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Cortisol as a Predictor of Simulation-Based Educational Outcomes in Senior Nursing Students: A Pilot Study

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KEYWORDS

simulation;
cortisol;
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Abstract

Background: Participation in a simulation may cause high levels of stress in students and negatively affect their learning outcomes. This pilot study investigated the association between nursing students' stress and their knowledge acquisition and improvement in self-confidence.

Method: This study used a quasiexperimental design. The experimental group (n = 12) participated in the birthing simulation. The control group (n = 11) watched a video of the normal delivery process. Participants' knowledge, self-confidence, and stress (salivary cortisol levels) were measured before and after the interventions. Twenty-three senior nursing students participated in this study.

Results: Regression analyses revealed that being in the experimental group was associated with greater knowledge acquisition and improved self-confidence. Higher cortisol levels were associated with greater knowledge acquisition, and previous simulation experience was associated with improved confidence.

Conclusion: The learning outcomes of simulation-based education may vary according to students' emotional status.

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Background

Simulation-based education in maternal-child nursing is highly regarded as an effective and creative teaching modality by nurse educators (Jeffries, Bambini, Hensel,

Moorman, & Washburn, 2009). A simulation-based orientation using a birthing simulator is appropriate for nursing students before their clinical rotation in obstetrics (Dearmon et al., 2013). A preclinical experience using a birthing simulator should help students prepare themselves to care for newborns and laboring women and eventually achieve the course competencies in obstetrics (Simonelli & Paskausky, 2012).

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An advantage of clinical simulations is that nursing students experience real clinical practice in a controlled and imitated environment (Jones et al., 2011). However, students' stress and anxiety related to simulations might increase if they closely mimic real situations and environments

Key Points

- Simulation-based orientation increased students' knowledge and confidence.
- Higher cortisol levels were associated with greater knowledge acquisition.
- Previous simulation experience was associated with improved confidence.

(Dearmon et al., 2013). The perceived stress of nursing students in a simulation-based orientation was significantly higher than the norm (Dearmon et al., 2013). Increased physiologic stress, as measured by heartbeat and salivary cortisol, also was found in clinicians participating in high-fidelity simulations (Bong, Lightdale, Fredette, & Weinstock, 2010).

In general, increases in stress or anxiety seem to have a negative effect on the skill acquisition and performance of students and nurses (Cheung & Au, 2011; Rhodes & Curran, 2005). Nursing students who watched anxiety-provoking video clips were significantly less proficient in performing newly acquired procedures than nursing students who watched pleasant video clips (Cheung & Au, 2011). The perceived stress of nursing students also was significantly correlated with decreased self-confidence in their first clinical experience (Dearmon et al., 2013). In contrast, medical students' heightened anxiety from adding emotional stressors to simulation training was positively correlated with improved performance in advanced cardiac life support skills, even 6 months later (DeMaria et al., 2010). Thus, the results of studies about the relationship between the emotional status and performance and self-confidence of students are inconsistent (Bong et al., 2010; Cheung & Au, 2011); yet no study has investigated the effect of emotion on knowledge acquisition.

Salivary cortisol levels have been used extensively as an objective measure of stress (Bong et al., 2010; Jones et al., 2011). As a biological marker of stress, cortisol levels rise in response to it and to numerous environmental changes. Thus, this pilot study investigated whether emotional status, as measured by the salivary cortisol levels of senior nursing students, could predict their knowledge acquisition and self-confidence.

Sample

Twenty-three senior nursing students were recruited from a college of nursing located in Korea. The inclusion criteria were having completed a maternal-child nursing theory course and having finished a clinical rotation in postpartum care. Among 23 students enrolled, 17 students did not have

any prior simulation exposure. Six students had previous simulation experience from their elective class, "Clinical Reasoning," which is the only class offered in the school that uses simulation teaching method. Students were randomly assigned to an experimental group (n = 12) or control group (n = 11) by drawing lots.

Methods

Study Design

This study used a quasi-experimental design.

Measures

Knowledge

Basic knowledge of labor and delivery and the nursing care of newborns and laboring women were measured using 15 multiple-choice questions selected from the item pool of the Nursing Board Examination of Korea. The content and representativeness of these questions were validated by a faculty member who specialized in maternity nursing and taught the maternity theory class. The range of possible scores is 0-15, with one point assigned to each correct answer. A higher score indicates a higher level of knowledge of content related to labor and delivery.

Self-confidence

Self-confidence in providing care to newborns and laboring women was measured using an 11-item questionnaire developed for this study based on research and theory covered in class by the same faculty member who selected the study's knowledge questions. Students rated their self-confidence using a five-point scale, with 1 = "not at all confident," to 5 = "very confident." A higher total score indicates greater self-confidence. Cronbach's alpha in this study was 0.91.

Salivary Cortisol Levels

Participants' saliva samples were collected in clean test tubes and immediately sent to the college's laboratory to freeze to -20°C in the freezer. The following day, salivary cortisol levels were measured using enzyme-linked immunosorbent assay kits supplied commercially for single measurements, but the supplied standards were assayed in duplicates (R&D, Minneapolis, MN). To reduce variations in measurements, one person measured all parameters throughout the study. The intra- and interassay coefficients of variation for salivary cortisol were $6.9\% \pm 1.9\%$ and $9.9\% \pm 0.8\%$, respectively.

Data Collection

After obtaining approval to conduct the study from the college's research board, the researchers contacted potential participants by telephone to explain the study and invite them

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