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Teamwork in the Intensive Care Unit

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Abstract

Intensive care units (ICUs) provide care to the most severely ill hospitalized patients. Although ICUs increasingly rely on interprofessional teams to provide critical care, little about actual teamwork in this context is well understood. The ICU team is typically comprised of physicians or intensivists, clinical pharmacists, respiratory therapists, dieticians, bedside nurses, clinical psychologists, and clinicians-in-training. ICU teams are distinguished from other health care teams in that they are low in temporal stability, which can impede important team dynamics. Furthermore, ICU teams must work in physically and emotionally challenging environments. Our review of the literature reveals the importance of information sharing and decision-making processes, and identifies potential barriers to successful team performance, including the lack of effective conflict management and the presence of multiple and sometimes conflicting goals. Key knowledge gaps about ICU teams include the need for more actionable data linking ICU team structure to team functioning and patient-, family-, ICU-, and hospital-level outcomes. In particular, research is needed to better delineate and define the ICU team, identify additional psychosocial phenomena that impact ICU team performance, and address varying and often competing indicators of ICU team effectiveness as a multivariate and multilevel problem that requires better understanding of the independent effects and interdependencies between nested elements (i.e., hospitals, ICUs, and ICU teams). Ultimately efforts to advance team-based care are essential for improving ICU performance, but more work is need to develop actionable interventions that ensure that critically ill patients receive the best care possible.

Keywords

Teamwork; performance; critical care; patient care; collaboration

Teamwork in the Intensive Care Unit

The intensive care unit (ICU) is a specialized hospital unit dedicated to the care of patients requiring life-support and those at extremely high risk for organ failure and death. Approximately 5.7 million individuals are admitted to an ICU in the United States each year (Barrett, Smith, Elixhauser, Honigman, & Pines, 2011). ICUs care for the most severely ill hospitalized patients, and in doing so are one of the most resource demanding and stressful areas of the hospital. The field of critical care medicine has embraced a standard whereby care is provided by an interprofessional team of clinicians (Weled et al., 2015). Under such a model, intensivists (i.e., physicians with specialized training in intensive care medicine) or other types of attending physicians collaborate with and capitalize on the interprofessional

expertise of bedside nurses, respiratory therapists, clinical pharmacists, dieticians, and clinical psychologists (Durbin, 2006).

Recent shifts toward interprofessional care have resulted in lower morbidity and mortality rates among ICU patients (Curtis et al., 2006). However, little about actual teamwork in the ICU is well understood. Few existing studies focus on the form and function of interprofessional collaborations among critical care clinicians or provide insight as to how these relationships influence team performance. As a result, critical care providers lack guidance on how to leverage team function in order to improve patient outcomes and reduce health care costs in the ICU. In this review we address this gap by synthesizing extant research on teamwork in the ICU and providing a roadmap for future research in this domain. First, we describe the extent to which ICU teams are similar to and yet distinct from teams in other organizational contexts. Second, we review the existing research on team performance in the ICU. Third, we highlight key areas for future study, including outcome indicators that reflect effective team processes.

Characteristics of Intensive Care Teams

The social scientific definition of a team is “a distinguishable set of 2 or more people who interact dynamically, interdependently, and adaptively toward a common and valued goal/object/mission, who have each been assigned specific roles or functions to perform” (Salas, Dickson, Converse, & Tannenbaum, 1992, p. 4). When defined in this manner, effective team performance is contingent upon *conflict, cooperation, coordination, coaching, communication,* and *cognition* between team members (Salas, Shuffler, Thayer, Bedwell, & Lazzara, 2015). Analogously, team-based medicine refers to care that requires the expertise and coordinated efforts of two or more clinicians. Successful ICU teams are able to exchange information and work together on some shared goal or task, such as managing an artificial respirator, providing intravenous sedation to keep patients comfortable, or dealing with the emotional distress of family members whose loved ones are critically ill.

There is no single defining feature that makes the ICU a unique context for collective behavior; rather, ICU clinicians face a combination of specific structural and situational demands that differentiates them from members of other organizational and healthcare teams. These include but are not limited to differences in the lifespan of ICU teams and the physical and emotional challenges faced by those working in the ICU (e.g., Salas et al., 2015). With regard to lifespan, ICU teams are low in temporal stability in that the identity of individual team members changes from day to day (Alexanian, Kitto, Rak, & Reeves, 2015; Andreatta, 2010; Hughes et al., 2016). Yet unlike other health care teams that are low in temporal stability, such as cardiac resuscitation teams or trauma teams, the tasks for ICU teams are longer in duration than the life of each team. For example, a single patient might spend 14 days or longer in an ICU, during which time team composition and related dynamics are in flux (Wildman, Shuffler, Lazzara, Fiore, & Burke, 2012).

ICU teams function in spite of low temporal stability because the persons fulfilling each position are expected to bring shared knowledge about caring for critically ill patients and shared expectations about their specific roles in the ICU (Alexanian et al., 2015). Formal and informal hand-off processes also contribute to team functioning in this setting of variable

team membership. Formally, hand-off protocols can improve the efficiency and effectiveness of face-to-face communication during shift changes, reducing errors, improving continuity and reducing uncertainty about patient goals of care (Patterson, Roth, Woods, Chow, & Gomes, 2004). Informally, unstructured handoffs (Ong, BiomedE, & Coicera, 2011) and electronic health records that, if properly maintained, allow clinicians to access, update, and manage patient information, contribute to continuity of care (Hoover, 2017).

ICU teams are also distinguished by the unique physical and emotional constraints that affect team performance. With regard to the physical environment of the ICU, near constant alarms, uneven lighting, poorly placed equipment, and space limitations mean that the physical environment is at best not helpful and at worst harmful to the goals of team-based critical care (Alameddine et al., 2008; Salas, Cooke, & Rosen, 2008; Shortell et al., 1994; Xie & Carayon, 2015). Perhaps in response to the substantial variation that exists in the use of physical space, as well as the recognition that many hospitals and ICUs do not use space optimally, hospital and ICU design is a burgeoning area of multidisciplinary research (e.g., Rashid, 2006; Thompson et al., 2012). Early results from this research suggest that open floor plans, easy circulation around the patient's bed, clear lines of sight between nursing stations and rooms, and single-patient rooms can improve communication and family satisfaction with care (Kesecioglu, Schneider, van der Kooi, & Bion, 2012).

With regard to the emotional constraints, death and dying is a daily occurrence in the ICU, forcing the team to function in a highly charged emotional environment characterized by persistent grieving and moral distress (Embriaco, Papazian, Kentish-Barnes, Pochard, & Azoulay, 2007; Henrich et al., 2016). Despite having access to support, emotional distress is common among care providers and spreads easily to other team members, which can increase collective anxiety and reduce team performance (Picquette, Reeves, & LeBlanc, 2009).

These unique characteristics of ICU teams have several implications for critical care. First, effective communication is a necessity. In this context, effective communication refers to the ability to transfer information, ideas, and opinions across team members with widely varying backgrounds, experiences, and skill-levels (e.g., Reader, Flin, Mearns, & Cuthbertson, 2009). Second, ICU team members must trust in others' knowledge, skills, and training so that teams can perform in high stakes situations despite little or no shared history (Hughes et al., 2016; Wildman, et al., 2012). Third, team leadership should balance authority with inclusiveness while establishing shared goals and fostering sense of shared responsibility for patient care (Fernandez & Grand, 2015; Manthous & Hollingshead; 2011; Manthous, Nembhard, & Hollingshead, 2011). In order to facilitate team learning and foster a sense of psychological safety, ICU team leaders must talk openly about mistakes and difficulties in order to create a culture where there is no fear of retribution for clear and candid communication about potential problems (e.g., Edmonson, 2012).

Team Performance in the Intensive Care Unit

The goals of ICU teams are multifold. In most published research, patient outcomes in general, and mortality rates specifically, are the most common metric of ICU team performance. Although mortality rates are a commonly used performance metric, they are

not necessarily the best indicator of success considering that end-of-life care is a primary treatment administered in the ICU. The goal of end-of-life-care is to agree upon desired outcomes and achieve *realistic* goals of care; yet many of these decisions are complex (i.e., many factors must be considered by families and care providers) and sometimes even controversial, which can complicate coordination of care (e.g., Cook & Rocker, 2014).

Thus, mortality should not be the only indicator for determining successful ICU team performance. Other goals include but are not limited to improving health-related quality of life among ICU survivors, improving the quality of death and dying among ICU decedents, acting as efficient stewards for health care resources by avoiding waste, and tending to the needs of family members with loved ones in the ICU. However, understanding team performance is complicated by the fact that these goals do not always align. For example, heroic efforts to save lives are costly, necessitating time and expensive technology. In contrast, early deaths are inexpensive. In this way, an ICU team with high performance along the domain of mortality can be a low performer along the domain of costs. These tensions have several implications for how we understand ICU team performance. First, it is difficult to characterize effective teams, in that high performance along one domain does not necessarily translate to high performance along another domain. The challenge for efforts to improve ICU teamwork, then, is to identify not only what kinds of processes or interventions could improve specific outcomes, but also to elucidate boundary conditions and unintended negative consequences of different practices. Second, it demonstrates the need for ICU teams themselves to define their goals and agree upon their prioritizations. Goal priorities will vary from patient to patient within a single day and over time, and to the degree that ICU teams do not a priori agree on the goals for a given patient, team performance can never be optimized.

Acknowledging the issue of competing goals, in the following sections we review the literature on ICU team performance with a focus on risk-adjusted mortality rates, as mortality is by far the most commonly employed performance metric in the literature. For clarity, we also focus on studies examining adult general, non-specialty critical care, although the issues we discuss also apply to specialty units such as neonatal ICUs, pediatric ICUs, and neurological ICUs.

Team Composition—ICU teams are typically composed of an intensivist physician, a clinical pharmacist, a dietician, several respiratory therapists and bedside nurses, and other health care providers such as clinical psychologists. The intensivist, a physician with specialized training in critical care medicine, is the leader of the team and has ultimate responsibility for medical decision-making. An extensive body of literature demonstrates that the presence of an intensivist as team leader as opposed to a physician without specialty critical care training, is associated with lower mortality (Wilcox et al., 2013), yet little is known about the underlying reasons for this observation. The conventional wisdom is that intensivists bring experience and expertise in the care of critically ill patients that non-intensivist physicians do not possess, which may lead to improve leadership skills and improved team performance (Cooke et al., 2008; Kahn, Brake, & Stenberg, 2007).

Current professional guidelines recommend intensivist-led care for all ICU patients, although not all ICUs in the United States conform to this standard (Weled et al., 2015). One reason for such variability is that over the past decade the interprofessional care model has also become more prevalent (Kohn et al., 2017). Patient care under this model relies on collaborations from experts from various domains (e.g., respiratory therapy, clinical pharmacy, critical care nursing, clinical psychology) in the ICU. With the increasing popularity of the interprofessional care model, the value of an intensivist appears to be decreasing, as interprofessional providers have gained expertise and are able to take a more active role in caring for patients, thus diffusing medical decision-making responsibilities across members of the care team. In addition, the increased use of protocols and other communication tools has lessened the need for intensivist-led care (Costa, Wallace, & Kahn, 2015; Kohn et al., 2017; Wilcox et al., 2014; Yoo, Edwards, Dean, & Dudley, 2014).

Clinical pharmacists provide unique expertise on drugs that are the cornerstone of ICU treatment. Drug administration and dosages can be highly influential on patient outcomes, and intensivist physicians might not possess all of this information at the ready. Data demonstrate that the presence of a clinical pharmacist in the ICU is associated with lower adverse drug events and improved patient outcomes (Kane, Weber, & Drasta, 2003; Leape et al., 1999; Rivkin & Yin, 2011; Stone et al., 2011).

Dieticians provide unique expertise for patients' nutritional needs, and must account for the problem that feeding protocols are often contingent upon other therapies (Cahill, Dhaliwal, Day, Jiang, & Heyland, 2010). For example, when and how patients are provided nutritional support is in part determined by whether they are placed on a ventilator, their level of alertness, and their immune system functioning. Therefore, dieticians must collaborate with all members of the ICU team to ensure that patients receive adequate and timely nutritional support.

Respiratory therapists typically oversee the provision of mechanical ventilation, which is the central supportive therapy for patients experiencing respiratory failure and among the most common ICU treatments (Netzer et al., 2011; Stamm, 2005). Although the provision of mechanical ventilation is collaborative by nature, respiratory therapists possess unique expertise and experience in how to operate the ventilator, and, like pharmacists, their involvement in care is associated with lower mortality in the ICU (Ely et al., 1996).

Nurses are, among other things, responsible for closely monitoring and reporting changes in patients' health and wellbeing (Baggs et al., 1999; Knoll & Lendner, 2008). Unlike other members of the ICU team who care for most if not all patients at any given time, nurses only care for a subset of patients, typically no more than two at any one time. Yet nurses are central members of the ICU team because they are directly involved in nearly all ICU treatments, in that they are responsible for assessing vital signs, delivering drugs, and monitoring for complications of therapy. Greater nursing education and expertise is associated with lower mortality among ICU patients (Kelly, Kutney-Lee, McHugh, Sloane, & Aiken, 2014).

When available and able to join the care team, clinical psychologists and other behavioral healthcare specialists play a unique role in that they specifically address patients' psychological recovery and they provide care for patients, families, *and* critical care providers. Particularly noteworthy is that patients who receive care by a clinical psychologist have lower rates of anxiety, depression, and post-traumatic stress following admission to the ICU (Nova & Ballesteros de Valderama, 2006; Peris et al., 2011).

Some team members might be in training to become critical care providers, and may come from any of the above disciplines. Most common are physicians-in-training (i.e., medical students, interns, residents, and fellows), and advanced practice providers (APPs) who are nurse practitioners and physician assistants being trained to perform many of the same tasks as an attending physician. The presence of clinicians-in-training is positively associated with role clarity, as well as the frequency and quality of information exchanges among ICU team members (Hawryluck, Espin, Garwood, Evans, & Lingard, 2002; Joffe, Pastores, Maerz, Mathur, & Lisco, 2014; Valentin & Ferinande, 2011, but see Almoosa, Goldenhar, Puchalski, Ying, & Panos, 2010; Costa, Wallace, Barnato, & Kahn, 2014). And, while there has been some concern that reliance on nurse practitioners and physician assistants in training might negatively impact patient outcomes, findings suggest that this is not the case (e.g., Costa et al., 2014).

Each of the clinician types possesses a diverse array of knowledge acquired through different training pathways. In turn, each possesses unique skills, jargon, and status within the team (Alexanian et al., 2015; Azoulay et al., 2009; Ferrand et al., 2003; Kho, Carbone, Lucas, & Cook, 2005). These differences can improve the quality of care but can also lead to ineffective interprofessional interactions and conflict among the clinicians. These interprofessional conflicts tend to be multifactorial, making them difficult to solve. Importantly, unresolved conflict can impede open exchanges of information and reduce appreciation of one another's expertise (Mitchell, Parker, Giles, & Boyle, 2014; Wright, Bowkett, & Bray, 1996), which delays and reduces the quality of patient care (Azoulay et al., 2009; Lindgard, Epsin, Evans, & Hawryluck, 2004; Ten Have & Nap, 2014; Wysham et al., 2017).

In the modern ICU, family members are increasingly considered to be part of the ICU team, especially when they take on the role of surrogate decision makers for loved ones who are too ill to advocate for themselves. The practice of family participation on medical rounds has received the most attention in this area, with data suggesting that while rounds are traditionally viewed as a forum for collaboration among clinicians, they can also be used for collaboration with family members, including information exchanges and reducing decisional conflict (Davidson et al., 2017). However, some clinicians feel that family presence can disrupt important communication processes (Jacobowsky, Girard, Mulder, & Ely, 2010; Reeves, et al., 2015; Santiago, Lazar, Jiang, & Burns, 2014). For instance, clinicians have expressed reluctance to engage in candid discussions about patient prognoses while in the presence of family members (Au, des Ordons, Soo, Guienguere, & Stelfox, 2016; Azoulay et al., 2009; Huffines et al. 2013; Maxwell et al., 2007).

Team Collaboration and Decision Making—The foundation of ICU team collaboration and decision-making is daily rounds. Rounds are the formal, daily face-to-face meetings that are attended by most if not all of the ICU clinicians that are directly involved with patient care (Hawryluck et al., 2002). On rounds each ICU patient is discussed either at the bedside or in another area such as a hallway or conference room. As a conduit for team processes, rounds provide a context for critical care providers to share information and engage in shared decision-making processes. Rounds also serve as a platform for clinicians to share their experiences and advice concerning critical care more broadly, such as sensitive issues regarding patient and family communication, strategies for dealing with difficult situations, and to provide other forms of psychosocial support (Lown & Manning, 2010). Rounds are typically structured such that clinicians work systematically through all of the patients admitted to the ICU on a given day, meaning that as the team moves through the ICU, team member rotate in and out of the discussion such that the composition of the team varies from patient to patient.

Due to their ephemeral nature, collaborative information sharing during rounds is a difficult endeavor. Effective rounds allow clinicians to openly exchange information about patient care, which should result in fewer knowledge- and/or training-related errors (Hawryluck et al., 2002; Kim, Barnato, Angus, Fleisher, & Kahn, 2010; Montague, Lee, & Hussain, 2004). Yet rounds are frequently interrupted by phone calls and clinical emergencies, which disrupts flow and increases the amount of time clinicians spend during rounds, thereby limiting the time left in the day to care for patients or communicate with family members (Alverez & Coicera, 2005; Fackler, Watts, Grome, Miller, Crandall, & Pronovost, 2009; Giri et al., 2013; Hawryluck et al., 2002; Ward, Read, Afessa, & Kahn, 2012). Clinicians will often compensate for anticipated interruptions by withholding information during rounds to speed up the process, which can increase the efficiency yet the decrease the effectiveness of rounds as a communication tool (Costa et al., 2014).

While rounds represent formal communication procedures in the ICU, informal information sharing and decision making will often take place between small subsets of members of the team throughout the day (Alexanian et al., 2015; Costa et al., 2014). These types of informal interactions are particularly prevalent when (a) rounds are not conducted in a timely manner, (b) family member presence makes clinicians reticent to discuss negative patient prognoses or other sensitive information, and (c) clinicians are unsure of their positions and/or lack the psychological safety needed to speak up in the presence of other team members during rounds. While informal discussions cannot be avoided altogether, they are problematic in that they perpetuate information gaps among care providers.

Checklists and Protocols—To overcome barriers to effective formal and informal collaboration, many ICUs have developed communication and decision-making strategies to facilitate team functioning and performance. For example, many ICUs have implemented checklists or daily goal forms to promote effective communication among clinicians (Gawande, 2009). These tools systematize the ways that clinicians discuss key treatments, and provide structure and guidelines for interactions that should establish shared goals of care and clarify clinicians' roles. Checklists and protocols are meant to streamline care, which is an important consideration in that many critical care providers report time

constraints as one of the biggest challenges to providing high quality care (Azoulay et al., 2009; Dodek & Rabound, 2013; Narasimhan, Eisen, Mahoney, Acerra, & Rosen, 2006; Idahosa & Kahn, 2002; Pronovost et al., 2003; Ward et al., 2013; Weiss et al., 2011). However, implementation of these tools can be time consuming and reduce complex decisions to rote processes, which can lead to fatigue. These types of protocols also do consistently improve patient outcomes (Writing Group for the CHECKLIST-ICU Investigators and the Brazilian Research in Intensive Care Network, 2017).

Other Determinants of ICU Team Performance—ICU team performance is determined not only by effective coordination and conflict management, but also by organizational and environmental characteristics exogenous to team processes and protocols. As suggested by the existing literature, team formation and rounding processes appear to be the most consequential factors to consider for influencing team performance, and therefore the likely levers for change to be targeted by future interventions.

First, with regard to staffing decisions, our takeaway from the research is that it is not necessarily whether an ICU has an intensivist present that is at issue, but rather the extent to which a team leader is able to help overcome barriers to effective communication that are inherent in interprofessional and interdisciplinary teams. Having an intensivist lead the ICU team might help mitigate problems associated with status differences and jargon unique to a clinician's specialty, and to provide role and goal clarity (Hawryluck et al., 2002; Kim et al., 2010), but there may be other ways to address these processes that do not require an intensivist on the team.

Second, rounding processes represent the time when ICU teams are most "team like," in that most members are present and have the option to speak up during rounds, and shared goals can be established and/or maintained. As such, we believe that practices that facilitate effective problem solving and the establishment of psychological safety during rounds will have positive carryover effects as team members interact throughout the day. Thus, interventions aimed at improving ICU team functioning should target team-level behaviors that influence communication, conflict, and group decision-making during rounds.

Future Directions

Improving ICU teams will require research and quality improvement efforts that draw directly from the team science literature, which can provide relevant theories and concepts that will elicit a better understanding of whether and how various psychosocial factors develop and influence team effectiveness over time. Extant studies predominantly focus on leadership and psychological safety, but many other theories and concepts potentially apply to ICU teams. For example, conflict can have either positive or negative effects on team performance depending on situational and team factors (De Dreu & Weingart, 2003; de Wit, Greer, & Jehn, 2012). Yet little is known beyond the fact that (a) nurses and intensivists report engaging in the most conflict (e.g., Azoulay et al., 2009), and (b) nurses engage in a fair amount of (negative and sometimes abusive) conflict with other nurses (Alspach, 2007). Future work on ICU teams should examine different sources of conflict (Cronin & Weingart, 2007) as well as the frequency, intensity, and expression of different types of conflict

(Weingart, Behfar, Bendersky, Todorova, & Jehn, 2015) in order to determine more effective ways to manage conflict in the ICU.

Another issue that currently lacks resolution is how precisely to define an ICU "team." At one extreme, the most inclusive characterization would define the team as all ICU staff, to include administrators and those only indirectly involved with patient care. However, such a definition ignores important interdependencies among clinicians who work together to provide direct care for patients, and discounts temporal dynamics related to team composition (Shortell et al., 1994). At the other extreme, a minimal definition would characterize an ICU team as two clinicians working together to provide a given treatment to a given patient at a particular point in time. By this definition, though, ICU teams are probably too transitory to warrant attempts to make generalizations across teams or ICUs. Future research should consider linking daily team composition (of those directly involved with the care of a given patient) and related dynamics to quality care indices and patient outcomes over time. The literature on multiple team membership could inform this research (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; O'leary, Mortensen, & Woolley, 2011) and make for an exciting new research direction that informs our understanding of ICU team functioning and multiple team membership more generally. An alternative but equally fruitful approach could apply network analysis to evaluate dynamics of critical care providers and ICU teams as parts of a larger multi-team system (Poole and Contractor, 2012).

Finally, efforts to reconcile the varying and often competing measures of ICU team effectiveness and performance is needed. Considering the increased reliance on team-based care in the ICU, it is paramount that we continue to elucidate connections between the team processes and patient-, family-, ICU-, and hospital-level outcomes. Moreover, risk-adjusted mortality alone does not allow the identification of how to leverage the team when accounting for the varying and sometimes contradictory goals of these stakeholders. Reader et al. (2009) offered a model to categorize and test the impact of team inputs and processes on different ICU team outcomes. An adapted version of this model can help account for different ways the *team* will influence and can produce optimal levels of patient satisfaction and quality care, or lower staff burnout and turnover, health care costs, or one of the many other potential outcomes of interest.

For the most part we have refrained from commenting on interventions, as thorough reviews on medical teams are available elsewhere (e.g., Hughes et al., 2016), and we are somewhat agnostic as to whether unique features of the ICU enable the generalization of that work to teams in this domain. Furthermore, most of the critical care research to date is focused primarily on academic medical centers. Due to idiosyncrasies and differences across community samples, we also know little about how teamwork might operate differently within these settings. Nevertheless, the ultimate goal we share with others is to understand how to provide better team-based care and intervene with informed evidence-based practices when necessary.

In the meantime, both clinical psychologists and researchers in the field of psychology can approach the ICU as an opportunity to extend our understanding of team functioning in

health care, one in which the existing research demonstrates the importance of role clarity, psychological safety, and leader inclusiveness in teams that are both highly hierarchical and low in temporal stability. With extremely high stakes, not only for patients at risk of death and disability but also family members and providers at risk for psychological distress and burnout, the team is likely to play an increasingly vital role in ensuring the ICU meets its goal of saving lives by ensuring that critically ill patients receive the best care possible.

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