Research Article

Introduction of Crew Resource Management in Emergency Medical Dispatch Centre: A Prospective Qualitative Study

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Abstract

Crew Resource Management (CRM) was adapted from the aviation industry and has spread to other professions including health-care professionals, with the intent of improving critical decision making, situation awareness and team performance. In an Emergency Medical Dispatch Center (EMDC) in Denmark, a need for CRM skills was identified and it was decided to introduce a tailored CRM course. In order to evaluate the impact of CRM introduction on EMDC performance, a prospective qualitative study was initiated.

Methods: Prior to the CRM courses, a questionnaire was sent to all personnel assigned. A follow-up questionnaire was sent one month post-course. Three months after completion of the courses, the frequency of complaints and incidents relating to critical decision making and patient safety were recorded. For comparison, the same period the previous year was analyzed retrospectively.

Results: 44 out of 72 answered both questionnaires (61,11 %). There was no significant change in the respondent's own perception of 18 predefined CRM topics. The number of patient safety related incidents remained unchanged, however the degree of severity improved (4 vs. 8). The number of complaints to the EMDC regarding untoward communication with patients and health professionals was unaffected.

Conclusion: Introduction of CRM in the EMDC did not improve situation awareness and team performance. Patient safety related incidents and complaints were unaffected. The severity of unintended incidents improved. Physicians were the most positive group towards CRM, while technicians were the most negative.

Discussion: A literature review suggests that 10% of all CRM course participants are non-responders. This may reflect the fact that prerequisite level of education is an important factor in acquisition of new information and the ability to change behavior. For high reliability organizations, the pursuit of safety is about making the system as robust as is practicable in the face of its human and operational hazards.

ABBREVIATIONS

CRM: Crew Resource Management; EMDC: Emergency Medical Dispatch Center; SA: Situation Awareness; TP: Team Performance; NLA: Norsk Luftambulanse (Norwegian Air Ambulance); EHAC: European HEMS and Air Ambulance Committee; HEMS: Helicopter Emergency Medical Service ; CDM: Critical Decision Making; PRCQ: Pre Course Questionnaire; POCQ: Post Course Questionnaire

INTRODUCTION

The concept of Crew Resource Management (CRM) was adapted from the aviation industry and has spread to other professions including health-care professionals in the last decades [1-4]. Criteria based emergency medical dispatch and critical decision making is one of the tasks in the Emergency Medical Dispatch Center (EMDC), performed by both health-care professionals and technicians. We identified a need for CRM skills in general and Situation Awareness (SA) and Team Performance (TP) specifically in an EMDC in Denmark. Consequently, it was decided by the hospital management that CRM should be introduced. Prior to the courses, the core CRM principles were presented to the participants on meetings and in a newsletter, giving introduction to the CRM principles and preparing the participants for the courses.

1. Effective communication

2. Team leadership

3. Problem-solving

4. Situational awareness

5. Interdisciplinary collaboration

6. Decreased medical error

7. Creating and managing teams

8. Recognizing adverse situations (red flags)

9. Cross-checking and communication

10. Decision making

From Human Factors Attitude Survey (HFAS) Table 1

MATERIALS AND METHODS

A CRM course tailored for the EMDC was set up and carried out by Norsk Luftambulanse (NLA), covering all personnel in the EMDC involved in patient handling, including nurses, paramedics, physicians and technicians. A prospective qualitative study was conducted along with the course.

The tailoring of the course was conducted by a European HEMS and Air Ambulance Committee (EHAC) certified CRM instructor from NLA in cooperation with the medical director of EMDC. The generic CRM course was adapted from NLA and certified by EHAC. A template was set-up by the instructors to identify the issues relevant to daily performance in EMDC that were critical. Ten parameters essential to SA, TP and critical decision making (CDM) were identified and the questionnaire was designed to cover the parameters.

Four sessions were performed in the autumn of 2017, offering all patient related EMDC personnel a tailored CRM course.

A pre-course questionnaire (PRCQ) was sent to all eligible participants in the CRM courses one week before the first session. One month after completion of the CRM course, a post-course questionnaire (POCQ) with the same questions was distributed along with an End-of-Course Critique. Reminders were sent out one day prior to the course in the event that the course participants had not answered the online questionnaire, similar scheme was used in regard to the one-month POCQ (See Figure 1).

The number and nature of complaints and unintended events regarding EMDC relating to critical decision making and patient safety in a two-month period were recorded prospectively three months after completion of the last of the four CRM modules. A retrospective recording of the complaints and unintended events in the same period one year before was conducted. An independent reviewer analyzed complaints and incidents and decided on the severity of the complaint, i.e. if it was patient critical or related to communication, attitude or technical issues. Data were analyzed according to Vancouver Declaration guidelines. Since patient sensitive data was not handled, permission from the local ethics committee was not mandatory.

Each graph in a graphic presentation depicts one or more means of difference scores contained in a confidence interval (Figure 2). These means of difference scores are calculated in the following way: First paired differences are calculated for

each respondent on each variable, thus yielding 18 new variables consisting of paired differences for each respondent on question 1-18. The paired differences are calculated in the following way: value for respondent i1 at time j1 on variable x1 subtracted from the value for respondent i1 at time j2 on variable x1. Calculating the mean on each variable consisting of paired differences yields the mean of the difference score. The confidence interval for the means of the difference scores are calculated in STATA (StataCorp LLC, College Station, Texas, USA) using the following

Figure 1 Study Flow Chart
Abbreviations: CRM: Crew Resource Management
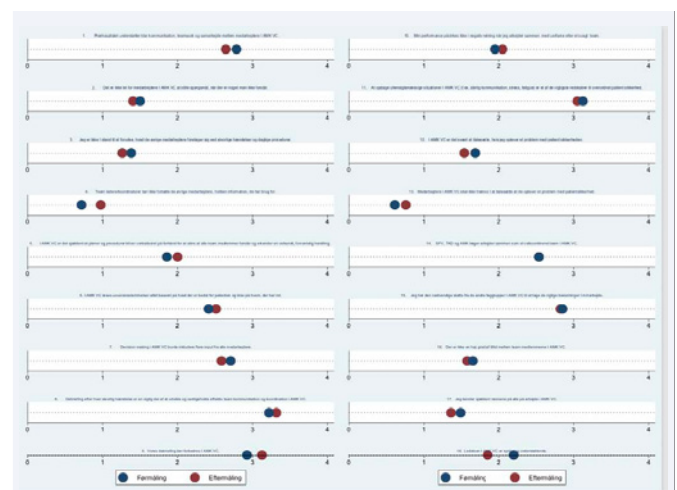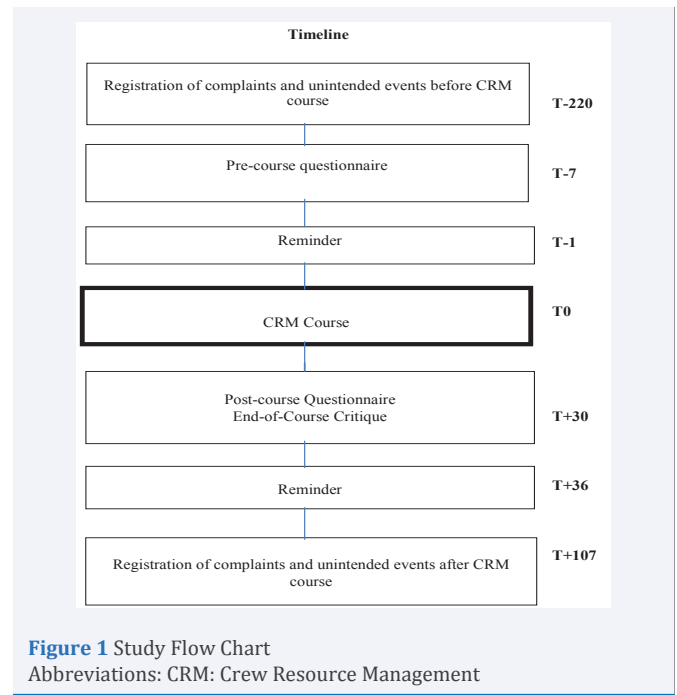
Figure 2 Graphic Presentation of Means of Difference Scores
Each graph depicts one or more means of difference scores contained in a confidence interval. Calculation method is explained in Material and Methods.
Blue dots represent pre-course evaluations.
Red dots represent post-course evaluations.
Text in Danish is translated in Table 1 along with mean of difference scores and p-values.

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Table 1: Human Factors Attitude Survey.
Survey questions adapted from Helmreich 1990

Mean of difference scores and p-values	Pre Post p Value
1. Prehospital Medical Services supports transparent communication, teamwork and cooperation in the EMDC	69.64 66.07 0.2786
2. It is not easy for EMDC professionals to ask questions, when something is not understood	62.50 64.88 0.5529
3. I am not able to predict how other EMDC members act in serious events and daily procedures	65.48 68.45 0.3905
4. Team leaders/coordinators should not tell the staff what information they are in need of	82.05 75.64 0.1768
5. In the EMDC, plans and procedures are rarely verbalized in advance to ensure that all team members understand and recognize a well-known and expected action	53.57 50.00 0.4527
6. In the EMDC, discrepancies are always solved on the basis of patient needs and not on who is right	60.37 62.80 0.5231
7. Decision making in the EMDC should include input from all team members	32.32 35.37 0.4990
8. A debriefing after each event is an important part of developing and maintaining effective team coordination	80.49 82.93 0.4004
9. Debriefing in the EMDC should be improved	26.88 21.88 0.0732
10. My performance is not affected negatively when working with inexperienced or a weak team	48.75 51.25 0.4397
11. Recognizing adverse events is one of the most important keys to overall patient safety	78.95 76.22 0.4981
12. I the EMDC, it is difficult to verbalize, if I discover problems with patient safety	57.93 61.59 0.3366
13. In the EMDC, workers should not be trained in verbalizing problems with patient safety	84.76 81.10 0.2250
14. Nurses, technicians and doctors work together as a well-coordinated team in the EMDC	63.41 63.41 1.0000
15. I have the sufficient support from other team members in the EMDC to make the right decisions in my work	71.25 70.63 0.7990
16. There is not a high degree of confidence between team members in the EMDC	58.75 60.63 0.5703
17. I rarely know the names of everyone at work in the EMDC	62.82 66.03 0.3032
18. Management in the EMDC is visible and supportive	52.06 48.71 0.1639

formula: (see Agresti & Finlay 2009). For each mean of difference scores a 95 pct. confidence interval is used. A confidence interval not containing 0 equals a mean of difference scores significantly different from 0 at a conventional alpha level ($p<0.05$).

RESULTS AND DISCUSSION

44 out of 72 eligible participants answered both questionnaires (61,11%). There was non-significant improvement in the respondent's own perception of SA, critical decision making (CDM) and team performance (TP). There was no significant change in the number of patient safety related unintended incidents (17 vs.18), however the number of severe incidents improved (4 vs.8). The number of complaints to the EMDC regarding untoward communication with patients and health professionals was unaffected (2 vs. 2). The number of contacts to the EMDC in the compared periods was 38936 vs. 41136.

There was improvement in 7/18 (38.89%) predefined CRM topics in the questionnaire, no change in 1/18 (5.56%) and deterioration in 10/18 (55,56%).

A significant effect of CRM introduction in our organization was anticipated, however not met. There may be many reasons for this, i.e. timing of introduction, lack of purpose, commitment and interest. CRM is a process that needs to be maintained and nurtured and it demands that both employees and leaders are prepared to contribute to that process [6,7].

Organizational changes in the EMDC management during the courses may have influenced the negative feedback on leadership in terms of visibility and responsiveness.

Helmreich et al. [8], suggest that approximately 10% of all CRM course participants are non-responders, i.e. not capable or willing to change attitude. In the same study, they describe that the non-responders may display the boomerang effect, i.e. some individuals change in the direction opposite of that intended, while others show extremely large, positive change or little or no reaction.

The boomerang-personality may be challenging for any CRM instructor in the implication that the types of individuals who seem to need the training most may be less or unlikely to be influenced in the desired manner, giving rise to the fact that some individuals in an organization is beyond reach. This is a condition that an organization must accept and deal with. However, it will always represent a major challenge to an instructor to have reluctant participants on a course.

This may have been the case in our study, suggesting that expectations were too high prior to introduction. Furthermore, in an organization such as EMDC, employees are expected to perform flawless and the introduction of a mindset that states that errors will occur and is something, we can learn from, is controversial and may confuse employees. The course participants could have benefitted from a more detailed information and description of the goals and purposes of the course, preparing their mindset to this new behavior.

The highest degree of negative feedback came from the employees with the lowest level of education. This may reflect the fact that prerequisite level of education is an important factor in acquisition of new information and the ability to change

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behavior as stated in numerous studies [9-11]. Another reason for this finding may be that these groups are working based on instructions compiled by others, flow charts and standardized operational protocols. A dynamic approach to the task that is the core of CRM does not go well in line with lower levels of education, where employees are trained to follow an instruction and consider this to be the right solution to any given situation.

What should be taken into consideration is the fact that EMDC is a non-failure or high reliability organization, allowing little or no room for mistakes, which is the case in nuclear plants, air traffic control and naval aircraft carriers. This is in contradiction to basic CRM principles, where human error is to be expected and it is the task of the management to eliminate the risk of system failure to occur and to support the building of a sound safety culture[12]. It is however difficult to convince medical directors that there is a distinction between recognizing the probability of error and to accept error. Learning from mistakes is essential in order to prevent them from happening again.

For high reliability organizations, the pursuit of safety is about making the system as robust as is practicable in the face of its human and operational hazards. High reliability organizations are not immune to adverse events, but they convert them into enhanced resilience of the system by learning from errors.

Furthermore, it may be a challenge to determine what human error is and what system failure is since the extensive use of data processing and IT in the EMDC may blur the distinction although efforts have been made to validate the probability of human error to occur [13].

Leadership and followership are closely linked together and dependent of each other [14,15]. The negative findings in relation to leadership in this study suggest that this may not be case in the EMDC.

CONCLUSION

Introduction of CRM in the EMDC did not improve situation awareness and team performance as per reported by the course participants. Patient safety related incidents and complaints were unaffected. Severity of unintended incidents improved. Level of education and prerequisite self-perception of role in EMDC may be attributed to the negative findings.

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