Dosage miscalculations at the point of care: An innovative look at why

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Conflict of Interest

–Tonya Schneidereith reports no conflict of interest

–Julia Greenawalt (INACSL Conference Administrator & Nurse Planner) reports no conflict of interest

–Leann Horsley (INACSL Lead Nurse Planner) reports no conflict of interest
Successful Completion

- Attend 90% of session
- Complete online evaluation
Objectives

Upon completion of this presentation, participants will be able to:

1. Illustrate the most recent available statistics on medication errors in the United States.
2. Demonstrate the technology and perspective of recorded video from Google glass.
3. Illustrate remedial mathematical errors.
4. Formulate effective strategies to improve dosage calculation proficiency at the point-of-care.
Background

• The AHRQ (Agency for Healthcare Research and Quality) defines an adverse drug event (ADE) as “harm experienced by a patient as a result of exposure to a medication” [1]
  - 700,000 ED visits and 100,000 hospitalizations every year
  - Affect 5% of hospitalized patients
  - Associated with “medication error” that can occur anywhere along the pathway from prescription to administration
• Incorrect medication administration, can be linked to bedside nursing issues such as forgetting doses, giving additional doses, or giving incorrect doses.

Rights of medication administration

- Students taught aspects of safe medication administration through the use of the 5 Rights:
  - Right patient
  - Right time
  - Right route
  - Right medication
  - Right dose
Dosage calculation requirements

- To address medication administration, nursing curricula typically add a dosage course at the beginning of nursing clinical courses.

- At SU, students take NURS 200: Dosage during the first semester of the junior year.

- For the following semesters and prior to the start of clinical rotations, students must pass paper-and-pencil dosage exams with 100% accuracy.

- This procedure lead faculty to believe that students possess the mathematical skills necessary for safe medication administration.
Medication Administration
Research

- Longitudinal study showed students become less rigorous with safety checks as they near graduation.
- Students would take prolonged periods of time in simulation to calculate dosages, but couldn’t see why.
- Google glass provided a unique perspective.
Google glass
Google Glass Technology

- Videos recorded in simulation using Google Glass (GG) technology revealed students’ inability to correctly calculate infusion rate and medication dosage.

- In fact, 30% of senior students made egregious calculation errors in simulation and proceeded to administer medication incorrectly during the simulation scenario.

- The views provided by the GG videos showed the miscalculations and a new perspective on students’ real time thought processes and deficient math skills.
Two main problems

Google glass revealed two main problems:

1. Students did not correctly identify when to convert kilograms to pounds or vice versa in order to determine the weight necessary for correct calculations.
2. Students lacked sufficient knowledge to appropriately determine needed information to extract for mathematical calculation.
Problem 1: Weight conversions

• Daisy Simms is a 19 kg, 18 month-old female admitted for RSV bronchiolitis. She is written for SoluMedrol 0.5 mg IV q 6h (0.11 mg/kg/day).

• As part of the 5 Rights safety checks, students should verify that the written dose is within the safe dose range for the patient.
Daisy Simms is a **19 kg**, 18 month-old female admitted for RSV bronchiolitis. She is written for SoluMedrol 0.5 mg IV q 6h (**0.11 mg/kg/day**).

\[
19 \times 0.11 \text{ mg per day} = 2.09 \text{ mg per day}
\]

\[
2 \text{ divided by 4 (every 6 hours)} = 0.5 \text{ mg per dose}
\]

Therefore, this dose is safe for the patient.
Daisy Simms is a 19 kg, 18 month-old female admitted for RSV bronchiolitis. She is written for SoluMedrol 0.5 mg IV q 6h (0.11 mg/kg/day).

- However, multiple times, the students would divide 19 kg by 2.2
- A conversion is necessary when needing to convert pounds to kilograms.
  - The weight was already in kilograms, so no conversion was necessary
  - To convert kilograms to pounds, the student should **multiply** the kilogram weight by 2.2 to calculate the weight in pounds.
• The calculations made to convert the weight led to an incorrect dosage.

• Students lacked confidence in their calculations, leading to frustration, delays, and an inability to critically appraise what should be done next.
Problem 2: Extracting information

Setting-up equations for dosage problems:

• Students learn to set-up dosage calculations using a "desired over have" proportional fraction.

• For example:
  Mr. Jones is ordered to receive 50 mg of Digoxin by mouth twice a day. Digoxin is supplied as 25 mg tablets.

• Desired = 50mg  Have = 25 mg

• Therefore, 50 mg/25 mg = 2 tablets
• When the problems became more complicated, students couldn't correctly extract the data needed to solve the equation.

• For example:
  Daisy Simms is ordered for Methylprednisolone 40 mg diluted in 10 mL Normal Saline. This medication is to infuse in a syringe pump over 15 minutes. The pump can only be set for an hourly rate. At what rate should the pump be set?
Necessary Information:

Daisy Simms is ordered for Methylprednisolone 40 mg diluted in 10 mL Normal Saline. This medication is to infuse in a syringe pump over 15 minutes. The pump can only be set for an hourly rate. At what rate should the pump be set?

\[
\frac{60 \text{ minutes}}{15 \text{ minutes}} = 4 \quad 10 \text{ mL} \times 4 = 40 \text{ mL/hour}
\]
• Some of the miscalculations set the infusion rate at:
  – 60 ml/hr
  – 10 mL/hr
  – 0.44 mL/hr
  – 0.66 mL/hr
What was learned…

• So, while nursing faculty have ensured dosage competency through paper and pencil examinations, students cannot correctly calculate dosages at the point of care.
• Students are extracting data to use for "desired over have" fraction, but don't always know the correct information to insert in the formula.
• The inability to calculate dosages extends into the classroom with many students unsuccessful on dosage questions embedded in course examinations.
• However, students may not be mathematically deficient.
• Instead, students may lack the ability to critically appraise and correctly extract data to use in the calculations.
Effects on Nursing Education

• Medication administration and dosage calculation will move into a lab setting and out of the classroom. This should provide more real-world application of skills necessary for safe administration.

• Reviewing relevance of content included on dosage exams that is no longer required in the clinical setting (ie-drip calculations).

• Smart pumps and electronic ordering systems make some point-of-care calculations obsolete.

• Will continue to talk with hospital administrators to discuss information needed for successful transition to practice and modify the dosage course as appropriate.
References


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Questions and Discussion
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