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The effect of Simulation-Based Training on the response of Healthcare Practitioners to COVID-19 in Riyadh, Saudi Arabia

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Abstract
The World Health Organization (WHO) has declared COVID-19 as a global pandemic, with rapid transmission between people through direct or indirect contact. COVID-19 has affected healthcare systems globally to control the transmission of the virus and manage patients (Somily & BaHammam, 2020).In the Kingdom of Saudi Arabia, the Ministry of Health MOHmade every effort to improve public health awareness to prevent the transmission of the virus in the community. Healthcare facilities in Saudi Arabia have maximized itseffort and capacity to safely admit all confirmed cases and prevent the transmission to healthcare workers (MOH, 2020).
Teaching healthcare providers how to safely manageinfectious patients is defining the purpose of using simulation-based training (SBT). SBT is an excellent option in many medical schools to improve thestudent'sclinical practice and outcome, and the quality of the teamwork (Algaissi, Alharbi, Hassanain, &Hashemf, 2020).
This paper aimed to explore the effect of the SBT on the healthcare practitioner's response to COVID-19, and to evaluate the level of improvement of the healthcare practitioners after attending SBT. Thedesign was a cross-sectional quantitative survey, conducted at the King Abdulaziz Medical City, Riyadh to identify thepotential effects of attending SBT sessions in terms of the practitioner's response in managing an outbreak crisis, such as COVID-19. Participants were selected convenientlyfrom healthcare practitioners who attended any COVID-19 related simulation session in the hospital simulation laboratory during the preparation stage forthe COVID-19 pandemic. Informed consent wasobtainedfrom the participants before completing the E-survey, which also provided the researcher's contact information.
In total, 201 participants completed the online survey.The first section of the questionnaire collected demographic data, including the age group, years of experience, and background specialties. The second section consisted of Likert scale questions concentrating on aspects such as an assessment of the participant's confidence level, preparedness in the crisis, the response to COVID-19, and the knowledge and skills related to the COVID-19 crisis.The resultshighlighted thepositive outcomes of the SBT related tothe healthcare practitioner's response to the COVID-19 crisis, in improving clinical and non-clinical skills, including communication skills, teamwork, decision making, and leadership skills.
In conclusion, SBT is an effective and supportive strategy to improve healthcare practitioners' non-clinical skills. SBT as a strategy to prepare for a crisis such asCOVID-19, has significant positive effects on the healthcare practitioners.

Key words: *Crisis, COVID-19, Simulation-based training, healthcare practitioners.*

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I. Introduction

The coronavirus disease (COVID-19) identified in December 2019 is a virus from the large Coronavirus family, known to cause respiratory infection (WHO, 2020).It originated from Wuhan, China. Researchers, experts, and healthcare providers are accumulatingall possible information about this virus and its

methods of transmission, treatment, or prevention (Yi-Chi, Chen, Ching-Sung & Yu-Jiun, 2020).COVID-19 caused a pandemic, affecting many countries globally and their healthcare systems. Due to the widespread transmission of the virus, community and healthcare practitioners in healthcare facilities are beingprepared to manage virus infected patients (WHO, 2020).

Saudi Arabia has experience in the management of an outbreak and the establishmentof a disaster plan. The Saudi Ministry of Health (MOH) established the Saudi Center for Disease and Prevention, with different levels of expertise to manage a crisis, including frontline experts and logistically skilled personal to benefit the whole population (Sawaya et al., 2020).

Healthcare practitioners are qualified to care forpatients in ahealthcare facility, and are included in the treatment plan (SCFHS, 2020). However, the practitioners sometimes lack self-confidence to manage a particular patient, how to prevent being infected while caring for the patient, or making a medical decision with team members (Marker, Mohr & Østergaard, 2019).SBT, defined as any medical educational activity using technology interaction and special computer software scenarios similar to reality, is a valuable tool to prepare the practitioners (Lloyd, Watmough, & Bennett, 2018).Using SBT for emergency situations has a significant effect on the healthcare practitioners' response in the hospital's outbreak crisis. Using SBT can affect the practitioner's preparedness to manage the infectious disease by using personal protective equipment, dealing with an arrested positive patient, crisis resource utilization, and makingthe correct medical decision under pressure (Abualenain & Al-Alawi, 2018).

In preparing for the COVID-19 pandemic, controlling and containing the virus from spreading to the healthcare practitioners or the patient in the healthcare facility wasa major challenge (Aldekhyl&Arabi, 2020). The Center for Disease and Control Prevention (CDC) has highly recommended the training of healthcare providers to manage highly contagious patients, through education emphasizing the use of universal personal protective equipment (PPEs) and the importance of hand hygiene (CDC, 2020). SBT was a usefulmethod in previous pandemics, such as the Ebola pandemic, to improve some difficult and soft skills such as intubating patients, or the management of an arrested contagious patient,for example a confirmed COVID-19 patient (Chen, Huang, Cheng, Wang, & Chan, 2009). However, there is a lack of literature regarding the response of healthcare practitioners to COVID-19 after attending simulation educational sessions.

II. Aims:

1. The aim of this paper is to explore the effect of the SBT on the healthcare practitioner's response to COVID-19.

III. Objectives:

The objectives of the study were:

1. To illustrate the effects of SBT on healthcare practitioners.
2. To evaluate the improvement level on the healthcare practitioners after attending a simulation- based training.
3. To measure the response of the healthcare practitioners to COVID-19 after the simulation- based training.

The contribution of the study is the focus on the effect of SBT on the healthcare practitioner's response to COVID-19 in Riyadh, Saudi Arabia.

IV. Materials and Methods

4.1 Study Method

An online survey withthe SurveyMonkey website was used to gather the data. The researcher used an E-survey link to send the questionnaire to the sample. The use of the link simplified the time commitment required from participants,to improve the response rate in a time when the participants have multiple tasks. The advantages to use an electronic method include low cost, as well as easy and fast distribution to the sample (Paradis, O'Brien, Nimmon, Bandiera,&Martimianakis, 2016).

4.2 Setting

The research was conducted at King Abdulaziz Medical City (KAMC), Ministry of National Guard-Health Affairs, Riyadh, Saudi Arabia.KAMC provides primary, secondary, and tertiary service with a bed capacity of 1600 beds and multiple outpatient visits a year. It is accredited by the (JCI) Joint Commission International standards asexcellent. It has a Trauma, Transplant and OncologyCenter, Cardiac,Dental Care Services as well as long term services (NGHA, 2020)

4.3 Study Sample

Participants were selected convenientlyfrom the healthcare practitioners who attended any COVID-19 related simulation session in the hospital's simulation laboratory during the preparatory stage for the COVID-19 pandemic stage.A convenient sampling method was used as a sampling technique, as it is suitable for participants who areavailable to complete the survey in the time they have available. The advantagesof using this method is that it facilitates pilot testing, data collection is completed in a short time, and it is inexpensive (Elfil&Negida, 2017).

The sample size calculation was done using the formula to determine the sizeof sample in the study.

$$\text{Sample size} = \frac{(\text{Z-score})^2 \text{ X StdDev X (1-StdDev)}}{(\text{Margin of error})_2}$$

In this formula, the confidence level is 95%, a fixed number used to measure how accurate the sample size reflects the population, this confidence level corresponds usually with the Z-score which is also a fixed number, (Z score = 1.96) (Hazra, 2017). The population size was determined as 5000, whichincludes the total estimated number of medical doctors, nurses, respiratory therapists, and others who have attended the simulation sessions in the intensive care unit. The margin of error that indicatesthe random sampling error from the sample size, was 5%. The ideal estimated sample size was357 participants (Lavrakas, 2008).

4.4 Inclusion andExclusion Criteria

The inclusion criteria were all health care practitioners, from different specialties such as medical doctors, nurses, respiratory therapists, and other specialties, who attended at least one simulation training session at KAMC, Riyadh.Non-healthcare providers, no attendance of any SBT session and participants who refused to give informed consent or to respond to the E-survey were excluded.

4.5 Study Design

Thedesignwas a quantitative cross-sectional survey. In a cross-sectional design, a particular issue or the relationship between two variables, which can be exposure and outcome, in one specific point of time, is evaluated. The design was used to collect numerical data.The focus of the study was to identify thepotential effects of attending SBT sessions in terms of the practitioner's response in managinganoutbreak crisis, such as COVID-19.

The questionnaire consisted of 26 questions, divided infive sections, and it onlyrequired five minutes to complete. The first three questions were related to demographic data, age, years of experience, and specialty or background. The demographic information was used to determine theireffect on the healthcare practitioner's response to COVID-19, after attending SBT.TheLikert scale questions followed in four different sections. The first section contained 11 questions to assess the participant's confidence level, including questions related to the participants' familiarity with the concept of SBT, if the patient simulator facilitates training, feeling comfortable in the simulation environment, and the experience of the semi-realistic environment in the simulation-based sessions. The second section contained five questions to assess the practitioner's preparedness in the crisis in terms of their ability to obtain all the requiredinformation in using PPE in updated protocols, the proper donning and doffing skills, and the psychological effect after attending SBT sessions. The third section contained four questions to measure the practitioner's response to COVID-19, evaluating the healthcare practitioners' understanding of the pandemic's operational process in the hospital, the ability to work with other team members during the crisis, and the importance of crisis leadership after attending a SBT. The last section had three questions to assess the practitioner's knowledge and skills related to the COVID-19 crisis, such as safely transporting and resuscitating ahighly contagious COVID-19 patient by using the ISOPOD.

The questionnaire used in the survey are available and accessible online, cited from literature. A few modifications were made to suit the current study.

4.6 Pilot Study

The researcher conducted an initial pilot testing with20 random participants to test the data collection method prior to launching the formal questionnaire. The survey was distributed to arbitrators in different specialties from junior to senior hospital staff, to obtaintheir feedback about the adjustments of the question statements and to test validity and reliability.

4.7Validity and Reliability

Validity and reliability are two concepts to measure the quality of the data collection method that was used in the research. The researcher measured the stability of the survey using the sample of (n=20). Reliability

was measured to assess participants' consistency which is distributing the survey to the same group of people at a different time, and look at their consistency of answer using monkey survey website. The same answer was collected from the sample size, which indicates the validity of the research questionnaire.

4.8 Data Analysis

The data were collected through the Survey Monkey website and entered manually in an Excel spreadsheet. All responses to the questionnaire were checked for missing values.Descriptive analyses were done to summarize the result in percentages and frequencies, means, median, and mode each survey question.

4. 9Ethical Considerations

Informed consent was obtained before the survey was completed. The participants were informed that there was no risk or benefits in participating and they were free to withdraw at any time, with no penalty accrued. The researcher's contact information was availableinthe consent form to enable participants to contact the researcher for clarification. Ethical approval was obtained fromthe Institutional Research Board of King Abdullah International Medical Research Center (KAIMRC).

V. Results and Discussion

The World Health Organization (WHO) has declared COVID-19 as a global pandemic, with rapid transmission between people through direct or indirect contact. COVID-19 has affected healthcare systems globally to control the transmission of the virus transmission and manage patients (Somily & BaHammam, 2020). In Saudi Arabia, the MOH exerted every effort to improve the level of public health awareness to prevent the transmission of the virus in the community. Healthcare facilities in Saudi Arabia have maximized its effort and capacity to safely admit all confirmed cases and prevent the transmission to the healthcare workers (MOH, 2020).Teaching healthcare providers how to safely managethis kind of patient is defining the purpose of using SBT. SBT is an excellent option in many medical schools to improve thestudent's clinical practice and outcome, and the quality of the teamwork(Algaissi, et al. 2020).

The studyincluded a sample of 201 participants,who already attended a SBT session, of different age groups, years of experience, and specialties. The resultsindicatethat more than 50% (n=180) of the sample agreed that SBT is a useful tool for learning, as they could improve their knowledge and skills before dealing with a real patient. They also indicated the need for more simulation training sessions because SBT is experienced as more interesting.This finding is supported by Lateef (2010), reporting that SBT improved skills before managing a real patient.

The majority (90%, n=170) agreed that what they have learned in the simulation was easily applied in reality, due to the semi-realistic environment and the increased retention of knowledge when dealing with areal patient. SBT also improved non-clinical skills such as communication skills with other team members, leadership skills, and decision making,as agreed by 80% of the sample.

A study done in 2016 in King Abdulaziz University Hospital'ssimulation center to explore the requirements to prepare for an Ebola outbreak as an infectious disease. A simulation drill or scenarios was designed to evaluate the participant's donning and doffing skills related to PPE wear in the infectious area or with the contagious patients (Abualenain & Al-Alawi, 2018). The authors reported that the majority (79%) of 163 participants agreed that learning the correct method PPEdonning and doffing in a safe simulation environment was clear and helpful. SBT had a significant impact on the COVID-19 crisis globally. Hospitals can easily prepare and educate a largenumber of healthcare providers regarding many aspects required to manage deal with such a crisis (Brazil, Purdy, & Bajaj, 2019). Using SBT is the appropriate approach to teach staff the required knowledge and skills regarding the utilization the resources during acrisis, as it can mitigate undesirable consequences of the COVID-19 crisis in healthcare facilities (Dieckmannet al., 2020). The majority of the current study (80%, n=160) agreed that they understood the COVID-19 pandemic hospital operation during the crisis, and 86% understood patient priority after attending SBT sessions.

Preparatory to the COVID-19 pandemic, controlling and containing the virus from spreading to the healthcare practitioners or the patient in the healthcare facility wasa major challenge (Aldekhyl&Arabi, 2020). The current study supports the finding as the majority indicated that due to attending the SBT sessionsregarding thepreparedness forCOVID-19 and themanagement of aninfectious patient, was effective in learning special skills, including safe transportation and resuscitating highly contagious patients using ISOPOD.

In summary, the survey was designed to assess the participant's confidence level, practitioner's preparedness in the crisis situation in general, the practitioner's response to COVID-19, and practitioner's knowledge and skills related to the COVID-19. The resultsindicatea positive effect on the healthcare practitioners'level of confidence, improvement of their skills in a crisis situation and more specifically, in the COVD-19 crisis

VI. Limitations

The study limitations include a delayin the ethical approval process of the Institutional Review Board to initiatethe data collection process, which allowedthe author only five days to collect the data. A second limitation was that the ideal sample size (n=357) to represent the targeted population was not achieved. Lastly, the time frame was limited as this research is a master's degree project with limited time.

VII. Conclusion

In the Kingdom of Saudi Arabia, the Ministry of Health (MOH) improved the general level of the population's awareness regarding how tocontrol the virus from transmission and all related preventive information.These measure included proper hand hygiene, wearing a facemask, social distance, and sneezing or coughing etiquette to keep themselves safe from the virus (MOH, 2020).In this critical time, the healthcare system of Saudi Arabia prepared all healthcare workers regarding asafe work environment, through using universal PPE, and repeated hand hygiene while caring for patients, regardless of their diagnosis and their COVID-19 status (MOH, 2020).

Several studies indicated that SBT is an effective and supportivestrategy to improve healthcare practitioners' clinical and non-clinical skills, for example their communication skills, dealing with other team members, decision making, and leadership skills (Cass, et.al. 2011). Another benefit of the SBT session is that it can also improve the participant's self-confidence in managing a highly contagious patient and improve knowledge retention (Marker et al., 2019).

The current studyincludedhealthcare practitioners with variousyears of experience and different specialties, who attended a SBT session preparatoryto the COVID-19 crisis. The result highlightspositive outcomes, the improvement of their skills and knowledge related to the COVID-19 crisis, including improving self-confidence, safely managinghighly contagious patients, knowledge retention, professional communication skills, dealing with other team members, improving leadership skills, and an efficient and effective way toutilize hospital resources during the crisis.

In conclusion, several factors support SBT to have a positive impact on healthcare practitioners ofdifferent levels of experience, including the safe environment of the simulation, the support from experts to learn and master the required skills.

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