Abstract

A 1999 report by the Institute of Medicine (IOM) suggests that medical errors are responsible for as many as 98,000 deaths annually. In response to this crisis, then President Clinton established the Quality Interagency Coordination (QuIC) Task Force to develop a Federal plan for reducing the number and severity of medical errors. One of the QuIC's primary recommendations was the adaptation of Crew Resource Management (CRM) training—a sub-domain of team training—to medicine.

This paper will present evidence to support the relation between team training and patient safety. It extends earlier work by Pizzi and colleagues who argue that CRM training has a great deal of potential as a safe patient practice. Training medical professionals to operate as a well-coordinated team should enhance patient safety and lead to a reduction in medical errors. We begin the paper by presenting background information related to teamwork, including the nature of effective teamwork, teamwork-related knowledge, skills, and attitudes, and contextual issues surrounding teamwork. We then provide further confirmation of team training effectiveness, taken from high-risk domains such as commercial aviation and the military. Details are provided on existing medical team training programs, including Anesthesia Crisis Resource Management, MedTeams™, Medical Team Management, Team-Oriented Medical Simulation, Dynamic Outcomes Management, and Geriatric Interdisciplinary Team Training, and the effectiveness of each is discussed. Finally, we offer specific recommendations to guide future medical team training research.

Summary

In 1999 the Institute of Medicine (IOM) published *To Err is Human: Building a Safer Health System*, a revealing indictment of the inadequate safety that the United States medical establishment too often provides its patients. Extrapolating from data gathered through the Harvard Medical Practice Study (HMPS) and the Utah-Colorado Medical Practice Study (UCMPS), the IOM report concluded that medical errors cause between 44,000 and 98,000 deaths annually—more than result from automobile accidents (43,458), breast cancer (42,297), or AIDS (16,516).

Since the IOM report, the health care community has had a renewed and continual focus on medical errors, patient safety, and the development of evidenced-based practices to improve the quality of care. At the federal level, the Agency for Healthcare Research and Quality (AHRQ) has assumed the lead role in the patient safety movement, funding dozens of grants on topics related to error reporting, working conditions, technology applications, and the like. One of AHRQ's first efforts was to commission Evidence Report 43 entitled, *Making Health Care Safer: A Critical Analysis of Patient Safety Practices*, which reviewed existing data on practices within and outside of health care that are regarded as having the potential to improve patient safety. As part of Evidence Report 43, Pizzi et al reviewed the evidence for Crew Resource Management (CRM)—a sub-domain of team training—and its medical applications and concluded that CRM has tremendous potential, based on its success in the aviation industry, though future research into its health care role is warranted.

This report extends and updates the Pizzi et al review and contends that the training of health care providers as teams constitutes a pragmatic, effective strategy for enhancing patient safety and reducing medical errors. The report is comprised of six substantive sections. The first reviews the recent patient safety initiatives and associated recommendations, many of which point to the need for improved teamwork in the delivery of health care. The second section reviews the key characteristics of a team and discusses the principles that underlie successful teamwork and effective team training. Next, the available research concerning the relation between teamwork and safety in real-world, high-risk settings is reviewed and evaluated. Fourth, the current trends and issues in medical team training are presented and the most well-known medical team training programs are summarized. Fifth, we offer a detailed set of conclusions and recommendations that are drawn from the literature review. Finally, we present directions for future research.

We began by searching the PsycARTICLES®, PsycINFO®, and the Sociological Collection® databases through January of 2003 for articles on teams, teamwork, and Crew Resource Management (CRM) training with relevance to commercial or military aviation. In addition, we conducted searches for journal articles involving medical team training, or key terms such as "crew resource management," "cockpit resource management," "medical error," "team training and aviation," and "team training and medicine," using the same databases, as well as MEDLINE® and HealthSTAR®.

Other key terms used in document searches included “team training” and medical specialties such as “anesthesiology,” “obstetrics,” “gynecology,” “emergency medicine,” and “geriatrics.” Searches also were conducted using specific medical team training program names, such as MedTeams™, Medical Team Management, Anesthesia Crisis Management, and Dynamic Outcomes Management. Parallel searches, using the same key terms, also were conducted with the aid of internet search engines to uncover any unpublished studies on these topics. The reference lists from each of the relevant articles then were used to identify additional resources, after which we contacted experts in the field to obtain unpublished technical reports and in-press manuscripts. It is important to note that particular domains of team performance and training literature have been emphasized in the development of this report. Specifically, we focused our attention on research involving parallel, high-stress, and high-risk environments (e.g., military and commercial aviation) where the consequences of error are extreme.

Teamwork is described traditionally using systems theory, which posits that team inputs, team processes, and team outputs are arrayed over time. Team inputs include the characteristics of the task to be performed, the elements of the context in which work occurs, and the attitudes brought forth by its members to a team situation. Team processes are the interactions and coordination necessary on the part of team members to achieve specific goals. Team outputs consist of the products derived from the team’s collective efforts. Thus, teamwork occurs in the process phase, during which designated members interact and collaborate to achieve the desired outcomes.

Effective team performance requires a willingness on the part of team members to cooperate in the service of a shared goal, such as the goal of improving patient safety and the creation of a treatment environment free from medical errors. Moreover, effective teamwork depends on effective communications within the team, along with adequate organizational resources and support.

The researchers identified three types of competencies that are critical for effective teamwork: (1) teamwork-related knowledge, (2) teamwork-related skills, and (3) teamwork-related attitudes.

Team knowledge competencies are the principles and concepts that underlie a team’s effective task performance. Broadly speaking, selected members should know the range of skills required, when particular behaviors are appropriate, and how the skills and behaviors are manifested in a team setting, if they are to function as a team.

Team skill competencies, defined by Cannon-Bowers and colleagues as the learned capacity to interact with other team members at some minimal level of proficiency, have received considerable research attention. But the same scientists contend the spectrum of literature regarding skill labels and definitions is confusing, contradictory, and plagued with inconsistencies.

Team attitude competencies have been defined as internal states that influence a team member’s decision to act in a particular way. Positive attitudes toward teamwork and a mutual trust among team members are critical to successful team processes.

A team's utility and efficiency is tied directly to its team members and their ability to integrate various personal and situational characteristics. Each team member must understand the technical and tactical considerations of the assigned task, as well as the strengths and weaknesses of their teammates. In addition to carrying out their own responsibilities and altering them when necessary, each member must also monitor their teammates' activities and diffuse potential team conflicts. Effective teams exhibit these competencies while maintaining a positive emotional attitude toward the team itself.

Team training could be described as the application of instructional strategies based on well-tested tools (e.g., simulators, lectures, videos) to a specific set of competencies. Effective team training reflects general learning theory principles, presents information about requisite team behaviors, affords team members the necessary skills practice, and provides them with remedial feedback.

Much research has been devoted to effective strategies and techniques for training specific team knowledge, skills, and attitude competencies. A comprehensive review of this research has resulted in an extensive collection of principles and guidelines concerning the design and delivery of team training. For example, guidelines exist for assertiveness training, cross-training, stress-management training, and team self-correction.

To design training strategies that will improve teamwork skills on the job is a challenge. Teams operate in complex and dynamic environments that are characterized by multi-component decisions, rapidly evolving and ambiguous situations, information overload, severe time constraints, and harsh consequences for mistakes.

In summary, this report merits the medical community's attention because it assesses the status of relevant team-training research from other domains in addition to aviation and, for the first time, applies this research to the field of medicine. Second, the report provides a comprehensive review and evaluation of the effectiveness of current *medical* team training initiatives.

Key Conclusions

1. The science of team performance and training can help the medical community improve patient safety.

A general science of team performance and training has evolved and matured over the last 20 years. This science has produced a number of principles, lessons learned, tools, and guidelines that will serve the patient safety movement.

2. Research has already identified many of the competencies that are necessary for effective teamwork in medical environments.

The science of team performance and training has identified the competencies that are required for effective team functioning in a number of complex settings. Many, if not most, of these competencies apply to the medical community.

3. A number of proven instructional strategies are available for promoting effective teamwork.

The science of team performance and training has also developed and validated numerous training strategies that can provide requisite competencies to teams who perform in complex environments. These strategies extend beyond CRM training and could easily be adapted to health care.

4. The medical community has made considerable progress in designing and implementing team training across a number of settings.

Our review of existing medical team training programs clearly shows that the health care community is striving to implement CRM training across a number of medical domains. We recommend that this trend be continued. However, the extent to which these programs are being implemented with the help of what we know from the science of learning, of team performance and of training is less clear. Thus, we recommend strengthening the link between scientific knowledge and medical-team training.

5. The institutionalization of medical-team training across different medical settings has not been addressed.

To make teamwork a common, effective practice throughout the delivery of health care, there is an imperative need to embed team training in professional development. By “embedding” we mean implementing and regulating team training throughout a healthcare provider’s career.