ANESTHESIOLOGY

Stress Management Training Improves Overall Performance during Critical Simulated Situations

A Prospective Randomized Controlled Trial

Florent Sigwalt, M.D., Guillaume Petit, M.D., Jean-Noel Evain, M.D., Damien Claverie, Ph.D., Monique Bui, B.S., Angélique Guinet-Lebreton, B.S., Marion Trousselard, Ph.D., Frédéric Canini, Ph.D., Dominique Chassard, Ph.D., Antoine Duclos, Ph.D., Jean-Jacques Lehot, Ph.D., Thomas Rimmelé, Ph.D., Marc Lilot, M.D.

ANESTHESIOLOGY 2020; 133:198–211

ABSTRACT

Background: High-fidelity simulation improves participant learning through immersive participation in a stressful situation. Stress management training might help participants to improve performance. The hypothesis of this work was that Tactics to Optimize the Potential, a stress management program, could improve resident performance during simulation.

Methods: Residents participating in high-fidelity simulation were randomized into two parallel arms (Tactics to Optimize the Potential or control) and actively participated in one scenario. Only residents from the Tactics to Optimize the Potential group received specific training a few weeks before simulation and a 5-min reactivation just before beginning the scenario. The primary endpoint was the overall performance during simulation measured as a composite score (from 0 to 100) combining a specific clinical score with two nontechnical scores (the Ottawa Global Rating Scale and the Team Emergency Assessment Measure scores) rated for each resident by four blinded independent investigators. Secondary endpoints included stress level, as assessed by the Visual Analogue Scale during simulation.

Results: Of the 134 residents randomized, 128 were included in the analysis. The overall performance (mean ± SD) was higher in the Tactics to Optimize the Potential group (59 ± 10) as compared with controls ([54 ± 10], difference, 5 [95% CI, 1 to 9]; $P = 0.010$; effect size, 0.50 [95% CI, 0.16 to 0.91]). After specific preparation, the median Visual Analogue Scale was 17% lower in the Tactics to Optimize the Potential group (52 [42 to 64]) than in the control group (63 [50 to 73]; difference, –10 [95% CI, –16 to –3]; $P = 0.005$; effect size, 0.44 [95% CI, 0.26 to 0.59].

Conclusions: Residents coping with simulated critical situations who have been trained with Tactics to Optimize the Potential showed better overall performance and a decrease in stress level during high-fidelity simulation. The benefits of this stress management training may be explored in actual clinical settings, where a 5-min Tactics to Optimize the Potential reactivation is feasible prior to delivering a specific intervention.

(ANESTHESIOLOGY 2020; 133:198–211)

EDITOR'S PERSPECTIVE

What We Already Know about This Topic

- Stress may be associated with impaired performance on cognitive tasks
- Stress management training may lead to a reduced response to stress

What This Article Tells Us That Is New

- Stress management training may improve performance among trainees subjected to a stressful simulated clinical environment

Acute stress is associated with decreased performance in complex cognitive tasks for health professionals.[1] Stress management training has recently been proposed to help healthcare practitioners who deal with stressful critical events in their daily clinical practice. While reducing the intensity of the stress reaction, which impedes individual performance during a crisis, stress management training also aims to reduce long-term stress-related effects such as sleep disorders, burnout and depression syndrome.[2,3] Despite potential benefits, stress management training outcomes

The first results of this study were presented at the 2017, 2018, and 2019 annual meetings of the French Society of Anesthesiology and Critical Care Medicine (SFAR; Paris, France) on September 23, 2017, September 29, 2018, and September 20, 2019, respectively, in Paris, France.

Submitted for publication September 11, 2019. Accepted for publication February 28, 2020. Published online first on April 16, 2020. Published online first on April 16, 2020. From the Departments of Anesthesia and Intensive Care, Hospices Civils of Lyon, Lyon, France (F.S., G.P., D.C., J.-J.L., T.R., M.L.); Departments of Anesthesia and Intensive Care, Grenoble Alpes University Hospital, Grenoble, France (J.-N.E.); Institute of Biomedical Research, Armies' Health Service, Bretigny sur Orge, France (D.C., M.T., F.C.); Desgenettes Hospital, Armies' Health Service, Lyon, France (M.B.); Seventh Medical Center of the Armies of Lyon, 76th Medical Antenna of Varces, Varces, France (A.G.-L.); Claude Bernard Lyon 1 University, high fidelity medical simulation center (CLESS; Centre Lyonnais d'Enseignement par Simulation en Santé), SAMSEI, Lyon, France (D.C., J.-J.L., T.R., M.L.); Health Data Department, Hospices Civils of Lyon, Lyon, France (A.D.); Claude Bernard Lyon 1 University, Health Services and Performance Research Lab (EA 7425 HESPER), Lyon, France (A.D., J.-J.L., M.L.); EA 7426 "Pathophysiology of Injury-Induced Immunosuppression" (Pi3), Claude Bernard Lyon 1 University-Biomérieux-Hospices Civils of Lyon, Lyon, France (T.R.); and Val-de-Grâce School, Paris, France (M.T., F.C.).

 Anesthesiology 2020; 133:198–211. DOI: 10.1097/ALN.0000000000003287

have not yet been explored in healthcare providers dealing with life-threatening situations. Furthermore, stress management training has not been formally incorporated in the resident medical curriculum.

Tactics to Optimize the Potential has been developed for managing preperformance stress in order to maintain optimal cognitive abilities.[4] Tactics to Optimize the Potential is a set of processes, mental strategies and cognitive toolboxes that optimize psychocognitive, physiologic and behavioral resources prior to an expected critical situation (appendix 1). These coping strategies improve job performance and well-being.[5] The use of Tactics to Optimize the Potential has recently been expanded from military units to high-performance sports.[6] As a stress management tool, it aims to increase overall performance during a critical situation through a reduction in individual stress reactions. Tactics to Optimize the Potential may lead to more regulated sympathetic activity within the amygdala and therefore allow for better emotional control.[7] High-fidelity simulation has been formally implemented in the curriculum for residents in anesthesia and intensive care in order to improve their performance in critical clinical situations.[8,9] Simulation provides opportunities for residents to actively develop their technical and nontechnical skills, which are required during realistic critical scenarios.[10] Although high-fidelity simulation allows for performance improvement, the high stress level induced by simulation scenarios impacts technical and nontechnical skills.[6,11] No study has assessed the impact of stress management training on the overall performance and stress levels experienced during high-fidelity simulation.

The hypothesis of this work was that residents coping with stressful simulated critical situations who have been trained with Tactics to Optimize the Potential would subsequently improve their overall performance during simulation in association with a decrease in stress level.

Materials and Methods

Design

This prospective randomized (1:1 allocation) controlled study with two parallel arms and a hypothesis of superiority was conducted in the Lyon teaching center for simulation in healthcare. The study protocol was preregistered on October 6, 2016 on clinicaltrial.gov (NCT02926599; Principal Investigator: Lilot Marc, Claude Bernard University, Lyon, France). The full trial protocol will be provided upon request. The study obtained approval from the Institutional Review Board of the Comité de Protection des Personnes SUD-EST II (2016-089). Two investigators (F.S. and G.P.) evaluated eligibility, provided information about the study, collected written individual informed consent, and enrolled residents. This study followed the recommendations of the International Committee of Medical Journal Editors and the results were reported using the Consolidated Standards of Reporting Trials guidelines.[12] No data monitoring committee was assigned and no interim analysis was done for the primary endpoint.

Population and Setting

This study involved all anesthesiology and critical care residents from the Lyon University who participated in high-fidelity simulation at the medical simulation center during the 2016 to 2017 academic year. These simulations were part of the resident educational program and were not used to certify these residents. No exclusion criteria were applied. Simulations were organized for the five postgraduate year residents as repetitive sessions of 4 to 5 h. Four different scenarios ran consecutively during each simulation so that each resident participated actively once in one scenario. Simulation followed the usual sequence: briefing, scenario, and debriefing.[9,13,14] Scenarios dealt with crisis situations in the emergency department, intensive care unit, and operating room (appendix 2). They were adapted to the training level of the residents. For a given scenario, the same instructor was embedded to play the role of a nurse acting as neutrally as possible and the same two instructors led all debriefings for that scenario. All instructors were anesthesiologists and intensivists certified in medical simulation or with at least 2 yr of instructor experience. Debriefings used Plus/Delta and Promoting Excellence and Reflective Learning in Simulation (PEARLS) models and lasted approximately 30 min.[15] SimMan Essential and SimBaby manikins (Laerdal Medical AS, Norway) were used.

Intervention

A blinded investigator (D.C.) performed a blocked and stratified randomization by postgraduate year, following simple randomization procedures (computerized random numbers) before the Tactics to Optimize the Potential training, by randomly picking concealed names to assign them to either the Tactics to Optimize the Potential or control groups.

Tactics to Optimize the Potential Training. Residents randomly assigned to the Tactics to Optimize the Potential group had a standardized stress management training based on strategies suitable for residents coping with stress induced by critical clinical situations. Residents from the same postgraduate year were convened in groups of 10 to 14. The training was provided in 60-min sessions, once a week during 5 consecutive weeks starting between 1 and 3 months before the scheduled simulation (appendix 3). Two Tactics to Optimize the Potential instructors (M.B. and A.G.-L.) led all of the workouts, which included controlled breathing control with relaxing and revitalizing breathing techniques,[16] as well as mental rehearsal[17] of upcoming actions to optimize the state of readiness and other techniques (mental imagery,[18,19] coherence cardiac biofeedback,[20] sensory relaxation[21]; appendix 1). Residents were not told they would be using Tactics to Optimize the Potential during the next simulation.

Residents were randomly allocated to a half-day session of simulation by residents from the same intervention group (Tactics to Optimize the Potential or control), in order to have at the end of each postgraduate simulation, for any given repeated scenario, the same number of residents from both groups. Residents (not informed of scenario assignment) were allocated by one investigator (F.S.) before the start of the simulation by randomly picking concealed names to assign them to the order of scenarios. All simulation instructors were blinded to the group allocation of each resident. During the simulation, residents from the Tactics to Optimize the Potential group had a specific reactivation of Tactics to Optimize the Potential immediately after the briefing and before involvement as active participants. The same investigator (G.P.) led the next active participant from the Tactics to Optimize the Potential group to sit down in a nearby isolated room. He guided each reactivation (standardized procedure for 5 min; appendix 4), by slowly reading a reactivation text starting with mental rehearsal for 4 min followed by revitalizing breathing for 1 min (appendices 5 and 6). At the end of the Tactics to Optimize the Potential reactivation, the active participant was brought into the simulation theater and the scenario started.

Residents from the control group had no training before the simulation. During the simulation, the same investigator (G.P.) led the active participant from the control group to sit down in the same nearby isolated room and to review normal printed laboratory test results unrelated to the scenario. The resident was asked, in a standardized manner, to read the results for 5 min to identify any abnormalities. Then the active participant was brought to the simulation theater and the scenario started.

Performance Evaluation

Technical Skills Evaluation. For each scenario, a scenario-specific checklist was established beforehand to assess clinical performance. Using a Delphi-inspired approach, checklists were collaboratively developed by simulation instructors, taking into account available guidelines as well as the particularities of each scenario. These checklists have been described previously and contain multiple items corresponding to specific actions.[22] Each item is associated with a number of points so that the total was 100. When residents performed an action without suggestion by the embedded nurse, all points were awarded for the associated item. If residents did not perform an action essential to the scenario progression, the embedded-nurse instructor (linked to the chief instructor *via* a headset) suggested it implicitly to residents (implicit facilitation). If the essential action was not performed despite implicit facilitation, the instructor could suggest it explicitly (explicit facilitation). In case of implicit facilitation, only half of the points were awarded. No points were awarded if the action was not performed or if it was performed after explicit facilitation. The clinical performance score was obtained by summing all scored items. Two assessors (M.L. and J.-N.E.) blinded to group allocation evaluated all clinical performances independently, using the video recordings.

Nontechnical skills evaluation: For each scenario, two different performance evaluation scales were used to assess nontechnical skills by four independent assessors blinded to group allocation. The Ottawa Crisis resource management Global Rating Scale (Ottawa scale) was assessed by the same two clinical performance assessors (M.L. and J.-N.E.), using the video records. Ratings of the six criteria were summed, resulting in scores ranging from 6 to 42 points.[23] The Team Emergency Assessment Measure score was assessed independently by the two instructors prior to leading the debriefing. Ratings of the 12 criteria were summed, resulting in scores ranging from 1 to 54 points.[24]

The average of the two assessors' score for each performance scale was obtained for each resident.

Questionnaires and Physiologic Data

At the beginning of the Tactics to Optimize the Potential training, residents were asked to complete a demographic questionnaire, the French validated translation of the Perceived Stress Scale, the State-Trait Anxiety Inventory-Trait (from 20 to 80 points) and the Fear of Negative Evaluation scale (from 0 to 30 points).[25–27] At the end of the Tactics to Optimize the Potential training, residents asked to report a Visual Analogue Scale (VAS) rating of Tactics to Optimize the Potential training (subsequently converted to a 0 to 100 mm numerical scale) assessing the perceived ease-of-use and efficiency-of-use of Tactics to Optimize the Potential.

On the day of simulation, residents were asked to complete a State-Trait Anxiety Inventory-State (from 20 to 80 points) immediately before the specific preparation.[26] VAS of stress were also completed interactively.[28] At the end of the debriefing, a VAS score of the effect of specific preparation for stress reduction (VAS-stress reduction) and a VAS score of effect of specific preparation for overall performance in simulation (VAS-simulation performance) were provided by residents (fig. 1).

Endpoints

The primary endpoint was the mean overall performance during simulation calculated as the sum of the clinical performance, the Ottawa scale and the Team Emergency Assessment Measure scores (maximum: 100 + 42 + 54 = 196). This overall performance was then divided by 1.96 in order to obtain an overall score between 0 and 100. Secondary endpoints were clinical performance, Ottawa scale score, Team Emergency Assessment Measure score, VAS of stress, and specific VAS collected at the end of the debriefing.

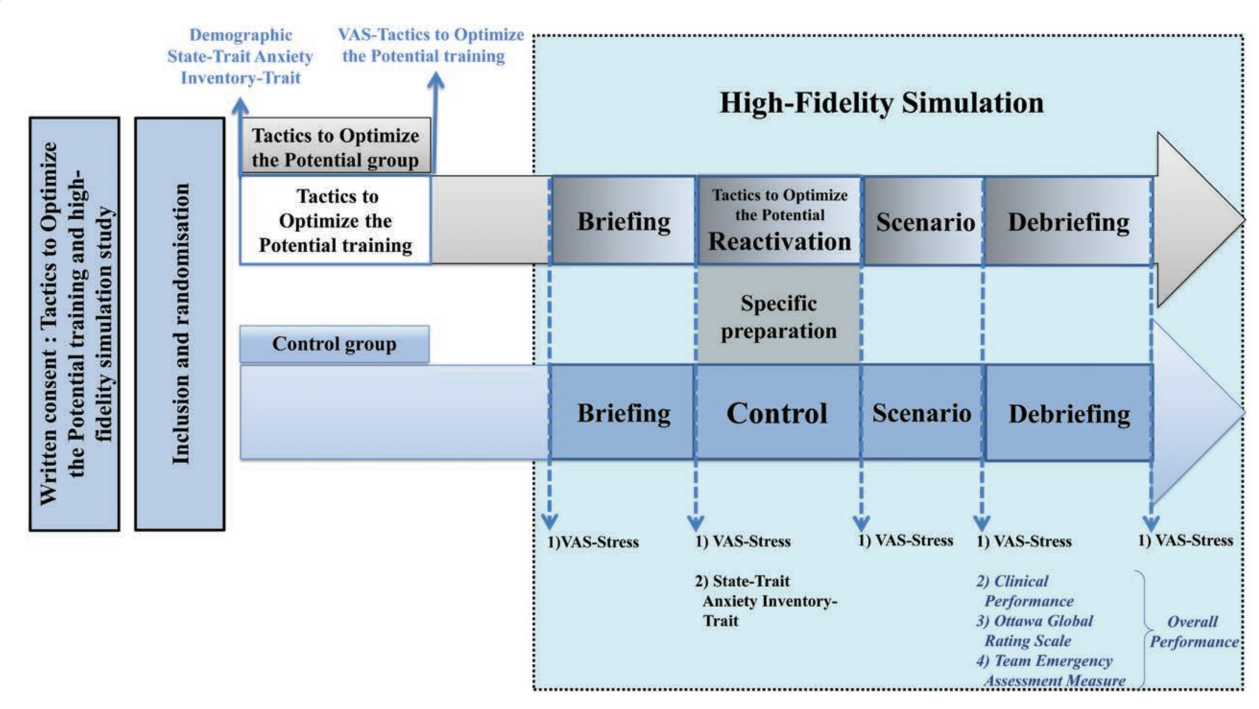


Fig. 1. Protocol timeline. VAS, visual analogue scale; VAS-Tactics to Optimize the Potential training, VAS at the end of the Tactics to Optimize the Potential training (including VAS ease-of-the-use and the VAS efficiency-of-the-use of the Tactics to Optimize the Potential).

Statistical Analysis

No data were available to predict the effect of the intervention; no sample size was calculated *a priori*. However, in order to obtain a representative cohort from each year of residency, all anesthesiology and intensive care residents scheduled for simulation during the 2016 to 2017 academic year were invited to be included. Statistical analysis was performed on an intention-to-treat basis. All tests were two-tailed, and $P < 0.05$ was considered statistically significant. Shapiro–Wilk W test was used to confirm the normality of the distribution. Difference estimates with 95% CIs (95% CI) are provided for all comparisons. Effect size and 95% CI is reported using Cohen's d for parametric data, Cliff's delta for nonparametric data or partial eta squared ($_p\eta^2$) for the analysis of covariance, using sjstats, as appropriate. The magnitude of Cohen's d is considered small, medium, or large when around 0.2, 0.5, or 0.8, respectively. The magnitude of Cliff's delta is considered small, medium, or large when around 0.2, 0.4, or greater than 0.5, respectively. The magnitude of $_p\eta^2$ is considered small, medium, or large when around 0.01, 0.06, or greater than 0.14, respectively.[29–31]

The primary endpoint was compared using independent *t* test. To refine the analysis, we performed an analysis of covariance with the scenario as cofactor.

Secondary endpoints: categorical variables were presented using absolute and relative frequencies and compared using Fisher's exact test. VAS continuous variables were described; using mean ± SD or median [25th to 75th] and compared using independent *t* test, independent samples Mann–Whitney test, or paired samples Wilcoxon test as appropriate. Clinical performance, Ottawa scale and Team Emergency Assessment Measure scores, were compared using independent *t* test. We also performed an analysis of covariance with the scenario as cofactor. Inter-rater reliability of investigators was assessed by calculating absolute interclass correlation coefficients and 95% CI for single and average measures for same raters or random raters as appropriate. Correlation between nontechnical skills scores was evaluated using the Pearson (r) correlation index.

Data analyses were performed using MedCalc version 12.1.4.0 (Medcalc Software, Ostend, Belgium) and R version 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

A total of 134 residents were randomized from November 22, 2016 to June 9, 2017. Of the 66 residents allocated to the Tactics to Optimize the Potential group, 61 received Tactics to Optimize the Potential training and 5 were unable to participate in the training. Of the 68 residents allocated to the control group, one declined to participate. One hundred twenty-eight residents were included in this intention-to-treat analysis (fig. 2). Characteristics of the two groups and the VAS of Tactics to Optimize the Potential training evaluation are presented in table 1.

Endpoints

The overall performance was 56 ± 10 out of 100 points. For all scenarios, the difference between minimum and maximum scores was 22 ± 9 points. Outcome data is presented in table 2.

Primary Endpoint

The overall performance was 9% higher in the Tactics to Optimize the Potential group (59 ± 10) as compared with the control group (54 ± 10; difference, 5 [95% CI, 1 to 9]; $P = 0.010$; effect size, 0.50 [95% CI, 0.16 to 0.91]; table 2). Having removed the variability due to scenarios (analysis of covariance), the *P* value improved ($P = 0.002$; table 3).

Secondary Endpoints

Clinical Performance. The absolute interclass correlation coefficients for the two independent assessments of clinical performance was 0.97 [0.96 to 0.98] for single measures and 0.99 [0.98 to 0.99] for average measures. There was no significant difference between Tactics to Optimize the Potential and control groups with regard to the clinical performance (respectively, 48 ± 11 *vs.* 44 ± 11 out of 100 points; difference, 4 [0 to 8]; $P = 0.073$). Having removed the variability due to scenarios (analysis of covariance), the *P* value improved ($P = 0.014$; table 3).

Ottawa Scale Performance. The absolute interclass correlation coefficients for the two independent assessments of Ottawa scale performance was 0.90 [0.85 to 0.93] for single measures and 0.95 [0.92 to 0.96] for average measures. The Ottawa scale score was 11% higher in the Tactics to Optimize the Potential group (29 ± 6) than in the control group (26 ± 6 out of 42 points; difference, 3 [1 to 5]; $P = 0.011$). Having removed the variability due to scenarios, the *P* value improved ($P = 0.004$, table 3).

Team Emergency Assessment Measure Performance. The absolute interclass correlation coefficients for the two independent assessments of Team Emergency Assessment Measure performance was 0.92 [0.89 to 0.94] for single measures and 0.96 [0.94 to 0.97] for average measures. The score was 8% higher in the Tactics to Optimize the Potential group (39 ± 9) than in the control group (36 ± 8 out of 54 points; difference, 3 [0 to 6]; $P = 0.049$). Having removed the variability due to scenarios, the *P* value improved ($P = 0.018$; table 3).

The Ottawa scale score was correlated with the Team Emergency Assessment Measure score ($r = 0.62$; $P < 0.0001$).

Psychometrics

There was no significant difference between groups with regard to the VAS of stress and State-Trait Anxiety Inventory state before specific preparation (table 1). Immediately after specific preparation, the median VAS of stress was 17% lower in the Tactics to Optimize the Potential group (52 [42 to 64]) than in the control group (63 [50 to 73]; difference, −10 [−16 to −3]; $P = 0.005$; table 2). The analysis of VAS of stress within groups showed a reduction of VAS of stress after intervention in both groups that was greater in the Tactics to Optimize the Potential group (table 4). No difference was observed between groups for subsequent VAS of stress. The VAS–stress reduction and VAS–simulation performance were higher in the Tactics to Optimize the Potential group as compared with the control group (table 2).

Discussion

This study shows that Tactics to Optimize the Potential, like a stress management training, improves the overall performance of residents during simulation by 9%. The associated quantitative effect size showed a magnitude of the phenomenon corresponding to a medium effect, which provides more significance.[29–31] One might question the practical implication of this increase in overall performance. The clinical importance of each additional performance point might vary depending on the scenario. However, it seems reasonable that an improvement in overall performance might be of interest if the results were applicable to the clinical setting. The increased performance score for residents in the Tactics to Optimize the Potential group provides new evidence for the use of cognitive stress management training to enhance participants' performance.

With respect to secondary endpoints, the two nontechnical skills evaluation scales reported better scores within the Tactics to Optimize the Potential group. Before analysis of covariance, no significant difference was observed for the clinical performance between groups. Assuming that the reactivation was effective in reducing residents' stress, one might conclude that the clinical performance is less affected by stress, and therefore less amenable to the benefits of Tactics to Optimize the Potential. Indeed, this stress management training cannot compensate for a lack of clinical knowledge, but it might help to mobilize resources already stored in memory. As opposed to clinical knowledge, nontechnical skills seem to be more influenced by Tactics to Optimize the Potential. Nontechnical skills refer to the "cognitive, social, and personal resource skills that complement technical skills and contribute to safe and efficient task performance."[32] These skills include teamwork, communication, leadership, decision making, and situational awareness, and are increasingly considered for minimizing adverse events resulting from errors and poor performance.[33] Adverse events occurring in the operating room are caused not only by poor technical performance but also by deficits in nontechnical skills.[34–36] Previous studies reported a decrease in nontechnical skills with stressors or higher stress level,[6,11] and another study reported specific preparation related improvement of nontechnical skills during simulation.[22] The choice of using two different

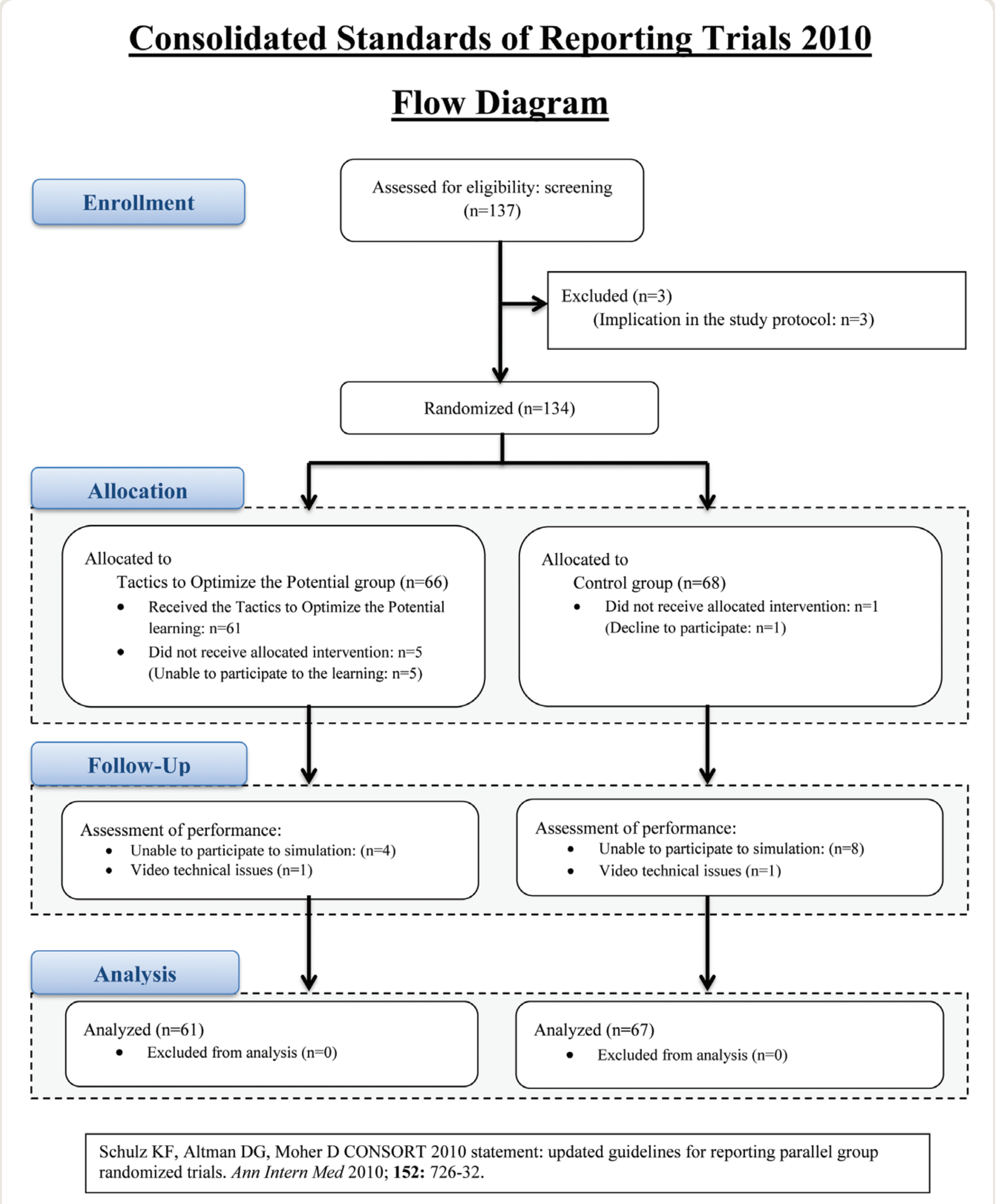


Fig. 2. Study flow chart.

validated scales was justified by the subjectivity of qualitative assessment: the Ottawa scale would be more appropriate for the leader assessment and the Team Emergency Assessment Measure scale for the teamwork assessment. However, as the embedded nurse was acting as neutrally as possible, the two scales were used to perform a more objective assessment of

Table 1. Demographic and Psychometric Data

	Tactics to Optimize the Potential (n = 61)	Control (n = 67)
Demographics		
Female, n (%)	27 (44)	27 (40)
Age, yr	27 (2)	27 (2)
Prior training to stress management techniques, n (%)	7 (11)	14 (21)
Previous participation to high-fidelity simulation, n (%)	48 (79)	52 (78)
Psychometric data at baseline		
Perceived stress scale, points	21 (9)	23 (7)
Fear of negative evaluation scale, points	15 (7)	17 (6)
State-Trait Anxiety Inventory–Trait, points	41 (10)	41 (9)
Tactics to Optimize the Potential training evaluation		
VAS–ease of use of Tactics to Optimize the Potential, mm	59 (21)	NA
VAS–efficiency of use of Tactics to Optimize the Potential, mm	62 (19)	NA
Psychometric data before specific preparation*		
Before briefing VAS of stress, mm	67 [49–72]	66 [60–74]
Before specific preparation VAS of stress, mm	66 [53–86]	68 [55–79]
Before specific preparation State-Trait Anxiety Inventory–State, points	46 (14)	49 (7)

Values are expressed as n (%), mean ± SD or median [25th to 75th]. Fear of Negative Evaluation Scale, from 0 to 30 points. State-Trait Anxiety Inventory from 20 (very low) to 80 (very high) points. VAS from 0 to 100 mm.

*The specific preparation is a 5-min Tactics to Optimize the Potential re-activation between the end of scenario briefing and the start of the scenario in the Tactics to Optimize the Potential group or a review of normal patient results for 5 min in the control group. There was no statistical difference for any characteristics or psychometric data between groups.

VAS, visual analogue scale.

Table 2. Outcome Data

	Tactics to Optimize the Potential (n = 61)	Control (n = 67)	*P* Value	Difference (95% CI)	Effect Size (95% CI)
Primary endpoint					
Overall performance*	59 ± 10	54 ± 10	0.010	5 (1–9)	0.50 (0.16–0.91)
Secondary endpoints					
Performance in high-fidelity simulation					
Clinical specific performance, points	48 ± 11	44 ± 11	0.073	4 (0–8)	0.34 (–0.05 to 0.74)
Ottawa Global Rating Scale score, points	29 ± 6	26 ± 6	0.011	3 (1–5)	0.49 (0.10–0.90)
Team Emergency Assessment Measure score, points	39 ± 9	36 ± 8	0.049	3 (0–6)	0.38 (0.01–0.80)
Psychometric data after specific preparation†					
After specific preparation VAS of stress, mm	52 [42–64]	63 [50–73]	0.005	−10 (–16 to −3)	0.44 (0.26–0.59)
Postscenario VAS of stress, mm	29 [21–50]	33 [21–55]	0.330	−4 (–12 to 4)	0.28 (0.10–0.44)
Postdebriefing VAS of stress, mm	12 [3–24]	13 [9–27]	0.293	−2 (–8 to 2)	0.29 (0.11–0.45)
VAS–stress reduction, mm	54 ± 25	30 ± 27	< 0.0001	24 (14–34)	0.92 (0.52–1.32)
VAS–simulation performance, mm	51 ± 22	26 ± 26	< 0.0001	25 (16–34)	1.04 (0.64–1.44)

Cohen's d effect size and 95% CI are reported for parametric data (including the primary endpoint). The magnitude of Cohen's d is considered small, medium, or large when it is around 0.2, 0.5, or 0.8, respectively. Cliff's delta effect size and 95% CI are reported for nonparametric psychometric data. The magnitude of Cliff's delta is considered small, medium, and large when around 0.2, 0.4, and greater than 0.5, respectively.[29,30] VAS from 0 to 100 mm. Statistics were calculated using analysis of covariance. Values are expressed as mean ± SD or median [25th–75th].

*Overall performance was calculated as follows to reach a score out of 100: (clinical specific performance + Ottawa Global Rating Scale + Team Emergency Assessment Measure Scale)/1.96. Clinical specific performance from 0 to 100 points. Ottawa Global Rating Scale score from 7 to 42 points. Team Emergency Assessment Measure score from 0 to 54 points. †The specific preparation is a Tactics to Optimize the Potential reactivation for 5 min between the end of the scenario briefing and the start of the scenario in the Tactics to Optimize the Potential group or a review of normal patient results for 5 min in the control group.

VAS, visual analogue scale; VAS–simulation performance, visual analogue scale of the effect of intervention on overall performance in high-fidelity simulation; VAS–stress reduction, visual analogue scale of the effect of intervention on before prescenario stress reduction.

nontechnical skills of the resident, and given approximately the same weight as the technical skills component in the overall performance score. Observing a score improvement in both scales, with heavy correlation between them and excellent inter-rater reliability (independent and blinded), provides strong evidence of the positive impact of the Tactics to Optimize the Potential.

Exploratory stress variables highlight the effects associated with Tactics to Optimize the Potential. First, no difference in anxiety scale was observed between groups

Table 3. Performance Data with Analysis of Covariance

	Tactics to Optimize the Potential (n = 61)	Control (n = 67)	*P* Value	Difference (95% CI)	Effect Size (95% CI)
Primary endpoint					
Overall performance*	59 ± 10	54 ± 10	0.002	5 (1–9)	0.099 (0.014–0.223)
Secondary endpoints					
Performance in simulation					
Clinical specific performance, points	48 ± 11	44 ± 11	0.014	4 (0–8)	0.064 (0.002–0.177)
Ottawa Global Rating Scale score, points	29 ± 6	26 ± 6	0.004	3 (1–5)	0.084 (0.008–0.204)
Team Emergency Assessment Measure score, points	39 ± 9	36 ± 8	0.018	3 (0–6)	0.059 (0.001–0.170)

Statistics of table 3 were calculated using analysis of covariance with scenario as cofactor. Values are expressed as mean ± SD. Partial eta squared effect size ($_p\eta^2$) and 95% CI are reported for the analysis of covariance of performance in high-fidelity simulation (including the primary endpoint). The magnitude of $_p\eta^2$ is considered small, medium, and large when around 0.01, 0.06, and greater than 0.14, respectively.[29–31]

*Overall performance was calculated as follows to reach a score out of 100: (clinical specific performance + Ottawa Global Rating Scale + Team Emergency Assessment Measure Scale)/1.96. Clinical specific performance from 0 to 100 points. Ottawa Global Rating Scale, score from 7 to 42 points. Team Emergency Assessment Measure score from 0 to 54 points.

before the reactivation. Therefore, Tactics to Optimize the Potential did not affect stress level or anticipatory anxiety before simulation. Despite the small effect size observed for the VAS of stress after intervention between and within groups, the VAS of stress after specific preparation showed a more significant stress reduction in the Tactics to Optimize the Potential group. These reductions might reflect the perceived beneficial effects of this stress management training before intervention, perhaps *via* better regulation of sympathetic activity. Further exploration of Tactics to Optimize the Potential effects may confirm the proposed mechanism of down-regulation of the amygdala observed with functional magnetic resonance imaging by other cognitive therapy.[37] The amygdala, part of the limbic system, is known to control the sympathetic nervous system.[7] Stress activation–induced burst activity from the amygdala may be attenuated by this stress management training.

Tactics to Optimize the Potential as a stress management training was created by E. Perreaut-Pierre and was reported to reduce stress assessed by the perceived stress scale in a military setting.[4] However, no evaluation of technical and nontechnical skills was reported. Autonomous practice of Tactics to Optimize the Potential as a stress management training was assessed in that study which reported poor compliance with no regular practice. In the current study, no assessment of daily practice training was performed, but it seems reasonable to expect greater benefits would result from regular practice. Another study in a military setting reported that a stress management training was effective in reducing stress with enhanced technical skills during simulated first aid.[38] The specific preparation was training in biofeedback and breathing during stress induced by a three-dimensions immersion first-person shooter video game. During subsequent simulation, a lower salivary cortisol response to stress was observed and the perceived ability to self-control stress was better in the stress management training as compared with the control group.

The current study provides new evidence for Tactics to Optimize the Potential as a toolbox to help practitioners structure stress preparedness in order to cope with difficult clinical situations. This is not a "stress inoculation" training technique to accustom practitioners to higher stress levels, but rather a toolbox to prevent, to anticipate, and to decrease *a priori* the consequences of stress activation. Therefore, a Tactics to Optimize the Potential intervention focusing on primary prevention of the negative effects of stress is an additional and nonexclusive strategy to be considered along with other existing options such as stress inoculation training and other stress management training. The potential of stress management training to reduce the incidence of stress-related long-term conditions while increasing well-being at work remains to be explored in further studies. The impact of excessive stress can lead to burnout, which is observed in up to 40% of intensive care and anesthesia practitioners, particularly younger clinicians working unconventional schedules.[39] Therefore, clinicians working in stressful medical disciplines with daily exposure to life-threatening situations should develop a mastery of stress management training. Tactics to Optimize the Potential also provides tools to improve recovery, especially sleep debt, using relaxation breathing (appendix 1), that may be useful for caregivers participating in overnight and weekend shifts.

This study has some limitations. The choice of a composite primary endpoint may be seen as a limitation. No standardization of the clinical competency of residents was performed before simulation. Therefore, to formally conclude about the effect of Tactics to Optimize the Potential on clinical performance, additional studies requiring prior standardization of residents' clinical performance before simulation must be done. The choice of the two scales used to measure nontechnical skills merits discussion. As many different scales have been reported in the literature, one

Table 4. Within Groups' VAS of Stress before and after Specific Preparation*

	Tactics to Optimize the Potential (n = 61)	Control (n = 67)
Before specific preparation VAS of stress, mm	66 [53–86]	68 [55–79]
After specific preparation VAS of stress, mm	52 [42–64]	63 [50–73]
P value	< 0.0001	0.010
Difference (95% CI)	–15 (–19 to –10)	–5 (–9 to –2)
Effect size (95% CI)	0.44 (0.24–0.60)	0.18 (–0.05 to 0.39)

Values are expressed as median [25th–75th]. Cliff's delta effect size and 95% CI is reported for nonparametric data. The magnitude of Cliff's is considered small, medium, and large when around 0.2, 0.4, and greater than 0.5, respectively.[29,30] VAS from 0 to 100 mm.

*The specific preparation is a Tactics to Optimize the Potential reactivation provided 5 min between the end of the scenario briefing and the start of the scenario in the Tactics to Optimize the Potential group or a review of normal patient results for 5 min in the control group.

VAS, visual analogue scale.

might suspect that different scores could have been observed with different scales.[40,41] One might acknowledge that even if the two nontechnical skills scales are somewhat different, they are partly composed of elements that could be measuring the same behavior and would be "double counted" in their presence or absence. This choice may have influenced the overall performance score.

Given that no difference in stress level could be detected between the two groups before participation in the scenario, it is possible that the reactivation alone might have led to attenuation of the stress response. Despite standardization of each specific preparation, there could be an associated bias in how the control group was treated as compared to the Tactics to Optimize the Potential group. The control intervention might be seen as a non–null event generating some stress and frustration in the residents. Except for the VAS of stress, which was also reduced to a lesser extent in the control group, no specific detailed data were collected to confirm this hypothesis. However, this control intervention has been used previously and was designed to mentally stimulate participants of the control group in a standardized and realistic manner.[22] Importantly, the 5 min required to reactivate Tactics to Optimize the Potential may prevent healthcare providers from doing the reactivation in unexpected situations where immediate care delivery is indicated. Nevertheless, many clinical situations might benefit from the reactivation without delaying care. These may include paramedics or medical assisted transport on the way to the patient, the trauma team waiting to receive a patient, expected difficult airway management, unusual or difficult clinical situation, or a complex procedure. Residents' frequency of practicing Tactics to Optimize the Potential in the interval between training and simulation was most likely heterogeneous. Moreover, residents may have been more influenced by some specific tactics over others. Therefore, the specific reactivation could have been tailored to residents' preference in order to potentially achieve a better performance. Finally, the reactivation-to-performance timing should be explored in order to optimize the timing applicability of Tactics to Optimize the Potential. Likewise, the training timeframe was arbitrarily decided between training instructors and the residents' curriculum coordinators to better fit with residents' schedule constraints and specific objectives of this training. The optimal modulation of Tactics to Optimize the Potential training (items and duration) in a competency-based learning strategy remains to be explored as it could influence the reactivation. A specific study should be performed to address this point because a shortening of the preparation interval might enhance the efficacy of this stress management training.

In conclusion, an increase of 9% in overall performance, probably resulting from a significant increase in the nontechnical skills scores, was observed during high-fidelity simulation after residents were trained in stress management techniques with Tactics to Optimize the Potential in addition to immediate Tactics to Optimize the Potential reactivation before the scenario. Confirming the effects on specific performance areas would be relevant before implementation as part of global team training for critical situations where 5 min of reactivation is feasible before delivering specific care. The exploration of Tactics to Optimize the Potential effects on patient care delivery and on team wellness might be particularly relevant.[42]

Acknowledgments

The authors thank: Jacques Escarment, M.D., Ph.D., (Regional Direction of French Military Health Service) for his support and encouragement for the Tactics to Optimize the Potential training study (Lyon, France); Carole Sage for her help with scheduling residents for Tactics to Optimize the Potential training and for simulation, Secretary of the Anesthesia Department (Bron, France); Darren Raphael, M.D., University of California Irvine Medical Center (Orange, California); Christopher Blakeley, M.D., Ph.D., Emergency Department, Westnine Medical Ltd. (London, United Kingdom); Pierre Duhamel, English teacher (Le Havre, France) and Malcolm Bickford, English native (Paris, France) for the substantial English revision of the manuscript; Pascal Roy, M.D., Ph.D., Hospices Civils de Lyon, Health Data Department (Lyon, France), Sophie Schlatter, M.P.H., Motricity Biology Inter-university Laboratory, University Claude Bernard Lyon 1 (Lyon, France), and Baptiste Balança, M.D., Ph.D., Hospices Civils of Lyon, Pierre Wertheimer Hospital, Anesthesia and Intensive Care Department (Bron, France); Inserm U1028, CNRS UMR 5292, Lyon Neuroscience Research Centre, TIGER Team (Lyon, France) for the substantial statistical help; and the students, simulation instructors, and simulation technicians (Lucas Denoyel and Sebastien Sygiel) of Université Claude-Bernard Lyon 1 Simulation Center (Lyon, France).

Research Support

Support was provided solely from institutional (Université Claude Bernard Lyon 1) and/or departmental sources (Hospices Civils de Lyon, Departments of Anesthesia and Intensive Care, Lyon, France).

Competing Interests

The authors report no competing interests.

Reproducible Science

Full protocol available at: marclilot@hotmail.com. Raw data available at: marclilot@hotmail.com.

Correspondence

Address correspondence to Dr Lilot: Département d'anesthésie, Hôpital Femme Mère Enfant, Hospices Civils de Lyon, 59 Boulevard Pinel, 69500 Bron, France. marclilot@hotmail.com. Information on purchasing reprints may be found at www.anesthesiology.org or on the masthead page at the beginning of this issue. ANESTHESIOLOGY's articles are made freely accessible to all readers, for personal use only, 6 months from the cover date of the issue.

Appendix 1. Tactics to Optimize the Potential Toolbox: Techniques Adapted to Each Goal

Techniques	Description	Goal
Mental projection of success	Technique to positively approach any difficult or stressful situation in an optimal state. It is the mental anticipation of a perfectly executed action, whether occurring the next day or months in the future. It is based on the representation of the subject to himself and the situation to which he is (or will be) confronted. This technique is often used in professional sports.	Energizing activation
Mental rehearsal[17]	A boosting technique. Mental repetition, while in a state of relaxation, of an action that has been performed before. When engaging in mental rehearsal one imagines performing without having to actually do anything.	
Revitalizing breathing[43]	Breathing technique based on inspiration lasting four times longer than expiration. This technique is better when performed in the standing position, with arms stretched to the sides in a "T-body formation." The expiration must be quick and the revitalizing breathing cycle repeated 10 times.	
Psychophysiological dynamization	A physical warm-up combined with a mental preparation performed immediately before an essentially physical activity. This technique uses the following principles: alternating tension-muscle relaxation, respiratory rhythm favoring relaxation, synchronous breathing, and alternating gesture-recovery.	
Activation level regulation	Derived from psychophysiological dynamization. A technique to maintain or to return to the desired activation level (optimal performance zone) during an activity, which may include breaks where the action is less intense. This technique combines relaxation or warm-up exercises with imaging strategy.	Regulation
Positive reinforcement	Envisioning a previous success (positive or pleasant event) while in a state of relaxation. It is a technique which increases the frequency of appearance of a desired behavior owing to the appearance of a pleasant stimulus.	
Mental imagery[44,45]	Symbolic representation that allows learners to cognitively process objects momentarily or permanently, absent from their perception. Mental imagery consists of mentally picturing a situation or an action by integrating the maximum of relevant sensitive elements (in particular kinesthesia, sight, and hearing).	
Cardiac coherence biofeedback[21]	Breathing modulates the autonomic nervous system regulation of the heart rate. Exhalation boosts the parasympathetic tone leading to a decreased heart rate. Conversely, inhalation decreases the parasympathetic tone resulting in an increased heart rate. Cardiac coherence biofeedback regulates heart rate variability by applying standardized breathing (6 breaths/min).	
Muscular relaxation	Based on the tension–relaxation response: focused muscle contraction and relaxation of different target muscle groups, usually starting with the feet and moving up to the head.	Recovery
Breathing relaxation[43]	A very simple relaxation breathing exercise based on expiration lasting four times longer than inspiration. This may be performed in a standing, sitting or supine position. It may be repeated during several minutes.	
Paradoxical relaxation	Focused attention on different parts of the body using imagery to optimize muscle tone (relaxed, tense). The objective is to focus on and understand the physical and psychological events that interfere with achieving profound relaxation.	
Postural relaxation	Relaxation technique designed to reduce painful muscle contractions due to prolonged heavy loads in order to accelerate recovery.	
Sensory relaxation[21]	Inspired by the autogenic training[46] and based on the use of different senses in order to relax. This can be practiced through simple meditation or reflection on pleasant mental images or sounds. Modern approaches include watching a video or listening to a recording.	

For more details, refer to the book written by Dr. Perreaut-Pierre entitled "Comprendre et pratiquer les Techniques d'Optimisation du Potentiel," InterEditions.
Here are few web links suggested for further details about Tactics to Optimize the Potential applications, all accessed March 30, 2020:
https://www.youtube.com/watch?v=1-ODfP6gdMU (Short presentation of Tactics to Optimize the Potential, subtitles available in English on YouTube)
https://www.youtube.com/watch?v=iMeD_Ce2vYw (Subtitles available in English on YouTube)
https://www.coevolution.fr/presentation-en/ (Tactics to Optimize the Potential training, English version available)
https://www.optimisermonpotentiel.fr/ (French website about Tactics to Optimize the Potential)

Appendix 2: Topics of the Simulated Scenarios and Related Briefings

Scenario	Postgraduate Yr	Topic	Summary of the Briefing
Accidental disconnection of ventilator	1	Accidental disconnection of corrugated hose from the ventilator by a student	You are supervising general anesthesia.
Tracheal tube obstruction	1	Endotracheal tube obstruction occurring during intra-hospital transport	You are supervising the transport of an intubated patient with pneumonia to the computed tomography scanner.
Tension pneumothorax	1	Tension pneumothorax occurring during intra-hospital transport	You are supervising the transport of an intubated patient with chest trauma to the computed tomography scanner.
Hyperbaric chamber	1	Desaturation during a hyperbaric session	You are supervising the hyperbaric session for a patient with carbon monoxide poisoning.
Cardiogenic shock	2	Myocarditis-associated severe cardiogenic shock	You admit a young man with acute hypotension and tachycardia associated with fever.
Pulmonary embolism	2	Massive pulmonary embolism leading to cardiac arrest	You are called to see a woman with loss of consciousness after standing.
Septic shock	2	Cardiovascular collapse during a septic shock	You are called to see a woman with cardiovascular collapse in the emergency room.
Anaphylactic shock	2	Anaphylactic shock during injection of antibiotics	You are supervising a general anesthesia.
Malignant hyperthermia	3	Malignant hyperthermia with severe hyperkalaemia in recovery room	You are called to see a man with hyperthermia and hypercapnia after general anaesthesia.
Postpartum hemorrhage	3	Severe postpartum hemorrhage with hemorrhagic shock	You are called to see a woman with severe bleeding after delivery.
Local anesthetics intoxication	3	Severe local anesthetic intoxication leading to cardiac arrest	You are going to care for a patient under regional anesthesia for a fracture fixation.
Medication error	3	Accidental curare injection due to a medication error in recovery room	You are going to check on a patient before leaving the recovery room.
Epiglottitis	4	Epiglottitis leading to airway obstruction with hypoxic coma	You are called to see a young man with dyspnea associated with sore throat and fever.
Difficult airway before C-section	4	Urgent caesarean section with need for general anesthesia and difficult airway management	You are called to see a pregnant woman who requires general anesthesia for an urgent caesarean section.
Fiberoptic intubation	4	Fiberoptic intubation procedure	You are going to manage a fiberoptic intubation procedure in a patient with complete trismus.
Pediatric laryngospasm	4	Laryngospasm after extubation	You are supervising the end of a pediatric general anesthesia (extubation and emergence).
Tamponade	5	Hemopericardium leading to tamponade and cardiac arrest	You are called to see a man with acute dyspnea and hypotension occurring after cardiac surgery.
Neonatal cardiac arrest	5	Desaturation and neonatal cardiac arrest after childbirth	You are called for neonatal desaturation in the delivery room.
Amniotic fluid embolism	5	Amniotic fluid embolism leading to cardiac arrest during a caesarean section	You are going to care for a pregnant woman for a nonurgent caesarean section.
Pacemaker dysfunction	5	Pacemaker dysfunction during surgery (while using electrocautery)	You are supervising a general anesthetic for a patient who has a pacemaker.

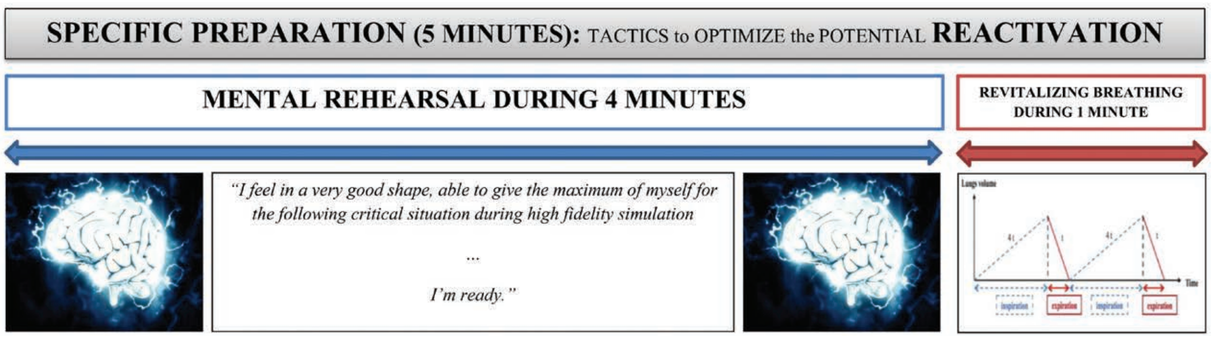
Appendix 3. Tactics to Optimize the Potential Group Training

Program Used in the Five Initial Tactics to Optimize the Potential Training Sessions

Session 1	Session 2	Session 3	Session 4	Session 5
Introduction to the Tactics to Optimize the Potential	Breathing relaxation	Psychophysiological relaxation	Psychophysiological relaxation	Psychophysiological relaxation
Breathing relaxation Psychophysiological relaxation Cardiac coherence	Psychophysiological relaxation Positive reinforcement Cardiac coherence	Cardiac coherence with standardized breathing (biofeedback)	Cardiac coherence with standardized breathing (biofeedback)	Cardiac coherence with standardized breathing (biofeedback) - Revitalizing breathing - Mental rehearsal
with standardized breathing (biofeedback)	with standardized breathing (biofeedback)	Mental rehearsal	Revitalizing breathing Mental rehearsal	

Five sessions of one hour during five consecutive weeks

Appendix 4: Specific Preparation during 5 Min Using Mental Rehearsal Rehearsal (Appendix 5) and Revitalizing Breathing (Appendix 6) Over Time



Appendix 5. Standardized Mental Reactivation Text (Mental Rehearsal) during 4 Min

Tactics to Optimize the Potential instructor to participant: "Take 30 sec to sit comfortably on your chair, breathe deeply once, and then you will begin to read the reactivation text."

1) Text read slowly by the participant: 30 sec

"I feel in very good shape.
Able to give the maximum of myself for the following critical situation during high fidelity simulation.
I am calm and full of energy, ready to react to any stimulation."

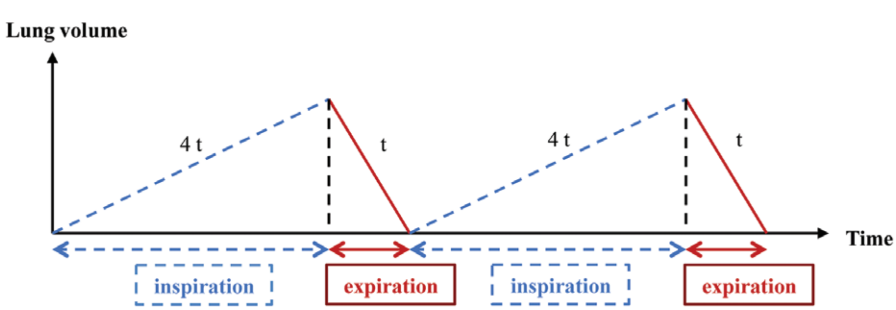
2) Text read slowly by the Tactics to Optimize the Potential instructor: 2 min and 30 sec

"You figure out the gestures, the sequences, the delicate phases, to anticipate the actions of the partners, anticipate different strategies… anticipate the unpredictable…
Get ready for the unexpected…
All this with the required psychologic qualities: energy, dynamism, efficacy, serenity and the pleasure of giving the maximum of yourself."

3) Text read slowly by the participant: 30 sec

"Now I feel in full control of my capacities, technically ready…
Physically at the maximum…
I'm ready!"

Appendix 6. Revitalizing Breathing during 1 Min



Revitalizing breathing is based on inspiration lasting four times longer than expiration. It was part of the tactics to optimize potential reactivation and was performed during 1 min just after the mental reactivation.

References

1. LeBlanc VR: The effects of acute stress on performance: Implications for health professions education. Acad Med 2009; 84(10 Suppl):S25–33
2. Hawryluck L, Brindley PG: Psychological burnout and critical care medicine: Big threat, big opportunity. Intensive Care Med 2018; 44:2239–41
3. Regehr C, Glancy D, Pitts A, LeBlanc VR: Interventions to reduce the consequences of stress in physicians: A review and meta-analysis. J Nerv Ment Dis 2014; 202:353–9
4. Trousselard M, Dutheil F, Ferrer MH, Babouraj N, Canini F: Tactics to optimize the potential and cardiobiofeedback in stress management: The French experience. Medical Acup 2015; 27: 367–75
5. Penley JA, Tomaka J, Wiebe JS: The association of coping to physical and psychological health outcomes: A meta-analytic review. J Behav Med 2002; 25:551–603
6. Krage R, Zwaan L, Tjon Soei Len L, Kolenbrander MW, van Groeningen D, Loer SA, Wagner C, Schober P: Relationship between non-technical skills and technical performance during cardiopulmonary resuscitation: Does stress have an influence? Emerg Med J 2017; 34:728–33
7. Yoshihara K, Tanabe HC, Kawamichi H, Koike T, Yamazaki M, Sudo N, Sadato N: Neural correlates of fear-induced sympathetic response associated with the peripheral temperature change rate. Neuroimage 2016; 134:522–31
8. Goldberg MB, Mazzei M, Maher Z, Fish JH, Milner R, Yu D, Goldberg AJ: Optimizing performance through stress training - An educational strategy for surgical residents. Am J Surg 2018; 216:618–23
9. Motola I, Devine LA, Chung HS, Sullivan JE, Issenberg SB: Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82. Med Teach 2013; 35:e1511–30
10. Gaba DM: Crisis resource management and teamwork training in anaesthesia. Br J Anaesth 2010; 105:3–6
11. Leblanc VR, Regehr C, Tavares W, Scott AK, Macdonald R, King K: The impact of stress on paramedic performance during simulated critical events. Prehosp Disaster Med 2012; 27:369–74
12. Schulz KF, Altman DG, Moher D; CONSORT Group: CONSORT 2010 statement: Updated guidelines for reporting parallel group randomized trials. Ann Intern Med 2010; 152:726–32
13. Rudolph JW, Raemer DB, Simon R: Establishing a safe container for learning in simulation: The role of the presimulation briefing. Simul Healthc 2014; 9:339–49
14. Zigmont JJ, Kappus LJ, Sudikoff SN: The 3D model of debriefing: Defusing, discovering, and deepening. Semin Perinatol 2011; 35:52–8
15. Sawyer T, Eppich W, Brett-Fleegler M, Grant V, Cheng A: More than one way to debrief: A critical review of healthcare simulation debriefing methods. Simul Healthc 2016; 11:209–17
16. Van Diest I, Verstappen K, Aubert AE, Widjaja D, Vansteenwegen D, Vlemincx E: Inhalation/exhalation ratio modulates the effect of slow breathing on heart rate variability and relaxation. Appl Psychophysiol Biofeedback 2014; 39:171–80
17. Allami N, Paulignan Y, Brovelli A, Boussaoud D: Visuomotor learning with combination of different rates of motor imagery and physical practice. Exp Brain Res 2008; 184:105–13
18. Anton NE, Bean EA, Hammonds SC, Stefanidis D: Application of mental skills training in surgery: A review of its effectiveness and proposed next steps. J Laparoendosc Adv Surg Tech A 2017; 27:459–69
19. Wright BJ, O'Halloran PD: Perceived success, auditory feedback, and mental imagery: What best predicts improved efficacy and motor performance? Res Q Exerc Sport 2013; 84:139–46
20. Goessl VC, Curtiss JE, Hofmann SG: The effect of heart rate variability biofeedback training on stress and anxiety: A meta-analysis. Psychol Med 2017; 47:2578–86
21. Schultz JH: [Autogenic training in general practice]. Med Klin 1950; 45:945–9
22. Evain JN, Perrot A, Vincent A, Cejka JC, Bauer C, Duclos A, Rimmelé T, Lehot JJ, Lilot M: Team planning discussion and clinical performance: A prospective, randomised, controlled simulation trial. Anaesthesia 2019; 74:488–96
23. Kim J, Neilipovitz D, Cardinal P, Chiu M, Clinch J: A pilot study using high-fidelity simulation to formally evaluate performance in the resuscitation of critically ill patients: The University of Ottawa Critical Care Medicine, High-Fidelity Simulation, and Crisis Resource Management I Study. Crit Care Med 2006; 34:2167–74
24. Cooper S, Cant R, Connell C, Sims L, Porter JE, Symmons M, Nestel D, Liaw SY: Measuring teamwork performance: Validity testing of the Team Emergency Assessment Measure (TEAM) with clinical resuscitation teams. Resuscitation 2016; 101:97–101
25. Cohen S, Kamarck T, Mermelstein R: A global measure of perceived stress. J Health Soc Behav 1983; 24:385–96
26. Gaudry E, Vagg P, Spielberger CD: Validation of the state-trait distinction in anxiety research. Multivariate Behav Res 1975; 10:331–41
27. Watson D, Friend R: Measurement of social-evaluative anxiety. J Consult Clin Psychol 1969; 33:448–57
28. Williams VS, Morlock RJ, Feltner D: Psychometric evaluation of a visual analog scale for the assessment of anxiety. Health Qual Life Outcomes 2010; 8:57
29. Cohen J: A power primer. Psychol Bull 1992; 112:155–9
30. Kelley K, Preacher KJ: On effect size. Psychol Methods 2012; 17:137–52

31. Levine T, Hullett C: Eta squared, partial eta squared, and misreporting of effect size in communication research 2002
32. Flin R: Safety at the sharp end: A guide to non-technical skills. Aldershot, UK: Ashgate: Paul O'Connor, and Margaret Crichton 2008
33. Kohn L, Corrigan J, Donaldson M: To err is human: Building a safer health system. Washington (DC): National Academies Press (US) 2000
34. Catchpole K, Mishra A, Handa A, McCulloch P: Teamwork and error in the operating room: Analysis of skills and roles. Ann Surg 2008; 247:699–706
35. Lingard L, Espin S, Whyte S, Regehr G, Baker GR, Reznick R, Bohnen J, Orser B, Doran D, Grober E: Communication failures in the operating room: An observational classification of recurrent types and effects. Qual Saf Health Care 2004; 13:330–4
36. Siu J, Maran N, Paterson-Brown S: Observation of behavioural markers of non-technical skills in the operating room and their relationship to intra-operative incidents. Surgeon 2016; 14:119–28
37. Gingnell M, Frick A, Engman J, Alaie I, Björkstrand J, Faria V, Carlbring P, Andersson G, Reis M, Larsson EM, Wahlstedt K, Fredrikson M, Furmark T: Combining escitalopram and cognitive-behavioural therapy for social anxiety disorder: Randomised controlled fMRI trial. Br J Psychiatry 2016; 209:229–35
38. Bouchard S, Bernier F, Boivin E, Morin B, Robillard G: Using biofeedback while immersed in a stressful videogame increases the effectiveness of stress management skills in soldiers. PLoS One 2012; 7:e36169
39. Sanfilippo F, Noto A, Foresta G, Santonocito C, Palumbo GJ, Arcadipane A, Maybauer DM, Maybauer MO: Incidence and factors associated with nurnout in anesthesiology: A systematic review. Biomed Res Int 2017; 2017:8648925
40. Boet S, Larrigan S, Martin L, Liu H, Sullivan KJ, Etherington N: Measuring non-technical skills of anaesthesiologists in the operating room: A systematic review of assessment tools and their measurement properties. Br J Anaesth 2018; 121:1218–26
41. McMullan RD, Urwin R, Sunderland N, Westbrook J: Observational tools that quantify nontechnical skills in the operating room: A systematic review. J Surg Res 2020; 247:306–22
42. Wallace JE, Lemaire JB, Ghali WA: Physician wellness: A missing quality indicator. Lancet 2009; 374:1714–21
43. Van Diest I, Verstappen K, Aubert AE, Widjaja D, Vansteenwegen D, Vlemincx E: Inhalation/exhalation ratio modulates the effect of slow breathing on heart rate variability and relaxation. Appl Psychophysiol Biofeedback 2014; 39:171–80
44. Anton NE, Bean EA, Hammonds SC, Stefanidis D: Application of mental skills training in surgery: a review of its effectiveness and proposed next steps. J of Laparoendosc Adv Surg Tech 2017; 27:459–69
45. Rocco L, Pisani A, Genot M, Pernot M: Tactics to Optimize the Potential (TOP) program for French military forces. J Sci Med Sport 2017; 20:S126.
46. Goessl VC, Curtiss JE, Hofmann SG: [The effect of heart rate variability biofeedback training on stress and anxiety: A meta-analysis]. Psychol Med 2017; 15:2578–86