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Development, implementation and evaluation of a disaster training programme for nurses: A Switching Replications randomized controlled trial

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ABSTRACT

Background: Training efforts in disaster education need to provide updated knowledge, skills and expertise to nurses through evidence-based interventions.
Aim: The purpose of the study was the development, implementation and evaluation of an educational programme for nurses regarding the provision of health care during disasters.
Methods: A randomized controlled trial using Switching Replications design was conducted for the evaluation of the programme. 207 hospital-based nurses were randomly assigned into intervention ($n = 112$) and original control ($n = 95$) groups. Changes between groups and over time were measured by questionnaire and used as the outcome measure to demonstrate effectiveness of the training intervention.
Results: The intervention improved nurses' knowledge and self-confidence levels while no significant changes were detected in behavioral intentions. A significant increase in the mean knowledge score was observed in both groups in times 2 and 3 compared to time 1 [pre-test: 6.43 (2.8); post-test: 16.49 (1.7); follow-up test: 13.5 (2.8)], ($P < 0.002$). Changes in knowledge between intervention and control group were significantly different ($P < 0.001$) with a large effect size (eta-squared = 0.8).
Conclusions: The training programme was feasible and effective in improving nurses' knowledge concerning disaster response.

Introduction

The past few years mankind have witnessed many natural and man-made disasters that have influenced the life of billions around the globe. It is estimated that only in the past decade, about 2 million people lost their lives due to a disaster, 4.2 million were injured, 33 million left homeless and about 3 billion people affected due to any disasters (EM-DAT, 2013). The impact and ongoing nature of many of these events highlight the need for nurses to be prepared to work effectively in disaster situations. The meaning and definitions of disasters are broad and varied, depending on the scientific perspective (Fung et al., 2009). Noji (1997) describes disasters quite simply, as "events that require extraordinary efforts beyond those needed to respond to everyday emergencies".

Although a variety of disasters in recent years have brought disaster education to the forefront, yet, disaster nursing knowledge has been characterized as "inadequate" in many countries (Weiner, 2006; O'Sullivan et al., 2008; Veenema et al., 2008; Powers and Daily, 2008). Furthermore, the issue of inadequate disaster nursing education and the lack of standard competencies for nurses in order to provide efficient nursing care during catastrophic events became a political issue in the United States after Hurricane Katrina (Couig et al., 2012). To address the new challenge, several nursing schools have developed certificate and master's degree programmes the past decade focused in disaster preparedness and management (Stanley, 2007). In addition, organizations and health care institutions have to become learning organizations, providing the skills and knowledge to its workforce (Holland and Lauder, 2012). To meet the goal of preparing registered nurses regarding the provision of care during disasters, training programmes have developed and implemented worldwide, as part of the continuing professional development (Hsu et al., 2004). Although a series of training programmes, aiming to improve nurses' capability of disaster preparedness have been carried out, in many cases it

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remains unclear if these training programmes are effective (Wang et al., 2008). Furthermore, evidence-based disaster training is necessary to improve the effectiveness of nurses' response to disasters (Burstein, 2006; Williams et al., 2007). Moreover, educational interventions ought to describe in a clear manner its objectives, content, evaluation methods and effect size through scientifically rigorous research (Rahm Hallberg, 2006; Borglin and Richards, 2010). The purpose of the study was the development, implementation and evaluation of an educational programme regarding the provision of health care during disasters and emergencies in hospitals, by nurses.

Methods

The objectives of the study were to: (1) assess nurses' baseline knowledge and behavioral intentions to provide health care during disasters; (2) develop and deliver a training programme in disaster education to hospital-based nurses; (3) improve nurses' knowledge, skills and willingness to respond; and (4) evaluate the effectiveness of the training programme (before training, immediately after training and 5–6 months later). A randomized controlled trial (RCT) and, specifically, a Switching Replications design – two-group experiment with three waves of measurement, using an intervention and a control group, with parallel pre- and post-tests and then, the roles are switched and the intervention is applied to the control while the initial intervention group becomes the control – was used (Trochim, 2000). This study was approved by the institutional review boards of each participating hospital.

Sample

Participants in the study were selected from two tertiary public hospitals in Athens and Thessaloniki metropolitan areas in Greece, using systematic random sampling. The sample was consisted of 207 registered general nurses. In particular the intervention group consisted of 112 nurses and the original control group of 95 nurses.

Sample size

A priori power analysis and sample size calculations showed that 176 participants (88 in each group) were required in order to have a 90% chance of detecting as significant (at the 5% level) an absolute increase in score equal to 5%. Sample size was calculated with 90% power and 95% confidence interval.

Intervention design

A systematic development of evidence-based nursing intervention was used based on the model of van Meijel et al. (2004). The first step aimed at examining the evidence already available in the literature about disaster training programmes for nurses. A qualitative study in 87 senior nursing students about disaster training was carried out with the aim to explore gaps in knowledge before graduation (Pesiridis et al., 2013). Additionally, fifteen registered nurses and nursing directors, who did not participate in the training, were interviewed, using an interview guide with open-ended questions with the purpose to explore nurses' training needs regarding the provision of health care during disasters.

The training programme was designed by an educational board of academics who were experts in public health and community nursing after examining the above results carefully. In brief, the final programme consisted of the following domains: (1) definitions and essentials about disaster management; (2) national emergency plans during disasters, such as fire, earthquake, flood, drought, extreme temperature, epidemic and the chain of command; (3) nurses' role during disasters and emergencies; (4) triage algorithms; (5) hospital evacuation procedures and safe transfer of patients; (6) decontamination procedures and (7) the proper use of personal protective equipment (PPE) during Chemical, Biological, Radiological and Nuclear (CBRN) incidents. Various training methods were planned, including case studies, workshops, tutorials, group discussions, role playing, demonstration and lecturing as the least used training method. The length of the programme was set at 8 h during one day.

Procedures

An accompanying letter explaining the purposes of the study and an informed consent form was attached to each numbered pre-test questionnaire. Head nurses from each nursing ward were informed about the study and the randomization procedure and invited to distribute the questionnaires to nurses and collect them in sealed envelopes one week later. Nurses were then randomly assigned to intervention and control groups in each hospital. The training programme was conducted on separate days for each group. The first day, participants in the intervention group attended the 8-h training programme and a post-test was distributed and returned completed after the end of the programme. The following day the implementation of the training programme was repeated to the original control group but unlike the intervention group, a second pre-test was distributed prior to the training while a post-test was distributed and returned completed at the end of the programme. For the follow-up test, a questionnaire was distributed by the researchers, 5 months after the training. Participants in both groups completed the same survey questionnaire in all measurements of the study.

Implementation of the training programme

The intervention was conducted by the principal investigator for all groups at the training center of each hospital which was equipped with audiovisual aids for training purposes and a light meal was provided to the participants during the breaks, free of charge. At the beginning of the training each participant received a copy of the programme slides and a copy of the National Emergency Response chain of command attached by the nurses' role during emergencies and disasters as described in the national plan for hospitals. The last session was delivered by the hospitals' Infection Control Nurse on the use of different PPE during CBRN incidents. A demonstration was conducted on the proper donning and removal of PPE according to Centers for Disease Control and Prevention (CDC, 2012) followed by clinical practice by participants.

Survey development/validation

A questionnaire was developed to estimate knowledge levels and behavioral intentions of nurses, regarding the provision of health care during disasters. Knowledge score was estimated, by using a knowledge scale, consisting of 19 dichotomous (True/False) items based on the content of the training programme. If the correct answer was given, the participant received one point, whereas an incorrect answer received zero points. To assess behavioral intentions (BI) of nurses, Ajzen's Theory of Planned Behavior (TPB) was applied (Ajzen, 1991), following guidelines for constructing a short version of a TPB questionnaire (Ajzen, 2002). Twelve items were used in the final BI scale, three for generalized intention, and additional nine for the predictor variables of the TPB theory which were attitudes, subjective norms and perceived behavioral control. All items were answered on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Demographic