Neuro[de]cision

Supporting medical students in making informed decisions for their neurosurgery residency pathways

Brainwave:
An Immersive Neurosurgical Skills Challenge

High-Fidelity Neurosurgical Simulation Experience

List of Content:

7.1. Standardized Patient Actors

This document provides a clear and organized overview of the NeuroSim high-fidelity neurosurgical simulation experience, covering all key aspects of the program from its goals and methodology to the practical implementation and evaluation processes.

1. Introduction

Overview of Brainwave: An Immersive Neurosurgical Skills Challenge

This innovative simulation-based educational activity aims to provide an immersive, high-stakes training experience for medical students interested in pursuing a career in neurosurgery. Utilizing cutting-edge high-fidelity simulation technology and guided by expert simulation tutors and practicing neurosurgeons, students will confront realistic neurosurgical scenarios that accurately replicate the intense pressures and critical decision-making demands faced in the real clinical practice. This experiential learning approach offers a safe, constructive environment to expose students to the acute technical and cognitive challenges inherent to this extremely demanding specialty.

1.2. Neurodecision Program and Partners

The activity is a core component of the Neurodecision program, a 2-year Cooperation Partnership project funded by Erasmus+ and led by Humanitas University in collaboration with the International Neuroscience Institute (Hannover, Germany), Univerzitet u Beogradu (Belgrade, Serbia), and Lusiadas Hospital Porto (Porto, Portugal).

2. Goals and Objectives

1. Enhance students' understanding of the rapid diagnostic skills, surgical dexterity, and critical decision-making processes required for success in neurosurgery.
2. Provide an authentic simulated experience of the extreme mental stamina and precise technique necessitated by neurosurgical procedures.
3. Expose students to the high-stress, high-stakes environment of the neurosurgical operating rooms to gauge their responses under intense pressure.
4. Evaluate the efficacy of cutting-edge simulation-based learning methodologies for supplementing neurosurgical training curricula.

3. Methodology

3.1. Pre-Activity Knowledge Assessment

Students will complete a comprehensive test evaluating their current knowledge of neurosurgical pathologies, procedures, decision-making frameworks and related clinical areas. This will establish a baseline for measuring knowledge gains.

The Pre-Activity Knowledge Assessment is a crucial component of our high-fidelity neurosurgical simulation experience. This assessment will be delivered electronically to all participants immediately before the simulation activity begins.

Purpose:

a. To establish a baseline of each participant's current knowledge in relevant areas of neurosurgery.
b. To identify specific areas where knowledge gaps may exist across the group.
c. To provide a benchmark for measuring the educational impact of the simulation experience.

Format:

- The assessment will be conducted via a secure online platform accessible from smartphones, tablets, or computers.
- It will consist of a series of multiple-choice questions covering key areas of neurosurgical knowledge, decision-making processes, and crisis management strategies.
- The questions will be designed to test both theoretical knowledge and practical application of concepts.

Time Allocation:

- Participants will have 10 minutes to complete the assessment.
- The platform will automatically submit responses at the end of the simulation activity.

Scoring and Analysis:

- Responses will be automatically scored by the online system.
- Individual scores will remain confidential and will only be used for educational purposes.
- Aggregate data will be analyzed to identify common areas of strength or weakness across the group.

Utilization of Results:

- Facilitators will use the data to guide debriefing sessions and focus on areas needing improvement.
- A comparison with the Post-Activity Assessment will quantify the educational impact of the simulation experience.

By implementing this Pre-Activity Knowledge Assessment, we aim to enhance the educational value of the simulation experience and provide a data-driven approach to assessing its effectiveness in improving neurosurgical knowledge and skills.

3.2. Post-Activity Knowledge Assessment

Post-Activity Knowledge Assessment is a critical element of our high-fidelity neurosurgical simulation experience, designed to measure the educational impact of the activity.

Purpose:

a. To quantify the knowledge gained by participants through the simulation experience.
b. To identify areas where the simulation was particularly effective in improving understanding.
c. To highlight any remaining knowledge gaps that may require further attention.
d. To provide data for evaluating the overall effectiveness of the simulation-based learning approach.

Implementation:

- The assessment will be administered electronically, mirroring the format of the Pre-Activity Knowledge Assessment.
- It will be conducted immediately after the completion of all simulation scenarios and debriefing sessions.
- Participants will answer the same set of questions presented in the pre-activity assessment, allowing for direct comparison.

Content and Format:

- Questions will be presented in the same order as in Pre-Activity Knowledge Assessment to ensure consistency.
- The time allocation will remain the same as the pre-activity assessment (10 minutes).

Analysis and Comparison:

- Individual pre- and post-activity scores will be compared to measure personal improvement.
- Aggregate data will be analyzed to identify trends in knowledge acquisition across the group.
- Statistical analysis will be performed to determine the significance of any observed improvements.

Utilization of Results:

- Results will be used to evaluate the effectiveness of different aspects of the simulation experience.
- Areas showing significant improvement will be noted as strengths of the current simulation design.

- Topics where improvement was limited may be targeted for enhancement in future iterations of the program.
- The data will contribute to ongoing research on the efficacy of simulation-based learning in neurosurgical education.

Feedback to Participants:

- Individual participants will receive a confidential report comparing their pre- and post-activity performance.
- This personalized feedback will help students identify areas for further study and improvement.

By implementing this Post-Activity Knowledge Assessment, we aim to provide concrete evidence of the educational value of our high-fidelity simulation experience. This data-driven approach not only validates the effectiveness of the program but also guides its continuous improvement, ensuring that it remains a cutting-edge tool in neurosurgical education.

3.3. Student Satisfaction Survey

An anonymous survey will be conducted to evaluate students' self-reported satisfaction with the simulation experience, evaluating factors such as realism, educational value, technical delivery, and overall impact on their interest in neurosurgery after the whole activity is concluded.

The Student Satisfaction Survey is a crucial component of our high-fidelity neurosurgical simulation experience, designed to capture participants' perceptions and feedback about the activity.

Purpose:

a. To assess the overall quality and effectiveness of the simulation experience from the students' perspective.
b. To identify strengths and areas for improvement in the program.
c. To gather qualitative feedback that can inform future iterations of the simulation activity.
d. To evaluate the relevance and perceived value of the experience to students' educational goals.

Implementation:

- The survey will be administered electronically immediately after the completion of the Post-Activity Knowledge Assessment.
- It will be anonymous to encourage honest and candid responses.

Content and Format:

The survey will include a mix of quantitative and qualitative questions, covering areas such as:

✓ Overall satisfaction with the simulation experience (Likert scale)

- ✓ Perceived realism of the simulation scenarios (Likert scale)
- ✓ Effectiveness of the debriefing sessions (Likert scale)
- ✓ Quality of instruction and guidance from facilitators (Likert scale)
- ✓ Relevance of the scenarios to their neurosurgical education (Likert scale)
- ✓ Impact on their interest in pursuing neurosurgery as a career (Likert scale)
- ✓ Comfort level with neurosurgical procedures after the simulation (Likert scales)
- ✓ Most valuable aspects of the experience (open-ended)
- ✓ Areas for improvement (open-ended)
- ✓ Suggestions for additional scenarios or topics to cover in future simulations (open-ended)

Analysis of Results:

- Quantitative data will be analyzed statistically to identify trends and overall satisfaction levels.
- Qualitative responses will be reviewed and categorized to identify common themes and specific suggestions.

Utilization of Feedback:

- Results will be used to refine and improve future iterations of the simulation experience.
- Positive feedback will help identify successful aspects of the program to be maintained or expanded.
- Constructive criticism will guide targeted improvements in specific areas.
- Suggestions from students may be incorporated into future scenario designs or program structure.

Reporting:

- An anonymized summary of the survey results will be shared with faculty and program designers.
- Key findings may be presented to future participants to demonstrate the program's commitment to continuous improvement.

The Student Satisfaction Survey is an essential tool for ensuring that our high-fidelity neurosurgical simulation experience remains student-centered, relevant, and effective. By actively seeking and incorporating student feedback, we aim to continuously enhance the educational value of the program and its ability to prepare students for the challenges of neurosurgical practice.

4. Simulation Scenarios

4.1. Design and Implementation

The design and implementation of the simulation activity will be carried out in a collaborative manner by all four centers.

The activity will be based on the following facts:

- Four (4) distinctly complex clinical neurosurgical scenarios will be recreated using high-fidelity simulation technology and patient mannequins capable of exhibiting symptoms, vital signs and responsive behaviors.
- Templates for the construction of the clinical scenarios and detailed instructions on how the scenarios need to be prepared will be shared with all partners. This will ensure consistency and quality across all participating institutions.
- Four (4) distinctly complex clinical neurosurgical scenarios will be recreated using these templates. The scenarios will utilize high-fidelity simulation technology and simulated patients capable of exhibiting symptoms, vital signs, and responsive behaviors. These advanced simulations will allow for a highly realistic and immersive experience.
- The shared templates and instructions will cover:
    - Patient history and presentation
    - Progression of symptoms and complications
    - Critical decision points
    - Expected interventions and procedures
    - Technical setup for mannequins and monitoring equipment
    - Guidance for scenario facilitators
- By providing these resources, we aim to standardize the simulation experience and reproduction in the future across all institutions while allowing for local adaptations as needed. This approach will ensure that all participants, regardless of location, receive a comparable, high-quality educational experience.
- For each scenario, 2-3 students will be selected to actively participate as the leading surgeon and surgical team, managing the patient situation.
- The remaining students will observe the scenarios unfolding in real-time via multi-angle audio/video feeds in a classroom setting.
- Expert simulation tutors will control the evolving simulation parameters to forced decisive actions and rapid surgical interventions.
- All partner institutions will be able to remotely follow and observe the simulation scenarios and subsequent debriefings via live video stream in their classrooms with the supervision of their tutors.
- Immediately following each scenario, students will participate in a guided non-judgmental debriefing session facilitated by simulation tutors and neurosurgeon experts. This will involve a candid review of all decision points, actions taken, potential complications, and key learning objectives reinforced by the experience.

4.2. Student Participation

The simulation activity will take care at Humanitas University Simulation Center.

4.3. Remote Observation

The activity will be followed by remote students through Teams platform. Remote students will be able to actively participate during the pre-test, post-test, survey and debriefings that will take place after the clinical scenarios are finished. Activities will be recorded.

5. Deliverables

5.1. Comprehensive Guidelines

Comprehensive guidelines and material requirements produced by Humanitas University for recreating the high-fidelity neurosurgical simulation scenarios at all partner institutions. This detailed document will include:

- Full clinical descriptions of the four simulation cases
- Tips and best practices for guiding the pre-briefing to effectively set up the scenarios
- Suggested techniques for facilitating the post-simulation debriefings
- Recommendations for providing constructive feedback to students
- Lists of required equipment, materials and personnel roles
- This will enable sustainable replication and standardization of the simulation activity across all partner centers.

5.2. Analysis Reports

Comparative analysis report of the pre/post simulation knowledge assessment scores to quantify the didactic efficacy of this methodology.

Summary report consolidating findings from the student satisfaction surveys with recommendations for enhancing future simulation-based neurosurgical training initiatives.

This comprehensive documentation package will allow the high-fidelity simulation experience to be consistently reproduced at any other center according to the established standards and protocols pioneered at Humanitas University. This standardization will support effective benchmarking and data sharing among partners.

6. Timeline

The simulation experience will take place over a full day on 5th September 2024, with the pre-assessment electronically administered before the initiation of the activity and post-assessment occurring immediately after. The student satisfaction survey will be issued as a conclusion of the activity.

A final report incorporating all deliverables will be prepared by end September 2024 by Humanitas for dissemination to all partner institutions.

7. Alternative Implementation

7.1. Standardized Patient Actors

For partner institutions that may not have access to dedicated high-fidelity simulation centers or technologically advanced patient mannequins, this neurosurgical training experience can be effectively replicated using standardized patient actors.

The documentation provided by Humanitas will include detailed guidelines for staging the clinical scenarios with live standardized patients played by actors, medical students, nurses or other professionals. While lacking the advanced simulation technology, this methodology still allows students to practice real-world diagnosis, surgical decision- making, and crisis management in an immersive, high-pressure environment.

Standardized patients can be trained to consistently portray symptoms, express pain, and respond with vital sign fluctuations based on the students' care decisions and actions. Simple props and theatrical effects can recreate bleeding, surgical complications, and other critical events to test students' technical skills and clinical judgment.

The pre-briefing, simulation execution, debriefing, and feedback protocols will remain consistent whether using standardized patient actors or high-fidelity mannequin simulators. This alternative approach prioritizes realism over technology to achieve comparable learning objectives.