# The effect of verbal pressure on students' performance during simulated emergency situation—a randomized pilot study

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**Background:** The verbal pressure generated by co-workers and superiors adds to the stress of having even more limited time to make the right decisions, and consequently affects the quality of medical services provided. In our study, we decided to evaluate the effect of verbal pressure, which involved urging paramedic students by team leader, on the effectiveness of chest compressions and preparation for endotracheal intubation (time and completeness of the kit).

**Methods:** Fourteen Polish male paramedic students were randomized into two groups. Participants took part in a low-fidelity simulation scenario of advanced life support. Both groups were tasked with completing an intubation kit based on the SPEEDBOMB checklist, and then performing 2 minutes of cardiopulmonary resuscitation (CPR). During the simulation, the control group was subjected to verbal pressure. Students were evaluated using a special prepared score.

**Results:** In general, the research group performed the task with a lower total score, which means they were more efficient. A statistically significant difference was shown in this aspect between the control group and the study group. In addition, there is a negative correlation between the level of stress and the speed of chest compressions. This means that higher levels of stress are associated with slower performance of chest compressions.

**Conclusions:** The stress factor is perceived on an individual basis and can have both positive and negative effects on the performed medical activities. This aspect requires further evaluation on a greater number of participants.

**Keywords:** Simulation study; cognitive aid; emergency medicine; cardiopulmonary resuscitation (CPR)

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## Introduction

### *Background*

Making quick as well as accurate decisions is an indispensable part of health care professionalists' work. The further fate of human life and health often depends on their decisions. In such difficult conditions a key role plays harmony based on everyone's awareness about her/his role. Verbal pressure generated by co-workers and superiors causes additional stress due to even more limited time to make the right decisions or accurately perform activities. Even the surrounding environments and team relationships affect professional well-being more than the event or medical procedure itself (1). Such a situation can impinge on the accuracy of choices and the quality of execution of medical procedures, which will reduce the health benefits of these activities.

Paramedics struggle especially with time pressure and their work is often accompanied by inconvenient conditions. They are often forced to secure the airway quickly. Endotracheal intubation performed in emergency conditions, compared to scheduled intubation, is much more likely to lead to complications (2). Checklists have been developed to improve medics' work and minimize the risk of complications (3). One of them is the SPEEDBOMB checklist (S—suction, P—positioning, E—equipment for intubation, E—end-tidal $CO_2$, D—drugs and intravenous access, B—back up airway ready, O—oxygen, M—monitoring minimum, B—briefing) (4). Each of the nine letters that make up the words SPEEDBOMB formulates a list of things which should be checked before starting rapid sequence intubation (RSI). This action helps to prepare diligently and efficiently for this demanding procedure (5).

Another precision demanding procedure in which rescuers must follow established rules is cardiopulmonary resuscitation (CPR). What is required is a flat positioning of the patient and a correct hand arrangement with intertwined fingers compressing the middle part of the thorax, while straightening at the elbows and with the shoulders positioned directly over the patient's chest. In adults, compressions should be performed at a depth of 5–6 cm, at a rate of 100–120/min, and the applicable ratio is 30:2 (in non-intubated patients): 30 sternal compressions followed by two rescue breaths (6).

The above procedures can cause difficulties themselves, even without the pressure imposed by co-workers. Distraction factors compromise the quality of compressions in terms of speed and chest wall recoil (7).

**Highlight box**

**Key findings**

- Verbal pressure can lead to better students' performance during simulated scenario (faster preparation of emergency endotracheal intubation kit) but higher level of participants' stress is associated with slower chest compression during cardiopulmonary resuscitation (CPR) which may lead to worse outcome.

**What is known and what is new?**

- The verbal pressure generated by co-workers and superiors adds to the stress of having even more limited time to make the right decisions, and consequently affects the quality of medical services provided.
- Our study shows that too high level of stress worsen the quality of CPR but some urging during scenario could improve other tasks.

**What is the implication, and what should change now?**

- It should be discussed if the team leader task is to harry up others. Moreover, it is hard to estimate the proper 'stress ranges' which are responsible for proper performance during emergency because too high level of stress could even worsen the patient's chances.

### *Rationale and knowledge gap*

There is still insufficient scientific data about the influence of team leader urging on medical staff. Moreover, there are numerous tasks to do during emergency situation and even if stressing is made for a while, its effect may last for further performance. We should discuss if it is good to hurry up our co-workers in context of their mental health, burn-out as well as their ability to work properly.

### *Objective*

In our study, we decided to evaluate the effect of verbal pressure, which involved urging paramedic students by team leader, on the effectiveness of chest compressions and preparation for endotracheal intubation (time and completeness of the kit). The parameters we evaluated for chest compressions were the depth and appropriate speed rate of compressions. We present this article in accordance with the CONSORT reporting checklist (available at https://jphe.amegroups.com/article/view/10.21037/jphe-23-89/rc).

## Methods

Our study was prospective in design and was conducted in Powiślański University in Kwidzyn. We used simple randomization using Research Randomizer.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study does not require bioethics committee approval. Due to the fact that conducted simulator studies are not subject to the evaluation of bioethics committees. All participants gave written voluntary consent to participate in the study. The students were not gratified in any form.

Fourteen Polish male paramedic students ("*3. semester out of 6 foreseen in the study program*") were randomized into two groups. Participants took part in a low-fidelity simulation scenario of advanced life support (prehospital resuscitation of adult patient by three members team). One of the paramedics was performing chest compressions while the team leader was ventilating with a face mask, self-inflating bag (without oxygen supply) and oropharyngeal airway. Both of them were researchers. Participants of both groups (being the third member of the resuscitation team) were asked to quickly prepare the endotracheal intubation kit based on the SPEEDBOMB checklist in the environment of the emergency department (all necessary equipment was available in properly prepared drawers). During this activity eight students (control group) worked without any additional comments from anyone while the leader was urging six students (study group) using previously prepared words and phrases: 'hurry up', 'faster', 'we need to perform an intubation quickly'. Immediately after preparation (when each participant claimed to be ready for intubation), participants were asked to perform 2 minutes of chest compressions (*Figure 1*). Average depth and compressions speed rate were being examined with Resusci Anne quality cardiopulmonary resuscitation (Q-CPR) medical manikin (Laerdal Medical AS, Stavanger City, Norway). At the end

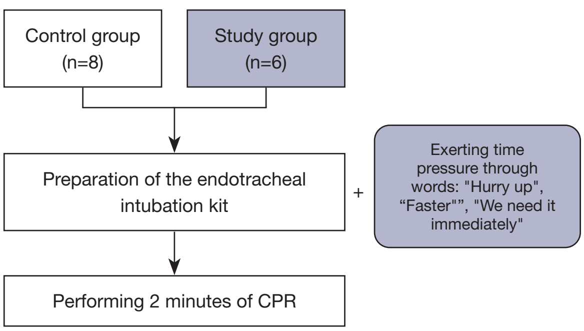


**Figure 1** Stages of the simulation. CPR, cardiopulmonary resuscitation.

of the scenario missing elements from the proper intubation kit were counted.

List of expected equipment is given below (based on the SPEEDBOMB checklist) (*Table 1*):

- ❖ Laryngoscope (two blades in different sizes);
- ❖ Endotracheal tube (two sizes proper for adults);
- ❖ Supraglottic device;
- ❖ Tracheal tube introducer;
- ❖ Suction;
- ❖ Syringe;
- ❖ Oxygen catheter;
- ❖ End-tidal $CO_2$ detector;
- ❖ Tube fixation.

In our study, we required only a few specific elements of the SPEEDBOMB checklist from the participants. This is because the scenario was related to CPR not RSI (so there is no need to prepare medications) and the team leader was responsible for some items (e.g., head position and debriefing).

After the whole scenario each student was rated by calculating points: the time of kit preparation with adding 5 s for each missing element from the list, 1 s was added for each 1 mm of average depth below 50 mm and 1 s was added for each difference in average speed rate from the norm 100–120/min (for example if someone performed chest compressions with mean speed rate at 128/min, 8 points were added to general grade of the participant; on the other hand, if someone's result was 97/min, 3 points were added) (*Table 2*).

After all, participants were asked to evaluate their level of stress and satisfaction connected with their work in

**Table 1** SPEEDBOMB checklist

| Letter | Meaning |
|---|---|
| S | Suction |
| P | Position (especially head position) |
| E | Equipment for intubation (two endotracheal tubes, two laryngoscopes, equipment for tube fixation, tube introducer) |
| E | End-tidal $CO_2$ detection (capnometry, capnography) |
| D | Drugs (in case of RSI) |
| B | Back up (e.g., supraglottic device) |
| O | Oxygen |
| M | Monitoring |
| B | Briefing |

RSI, rapid sequence intubation.

**Table 2** Points allocation system

| |
|---|
| Kit preparation time |
| +5 seconds: for each omitted element in completing endotracheal intubation kit |
| +1 second: for each 1-millimeter difference in the average depth of chest compressions |
| +1 second: for each difference in the average speed of chest compressions |

**Table 3** Characteristics of study and control group

| Feature | Study group (n=6) | Control group (n=8) | P value |
|---|---|---|---|
| Time of intubation kit preparation (s) | 78.50±9.52 | 126.13±76.03 | 0.06 |
| Number of missing elements | 5.67±2.50 | 5.75±2.66 | 0.85 |
| Chest compressions speed rate (/min) | 105.00±10.58 | 107.88±18.88 | 0.85 |
| Depth of chest compressions (mm) | 60.33±5.75 | 55.38±8.09 | 0.28 |
| Total points | 109.33±14.99 | 163.13±69.42 | 0.02* |
| Self-reported stress (0–10) | 5.00±2.97 | 4.75±2.43 | 0.75 |
| Satisfaction level (0–10) | 6.00±1.41 | 6.50±1.41 | 0.49 |
| Heart rate before simulation (/min) | 79.83±25.57 | 80.88±13.85 | 0.66 |
| Heart rate after simulation (/min) | 94.50±28.89 | 88.12±8.77 | >0.99 |
| Heart rate change (%) | 19.19±11.15 | 10.86±17.02 | 0.18 |

Data are presented as average ± standard deviation. *, P<0.05.

0–10 scales (while 0 means no stress and no satisfaction and 10 means a huge level of stress and the highest level of satisfaction). Participants' heart rates (HRs) were measured before and immediately after the scenario.

Statistical analysis was performed with software Statistica 13. Mann-Whitney *U* and Spearman correlation tests were applied since collected data was not parametric. Equality of both groups has been considered as null hypothesis. The level of significance was set at P value ≤0.05 and all results are presented as average ± standard deviation (SD).

## Results

General characteristics of study and control groups are presented in *Table 3*. The only statistically significant difference between groups is in total points graded at the end of the scenario. Box and whisker plot (*Figure 2*) shows also the biggest spread of data (participants being urged gained points in a narrower range). In general, the study group accomplished the task with a lower sum of points (despite similar chest compression quality and accuracy of intubation kit preparation so the majority of differences between groups is connected with time). There is no difference in the level of stress and work satisfaction between both groups.

Moreover, there is a negative correlation between the level of stress and chest compressions speed rate (r=−0.538; P value =0.047). It means that higher level of stress is related to slower chest compressions (*Figure 3*).

HR change during the scenario is negatively correlated with total points gained by participants (r=−0.577; P value =0.03). Members of both groups whose HR was increased by at least 15% obtained statistically significantly less points (*Figure 4*). It means they were more effective during the scenario irrespectively if they were urged by the leader or not.

## Discussion

### *Key findings*

Participants who were given a hurry did better in their performance. The higher level of stress is correlated with a slower chest compression during CPR.

 

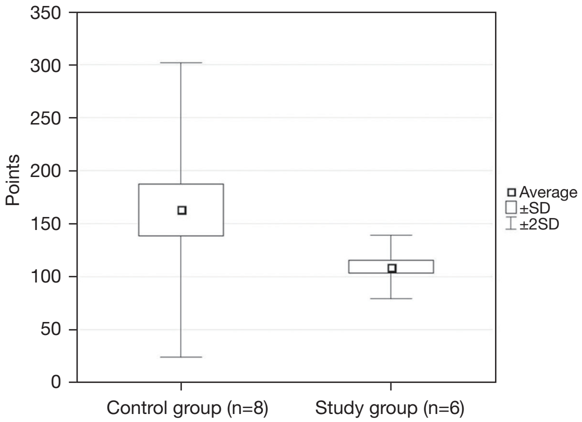


**Figure 2** Box and whisker plot showing difference between groups in total points graded at the end of the scenario (P value =0.02). SD, standard deviation.

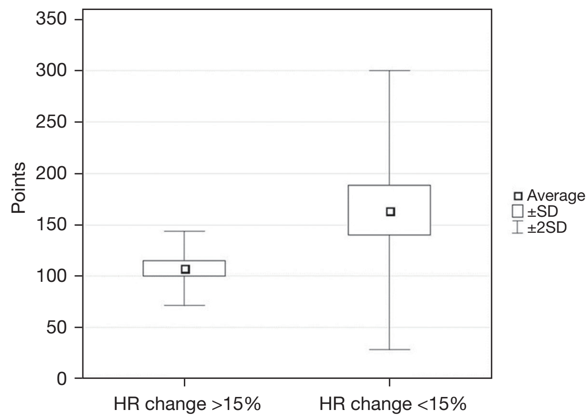


**Figure 4** Difference in total points between participants whose HR changes >15% and <15% during the scenario (P value =0.005). SD, standard deviation; HR, heart rate.

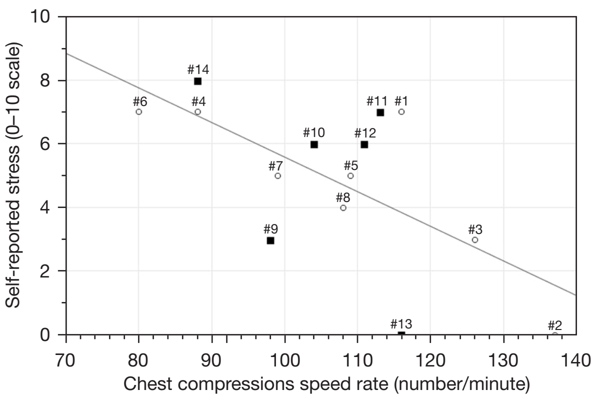


**Figure 3** Correlation between chest compressions speed rate and stress reported by participants during the scenario (0–10 scale). Study group members are marked with squares. Digits in the graph correspond to order numbers of participants.

### *Strengths and limitations*

Advantage of our study is completely new scoring system which includes both time and completeness of intubation kit as wall. Moreover, we tried to evaluate the influence of stress factor on CPR performed after intubation kit preparation. We have to remember that during emergency situation, even if we are stressed (e.g., by urging during one task), there are more tasks to do and we may be affected by the previous situation. We also measure participants' HR as some kind of independent stress marker from subjective 0–10 scale.

The main limitation of this study, which significantly affects its results, is the very few participants. The group included is therefore not very representative, which directly impacts our results. This implies a further need to conduct the survey on a larger number of participants, which will confront our results. Another imitation of this study is the personal experience of the participants and their level of knowledge. We cannot exclude the fact that our participants took part even passively in the CPR procedure. At the same time, this may have impacted their performance and the quality of the activities performed. Personal stress response of the study participants is another limiting factor.

Equipment limitations and the simulation itself are also an obvious limitation of this work. The scenario carried out may induce less stress for the participants compared to a real-life patient emergency. In addition, we did not require participants to perform all the points on the SPEEDBOMB list, which could have greatly facilitated the participants' phase of completing the intubation kit. We are sure that requiring students to complete the full list would have resulted in an increase in their mistakes.

### *Comparison with similar researches*

Stress is a stimulus that can affect human behavior in both positive and negative ways. The spectrum of human behavior in a stressful situation is very extensive, ranging from a state of stupor to engaging in risky behavior. In this work, we demonstrated the positive effects of stress on participants. Our participants who were pressured were highly motivated by it and thus performed better on the given task. The studies so far show mostly negative effects of stress (8). In contrast, the study shows that stress directly affects the potential threat to patients' safety (9). Subsequent researches confirm that increased stress levels in students correlate with poor academic performance (10,11). Therefore, it is crucial to introduce ways to reduce stress in emergency medics. One study suggests using techniques such as self-talking, breath control or trigger word (12). This was also used in Hunziker's study, where the loudly posing two task-focusing question technique used reduced his perception of stress among students. In addition, the study also highlights the role of the team's non-technical skills during a critical situation, when noise and the presence of a patient's family member are the main distractors (13).

Study conducted under standardized conditions assessing the effectiveness of CPR among students and paramedics reported inadequate chest compressions in a significant percentage of participants in both groups (14). This may expose more serious problems in the education of practical activities in both the group of future physicians and paramedics. Visual perception of the quality of CPR by health care professionals remains low (15). Thus, cyclic retraining of medical professionals seems to be a valuable solution. At the same time, the literature emphasizes the role of feedback to retrainees (16). This is also confirmed by the Tavan *et al.*'s study, in which, after face-to-face training, participants exhibited higher effectiveness in performing CPR compared to those trained via video recording (17). This helps to raise awareness of errors that medical professionals are often not aware of.

Influencing such positive results also may have been the use of the SPEEDBOMB checklist, which is designed to reduce cognitive load in medical professionals. According to one study, the use of an airway checklist in a simulation setting reduced the number of important airway tasks omitted by participants, but at the same time increased airway management time (18). Whereas the study showed the positive value of the presence of cognitive aids in hospital premises (19,20). This clearly demonstrates the need to teach the correct use of checklists as early as the training of students (21).

### *Explanations of findings*

Our study found no direct correlation between ambient pressure and participants' HR or their perceived level of stress. The study of physicians during the actual performance of CPR also showed no inconsistent correlation between different physiologic measures and psychometric scores (22). It is unclear from the cited study whether this is the result of differences in the physiology of the participants, the different requirements of each CPR case, or the measurement techniques. We can speculate in line with Marshall's postulation that it is necessary to adjust the score under the simulation being performed (23). The starting point for further discussion and research in this direction is our demonstration of collateralization between the two groups, and specifically created for the point system simulation used in the study.

Our study showed that increased stress levels resulted in a slower rate of chest compressions. Undoubtedly, the physical condition of the participants contributes to this. The study shows that physically better-prepared students perform better in CPR despite the limiting performance of biological protection (24). We are not quite sure what is more responsible for this result, whether it is the "fatigue" of the participants in the study group or the higher accuracy. One thing is certain, the topic of stress and the impact on medical activities should be further investigated by conducting further research in this direction.

### *Implications and actions needed*

There is a need for discussion if the team leaders should harry up their co-workers. Even if sometimes it may seem to be right in the particular situation, stressed team members might perform other tasks worse. We see a need for further investigations about effects of stressing medical staff and clue findings should be implemented as some kind of guidelines for good team leaders.

## Conclusions

The stress factor is perceived on an individual basis and can have both positive and negative effects on the performed medical activities. This aspect requires further evaluation on a greater number of participants.

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## Footnote

*Reporting Checklist*: The authors have completed the CONSORT reporting checklist. Available at https://jphe.

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*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at https://jphe.amegroups.com/article/view/10.21037/jphe-23-89/coif). M.M. is employed by Powiślański University which supplied all necessary equipment. The other authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Due to the fact that conducted simulator studies are not subject to the evaluation of bioethics committees. No ethical approval nor informed consent was required.



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