Tom W. Reader, Rhona Flin and Brian H. Cuthbertson
Team leadership in the intensive care unit: the perspective of specialists

Article (Accepted version)
(Refereed)

http://eprints.lse.ac.uk

Team Leadership in the Intensive Care Unit: The Perspective of Specialists

Tom W Reader PhD*, Rhona Flin PhD**, Brian H Cuthbertson*** MD FRCA,

* Institute of Social Psychology, London School of Economics, Houghton Street, London, UK, WC2A 2AE

** School of Psychology, University of Aberdeen, Kings College, Aberdeen, Scotland, UK, AB24 2UB

*** Department of Critical Care Medicine, Sunnybrook Health Sciences Centre, Toronto, 2075 Bayview Avenue, Toronto, Canada

Short title: Team Leadership in the ICU

Name of institution where worked performed: University of Aberdeen, Aberdeen Scotland, UK.

Address for correspondence: Dr Tom Reader, Institute of Social Psychology, London School of Economics, Houghton Street, London, UK, WC2A 2AE

Phone +44 7955 7712; Fax +44 20 7955 7565; E-mail t.w.reader@lse.ac.uk

Objective: To identify the behaviours senior physicians (e.g. specialists, staff attendings) report using to lead multidisciplinary teams in the intensive care unit (ICU).

Design: Semi-structured interviews focussing upon team leadership, crisis management, and development of an environment that enable effective team performance in the ICU.

Setting: Seven general intensive care units based in NHS hospitals in the UK

Participants: 25 senior Intensive Care Medicine physicians

Measurements: Responses to a semi-structured interview were transcribed and subjected to 'theoretical sampling' analysis. The interview analysis focussed on references to the 'functional' behaviors used by leaders to manage team performance, and the 'team development behaviors' used to build the conditions that enable effective team performance. Seven of the interviews were coded by a second psychologist in order to measure inter-rater reliability.

Main results: Inter-rater reliability (Cohen's kappa) was acceptable for both scales ($\kappa = 0.72$ and $\kappa = 0.75$). In total, 702 functional leadership behaviours (behaviours for information gathering, planning and decision-making, managing team members) were coded as being used to manage the ICU, along with 216 team development behaviours (for providing team direction and establishing team norms). These behaviours were grouped together in a theoretically driven framework of ICU team leadership.

Conclusions: ICU senior physicians report using a variety of leadership behaviours to ensure high-levels of team performance. The data described in this study provide insight into the team leadership behaviours used by ICU team leaders, and have implications for the development of team leadership training and assessment tools.

Team leadership refers to the actions undertaken by a team leader to ensure the needs and goals of a team are met (1). Team leadership is distinct from organisational or strategic leadership (2), and a team leader can be characterised as the individual(s) engaged in, and responsible for, guiding a team through its work cycle (1). Psychology research shows the skills and behaviours of team leaders (e.g. for defining goals, setting expectations, monitoring teamwork) to predict team performance in experimental and work settings (2-8). In the intensive care unit (ICU), team leadership is crucial for determining the extent to which teams provide co-ordinated and safe patient care (figure 1) (9-13). Senior ICU physicians (e.g. specialists, staff attendings, or consultants) are usually identified as the team leader due to their formal responsibilities for providing patient care, although other team members (e.g. fellows and nursing staff) may also demonstrate leadership behaviours (14, 15). The importance of leadership in the ICU is acknowledged by current training systems (e.g. the Competency Based Training programme in Intensive Care Medicine for Europe (CoBaTRICE) programme (16)). However, there is only limited research on the specific skills and behaviours that constitute, and are indicative of, effective team leadership in the ICU (12), and there is a need to integrate healthcare leadership research with psychology theory (17). Other high risk industries have identified important leadership behaviors in granular detail so to build detailed training programmes (18-20), and such research would be informative for developing ICU team leadership training and assessment tools.

INSERT FIGURE 1 HERE

This article aims to capture in detail the behaviours used by ICU team leaders to lead teams during both normal and emergency situations (termed *functional leadership behaviours* (21, 22)), alongside the behaviours taken to create conditions that enable effective team performance (termed *team development behaviours* (21, 23, 24)). These behaviours are particularly relevant for the ICU. For example, senior physician' information gathering activities (e.g. reviewing patient notes, discussions with nursing staff), decision-making processes (e.g. during emergency scenarios), and support of team members (e.g. supervising trainees) are functional leadership behaviours important for ICU team performance (12, 25-27). Senior physician' team development behaviours such as developing team norms (e.g. a culture of open communication) and shared team goals are also important for safety (12, 28). We aim to develop a framework of the leadership behaviours used by ICU team leaders to guide their teams in providing safe and effective patient care.

MATERIALS AND METHODS

Participants

All senior ICU physicians (UK consultants) from 7 hospitals (two District General and five University hospitals) in the UK were contacted by letter to volunteer for the study (n=41). In total, 25 agreed (60%). On average, they had been in position for 11 years (range 1 to 25 years), with 22 males and 3 females. Ethical approval was given by NHS research ethics committee.

Design

A semi-structured interview applying a variation of the critical incident technique was used (29). Experts are asked to describe their behaviours during a complex task where they performed effectively. Insight is gained into the specific skills and behaviours underpinning successful task performance. The interviews focused on leadership behaviours used by senior physicians to lead ICU teams during routine and emergency phases of work.

Team leadership theory

Current team leadership theory guided interview protocol design and data analysis (21-23). This literature shows team leaders to use *functional leadership behaviours* to influence team performance as a task is performed, and *team development behaviours* to develop the conditions/environment within which team members will perform effectively. Table 1 defines and lists the categories of behaviour that underpin each dimension of team leadership.

Interview protocol

Industrial psychologists and intensive care specialists developed the interview schedule (see appendix 1). The interview content was influenced by interviewing principles (30, 31), previous ICU leadership research (9, 12), and team leadership theory (21, 22, 23, 32). Minor changes to the schedule were made after piloting. The interview structure was as follows:

- Phase 1. Interviewees described a routine day in ICU, focussing on how they led the ICU team to provide effective patient care.

- Phase 2. Interviewees recalled a critical event in ICU, and described the scenario, the team's performance, outcomes, and their leadership of the team.

- Phase 3. Interviewees discussed the general leadership skills or behaviours they thought important for producing effective (or ineffective) team performance.

The interview protocol included open-ended or direct questions, and additional generic prompts were used to spontaneously elicit information (e.g. 'how did you communicate this?', or 'what indicated this to you?'). The interviews were conducted by a single interviewer (TR). All interviews were digitally recorded and transcribed verbatim for analysis.

Analysis of interviews and coding reliability

Interviews were analysed using content analysis (30), whereby transcripts are analysed using an *a priori* framework to identify whether the interview captures concepts of interest. Coders applied the following analysis procedure, with each interview transcript being:

1. Read without notes being made.

2. Analysed to identify and code statements referring to functional leadership behaviours (table 1).

3. Analysed to identify and code statements referring to *team development* behaviours (table 1).

All interviews were coded by a single coder (TR), with a randomly selected sample of 7 interviews being independently coded by a trained Human Factors psychologist. An acceptable level of inter-rater reliability using Cohen's kappa co-efficient (33) was found between coders for statements relating to functional leadership behaviours ($\kappa = 0.72$) and team development ($\kappa = 0.75$).

RESULTS

Senior physicians (n=25) described the medical team as a hierarchical structure consisting of themselves, and senior and junior trainee physicians. The nursing team was described as a hierarchical structure of senior and bedside nurses. Although senior physicians described leading the ICU team, the overlap between medical and nursing teams was not always clear. Furthermore, support staff were often considered part of the wider ICU team. The senior physicians focussed mainly on their leadership of the medical team, although interactions with nurses were discussed.

All interviewees discussed a 'unit assessment' phase at the beginning of a standard day in ICU. Most senior physicians (n=21) described conducting an initial informal brief assessment on arrival, when they identified new patients, made ad-hoc management plans, met team members, and initialised urgent treatments. All senior physicians referred to a subsequent in-depth 'unit assessment' phase (i.e. the morning round) where patient information was collected from team members, diagnoses formed, care plans and

contingencies formalised with trainee doctors, teaching performed, and tasks delegated. Most interviewees (n=24) described a transition from an 'in-depth' to an 'ongoing' assessment phase as the day progressed, whereby they monitored the progress of patient management plans, intervened when problems arose, or adapted plans according to changing circumstances. For interview phase two, 21 senior physicians described an emergency scenario they had experienced in the ICU, and described their leadership of the team. Cases focused on sudden haemorrhages, resuscitations, major surgical complications, septic shock, cardiac arrests, drug overdoses, trauma victims, and sudden influxes of patients to busy ICUs. Three interviews focussed on non-ICU critical events, and one collected no second phase data (these interviews were removed from analysis of phase 2 data). Finally, all interviewees described the general leadership skills or behaviours they thought represented effective or ineffective team leadership.

Table 2 shows the number of statements made by senior ICU physicians that referred to behaviours within the functional leadership or team development dimensions (by interview phase). Most references were to functional leadership behaviours (76.5%).

INSERT TABLE 2

Functional Leadership Behaviours

References to functional leadership behaviours were made during interview phases 1 and 2 (99%). Half of all 702 references (48%) were to behaviours for 'managing team members'. Of behaviours relating to a routine day (phase 1), 29% referred to information

gathering, compared to 18% for critical events (phase 2). References to 'managing materials' accounted for just 3% of all behaviours, and this category was excluded from further analysis. Of the specific functional leadership behaviours discussed, some were described by all interviewees (e.g. delegating tasks and tailoring instructions to the skills and knowledge of trainee staff), by a subset (e.g. 8 interviewees described applying prepared contingency plans in response to patient deteriorations), or by a single interviewee (e.g. thinking aloud when gathering information). Furthermore, behaviours appeared specific to phases of work, for example developing patient plans ('planning and decision-making') during unit assessments (n=25), checking patient plan progression ('information gathering') whilst monitoring the ICU (n=22), and assuming decision-making authority ('managing team members') during emergencies (n=14).

Table 3 synthesises and lists the functional leadership behaviours described by senior physicians. The focus is on behaviours discussed by more than one interviewee (i.e. commonly used strategies), although behaviours discussed by a single interviewee were included if there was sufficient rationale (e.g. consistency with the leadership literature). To produce a concise list, similar behaviours were combined (e.g. the various indicators used to assess whether trainee doctors required assistance). Finally, it should be noted that the leadership behaviours in the framework are not weighted according to their prominence in the interviews, nor is the framework intended to be linear.

INSERT TABLE 3 HERE

Team development behaviours

Of the 216 references to team development behaviours, 62% were made in relation to a routine day (interview phase 1), and 33% when discussing general leadership skills (phase 3). Over a third (41%) related to behaviours aimed at establishing team norms. Virtually no references (1%) were made to behaviours for 'providing organisational support' (e.g. designing official rewards systems), and this category was excluded from further analysis. Furthermore, over 70% of references to 'coaching' were also coded as belonging to the functional leadership categories of 'planning and decision making' and 'managing team members' (e.g. teaching during the round). As 'coaching' behaviours were described as integral to leading ICU teams, and were mostly captured within the analysis of functional leadership behaviours, the category was excluded from further analysis.

Senior physician' references to team development behaviours focussed on, but were not exclusive to, medical trainees. In analysing behaviours used to 'provide team direction', two sub-categories emerged. Senior physicians described i) demonstrating the clinical standards expected of team members (e.g. taking responsibility for decision-making), and ii) developing a shared perspective on the goals and vision for the unit (e.g. having senior physicians cooperate on developing unit goals) that would withstand changes in personnel. Similarly, two sub-categories emerged in the analysis of behaviours to 'establish team norms'. Senior physicians described i) building expectations for teamwork that facilitated team members working well together (e.g. explaining team structures, asking team members to co-ordinate on information sharing), and ii) building

a positive and open relationship between team members and the senior physician (e.g. through encouraging novel ideas, not over-reacting to mistakes).

Table 4 synthesises and lists the team development behaviours used by senior physicians to create conditions that will enable team performance. The procedure used to develop the functional leadership behaviours (table 3) was replicated, albeit with two key distinctions. Firstly, team development behaviours were not associated with a phase of work within the ICU, and referred to general behaviours that are demonstrated during patient care or discussions with staff (e.g. establishing/following treatment protocols), or demonstrations of attitude (e.g. asking for opinions). Furthermore, the categories of 'providing team direction' and 'establishing team norms' were each broken down into the two emergent sub-categories described above.

INSERT TABLE 4 HERE

DISCUSSION

Senior physicians illustrated the importance of team leadership in the ICU. Team leadership was described as a complex set of functional and adaptive (according to scenario and team) behaviours, whereby senior physicians constantly attempted to i) understand and interpret challenges facing the ICU team (e.g. through patient reviews, discussing patient progression), ii) make and effectively communicate decisions on patient care (e.g. developing patient care plans), and iii) manage the activities and needs

of team members whilst prioritising patient safety (e.g. task delegation for developing trainees, directive decision-making during crisis). Furthermore, a core function of the team leader is to develop a stable and safe environment where a constantly changing group of team members can develop their skills and knowledge. Key to this are senior physicians working to develop a common perspective (for team members) on the goals and expectations within the ICU, and by establishing a positive team culture (e.g. encouraging team members to understand their inter-dependencies, and to contribute to patient planning).

The structured interviews found senior physicians to report using a variety of team leadership behaviours. The framework presented in tables 3 and 4 structures these data in a manner that, i) reflects the established two dimensions of team leadership, ii) provides example behaviours for the behavioural categories underlying each dimension, and iii) identifies behaviours used to lead teams during specific phases of work. The framework shows leaders to constantly adapt their leadership strategies (34). During the 'unit assessment' phase, senior physicians guide team members in developing their understanding of patient conditions, and facilitate the team to develop patient treatment plans. During the 'monitoring phase', senior physicians provide a supportive function, whereby they identify problems and assist team members in providing patient care. Lastly, during 'crisis management' phases, team leaders tend to adopt a more directive approach to leadership, developing/sharing crisis management plans and delegating tasks to team members. This framework is intended to provide insight into the team leadership behaviours used by ICU team leaders. It could be used to contribute to the future

development of team leadership training and assessment tools for trainee physicians, and to provide a frame of reference for trainees developing leadership skills.

To validate the leadership framework it is necessary to reflect on whether the behaviours identified are likely to influence team or patient outcomes. Although leadership is important for safety in numerous domains, only limited behavioural research has been conducted in intensive care. However, research in other healthcare domains can provide insights. For example, in surgery, anaesthesia, and neonatal care, team leader information gathering behaviours for collecting data from team members, cross-checking information, ensuring team members comprehend patient data, and identifying team information gaps are important for performance (26, 35-39). Similarly, team leader planning activities for establishing patient plans and task priorities, encouraging participation in decision-making, communicating thresholds for contingency plan application, and systematically recapping plans are also important (35, 36, 40-42). Furthermore, research with emergency medicine teams highlights the need for team leaders to delegate and tailor instructions to team member skills, develop clear team roles/structures, and delegate leadership duties to trainees when workloads are low (43-47). Leader monitoring behaviours have also been identified as crucial for ensuring safety (48, 49). Research with emergency teams has emphasised team leaders asserting their authority, providing increased guidance for complex/novel tasks, focussing on situation assessment when arriving late, remaining calm, and delegating leadership authority as task load lessens (25, 48, 50, 51).

In terms of team leadership behaviours to develop an environment where team members perform effectively, the behaviours captured within the framework resonate with the medical literature. For example, team leaders creating a culture of open communication, particularly for listening to trainee and nurse concerns during decision-making is important for patient safety (11, 27, 52, 53). Furthermore, research in trauma and resuscitation units emphasises team leaders developing clear expectations for team member behaviours, displaying a positive attitude, developing rationales for change, and setting standards for teamwork through their own cooperative behaviours (43, 54, 55). In addition, research with trauma, surgical, and ICU teams has highlighted goal setting and the development of a safe learning environment in which constructive feedback is provided (48, 56-59). Although healthcare research has also identified leader behaviours not captured in the framework (e.g. debriefing (60)), the framework structures and develops the existing healthcare leadership literature, and identifies new team leadership behaviours (e.g. senior physicians collaborating to avoid inconsistencies in instructions on patient care and their behavioural expectations of staff). The interview data are also consistent with psychology research differentiating between dimensions of team leadership (1, 21), alongside complementing adaptive leadership research (34, 47, 48). Finally, three of the team leadership behavioural categories (managing materials, coaching, providing organisational support) were excluded from the analysis, potentially signifying their lack of relevance to ICU team leadership..

The sample was limited to senior physicians, with the interviews focussing on the behaviours they report using to lead teams. In validating the framework, outcome data is

required alongside additional interviews with nurses and trainees (41). Future research will compare ICU team member' perceptions of effective leadership skills, and will build upon informal follow-up interviews conducted with a small sample of senior trainee physicians. These interviews provided similar and additional insights to those provided by ICU specialists. For example, senior trainees described themselves as the 'conduit' between the senior physicians and trainees and nurses (e.g. ensuring information is understood). They also highlighted challenges of having leadership rotated between senior physicians on a given day/week, with trainees adapting their behaviours to meet the perceived expectations of the lead ICU physician.

Semi-structured interviews provide rich data, with interviewees describing behaviours and cognition in high detail, however they do have limitations. Although interviewees were ICU experts, it is not possible to ascertain their leadership qualities. Critical incident interviews attempt to overcome this limitation by having interviewees focus on successful behaviours engaged during an event, rather than focussing on subjective opinions. However interviewees may have recalled behaviours inaccurately (61), and focussed on the aspects of their behaviour they *believed* most important (irrespective of their actual effectiveness). The analysis attempted to reduce this limitation through focussing on behaviours recalled by several interviewees, or by interpreting behaviours using existing leadership research. It is also not possible to ascertain whether interviewees did not focus on their own behaviours, but instead discussed behaviours they *expected* to be important. The extent to which stated behavioural preferences and intentions (e.g. for prescribing behaviours) predict the actual behaviours of clinicians

varies (62), and is considerably stronger when self-report measures (as opposed to objective measures) of behaviour are used. Thus, interviewee actual behavioural engagement cannot be established, and recollections may be influenced by social desirability (63) and hindsight biases (64).

CONCLUSIONS

Effective team leadership is essential for ensuring team performance and patient safety. Through applying team leadership theory and semi-structured interviews, a preliminary framework has been developed to capture the team leadership behaviours reportedly used by senior physicians to facilitate effective ICU team performance. Although the framework requires validation, it provides insight into the team leadership behaviours used by ICU team leaders, and can potentially contribute to the future design of ICU team leadership training and assessment tools, alongside providing trainee physicians a framework against which to develop their leadership skills.

ACKNOWLEDGEMENTS

REFERENCES

1. Morgeson F, DeRue D, Karam E: Leadership in teams: A functional approach to understanding leadership structures and processes. *Journal of Management* 2010; 36:5-39

2. Yukl G: Leadership in Organizations. Sixth Edition. Upper Saddle River NJ, Pearson Prentice Hall, 2006

3. Amabile T, Schatzel E, Moneta G, Kramer S: Leader behaviors and the work environment for creativity: Perceived leader support. *Leadership Quarterly* 2004; 15:5-32

4. Barry B, Stewart G: Composition, process, and performance in self-managed groups: The role of personality. *J Appl Psychol* 1997; 82:62-78

5. DeChurch L, Marks M: Leadership in multi-team systems. *J Appl Psychol* 2006; 91:311-329

6. Druskat V, Wheeler J: Managing from the boundary: The effective leadership of self-managing work teams. *Academy of Management Journal* 2003; 46:435-457

7. Keller R: Transformational leadership, initiating structure, and substitutes for leadership: A longitudinal study of research and development project team performance. *J Appl Psychol* 2006; 91:202-210

8. Zaccaro S, Rittman A, Marks M. Team Leadership: *Leadership Quarterly* 2001; 12:451-483

9. Malhotra S, Jordan D, Shortliffe E, Patel V: Workflow modeling in critical care: Piecing together your own puzzle. *Journal of Biomedical Informatics* 2007; 40:81-92

10. Manser T: Teamwork and patient safety in dynamic domains of healthcare: a review of the literature. *Acta Anaesthesiol Scand* 2009; 53:143-151

11. Nembhard I, Edmondson A: Making it safe: The effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. *J Organ Beh* 2006; 27:941-966

12. Reader T, Flin R, Mearns K, Cuthbertson B: Developing a team performance framework for the Intensive Care Unit. *Crit Care Med* 2009; 35:1787-1793

13. Shortell S, Zimmerman J, Rousseau D, Gillies R, Wagner D, Draper E, et al: The performance of intensive care units: Does good management make a difference? *Med Care* 1994; 32:508-525

14. Bion J, Fox-Kirk W: Eighteenth century mindsets, twenty-first century challenges: the physician as team player. *Crit Care Med* 2009; 37:1288-1289

15. Reader T, Flin R, Cuthbertson B: Factors affecting team communication in the intensive care unit. *In*: *Improving healthcare team communication: Building on lessons from aviation and aerospace.* Nemeth C (Ed). Ashgate, 2008, pp 117-134

16. The CoBaTrICE Collaboration: Development of core competencies for an international training programme in intensive care medicine. *Intensive Care Med* 2006; 32:1371-1383

17. Künzle B, Kolba M, Grote G: Ensuring patient safety through effective leadership behaviour: A literature review. *Safety Science* 2010; 48:1-17

18. Flin R, Maran N: Identifying and training non-technical skills for teams in acute medicine. *Qual Saf Health Care* 2004; 13(Supplement 1):80-84

19. Helmreich R, Merritt A, Wilhelm J: The evolution of crew resource management training in commercial aviation. *Int J Aviat Psychol* 1999; 9:19-32

20. Sevdalis N, Davis R, Koutantji M, Undre S, Darzi A, Vincent C: Reliability of a revised NOTECHS scale for use in surgical teams. *Am J Surg* 2008; 196:184-190

21. Burke C, Stagl K, Klein C, Goodwin G, Salas E, Halpin S: What type of leadership behaviors are functional in teams? A meta-analysis. *Leadership Quarterly* 2006; 17:288-307

22. Fleishman E, Mumford M, Zaccaro S, Levin K, Korotkin A, Hein M: Taxonomic efforts in the description of leader behavior: A synthesis and functional interpretation. *Leadership Quarterly* 1991; 2:245-287

23. Hackman J: Leading teams: Setting the stage for great performances. Boston: Harvard Business School Press, 2002

24. Hackman J: Groups that work (and those that don't). San Francisco: Jossey-Bass, 1990

25. Tschan F, Semmer N, Gaustchi D, Hunziker P, Spychiger M, Marsch S: Leading to recovery: Group performance and coordinative activities in medical emergency driven groups. *Human Perform* 2006; 19:277-304

26. Thomas E, Sexton J, Lasky R, Helmreich R, Crandell D, Tyson J: Teamwork and quality during neonatal care in the delivery room. *J Perinatol* 2006; 26:163-169

27. Reader T, Flin R, Lauche K, Cuthbertson B: Non-technical skills in the intensive care unit. *Br J Anaesth* 2006; 96:551-559

28. Reader T, Flin R, Mearns K, Cuthbertson B: Interdisciplinary communication in the intensive care unit. *Br J Anaesth* 2007; 98:347-352
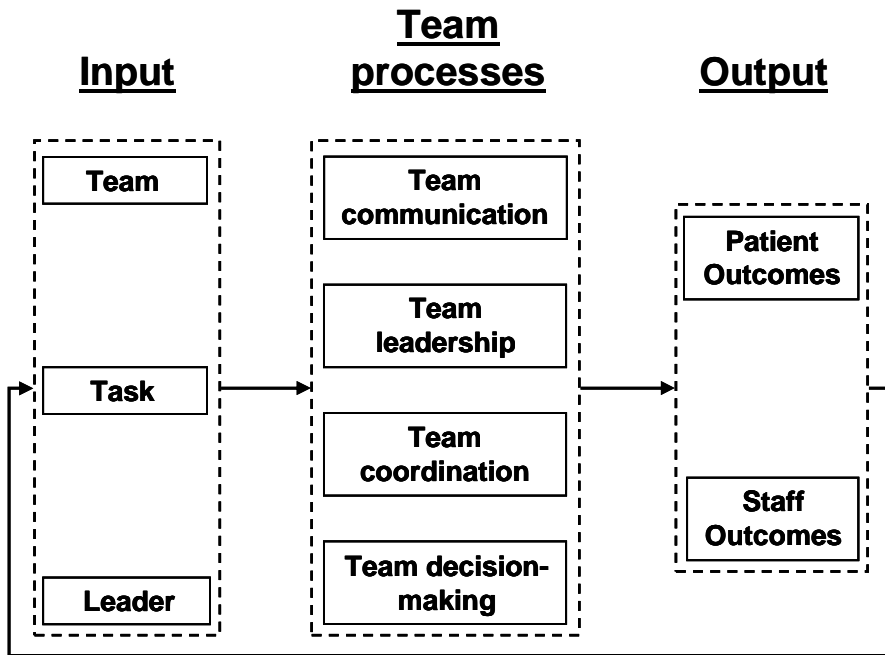
29. Hoffman R, Crandall B, Shadbolt N: Use of the critical decision method to elicit expert knowledge: A case study in the methodology of cognitive task analysis. *Hum Factors* 1998; 40:254-276

30. Corbin J, Strauss A: Basics of qualitative research: Techniques and procedures for developing grounded theory. London, Sage, 2008

31. Kvale S, Brinkmann S: Interviews; Learning the craft of qualitative research interviewing. London, Sage, 2009

32. Burke CS, Stagl K, Salas E, Pierce L, Kendall D: Understanding team adaptation: A conceptual analysis and model. *J Appl Psychol* 2006; 91:1189-1207

33. Cohen J: A coefficient of agreement for nominal scales. *Educational and Psychological Measurement* 1960; 20:37-46

34. Xiao Y, Seagull FJ, Mackenzie C, Klein K: Adaptive leadership in trauma resuscitation teams: a grounded theory approach to video analysis. *Cog Tech Work* 2004; 6:158-164

35. Albolino S, Cook R, O'Connor M: Sensemaking, safety, and cooperative work in the intensive care unit. *Cognition, Technology & Work* 2007; 9:131-137

36. Fletcher G, Flin R, McGeorge P, Glavin R, Maran N, Patey R: Anaethesists' Non-Technical Skills (ANTS): evaluation of a behavioural marker system. *Br J Anaesth* 2003; 90:580-588

37. Ottestad E, Boulet J, Lighthall G: Evaluating the management of septic shock using patient simulation. *Crit Care Med* 2007; 35:769-775

38. Patel V, Arocha J: The nature of constraints on collaborative decision making in health care settings. *In:* Linking Expertise and Naturalistic Decision Making.

Salas E, Klein G (Eds). New Jersey, Lawrence Erlbaum Associates, 2001, pp 383-405

39. Patrick J, James N, Ahmed A, Halliday P: Observational assessment of situation awareness, team differences and training implications. *Ergonomics* 2006; 49:393-417

40. Baggs J, Schmitt M, Mushlin A, Mitchell P, Eldrege D, Oakes D: Association between nurse-physician collaboration and patient outcomes in three intensive care units. *Crit Care Med* 1999; 27:1991-1998

41. Dodek P, Raboud J: Explicit approach to rounds in an ICU improves communication and satisfaction of providers. *Intensive Care Med* 2003; 29:1584-1588

42. Pronovost P, Berenholtz S, Dorman T, Lipsett P, Simmonds T, Haraden C: Improving communications in the ICU using daily goals. *J Crit Care* 2003; 18:71-75

43. Cooper S, Wakelam A: Leadership of resuscitation teams: 'Lighthouse Leadership'. *Resuscitation* 1999; 42:27-45

44. Marsch S, Muller C, Marquardt K, Conrad G, Tschan F, Hunziker P: Human factors affect the quality of cardiopulmonary resuscitation in simulated cardiac arrests. *Resuscitation* 2004; 60:51-56

45. Xiao Y, Seagull J, Mackenzie C, Ziegert F, Klein J: Team communication patterns as measures of team processes: Exploring the effects of task urgency and shared team experience. Paper presented at the Human Factors and Ergonomics Society 47th Annual Meeting, Denver, 2003

46. Yule S, Flin R, Paterson-Brown S, Maran N, Rowley D: Development of a rating system for surgeons' non-technical skills. *Med Educ* 2006; 40:1098-1104

47. Yun S, Faraj S, Sims H: Contingent leadership and effectiveness of trauma resuscitation teams. *J Appl Psychol* 2005; 90:1288-1296

48. Klein K, Ziegert JC, Knight P, Xiao Y: Dynamic delegation: Shared, hierarchical, and de-individualized leadership in extreme action teams. *Adm Sci Q* 2006; 51:590-621

49. Risser D, Rice M, Salisbury M, Simon R, Jay G, Berns S: The potential for improved teamwork to reduce medical errors in the emergency department. *Ann Emerg Med* 1999; 34:373-383

50. Grote G, Zala-Meza E, Grommes P: The effects of different forms of co-ordination on coping with workload. *In: G*roup interaction in high risk environments. Dietrich R, Childress T (Eds). Aldershot, Ashgate, 2004, pp 39-55

51. Wetzel C, Kneebone R, Woloshynowych M, Moorthy K, Kidd J: The effects of stress on surgical performance. *Am J Surg* 2006; 191:5-10

52. Donchin Y, Gopher D, Olin M, Badihi Y, Biesky M, Sprung C, et al: A look into the nature and causes of human errors in the intensive care unit. *Crit Care Med* 1995; 23:294-230

53. Reader T, Flin R, Cuthbertson B: Communication skills and error in the intensive care unit. *Curr Opin Crit Care* 2007; 13:732-736

54. Edmondson A: Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. *Journal of Management Studies* 2003; 40:1419-1452

55. Clemmer T, Spuhler V, Berwick D, Nolan T: Cooperation: the foundation of improvement. *Ann Intern Med* 1998; 128:1004-1009

56. Jain M, Miller L, Belt D, King D, Berwick D: Decline in ICU adverse events, nosocomial infections and cost through a quality improvement initiative focusing on teamwork and culture change. *Qual Saf Health Care* 2006; 15:235-239

57. Laporta D, Burns J, Doig C: Bench-to-bedside review: Dealing with increased intensive care unit staff turnover: a leadership challenge. *Crit Care* 2005; 5:454-458

58. Thilo J: Leadership in the ASC opportunity and responsibility. *Journal of Ambulatory Surgery* 2005; 12:11-14

59. Thomas E, Sexton J, Helmreich R: Discrepant attitudes about teamwork among critical care nurses and physicians. *Crit Care Med* 2003; 31:956-959

60. Meerabeau L, Page S: "I'm sorry if I panicked you": nurses' accounts of teamwork in cardiopulmonary resuscitation. *J Interprof Care* 1999; 13:29-40

61. Tulving E. Precis of elements of episodic memory. *Behavioural & Brain Science* 1984; 7:223-268.

62. Eccles M, Hrisos S, Francis J, Kaner E, Dickinson H, Beyer F, et al. Do self-reported intentions predict clinicians' behaviour: a systematic review. *Implement Sci* 2006;1:28.

63. Zerbe W, Paulhus D: Socially desirable responding in organizational behavior: A reconception. *The Academy of Management Review* 1987; 12:250-264

64. Bradfield A, Wells G: Not the same old hindsight bias: Outcome information distorts a broad range of retrospective judgments. *Memory & Cognition* 2005; 33:120-130.

Input — Team processes — Output

Input

- Team
- Task
- Leader

Team processes

- Team communication
- Team leadership
- Team coordination
- Team decision-making

Output

- Patient Outcomes
- Staff Outcomes

Figure 1. Input-process-output model used to explain team performance in the ICU (12) Please see Crit Care Medicine 2009; 53:1791 for the expanded framework.

Table 1. Dimensions of 'functional leadership behaviours' and 'team development behaviours' that underpin effective team performance (21, 22, 23)

Functional leadership behaviours: Context specific behaviours or thought processes used to facilitate team performance	*Team development behaviours:* Development of the underlying conditions necessary for facilitating team performance
Information gathering: The leader's systematic search, acquisition, evaluation and organization of information regarding team goals and operations.	**Providing team direction:** Motivating team members and ensuring they have a clear and challenging role.
Planning and decision-making: The leader's application of information to structure solutions in the pursuit of a team goal.	**Establishing team norms:** Establishing team norms (i.e. rules governing interactions and cooperation between team members) that encourage effective teamwork
Managing team members: Obtaining, assessing, developing and motivating personnel, utilizing personnel to enact a plan, and monitoring the progress of the team/team members.	**Coaching:** Helping and ensuring that team members develop their skills.
Managing materials: Obtaining and allocating material resources, utilizing resources to enact a plan, and monitoring the status of material resources.	**Providing organizational support:** Design of rewards systems, information systems and training opportunities.

Table 2. Number and percentage of references to 'functional leadership behaviours' and 'team development behaviours' made by senior physicians (n=25), according to interview phase.

Functional leadership behaviours:					**Team development behaviours:**				
	Interview Phase 1 %	Interview Phase 2 %	Interview Phase 3 %	**Total (%)**		Interview Phase 1 %	Interview Phase 2 %	Interview Phase 3 %	**Total (%)**
Information gathering:	145 (29.2)	31 (15.5)	0 (0)	**176 (25.1)**	Providing team direction:	37 (27.8)	1 (0.6)	26 (36.6)	**64 (29.6)**
Planning and decision-making:	111 (22.3)	51 (25.5)	0 (0)	**162 (23.1)**	Establishing team norms:	47 (35.3)	6 (3.4)	35 (49.3)	**88 (40.7)**
Managing team members:	222 (44.7)	112 (56)	4 (100)	**338 (48.1)**	Coaching:	46 (34.6)	5 (2.9)	8 (11.3)	**59 (27.4)**
Managing materials:	17 (3.4)	4 (2)	0 (0)	**21 (2.9)**	Providing org support:	1 (0.8)	0 (0)	2 (2.8)	**3 (1.4)**
Other	2 (0.4)	2 (1.1)	1 (0)	**5 (0.8)**	Other	2 (1.5)	0 (0)	0 (0)	**2 (0.9)**
Total	497	200	5	**702**	Total	133	12	71	**216**

Phase 1: Leadership behaviours reported by senior physicians as being used to lead the ICU team on a typical day
Phase 2: Leadership behaviours reported by senior physicians as being used during an emergency
Phase 3: General leadership behaviours that result in effective team performance

Table 3. Functional leadership behaviours reported by senior physicians as being used to lead intensive care unit teams.

	Information Gathering	Planning and Decision-Making	Managing Team Members
Unit Assessment: *Guiding the team to understand patient/unit conditions, and to develop patient treatment plans.*	• Status/condition of new patients is assessed on arrival at the ICU; • Expected changes in status of existing patients are confirmed; • Patients for potential discharge from ICU are identified; • Patient information sources (e.g. charts, x-rays, blood tests, drug charts) are reviewed in-depth with multidisciplinary team; • Information on patient progression is gleaned from nursing/medical staff (e.g. drugs, feeding, sedation, discussions with family); • Future information (e.g. CT scan) or resource (materials, expertise) requirements/gaps are identified with team, and tasked accordingly;	• Ad-hoc patient management plans generated during initial walk-round; • Procedures or tasks that require immediate activation by team members (e.g. extubation) due to patient developments are initiated; • In-depth patient care plans are developed with medical/nursing teams • Team member concerns are invited and discussed, and key patient treatments/investigations are outlined and prioritised; • Potential developments in patient progression are discussed, and contingency plans outlined; • Where appropriate, major decisions are postponed until further information/second opinion has been received; • Patient management plans, key decisions and main information points are recapped with the nursing and medical staff;	• Staff rota is checked and new trainee doctors met during initial tour; • The skills, knowledge and experience levels of new trainee doctors are considered (e.g. through informal discussion, stage of training); • Contributions to the patient care plans are invited from team members, and questions invited on previously unseen illnesses/treatments; • Dependent on workload/team, junior trainees are asked to present cases, nurses to discuss patient care, and senior trainees to lead on care plans; • Tasks and responsibilities are delegated with instructions tailored to trainee physician skills, knowledge, experience and training needs; • Team members are asked to verbally confirm their specific duties and responsibilities for each patient before next patient is reviewed; • Team satisfaction with patient care plan is checked;
Unit Monitoring *Supporting the team in providing patient care, and identifying/applying solutions to potential problems.*	• Information sources (charts, x-rays) are periodically reviewed; • Status/progress of priority patient treatments is monitored through visual inspections and discussions with medical and nursing staff; • Patient plans with inadequate progress are identified/highlighted and discussed further with team members; • Problems or unexpected changes to patient conditions are detected through dialogue with medical and nursing staff; • Awareness for potential incoming/outgoing patients is maintained through communication with senior trainees/other units; • Completion of routine housekeeping/care tasks (e.g. paperwork, patient nourishment) is checked;	• Patient management plans are evaluated and adapted (e.g. changing treatments, conducting further tests) with senior trainee as patient conditions change; • Factors impeding progression of patient management plans are identified and remedial steps taken (e.g. re-establishing team priorities); • Contingency plans (e.g. re-allocating team duties) are utilised in response to unexpected events/data (e.g. rapid patient deterioration); • Patients are admitted and discharged according to current and likely future demands within the unit (e.g. occupancy and staffing levels); • Management plans are recapped on leaving the unit;	• Issues/problems in enacting the care plan are discussed with team members, and guidance is given on technical/organisational issues; • Medical trainees and nursing staff are made aware of new information on their unit or patient responsibilities (e.g. admissions, test results); • Trainee doctors are observed performing tricky procedures so to detect indicators (e.g. stress, distraction, nurse unease) of a need to intervene; • Tasks which trainees have not previously performed, or are struggling to perform, are supervised or performed by the senior physician for demonstration and skill retention purposes; • Team members co-ordination is assessed (e.g. task duplication, information sharing), and instructions given where necessary (e.g. re-confirming tasks, priorities and inter-dependencies);
Crisis Management *Developing crisis management plans, and providing directive leadership during emergency situations.*	• A concise analysis of the situation from the trainee doctors/senior nurse is requested; • Where situation is managed by a trainee physician, indicators showing need for senior physician intervention are monitored (e.g. trainee indecision, severity of illness, management plan quality); • When performing tasks requiring high-levels of attention (e.g. line insertion), team members instructed to verbally update on new information (e.g. physiological measures); • Information is considered 'aloud' in order to share and confirm (i.e. identify inconsistencies) team member perspectives; • Future situational/system information requirements are identified (e.g. availability of surgical support);	• A crisis management plan is quickly developed/adapted with the support of team members, and situational overview is communicated; • As required, team members opinions are sought on the management plan, and alternative ideas considered if appropriate; • Task priorities and contingency plans are quickly communicated to the team; • Team members are verbally updated on changes to the management plan as the situation progresses; • Team members not needed to provide support are tasked to focus on normal patient care duties outlined within unit management plan;	• Decision-making authority assumed if trainee is not coping, or if patient safety may be at risk (e.g. time constraints, illness complexity) • Decision-making authority is asserted through clearly and appropriately delegating tasks (e.g. by seniority), and by giving precise instructions; • Calmness is shown in decision-making, and team members are encouraged to contribute information to the decision-making process; • Difficulties in team members performing technical tasks are anticipated, with the senior physician being prepared to supervise or dynamically swap functions with trainees as necessary; • Should another team member or specialist be better suited to performing a task than the senior physician, help is requested; • Team members are coordinated through them confirming their task duties, and providing constant updates on task progression; • As control is gained of the situation, decision-making is distributed back to senior trainee and nursing staff;

Table 4. Leadership behaviours of senior physicians reported as being used to develop the underlying conditions necessary for effective team performance

Providing Team Direction	**Demonstrating Clinical Excellence**	• Protocols and guidelines are followed, and if not an explanation is given; • Responsibility for medical decisions is taken, with trainees expected to take responsibility for their work; • Interest is shown in clinical work, and also development of trainee physicians and nursing staff; • Low level tasks are performed (e.g. notes, answering telephone) to demonstrate their importance; • Clinical competence is displayed through concisely reaching and explaining decisions on patient management; • Procedures are always performed to the highest of clinical standards ; • The successful management of difficult cases are used as ad-hoc teaching points for trainees;
	Developing a Share Perspective With The ICU team	• A unified message on the unit's goals and expectations of staff is reached between senior physicians; • Protocols and guidelines are kept up to-date, are evidence-based, reflect operational realities, and are shared with all team members; • Inconsistencies with other senior physicians on patient management strategies are avoided; • Specific goals for the ICU are developed (e.g. on patient safety, sedation, feeding); • Broader targets for the ICU are developed (e.g. lowest standard ICU mortality rates in regional area); • Unit successes are promoted in terms of patient care quality, safety data, goal attainment, and research; • Trainees are provided with a broader vision on the purpose of intensive care, beyond the performance of technical tasks and medical training
Establishing Team Norms	**Building Expectations for Teamwork**	• Patient safety is explicitly made key to ICU, with team members being asked and expected to work effectively and courteously together regardless of personal issues; • Team structures and hierarchical systems through which tasks are allocated and information communicated are clearly explained to trainees and nursing staff; • Trainee staff are taught to expect challenges on their decision-making by either medical or nursing staff; • Co-ordination and communication on task-work (e.g. data sharing, resource planning) is emphasised to team members so that functions are synchronised (e.g. multiple treatments, procedures or tests); • All team members are asked and expected to perform menial or administrative tasks;
	Team Member Interactions with the Senior Physician	• Formalities are clearly established to new team members (e.g. calling the senior physician by title); • Trainee doctors are supported in contacting the senior physician when they have significant patient care concerns, and are not criticised for raising false alarms; • Contributions and novel ideas from team members on unit and patient management are encouraged; • Team members are encouraged to approach the senior physician if they experience professional/personal difficulties; • When unintentional mistakes are made by medical or nursing staff, the senior physician remains calm in order to establish a learning culture; • Empathy and compassion is shown to the trainees, with feedback being structured into learning points;