Team Training and Resource Management in Health Care: Current Issues and Future Directions

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Many authorities have suggested that some variant of team training is likely to be an effective means to reduce human error in operating rooms, emergency departments, resuscitation teams and other settings within healthcare where human interaction is common, and where breakdowns in communication and teamwork can have critical consequences. The implementation of formal training in teamwork for healthcare workers, analogous to aviation's crew resource management (or CRM) used to train pilots, was a specific recommendation of the Institute of Medicine's landmark report, *To Err is Human: Building a Safer Healthcare System*, released in 2000.[1] Indeed, our own research group has made this same recommendation on multiple occasions over recent years.[2-4] Team training is also currently suggested as part of a comprehensive Patient Safety Plan published by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the regulatory agency charged with hospital accreditation in the United Sates.[5-6]

A major problem, however, is that few clear guidelines exist to help guide the implementation of such recommendations in healthcare settings. In general, training programs designed to improve team skills are a new concept for medicine, particularly for physicians who are trained largely to be self sufficient and individually responsible for the care they deliver. While many parties acknowledge a need for such training, exactly how to go about developing

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such programs is truly uncharted territory. It is tempting to borrow such programs from industries such as aviation, and this practice is certainly occurring in both the patient safety research community and the private quality improvement consulting industry. Unfortunately, the experiences of aviation and other industries have been that such training tends to be domain and even organizationally and culturally specific, and that the straightforward transfer of training from one work setting to another has often been ineffective and problematic, even despite initial appearance that the borrowed training programs seemed to make sense.

In the sections to follow, this paper will begin by clarifying in some detail what is involved in these team or human resource training programs. Following that, we will describe recent advances in applying team and resource management training in healthcare, including an overview of the involvement of our group, the efforts of other researchers, and of the role currently played by private training and consulting groups. Following that, we will provide some background of what historically has been involved in another industry, in this case aviation, in designing and implementing such training. Aviation has frequently been cited as a model industry for the employment of such programs, and it is our belief that the experience of aviation and other industries can provide valuable lessons on how this training should be developed and implemented and how it should not. Drawing on our research group's experience with CRM and CRM-related training in aviation and an assessment of how such training is progressing in medicine, we present several concerns about the way such programs are advanc-

ing in medicine. This leads to a number of recommendations, some quite specific and some quite general, that will be elaborated upon at the end of this paper.

What is Team Training or Crew Resource Management (CRM)?

Before exploring the nature and issues surrounding team training and human resource management programs in healthcare any further, it is would be helpful to more fully define what is meant by these terms and useful to discuss what such programs typically entail in other industries. In aviation, for example, training programs for aircrew have developed over a 25 year history to include basic education about human factors and human limitations, appropriate techniques of leadership and followership, formal guidelines for addressing safety concerns in the face of command hierarchies and interpersonal disagreements and, in general, a shift away from autocratic and individualist styles of aircraft command to one that is more team based with mutual interdependence and shared responsibility.

While a detailed elaboration of CRM is beyond the scope of this paper, it is worthwhile to cite key elements that have been identified as being particularly relevant to healthcare. One such element includes the concept of briefings – short synopses of intended actions by the individual in charge. In aviation, briefings by the captain to other cockpit crew and to cabin crew have become standard. Intended course, any expectations of delay or bad weather, specific crewmember roles as well as expected norms of behavior are

all communicated before each flight. More specifically, in an ideal briefing, acceptable means of communicating safety concerns and the importance of having such concerns dealt with in a manner acceptable to all crew members are discussed. Furthermore, specifics of the intended flight plan are communicated, and each crewmember should be asked to verify their understanding of those plans. This is generally referred to as establishing a "shared mental model" of the flight and allows crewmembers to anticipate each other's needs in a timely manner and to understand their own role in what is to come. Briefings occur not only before the flight, but at predetermined points in the flight where safety is critical (immediately before take off and again before landing, for example) as well as whenever the crewmember in command decides such a briefing is appropriate. It would also be a reasonable course of action for a junior crewmember to request a briefing prior to something unfamiliar or potentially complex.

Another key element of CRM includes training crews in acceptable ways to challenge the actions of other crewmembers and to assert safety concerns in a manner that is not only appropriate but expected. This has involved a shift away from the belief that such behavior is a personal attack or insubordinate to an understanding that such behavior is expected and even demanded from fellow crewmembers.

A third essential aspect of CRM has been the incorporation of behaviors to monitor other crewmembers on actions that are critical to safety. Examples of such behavior include verifying inputs to autopilot and flight computer systems, reviewing aircraft configuration settings performed by a crewmember, and confir-

mation of communications between crewmembers and between air traffic control and the crew. Such verifications are often highly formalized and require specific actions from specific crewmembers as prescribed by standard operating procedures (SOPs) and the flight operations manual.

As mentioned above, CRM programs also include education on issues relevant to flight safety and human performance limitations. Typically, pilots will be instructed on how fatigue may impair cognitive performance and thus lead to an increased likelihood of making errors, or how personal concerns such as family illness or marital discord may serve as a distraction over the course of a long, monotonous flight. It is not rare to hear such issues being discussed during preflight briefings as crewmembers have become accustomed to the idea that potential human performance decrements are simply another aspect of flight safety that should be placed on the table along with weather, fuel status and terrain considerations.

In general, good CRM programs are developed within a specific organization (military command or commercial airline) and are intimately combined with regular training programs. While some of the concepts of CRM may be communicated in a didactic setting, they are practiced at the same time as more technical skills, often in high fidelity simulators. Pilots are given feedback not only on their technical skills and decision making strategies, but also on crew management and resource utilization.

A complete discussion of the various aspects of CRM is beyond the scope of this review, but the elements presented above should serve to illustrate the key areas that many patient safety advocates have

suggested are of practical importance for health care. For more detailed discussions of CRM, the reader is referred to a number of authoritative works that have been written on the subject.[7,8]

Current Activity in Healthcare CRM and Team Training

Like many aspects of patient safety and error reduction in healthcare, much of the current interest in the applicability of CRM training and principles to medicine stems from the Institute of Medicine's 2000 report *To Err is Human: Building a Safer Health System*. This report, with which the reader is likely familiar, detailed current concerns regarding excessive error rates in U.S. healthcare, and made sweeping recommendations to ameliorate this problem.[1] Among its many recommendations, specific reference was made to aviation as an industry that has successfully reduced human error in complex, safety critical operations. Even more specifically, this report suggested that healthcare look to aviation and

> establish team training programs for personnel in critical care areas (e.g., the emergency department, intensive care unit, operating room) using proven methods such as the crew resource management training techniques employed in aviation[…] (p.149)

While the impact of the IOM report has been remarkable at initiating a virtual revolution in systems thinking in medicine (though still in its early stages), it is im-

portant to note that a number of parties had made these recommendations in the years preceding this report. Most notably among these have been David Gaba's group at Stanford University and Robert Helmreich and Hans Schaefer's collaboration between the University of Texas and The University of Basel Kantonsspital in Switzerland, and in later years, the commercially available medical team training program developed by the Dynamics Research Corporation in Boston, Massachusetts.

At Stanford, David Gaba established a training program in the department of anesthesia that was entitled Anesthesia Crisis Resource Management (ACRM) that borrowed heavily from aviation CRM. Using high fidelity patient simulators and principles of resource management, Gaba paved the way for advanced anesthesia simulation training in the early 1990s. At around the same time, Helmreich and Schaefer created the Team Oriented Medical Simulator (or TOMS) in the department of anesthesiology at the Kantonsspital in Basel. The TOMS was a complete operating room simulator incorporating an instrumented mannequin "patient" and was designed to teach surgical team skills to mixed teams of physicians and nurses.

Following the release of the IOM report, funding for research into patient safety and error reduction in medicine increased dramatically. Through the Agency for Healthcare Research and Quality (AHRQ), multiple projects have been proposed and funded that look at various aspects of teamwork and training. For example, the Center of Excellence in patient safety research based at the University of Texas Health Sciences Center in Houston, Texas has been funded to look at trans-

lating some of the error reduction strategies developed in aviation into health care, including CRM. Another AHRQ funded project combines resources at the University of Florida, Dalhousie University, Northwestern University and Brown University and is looking at error reduction in emergency rooms. Still another AHRQ funded project is looking at human factors and trauma resuscitation at the University of Maryland. Certainly these and other projects share some common lines of investigation, yet each is focused on different issues and poses different questions to be answered. Some investigations look at system factors, some at ergonomic and technical issues, while others focus on team related and CRM specific issues.

As much as agencies such as AHRQ have solicited proposals and funded research projects, the demand from the healthcare industry for solutions appears at the present time to outstrip what a handful of research projects are able to supply in terms of validated training solutions. Spurred on by a combination of sincere desire for improvement, recent requirements by regulatory agencies to demonstrate proactive attempts to reduce error, an explicit requirement to implement loosely defined "team training" and, perhaps, a certain fear of accountability, scores of Health Maintenance Organizations (HMOs), private and public healthcare institutions, medical schools, medical groups and other bodies are currently seeking out some form of team training to both reduce error rates and demonstrate their commitment to patient safety.

Many healthcare organizations are turning to the private sector to provide such training. Among such entities, Dynamics Research Corporation (DRC) is probably near the forefront of corporate trainers in medical team training and is expanding beyond its emergency department training program into the labor and delivery environment – another area frequently cited as potentially benefiting from CRM-like interventions. To its credit, DRC has partnered with a number of institutions in an effort to advance and validate its training programs. The number of consulting and training groups offering CRM, team or human factors training to the healthcare industry is growing rapidly. Products offered run the course from one-shot, day-long classroom lectures to major overhauls of routine operations, with highly involved training sessions and complete process analyses and restructuring. Many of these training entities have prior experience in aviation.

A simple fact of the matter is that the aviation human factors industry was already highly competitive before September 11, 2001, and the massive downturn in the aviation industry since that tragic day has left fewer dollars for contractors, including human factors training specialists. Medicine, in contrast, is a sellers market for anyone offering expertise in system safety, error reduction and CRM. Virtually all of the current commercially available training programs have their roots in aviation CRM or CRM-like training programs. It appears to us that such programs are highly variable in the degree to which they have borrowed training materials and course content directly from aviation. Since most such training providers consider their course content to be proprietary, there is little opportunity to objectively compare such programs or to evaluate their specific training products.

Early research has already suggested that, in general, CRM-like training in medicine has initially been well received, and a small number of studies have suggested that errors may indeed be reduced. As has been found in aviation, however, it appears from multiple accounts and the experience of our own and other research groups that the implementation of such programs is as complex a question as what to train.

The Aviation Experience

Before we comment on specific concerns about the current situation surrounding CRM and human factors training in medicine, it is worth reviewing what our comparison industry, aviation, has done well and not so well in its struggle to develop effective CRM training. Such an analysis may provide some guidance for similar efforts in medicine, and hopefully will allow us all to avoid repeating some hard learned lessons.

First and foremost, it would be wrong to assume that the development of CRM in aviation was simple and happened rather quickly. Most researchers acknowledge that current programs have significantly improved over the last 10 years, and that programs in the early 1990's were far superior to the initial programs of the 1980s. By such comparisons, medicine should have good CRM by 2020 unless the learning curve is steeped somewhat.

The initial interest and mandate to train aviation human factors grew out of a series of studies and workshops organized by NASA in the early 1980s. Crew breakdowns in communication, fixation of the crew upon sometimes trivial mechanical failures, and other non-technical issues were identified as being contributory in a significant proportion of aviation accidents. Commercial aviation embraced training before it was made mandatory by the Federal Aviation Administration both because it was seen as a significant safety initiative and because of fears liability in the event of an accident could be greater if crews had not received such training. While resistance to mandated training among some individuals was not insignificant, key players acknowledged that something needed to be done. This situation was not dissimilar from the current climate surrounding CRM training in medicine.

A common criticism of early aviation CRM programs is that they were overly theoretical and based on techniques from management training programs of the day. Such programs often involved role playing and games designed to elicit the value of teamwork. Predictably, most pilots did not see benefit in this approach and some argue that early resistance among pilots to subsequent CRM training was due in part to perceptions of the ineffectiveness of these programs.

In the early years of CRM, airlines usually established the requisite educational program within their pre-existing training departments, though typically as stand alone courses of variable quality. Even from the start, these departments have tended to communicate with each other between airlines; as such training was conducted under the super-ordinate umbrella of flight safety. Since they existed as part of flight safety, shared resources and expertise did not threaten airline competitiveness, and a collegial community of flight safety and CRM development has been characteristic of the airline industry for many years. In addition to airline flight

safety and training personnel, this community has also consisted of academic researchers from aviation safety programs, team training, social psychology, cognitive science, human factors and aerospace engineering and even military stakeholders.

While early courses consisted of management theory and role playing games as described above, more effective subsequent training has been based upon more practical material. Initially, CRM was founded upon results of crash and incident investigations, and on the expert input of experienced operators and specialists in group dynamics and performance under stress. More recently, the most effective courses combine material garnered from analyses of specific incidents and operational experiences within each airline. In addition, data from observations of crew behavior in actual flight operations are integrated into CRM training in an ongoing and iterative process. The Line Operations Safety Audit (LOSA) developed at the University of Texas at Austin is an example of such an observational methodology, and is currently being used by a number of U.S. and international carriers to inform CRM training within those airlines.[9] Such CRM training is generally viewed as relevant by aircrew since it incorporates specific events and experiences from pilots' own complex work environment. Over the last ten years, CRM has shifted from a set of formal, static behaviors to a combination of core behaviors and constantly evolving lessons-learned from actual flight operations. This later approach has been termed "Threat and Error Management" and reflects what our group feels is the state of the art in threat avoidance and error mitigation in aircrew performance.

It is probably reasonable to state that in aviation, the major advances in CRM have come from a combination of government funded, academic research and commercial flight safety and training efforts. While there are a number of corporate CRM trainers for smaller airlines that do not have the capacity for internal training development, it is our position that these commercially available training programs draw heavily and appropriately from major airline practices and academic research. These commercially available corporate CRM trainers fulfill a critical role in providing quality training to smaller carriers, independent operators and pilots in training during the early stages of their careers.

An extremely important outcome of the 25 year history of CRM in aviation has been what is best described as a reform of the professional culture of pilots. As pilots come into an airline, basic flight training includes training in CRM principles and practice, and CRM subsequently becomes part of how they do their job. Currently in aviation, CRM has become the normal way of doing business – for many pilots it has been there throughout their careers. As these pilots rise to positions of management, it is arguable that if they perceive the principles of CRM to be valuable, they both foster them within the systems they manage and incorporate their principles in the way they do their job – even though they may no longer spend the majority of their time in the cockpit. In general, good pilots are now seen as those individuals with the requisite skills, and this now includes good CRM.

Current Concerns

This brings us back to healthcare and to concerns that were hinted at in the opening paragraphs. In general, we see a certain lack of community in medical human factors training and a definite lack of sharing information.

The leading role in developing CRM type programs in healthcare is currently being taken by private corporations. The Joint Commission on Accreditation of Healthcare Organizations (or JCAHO) and other forces have created a sense of need for team training in healthcare organizations. Unfortunately, as much as we agree with this concept, there are currently precious few resources to satisfy this need. Private entities are stepping forward to fill this demand, and in doing so they are laying the foundations of team or CRM training in the industry, and with a few notable exceptions are drawing very heavily from aviation. Even companies that are doing things in a manner that may be appropriate tend to be somewhat protective of programs that have been expensive to develop and whose content is essential to their future economic success. Perhaps this is a cultural characteristic of medicine. As practitioners fulfill their primary role in patient care, development of new technologies is often left to private industry – driven by the incentive of patent protection and future profits. We see patient safety, however, as something akin to practice guidelines – something to be shared, debated, continually improved upon and hopefully embraced by the larger community.

We also have specific concerns about the way CRM is developing in medicine in that it is drawing so heavily from aviation.

Indeed, aviation has taught us that lessons learned and illustrative materials should best come from within one's own industry. Specific trained behaviors and practices must come from medical experiences. While undoubtedly many of the lessons learned in aviation will have counterparts in medicine, trying to directly apply one industry's practices to the other risks both the application of unwarranted elements as well as the omission of aspects specific to medical practice. In the larger picture this risks both ineffectiveness and subsequent backlash when such programs are shown to be minimally effective. Particularly worrisome are one-time team training programs – typically provided by aviation training organizations with little or no consideration for the specific healthcare organization in question, or (more worrisome) little or no development within the healthcare setting. While such courses may offer introductory awareness of human factors issues, the very lesson of aviation human factors training has been that a lack of operational relevance was a serious shortcoming of early CRM training programs. It is somewhat ironic that these lessons have been forgotten by some, and the very industry that learned them may be inflicting the same mistakes on health care.

A major reason for the tendency to borrow directly from aviation is that current research funding programs encourage the development of CRM training through rigorous scientific research. While few would argue against the importance of such an approach, it may not be the most practical for improving system safety. This point has been well made by various authors, most notably by Leape, Berwick and Bates in a recent issue of the Journal of the

American Medical Association (JAMA).[10] It is important to remember that the major advances in aviation CRM have been due to accident investigation, incident analysis and expert opinion on the most effective and safest manner in which to command an aircraft. Many of the most important threats in flight safety are rare and strict scientific validation of the effectiveness of an intervention to prevent them is exceedingly difficult. Things are often done because it seems to all involved to be the safest way to get the job done.

Current funding practices for patient safety research, and more specifically for the development of team training and resource management programs, may not be optimally designed to produce the desired results. The scientific model for funding research, with its emphasis on reproducibility and scientific rigor may suit the development of pharmacologic and therapeutic interventions but may not be completely appropriate for matters that are more sociological and anthropological than healthcare agencies are used to supporting. While a given therapeutic agent should usually be expected to work in most individuals suffering the identical disorder, the same may not be true for a team training curriculum. Training may need to be highly customized for the size of an institution, the nature of the procedures being performed, the culture of the organization and even the national or regional cultures of the individuals employed. While we are not suggesting that a rigid scientific approach to the development of these programs in medicine should be completely abandoned, we are suggesting that there are important additional approaches to consider in designing training interventions. Health care may be well advised to

examine how other industries have supported such research, and how successful interventions were employed, rather than attempt to adopt specific training elements or seek validation of every component of complex and institutionally specific training programs. A random, double blind, placebo-controlled study of the utility of team training programs may be both virtually impossible and potentially meaningless in its results. It is important to recognize that while this study design may be the gold standard for validation in medicine, it may not be appropriate for complex socio-technical interventions. This does not mean that the intervention itself is inappropriate.

Recommendations

The concerns articulated above lead us to propose a number of specific recommendations for the development of team training and CRM training in medicine. These recommendations are open for debate; indeed debate is invited. We see lack of debate on these issues among some parties as a major failing of patient safety at the present time.

Hospitals, medical organizations and, most importantly, teaching centers must take the lead in developing team training and CRM programs in health care. To fail to do so will result in private consulting taking the lead. While private consulting undoubtedly has a role to play, human factors and resource management training must be lead by institutions willing to share their experiences, training materials and lessons learned in an open forum for scholarly debate and feedback from practical experience.

Physicians, in particular, need to take a leadership role in designing and developing the kinds of training described in this paper. Much as pilots have been among the principal developers of human factors training in aviation, physicians must step forward to do the same in medicine. Failing to do so will undoubtedly result in decreased acceptance of such training programs among the physician community, and the reduced effectiveness of those courses.

Team training as a concept is much narrower than what is really required to improve patient safety. Improved safety will come from a combination of many factors. In terms of training, this may entail education about basic human performance, formal training in running small groups and the opportunity to practice such training until it becomes a part of "normal" operations. Team training should be integrated with these other elements in a comprehensive educational approach whose goal is to reduce error, not simply form better teams.

Simulation in aviation, maritime and other environments suggests that realistic role play is essential for acquisition of new skills, and that recurrent practice is essential for skills maintenance. Key to this process is the opportunity to learn from non-threatening debriefing by a qualified peer or instructor. It seems important to allow people to make mistakes in the learning process, and medicine needs to find ways of doing this that do not put patients at risk. Currently exemplified by a number of leaders in this area, most notably in anesthesia, medicine needs to expand virtual and simulated training opportunities to enhance not only technical skills, but also interpersonal, small group and interdisci-

plinary skills. This point has been made before, but it is as valid now as ever.

One of the main outcomes of CRM has been a gradual change in the culture of aviation to one of safety. For this reason, human factors awareness and interprofessional teamwork training needs to be introduced early in healthcare training – specifically at the medical student and nursing student level as this is the period of acculturation in to these professions. Medical and nursing schools must invest in curriculum development to address these issues at the earliest stages of clinical training. As medicine becomes even more complex in years to come, non-technical and interpersonal skills will become increasingly important. Changes in the professional culture begin with the first few years of training.

Summary

In this paper we have attempted to explain how health care is moving towards team training and some variant of CRM. While we have strongly advocated the value of such training in medicine for a number of years, we have some concerns about how it is being implemented. The overwhelming demand for such training at the present time exceeds available resources, and commercial training entities are largely fulfilling that need. Our major concerns stem from the fact that in aviation CRM was successfully developed in an open, shared and non competitive forum over a significant period of time. In our view it is imperative that academic institutions and publicly funded research programs take the lead in producing theoretical and practical training solutions in the most trans-

parent manner possible.

Furthermore, we are somewhat wary of the dependence upon the specific aviation content of some currently available training programs. In their recommendation for medicine to adopt CRM like practices from aviation, the authors of the IOM report were wise in their caution that such programs should be developed largely within medicine and not borrowed directly from aviation. We fear that this caution has been overlooked by some in their rush to provide services to health care. Such programs risk irrelevance and may hinder future programs with more valid content.

We firmly believe that CRM development in medicine should be conducted in an open, debated and shared manner. We have no objection to private corporations providing such training – indeed they do and will continue to fulfill a critical role in improving healthcare safety, as they have done in other industries. Our major concern is that the leadership that should be provided by the practicing and academic medical community in the development of this training is currently lacking. In particular, physician involvement in this endeavor is imperative for a number of reasons that include both eventual acceptance and maximum relevance. It is our hope that this paper stirs some debate as this is what seems to be lacking at present.

References

1. Institutes of Medicine. 2000. *To Err is Human: Building a Safer Health System*. Edited by L.T. Kohn, J. Corrigan, and M. S. Donaldson. Washington, D.C.: National Academies Press.

2. Robert. L. Helmreich and Hans. G. Schaefer. 1994. Team performance in the operating room. In Human Error in Medicine, edited by Bogner, M. S. (Hillsdale, N.J.: Lawrence Erlbaum Associates).

3. Robert. L. Helmreich and David. M. Musson. 2000. Surgery as a team endeavor [Editorial]. Canadian Journal of Anaesthesia 47, no. 5:391-392.

4. Robert. L. Helmreich, David. M. Musson, and J. Bryan Sexton. 2001. Applying Aviation Safety Initiatives to Medicine. Focus on patient safety; newsletter of the National Patient Safety Foundation 4, no.1:1-2.

5. "Patient Safety: Instilling Hospitals with a Culture of Continuous Improvement" Testimony of Dennis O'Leary, M.D. President, Joint Commission on Accreditation of Healthcare Organizations, Before the Senate Committee on Governmental Affairs. Webpage Created: Wednesday, June 11, 2003, Last Modified: Thursday, January 08, 2004 2:50:38 PM, Accessed: Tuesday, March 23, 2004. URL: http://www.jcaho.org/news+room/press+kits/executive+summary.htm

6. Joint Commission on Accreditation of Healthcare Organizations. Sample Outline for a Patient Safety Plan. Webpage Created: Friday, April 19, 2002, Last Modified: Wednesday, March 17, 2004, Accessed: Tuesday, March 23, 2004 URL: http://www.jcaho.org/accredited+organizations/patient+safety/plan+outline/

7. Robert. L. Helmreich, Earl L. Weiner, and Barbara G. Kanki. 1993. *Cockpit Resource Management*. San Diego, CA: Academic Press, Inc.

8. Eduardo Salas. 1999. Team training in the skies: Does crew resource management (CRM) training work? *Human Factors* 41, no. 1:641-674.

9. James R. Klinect, John A. Wilhelm and Robert L. Helmreich. 2002. Threat and error management: data from line operations safety audits. 3 1999, at The Tenth International Symposium on Aviation Psychology: Vol 2. Columbus, Ohio.

10. Lucian L. Leape, Donald M. Berwick, and David W. Bates. 2002. What practices will most improve safety? Evidence-based medicine meets patient safety. *Journal of the American Medical Association* 288, no. 4:501-507.