Chapter 14
Evaluating Team Performance: A Systematic Review

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Abstract Effective teamwork amongst healthcare professionals has been shown to correlate with positive patient outcomes. This paper reviews research conducted with healthcare professionals to determine the extent to which assessments of team performance had been developed and evaluated between 2006 and 2012. The National Library of Medicine's indexed database PubMed was used to identify potential articles for inclusion in the review. Of the 549 articles retrieved, 158 articles were selected for inclusion in the study based on review of the article abstracts. Of the 158 articles, 26 of the articles examined psychometric characteristics of the measures. Most instruments were observation checklists, and research was conducted primarily in emergency medicine and surgery. Measures developed that can be used in a variety of healthcare settings, in addition to surgery and acute care, will be invaluable as the complexity of providing adequate patient care will increasingly require the coordinated efforts of team members.

Takeaways

- Frameworks for training health professionals in functioning as teams should provide the basis for the development of assessment instrucments.
- In designing an assessment of skills in teamwork, one should consider how the results are going to be used. Is the intention to provide feedback to individual team members? Will assessment results be used to evaluate educational programmes?.
- Assessment purpose will determine content and format for the assessment.
- A number of instruments have already been developed and validated. If at all possible, use an assessment that has been studied.

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14.1 Evaluating Team Performance: A Systematic Review

Almost all of us are familiar with teams and/or team observation thanks to sports teams. Whether recreational, school-based, or professional, athletic teams are an example of what a group of people can do to reach a common goal. Assessment of team performance in sports is well established, and the outcomes are obvious (did they win?). For teams in aviation and health care, the outcomes are significantly more important. Did the plane land safely? Is the patient alive? Aviation and health care share a common feature, the potential of tragic consequences when errors occur. Because of the consequences associated with failure, these professions are said to be examples of high-reliability organizations.

The nature of the "hypercomplex environment" in which health care occurs is characterized by several decision makers, whose roles are embedded in an "extreme hierarchical differentiation," they note that the assurance of patient safety requires interaction and communication in "compressed time" with a "high degree of accountability" (Baker et al. 2006). In identifying the characteristics of high-reliability organizations, Baker, Day, and Salas argue that healthcare providers are often organized in teams, and that their interactions are part of the vital operations in various settings (Baker et al. 2006). The hypercomplexity of the context in which health care occurs is characterized by specialization, where team members have specific roles, responsibilities, and knowledge (Orchard et al. 2012). Because errors, although rare, result in serious consequences, teamwork is essential. Knowledge of their own roles and responsibilities, monitoring of team member performance, and a positive attitude toward teamwork have been shown to relate to team effectiveness (Baker et al. 2006; Driskell and Salas 1992).

Team competencies typically considered for training programs have been identified as leadership, mutual performance monitoring, mutual support, adaptability, team orientation, mutual trust, shared mental models, and communication (Baker et al. 2006; Salas et al. 2005). The extent to which interdependent healthcare professionals are able to communicate and coordinate activities has been shown to relate to failures as well as successes (Healey et al. 2006; Nagpal et al. 2012). While team competencies have been studied extensively in aviation and the military, research on teamwork training and evaluation is gaining prominence in healthcare professions (e.g., Capella et al. 2010; Lurie et al. 2011; Tumerman and Carlson 2012). When considering patient outcomes, patient safety and team performance have been linked to surgery (e.g., Lawton et al. 2012; Nagpal et al. 2012).

Considerable research has been conducted in organizational and cognitive psychology, providing a theoretical basis for competencies associated with effective team performance. While several training programs focusing on team training have been started in health professions, little research has been done to determine whether the theories developed for aviation and military operations are applicable to healthcare settings (Baker et al. 2006). The increasing emphasis on the link between effective teamwork and positive patient outcomes demands that research provide

evidence supporting training programs as well as assessment and evaluation of team processes in health care.

Measurement of team processes that lead to successful performance can be challenging. In the health professions, teamwork training introduces new concepts, where autonomy had previously been emphasized (Lerner et al. 2009). Research in other fields has shown that the development of readily observable behavior checklists is likely to be more accurate than self-assessment (Baker and Salas 1992), although more work regarding the extent to which these measures are specialty- or context-specific needs to be done. What is the current state of affairs in assessment of teamwork for these professionals? How has theory from other fields been incorporated in the training and evaluation of health professionals?

Principles meant to guide the development of assessment tools provide a framework for the categorization of the research reviewed in this paper. Baker and Salas (1992) indicated that measures should show clear relation to theory, should present evidence of reliability and validity, should indicate the developmental nature of teams, and should be observation based. In the current investigation, a review of research published that involved healthcare professionals was conducted to determine the extent to which assessments of teamwork had been developed and evaluated between 2006 and 2012. The goal of the study was to summarize the extent to which instruments had been developed, adhering to the principles proposed by Baker and Salas (1992).

14.2 Methods

The National Library of Medicine's indexed database PubMed was used to identify potential articles for inclusion in the review. Articles published in English between 2006 and 2012 were searched for potential inclusion. Using the search term "assessment OR evaluation AND teamwork," a total of 549 articles were retrieved. Only those articles that referenced assessment of teamwork were selected for inclusion. Articles were classified by healthcare profession (e.g., pharmacy, medicine, nursing), specialty (e.g., surgery, oncology, anesthesiology), type of research (e.g., program evaluation, quality assurance, psychometric), and factor measured (process, skill, or task).

Of the 549 articles retrieved, 158 articles were selected for inclusion in the study based on review of the article abstracts. Since the current investigation focuses on assessment and evaluation of teamwork amongst health professionals, articles focusing on training, quality assurance, or safety climate were eliminated from further review. Of the 158 articles included for second-level review, 45 were identified that focused specifically on assessment or evaluation of teams, the remainder focused on some other aspect of teamwork (see Fig 14.1).

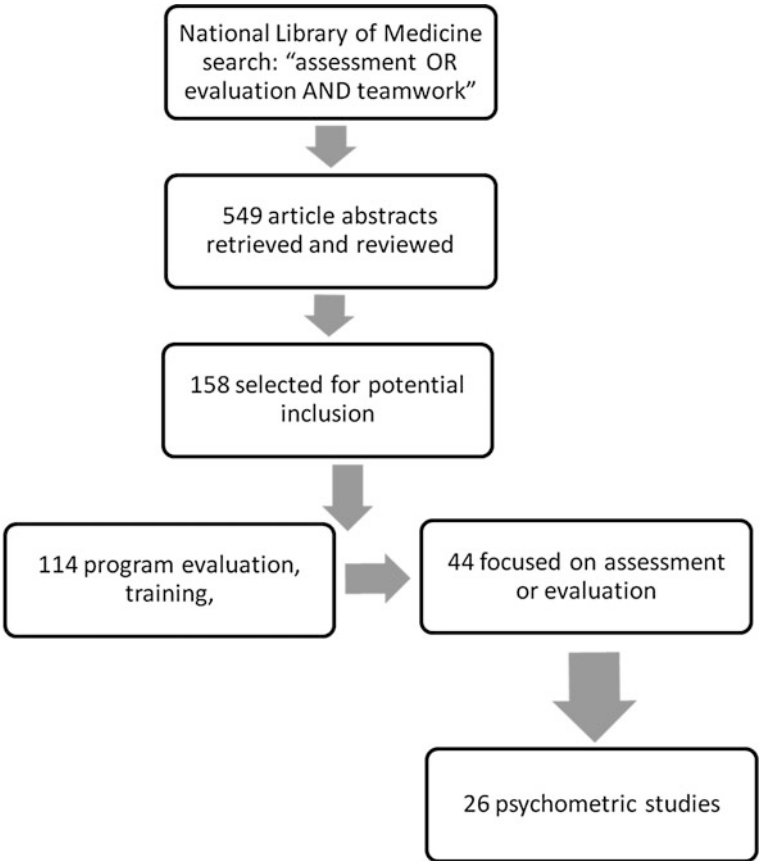

Fig. 14.1 Review and selection process

14.2.1 Results

Nonmeasurement articles on teamwork. Based on the review of 158 articles on teamwork, 113 of the articles reported research focused on topics other than assessment, most of which reported on program evaluation (45 articles, 40 %). Although the majority of these studies focused on medicine ($n = 53$, 47 %), a number of the studies included various members of the healthcare team (48 articles, 42 %). While surgical teams ($n = 12$; 11 %) and emergency medicine teams ($n = 8$; 7 %) were studied, there was an effort to study healthcare teams in a variety of specialties ($n = 48$; 42 % of articles did so). The primary focus of the articles was on program or training evaluation ($n = 45$; 40 %), theory specific to healthcare settings ($n = 15$; 13 %), and program development ($n = 15$; 13 %). The remaining categories included quality assurance and patient safety (10 articles), review of research on teamwork (9 articles), and attitudes toward teamwork (5 articles), amongst others. Appendix A provides the listing of articles on teamwork that were not focused on assessment.

Review of the 45 articles on assessment and evaluation was primarily focused on psychometric issues (i.e., reliability and/or evidence of validity); 26 of the articles examined psychometric characteristics of the measures (59 %). Other study types included evaluation (n = 11; 22 %), theoretical study of teamwork competencies specific to healthcare professionals (4 articles, 9 %), and review articles on teamwork measures in health professions (n = 2; 4 %). Most of the studies were focused on medicine (n = 27; 60 %), predominately in surgery (n = 17; 37 %), although several of the studies that reported on measures were interdisciplinary (i.e., across professions, but in a particular specialty). Articles classified as general (n = 12; 28 %) included settings that crossed specialties (e.g., Orchard et al. 2012). The investigations primarily focused on measures intended to evaluate teamwork skills (n = 22; 49 %), with eight (18 %) of the measurement themed articles measuring skills and tasks, and eight measuring only tasks. The remaining articles measured attitudes toward teamwork (n = 5; 11 %), climate (n = 1; 2 %), and the relation between teamwork and patient outcomes (1 article).

Because the focus of the article is specifically on assessment, further characterization of articles reporting on measures that examined psychometric qualities were conducted to determine whether the measures studied were self-report, self-assessment, or meant for observation. Of the 26 articles containing information specific to the measure(s) studied, one did not provide sufficient information to determine how the measure would be used (Varkey et al. 2009). Of the remaining 25 articles, 9 (35 %) were self-report or self-assessment measures; and two of these were attitude toward teamwork measures. The remaining 17 articles were observational measures; 8 of those were conducted in surgical settings. Generally, team activities were videotaped, and then the checklists were used to rate performances. Table 14.1 provides information on the articles in which measures were studied.

When examining which competencies were measured, the work of Salas et al. 2008 was used as the theoretical basis for team training. These included team leadership, mutual performance monitoring, backup behavior, adaptability, team orientation, shared mental models, mutual trust, and closed-loop communication (Salas et al. 2008, p. 1003). Whether these constructs were measured as part of the assessment was examined by review of articles that detailed instrument content. Table 14.2 presents the overlap between the theorized constructs and those measured in the studies included in the review. The work of Patterson et al. (2012) showed that it was possible to design an instrument that measured all of the competencies for effective teamwork, and in addition, they included measures of conflict. Lurie et al. 2011 studied whether the burden of rating using longer checklists could be reduced without loss of information and reliability. In their study, they found that a 29-item checklist could be reduced to as few as five items with similar reliability and factor structure, and that observations could be completed in as few as 3 minutes or less.

For articles that included the measures as an appendix, authors often found that the items used could be labeled as constructs other than those included in theory focused on training. Team orientation, shared mental models, and mutual trust may have been measured in studies of attitudes more often than in studies which focused on evaluation of teamwork skills. For the six studies included in Table 14.2, most included measures of communication and leadership. These factors are those

Table 14.1 Studies focused on assessment of teamwork

Publication Year	First Author	Title	Study type	Profession	Specialty	Comments
2006	David R. King	Simulation training for a mass casualty incident: two-year experience at the Army Trauma Training Center	Evaluation	Medicine	Emergency/Trauma	Meant to identify skills for additional training
2006	E.J. Thomas	Teamwork and quality during neonatal care in the delivery room	Evaluation	Interdisciplinary	Neonatology	Measure used with videotaped teamwork in neonatal resuscitation. Intended to use results to improve training
2006	JoDee M. Anderson	Simulating extracorporeal membrane oxygenation emergencies to improve human performance. Part II: assessment of technical and behavioral skills	Evaluation	Medicine	Emergency/Trauma	Nursing simulation based on very specific type of emergency. Pretest–posttest design to evaluate training program. Observation-based measure
2006	Katherine C. Pollard	A comparison of interprofessional perceptions and working relationships among health and social care students: the results of a 3-year intervention	Evaluation	Interdisciplinary	General	Participant perception of how team members related to each other
2006	Susan Mann	Assessing quality obstetrical care: development of standardized measures	Evaluation	Medicine	Obstetrics	Teamwork measured as part of a study on quality indicators for obstetrics. Benchmarking study
2006	A. Hutchinson	Use of a safety climate questionnaire in UK health care: factor structure, reliability and usability	Psychometric	Interdisciplinary	General	Safety climate survey
2006	Aysegul Yildirim	Turkish version of the Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration: a preliminary study	Psychometric	Nursing	General	Nurses and physicians rate attitudes about collaboration between the two groups

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Table 14.1 (continued)

Publication Year	First Author	Title	Study type	Profession	Specialty	Comments
2006	J. Bryan Sexton	Teamwork in the operating room: frontline perspectives among hospitals and operating room personnel	Psychometric	Medicine	Surgery	
2006	Steven Yule	Development of a rating system for surgeons' non-technical skills	Psychometric	Medicine	Surgery	
2006	Shabnam Undre	Observational assessment of surgical teamwork: a feasibility study	Psychometric	Medicine	Surgery	Used OTAS (see Healey)
2006	Andrew N. Healey	The complexity of measuring interprofessional teamwork in the operating theatre	Theory	Medicine	Surgery	
2007	Shabnam Undre	Multidisciplinary crisis simulations: the way forward for training surgical teams	Evaluation	Interdisciplinary	Surgery	
2007	Daniel L. Davenport	Risk-adjusted morbidity in teaching hospitals correlates with reported levels of communication and collaboration on surgical teams but not with scale measures of teamwork climate, safety climate, or working conditions	Organizational climate	Medicine	Surgery	
2007	Allan Frankel	Using the communication and teamwork skills (CATS) Assessment to measure health care team performance	Psychometric	Interdisciplinary	General	
2008	Mirjam Körner	Analysis and development of multiprofessional teams in medical rehabilitation	Psychometric	Medicine	Physical medicine and rehabilitation	

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Table 14.1 (continued)

Publication Year	First Author	Title	Study type	Profession	Specialty	Comments
2008	Steven Yule	Surgeons' non-technical skills in the operating room: reliability testing of the NOTSS behavior rating system	Psychometric	Medicine	Surgery	
2008	Amy H. Kaji	Assessing hospital disaster preparedness: a comparison of an on-site survey, directly observed drill performance, and video analysis of teamwork	Quality assurance	Interdisciplinary	General	Disaster preparedness
2008	K. Catchpole	Teamwork and error in the operating room: analysis of skills and roles	Theory	Interdisciplinary	Surgery	
2009	P. McCulloch	The effects of aviation-style non-technical skills training on technical performance and outcome in the operating theatre	Evaluation	Interdisciplinary	Surgery	Crew resource management training applied to healthcare setting. Pretest–posttest evaluation of training with observation of skills. Used to identify areas challenges based on measures for specific types of surgical procedures
2009	A. Mishra	The Oxford NOTECHS System: reliability and validity of a tool for measuring teamwork behaviour in the operating theatre	Psychometric	Interdisciplinary	Surgery	
2009	Karen Mazzocco	Surgical team behaviors and patient outcomes	Psychometric	Interdisciplinary	Surgery	
2009	Melanie C. Wright	Assessing teamwork in medical education and practice: relating behavioural teamwork ratings and clinical performance	Psychometric	Medicine	General	

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Table 14.1 (continued)

Publication Year	First Author	Title	Study type	Profession	Specialty	Comments
2009	Nicholas Hamilton	Team behavior during trauma resuscitation: a simulation-based performance assessment	Psychometric	Medicine	Emergency/Trauma	
2009	Nick Sevdalis	Observational teamwork assessment for surgery: construct validation with expert versus novice raters	Psychometric	Medicine	Surgery	
2009	Prathibha Varkey	An innovative team collaboration assessment tool for a quality improvement curriculum	Psychometric	Interdisciplinary	General	
2009	D. Tregunno	Development and usability of a behavioural marking system for performance assessment of obstetrical teams	Theory	Interdisciplinary	Obstetrics	
2010	David P. Baker	Assessing teamwork attitudes in healthcare: development of the TeamSTEPPS teamwork attitudes questionnaire	Attitudes	Interdisciplinary	General	Relationship between attitude toward teamwork and team functioning
2010	Jeannette Capella	Teamwork training improves the clinical care of trauma patients	Evaluation	Medicine	Emergency/Trauma	Reported on the evaluation of team training using "Trauma team performance observation tool"
2010	Chris Kenaszchuk	Validity and reliability of a multiple-group measurement scale for interprofessional collaboration	Psychometric	Interdisciplinary	General	Nurses rating physician skills
2010	Simon Cooper	Rating medical emergency teamwork performance: development of the Team Emergency Assessment Measure (TEAM)	Psychometric	Medicine	Emergency/Trauma	

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Table 14.1 (continued)

Publication Year	First Author	Title	Study type	Profession	Specialty	Comments
2010	Michael A. Rosen	Tools for evaluating team performance in simulation-based training	Review	Medicine	Emergency/Trauma	Review article on instruments evaluating team performance
2011	Jan Schraagen	Assessing and improving teamwork in cardiac surgery	Evaluation	Medicine	Surgery	Coding of nonroutine events in the OR: "Real-time teamwork observations were supplemented with process mapping, questionnaires on safety culture, level of preparedness of the team, difficulty of the operation, and outcome measures"
2011	Jennifer Weller	Evaluation of an instrument to measure teamwork in multidisciplinary critical care teams	Psychometric	Medicine	Critical care	Measure of individuals within team
2011	Louise Hull	Assessment of stress and teamwork in the operating room: an exploratory study	Psychometric	Medicine	Surgery	Relationship between stress and teamwork in the OR
2011	Stephen J. Lurie	Assessing teamwork: a reliable five-question survey	Psychometric	Medicine	Family medicine	
2011	Bharat Sharma	Non-technical skills assessment in surgery	Review	Medicine	Surgery	Review article on instruments evaluating team performance
2012	Jeffrey Braithwaite	A four-year, systems-wide intervention promoting interprofessional collaboration	Evaluation	Interdisciplinary	General	Measure of attitudes toward interprofessional collaboration and learning
2012	Simon Cooper	Managing patient deterioration: assessing teamwork and individual performance	Evaluation	Nursing	Emergency/Trauma	Reported using the "Team emergency assessment measure" and observation during OSCE to assess teamwork. Program evaluation more than assessment of teams

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Table 14.1 (continued)

Publication Year	First Author	Title	Study type	Profession	Specialty	Comments
2012	C. Taylor	Developing and testing TEAM (Team Evaluation and Assessment Measure), a self-assessment tool to improve cancer multidisciplinary teamwork	Psychometric	Medicine	Oncology	Self-assessment measure
2012	Carole A. Orchard	Assessment of interprofessional team collaboration scale (AITCS): development and testing of the instrument	Psychometric	Interdisciplinary	General	Individual measure of perception of collaboration amongst team members including patients and their families
2012	Douglas R. Wholey	The teamwork in assertive community treatment (TACT) scale: development and validation	Psychometric	Medicine	Psychiatry	
2012	Kamal Nagpal	Failures in communication and information transfer across the surgical care pathway: interview study	Psychometric	Medicine	Surgery	Study of reliability and feasibility of a tool measuring teamwork based on postoperative handover
2012	Kevin J. O'Leary	Assessment of teamwork during structured interdisciplinary rounds on medical units	Psychometric	Medicine	General	Adaptation of OTAS instrument demonstrated relevance across settings
2012	P. Daniel Patterson	Measuring teamwork and conflict among emergency medical technician personnel	Psychometric	Medicine	Emergency/Trauma	Measure of task performance for EMTs
2012	Stephanie Russ	Observational teamwork assessment for surgery: feasibility of clinical and nonclinical assessor calibration with short-term training	Psychometric	Medicine	Surgery	

Table 14.2 Constructs measured by teamwork assessments

Publication year	First author	Title	Profession	Leadership	Communication	Mutual performance monitoring	Backup behavior	Adaptability	Team orientation	Shared mental models	Mutual trust	Other
2010	Jeannette Capella	Teamwork training improves the clinical care of trauma patients	Medicine	Y	Y	Y	Y	N	N	N	N	
2011	Louise Hull	Assessment of stress and teamwork in the operating room: an exploratory study	Medicine	Y	Y	Y	Y	N	N	N	N	Coordination
2010	Chris Kenaszchuk	Validity and reliability of a multiple-group measurement scale for interprofessional collaboration	Interdisciplinary	N	Y	N	Y	N	N	N	N	Isolation
2011	Stephen J. Lurie	Assessing teamwork: a reliable five-question survey	Medicine	Y	Y	N	Y	N	Y	Y	Y	Problem-solving
2012	P. Daniel Patterson	Measuring Teamwork and Conflict among Emergency Medical Technician Personnel	Medicine	Y	Y	Y	Y	Y	Y	Y	Y	Process conflict; task conflict; interpersonal conflict
2012	Carole A. Orchard	Assessment of Interprofessional Team Collaboration Scale (AITCS): development and testing of the instrument	Interdisciplinary	Y	Y	N	N	N	Y	N	N	Partnership

considered to have the most negative effects when teamwork fails (Nagpal et al. 2012). Two studies (Kenaszchuk et al. 2010; Patterson et al. 2012) considered negative behaviors that could hamper teamwork, isolation, and sources of conflict. In general, instruments described were theory based, and the authors defined constructs in a manner consistent with the theoretical literature.

14.3 Discussion

Research conducted with the military and aviation has informed practices in health care (Baker et al. 2006; Kendall and Salas 2004; Salas et al. 2008). Research on the development of measures that are reliable and based on theory have been conducted and have advanced adaptation of measures of team interaction from other professions. The predominance of articles on psychometric issues is not surprising; work to determine whether measures could be developed or adapted for use with healthcare teams in a variety of settings is essential, and was recommended by those pivotal in the development of teamwork theory in other professions (e.g., Baker and Salas 1992). In addition, study of the factors that can affect teamwork or result in negative performance (e.g., Baker 2010; Capella et al. 2010) support the identification of factors related to the avoidance of negative consequences.

Measurement of teamwork amongst healthcare professionals faces several challenges. First, efforts continue to be specialty-specific (e.g., surgical, emergency medicine, community medicine), although there are studies that have looked to see if the measures can be used across settings (e.g., O'Leary et al. 2012). While several of the measures developed are based in theory, different constructs may be measured. Although there was minimal inconsistency in terminology, papers that do not clearly define the constructs measured can make this effort challenging, particularly if measures are to be used across health professionals and settings.

Interestingly, research has shown that team members are generally not reliable at assessing their level of skill (Baker and Salas 1992; Eva et al. 2004), but practitioners are generally able to self-monitor (Eva and Regehr 2010). Seven of the articles reviewed were self-report or self-assessment measures. Since two of those were attitude measures, the importance of the effect of self-assessment may not have the same significance as it does in measurement of competence.

Although observational measures have been said to be preferable, securing the necessary number of raters to produce reliable measures has been challenging (Morgan et al. 2007), although recent work has shown promise (Russ et al. 2012). Efforts are underway to show that shorter versions of long measures can be used in a fashion that may facilitate recruitment and training of raters, generating more ratings available for the evaluation of teamwork skills (Lurie et al. 2011).

A number of publications that focused on program evaluation highlight a challenge in assessment of teams: finding reliable measurement tools that assess group interaction (Morgan et al. 2007; Murray and Enarson 2007), particularly when targeted training in teamwork skills has been conducted. These studies typically rely on pretest–posttest design (e.g., Aboumatar et al. 2012; Vyas et al. 2012),

and often include measures of participant opinion regarding training. While this is legitimate for program evaluation, measures that can be used in practice (i.e., workplace setting) can provide additional evidence of the effect of training in interprofessional teamwork.

Although this review has provided information on the development of assessment tools for use with healthcare professionals it is not without limitations. First, only the author reviewed the abstracts, so no consistency of coding was provided. Other researchers may disagree with the categorization of the studies included in this report. However, the appendices, which include a complete reference list, can be used by others who are interested in the topic. Also, only abstracts were reviewed to determine inclusion/exclusion, and reference lists of included articles were not used to identify other articles for potential inclusion. Additional review and categorization may have examined whether reliability was reported, and the extent to which validity evidence was provided for the measures. Despite these limitations, this review provides preliminary information on the methods used to evaluate teamwork amongst healthcare professionals.

The nature of health care, as typified by Baker et al. 2006, is increasingly complex, and errors have serious consequences. The rigid hierarchical roles that health professionals have traditionally had must change; although knowledge of each person's role in the team is essential, adaptability and monitoring are important components of successful teamwork. Studies have begun to show the relationship between effective teams and positive patient outcomes (e.g., Mazzocco et al. 2009). Measures developed that can be used in a variety of healthcare settings, in addition to surgery and acute care, will be invaluable as the complexity of providing adequate patient care will increasingly require the coordinated efforts of team members.

Issues/Questions for Reflection

- Training in use of the assessment may be necessary, particularly if observation of teams will occur.
- How can work done in psychology on human interaction support the assessments developed for teamwork?
- The effect of team size, team formation (standing teams vs. dynamic teams), hierarchical structure, professional identity, and more will need to be studied in compiling evidence of validity of team measures.

Appendices

Appendix 1: Studies Without Investigation of Teamwork Measure

Publication year	First author	Title	Study type	Profession	Specialty	Comments
2006	A. Flabouris	Incidents during out-of-hospital patient transportation	Quality assurance	Medicine	General	Evaluation of factors affecting adverse outcomes in patient transport
2006	Alison Bellamy	Case reviews: promoting shared learning and collaborative practice	Evaluation	Medicine	General	Case review of teamwork
2006	B.J. Moran	Decision-making and technical factors account for the learning curve in complex surgery	Clinical	Medicine	Surgery	
2006	Cheryl Knapp	Bronson Methodist Hospital: journey to excellence in quality and safety	Evaluation	Medicine	General	QA for Hospital
2006	Debra Parker Oliver	Inside the interdisciplinary team experiences of hospice social workers	Evaluation	Medicine	Social work	Study of experiences of social workers in hospice care
2006	D. Lamb	Collaboration in practice—assessment of an RAF CCAST	Theory	Medicine	Critical care	Looked at the factors in critical care that may affect climate
2006	E. Anderson	Evaluation of a model for maximizing interprofessional education in an acute hospital	Program development	Interdisciplinary	Emergency/Trauma	Development and evaluation of a training program in an acute care setting
2006	E.K. Mayer	Robotic prostatectomy: the first UK experience	Procedure evaluation	Medicine	Urology	Clinical procedure evaluation, not team assessment
2006	Eileen B. Entin	Training teams for the perioperative environment: a research agenda	Theory	Medicine	Surgery	
2006	Elaine Cole	The culture of a trauma team in relation to human factors	Theory	Interdisciplinary	Emergency/Trauma	Ethnographic study of trauma team culture

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2006	Elie A. Akl	Brief report: Internal medicine residents', attendings', and nurses' perceptions of the night float system	Evaluation	Medicine	Internal medicine	Evaluation of residents on night shift
2006	H. Patrick McNeil	An innovative outcomes-based medical education program built on adult learning principles	Training	Medicine	General	
2006	J. Randall Curtis	Intensive care unit quality improvement: a "how-to" guide for the interdisciplinary team	Quality assurance	Interdisciplinary	Critical care	
2006	James K. Takayesu	How do clinical clerkship students experience simulator-based teaching? A qualitative analysis	Evaluation	Medicine	General	
2006	Jean Kipp	What motivates managers to coordinate the learning experience of interprofessional student teams in service delivery settings?	Evaluation	Interdisciplinary	Various	
2006	Jill Scott-Cawiezell	Nursing home safety: a review of the literature	Review	Nursing	Geriatrics	Author argued that "better outcome measures must be developed that are nurse sensitive"
2006	Kanakarajan Saravanakumar	The challenges of obesity and obstetric anaesthesia	Clinical	Medicine	Anesthesiology	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2006	Karen S. Martin	Introducing standardized terminologies to nurses: Magic wands and other strategies	Program Development	Nursing	General	Focused on nurses' of clinical data information collection
2006	Kathleen Rice Simpson	Nurse-physician communication during labor and birth: implications for patient safety	Theory	Interdisciplinary	Obstetrics	Description of communication between nurses and physicians with suggestions for improvement to teamwork for improved patient safety
2006	Kenn Finstuen	Executive competencies in healthcare administration: preceptors of the Army-Baylor University Graduate Program	Theory	Medicine	General	Preceptor competencies
2006	Marsha Sharp	Enhancing interdisciplinary collaboration in primary health care	Report	Interdisciplinary	Dieticians	
2006	Martin Rhodes	Teaching evidence-based medicine to undergraduate medical students: a course integrating ethics, audit, management and clinical epidemiology	Evaluation	Medicine	General	
2006	Nadia Abdulhadi	Quality of interaction between primary health-care providers and patients with type 2 diabetes in Muscat, Oman: an observational study	Evaluation	Medicine	Primary care	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2006	Phillip G. Clark	What would a theory of interprofessional education look like? Some suggestions for developing a theoretical framework for teamwork training 1	Theory	Interdisciplinary	General	
2006	Ping-Chuan Hsiung	Evaluation of inpatient clinical training in AIDS care	Program development	Medicine	General	Medical students' attitudes about AIDS
2006	Roy T. Dobson	Interprofessional health care teams: attitudes and environmental factors associated with participation by community pharmacists	Theory	Pharmacy	General	Participation of pharmacists as members of primary healthcare team
2006	S.M. Handler	Patient safety culture assessment in the nursing home	Patient safety	Interdisciplinary	Geriatrics	
2006	S. Yule	Non-technical skills for surgeons in the operating room: a review of the literature	Theory	Medicine	Surgery	
2006	Sally O. Gerard	Implementing an intensive glucose management initiative: strategies for success	Evaluation	Nursing	Primary care	
2006	W. Wellens	Keys to a successful cleft lip and palate team	Commentary	Interdisciplinary	Cleft lip/palate	
2006	William B. Brinkman	Evaluation of resident communication skills and professionalism: a matter of perspective?	Evaluation	Medicine	Pediatrics	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2006	William J. Swartz	Using gross anatomy to teach and assess professionalism in the first year of medical school	Program development	Medicine	Anatomy	Teamwork/professionalism teaching in the gross anatomy lab; first year of medical school
2007	A.M. Chiesa	An educational process to strengthen primary care nursing practices in São Paulo, Brazil	Program development	Nursing	Family medicine	
2007	Helen Cleak	Preparing health science students for interdisciplinary professional practice	Program Implementation	Interdisciplinary	General	
2007	L. Birch	Obstetric skills drills: evaluation of teaching methods	Evaluation	Interdisciplinary	Obstetrics	
2007	S. Lesinskiene	Use of the HoNOSCA scale in the teamwork of inpatient child psychiatry unit	Evaluation	Interdisciplinary	Psychiatry	Diagnostic scale for use in child psychiatry, not a measure of teamwork
2007	Sarah J. Rudy	Team management training using crisis resource management results in perceived benefits by healthcare workers	Evaluation	Interdisciplinary	General	
2007	Tom W. Reader	Communication skills and error in the intensive care unit	Review	Medicine	Critical care	
2007	V.R. Curran	A framework for integrating interprofessional education curriculum in the health sciences	Evaluation	Interdisciplinary	General	
2007	Vernon R. Curran	Attitudes of health sciences faculty members towards interprofessional teamwork and education	Attitudes	Interdisciplinary	General	Evaluation of interdisciplinary training program

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2008	Andreas Xyrichis	What fosters or prevents interprofessional team working in primary and community care? A literature review	Review	Interdisciplinary	General	Thematic analysis of the literature to identify processes impacting teamwork; barriers to process
2008	Chayan Chakraborti	A systematic review of teamwork training interventions in medical student and resident education	Review	Medicine	General	
2008	Chris Hughes	eMed Teamwork: a self-moderating system to gather peer feedback for developing and assessing teamwork skills	Peer feedback	Medicine	General	
2008	Christopher M. Hicks	Building a simulation-based crisis resource management course for emergency medicine, phase 1: Results from an interdisciplinary needs assessment survey	Program development	Interdisciplinary	Emergency/Trauma	
2008	Dilip R. Patel	Team processes and team care for children with developmental disabilities	Review	Interdisciplinary	Psychiatry	
2008	Eloise Nolan	Teamwork in primary care mental health: a policy analysis	Policy analysis	Medicine	Psychiatry	
2008	Emmanuelle Careau	Assessing interprofessional teamwork in a videoconference-based telerehabilitation setting	Evaluation	Interdisciplinary	Physical medicine and rehabilitation	
2008	Gillian Nisbet	Interprofessional learning for pre-qualification health care students: an outcomes-based evaluation	Evaluation	Interdisciplinary	General	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2008	Guy Haller	Effect of crew resource management training in a multidisciplinary obstetrical setting	Evaluation	Interdisciplinary	Obstetrics	
2008	Haim Berkenstadt	Improving handoff communications in critical care: utilizing simulation-based training toward process improvement in managing patient risk	Evaluation	Nursing	General	
2008	Janet R. Buelow	Building interdisciplinary teamwork among allied health students through live clinical case simulations	Program development	Interdisciplinary	General	
2008	Janine C. Edwards	Promoting regional disaster preparedness among rural hospitals	Quality assurance	Interdisciplinary	General	Disaster preparedness
2008	Jeffrey Damon Dagnone	Interprofessional resuscitation rounds: a teamwork approach to ACLS education	Evaluation	Interdisciplinary	General	
2008	John T. Paige	Implementation of a preoperative briefing protocol improves accuracy of teamwork assessment in the operating room	Evaluation	Interdisciplinary	Surgery	
2008	Marc J. Shapiro	Defining team performance for simulation-based training: methodology, metrics, and opportunities for emergency medicine	Theory	Medicine	Emergency/Trauma	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2008	Niraj L. Sehgal	A multidisciplinary teamwork training program: the triad for optimal patient safety (TOPS) experience	Evaluation	Interdisciplinary	Internal medicine	
2008	Peter J. Pronovost	Improving patient safety in intensive care units in Michigan	Evaluation	Interdisciplinary	Critical care	
2008	Rosemarie Fernandez	Toward a definition of teamwork in emergency medicine	Theory	Medicine	Emergency/Trauma	
2008	Terri E. Weaver	Enhancing multiple disciplinary teamwork	Commentary	Interdisciplinary	Research	
2009	Amy L. Halverson	Surgical team training: the Northwestern Memorial Hospital experience	Attitudes	Interdisciplinary	Surgery	
2009	Andrea Cameron	An introduction to teamwork: findings from an evaluation of an interprofessional education experience for 1000 first-year health science students	Attitudes	Interdisciplinary	General	
2009	Anna R. Gagliardi	Identifying opportunities for quality improvement in surgical site infection prevention	Program development	Medicine	Surgery	
2009	Beatrice J. Kalisch	What does nursing teamwork look like? A qualitative study	Theory	Nursing	General	Qualitative research
2009	Della Freeth	Multidisciplinary obstetric simulated emergency scenarios (MOSES): promoting patient safety in obstetrics with teamwork-focused interprofessional simulations	Evaluation	Interdisciplinary	Obstetrics	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2009	Karen Stead	Teams communicating through STEPPS	Evaluation	Interdisciplinary	General	
2009	Karin Hallin	Active interprofessional education in a patient based setting increases perceived collaborative and professional competence	Evaluation	Interdisciplinary	General	
2009	Leslie W. Hall	Linking health professional learners and health care workers on action-based improvement teams	Quality assurance	Interdisciplinary	General	
2009	Ling Rothrock	Analyses of team performance in a dynamic task environment	Methods	Interdisciplinary	General	Statistical procedure that "takes into account the correlation structure within team members." Temporal accuracy
2009	Matthew T. Gettman	Use of high fidelity operating room simulation to assess and teach communication, teamwork and laparoscopic skills: initial experience	Evaluation	Medicine	Urology	
2009	Patricia Frakes	Effective teamwork in trauma management	Program Development	Interdisciplinary	General	
2009	Sue Corbet	Teamwork: how does this relate to the operating room practitioner?	Commentary	Medicine	Surgery	
2009	Susan Lerner	Teaching teamwork in medical education	Program development	Interdisciplinary	General	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2009	T. Manser	Teamwork and patient safety in dynamic domains of healthcare: a review of the literature	Review	Interdisciplinary	General	
2009	Tom W. Reader	Developing a team performance framework for the intensive care unit	Theory	Medicine	Critical care	
2010	Brigid M. Gillespie	The impact of organisational and individual factors on team communication in surgery: a qualitative study	Theory	Interdisciplinary	Surgery	Program development
2010	Gudrun Johansson	Multidisciplinary team, working with elderly persons living in the community: a systematic literature review	Review	Interdisciplinary	Geriatrics	
2010	Helen I. Woodward	What have we learned about interventions to reduce medical errors?	Program development	Interdisciplinary	General	
2010	John R. Boulet	Simulation-based assessment in anesthesiology: requirements for practical implementation	Review	Medicine	Anesthesiology	Review of factors supporting successful implementation of simulation-based assessment
2010	Kamal Nagpal	An evaluation of information transfer through the continuum of surgical care: a feasibility study	Quality assurance	Medicine	Surgery	
2010	Katri Hämeen-Anttila	Professional competencies learned through working on a medication education project	Evaluation	Pharmacy	General	Reports on competencies, medical students said they acquired while working on a medication education project

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2010	Lynne A. Donohue	Track, trigger and teamwork: communication of deterioration in acute medical and surgical wards	Quality assurance	Nursing	General	Protocol development
2010	Myrta Rabinowitz	Storytelling effectively translates TeamSTEPPS skills into practice	Evaluation	Nursing	General	Commentary on teaching methods TeamSTEPPS
2010	Sara Evans-Lacko	Facilitators and barriers to implementing clinical care pathways	Theory	Medicine	General	Implementation of care pathways
2011	Aled Jones	Improving teamwork, trust and safety: an ethnographic study of an interprofessional initiative	Evaluation	Interdisciplinary	Geriatrics	Perception of staff regarding improvements in teamwork
2012	A.M. Aboul-Fotouh	Assessment of patient safety culture among healthcare providers at a teaching hospital in Cairo, Egypt	Quality assurance	Interdisciplinary	General	"Assessed healthcare providers' perceptions of patient safety culture within the organization and determined factors that played a role in patient safety culture"
2012	Andreas H. Meier	A surgical simulation curriculum for senior medical students based on TeamSTEPPS	Program development	Medicine	Surgery	
2012	Anna Chang	Transforming Primary Care Training-Patient-Centered Medical Home Entrustable Professional Activities for Internal Medicine Residents	Program development	Medicine	Internal medicine	

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2012	Annemie Vlayen	A nationwide hospital survey on patient safety culture in Belgian hospitals: setting priorities at the launch of a 5-year patient safety plan	Attitudes	Medicine	General	Measure of patient safety culture
2012	Audrey Lyndon	Predictors of likelihood of speaking up about safety concerns in labour and delivery	Attitudes	Medicine	Obstetrics	Study of likelihood of clinicians speaking up about potential harm to patients
2012	Bradley Peckler	Teamwork in the trauma room evaluation of a multimodal team training program	Evaluation	Medicine	Emergency/Trauma	Evaluation of one-day workshop using simulation
2012	Catherine Ménard	Decision-making in oncology: a selected literature review and some recommendations for the future	Evaluation	Medicine	Oncology	Proposal of constructs to measure in evaluating teamwork in oncology
2012	D. Freeth	A methodological study to compare survey-based and observation-based evaluations of organisational and safety cultures and then compare both approaches with markers of the quality of care	Quality assurance	Medicine	Obstetrics	
2012	David J. Klocko	Development, implementation, and short-term effectiveness of an interprofessional education course in a school of health professions	Evaluation	Interdisciplinary	General	Focused on students' understanding of skills needed for interprofessional work; pretest–posttest design

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2012	Deepti Vyas	An interprofessional course using human patient simulation to teach patient safety and teamwork skills	Evaluation	Pharmacy	Pharmacy	Pretest–posttest evaluation of training program with students responding individually to survey items on knowledge, skills, and attitudes
2012	Hanan J. Aboumatar	Republished: development and evaluation of a 3-day patient safety curriculum to advance knowledge, self-efficacy and system thinking among medical students	Program development	Medicine	General	Patient safety curriculum for medical students
2012	Helen A. Scicluna	Clinical capabilities of graduates of an outcomes-based integrated medical program	Evaluation	Medicine	General	Individual "self-perceived" capability. Results state that "Clinical supervisors rated new program graduates highly capable for teamwork, reflective practice, and communication" although the goal of the study was evaluation of an outcomes-based program
2012	Irmajean Bajnok	Building positive relationships in healthcare: evaluation of the teams of interprofessional staff (TIPS) interprofessional education program	Evaluation	Nursing	General	Measure of satisfaction with educational program: "A comprehensive formative and summative evolution revealed that all teams perceid they benefitted from and engaged in successful team development"

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2012	Lukasz M. Mazur	Quantitative assessment of workload and stressors in clinical radiation oncology	Other	Medicine	Oncology	Measure of stressors in oncology
2012	Maja Djukic	NYU3T: teaching, technology, teamwork: a model for interprofessional education scalability and sustainability	Program description	Interdisciplinary	General	
2012	Marc Tumerman	Increasing medical team cohesion and leadership behaviors using a 360° evaluation process	Evaluation	Medicine	Family medicine	Study of the design and implementation of a 360° evaluation project
2012	Margaret Bearman	Learning surgical communication, leadership and teamwork through simulation	Evaluation	Medicine	Surgery	Participant reaction to training provided in course
2012	Nancy C. Elder	Care for patients with chronic nonmalignant pain with and without chronic opioid prescriptions: a report from the Cincinnati Area Research Group (CARinG) network	Outcomes	Medicine	Family medicine	Study of pain medication care for patients in Family Medicine settings
2012	Nicholas R.A. Symons	An observational study of teamwork skills in shift handover	Quality assurance	Medicine	Surgery	
2012	Pamela Turner	Implementation of TeamSTEPPS in the Emergency Department	Evaluation	Interdisciplinary	Emergency/Trauma	
2012	Priscilla Magrath	Paying for performance and the social relations of health care provision: an anthropological perspective	Theory	Medicine	General	Study of pay for performance and social relationships amongst health providers

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2012	Rebecca Lawton	Development of an evidence-based framework of factors contributing to patient safety incidents in hospital settings: a systematic review	Review	Medicine	General	Patient safety framework
2012	Reece Hinchcliff	Evaluation of current Australian health service accreditation processes (ACCREDIT-CAP): protocol for a mixed-method research project	Evaluation	Medicine	General	Accreditation processes
2012	Roxanne Tena-Nelson	Reducing potentially preventable hospital transfers: results from a thirty nursing home collaborative	Evaluation	Medicine	Geriatrics	Study of hospital transfers amongst nursing home patients
2012	Susan Brajtman	Toward better care of delirious patients at the end of life: a pilot study of an interprofessional educational intervention	Evaluation	Interdisciplinary	End of life	Training program evaluation specific to competencies associated with end-of-life care
2012	Svin Deneckere	The European quality of care pathways (EQCP) study on the impact of care pathways on interprofessional teamwork in an acute hospital setting: study protocol: for a cluster randomised controlled trial and evaluation of implementation processes	Evaluation	Interdisciplinary	General	Proposal for a "cluster randomized control trial and evaluation of implementation processes"—care pathways

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Publication year	First author	Title	Study type	Profession	Specialty	Comments
2012	Vernon Curran	An approach to integrating interprofessional education in collaborative mental health care	Psychometric	Medicine	Psychiatry	Evaluation of training program with pretest–posttest design. Attitudes concerning interprofessional teamwork measured
2013	Narelle Aram	Intern underperformance is detected more frequently in emergency medicine rotations	Evaluation	Medicine	Emergency/Trauma	Retrospective study of assessment of interns
2013	Nishchay Mehta	Multidisciplinary difficult airway simulation training: two year evaluation and validation of a novel training approach at a district general hospital based in the UK	Evaluation	Medicine	Interdisciplinary	Evaluation of training program using simulation; evaluation included measures of patient outcome regarding airway fatalities

Appendix 2: Complete Reference List for Publications Included in Review

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