsened diagnostic performance because it impaired information-sharing and worsened procedural performance because it decreased help-seeking. While this single study needs to be duplicated, the implication is that we should avoid rudeness. Again, we should also work just as hard not to take offense.

Shared Cognition and Cross-Monitoring

A key teamwork strategy is the "shared mental model" (a common understanding, or, in colloquial terms, a sense that everyone is "on the same page").[3] This helps to form a task-focused and people-focused (rather than power-focused or ego-focused) team. This shared cognitive roadmap also helps the team prioritize duties, manage information, establish roles, stabilize emotions and build confidence.[3] Shared cognition can help us anticipate the needs of other team members and could spur innovation when faced with uncommon problems.[4,26] The development of mental models can begin before the resuscitation. For example, in the minute before patient arrival the team can undergo psychophysical rehearsal or mental "warm-up." This can help anticipate and establish early priorities across interprofessional team members.[27]

If time allows, the team leader should invite members to suggest a mental model ("What do you think? What should we do?"). After all, diverse inputs can provide the team with more options.[3,16] However, under time-pressure, the leader needs to rapidly establish a reasonable mental model that members will support ("I believe it is hemorrhagic shock; please do the following.").

The mental model can and should be repeated and revised as the resuscitation progresses, or as more information become available. For example, a team might have

been working under the assumption that the patient was bleeding, but a bedside ultrasound shows right ventricular pressure overload; this team needs to be reoriented to the likelihood that the patient may have a massive pulmonary clot and that the necessary treatment has to change dramatically. Regardless of the clinical example used, the more that mental models overlap, the more likely that team members will predict, adapt and coordinate, even when stressed or dealing with a novel situation.[3,26]

High-performing teams look out for one another. This means that while our primary goal is patient rescue, we must simultaneously attend to the needs of the team. Cross-monitoring includes observing how members react to stimuli, stress and distractions. Similarly, if any single team member is overloaded or inappropriately self-blaming, we must look for ways to compensate. Regular practice and regular debriefs reinforce clinical messages, but they also allow for multiple opportunities to bolster team empathy and cohesion.[28] The goal is to not only practise to the point of reflex, but also to make it abundantly clear that all team members are highly valued.[3]

Training

The best situational awareness (see Awareness and Attention in Acute Medicine chapter) and the shortest reaction time come from practice, exposure and reflection.[16] As a result, medical simulation (whether using high-fidelity simulators, actors, or pre-emptive cognitive imaging) is more than just a trendy teaching tool. Instead, simulation represents a unique, badly needed and safe team-training tool. Simulation is a great way to "learn by doing" and to hone team reflexes. It is also a way to become resilient to stress, to demonstrate the power of the "shared mental model," and to identify fixation errors and cognitive overload.

Medical simulation research is still relatively new, especially when compared to aviation. However, medical simulation training performed in one's actual work environment (in situ simulation) has been associated with the identification of previously unrecognized threats to patient safety. Simulation has also led to practical recommendations to improve systems and infrastructure.[29] In a variety of formats and for trainees from many backgrounds, team training that includes simulation appears to improve both team-based performance and patient outcomes.[13]

Simulation should not be thought of as merely an expensive task-trainer, a luxury or a fad. Instead, a robust simulation program can be a prudent investment in team resilience, staff retention and patient safety. We may also increasingly find low-cost ways to offer high-fidelity team simulation. After all, technology is becoming ever more accessible, and the participants' imaginations are an excellent cost-free simulator. The goal of simulation is to benignly manipulate and, in turn, for team members to eventually, as the author C.S. Lewis famously stated, "do the right thing, even when nobody is watching."

Psychological Cautions

We do not only need more teamwork; we need better teamwork. Not all teamwork is inherently good, and, again, psychology offers cautionary tales.[30] Phillip Zimbardo's infamous Stanford Prison experiment had students assume the roles of prisoners and prison guards. It demonstrated how easily we can be made to assume roles even when they are not beneficial. Though the students were acting, the teams became excessively unruly (the student prisoners) or excessively mean (the student guards).[31]

In a different experiment, Stanley Milgram was able to get people to administer electric shocks to others, further demonstrating our propensity toward unquestioning obedience.[32] Furthermore, Solomon Asch's experiments in which he was able to get experts to give incorrect answers just by having confederates answer incorrectly beforehand show how easily we do things that we know are wrong. In Asch's experiments there was no overt coercion, merely the threat of social embarrassment and reward of social conformity.[33]

The psychologist Leon Festinger[34,35] stated that "man is not a rational animal, he is a rationalizing animal." His research group studied a religious group after their predicted apocalypse did not occur.[34] This episode strengthened rather than weakened the group's irrational beliefs after they concluded their unwavering faith had saved humanity. Festinger also helped introduce the idea of cognitive dissonance: the mental stress or discomfort experienced by individuals holding simultaneously contradictory beliefs, ideas or values.[35] Dissonance causes psychological discomfort; therefore, individuals are motivated to avoid, fight, or refuse information that challenges their sense of self. It means that while we clearly see others' failings, we are often blind to our own.

Working in a team can force an individual to face their shortcomings or dissonance. Socioevaluative stress induced by the fear of being judged by one's peers is a powerful driver of both good and bad behaviour.[36] Therefore, being in a team can mean beneficial conformity and a level of performance superior to that achieved alone. However, the examples discussed in this section show that we are biased toward "group think" and following the majority opinion rather than the most rational.[3,17] Teams can just as easily reinforce false assumptions, denial, intransigence and magical thinking. Teams often amplify individual behaviour and performance for both good and bad. In acute care medicine this means that groups also tend toward greater risk if individuals' initial tendencies were to be risky and toward more caution if individuals were risk-averse.[3,17]

It can be tough to accept that motivated teams are prone to making routine, non-technical mistakes.[16] This acceptance may be even harder once we consider all of medicine's remarkable technical advances. However, humans evolved as social beings and are therefore highly susceptible to social foibles and pressures.[3,16] We resort to behaviours that worked well during our evolutionary past, especially during crises.[16] In fact, high-functioning teams can be partially defined by the degree to which they exploit the best of our primitive crisis behaviour and protect against our shortcomings. For example, good leaders can capitalize on our propensity toward obedience during a crisis

by raising their voices. Because of cognitive dissonance, insightful team leaders know that once a majority of team members have formed an opinion they usually stick with it despite contradictory information.[3] As a result, a good team leader will deliberately and routinely challenge assumptions.

Summary

This chapter demonstrates that without effective teamwork high-quality modern healthcare is largely impossible. In addition, part of being an expert in acute care means understanding the psychological underpinnings of team success and team failure. Good teams needs good leaders, which means understanding and guiding human performance at the level of the individual, the team and the overriding culture.

Teamwork does not need to be left to chance. Like other aspects of crisis resource management, teamwork should be deliberately taught, routinely practised and rigorously studied. In the short term we need to rapidly adopt the best strategies from other high-stakes professions and high-performing teams. Over the longer term we need to grow our own science of medical team excellence. It remains to be seen whether we have the courage to protect the best of our traditions and the humility to evolve.

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This picture is intended for reflection. This resuscitation is going to complex and requires mastery of all of the topics discussed in this book; awareness and attention (because of the difficult airway), decision-making (what to manage first), communication (complicated by the wearing of masks), task management (concomitant rather than sequential management of the A,B,Cs), leadership and followership (who needs to speak up and who needs to listen up) and teamwork (how do we put it all together).

Figures and Diagrams

The aim of this book is simple, yet profound: to improve acute care patient safety by enhancing performance during medical crises and by developing better healthcare providers and teams. It includes both theoretical underpinnings and practical insights. This is because the unique demands of acute care mean that we need to increase not only understanding, but also the likelihood of patient rescue and the resilience of healthcare professionals. This book, coauthored by experts from the clinical and behavioural sciences, is concise in size but ambitious in intent.

Evidence is increasingly showing that our ability to manage the crisis matters just as much as factual recall or manual dexterity. This practical book equips clinicians with not only the basics, but also a more sophisticated understanding of six central crisis resource management skills: attention and awareness, decision-making, verbal communication, task management, leadership and followership, and teamwork. We are not offering a one-size-fits-all model, because the inherent complexity of acute care requires more. We offer this practical book to protect and to strengthen our valued patients and colleagues.

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