Chapter 6. Research Needs: Where Do We Go from Here?

We believe this review advances the information provided by Pizzi and colleagues[5] in AHRQ's Evidence Report 34, and its assessment of team training and its potential for reducing medical errors and bolstering patient safety. Specifically, we have included all available findings from military programs and have provided a more comprehensive summary regarding the state of team training. In addition, and perhaps most significantly, this report provides a comprehensive look at the current state of medical team training with evaluations of the existing programs.

This chapter outlines research needs that we have identified in the course of our investigation. The common theme for these suggestions is the need for a more thorough understanding of the medical team and medical-team training performance domains than the scientific evidence currently permits.

Research Need 1: A medical team performance model.

The available research has not yielded a comprehensive model of team performance in a medical treatment context. Therefore, we propose the development of the first theoretical model for medical team performance.

The advantages of such a model are fourfold. First, the model would provide researchers with a common language useful for labeling and defining the key personal behaviors affecting medical team performance, using recommended generic and practice-specific competency taxonomies. Moreover, the available research provides a foundation for defining the environmental variables that influence effective medical teamwork (e.g., organizational climate factors**,** such as the sanctions resulting from reporting errors or near misses; the degree to which teamwork is supported at the executive level; the extent to which the organization mandates team training and retraining; etc.). In addition, supplemental research would lead to a universal set of process and evidence end result measures, for use in outcome comparisons. Finally, such a model would provide researchers with a common framework for describing and testing hypotheses concerning the interrelationships of various performance predictors, as well as the interdependencies of the predictors and the outcome criteria. This programmatic research effort ultimately would generate a body of applied scientific knowledge tailored to the medical community's patient safety concerns.

Research Need 2: Teamwork process and outcome measures, relative to medicine.

Given that medical teamwork and team training research are not formally linked to medical team performance theory, previous research often does not contain criteria relating it directly to error reduction and patient safety. In addition to developing valid prediction measures, future research must define and build valid measures of relevant outcomes. As mentioned in the Chapter 3 discussion of aviation CRM training, the low base rate of serious errors precludes the use of death avoidance as a viable outcome construct in CRM training research.[62] Conversely, the vast number of medical procedures performed each day makes the application of this "ultimate criterion" to the medical-team performance domain equally impractical, despite the prevalence of errors noted in our introduction.

We recommend a more theory-based perspective as a starting point for the development of medical teams and medical team training criterion measures. A theory of medical team performance, once properly defined, would suggest process criteria with a theoretical relation to the ultimate criterion, while at the same time reflecting actual performance behavior. Examples include the time needed to execute an initial decision in a hospital ER unit, the number of times operating room attendants ask for instructions to be repeated during surgery, or the regularity with which intensive-care providers apprise physicians of patients' status. The advantage of such measures, aside from their relative ease of development and implementation, is the objective performance assessment they bring to a process that is theoretically linked to patient safety outcomes. Moreover, process-oriented and behavior-based criteria provide relevant performance measures for use in comparing teams or team training programs.

A final issue that bears mention is the possible use of near-miss events as a proxy criterion for errors. Near misses are examined in aviation research, though generally not with regard to teams. Near-miss research was not mentioned in any of the medical team literature that we reviewed. Nevertheless, near misses could prove their worth as an outcome criterion with a prevalence likely greater than that of error, provided the data could be collected. Furthermore, the use of near-miss criteria suggests two worthwhile avenues of investigation: (1) an examination of the predictive factors or process outcomes that contributed to the near miss, and (2) an examination of the factors or processes that ultimately prevented the error. The findings from either investigative tact would foster valuable insight with regard to the interrelationships of teamwork and patient safety.

Research Need 3: More efficient practices for evaluating medical team training programs.

The ability to evaluate team training from the standpoint of effectiveness is a natural extension of the aforementioned need for a testable, conceptual model of medical team performance. In short, this need reflects our firm opinion that reaction criteria (in which training participants indicate their like or dislike for a training program and offer their opinion on how a program might help them do their jobs better) is not an adequate basis for determining program

effectiveness. The previous discussion into the need for performance-based criteria in some ways addresses this issue. Just as important as measurement criteria, however, is the need to conduct team training program evaluations in a consistent and agreed-upon manner. Bringing a clear and uniform structure to evaluations of performance-based criteria would permit researchers to directly compare the effectiveness of diverse programs and training strategies.

Research Need 4: Team performance diagnostics.

This research need also is based on the development of a theoretical medical team performance model. That is, once research has identified the personal and environmental variables relevant to effective medical teamwork—and has linked them to performance-based criteria—any team's collective efficiency and effectiveness would be open to examination. These examinations, primarily qualitative in nature, would identify areas of performance in which the team has met or failed to meet expectations. More important, they also would reveal the potential reasons behind these outcomes.

More significant still, indepth quantitative diagnoses could be extended across teams to yield data revealing the degree to which certain outcomes are attributable to certain predictor variables. This generalized data then could be compared to a single team's scores for the same variables, to determine if the team's effective or ineffective performance is a function of personal competencies, organizational characteristics, intermediate process criteria, or a combination of factors.

Given a team's performance rating, the evaluator might find the need to conduct a qualitative case study, using personnel records or other sources to determine the team's "scores" with respect to certain predictors. Quantitative analyses of a single team would not be possible unless the team had participated in numerous team training trials (and, even then, repeated exposure to the same stimuli creates its own evaluation confound). Such scores could be compared, however, to norms established through the use of previous across-group research. In addition, case studies could include content analyses of various team behaviors. Examined in tandem, the norm and the content analysis information may provide rich insight into a particular team's performance—as well as those factors hindering it and applicable interventions.

Research Need 5: Simulation-based training applications.

The final research need to be addressed in this report is one of simulation-based training and its most effective contributions to medical team training. Previous research documented throughout this review has established the fact that simulators provide training participants with an incomparable opportunity to practice both technical and team-process skills, while receiving vital feedback on their strengths and weaknesses. Moreover, simulators provide this practice in a virtually risk-free environment. Despite their recognized value, however, high-fidelity simulators and the training they provide can be extremely expensive.

Therefore, the overall question that future research must address is "How best to achieve the optimal trade-off between training effectiveness and cost effectiveness?" Numerous subsidiary issues, including the number of specialty clinics sponsoring the training, the number of trainees involved, and the financial and personnel resources available, must be considered in arriving at a reasonable conclusion. A more important and more focused central research question is "To what degree must an effective simulation reflect physical versus psychological fidelity?" Previous simulation-training research supports the assumption that the more realistic the scenario and the more fidelity built into the simulator, the more effective the training will be.[34, 88] Nevertheless, we believe that it is often unnecessary for a simulation to replicate exactly the same *physical* environment in which the actual teamwork will take place.

Still, some degree of physical fidelity is necessary for medical team training effectiveness, whereas this might not be the case for all medical training. For example, paper scenarios—which might play a valuable role in training medical diagnostic skills—are not conducive to the acquisition of teamwork skills. In short, teams must *function* as teams during simulator scenarios for the training to be effective. The extent to which physical fidelity can be and must be sacrificed to cost and other constraints remains the ultimate simulation-related question for future research to answer.