VIRTUAL SIMULATION TRAINING FOR ENHANCING THE MENTAL HEALTH PREPAREDNESS OF HEALTH PROVIDER, RESPONDER AND SOCIAL WORKFORCE IN THE EMERGENCY AND MITIGATION SETTING: A LITERATURE REVIEW

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ABSTRACT

**Background:** The vital role of responder in crisis management setting are required them to be quick response and accurate in helping the victim. Unfortunately, statistic data showed PTSD among health providers and social worker is increasing. The current preparation is expensive and labor intensive. There is needed an effective and efficient for preparing the real conditions using technology. **Objective:** The aim of this paper was to review the existing literature and formulated audiovisual media which can improve better coping and positive response of them. **Method:** Literature review taken from essential of researches and combining theories. A search of diverse databases was performed from Proquest, PubMed, Ebscohost, and Google scholar with the keyword: virtual simulation training, emergency preparedness, mental health and PTSD to identify research on sources of the simulation of multimedia. Inclusion criteria were: empiric literature, written in English, peer-reviewed literature and published during the time period of 2007-2017. An exclusion criterion was the use of mixed simulation training. **Result:** Ten research articles were selected for being reviewed. Principle findings identified three major themes including: descriptions of the participant’s virtual training experiences, learning results after participation and an exploration of how knowledge construction occurs in the virtual environment. **Conclusion:** it was found that formulation of audiovisual media which reflected reality based on relevant condition of emergency and or disaster setting was combined from those papers. Rigorous studies are needed for future development.

**Keywords:** virtual simulation training, emergency preparedness, mental health, health provider, social worker.

I. Introduction

Disastrous events are unpredictable condition which occurred due to the natural cause, human error or several different hazards. The Emergency Events Database (EM-DAT: The international disasters database) in 2015, revealed the latest statistics data that there are 346 reported disasters, 98.6 million people affected and 22 773 people dead in a year period. US$66.5 billion economic damage was drastically because of those unwilling events (EM-DAT, 2016). While Central Research of Epydemiology Disaster (CRED, 2016) reported the 2016 preliminary data: human impact of natural disasters December 2016 which showed that there occurred 301 disasters, 102 countries, 7,628 deaths, 411 million affected and US$97 billion damages. The United Nations Office for Disaster Risk
Reduction (UNISDR) prevention strategy within the Disaster-related Data for Sustainable Development Sendai Framework. Data Readiness Review 2017 Global Summary Report showed the inter collaborative and integrated of as many as the parties will create preparedness of catastrophe tragedy (UNISDR, 2017). The emergency management could include preparation & Protection, Mitigation Respond, and Recovery. While the purposes of disaster simulation are to assess and validate our capabilities and role in the communications, critical resource logistics and distribution, mass care, medical surge, citizen evacuation and shelter-in-place, emergency public information and warning, Emergency Operations Center (EOC) management, and long-term recovery (Haedar et al, 2017).

The essential role of health provider and social worker/volunteer in crisis management setting are required them to be quick response and accurate in helping the victim. While health personnel are responsible for ensuring the effective coordination and evaluation of the emergency medical services systems and for evaluating the threat and best means for protecting people. Their priorities are the recent reduction of funding for emergency services has had a direct impact on crisis condition, personnel and laboratories. People need to know how to avoid the further damage, safe places to go, what to do with those who have become injured. Number one issue is where to send people that are sick to get the nearest medical help.

Unfortunately, statistic data showed PTSD among health providers and social worker high incidence exists. The current preparation of actual condition is real simulation, education, training and workshop which expensive and labor intensive. There are needed an effective and efficient for preparing those real conditions.

The purpose of this paper was to review the existing literature and formulated audiovisual media which reflected reality based on relevant condition of emergency and or disaster setting. Which can be increasing PTSD incident of responder, improving better coping and positive response of them.

II. Method

A six-stage process was followed as the methodological strategy for the literature review. These stages included the problem and purpose definitions for the impact of virtual simulation training for the mental health preparedness of health, responder and social personnel, creating conceptual schema of literature review, exploration of various databases, evaluation and analysis of articles, and the presentation of findings. An exclusion criterion was the use of mixed simulation training of the real simulation and the virtual training. The inclusion criteria were:

- empiric literature which has variety of design research;
- written in English standardly published by the database provider;
- peer-reviewed literature from literature review, synthesize-analyzed and meta-analysis;

A. Instrument

Joanna Briggs Institute (JBI) Critical appraisal tools was used for reviewing the journals which designed for use in systematic reviews and can also be used when creating Critically Appraised Topics (CAT), in journal clubs and as an educational tool. The checklist has 11 question items and each
rating component from different categories from yes/applicable, no, unclear to not applicable. It is used for scaling the existing researches (Joanna Briggs Intitute, 2016).

B. Data Collection

Literature review was taken from essential researches and combining theories. A search of diverse databases was performed from Proquest, PubMed, Cambridge University Press, Ebscohost, and Google scholar with the keyword: virtual simulation training, emergency preparedness, mental health and PTSD to create critical appraisal and find a more comprehensive model of the multimedia simulation. Ten research articles were selected for being analyzed and synthetized in this article.

C. Data Analysis

The analysis result of the gotten researches was using summarizing table by using the designated table and implemented the result of JBI critical appraisal tools. Data analysis is going to involve identifying common patterns within the responses and critically analyzing them in order to achieve research aims and objectives. Qualitative analysis which is the process of interpreting collected data was used to synthesize the articles. The process used to obtain the final sample included three steps. Step one was the review of the abstracts for articles believed to meet the inclusion criteria. In step two, the full articles were printed from those identified articles (n=27).

Finally, each printed article was read in its entirety for inclusion and exclusion criteria. Many of the articles were informational related to specific product development and implementation. These articles were excluded as they did not inform on the scientific state of immersive virtual reality disaster training.

III. Results

Ten articles were reviewed in this paper. The entire summaries of the articles were showed in the table below:

<table>
<thead>
<tr>
<th>First Author/Year</th>
<th>Purpose</th>
<th>Analysis Design/Method</th>
<th>Finding(s)</th>
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</thead>
<tbody>
<tr>
<td>Andreatta (2010)</td>
<td>to compare the relative impact of two simulation-based methods for training emergency medicine (EM) residents in disaster triage using the Simple Triage and Rapid Treatment (START) algorithm, full-immersion virtual reality (VR), and standardized patient (SP) drill.</td>
<td>Experimental assigned to two groups: VR or SP</td>
<td>The mean pretest scores were similar and no significant differences but the data showed an effect in favor of the SP group performance on the posttest.</td>
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<tr>
<td>Chang (2016)</td>
<td>provide examples of types of Screen-based simulation (SBS) and 3-dimensional virtual reality (3D VR) applied to pediatric emergency medicine (PEM) that are currently available and in development; PEM-specific uses of SBS and 3D VR for training and testing, as well as uses for research to determine best practices for acquiring and retaining PEM knowledge</td>
<td>A research agenda within PEM for SBS and 3D VR currently reflects on understanding the best practices on how users acquire knowledge and skill using the current technologies available</td>
<td>A form of simulation that share some similarities and also differences from MBS. Virtual patients, VWs, virtual task trainers, and resource management simulations offer types of simulation possible through the technological advances of computerized and screen-based simulations</td>
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Well explained the VR and emergency setting concept.
<table>
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<tbody>
<tr>
<td>Farra (2015)</td>
<td>to translate research findings related to the use of virtual reality simulation in disaster training into education practice.</td>
<td>The Ace Star Model serves as a valuable framework to put evidence into practice, strategies for implementing a virtual reality simulation are addressed. Practice guidelines, implementation recommendation, integration to practice and evaluation</td>
<td>Experimental one-group</td>
<td>Accomplish the first large-scale combat casualty training using multiple-modality hybrid simulation in WAVE medical.</td>
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<td>Gerardi (2010)</td>
<td>review evidence on the application of virtual reality exposure therapy to the treatment of specific phobias and post-traumatic stress disorder and discuss its advantages and cautions.</td>
<td>Review in theories and researches</td>
<td></td>
<td>The evidence is compelling that VR-assisted exposure therapy is effective and efficient in the treatment of patients with anxiety disorders. Reviewing both PTSD and virtual simulation but not in emergency setting and patient focusing.</td>
</tr>
<tr>
<td>Farra (2013)</td>
<td>to examine the scientific evidence pertaining to the efficacy of virtual reality training in disaster training of healthcare workers</td>
<td>A five-stage process was followed as the methodologic strategy for the integrative review</td>
<td></td>
<td>Principle findings identified three major themes including: descriptions of the participant’s VRS experiences, learning results after participation in VRS and an exploration of how knowledge construction occurs in the virtual environment.</td>
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<tr>
<td>Difede (2007)</td>
<td>Endeavores to evaluate the use of virtual reality (VR) enhanced exposure therapy for the treatment of posttraumatic stress disorder following September 11, 2001.</td>
<td>Related the material with PTSD diagnose and well explained virtual reality exposure therapy. It only explain the post emergency setting.</td>
<td>Experimental two group pre-post-test</td>
<td>The VR showed both statistically and clinically significant improvement of score than the waitlist comparison group.</td>
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<tr>
<td>Dubovsky (2017)</td>
<td>whether a novel computer simulation has the potential to serve as a valid and reliable model of on essential function in a busy ED.</td>
<td>Nurses perceived their work on the simulation task to be equivalent to their workload on the job in all aspects except for physical exertion.</td>
<td>Descriptive statistics and paired t test</td>
<td>Most closed to the research but different method of review, unclear design of VR simulation model also only focus on learning process.</td>
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<td></td>
<td>and skills; and strategies for integrating SBS and 3D VR into training and PEM practice.</td>
<td></td>
<td></td>
<td>Formulae but undetailed in explaining the model of simulation.</td>
</tr>
<tr>
<td>First Author/Year</td>
<td>Purpose</td>
<td>Analysis Method</td>
<td>Finding(s)</td>
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<td>the Uniformed Services University’s one-of-a-kind three-dimension Wide Area Virtual Environment (WAVE).</td>
<td></td>
<td>simulator.</td>
<td>Related to the same respondent (health worker) and applicable detailed simulation model</td>
<td></td>
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<tr>
<td>Krange (2012)</td>
<td></td>
<td></td>
<td>Highly specialized virtual worlds, like this computer-based 3D model simulating a trauma team setting, have the potential to work as an arena for communication training among trauma team members</td>
<td></td>
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<tr>
<td>Hsu (2013)</td>
<td></td>
<td></td>
<td>Collaborative work based, clear media and emergency setting but focused on the clinical &amp; diagnose trauma</td>
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<td>The emergence of virtual reality platform-based technologies applied to disaster preparedness and response training offers significant potential advantages over other traditional forms of training, and is gaining increasing acceptance. Applying the detailed model of simulation but it does not focus on mental health preparedness.</td>
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### IV. Discussion

Disasters occur at a rate of approximately one per day worldwide according to the data of . A well-trained healthcare workforce is needed to respond to these disasters. Current levels of training are not sufficient to prepare the workers. Cost restraints and logistic constraints make live simulation difficult, yet are critical in educating responders. VRS offers a potentially cost effective and efficient viable alternative.

Principle findings identified three major themes including: the beneficial aspect of virtual training experiences, the mental health preparedness of emergency setting and the of virtual environment simulation model.

#### D. Benefit of VR simulation

1. Practical and specialized simulation  
   Goolsby (2014) Highly specialized virtual worlds, like this computer-based 3D model simulating a trauma team setting, have the potential to work as an arena for communication training among trauma team members. Hsu (2013) the immersive and participatory nature of VR training offers a unique realistic quality that is not generally present in classroom-based or web-based training. Chang (2016) Advantages of SBS and 3D VR simulation over mannequin-based simulation are that it is infinitely replicable; can be distributed widely to devices simultaneously; is portable; enables tracking, storing, and analysis of massive amounts of usage and performance data; and does not require the presence of a live instructor.

2. Powerful educational tool
Farra (2015) Virtual reality simulation is a teaching methodology that has the potential to be a powerful educational tool. Virtual reality can provide a feasible alternative for training EM personnel in mass disaster triage, comparing favorably to SP drills. Virtual reality provides flexible, consistent, on-demand training options, using a stable, repeatable platform essential for the development of assessment protocols and performance standards (Andreatta, 2008).

3. Effective for PTSD therapy
Difede (2007) VR is an effective treatment tool for enhancing exposure therapy for both civilians and disaster workers with PTSD may be especially useful for those patients who cannot engage in imaginal exposure therapy. Gerardi (2010) Virtual reality exposure therapy, an alternative to more traditional exposure-based therapies, involves immersion in a computer-generated virtual environment that minimizes avoidance and facilitates emotional processing.

4. Cost and labour effective
Farra (2013) Because live disaster exercises are expensive and labor intensive, virtual reality simulation may offer a viable solution as a disaster training method. Hsu (2013) VR simulation retains considerable cost advantages over large-scale real-life exercises and other modalities and is gaining increasing acceptance.

5. Improving perform of responders
The result of research indicated a strong desire for more WAVE training in the curriculum (2.9 on a 3-point Leikert scale), and a strong preference for training in the WAVE vs. traditional training methods (4.6 on a 5-point Leikert scale). The novel WAVE platform can be implemented successfully for combat casualty training and represents a significant technological advancement in simulated military medical training (Goolsby, 2014). Dubovsky (2017) proved that time to perform triage corresponded to the time required in the ED and virtual patients were prioritized appropriately according to severity. This computerized simulation appears to be a reasonable accurate proxy for ED triage.

E. First-responders Mental Health Preparedness
Disasters are traumatic events that may result in a wide range of mental and physical health consequences. Post-traumatic stress disorder (PTSD) is probably the most commonly studied post-disaster psychiatric disorder. This review aimed to systematically assess the evidence about PTSD following exposure to disasters (Neria, Nandi, & Galea, 2008). Benedek, Fullerton, and Ursano (2007) said that first responders, including military health care workers, public health service workers, and state, local, and volunteer first responders serve an important role in protecting our nation’s citizenry in the aftermath of disaster. Public health and public safety workers experience a broad range of health and mental health consequences as a result of work-related exposures to natural or man-made disasters. Psychological and physical responses to traumatic events vary with the social context of the event, biological and genetic makeup, and past experiences and expectations. Three categories of response
and their needed interventions have been described:

- Most people may experience mild, transient distress such as sleep disturbance, fear, worry, anger, or sadness or increased use of tobacco or alcohol. Persons experiencing such responses may return to normal function without treatment but might benefit from community-wide support and educational interventions.

- A smaller group may experience moderate symptoms such as persistent insomnia or anxiety or changes in travel patterns or workplace behavior. Although these changes would not necessarily meet threshold criteria for disease or disorder, such symptoms may affect work or home functionality. These symptoms will likely benefit from psychological and medical intervention.

- A smaller subgroup may develop psychiatric illness such as PTSD or major depression and will require specialized treatment.

Our understanding of the effects of highly stress environments on health care providers has progressed considerably through the study of health care delivery in military conflict and peacekeeping missions. In the health care populations where combat or threat of personal injury is minimal, symptoms of depression and anxiety were noted.

The recovery and response to natural as well as man-made disasters require the integrated efforts of traditional public health responders, firefighters, police, EMTs search and rescue, and hospital-based providers. However, construction engineers, heavy equipment operators, mechanics, carpenters, and laborers work to remove rubble from debris piles (allowing for further rescue and recovery); rebuild roads to allow for transportation of the sick, injured, or dead as well as needed food and supplies for survivors and rescue workers alike; and resurrect or rebuild shelters and lines of communication for these victims and responders. Their immediate proximity to disaster sites may also prompt or necessitate participation in medical aspects of recovery operations more traditionally associated with previously defined public health workers. In addition, they often perform their work in treacherous conditions.

Rutkow, L., Gable, L., & Links, J. M. (2011) explained the public safety, human services, health, and relief workers who comprise the first wave of a response to natural or man-made disasters play a critical role in emergency preparedness. These first responders provide care and services in the immediate aftermath of emergencies and may remain in affected communities for weeks or months. They often work long hours under stressful conditions, witnessing the human harms, physical destruction, and psychological devastation that can accompany disasters.

In recent years, emergency preparedness researchers have focused on environmental exposures and other risk factors, such as structural instabilities within the built environment, which may impact first responders’ physical health. Harms to first responders’ mental health, however, are equally important to consider. Although mental health conditions may be overlooked because they can be difficult to visibly identify and diagnose, their presence may significantly affect first responders’ ability to function.
Studies have demonstrated that, after participating in disaster responses, first responders experience elevated rates of depression, stress disorders, and posttraumatic stress disorder (PTSD) for months and sometimes years. Those without disaster response training face a greater risk of receiving a PTSD diagnosis after the response concludes. Trained responders may not be prepared for a disaster response’s psychological challenges, because training cannot truly replicate a disaster environment. Furthermore, most trainings do not explicitly include sufficient content regarding psychological self-aid.

**F. More integrated model of VR**

One component of psychological first aid is the establishment of a sense of safety (e.g., through evacuation or protection from retraumatization). Other components include facilitation of social connectedness, fostering optimism, decreasing arousal, and restoring a sense of self-efficacy through psychoeducation, basic relaxation training, and cognitive reframing. Models using multidisciplinary or critical incident needs assessment teams (CINAT) to assist in the implementation of psychological first aid in the workplace, to identify at-risk individuals and groups, and to provide consultation to leadership around risk communication, grief leadership (actions to facilitate adaptive responses to the loss of coworkers), and psychological consequence mitigation strategies within the workplace have been described.

The Principles of psychological first aid

- Safety: Develop a physically safe environment; identify safe areas and behaviors
- Efficacy (individual and community): Maximize individuals’ ability to care for self, family, and others through measures, clear policies, guidance (e.g., evacuation or shelter-in-place procedures; mechanisms for obtaining food, shelter, vaccination, medical care)
- Calmness: Teach and encourage relaxation and calming skills and maintenance of natural body rhythms (e.g., nutrition, sleep, rest, exercise)
- Connectedness: Maximize and facilitate connectedness to family and other social supports to the extent possible
- Foster hope and optimism without minimizing ongoing risks

Critical Incident Needs Assessment Team (CINAT) functions in workplace/workforce

- Institute a pre-clinical, multidisciplinary team approach
- Identify high-risk groups/individuals and target mental health, resilience, distress, and risk behaviors
- Identify barriers to care and services
- Offer health education for prevention, assessment, and referral
- Hold informational briefings (leader participation) and or offer grief leadership
- Integrate family support into worker/workplace support
This diagram systematically directs disaster mental health responders through 3 components of psychiatric assessment, starting with identification of psychopathology and differentiating it from normative emotional distress, proceeding to triage to the appropriate type of care, and concluding with delivery of appropriately targeted interventions based on accurately assessed needs.

Activities are shown in the general sequence in which they would occur and at the approximate time they would first occur; activities would continue beyond 6 weeks into the indefinite future, as indicated by the particular situation.


b. Major depression, bereavement, anxiety.

c. Screening may be conducted as a first step to identify individuals unlikely to develop a psychiatric disorder, but full diagnostic assessment is needed before formal psychiatric decisions are made (2 weeks are required after disaster for diagnosis of new cases of major depression and 1 month for PTSD).

d. Suicidal or homicidal ideation, psychosis, psychiatrically based inability to care for self or dependents (North, & Pfefferbaum, 2013).

Multiple attempts to standardise the education and training of disaster and emergency responders have been made; these focused mainly on an individual’s professional development rather than improved team operational performance (Camacho et al, 2016).

V. Conclusion

It was found that the result of the literature reviews were synthesized and analyzed using critical appraisal standard. It is the result of combined theories and reviewed article above which implemented the virtual simulation emergency in not only before the incident but also as soon as possible after the disaster. The virtual design of simulation will be more applicable if collaborative with the expert of psychiatry and emergency team. The formulation of audiovisual media which reflected reality based on relevant condition of emergency and or disaster setting was combined from the reviewed papers above with comprehend

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