



A comparative assessment of nursing students' cognitive knowledge of blood transfusion using lecture and simulation



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ARTICLE INFO

Article history:

Accepted 16 May 2015

Keywords:

Nursing education
Human patient simulation
Quantitative research
Blood transfusion

ABSTRACT

Professional nurses must have the knowledge and skills to safely administer blood products and monitor for life-threatening complications. Nurse educators should ensure that student nurses also learn how to safely administer blood products; however students rarely have the opportunity to witness and manage adverse transfusion reactions. Despite the low incidence of rare adverse transfusion reactions, nursing students must be able to immediately recognize transfusion reactions, implement appropriate interventions, and communicate effectively with health care providers. To reinforce blood transfusion knowledge, practice technical skills, and promote management of adverse reactions, a human patient simulation experience was created for baccalaureate nursing students to provide application of related classroom content. Using a quasi-experimental design, students who received a related didactic lecture preceding the simulation were compared with students who did not receive the lecture. The lecture group's pre/posttest mean scores ($n = 42$) were significantly higher than the no lecture group's mean scores ($n = 44$). This simulation design included proper blood administration procedures, patient monitoring, management of transfusion reactions, and practice with interdisciplinary communication. Participation in a human patient simulation following a related didactic lecture may be useful to strengthen cognitive learning and help bridge the didactic-clinic gap.

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Introduction

Across the globe, professional nurses must have the knowledge and skills to safely administer blood products and monitor for potential adverse reactions. According to the World Health Organization (WHO, 2011), over nine million patients in 90 different countries receive blood in a given year. "In high income countries, transfusion is most commonly used for supportive care in cardiovascular and transplant surgery, massive trauma and therapy for solid and hematological malignancies. In low- and middle-income countries, it is used more often in pregnancy-related complications and severe childhood anemia" (WHO, 2011 p. 8).

Nurse educators must ensure that student nurses learn how to safely administer blood; however, it may be difficult to provide each student with an actual patient transfusion experience, and rare for students to witness potentially fatal adverse transfusion

reactions which occur in 1–2% of patients receiving blood (WHO, 2002). Despite a low incidence, transfusion reactions can be life-threatening, and students as well as professional nurses must be able to immediately recognize these reactions, implement appropriate interventions, and communicate effectively with health care providers to ensure optimal patient outcomes. To help nursing students learn to recognize blood transfusion reactions as well as practice the required safety procedures and related technical skills, a high fidelity scenario using human patient simulation (HPS) was developed to provide application of a related classroom lecture. Students' cognitive learning was assessed using a quasi-experimental pre/posttest design to compare the lecture/simulation group with the simulation-only group.

Background/literature

A review of the nursing literature related to blood transfusion revealed only two pedagogical studies involving nursing students (Mole et al., 2007; Smith et al., 2010) and one report of using HPS to teach nursing students about transfusion reactions (Prentice & O'Rourke, 2013). Related to general clinical practice, relevant

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studies included data from the United Kingdom's *Serious Hazards of Transfusion (SHOT) 2012 Annual Report* (Bolton-Maggs et al., 2013) and two reviews on improving transfusion safety (Dzik, 2003; Vasiliki, 2011). Interestingly, there is also paucity of studies investigating staff nurses knowledge of blood transfusion (Hijji et al., 2010, 2012a, 2012b; Hogg et al., 2006; Rowe and Doughty, 2000) and only one study which examined the patients' perspective related to receiving a blood transfusion (Adams and Tolich, 2011).

To teach nursing and midwifery students in the United Kingdom, Mole et al. (2007) created a classroom transfusion lecture along with simulated practice with blood units. Using pre/posttests at 4 weeks and 1 year, the students seemed to learn with these methods, but some knowledge was lost over time. Smith et al. (2010) used questionnaires with Scottish nursing students administered after a standardized didactic unit and simulated exercise to assess retention of blood administration knowledge over 12 months. While the researchers found approximately two-thirds of the students could initially identify transfusion reactions, this knowledge was not well retained at six and twelve months and were unsure if the learning transferred into clinical practice. Prentice and O'Rourke (2013) designed a blood transfusion HPS experience for Canadian nursing students following a related didactic lecture. Although no quantitative learning was measured, the students' reported the HPS experience improved their understanding of potential reactions.

Regarding clinical practice, the UK in 1996 began the first haemovigilance scheme in the world to collect and analyze data on adverse events and blood transfusion reactions. The Serious Hazards of Transfusion (SHOT <http://www.shotuk.org/home/>) program provides annual recommendations to improve patient safety in England, Wales, Scotland, and Northern Ireland. Data from the *SHOT 2012 Annual Report* (Bolton-Maggs et al., 2013) indicates that 62% of transfusion mistakes are preventable with the main error being incorrect blood component transfusion. Some of the SHOT recommendations to address these preventable errors include confirming patient identity and improved communication including clinical staff handovers.

Regarding professional nurses' knowledge and skills related to blood transfusion, Rowe and Doughty (2000) in an audit of clinical notes, reported inconsistent compliance with British national standards including incomplete baseline vital signs and a lack of documented observations after the first fifteen minutes of the transfusion. Hijji et al. (2010) observed staff nurses in the United Arab Emirates before/after blood transfusions documenting deficiencies related to improper patient preparation, identification, and blood product handling, as well as suboptimal assessments which included vital sign monitoring. In a later study, Hijji et al. (2012b) using questionnaires, found overall knowledge deficits and significant relationships between nurses' knowledge, work setting, country where trained and type of nursing qualifications. Hijji et al. (2012a), also surveyed Jordanian hospital nurses' and reported significant knowledge deficits related to answering survey questions correctly. Interestingly, most of the staff nurses in these four studies indicated that they had received minimal to no hospital training related to blood transfusions (Hijji et al., 2010, 2012a, 2012b; Rowe and Doughty, 2000). Hogg et al. (2006) used both HPS and standardized patients to effectively increase U.K staff nurses' awareness of safe transfusion care. Although the participants viewed these methods positively, but the researchers identified barriers related to simulation use in hospitals: time, cost, and use of small groups.

A review of HPS nursing research involving pre/posttest designs to evaluate cognitive learning revealed several relevant studies. Students in the United States (U.S.) taught with HPS showed significant knowledge gains when compared to those taught with a

traditional lecture (Brannan et al., 2008; Burns et al., 2010) and interactive case studies (Howard et al., 2010). Elfrink et al. (2010) evaluated U.S. nursing students' knowledge before participation in HPS, immediately after, and later during final exams. The researchers found knowledge significantly improved after the simulation experience, but noted mixed results related to retention on the final exams. Cook (2014) using meta-analysis concluded, that simulation in health education is an effective teaching method, but recommended more comparisons of lecture-based approaches and simulations with variable repetitions. Thus, despite the increased use of simulation in nursing education, more research is needed to determine if knowledge is retained over time (Elfrink et al., 2010; Mole et al., 2007; Smith et al., 2010), the effect of repetition during simulation (Cook, 2014), and most importantly if knowledge and skills transfer to clinical settings (Norman, 2012; Seropian et al., 2004; Smith, 2010; Weaver, 2011).

Research design

This study was designed to measure cognitive knowledge in nursing students who received a related didactic lecture prior to participating in a blood transfusion HPS experience compared with students who did not receive the lecture. The research questions included: 1) Did participation in a HPS significantly enhance students' cognitive knowledge? and 2) Is there a significant difference in the lecture group's pre/posttests scores compared to the no lecture group?

Development of didactic lecture

A standard lecture was created as part of a two hour didactic class addressing hematology topics by a faculty not involved in the study. The lecture was created and presented using PowerPoint software and included content on procedural information, circulatory overload, and transfusion reactions (febrile, hemolytic, allergic, and delayed).

Development of the simulation and related scenario

The blood transfusion simulation and related scenario was created in the fall of 2010 using the Nursing Education Simulation Framework (Jeffries, 2005, 2007). The Framework's five major components: teacher, student, educational practices, design characteristics, and outcomes were considered during development. All faculty were given detailed simulation instructions, equipment lists, debriefing questions, and copies of the local hospital's blood transfusion procedure. The simulation was devised for second semester students who were enrolled in their first acute hospital-based clinical course.

The simulation was designed to meet the following objectives: 1) correct identification of patient and donor, 2) demonstration of blood tubing preparation and product handling, 3) safe monitoring during blood administration, 4) prompt recognition of signs/symptoms of a transfusion reaction, 5) verbalization of correct interventions related to specific reactions, 6) accurate communication and documentation of the procedure and reactions, and 7) verbalization of appropriate patient teaching. Educational methods included: active learning, role play, collaborative problem solving, and faculty interaction.

The scenario provided relevant contextual information involving an older patient who was experiencing a GI bleed with salient cues such as symptomatic low blood counts. Students begin the simulation by selecting specific roles to play and receiving a shift report. The simulation concluded with students role-playing a phone call to a medical provider to report the identified adverse

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