Development and Quality Assessment of a High-Alert Medication Simulation for Education or Research

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Problem - Theory to Practice Gap in Nursing



Two gaps require immediate attention: making clinical nursing judgments and implementing quality and safety education standards for nurses (QSEN). Nurse educators, and our colleagues in nursing service, must collaborate to close these gaps, as safe and patient-centered care depend on

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Educational Methodology - Simulation-Based Learning



- Why Simulation-Based Learning (SBL)?
 - Links theory to practice
 - Develops clinical decision making
 - Provides a safe space for students to learn from their mistakes
 - Allows the application of nursing knowledge, skills and attitudes (KSA) without putting the patient at risk
 - Develops communication and collaboration skills
 - Improves student confidence

Aim



 Teach nursing students High-Alert **Medication** (HAM) administration safety • Why HAM safety? Safe administration: Relies on clinical judgment Requires collaboration Is technologically complex

Goals



- To develop two HAM SBL scenarios
 - Highly realistic
 - Based on evidence-based nursing practice
 - Incorporate evidence-based practice guidelines
 - INASCL Standards
 - Grounded in theory
 - High quality
 - For use in education or research
 - Measure learning outcomes
 - Utilization of quality metrics to evaluate simulation scenarios

EBP - Nothing is as easy as it sounds!



- Limited evidence base for HAM safety
 Hugo variability in current practicos
- Huge variability in current practices

Factors Contributing to HAM Errors:

- Frequent unit transfers²
- Interruptions and workflow issues³
- Nurse knowledge^{3,4,5}
- Failure to implement bar-code scanning appropriately⁶

And down the rabbit hole we go...



• What are the supports and barriers to HAM safety?

JAN Leading Global Nursing Research

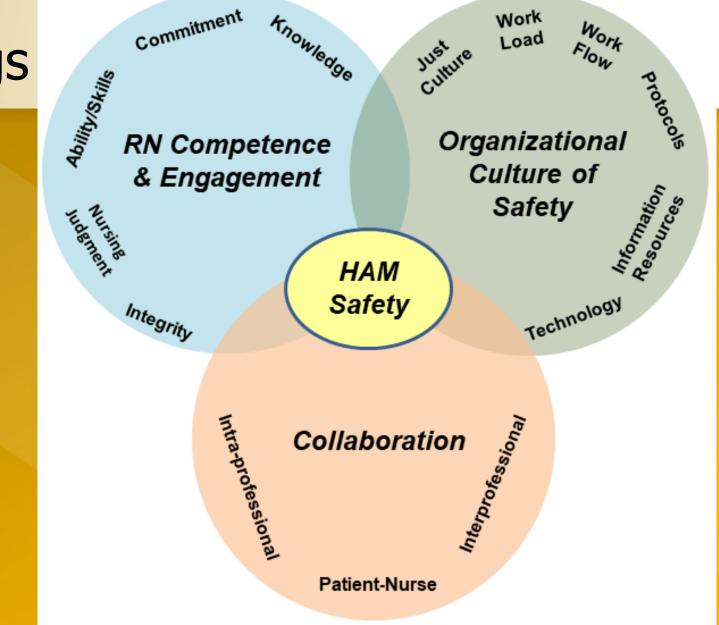
ORIGINAL RESEARCH: EMPIRICAL RESEARCH – QUALITATIVE

Nurses' perceptions of high-alert medication administration safety: A qualitative descriptive study

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First published: 18 August 2019 | https://doi.org/10.1111/jan.14173

Findings







Medication errors result from gaps in the safety processes of complex systems, when humans fail to identify the problem and intervene before the patient receives the medication.^{7,8}

Nurses confirmed that HAM errors are complex

Reason's Swiss Cheese Model would support inclusion of HAM complexity in the SBL design

The use of the NLN Jeffries Simulation Theory would support overall SBL design

NLN Jeffries Simulation Theory⁹



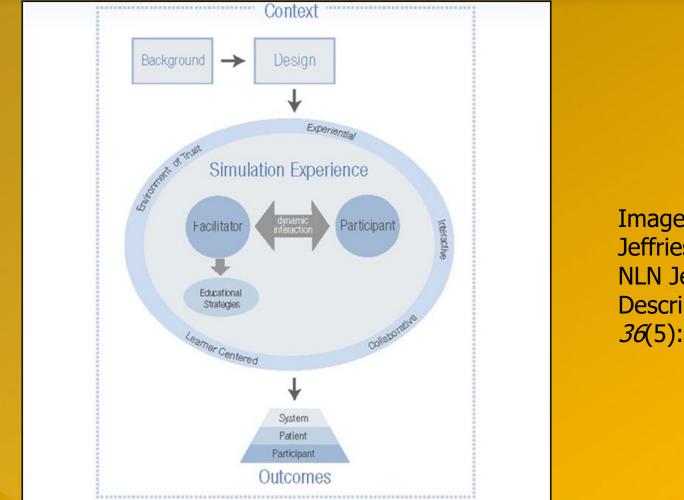


Image source:

Jeffries, P.; Rodgers, B.; Adamson, K. (2015). NLN Jeffries Simulation Theory: Brief Narrative Description. *Nursing Education Perspectives*. *36*(5):292-293.

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Clinical Simulation and Learning (NACSL)¹⁰



Clinical Simulation in Nursing (2016) 12, S5-S12





Standards of Best Practice: Simulation

INACSL Standards of Best Practice: SimulationSM Simulation Design

INACSL Standards Committee

Clinical Simulation in Nursing

www.elsevier.com/locate/ecsn

INASCL Standards – NLN/JST



NLN/Jeffries Simulation Theory (NLN/JST)	INACSL
Context: Circumstances, setting and purpose	Criterion 1: Performs a needs assessment
of the simulation (education or evaluation)	
Background: Goals and expectations	Criterion 2: Measurable Objectives
Background: Theoretical perspective	Criterion 3: Format based on purpose &
	theory
• Design: Utilize specific learning objectives	Criterion 4: Design scenario to provide
to guide development/selection of	context for the simulation-based
simulation activities	experience. Include a case or backstory,
 Design: Participant and observer roles, 	participant roles, clinical progression and
progression of activities	time frames
 Participant attributes considered in 	
scenario design	
Design: Physical fidelity - equipment,	Criterion 5: Use of various types of fidelity
moulage	

INASCL Standards - NLN/JST



NLN/JST	INACSL
Design: Conceptual fidelity - predetermined	Criterion 6: Participant centered
facilitator responses	facilitative approach driven by
Simulation experience: Experiential, interactive,	objectives
collaborative, and learner centered	
 Facilitator & educational strategies: Skill, 	
educational techniques, preparation	
Responds to learner needs	
Design: Pre-briefing activities	Criterion 7: Pre-briefing
 Facilitator and educational strategies: Provides 	Criterion10: Preparation material
appropriate feedback	& resources
Background: Access to and allocation of resources	
Design: Debriefing activities	Criterion 8: Debriefing
Facilitator and educational strategies: Provides	
appropriate feedback	



Needs assessment

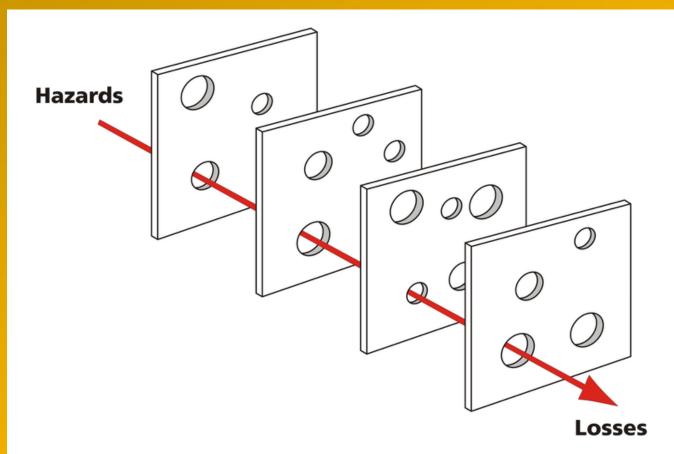
- Review of literature on HAM safety
 - Medication errors
 - 7000 inpatient deaths occur in US hospitals annually from medication errors⁹
 - Increased risk of harm from high alert medications (HAM)
 - HAMs increase risk of causing serious patient harm even when administered correctly
 - Risk increases when associated with a medication error¹⁰
 - HAM errors: 14% and 50% of medication incidents;11-29% occur with administration^{11,12,13}
 - Nurses receive little training on HAM best practices⁴
- Qualitative Research on HAM Safety



- Construct measureable objectives
 - Based on *Quality and Safety Education for Nurses Pre-licensure Competencies*
 - Performs a focused assessment of the client prior to procedure.
 - Interprets data to determine the appropriate nursing actions.
 - Follows policy and procedure regarding administration of high-alert medications.
 - Communicates effectively with the health care team.
 - Prioritizes and implements nursing actions effectively based on client needs.



- Structure the format of a SBL scenario on the purpose, theory, and modality for the simulation-based experience
 - Purpose: Improve safety during HAM administration
 - Theory: Reason's Swiss Cheese Model¹⁶
 - Modality: Mannequinbased Patient Simulation



Swiss Cheese Model

https://commons.wikimedia.org/wiki/File:Swiss_cheese_model_of_accident_causation.png



Design a SBL scenario to provide the context

- NLN simulation design template¹⁷
- Structured written situation and backstory created
- Role cards directing student performance (e.g. nurses, family, unit secretary)
- Clinical progression & cues
- Simulation timeframe allowed for achievement of outcomes
- Evidence based performance measures identified



Name: Keaton, Debra

Gender: F Age: 34 Race: White Weight: 1161b/53kg Religion: None identified Major Support: Sibling Support Phone: 443.518.XXXX Allergies: Apixaban, seasonal allergies Immunizations: UTD Primary Care Provider/Team: Dr. Nyugen Past Medical History: Appendectomy age 9 History of Present Illness:

The patient ran a half-marathon 2 days ago and twisted her right ankle during the last 2 miles. She wrapped the injury with an elastic bandage and applied ice. When she awoke yesterday her right leg was stiff, swollen and warm to the touch. She went to the walk-in clinic where she was diagnosed with a deep vein thrombosis and started on apixaban 10 mg BID for 7 days, then 5 mg BID. Today she noted that she had generalized swelling and hives. She called her PCP and was told to stop the apixaban, take diphenhydramine 50 mg and report to the emergency department. There she had a Doppler ultrasound that showed a DVT in her right femoral vein. Her

Keaton, Debra MRN: 1-222222 ADMISSION ORDERS DOB: 1/2/XX 34-years-old Room: HS 352 Page 1 of 2 1. Attending Physician: Dr. Amy Halter Resident Dr. Brian Simpson Consult: GI Surgery 2. Location:
ICU 🖾 MS Weight: 116 Lb/53 Kg Length: 66 inches_BSA: 3. Admission Dx: Venous Thromboembolism Isolation: Status: X Full Admission Condition:
Stable ⊠ Serious Critical Observation 🗆 Fair 4. Allergies: 🗆 NKDA Allergic to: Apixaban HEPARIN PROTOCAL Keaton, Debra Local Walk-In Clinic DOB: 1/2/XX 34-years-old Date: 1 day ago 1. Patient's weight: Maximum dosing weight -100kg (Dose any patients > 100kg at 100kg IDENTIFICATION: The patient is a 34-year-old female. 2. Bolus Heparin: 80 units/kg = units Maximum 8.000 units for bolus CHIEF COMPLAINT: Right ankle pain HISTORY OF PRESENT ILLNESS: The patient ran a half-marathon vesterday and twisted her right 3. Heparin Infusion: 25,000 units/250 mL D5W or NS (100 units/mL) ankle during the last 2 miles. She continued to walk/run on the ankle in order to complete the race. There Initial infusion rate 18 units/kg/hr = _____ units/hr (_____ mL/hr) were no other injuries. She initially had right ankle pain on the lateral aspect. She wrapped the injury with Maximum 1.800 units/hr an elastic bandage and applied ice. When she awoke today her right leg was stiff and swollen and warm to the touch. She is accompanied by her sister. Her primary care physician is Dr. Nyugen. Laboratory: aPPT, CBC before bolus **REVIEW OF SYSTEMS:** Otherwise negative except as stated above. STAT aPPT 6 hours after initial bolus (and 6 hours after any change) aPPT every 24 hours (once therapeutic) PAST MEDICAL HISTORY: None PAST SURGICAL HISTORY: Appendectomy age 9 5. Adjust Heparin infusion based on sliding scale below: Stop Infusion MEDICATIONS: Norethindrone and Mestranol (Necon 1/50) **Bolus Dose** Rate/Change Repeat ATT PPT for minutes < 35 sec 80 u/kg + 4 u/kg/hr 6 hrs SOCIAL HISTORY: Single. Lives in a condominium. Works for the Department of Energy. There is no 36-45 sec 40 u/kg + 2 u/kg/hr 6 hrs evidence of substance abuse. 46-70 0 (no change) Next AM 0 0 71-90 - 2 u/kg/hr 6 hrs. 0 ALLERGIES: No known drug allergies. Seasonal allergies to grasses and pollen. > 90 sec 60 - 4 u/kg/hr 6 hrs. PHYSICAL EXAMINATION: General: The patient is alert and oriented x 4. Vitals: Within normal limits. The right ankle shows significant swelling and purple ecchymosis. There is significant tenderness to palpation and rotation. The ankle has poor range of motion. The foot is nontender, Vascular: The right leg has generalized non-pitting edema and is warm to the touch. The patient complains of pain when inner aPPT every 24 hours, and readjust Heparin drip as needed. aspect of thigh is palpated. +2/2 dorsalis pedis pulse. Capillary refill less than 2 seconds. A Doppler ultrasound of the right femoral vein indicated presence of an occlusion - possible deep vein thrombosis. ASSESSMENT/PLAN: 1. Right ankle sprain - Discharge the patient home. Continue RICE. 2. Possible deep vein thrombosis - Patient started on Apixaban 10 mg BID for 7 days, then 5 mg BID. Please make changes as promptly as possible and round off to the nearest mL/hr (100 units/hr) 3. If symptoms worsen or patient develops shortness of breath, report to the Emergency Department immediately 4. Follow-up with primary care doctor in 1 week.

Primary Nurse B: Work with Primary Nurse 1 - -+Responsible for assessment, interpretation of diagnostic data, responding to patient's condition, starting heparin drip

Secondary Nurse: Is the co-sign for high-alert medication heparin. Instructed to ignore protocols (e.g. doesn't verify the medication: "states "I am really busy right now", or "Let me just co-sign in the record and I will come back and check it later." Or "I'm going to sign this, I trust you" without verifying the medication.)

Significant Support Person: Role is to be distracting. Asks lots of questions about what is happening. "Why does the patient need to be in the hospital?" "Is the heparin to treat her allergy?" "Won't giving the medication IV make the allergy worse?" "The doctor at the clinic said she did not want to give heparin because it had lots of dangerous side effects, like bleeding." "When can she go home?" Plan interruptions during medication administration.

HEPARIN FLOW SHEET						Keaton, Debra MRN: 1-22222 DOB: 1/2/XX 34-years-old Room: HS 352					
Date/Time	aPTT	N = No	Date/Time	Heparin Held 1 Hour		Heparin	Heparin	Heparin	aPTT to	RN 1 ID #	RN 2 ID #
aPTT	Result	Change	Heparin			Bolus/Unit	Infusion	Infusion	be Drawn		
Drawn		in	Changed			s	Changed to	in mL/Hr	at		
		Heparin					Units/Hr				
		-		From	To						
Admit/0930	26					4240			1530	JM24597	PL 95784
Day 1/1015							954	9.5	1530	SL 11654	MW 69874
Day 1/1615	30		Day 1/1615			4240	1166	11.7	2245	SL 11654	MW 69874

1030

1600

RE 85247 LS 753159

SL 11654 MW 69874

Day 1/2230 37 Day 2/0430 40

Day 2/0945 96

Day 1/2241 Day 2/0500

Day 2/1000

1000

Richard Fowler MO. PH

- 6. Order aPPT 6 hours after any dosing change, adjusting Heparin infusion by the sliding scale until aPPT is therapeutic (46-70 seconds). When 2 consecutive aPPT's are therapeutic, order
 - 7. In the event that an IV Heparin infusion should infiltrate, the following guidelines shall be used. If the IV has been infiltrated less than 4 hours, re-bolus with the amount that would have infused during the time (units per hour x approximate hours infiltrated). If the IV has been infiltrated for more than 4 hours, the physician must be contacted for a restart order.

MD/NP Signature:

- Use fidelity to create the required perception of realism
 - High fidelity mannequin
 - Moulage
 - Used makeup to simulate reddened
 area for DVT
 - Sewed bubble wrap between two ace bandages to wrap the injured ankle
 - Wig and makeup to simulate a female





- Cognitive Pretesing
 - Two master's prepared ICU nurses pretested the SBL scenarios
 - Needed to develop:
 - Electronic medical record
 - Electronic medication administration system with bar-code scanning



- What was of value to you in this scenario?
- What do you wish you knew prior to the simulation experience?
- What do you wish you knew about the Simulation Lab and equipment prior to the simulation experience?
- Were the expectations of what you would be doing in the simulation made clear before you started the scenario?
 - Were the objectives clear? Why or why not?
- How did the preparation actives help you prepare for the simulation?
 - How would you enhance these activities?
- What challenges did you experience when completing the simulation?
 - o What can we do to fix these for future students?
 - Describe the challenges you experienced working with the SimMan[™].
 - What equipment do you wish you had that was not available to you during the scenario?
- How could the room be made to simulate a more realistic environment?
- Was there enough information in the patient's medical record for you to provide safe patient care?
 - What information needs to be added to the patient record so that you feel you could provide safe patient care?
 - What information could be removed from the patient record?
- What about the scenario was realistic? What was not realistic?
- In what ways did the scenario match the objectives? Where could the objectives be enhanced?
- What was the scenario was asking you to do?
- In what ways did the scenario require you to use your nursing judgment to care for the patient?
- In what ways did you feel supported during the scenario? How could support be enhanced?
- In what ways was the scenario realistic? How could realism be enhanced?
- Please describe the impact of the debriefing experience. How was it effective? What could have been improved?
- Describe your level of comfort during debriefing. What would have increased your level of comfort?
- In what ways did the debriefing discussion add to your understanding of caring for a patient receiving a high-alert medication?
- What were the most important things you learned about safely administering a high-alert medication during the scenario and debriefing?
- In what ways did this experience affect your ability to safely administer highalert medications?
- Overall, how could this learning experience be improved?

 Students' iterative evaluation of SBL scenarios

- Groups of six
- Focus groups
- Revisions made based on each simulation groups feedback
 - Multiple revisions to Heparin Protocol and Flow Sheet



Facilitative approach

- Facilitator SEL II trained
- Scripted report
- Built in learner cues
- Communication cues designed based on

Report Students Will Receive Before Simulation

Time: 1000

PMH: Ms. Keaton is a 34-year-old female who works for the Department of Energy as a Human Resources Specialist. Her past medical history is unremarkable except for an appendectomy at age 9. She took up running 4 years ago and tries to run a marathon at least every other month. She does not take any medications except for acetaminophen and NSAIDs PRN for muscle pain, and norethindrone and mestranol (Necon 1/50) daily for birth control.

Report:

Situation: Ms. Keaton has a right femoral DVT and is being admitted to your medical/surgical unit for heparin therapy.

<u>Background:</u> The patient ran a half-marathon 2 days ago and twisted her right ankle during the last 2 miles. She wrapped the injury with an elastic bandage and applied ice. When she awoke yesterday her right leg was stiff, swollen and warm to the touch. She went to the walk-in clinic where she was diagnosed with a deep vein thrombosis and started on apixaban 10 mg BID for 7 days, then 5 mg BID. Today she noted that she had generalized swelling and hives. She called her PCP and was told to stop the apixaban, take diphenhydramine 50 mg and report to the emergency department. There she had a Doppler ultrasound that showed a DVT in her right femoral vein. Her D-dimer was elevated. She received a heparin bolus in the ED and is being admitted for heparin therapy since it appears she is allergic to apixaban. She also took ibuprofen this morning for her ankle pain.

<u>Assessment:</u> Lungs are clear, heart rate is regular, and vital signs are within normal limits. She rates her pain as 2/10. She has a #18 IV SL in her right AC that was placed around 0900 and remains patent. She is drinking well. She received a heparin bolus of 4,240 units at 0915 this morning. Her PT, aPTT and INH are within normal ranges.

<u>Recommendation</u>: Pharmacy received the order for the heparin drip and will be sending the IV heparin to your floor. Once the drip is started she will need an <u>aPTT</u> in six hours.

INASCL – Criterion 7 & 10





Evidence-informed practice at the point of care

Intravenous Heparin Infusion

11 January 2016

10 Provide preparation materials and resources

- Textbook resources
- Intravenous Heparin Infusion (2016). JBI Recommended Practice: IV Heparin Infusion¹⁸

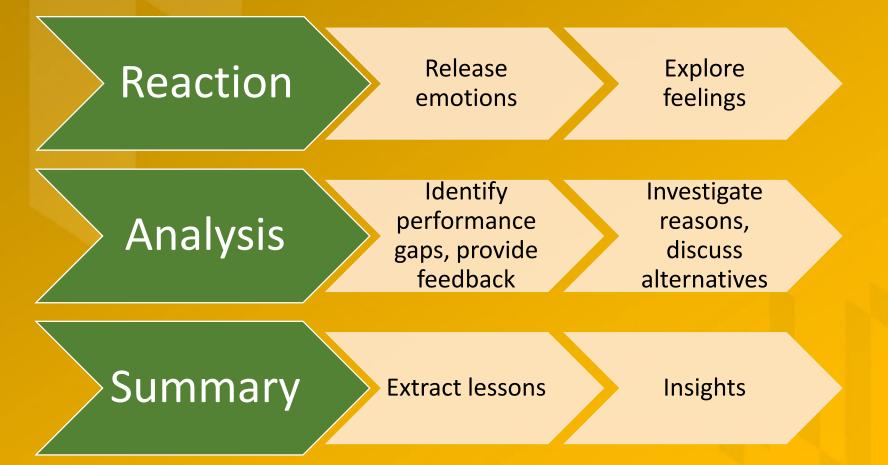
7 Prebriefing

- Simulation orientation
- Scripted pre-brief topics based on objectives



Debriefing

• The Reaction, Analysis, and Summary¹⁹ method used for debriefing



INASCL – Criterion 9 & 11



#9 Evaluation

- •SBL Quality outcomes measured with:
 - •Simulation Design Scale (SDS)²⁰
 - Debriefing Assessment for Simulation in Healthcare (DASH)²¹
 - Focus group feedback
- Participant outcomes Focus groups "what did you learn?"

11 **Pilot test** simulation-based experiences

Outcome Findings - Quantitative



- Participants rated the simulations highly!
 Simulation Design Scale (0-5)
 Sim 1: M = 4.86, SD = .4
 Sim 2: M = 4.86, SD = .422
- Debriefing Assessment for Simulation in Healthcare (0-7)
 - Sim1: M = 6.84, SD = .476
 - Sim 2: M = 6.86, SD = .410

Outcome Findings – Qualitative



Participant Learning

- "I liked the affirmation that it's okay to say, 'Hold on. Let's take a moment. This is time that I need for my patient.'... Like the unit secretary comes over and says, 'Hey, we need you', and it's okay to be like, 'This is my priority right now', be able to prioritize your patient, make sure that you don't make mistakes..."
- "I feel like also as a new nurse, I would think, 'Oh, if I have to ask them repeatedly to check it, they might think I'm incompetent.' I feel like it'd be easy to feel like that when you're new."
- "We're so busy in nursing school. So, if I'm going to spend time doing something, I want to make sure it's going to be worth my time. And this, I felt like it was, because a lot of the things were realistic, like adding in the distractions and making things real like the nurse being too busy."

Questions?





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