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**A COMPARISON OF THE TEAMWORK ATTITUDES AND
KNOWLEDGE OF IRISH SURGEONS AND U.S NAVAL
AVIATORS.**

PAUL O'CONNOR, IVAN KEOGH, AND STEPHEN RYAN

ABSTRACT

Poor team work skills are contributors to poor performance and mishaps in high risk work settings, including the operating theatre. A questionnaire was used to assess the attitudes towards, and knowledge of, Irish surgeons ($n=72$) towards the human factors that contribute to mishaps and poor teamwork in high risk environments. The responses were compared to those obtained from U.S Naval aviators ($n= 552$ for the attitude questions, and $n= 172$ for the knowledge test). U.S Naval aviators were found to be significantly more knowledgeable, and held attitudes that were significantly more positive towards effective team working than the surgeons. Moreover, 78.9% of Senior House Officers and Registrars stated that junior personnel were frequently afraid to speak-up (compared with 31.3% of Consultants). Only 7.3% of surgeons stated that an adequate pre-operative brief team brief was frequently conducted, and only 15% stated that an adequate post-operative team brief was frequently conducted. It is suggested that the human factors training currently

provided to surgeons in Ireland is a positive first step. However, there is a need to stress the importance of assertiveness in juniors, listening in seniors, and more reinforcement of good team working behaviours in the operating theatre.

INTRODUCTION

Poor team work skills are contributors to poor performance and mishaps in high risk work settings, including the operating theatre. While patient safety problems can occur in non-acute domains of healthcare there are particular risks associated with surgery.¹ Surgical patients are involved in as many as 45% of medical adverse incidents.² Estimates of the percentage of surgical incidents that occur while the patient is in the operating room range from 35%³ to 66%.⁴ Observations of performance in operating theatres show that breakdowns in teamwork, leadership, communication, lack of situation awareness, and poor decision making are not uncommon and can lead to poor outcomes for patients.¹

The human factors that contribute to poor performance in surgery are common to other high risk environments. The first high-risk industry to recognise the contribution being made by human factors such as poor decision making and communication to mishaps was the civil aviation industry. Based upon research and accident analysis, crew resource management (CRM) training was developed to improve teamworking. Since first used to train civil aviation pilots in the early 1980s, CRM training has become the most widely used team training strategy in the world.⁵

The first applications of medical CRM training was with anaesthetists in 1989.⁶ However, CRM training is now used to train a wide range of medical teams (e.g. labour and delivery, intensive care, community hospitals).⁷ Evaluations of the effectiveness of this type of training in healthcare have generally been found to be positive. In fact, in a meta-analysis of CRM training evaluation studies from a range of industries, the most effective training was found to have been carried out in healthcare.⁷

Specific to surgery, a recent study by Neily et al was carried out to evaluate the effects of Medical Team Training (MTT) on surgical mortality.⁸ The MTT was delivered to complete surgical teams. Training was provided in teamworking, communication and challenging, and conducting checklist guided pre-operative and post-operative debriefings.⁸ It was found that the Medical Team Training program lead to a decline in surgical mortality of 18% at the 74 hospitals that implemented the training, compared with a 7% mortality reduction in 34 control hospitals. Other evaluations of the effectiveness of CRM/human factors training in surgery have found the training to have a beneficial effect on team performance.⁹

The purpose of the study reported in this paper was to assess the attitudes towards, and knowledge of, Irish surgeons regarding the human factors that contribute to mishaps and poor teamwork in high risk environments and compare these with the attitude and knowledge of U.S Naval aviators. Comparing the safety attitudes of military aviators and healthcare workers is not without precedent.^{10, 11} Although there are obviously differences between carrying out surgery and flying a military aircraft, there are also a number of key similarities. In both domains personnel work in large multi-disciplinary teams, have a range of levels of experience, must be flexible and have the ability to adapt to different situations, and may have to take risks to complete a task.

Human factors training for surgeons in Ireland

Human factors training has been provided for surgeons in Ireland by the Royal College of Surgeons in Ireland (RCSI) since 2005. The RCSI human factors and patient safety programme consists of 15 days of training delivered over the two years of Basic Surgical Training and the first three years of Higher Surgical Training.¹² A

range of topics are addressed from the standard CRM topics that are addressed in typical aviation/medical CRM training, to other topics that are not typically included in CRM training (e.g. presentation/interview skills, patient safety and error disclosure, emotional intelligence; a full description of the curriculum is provided in Doherty et al).¹² Teaching methods are typical of those used in other CRM training courses. The authors were unable to find any published evaluation of the effectiveness of the RCSI human factors training.

Human factors training in U.S Naval aviation.

CRM was first instituted in U.S Naval aviation in the late 1980s. The Navy's CRM training was based upon seven critical skills (decision making, adaptability/flexibility, situational awareness, mission analysis, communication, assertiveness, and leadership) that were derived from human factors research carried out in naval aviation. Every naval aviator must receive annual ground training and a CRM evaluation during an actual or simulated flight.¹³ A number of evaluations have been carried out of the effectiveness of the U.S Navy's CRM training programme. It has been found that naval aviators appear to think that CRM training is useful, are generally knowledgeable of, and display positive attitudes towards, the concepts addressed in the training.¹⁴ However, unlike the Neily et al⁸ study, there is a lack of evidence to support the view that CRM training has an effect on the mishap rate. Comparing the attitudes and knowledge of surgeons with U.S Naval aviation could allow the areas in which improvements could be made to be identified.

METHODS

Instrument

The questionnaire consists of 23 attitude items, and eight knowledge questions. The attitude items are divided into four scales: 'my stress' (emphasises the consideration of, and possible compensation for, stressors in oneself), 'stress of others' (emphasises the consideration of, and possible compensation for, stressors in other team members), 'communication' (encompasses communication of intent and plans, delegation of tasks and assignment of responsibilities, and the monitoring of team members), and 'command responsibility' (appropriate leadership and its implications for the delegation of tasks and responsibilities. These scales were established using confirmatory factor analysis, and have been shown to have levels of internal reliability that are typical of those associated with this type of survey (for the U.S Naval aviation sample the Cronbach's alphas ranged from 0.44 to 0.59).¹⁴ Three further attitude items were included that to obtain information on whether junior personnel were afraid to speak up to more senior personnel, and whether adequate pre- and post-operative team briefs were conducted (the latter two questions were only asked of the surgeons).

The eight item multiple-choice knowledge test was developed to address teamwork issues that have been identified as causal to accidents in aviation (situation awareness, decision making, communication, stress, and fatigue). However, as described in the introduction, these teamwork issues also contribute to poor performance and sentinel events in a surgical environments. As the questionnaire was initially developed for use with naval aviators, two surgeons checked, and where necessary adapted, the language so that it was not aviation specific (e.g. aircrew was changed to team member).

Procedure

Following approval by the Ethics Board Chairman of Galway University Hospital, all of the surgeons registered with the RCSI were sent an email asking them to participate in the study. There was a link to the survey in the email that allowed it to be completed on-line during early 2011. The responses from the U.S Naval aviators were collected as part of a larger study evaluation the effectiveness of the U.S Navy's CRM programme carried out in 2008 and 2009. The procedure for obtaining the questionnaire responses from U.S Naval aviators, and the findings from the analysis of the responses collected from this population, were reported by O'Connor et al.¹⁴

Participants

Complete responses were obtained from 73 surgeons (the response rate was 20.9%). A total of 21.9 % of respondents were Consultants, 41.1% Registrars, and 37.0% Senior House Officers (SHOs). The U.S Naval aviation benchmarking sample consisted of 552 naval aviators who responded to the attitude survey, and 172 responses to the knowledge test.

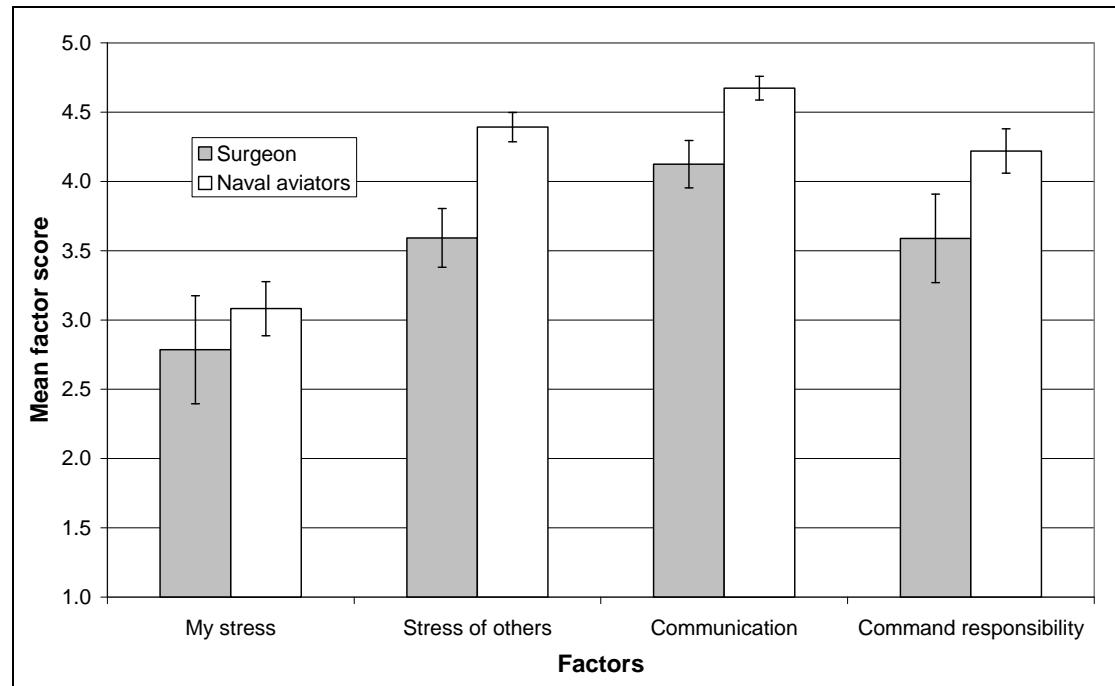
RESULTS

It was not possible to carry out a confirmatory factor analysis with the surgeon sample due to the small sample size. However, the internal consistency of the attitude survey subscales was found to be comparable to that of the U.S Naval aviation sample (the Cronbach's alpha scores for the surgeon sample ranged from 0.41 to 0.66).

An independent subjects t-test was used to assess whether there was a difference in the attitude factor scores and percentage correct on the knowledge test

between surgeons and U.S Naval aviators. The mean factor scores are shown in Figure 1.

Figure 1. Mean factors scores (error bars represent one standard deviation).



It was found that there were significant differences in the mean factor scores ('my stress' ($t= 3.05$, $df= 594$, $p<.05$); 'stress of others' ($t=14.63$, $df= 594$, $p<.05$);, communications ($t= 9.56$, $df= 82.8$, $p<.05$); and 'command responsibility' ($t= 7.76$, $df= 594$, $p<.05$). The surgeons got a mean of 58.2% (st dev= 14.4) of the questions correct on the knowledge test compared to a mean of 81.5% (st dev= 14.2) correct for the aviators. As would be expected, there was a significant difference between the knowledge test score for the surgeons and aviators ($t= 11.84$, $df= 257$, $p<.05$).

The overall effect size of the difference for the attitude questionnaire was Cohen's $d=1.84$, and $d=1.62$ for the knowledge test (both considered to be large effect sizes).¹⁵ Therefore, U.S Naval aviators have significantly more positive attitudes, and

are significantly more knowledgeable about the human factors that contribute to accidents and poor performance than Irish surgeons.

Table 1 provides a summary of the responses to the three items that address speaking up and adequacy of pre- and post-operative briefings. For the purposes of clarity, the ‘very frequently’ and ‘frequently’ responses were collapsed together, and the ‘seldom’ and ‘very seldom’ responses were collapsed together.

For comparative purposes, Table 1 includes the responses of U.S. Naval aviators regarding the willingness of juniors to speak-up. In terms of seniority, the junior aviators are broadly comparable to registrars, and the senior aviators are comparable to consultants. When examining the responses based upon seniority of surgeon, a significant difference was found in the pattern of responses, based upon seniority, for willingness of juniors to speak-up (Fischer’s exact test= 12.6, $p < .05$). However, no significant difference was found in the pattern of responses for the other two items in Table 1.

Table 1. Responses to the three items that address speaking up and pre- and post-operative briefing.

How frequently are junior personnel afraid to express disagreement with more senior personnel?			
	Frequently	Sometimes	Seldom
SHO	81.5	14.8	3.7
Registrar	76.7	20.0	3.3
Consultant	31.3	56.3	12.5
Junior Naval aviators	18.0	48.1	33.9
Senior Naval aviators	14.5	58.9	26.6
How frequently are adequate pre-operative team briefs conducted?			
	Frequently	Sometimes	Seldom
SHO	0	40.7	59.3
Registrar	23.3	30.0	46.7
Consultant	18.8	25.0	56.3
How frequently are adequate post-operative team briefs conducted?			
	Frequently	Sometimes	Seldom
SHO	3.7	18.5	74.1
Registrar	16.7	23.3	60.0
Consultant	31.3	31.3	37.5

DISCUSSION

The U.S Naval aviators were more knowledgeable, and held attitudes that were significantly more positive towards effective teamworking than the surgeons. The responses rate from surgeons was lower than would have been desirable (although not atypical of survey research of this kind), and so the findings from the surgeon sample should be regarded with some degree of caution. Nevertheless, the data were consistent with other studies comparing the safety attitudes of U.S naval aviators with healthcare personnel. Two studies that compared safety climate (employees' perceptions, attitudes, and beliefs about risk and safety) in U.S Naval aviators with that of U.S hospital personnel, found that the perception of the safety climate of the aviators was considerably superior to that of the hospital personnel.^{10, 11}

CRM training is only one of 14 different behavioural based safety programme used in U.S Naval aviation.¹⁶ Therefore, in addition to the annual CRM training, a consistent emphasis is placed upon team skills and human factors more generally in U.S Naval aviation. Moreover, when there is an aviation mishap, flight surgeons and aviators who have received specialised human factors training are included as members of the mishap investigation board. These two board members ensure that any potential human factors causes of the mishap are identified so that similar mishaps are prevented in the future. It is suggested that, in addition to human factors training, surgery safety could be improved by adapting the structures, systems, and practices that have proven to be effective in domains such as U.S Naval aviation.^{10, 17}

The specific findings from the survey that are worthy of highlighting are that almost four fifths of SHOs and Registrars and a third of Consultants reported that junior personnel were frequently or very frequently afraid to express disagreement with more senior personnel. Further, only 7.3% of surgeons stated that an adequate pre-operative team brief was frequently conducted, and only 15% stated that an adequate post-operative team brief was frequently conducted.

These findings suggest the need for emphasis upon encouraging assertiveness in junior personnel in the operating theatre. Assertiveness should not be confused with aggression. Assertiveness involves communicating one's feelings, concerns, ideas, and needs to others in a clear and direct manner, but without demeaning or infringing on the rights of others.⁵ Drawing upon methods used to improve communication in aviation, Brindle and Reynolds¹⁸ identified nine practical strategies for improving communication that have the potential for improving communication in the operating theatre. Specific to encouraging juniors to speak up, they discuss a graded approach to assertiveness in which personnel are taught about six different communication

strategies from least (a hint), to most direct (a command) in order to escalate concerns to more senior personnel.

Many consultants would appear to be unaware of the extent of the lack of willingness of junior personnel to speak-up. There is little point teaching juniors to be assertive unless seniors are willing to listen to them. Research shows that high performing teams have a climate of openness and trust, where team leaders are receptive to alternative views and team members are not afraid to express them.⁵ Therefore, consultants should ensure that they encourage junior personnel to speak-up, and provide opportunities for them to do so.

To aid in the improvement of communication, as well as other CRM (or nontechnical) skills, methods such as the non-technical skills for surgeons (NOTSS) behaviour rating system have been found to be effective.¹⁹ The NOTSS system allows surgeons to observe trainees' behaviour during surgery and provide feedback for skill improvement in a structured manner. Moreover, visible leadership has also been shown to be an important factor in encouraging the use of effective crew resource management skills and the implementation of preoperative briefing and postoperative debriefing in healthcare settings.^{20, 21}

The use of standardised briefing techniques are mandatory in U.S Naval aviation, and in surgery these types of briefing have been shown to be associated with improved patient outcomes.²² The World Health Organisation surgical safety is being implemented across Ireland with varying levels of adherence and criticism.²³ It is suggested there is a need for increased emphasis on the use of the surgical checklist, and the encouraging of questions from junior team members by senior personnel during both the preoperative briefing and postoperative debriefing.

CONCLUSION

The RCSI human factors training programme and the use of the surgical checklist represents positive first steps in providing surgeons in Ireland with the teamwork knowledge and skills required to effectively lead a surgical team. However, it is also important to recognise that a single training course, completed once in a surgeon's career, is unlikely to result in a sustained cultural shift. There is a need for continuous reinforcement of good team work behaviours in the operating theatre, as well as the involvement of other members of the theatre team. By leveraging the surgical human factors research being carried out in other countries, conducting surgical human factors research in Ireland, as well as avoiding the mistakes made in other organisations, a culture shift in Irish surgery could occur more rapidly than was the case in U.S Naval aviation. However, change is very much dependent on the support of senior surgeons in Ireland, and the need for them to model, and encourage, the appropriate behaviours in the operating theatre.

CONFLICT OF INTEREST STATEMENT

The authors report no conflicts of interest.

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