

# Incorporating Quantitative Reasoning in Your Course: Examples From Across Disciplines

Northern Essex Community College

## Presenters:

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**Ellen Wentland** – Associate Dean, Academic and Institutional Effectiveness

# NECC's Core Academic Skills

- Oral Communication
- Written Communication
- Global Awareness
- Information Literacy
- Quantitative Reasoning
- Science and Technology

# Process: Creating Core Skills Intensive Courses

- Faculty submit applications
- Each application includes:
  - ✓ Skill definition
  - ✓ Intensive course criteria
  - ✓ VALUE rubrics derived learning outcomes to be included on course syllabi

# Quantitative Reasoning

Students will learn to interpret and manipulate quantitative information and apply mathematical concepts and skills to solve real-world problems.

# Diversity and Multiculturalism in Education

Euthemia I Gilman, Ed.M.

# Quantitative Literacy Value Rubric

## QL Rubric

- Interpretation
- Representation
- Calculation
- Application/Analysis
- Assumptions
- Communications

## Diversity & Multiculturalism

- DESE School/District Profiles
- School/District Improvement Plans
- Compliance of Accommodation Services
- Action Plans, District Reviews
- District Analysis, Review

# Interpretation

- Explain trend data shown in graphs and make reasonable predictions regarding what the data suggest about future events
- **The Condition of Education 2012**
- Indicator 6 Racial/Ethnic enrollment in public schools
- Indicator 7 Family Characteristics
- **DESE School district Accountability 2012**
- Andover, North Andover
- Haverhill
- Lawrence
- Methuen
- Pentucket Regional (Groveland, Merrimac, West Newbury)

# Interpretation

- Explain trend data shown in graphs and make reasonable predictions regarding what the data suggest about future events
- Global Awareness
- **The Condition of Education 2012**
- Indicator 23 Reading Performance
- Indicator 24 Mathematics Performance
- Indicator 25 History, Geography, Civics Performance
- Indicator 26 International Reading, Math, Science Proficiency



# Representation

- Converts information into an insightful mathematical portrayal that contributes to a deeper understanding
- Demographic information ( median household income, household/family size, racial make-up)
- Development of possible trends
- Development of possible challenges for schools

# Calculation

- Clear and concise attempts to solve problems
- Accuracy of data source
- Budget projections
- Title I School Improvement Plans
- Charter School application
- Innovative School Planning

# Application/Analysis

- Qualitative analysis data used to base judgments, draw conclusions
- **The Condition of Education 2012**
  - Indicator 12 Characteristics of Elementary/Secondary Schools
  - Indicator 13 Eligibility for Free/Reduced Lunch
  - Indicator 14 School Crime and Safety
- **District and School Improvement Plans**

# Assumptions

- Ability to make and evaluate important assumptions in estimation, modeling and data analysis
- Global Awareness
- **The Condition of Education 2012**
  - Indicator 17 /18 Characteristics of Teachers/Administrators
  - Indicator 19 Public School Revenues
  - Indicator 20 Public School Expenditures
  - Indicator 21 Variations in Instruction Expenditures
  - Indicator 22 Education Expenditures by country

# Communication

- Expression of quantitative evidence in effective format
- Small Group written/oral presentation to simulate School Staff
- Individual written responses
- Final Projects

# Anatomy and Physiology I & II

Maria Carles, Associate Professor

# The Nervous System and Drugs

## How drugs affect the nervous system

Adapted from Biology by Sylvia Mader's in class activities  
(McGraw-Hill)

# Activity Objectives

During this activity the students will:

- Explain the basic modes of action of several drugs and chemicals that affect the central nervous system
  - **Interpretation**
  - **Communication**
- Draw a graph that demonstrates the effect of organophosphates and carbamates on acetylcholine esterase activity
  - **Calculation**
  - **Interpretation**
  - **Representation**
  - **Application/analysis**
  - **Assumptions**



## Activity Objectives (continued)

- Demonstrate understanding of the action of benzodiazepines by explaining how those could be used in a sinister/illegal fashion as a “date rape” drug.
  - Interpretation
  - Communication
  - Analysis

# The Nervous System and Drugs

- Students will work in groups of four
- Students will assume the role of a student in the process of finishing a pharmacy technician program
- Reinforce and understand the modes of action of certain drugs and chemicals in the CNS using examples that may be familiar to the students
- Students will be called on to present their group's answers to class.

# Activity

- How do Selective Serotonin Reuptake Inhibitors (SSRIs) work?
- Rationale for using carbamates as Alzheimer's treatment.
  - Graph of AChE activity vs. OP or carbamate concentrations.
- Effect of benzodiazepines on CNS
  - Explaining how those could be used in a sinister/illegal fashion as a “date rape” drug.

# How do Selective Serotonin Reuptake Inhibitors (SSRIs) Work?

- Inhibit transporter that takes up the serotonin that is released from serotonergic nerve terminals, so that **serotonin** stays in the synaptic cleft **longer** and has an effect on expression of post synaptic receptors.
- SSRIs are used to treat depression.

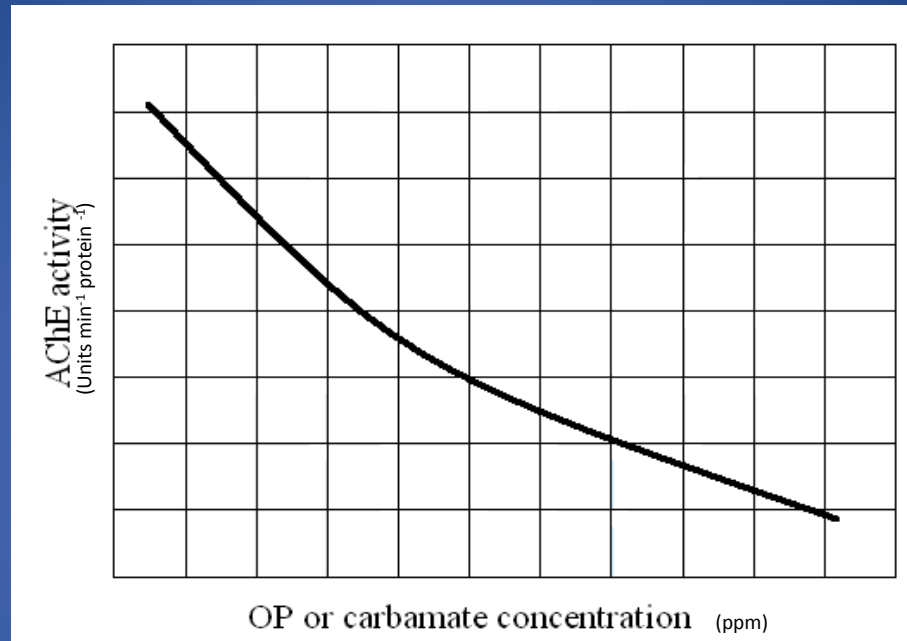
Decipher and explain information presented in words

# Rationale for Using Carbamates as Alzheimer's Treatment

- Alzheimer's dementia is often associated with a decrease in activity in CNS neurons that are stimulated by acetylcholine.
- Carbamates block AChE and increase acetylcholine concentration in the synaptic cleft.
- “The dose makes the poison” – Low Dose.
- Increase acetylcholine concentration at the synapse to counteract the loss of cholinergic neurons. Just a treatment for symptoms.

Successfully perform calculations required to solve a given problem.

# Graph of AChE Activity vs. OP or Carbamate Concentrations



Convert relevant information into mathematical forms, interpret and evaluate data, use quantitative information to support assertions and/or to solve real world problems.

# Effect of Benzodiazepines in CNS

- GABA is an inhibitory neurotransmitter, causes neurons to become hyperpolarized → less likely to initiate action potential → calming effect.
- Drugs such as Valium, Xanax act on GABA receptors and intensify the effect.
- Rohypnol is 10X more potent → extreme sedation and amnesia → Date Rape Drug

Use quantitative information to support assertions and/or to solve real world problems

# Macroeconomics & Microeconomics

Patricia Machado, PhD  
Associate Professor of Economics  
Program Coordinator for Liberal Arts  
Northern Essex Community College



# Sample Lessons

- **Macroeconomics – Does the Penny Make Cents?**
  - **Interpretation**
  - **Representation**
  - **Application/analysis**
  - **Assumptions**
  - **Communication**
  
- **Microeconomics – Cash-Strapped Farmers Feed Candy to Cows**
  - **Interpretation**
  - **Representation**
  - **Application/analysis**
  - **Communication**

# Sample Lessons (continued)

- Macroeconomics example of calculation:
  - $GDP = C + I + G + (X - M)$
  - Did you know that 70% of the US Economy is driven by C? Does anyone know what C stands for?
- Microeconomics example of calculation:
  - $PED = \% \text{ change in QD} / \% \text{ change in P}$
  - In other words, change in QD divided by average Q all divided by change in P divided by average P

# Summary of Quantitative Reasoning Selection

- Northern Essex Community College focus on Core Academic Skills
- Global Awareness, Writing, Information Literacy
- Natural Fit to Quantitative Reasoning
- Inherent versus Intentional
- Intentionality raises the importance of Quantitative Reasoning, Core Academic Skills, and Quantitative Literacy Value Rubric

# **EMT 104 Pharmacology for the Paramedic**

Rory S. Putnam, AA, NREMT-P, I/C

# Quantitative Reasoning Principles in EMT 104

- Demonstrate the ability to administer medications safely and effectively within the scope of practice for a paramedic including successfully performing drug calculations required to solve a given problem.
- Use quantitative information to support assertions and/or to solve real world math problems relevant to pharmacology and drug calculations.

# Principles (cont'd)

- Convert relevant information into various mathematical forms such as equations, diagrams and tables specifically related to drug calculations including charts and equations/formulas for medication administration dosing.
- Use Metric/English math system calculations in terms of drug administration, patient weights and other pharmacological applications.

# Drug Dosage Calculations

- What we cover:
  - The metric system & equivalents to English system
  - Common conversions
  - Multiplying and dividing fractions
  - Equivalencies and determining parts
  - Understand and interpret statistical data related to pharmacokinetics (action of drugs, efficacy rates, etc.), factors altering drug responses (half-lives), etc.



# More...

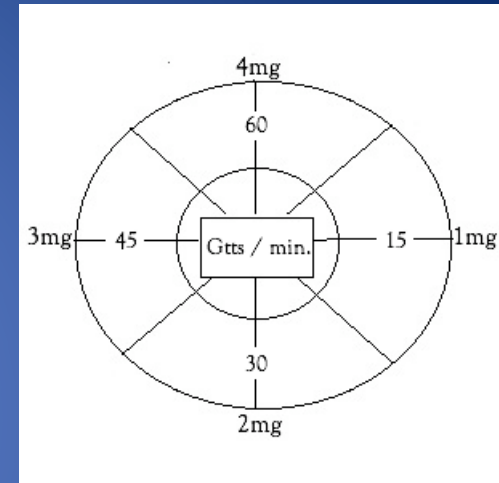
- Methods (equations) for figuring:
  - Patient weights based on metric (kg from lbs)
  - Medication and fluid infusion (drip) rates
  - Medication doses for single administration (IV, PO, SL, etc.)
  - Medication dose by weight
  - Medication dose by time (mg/min)



- All of these include a multi-part mathematical equation for the student.
- They must be able to determine:
  - The dose for the patient
  - How it is to be administered
  - What the concentration of the medication is on hand
  - How to achieve the desired dose

# EMT 104...by the numbers!

- Medication administration charts are also used to avoid lengthy calculations & drug errors to simplify the paramedic's job.
- Example: the Lidocaine or dopamine clock
- Medication dose charts



## Dopamine (Intropin) 2 - 20 mcg/kg/min

**A mixture of 400 mg Dopamine in 250 ml = 1,600 mcg/ml**

mcg/kg/ minute	Patient's Weight in Kilograms											
	2.5	5	10	20	30	40	50	60	70	80	90	100
2 mcg	-	-	1	2	2	3	4	5	5	6	7	8
5 mcg	-	1	2	4	6	8	9	11	13	15	17	19
10 mcg	1	2	4	8	11	15	19	23	26	30	34	38
15 mcg	1	3	6	11	17	23	28	34	39	45	51	56
20 mcg	2	4	8	15	23	30	38	45	53	60	68	75

With a 60 drop per ml drip set this is the number of drops/minute (or ml/hr)

**Observe for extravasation - swelling, pallor, pain, etc. at IV site.**

# How do we do it?

- Classroom discussions and exercises
- Real world scenarios in lab exercises
  - Meds math
  - IV stations
  - Medication stations
  - ‘Megacode’ stations (‘putting it all together’)
- Quizzing and testing
- Evaluation based on QR learning and outcomes criteria