

Does the High-fidelity Simulation Experience Impact (Student) Learning Outcomes with the Diabetic Ketoacidosis Patient?

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ABSTRACT

Background: Diabetes is one of the most common chronic diseases and a leading cause of morbidity and mortality in the United States (Desai et al., 2018). Diabetic ketoacidosis (DKA) is a life-threatening complication that warrants immediate nursing intervention. The purpose of this study is to determine if high-fidelity simulation experiences impact student learning outcomes for caring for DKA patients.

Methods: The participants had didactic instruction on DKA pathology and nursing care. Before the high-fidelity simulation, the participants received learning objectives and questions to research. The participants completed a pre-stimulation test, participated in the high-fidelity DKA simulation, and then completed the post-simulation test.

Results: The results of the study were overall positive. The students demonstrated a 70% increase in choosing the correct answer through pre and post-test analysis.

Conclusions: The results of this research demonstrated that including a DKA simulation experience increased the students' knowledge.

Keywords

High-fidelity simulation, diabetes, nursing students, diabetic ketoacidosis, learning outcomes.

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Received: March 10, 2022; **Accepted:** April 09, 2022; **Published:** April 15, 2022

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Citation: Blasingame T, Irons AM, Miles K. Does the High-fidelity Simulation Experience Impact (Student) Learning Outcomes with the Diabetic Ketoacidosis Patient?. *Int J Diabetes Metabolic Synd.* 2022;2(1):1-3.

Diabetes is one of the most common chronic diseases in the United States (U.S.). Diabetes is a leading cause of morbidity and mortality in the U.S. [1]. In the U.S., about 34.2 million people (10.5%) have diabetes, with 88 million people (34.5%) who are prediabetic or at high risk for developing diabetes [2]. Diabetic Ketoacidosis (DKA) is a complication of diabetes. It is a life-threatening condition that needs immediate attention and intervention. Healthcare providers must understand the disease process, prevention, and treatment to improve patient outcomes. The purpose of this study is to

determine if high-fidelity simulation experiences impact student learning outcomes with diabetic ketoacidosis patients.

Clinical instructors quickly realize that there are vast differences in the experiences students undergo during their clinical rotation. Their experiential learning depends on what patients are in the hospital, current illnesses present in the area they are assigned, physician orders are written, procedures are being done, and the acuity level of the patients.

How do we give our students experiences based on academic preparation and what they may encounter in the clinical setting solely based on what they have engaged in during their college career?

The simulation lab has proven to be beneficial to improving learning outcomes. Simulation experiences allow students to practice what they have learned in the classroom and apply it to a scenario using manikins or volunteers [3]. Students can also be provided with additional hands-on training in interprofessional collaboration skills to be part of an interdisciplinary team in the clinical setting.

Background

DKA is a life-threatening complication of diabetes and can result in coma and even death [4]. The number of discharges with DKA as the primary diagnosis rose by 59% from 2003 to 2014 [1]. According to Cohen [5], medication errors have a significant impact on patient outcomes. According to Hicks [6], “almost two out of five in patients with diabetes had a medication error on their chart during their hospital stay (38%) (p. 78). For example, a novice nurse administered only 1/100 of the required dose with each glucagon injection for a hypoglycemic patient. The nurse had never administered glucagon [5]. The patient had a delay in recovery due to a medication error.

Current clinical experience restrictions, such as limitations on direct patient and faculty to student ratio, have contributed to nursing students’ knowledge deficit of caring for a patient with a diagnosis of DKA. A high-fidelity simulation scenario involving a patient with DKA was assumed to help bridge this knowledge gap. In a quasi-experimental replication study by Craig, et al. [7], high fidelity simulation that using an evidence-based teaching strategy helps engage students in medication safety practices and should be implemented in curriculum design.

Methods

The senior-level undergraduate baccalaureate nursing students were given the opportunity to participate in a pre and post-test study. The senior-level nursing students have one more semester before they graduate. After obtaining institutional review board (IRB) approval, the study was explained, and a consent form who agreed to participate voluntarily was signed by participants.

The tests were administered through an anonymous Qualtrics survey. 43 senior-level nursing students consented to participate in the study. The students were given a QR code to scan and were monitored while completing the pre and post-test.

The study aims to determine the effects of high-fidelity simulation on student learning outcomes. The student had in-class didactic instruction on the diabetic disease process, which lasted 75 minutes and included a lecture, class discussion, and PowerPoint guide. The students then participated in the high-fidelity simulation diabetic ketoacidosis patient scenario. (See Appendix C). After the simulation experience, the student completed the post-test, which

contained the same questions as the pretest. The two tests were compared and analyzed for the difference in scoring.

After the completion of the simulation, the facilitator and students reflected on the experience as a group. The simulation facilitator reviewed any inappropriate activities observed, decision-making processes, communication strategies, what the students did well, and interventions to improve the patient’s outcome. Once the post-conference was concluded, the students completed the post-test.

Results

The results of the study were overall positive. The students demonstrated a 70% increase in choosing the correct answer when comparing the pre and post-test scores. Questions 1-7 showed an increase in the learning outcome. Question 8 went from a score of 67.44% choosing the correct answer to a decrease of 65.12%. Questions 9 and 10 were select all that apply questions. Overall, on questions 9 and 10 a decrease in the learning outcomes was noted. See Appendix C for the breakdown of each question.

Conclusion

The results of the pre and post-test study demonstrated that the DKA simulation experience increased the students’ knowledge of caring for a DKA patient. The activity also improved their overall scores on the post-test evaluation. Based on previous research and the results of this study, high-fidelity simulation improves learning outcomes related to DKA patients.

Appendix A

1. Which of the following is not a sign or symptom of Diabetic Ketoacidosis?
2. A patient is admitted with Diabetic Ketoacidosis. The physician orders intravenous fluids of 0.9% Normal Saline and 10 units of intravenous regular insulin IV bolus and then to start an insulin drip per protocol. The patient’s labs are the following: pH 7.25, Glucose 455, potassium 2.5. Which of the following is the most appropriate nursing intervention to perform next?
3. Which patient is MOST likely to develop Diabetic Ketoacidosis?
4. Which of the following statements are INCORRECT about Diabetic Ketoacidosis?
5. When priming the tubing for an Insulin infusion it is best practice to waste 50cc to 100cc of insulin prior to starting the infusion because insulin absorbs into the plastic lining of the tubing.
6. You are providing care to a patient experiencing diabetic ketoacidosis. The patient is on an insulin drip and their current glucose level is 300. In addition to this, the patient also has 5% Dextrose 0.45% NS infusing in the right antecubital vein. Which of the following patient signs/symptoms causes concern?
7. What type of insulin do you expect the doctor to order for treatment of DKA?
8. A patient diagnosed with diabetes mellitus is being discharged home and you are teaching them about preventing DKA. What statement by the patient demonstrates they understood your teaching about this condition?

9. A patient is brought to the Emergency Department with suspected diabetic ketoacidosis. Which clinical manifestations would support this diagnosis? Select all that apply.
10. A patient is being treated for diabetic ketoacidosis (DKA). Which cardiac monitor changes would the nurse evaluate as most significant?

Appendix B

The Diabetic Ketoacidosis Simulation Scenario

The students are caring for a 36-year-old male who is being admitted to the medical-surgical unit as a direct admit from his provider's office. He was diagnosed with type 1 diabetes mellitus 12 months ago and has experienced vomiting and anorexia over the last 5 days. He stopped taking his insulin 2 days ago when he was unable to eat. While at the primary care providers office the patient was noted to be hypotensive. A saline lock was placed in the right arm and a bolus of 250 mL of normal saline was administered. Once the bolus was completed the health care provider wrote orders for the patient to be directly admitted to the Medical-Surgical Unit. Prior to the patient's arrival on the medical-surgical unit, ordered labs were drawn, urinalysis was obtained, and a chest x-ray and ECG were completed [8].

The scenario takes place on the day of admission, at which time the student will perform a full assessment and implement the initial health care provider's orders [8]. The has three states that are transitioned manually at the discretion of the facilitator [8]. There are three sections in the simulation and the facilitator advanced the scenario to the applicable state when appropriate interventions are performed [8]. During the simulations the students should be performing a complete assessment, identify significant findings, initiate admission orders, identify the history of diabetes, time of last meal, time and amount of last insulin injection, review lab, urinalysis, ECG, and chest x-ray results [8]. The student needs to recognize important test results to report to the provider to receive their following orders for the patient's status to improve. The DKA simulation also prepares the learner for the following items on the NCLEX: safe and effective care environment, management of care, safety and infection control, health promotion and maintenance, psychosocial integrity, physiological integrity, basic care and comfort, pharmacological and parenteral therapies, reduction of risk potential, and physiological adaptations [8].

Appendix C

Pre/Posttest Scoring

Question Number	Pre-Simulation Score	Post-Simulation Score	Learning Outcome
Question 1	37.21%	48.84%	Increase
Question 2	51.16%	53.49%	Increase
Question 3	86.05%	90.7%	Increase
Question 4	65.12%	74.42%	Increase
Question 5	83.72%	90.70%	Increase
Question 6	81.40%	88.37%	Increase
Question 7	95.24%	100%	Increase
Question 8	67.44%	65.12%	Decrease
Question 9 Select all that apply	26.87%	23.40%	Decrease
	29.85%	27.66%	Decrease
	17.91%	24.11%	Increase
Question 10 Select all that apply	36.79%	38.32%	Increase
	21.70%	20.56%	Decrease
	30.19%	28.97%	Decrease

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