

Title: Human Factors Online: the power of digital forms of education to raise awareness on the importance of human factors

Keywords: Crisis Resource Management, simulation, human factors, e-learning

Background

Crew/Crisis Resource Management (CRM) aims to improve non-technical skills (NTS) to reduce and prevent medical errors in healthcare. The demand for an e-learning that introduces CRM in healthcare is increasing. Previous research described the positive effects of an e-learning on reaction and knowledge. However, little is known about the extent to which the knowledge gained in an e-learning is transferred to practice.

Aim

The objective of the study is to develop an e-learning that introduces CRM and its principles and to determine the learning level achieved after completing the e-learning (reaction, learning, behavior; Kirkpatrick).

Methods

In 6 Hospitals in Flanders (Belgium) 86 nurses of acute and non-acute care settings tested and evaluated the developed e-learning between October 2022 and March 2023. At the first phase of the study, the nurses went through the e-learning. Before and after the e-learning the participants completed the Human Factors Attitude Scale (HFAS), that investigates participants knowledge, skills and awareness concerning human factors and NTS. Paired samples t-tests were used to assess differences between the pre- and posttest (HFAS). Next, a questionnaire concerning the quality and experience of the e-learning was completed. At the second phase of the study, the participants went through a simulation in an immersive room (270°projection). In these simulations (n=18), a realistic scenario was presented in which the learned CRM principles can be applied. The researchers evaluated, by completing the Clinical Teamwork Scale (CTS), the overall teamwork, communication, decision-making, situational awareness, role responsibility and patient-friendliness of the team completing the scenario. Additionally, in 18 focusgroups the extent to which the e-learning played a role in the application of CRM in the simulations was explored.

Results

Responses to the HFAS (pre versus post) indicated that the e-learning had a positive impact on 19 of the 23 items and the responses revealed significant attitude shifts ($p < 0.05$) in 10 of the 23 items. Next, the mean overall score on the CTS was 6,27 (range 1=poor to 10=perfect). 10 of the 16 teams that went through simulation were rated as having 'average' teamwork according to CTS, 5 simulations were rated as 'good' and 1 was scored 'poor'. Based on the questionnaire concerning the quality and experience of the e-learning, and the focusgroups can be concluded that the e-learning was rated good and leads to an increased awareness according to CRM.

Discussion

The developed e-learning can be used to introduce and increase awareness about CRM in healthcare. However, more practical practice (simulation) is recommended to convert the knowledge and theory about CRM into behavior. Next, CRM needs to be supported by the entire healthcare team. In future studies it is recommended to carry out a pre-post CTS test, and to present a second simulation in which the learning effect can be increased.

Implications and future perspectives

The e-learning increases awareness according to CRM and is useful to introduce, repeat and reinforce CRM, and can be used as preparation of CRM training/simulation. It will be available and applicable in healthcare as well as education. Training (simulation) is recommended to further convert CRM into behavior.

References

- Deschepper, S. Geuens, N., Roes, L., Fransen, E., Hilderson, D. & Franck, E. (2021). Generic Crew Resource Management training to improve non-technical skills in acute care - Phase 2: A pre-post multicentric intervention study. *Clinical Simulation in Nursing*, Elsevier, 1-14.
- Gross, B., et al. (2018). Crew resource management training in healthcare: a systematic review of intervention design, training conditions and evaluation, *BMJ Open*, 9, 1-13.
- Guise JM, et al. (2008). Validation of a tool to measure and promote clinical teamwork. *Simul Healthc*, 3 (4), 217-23.
- Kirkpatrick, J. & Kirkpatrick, W. (2016) *Four levels of training Evaluation*. ATD Press, 256 blz.
- Rouleau, G., et al. (2019). Effects of E-Learning in a Continuing Education Context on Nursing Care: Systematic Review of Systematic Qualitative, Quantitative, and Mixed-Studies Reviews, *Journal of Medical Internet Research*, 21(10), e15118.
- Sinclair, P., Kable, A. & Levett-Jones, T. (2015). The effectiveness of internet-based e-learning on clinician behavior and patient outcomes: a systematic review protocol. *JBIC Database of Systematic Reviews and Implementation Reports*, 13(1):52-64.