

Teamwork and Communication

The Role of Teamwork in the Professional Education of Physicians: Current Status and Assessment Recommendations

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The Institute of Medicine (IOM), in its publication *To Err Is Human*, issued a number of recommendations to enhance patient safety which related to voluntary error reporting, systems changes, safety systems design, and standards for health care professionals. The recommendations that focus on the initial and continuing education and training of health care professionals have the greatest potential to change the present practice. The IOM recommended that health care organizations make patient safety a priority by establishing patient safety programs. These programs should “establish interdisciplinary team training programs, such as simulation, that incorporate proven methods for team management.”^{1(p. 135)} The IOM also recommended that standards and expectations for health care organizations and professionals place a greater emphasis on patient safety. The IOM proposed that such standards should mandate periodic recertification and relicensing of doctors, nurses, and other key providers. Recertification would focus both on provider competence and knowledge of patient safety practices such as functioning effectively in an interdisciplinary health care team.¹

Since the IOM report, others have suggested that the professional education of health care providers needs to be examined in relation to patient safety. For example, in his June 2003 testimony before the Senate Subcommittee on Government Affairs, Dr. Dennis O’Leary, President of the Joint Commission on

Article-at-a-Glance

Background: The Institute of Medicine (IOM) has recommended that organizations establish interdisciplinary team training programs that incorporate proven methods for team management. Teamwork can be assessed during physician medical education, board certification, licensure, and continuing practice. Team members must possess specific knowledge, skills, and attitudes (KSAs), such as the ability to exchange information, which enable individual team members to coordinate.

Assessing Physician Teamwork: KSAs might be elicited and assessed across a physician’s career, starting in medical school and continuing through licensure and board certification. Professional bodies should be responsible for the development of specific team knowledge and skill competencies and for promoting specific team attitude competencies. Tools are available to assess medical student, resident, and physician competence in these critical team KSAs.

Challenges and Complexities in Team Performance Measurement: For teamwork skills to be assessed and have credibility, team performance measures must be grounded in team theory, account for individual and team-level performance, capture team process and outcomes, adhere to standards for reliability and validity, and address real or perceived barriers to measurement.

Accreditation of Healthcare Organizations, stated the following:

I would finally suggest that consideration be given to a government commissioned study of the content of professional education as it relates to patient safety. Such a report could create pressure for sufficient reforms of medical and nursing education to permit appropriate allocations of time to systems learning, education about the contribution of human factors to patient safety, and inter-professional team training.”²

This article addresses how teamwork could be assessed during physician medical education, board certification, licensure, and continuing practice. We focus on the professional education of physicians, as opposed to other health care professionals, because physician training is defined by a specific series of events and assessments in which team principles could be readily integrated. Second, work by the Accreditation Council for Graduate Medical Education (ACGME) has led to revised lists of physician competencies that require physicians to demonstrate competence in teamwork; therefore, the timing is right to tackle such a discussion. We agree with Dr. O’Leary that team training should be integrated into training for all professional health disciplines (for example, nursing, pharmacy, physical therapy, etc.) but here we focus on physicians.

For the purpose of this article, we define a *team* as consisting of two or more individuals who have specific roles, perform interdependent tasks, are adaptable, and share a common goal. Moreover, members of teams must possess specific knowledge, skills, and attitudes (KSAs), such as the ability to exchange information, which enable individual team members to coordinate. Such KSAs comprise teamwork.

We focus on assessment because measurement is paramount to learning. Without reliable and valid measures, KSA deficiencies cannot be diagnosed, accurate feedback cannot be provided, and appropriate instructional strategies for remediation cannot be selected.

This article is intended to be a first look at how the assessment of team KSA competencies could be incorporated into the medical education process. It draws heavily on more than 22 years of research on teams, team training, and team performance measurement,³⁻⁵ as well as emerging research on team performance in

health care.⁶⁻⁹ In an earlier document, we reviewed this research and its evidence-based relation to patient safety.¹⁰ Here, we argue that specific team competencies are measurable and scalable and can be used to predict effective team performance in health care.

This article warrants the medical community’s attention for the following reasons. First, teamwork has been widely recognized as an important factor in patient safety. Although the evidence is still evolving, few would dispute the critical role teamwork plays in providing health care. Second, recent work by the ACGME and the Association for American Medical Colleges (AAMC) has led to revised lists of competencies for physicians that now encompass important aspects of communication, coordination, and collaboration.¹¹ Furthermore, the ACGME has recommended that such educational competencies shape resident education and that these competencies be assessed periodically. Third, current Joint Commission standards pertain to coordination, communication, and team training. For example, element of performance (EP) for Human Resources (HR) standard HR.2.30* states, “Ongoing in-services, training, or other education incorporate methods of team training, when appropriate.”¹² Therefore, the timing is right for considering the requirements for assessing team KSAs in the professional education of physicians.

We propose an approach and make recommendations for measuring specific team KSA competencies that span the career of a physician. To develop this approach we start by identifying the core KSAs that comprise teamwork. Research suggests that individuals must possess certain generalized KSAs to function effectively in different teams that perform a variety of tasks.^{13,14} Such competencies as communication and collective orientation (for example, a desire to work on teams) are generic rather than unique to a specific team, and individuals bring these KSAs to each of the teams to which they belong. In the first section of the article, we specify the generic team KSAs that physicians must possess to work in a variety of teams with various health professionals. Next, we examine the roles of various boards and licensing bodies for physicians and make recommendations

* “On-going education, including in-services, training, and other activities, maintains and improves competence.”[HR-8]

regarding the types of team KSAs that should be assessed and how they should be assessed by the AAMC, the ACGME, the 24 board specialties represented by the American Board of Medical Specialties (ABMS), the National Board of Medical Examiners (NBME), and the Joint Commission. We also examine where the best opportunities exist to assess physician-related team KSAs and the different measurement strategies available to conduct these assessments. Different measurement strategies exist for assessing team performance, and the evidence base to support the efficacy of these strategies varies greatly. Finally, we comment on the generalizability of team performance measurement from other domains to health care.

Teamwork and Health Care

Teamwork and Patient Safety

A tired anesthesiologist is asked to place an epidural at 3:00 A.M. Midway through the procedure, the nurse notices that before securing the epidural space, he is drawing up lidocaine into the epidural syringe instead of saline. She states, "That's interesting, is that how you do epidurals now?" The anesthesiologist looks at his hands, notices the error, and corrects it.

A nurse notices that a colleague is assigned to care for the next caesarian section patient, but that she also has to care for a mom who recently delivered. The nurse thus asks her colleague if she can help place the IV for the c-section patient to help get things moving.

It goes without saying that teamwork is critical to effective health care. Small groups of individuals work together in intensive care units (ICUs), operating rooms, labor and delivery wards, emergency departments, and family-medicine practices. Physicians, nurses, pharmacists, technicians, and other health professionals must coordinate their activities to make safe and efficient patient care a priority. As specified in our definition of a team, health care workers perform interdependent tasks while functioning in specific roles, sharing the common goal of safe, effective coordination of care for patients. However, even though all conditions addressed by health care professionals require interdisciplinary teams, members of these teams are rarely trained together; furthermore, they often come from separate disciplines and diverse educational programs.

Given the interdisciplinary nature of the work and the necessity of cooperation among the workers who perform it, teamwork is critical to ensuring patient safety and error recovery and mitigation. Teams make fewer mistakes than do individuals, especially when each team member knows his or her responsibilities, as well as those of other team members.¹⁵⁻¹⁷ However, simply installing a team structure does not automatically ensure it will operate effectively. Teamwork is not an automatic consequence of co-locating people together and depends on a willingness to cooperate for a shared goal. Teamwork also does not require that team members work together on a permanent basis. Teamwork is sustained by a commitment to a shared set of team KSAs rather than permanent assignments that carry over from day-to-day.¹⁸

Team KSA Competencies

Extensive research on teamwork during the past 20 years¹⁹⁻²² suggests that teamwork is defined by a set of interrelated KSAs that facilitate coordinated, adaptive performance and support one's teammates, objectives, and mission.^{3,10,13,23}

Teamwork is distinct from taskwork (for example, operational skills) but both are required for teams to be effective in complex environments.²⁴ Furthermore, in health care, knowledge and skill at the task are not enough. Teamwork depends on each team member's being able to do the following to be able to identify when errors occur and how to recover and correct for these errors:

- Anticipate the needs of others
- Adjust to each other's actions and to the changing environment
- Have a shared understanding of how a procedure should happen

Recently, key organizations involved in the education of physicians have recognized the importance of developing team-related knowledge and skills during medical education. For example, the ACGME has identified six Core Competencies of graduate medical education—patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.²⁵ The interpersonal and communication skills competency

requires residents to “demonstrate interpersonal and communication skills that result in effective information exchange and teaming with patients . . . and professional associates.” Residents are expected to “work effectively with others as a member or leader of a health care team or other professional group.” Residency review committees have begun to translate these six competencies into specific practice-based subcompetencies that can be trained and assessed in residency programs. The ACGME’s goal is to move resident training to a competency model where the focus is on educational and clinical outcomes, so that programs can be distinguished by strengths and weaknesses in each of these six areas.²⁶

Similarly, the AAMC recently funded a “critical incident” analysis to investigate the behaviors resulting in successful and unsuccessful performance during medical school and residency. More than 1,200 critical incidents were collected from medical students, residents, and medical school faculty from different regions of the United States. Independent sorting of these incidents resulted in eight dimensions of medical school performance and seven performance dimensions for residency; these dimensions indicate the importance of teamwork-related competencies, such as interpersonal skills and professionalism, interacting with patients and family, fostering a team environment, and mentoring/educating other students. These researchers concluded that the core competencies for success as a physician become important early and are important throughout the course of a physician’s career.¹¹

Finally, researchers have begun to identify skills that define team performance in health care. This line of research began with the work of David Gaba et al., who developed Anesthesia Crisis Resource Management (ACRM). ACRM was designed to help anesthesiologists effectively manage crises by working in multidisciplinary teams that include physicians, nurses, technicians, and other medical professionals.^{5,20,27} ACRM uses patient simulators to provide training in specific technical and generic teamwork skills. The team skills, adopted from research on aviation teams, include making inquiries and assertions, communicating, giving and receiving feedback, exerting leadership, maintaining a positive group climate, and reevaluating actions.

In addition, a number of researchers have recently begun to identify the team KSA requirements of teamwork in other health disciplines. For example, Healey et al. have developed the OTAS (Observational Assessment for Teamwork in Surgery) behavioral rating scale to assess cooperation, leadership, coordination, awareness, and communication in surgical teams.⁷ Thomas et al. have developed ten behavioral markers for teamwork in neonatal resuscitation teams,⁸ and Flin and Maran have identified nontechnical skill requirements for teams in acute medicine.⁹

Other researchers, in addition to studying and measuring team KSAs in health care, have developed training programs that teach teamwork to practitioners either through in-services, tools, simulation, or some combination thereof.^{28,29} For example, MedTeams™ training was developed from an evaluation-driven course design. Five critical dimensions for effective teamwork (and 48 behaviors) were identified from a closed-case analysis, and training and supporting tools were developed to improve team skill performance.³⁰ Similarly, ongoing efforts at Kaiser Permanente have focused on improving communication among staff. Strategies such as surgical briefings, critical event training, and a standardized process in communicating information in transfer of patients from the hospital to skilled nursing facilities have led to a reduction in wrong-side surgeries and nursing turnover and an increase in staff job satisfaction.³¹

These studies encapsulate the core KSA requirements for physicians (and other health care workers) to function effectively in a wide variety of health care teams. Although different researchers use somewhat different terminology to define these KSA requirements (for example, Thomas et al. identify one of their behavioral markers as “Information Sharing,”⁸ while others identify a requirement for “Communication”^{7,9,31}) we argue, much as have Salas and colleagues, that these generic KSAs can be clustered into eight broad competencies of teamwork.¹⁷ These competencies must be possessed by individual physicians (and other health care workers) so they can perform in the variety (1) of teams of which they are part and (2) of tasks requiring coordination in day-to-day practice. Table 1 (page 189) presents each KSA, its definition, and behavioral examples and references the supporting evidence.

Table 1. Team KSAs and the Coordinating Mechanisms of Teamwork

Teamwork	Definition	Behavioral Examples	Selected Citation
Team Leadership	Ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, develop team KSAs, motivate team members, plan and organize, and establish a positive atmosphere	<ul style="list-style-type: none"> ■ Facilitate team problem solving ■ Provide performance expectations and acceptable interaction patterns ■ Synchronize and combine individual team member contributions ■ Seek and evaluate information that impacts team functioning ■ Clarify team member roles ■ Engage in preparatory meetings and feedback sessions with the team 	Cannon-Bowers et al. ^{13*} Salas et al. ¹ Healey et al. ^{7*} Thomas et al. ^{8*} Fin and Maran ^{9*}
Mutual Performance Monitoring	Ability to develop common understandings of the team environment and apply appropriate task strategies in order to accurately monitor teammate performance	<ul style="list-style-type: none"> ■ Identifying mistakes and lapses in other team members actions ■ Providing feedback regarding team member actions in order to facilitate self-correction 	McIntyre and Salas ² Healey et al. ^{7*} Thomas et al. ^{8*}
Backup Behavior	Ability to anticipate other team member's needs through accurate knowledge about their responsibilities. The ability to shift workload among members to achieve balance during high periods of workload	<ul style="list-style-type: none"> ■ Recognition by potential back-up providers that there is a workload distribution problem in their team ■ Shifting of work responsibilities to under-utilized team members ■ Completion of the whole task or parts of tasks by other team members 	McIntyre and Salas ² Porter et al. ³
Adaptability	Ability to adjust strategies based on information gathered from the environment through the use of compensatory behavior and reallocation of intra-team resources. Altering a course of action or team repertoire in response to changing conditions (internal or external)	<ul style="list-style-type: none"> ■ Identify cues that a change has occurred, assign meaning to that change, and develop a new plan to deal with the changes ■ Identify opportunities for improvement and innovation for habitual or routine practices ■ Remain vigilant to changes in the internal and external environment of the team 	Cannon-Bowers et al. ^{13*} Kozlowski et al. ⁴ Klein and Pierce ⁵
Team/Collective Orientation	Propensity to take other's behavior into account during group interaction and the belief in the importance of team goals over individual member's goals	<ul style="list-style-type: none"> ■ Taking into account alternative solutions provided by teammates and appraising that input to determine what is most correct ■ Increased task involvement, information sharing, strategizing, and participatory goal setting 	Driskell and Salas ^{64*} Shamir ⁶ Wagner ⁷
Shared Mental Models	An organizing knowledge structure of the relationships between the task the team is engaged in and how the team members will interact	<ul style="list-style-type: none"> ■ Anticipating and predicting each other's needs ■ Identify changes in the team, task, or teammates and implicitly adjusting strategies as needed 	Cannon-Bowers et al. ^{13*} Klimoski and Mohammed ⁸ Mathieu et al. ⁹ Stout et al. ¹⁰ Wright et al. ¹¹

continued

Table 1. Team KSAs and the Coordinating Mechanisms of Teamwork, *continued*

Teamwork	Definition	Behavioral Examples	Selected Citation
Mutual Trust	The shared belief that team members will perform their roles and protect the interests of their teammates	<ul style="list-style-type: none"> ■ Information sharing ■ Willingness to admit mistakes and accept feedback 	Bandow ¹² Webber ¹³
Closed-loop Communication	The exchange of information between a sender and a receiver irrespective of the medium	<ul style="list-style-type: none"> ■ Following up with team members to ensure message was received ■ Acknowledging that a message was received ■ Clarifying with the sender of the message that the message received is the same as the intended message sent. 	McIntyre and Salas ² Healey et al. ^{7*} Thomas et al. ^{8*} Flin and Maron ^{9*} Leonard et al. ^{31*}

* See References, page 201.

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Measuring Teamwork

The growing importance of teamwork in health care and the move toward incorporating team KSAs into graduate medical education requires strategies for assessing physician performance in these dimensions. The ACGME commissioned the development of a toolbox that includes detailed descriptions of assessment methods, which can be used for evaluating residents in the six Core Competencies identified by the Outcomes Project. In addition to a brief description of each method, the toolbox provides information regarding each measure's use, psychometric qualities, and practicality.²⁵ However, the toolbox links measurement methods to the higher-order competencies and not the subcompetencies,

specifically those subcompetencies related to teamwork, which need to be assessed for a program to be successful. Toolboxes have yet to be developed for assessing similar competencies in medical school or for ensuring that proficiency is maintained postresidency.

With respect to the research literature on measuring team performance, there is a consistent argument that team process and outcomes must be distinguished.³² Process is defined by the activities, strategies, responses, and behaviors employed by the team in task accomplishment, whereas outcomes include variables related to the safety, efficiency, and effectiveness of team performance, to name but a few. Process measures are particularly important for training when the purpose of

Individual, Team, and Organization Model of Teamwork

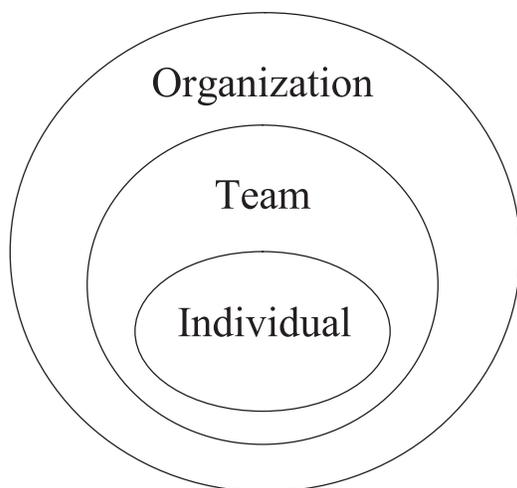


Figure 1. The figure highlights the challenges of measuring teamwork within a health care facility.

performance measurement is to diagnose performance problems and to provide feedback to trainees. Outcome measures, on the other hand, should be used when the underlying causes of performance are less of interest as in the case of certification of proficiency or readiness evaluations. When it comes to teams and health care, the medical community has focused more on outcomes than process, partly because outcomes measures (for example, time to incision, time between arrival and admission, errors in procedures) are more prevalent and therefore easier to collect. This is also due the fact that the medical community is only now beginning to understand the competencies that define effective team process.

Researchers have suggested that measurement requirements also should vary by performance level (that is, individual versus team level).³² The combination of these variables (process versus outcomes and individual versus team) produces a four-quadrant model for guiding team performance measurement strategies. However, dichotomizing performance and level is probably not an accurate conceptualization of the team performance space. For example, in some cases outcomes of performance at the individual level will be processes at the team level. Furthermore, this approach ignores the influence of organizational factors, such as culture, on a team's

performance. The model presented in Figure 1 (left) highlights the challenges of measuring teamwork within a health care facility. At the individual level, emphasis might be placed on measuring teamwork-related competencies of individual team members or what Cannon-Bowers et al. refer to as team competencies held at the individual level.³² As shown in Table 1, these competencies include team leadership, mutual performance monitoring, backup behavior, closed loop communication, and team/collective orientation. There is evidence, both within and outside health care, to support the competencies' efficacy in a wide variety of team settings.^{13,32}

At the team level, emphasis might be placed on measuring the performance of specific teams. The measurement might still focus on individual-level competencies, when team membership is variable, or more unique team-level competencies (for example, adaptability, shared mental models, mutual trust), if team membership is stable for extended periods. Finally, at the organizational level, emphasis might be placed on performance of the teams that comprise the organization. In this case, team-level performance data would need to be aggregated. Pioneering work on the role of microsystems helps underscore the need to train teams across the organization.³³

Summary

The critical role teamwork plays in patient safety is well recognized. Tremendous resources and lessons learned exist to help the field of health care improve teamwork and move toward a culture of safety. The teamwork competencies (Table 1) are an excellent starting point for developing an approach to assess physician teamwork in medical education, with due regard to the complexities involved in conducting such assessments in the health care system. We now turn to a discussion of how team performance might be measured and assessed within health care.

Assessing Physician Teamwork

Measuring physician teamwork in professional medical education is a challenging proposition. Therefore, we have focused on process as opposed to outcome measures—where, we believe, the greatest challenges and opportunities for improvement reside.

In the sections that follow, we describe the roles of different regulatory bodies in assessing team performance of physicians, where and when these assessments might take place, and how performance might be measured. These issues, in combination with the KSA competencies presented in Table 1, yield a preliminary approach for measuring team performance in health care.

Physician's Career

At a basic level, a physician's career progression is well defined by specific educational milestones, certification, and licensing requirements. The first two years of medical school generally focus on developing declarative knowledge in the chemical, physical, biological, and health sciences. In the final two years, medical students continue to develop their declarative knowledge but also begin to develop procedural knowledge and skills related to the practice of medicine. During this phase, medical students are exposed to different specialties through rotated assignments in an academic health center. On completion of medical school, physicians enter their residency programs where they receive specific training in their chosen specialty. Residency training varies in length from three to seven or more years, depending on the specialty. Throughout their training, physicians must pass licensing exams and complete any additional requirements for board certification. Finally, physicians must maintain their currency by completing a specific number of continuing education credits annually and addressing other requirements put forth by their specific specialty board.

Regulatory Bodies and Teamwork

A physician's career consists of a series of structured educational and certification milestones that are governed by specific regulatory bodies. Therefore, it is possible to identify the organizations that are responsible for ensuring that physicians develop the appropriate team KSAs. These organizations include AAMC, ACGME, the 24 specialty boards, the NBME, and the Joint Commission. What is more challenging is determining the specific team requirements that the different bodies might oversee and regulate. We advocate for a continuous learning process in which these assessments

are collected and trended. We provide recommendations for each of these organizations' roles in assessing teamwork in the professional education of physicians.

AAMC. The AAMC's purpose is to advance the nation's health care system through training new physicians in medical schools and teaching hospitals. The AAMC, with the assistance of its members, sets a national agenda for medical education.³⁴ We believe that the AAMC should play a central role in developing specific team KSA competencies, particularly at the individual level. Developing team knowledge and skills early in a medical student's career and fostering appropriate attitudes should enable new physicians to work in a team environment when they transition to residency. Results of the critical incident investigation by Adams and colleagues support this argument. These researchers found that teamwork was important for success in both medical school and residency. "Interpersonal Skills and Professionalism" and "Fostering a Team Environment" were viewed as two of the eight core competencies for medical students, whereas "Interpersonal Skills and Professionalism" was viewed as one of the seven core competencies as residents.¹¹

We recommend that the AAMC focus on introducing the concept of teamwork in health care and emphasize its importance in advancing patient safety (Table 2, page 193). We also recommend that the AAMC develop declarative knowledge of the critical components of teamwork in medical students by introducing these topics early in a student's training. Introducing such information in medical school and reinforcing its importance by adding it to curriculum assessment will help produce physicians who believe in teamwork and are prepared to acquire the necessary skills to function effectively in health care teams. We recognize that presently there are opportunities for team skill development in medical school, particularly when students transition to rotations in the hospital, but today they are viewed as opportunities to acquire knowledge as the central goal.

■ **Recommendation 1.** Declarative and procedural knowledge related to the critical components of teamwork should be introduced early and reinforced throughout the medical school curriculum.

ACGME. The ACGME is responsible for the accreditation of nearly 7,800 residency education programs and more than 100,000 residents. As stated, the ACGME has

Table 2. An Approach to Assessing Team KSA Competencies in Physician Medical Education*

	AAMC/ACGME	Team Literature	Responsible Org.	Measurement Strategy
Knowledge	<ul style="list-style-type: none"> Knowledge of the 5 core AAMC and 6 Core ACGME Competencies 	<ul style="list-style-type: none"> Knowledge About the Components of Teamwork Shared Task Models Knowledge of Teammate Characteristics Knowledge of Team Mission, Norms, Objectives, and Resources Task-Specific Responsibilities 	AAMC ACGME ABMS NMBE	<ul style="list-style-type: none"> Written Exam Standardized Oral Exams Situational Judgment Tests Microsimulation
Skills	<ul style="list-style-type: none"> Interpersonal Skills and Communication Professionalism Fostering a Team Environment 	<ul style="list-style-type: none"> Closed-Loop Communication Team Leadership Mutual Performance Monitoring Backup Behavior Adaptability 	ACGME ABMS NBME JCAHO	<ul style="list-style-type: none"> Simulation Objective Standardized Clinical Exams (OSCEs) On-the-Job Observations M&M Conferences Grand Rounds
Attitudes	<ul style="list-style-type: none"> Positive Attitudes toward Safety 	<ul style="list-style-type: none"> Belief in the Importance of Teamwork Mutual Trust Team Orientation 	AAMC ACGME NBME JCAHO	<ul style="list-style-type: none"> Surveys Self-Report Measures Conditional Reasoning Peer Assessment OSCE Role Playing Simulation 360 Degree Evaluation

* KSA, knowledge, skills, and attitudes; AAMC, American Association of Medical Colleges; ACGME, Accreditation Council for Graduate Medical Education; ABMS, American Board of Medical Specialties; NBME, National Board of Medical Examiners; JCAHO, Joint Commission on Accreditation of Healthcare Organizations; M&M, mortality & morbidity.

established the importance of teamwork within its six Core Competencies as part of the ACGME Outcomes Project. The ACGME specifically states that residents must “demonstrate interpersonal and communication skills that result in effective information exchange and teaming with patients . . . and professional associates” as well as be capable of “work[ing] effectively with others as a member or leader of health care team or other professional group.”³⁵ Therefore, we view residency training as the ideal opportunity for new physicians to refine and apply team-related KSAs that were taught in medical school as residents begin to practice medicine in their chosen subspecialty. For example, although empirical research has yet to confirm if the behaviors that comprise

team leadership, mutual performance monitoring, back-up behavior, and adaptability vary by medical specialty, we would hypothesize that this in fact would be the case.

The development and refinement of team KSAs during residency training should continuously reinforce the importance of teamwork in health care and help facilitate a shift toward a culture of safety. Embedding team training throughout commercial pilot training has been key to the culture of safety in this industry.^{36,37} Also key has been aviation’s shift, through the introduction of the Advanced Qualification Program, to certify pilots as line capable as a function of a flight deck crew’s performance in a Line Operational Evaluation (LOE) scenario at the end of initial and recurrent training. LOE requires pilots and

copilots to demonstrate acceptable teamwork skills during this critical certification event.^{36,38} Adapting lessons learned from the Advanced Qualification Program to health care would be an important first step.³²

■ **Recommendation 2.** Physicians should receive practice and feedback on team KSAs during residency training in order to refine the competencies learned in medical school.

■ **Recommendation 3.** Residency training should continuously reinforce the importance of teamwork in health care and help facilitate a shift toward a culture of safety.

■ **Recommendation 4.** Health care should adapt lessons learned from the Advanced Qualification Program.

NBME and ABMS. The NBME, a nonprofit organization responsible for the licensure of physicians, uses a three-step examination to assess a physician's ability to apply knowledge, concepts, and principles and demonstrate patient-centered skills that are important for safe and efficient patient care.³⁹ The ABMS, which represents 24 approved medical specialty boards, provides certification to provide assurance of a physician's successful completion of an approved training program and an ability to provide quality patient care in the specialty⁴⁰ (Table 2).

Given the regulatory nature of the NBME and ABMS, we recommend that they make it mandatory to ensure that physicians possess the necessary team-related KSAs to function effectively in health care teams (Table 1 and Table 2). This means that licensure and board certification should include assessments of each new physician's knowledge of the components of teamwork, interpositional knowledge, and shared task expectations for his or her chosen specialty. New physicians should be required to demonstrate their competence in the team leadership, mutual performance monitoring, backup behavior, and adaptability dimensions. Dillon et al. suggest that with the emergence of new technologies, such as more realistic simulations, assessing such KSAs as part of medical licensure might not be too far off in the future.⁴¹

■ **Recommendation 5.** The licensure and board certification process should assess and regulate physicians' teamwork-related competence.

■ **Recommendation 6.** Licensing exams and the board certification process should include assessments of each physician's knowledge of the components of team.

■ **Recommendation 7.** Licensing exams and the board certification process should require physicians to demonstrate their competence in team leadership, mutual performance monitoring, backup behavior, and adaptability.

Joint Commission.* The Joint Commission, the predominant standards-setting body in United States health care, evaluates and accredits more than 15,000 health care organizations that provide services addressed by the Joint Commission's standards. Joint Commission accreditation is recognized as a symbol of quality that reflects an organization's commitment to meeting the highest performance standards, including those associated with patient safety. To earn and maintain accreditation, an organization must undergo an on-site survey by the Joint Commission at least every three years and demonstrate an organizational commitment to patient safety.⁴²

We recommend that the Joint Commission ensure that team KSAs are supported and continuously reinforced throughout a health care organization. The Joint Commission has already called for implementation of team training through ongoing in-services, training, and education.¹² One aspect of the new survey agenda is the use of the tracer methodology, which is designed to "trace" the care experiences that a patient had while at the hospital.⁴³ The tracer's purpose is to assess compliance with Joint Commission standards by following specific patients through the hospital's processes with particular attention to selected priority focus areas (PFAs). Currently, there are a total of 14 defined PFAs, which include communication, orientation and training, and patient safety. We recommend that the Joint Commission identify *teamwork* as a PFA. We also recommend that Joint Commission surveyors be trained to assess important aspects of teamwork and that surveys include an assessment of teamwork within each tracer session.

Table 2 provides a summary of the approach we are advocating for assessing teamwork KSAs during physician education, licensure, board certification, and practice. Table 3 (page 195) presents a summary of our proposed recommendations.

* Although state and federal governments may recognize Joint Commission accreditation for licensure or deeming purposes, the Joint Commission itself is not a regulatory agency and does not have the power to levy fines, close organizations, or revoke operating licenses. — *Editor*

Table 3. Proposed Recommendations*

Recommendation 1. Declarative and procedural knowledge related to the critical components of teamwork should be introduced early and reinforced in medical school training.

Recommendation 2. Physicians should receive practice and feedback on team KSAs during residency training in order to refine the competencies learned in medical school.

Recommendation 3. Residency training should continuously reinforce the importance of teamwork in health care and help facilitate a shift toward a culture of safety.

Recommendation 4. Health care should adapt lessons learned from the Advanced Qualification Program.

Recommendation 5. The licensure and board certification process should regulate physicians' teamwork-related competence.

Recommendation 6. Licensing exams and the board certification process should include assessments of each new physician's knowledge of the components of teamwork, inter-positional knowledge, and shared task expectations for their chosen specialty.

Recommendation 7. Licensing exams and the board certification process should require physicians to demonstrate their competence on the team leadership, mutual performance monitoring, backup behavior, and adaptability dimensions.

Recommendation 8. The Joint Commission should identify teamwork as a priority focus area.

Recommendation 9. Joint Commission surveyors should be trained to assess important aspects of teamwork.

Recommendation 10. Teamwork should be evaluated within each tracer session.

* KSAs, knowledge, skills, and attitudes.

In the next section, we describe where these KSAs might be assessed. This section reviews several strategies that were presented in the ACGME toolbox, but from the perspective of measuring team KSAs rather than the higher-order ACGME competencies.

■ *Recommendation 8.* The Joint Commission should identify teamwork as a priority focus area.

■ *Recommendation 9.* Joint Commission surveyors should be trained to assess important aspects of teamwork.

■ *Recommendation 10.* Teamwork should be evaluated within each tracer session.

Where to Measure Teamwork Skills

Team-related skills are usually assessed in simulated situations that have been designed to elicit behaviors that represent the skill of interest.²⁹ Knowledge and attitudes are typically measured with more traditional assessments such as written or oral exams and self-reports, respectively. There are two categories of strategies that we consider useful for eliciting and measuring team skills. The first, simulation, includes screen-based microsimulators, patient simulators, standardized patients, and objective structured clinical examinations (OSCEs).^{29,44} The second, on-the-job clinical observations and measurements, includes observations, morbidity and mortality (M&M) conferences, and grand rounds interactions. We now assess the usefulness of each of these approaches for measuring physician team-level skills.

Simulations. Simulation, which has a long history in aviation training,⁴⁵ is now emerging as a critical training tool in patient safety.²⁹ Gaba, Cooper, and Helmreich have all demonstrated the value of simulators for training anesthesia and surgical teams and measuring these teams' performance.^{19,46,47}

Battles et al. have argued that standardized patients provide an excellent environment for measuring the competency of physicians on the quality of care they deliver.⁴⁸ We group patient simulators, standardized patients, and OSCEs all under the category of simulation in that all of these strategies, health care teams are confronted with a scenario while performing a simulated task. The ability to present behavioral challenges that evoke values, norms, attitudes, and skills is what sets apart these measurement tools.

Oser and colleagues outline specific steps for developing sound scenarios for eliciting team behaviors.^{49–52} The Federal Aviation Administration has adopted a approach, “line-oriented simulations,”⁵³ which entails the following steps:

■ Skill inventories and historical performance data are reviewed to identify “what” needs to be measured. Identifying the core measurement objectives builds content validity into the scenario.

■ Scenario events are developed to provide specific opportunities to observe and assess performance on the objectives that have been chosen. It is recommended that several events be developed for each objective so that performance on any objective can be assessed under shifting conditions and varying levels of difficulty.

■ Performance measures are developed that accurately and reliably assess performance of the learning objectives. Measures should have the ability to describe what happened (outcome measures) in addition to describing why certain outcomes were or were not attained (process measures). Employing this approach to scenario design should yield a reliable and valid tool for measuring team skills.

On-the-Job. We group clinical observations, M&M conferences, grand rounds, and physician diaries into this category. The fundamental difference between assessing team performance on the job, as opposed to in a simulated environment, is that there is far less control regarding when and which team behaviors will manifest themselves. Moreover, because events are not tightly controlled on the job, it would be hard to use this approach to make comparisons among physicians regarding team skills. M&M conferences, grand rounds, and diaries present a slightly more structured environment, because physicians may be probed about specific events and their responses to those events.

Observational data, which capture physician team skills in the actual environment, are more likely to paint an accurate picture of a physician's team skills. However, when observations are being made, either through direct (observers) or indirect (for example, video tape) measures, it is possible for a Hawthorne effect to occur. We believe, given stable conditions, that such observations can offer an incredible wealth of information about the team, communication skills, and the resilience of the team during an adverse event.⁵⁴

How to Measure Team KSAs

In this section, we review techniques used to measure team knowledge and attitudes. In addition, we review various strategies that have been used to observe and judge team skills during scenario-based exercises. In most cases, we begin with information presented in the

ACGME toolbox and then expand the review to cover issues specifically related to teamwork.

How to Measure Team Knowledge. The ACGME recommends multiple-choice examinations to assess residents' medical knowledge and understanding, with standardized oral exams recommended for clinical decision making and application of medical knowledge. We believe that the same strategies can be used to assess knowledge of the components of teamwork; of the team mission, norms, objectives, and resources; and of task-specific responsibilities. In addition, strategies such as situational judgment tests (SJTs) have the potential to probe alternative responses to ambiguous situations.⁵⁵ SJTs provide a verbal description of a scenario and a list of potential courses of action. Some formats ask the respondent to indicate which actions he or she believes to be the most and least effective,⁵⁶ whereas others ask respondents to indicate what they would be most or least likely to do in the situation.⁵⁷ SJTs, which have been developed for paper-and-pencil, computer-based, and video-based testing, have gained popularity because they are believed to address dynamic knowledge and skills that cannot easily be measured with traditional multiple-choice questions. They are often used to assess conflict resolution, managerial,⁵⁸ and technical skills.⁵⁹ Unfortunately, few valid measures of team knowledge competencies exist in the literature.⁶⁰

How to Measure Team Attitudes. The ACGME toolbox does not review any measures for physician attitudes. However, measures of team attitude competencies are far more prominent than team knowledge or skill measures in the academic literature. Measures of "belief in the importance of teamwork"⁶¹⁻⁶³ and an attraction to being part of a team have been developed, tested, and validated^{64,65}—these measures can all be characterized as self-reports.

The self-report method, by far the most common approach to assessing attitudinal characteristics, is based on the principle that individuals are both capable and willing to respond to a variety of probes related to certain attitudes measured by a particular inventory. Although research supports the idea that individuals are capable of accurately reporting this information, motivation often has strong effects on one's willingness to report this information accurately. When the results are

used for high-stakes decisions (for example, hiring or promotion decisions), an individual's motivation to report his or her actual attitudes and beliefs may be undermined by one's desire to score well on the test.

A new, innovative, and indirect method of assessing individual attitudes and personality is *conditional reasoning*. Conditional reasoning tests are based on the assumption that individuals develop cognitive mechanisms to explain and justify their own beliefs and behaviors, which reflect their attitudes and personality characteristics.⁶⁶ For some constructs, individuals differ substantially in the justification mechanisms they use to explain their beliefs. For these constructs, the extent to which an individual adopts particular justification mechanisms can be assessed and, as a result, should indirectly reflect the underlying attitude construct.⁶⁶

Conditional reasoning tests are composed of problem scenarios that are designed to elicit a response based on particular justification mechanisms.⁶⁶ The response options provided for each scenario are designed to represent different conclusions an individual might reach based on the information described in the scenario. The response options are designed to represent potential conclusions that would be logically derived if the respondent utilizes the justification mechanism targeted in the scenario description. O'Shea and colleagues have developed a Team Orientation Test that uses the conditional reasoning methodology.⁶⁷ In a pilot study, two aspects of their proposed theory of team orientation, Responsibility to Others and Negative Worldview, correlated with supervisor performance ratings and reports of soldier commitment to both the team and the military in general.

How to Measure Team Skills. The ACGME identified checklists and global rating scales as possible strategies to assess skills. In a checklist, desired behaviors, activities, or steps that define a complex competency are "checked" by a trained rater when the behavior is observed either in a simulated exercise or on-the-job. Global rating scales involve a trained rater's making judgments about an individual's competency in a general skill or knowledge area. In health care, global rating scales have been used for making end-of-clinical-rotation summative assessments.

Checklists and rating scales have been used with some success to assess teamwork skills. For example,

Dwyer and colleagues developed a checklist for assessing team behaviors of Navy teams using the TARGETs (Targeted Acceptable Responses to Generated Events or Tasks) methodology.⁴⁹ Smith-Jentsch and colleagues examined several rating scales developed under the Navy's Tactical Decision Making Under Stress project.⁶⁸ A detailed analysis of the Anti-Air Teamwork Observation Measure (ATOM) showed that observers had difficulty distinguishing among the 11 team skill competencies assessed. A revised ATOM metric involving only 4 of these competencies (information exchange, communication, supporting behavior, and team initiative/leadership) produced better psychometric evidence, leading Smith-Jenstch et al. to recommend that researchers use the simplest factor structure when assessing teamwork.⁶⁹

Observational measures have recently been developed to assess team performance in health care. For example, Healey et al. developed the observational teamwork assessment for surgery, which requires two observers. One monitors the task performance of the surgical team regarding tasks associated with the patient, environment, equipment, provisions, and communication. The other monitors teamwork—cooperation, leadership, coordination, awareness, and communication—during the preoperative, operative, and postoperative phases. Thomas et al. described the use of 10 teamwork behavioral markers and a corresponding observational form for neonatal resuscitation teams in observation of videos of neonatal resuscitations.

A carefully constructed checklist or rating scale tool is only half of the equation when human raters are involved. Rater training has been consistently shown to be the other critical factor in ensuring the quality, consistency, and robustness of observer ratings. Baker et al. have advocated "Gold Standards" to train pilot instructors to assess aircrew teamwork during line-oriented simulations.⁷⁰ A special issue of the *International Journal of Psychology* summarizes much of what is known about training observers that could be readily extended to health care.⁷¹

Summary

In this section, we presented our recommendations as to how team KSAs might be elicited and assessed across a

Table 4. Measurement Tool Properties, Scoring, and Administration Characteristics of Team KSAs*

Measurement Tools		Psychometric	Item Development	Administration	Scoring	Fakeability and Coach-ability	Evidence Base
Team Attitude Competencies	Self-Report	good reliability, low validity	—	large groups	machine	high	strong
	Conditional Reasoning Tests	good reliability and validity	intensive process, expensive	large groups	machine	low	emerging
Team Skill Competencies	Checklists	reliability dependent on rater training	—	individual teams	human raters	low	strong
	Rating Scales	reliability dependent on rater training	intensive process, expensive	individual teams	human raters	low/moderate	emerging/strong
Team Knowledge Competencies	Standardized Oral Exams	reliability dependent on rater training, good validity	—	individual	human raters	low/moderate	emerging
	Multiple Choice	good reliability, good validity	—	large groups	machine	low	emerging
	Situational Judgment Tests	good reliability, poor discriminant validity between dimensions	intensive process, expensive	large groups	machine	low/moderate	emerging

* KSAs, knowledge, skills, and attitudes.

physician's career, starting in medical school and continuing through licensure and board certification. We advocate that the various professional bodies be responsible for the development of specific team knowledge and skill competencies and for promoting specific team attitude competencies. In addition, we identified tools that could be used to assess medical student, resident, and physician competence in these critical team KSAs. Table 4 (above) provides in-depth information on the tools' psychometric qualities, development and administration requirements, and the degree to which an evidence base exists to support the use of these tools for measuring team KSAs.

Measurement of team KSA competencies is an evolving science. Research on team performance needs to be accelerated to respond to the recommendations set by the IOM, the Quality Interagency Coordination (QuiC) Task Force,⁷² and other agencies. Moreover, an understanding of the challenges allows one to judge the quality of new measures and training programs that are being

developed and implemented in health care facilities. Many of these measures have been derived directly from aviation and crew resource management (CRM) training programs. Baker et al. questioned this approach, particularly when measures and training strategies are rarely tested to determine their efficacy in the health care environment.²⁶ Furthermore, they are often not based on an evidence-based theory of teamwork.

Challenges and Complexities in Team Performance Measurement

For teamwork skills to be assessed and to have credibility within health care, five challenges in physician team performance measurement must be carefully considered.

1. Team Performance Measures Must Be Grounded in Team Theory

The measurement of any construct should be firmly rooted in theory, and the construct of teamwork is no

exception. Historically, different terms (for example, performance versus effectiveness, groups versus teams) have been used interchangeably to refer to different but related team constructs.¹³ Existing team performance models are plagued with labeling inconsistency and/or confusing terminology. Thus, it is essential that individuals seeking to measure team performance have a clear idea about what it is they are measuring. In this paper, we advocate for the Salas et al. model of teamwork.¹⁷ The model defines the constructs, which comprise the core of teamwork for most teams. Without thorough construct explication and development, the measurement, assessment, and ultimately the conclusions derived from team performance measurement research may be questioned. Before measurement systems are designed, the nature of each team and its operating circumstances must be understood.

2. Team Performance Measures Must Account for Individual and Team-level Performance

Teams are composed of individuals nested within an organizational context (Figure 1). Measurement approaches must acknowledge this fact as the extensive work on microsystems supports.³⁴ Although evaluating individual physician performance provides data for structuring training and education or certification and licensure, measurement at the team (and subteam) level should also be done. Thus, it is important for any performance measurement system to distinguish between individual and team performance. This begs the question of what to measure. Unfortunately, performance measurement research has typically focused on the performance of individuals. Balancing individual and team performance measurement may be a difficult challenge, but it can be done. Specifically, the utilization of multiple measurement systems will allow for the accurate diagnosis of performance deficiencies. This will facilitate the efficient use of resources in correcting sources of error at the individual or team level.

3. Team Performance Measures Must Capture Team Process and Outcomes

Just as it is important to assess both individual and team performance, it is also important that team performance measures capture processes and outcomes.

Although successful outcomes (for example, reduction in errors, improved recovery) are the ultimate goal of team performance and the typical focus of measurement, measurement of process is critical for diagnosing performance problems. Early in this article, we argued that the measures presented focus on the measurement of team KSA competencies that contribute to effective team process. If process measurement is the biggest challenge that confronts health care, then we believe that this is where the biggest payoff lies. Process measures provide answers to the “why” and “how” of performance, permitting the gathering of diagnostic information. Identification and targeting of flawed processes can lead to more effective outcomes.

Additionally, the dynamic nature of teamwork implies that team performance measurement should not be a one-shot occurrence—it should be sampled over a wide variety of occasions and conditions. Teams measured early in their life cycle may look very different from more seasoned teams.

4. Team Performance Measures Must Adhere to Accepted Standards for Reliability and Validity

Measurement instruments employed in the pursuit of team performance must adhere to accepted standards of reliability and validity. Unfortunately, teamwork measures are often described as unreliable, complex, insensitive, and measuring irrelevant variables. Without accurate, reliable measures of team performance, it is difficult to select or train members or to manage team performance. Concerning reliability, measures of team performance should be devised to reduce unsystematic error and improve consistency of measurement. Unreliable measurement is most often manifested in disparate scores generated by raters observing the same team behavior(s). It is recommended that team performance expert observers demonstrate high levels of agreement ($\geq 90\%$). Improvement in levels of interrater agreement may be facilitated via careful construct clarification, measure development, and rater training, which we recommend includes the use of Gold Standards.⁷⁰ Beyond interrater reliability, consideration should also be given to estimates of internal consistency and temporal stability.

Validity refers to the adequacy, appropriateness, and meaningfulness of inferences derived from test scores or other modes of assessment. It is most often assessed by gathering construct-, content-, and criterion-related forms of evidence. Team theory cannot meaningfully move beyond the conceptual stage without the development of valid measurement tools.

5. Team Performance Measures Must Address Any Real or Perceived Barriers to Measurement

A number of specific barriers to measurement may also present themselves as challenges to the organizations charged with reporting on a team's performance. First, those charged with conducting assessments of physician teamwork KSAs may believe that measures are hard to work with and are too time consuming. An overarching principle in this area is that team performance measurement tools should be easy to use. They should facilitate observation and be easy to implement and evaluate. Thus, while many practitioners would bemoan the fact that team performance measures are time consuming to use, once performance is defined in concrete, observable terms, measurement is fairly straightforward. The earlier recommendation to limit the number of behavioral dimensions to be rated is illustrative here. Using teams of raters and observers is a sound recommendation to support the use and reduce the cognitive demand of individual observers. Second, people may believe that some jobs cannot be measured. Once again, however, if the behavior is a performance episode, it can be measured. Even process variables such as communication and backup behaviors can be measured given the right tools. For example, the assessment of shared mental models in teams can be done through sorting tasks, probed protocol analysis, and structural assessment. A third barrier to measurement exists when it is viewed as an antecedent for punishment. Individuals in teams may view performance measurement as a negative experience and may even be fearful that any errors committed will

reflect negatively on them. However, the commission of errors and the recovery from them is a common and integral component of all (training or measurement) programs in which performance must be measured. Errors committed during the course of working in a team should be reframed as an opportunity to learn.

Conclusions

To successfully embed team training throughout a physician's professional training, we recommend that the medical community continue to inform itself of the progress of this science through a variety of venues, such as specialized workshops and books. We recommend that the medical community enlist the help of team-training experts to apply these principles and guidelines to advance the care of patients. We believe that the timing is right to support such an initiative. A combination of continued research and translation of research findings into practice will lead quickly to the best outcomes in patient care. **1**

The work described in this article was performed by the American Institutes for Research under contract to the Agency for Healthcare Research and Quality (AHRQ) and the TRICARE Management Activity, Department of Defense (DoD) (Contract No. 282-98-0029, Task Order No. 54). The views herein are those of the authors and are not to be construed as official or as reflecting the views of AHRQ, the DoD, or the United States Department of Health and Human Services.

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