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Cardiology 2019: Low vs. High fidelity simulation into cardiac training

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Crew Resource Simulation was inducted in the aviation industry during NASA workshop in 1979, designed as a training program to improve air safety and reduce the increasing number of fatal accidents attributable to human error. The primary cause of most aviation accidents occurring at that time were due to human error 85% & the leading causes of which were failures of interpersonal communication, leadership, & decision making in the cockpit. David Gaba, American anesthetist, trained as a pilot recognized similarities in high stake environment of the operating theatre & cockpit & so developed anesthesia crises simulation resources management. Medical simulations aim to imitate anatomic regions, clinical tasks, real patients, virtual reality devices & electronic manikins or to mirror real-life situations in which medical services are rendered. Simulation – based learning (SBL) applies these modalities. Benefits of medical simulation includes mistake forgiving, safe environment, trainee focused vs. Patient focused, controlled, structured, proactive clinical exposure, reproducible, debriefing, standardized, deliberate & repetitive practice. Medical simulation can assess professional competence as patient care, medical knowledge, practice-based learning & improvement, communication skills, professionalism, & systems-based practice. Patient safety priorities are at the forefront of health providers' concerns. Best summarized by "simulators have the potential to take the early & dangerous part of the learning curve away from patients". Simulation has rapidly evolved as a learning tool & technology over the past 15 years & has been shown to be an effective method for teaching. Despite this, the field of cardiovascular medicine is still in the primal stages of adopting simulation. The reasons cited for this include: the high price of simulators, a dearth of didactic curricula to accompany the psychomotor skill learned on a simulation, the wide variability &/or lack of consistency that exists among the simulation platforms & a complete absence of large trials showing that this expensive technology actually improves operators' skill in the angiography suite & presumably enhances patient outcomes. Despite all this, the ACGME now mandates that cardiovascular fellowship training programs must have simulation as part of fellow training. Cardiac simulation training ranges from as simple as training on listening to normal & abnormal heart sounds, differentiating different types of heart murmurs, interpreting ECG findings, utilizing high fidelity manikins for different cardiac scenarios such as heart failure & cardiogenic shock apply team work as crew resource management, practicing transthoracic echocardiogram plus transoesophegeal echo, cardiac catheterization & central line insertion up to different cardiac interventional procedures.

On June 2017- May 2018, we conducted once per month a one-day simulation cardiac course for pediatric residents who had attended different simulation courses at CRESENT, KFMC. All candidates went through pre course knowledge & clinical skills evaluation followed by the end of the day with post course knowledge & clinical skills evaluation like the pre course. 125 candidates were complex, 100% of the candidates had significant improvement in their knowledge & skills at post course test compared to pre course & non-had declined in their scores beside 100% of them found these courses are enjoyable, safe, not stressful & very useful training methods, 97% enjoyed it mostly because it is repetitive & mistakes are forgiven with nil hazards to patients.100% feels video debriefment following cardiac medical scenarios is very helpful as it clarify areas for improvement much better than conventional training. In conclusion, although cardiac Simulation courses is expensive but it plays vital role in patient safety so at the end it is cost effective so would encourage to make it mandatory in the curriculum for cardiac residents & fellows.

Many studies have investigated the educational value of simulations & found them to be valuable. Few articles have compared the educational outcomes between high- & low-fidelity simulations. Various disciplines & clinical skills were used to compare the fidelity effect on learning.

Norman & his colleagues defined five characteristics for simulations: validity, fidelity, reliability, learning, & feasibility. First, fidelity is the extent to which the appearance & behaviour of the simulation matches the appearance & behaviour of the simulated system. In 1954, Miller made an important distinction in simulations between the engineering or physical fidelity & the psychological or functional fidelity. Engineering fidelity is the extent to which the simulation replicates the physical characteristics of the actual task. This involves the environment & simulation device or tool. Psychological fidelity is the extent to which the skills of the real task are captured by the simulated task. Matthews & Yachmetz described four levels of simulation fidelity. The aim was to develop a common language in clinical simulation terminology. Level one (SF1) is state of the art fidelity, in which a computer-aided mannequin interacts with the trainees. Level two (SF2) is high fidelity, which includes a complex scenario that may involve multiple mannequins. Level three (SF3) is intermediate fidelity, which involves a series of procedures put together to resemble a simple scenario found in a clinical setting. Level four (SF4), low fidelity, is meant to demonstrate a simple skill, for example, airway management on an intubation head.

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Fidelity plays an important role in the choice of an appropriate simulation for a specific task. High fidelity is not always superior to lower fidelity because this is dependent on the type of task & the learner's level. The comparisons made between high- & low-fidelity simulations mainly investigated the educational impact. The psychometric advantages & disadvantages were evidently not elaborated. A more comprehensive evaluation of simulation training should include fidelity, reliability, validity, impact on learning & feasibility. Such an approach can be adopted to compare the psychometric advantages & disadvantages of high- & low-fidelity simulations in future studies.

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