MLT-1352: PROBLEM SOLVING TECHNIQUES FOR THE MEDICAL LABORATORY

Cuyahoga Community College

Viewing: MLT-1352 : Problem Solving Techniques for the Medical Laboratory

Board of Trustees:
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Academic Term:
Fall 2025

Subject Code
MLT - Medical Laboratory Technology

Course Number:
1352

Title:
Problem Solving Techniques for the Medical Laboratory

Catalog Description:
This course explores the vital role of quality assurance in the medical laboratory. Students will gain experience in formula evaluation, unit analysis, conversions, dilutions, and concentration calculations specific to clinical usage. Through problem-solving exercises and case studies, students will develop the skills to apply statistical methods to quality control and data analysis in a medical laboratory setting.

Credit Hour(s):
1

Lecture Hour(s):
1

Requisites

Prerequisite and Corequisite
MLT-1001 Introduction to Medical Laboratory Science and MATH-1410 Elementary Probability and Statistics I or higher level mathematics course.

Outcomes

Course Outcome(s):
A. Explain the system of measurements used in the lab and perform conversion.

Objective(s):
1. Compare and contrast the metric, standard, and US customary systems.
2. Perform conversions between systems of measurement.
3. Apply dimensional analysis to unit conversions.

Course Outcome(s):
B. Describe concentrations and perform solution concentration calculations.

Objective(s):
1. Define solution, solvent, solute, diluent, concentration, and dilution.
2. Define molarity, molality, and normality.
3. Perform conversions between molarity, molality, normality, and percent.
4. Explain the difference between dilution and ratio.
5. Calculate concentration when performing tube and serial dilutions.

6. List and describe the three grades of water used in the clinical laboratory.
7. Explain the proper way to reconstitute lyophilized and mix two part reagents, controls, and standards.

Course Outcome(s):

C. Review statistic fundamentals and perform basic statistical calculations used in quality control.

Objective(s):

1. Define and calculate mean, median, mode, standard deviation, coefficient of variation, variance, correlation coefficient, confidence limits, and reference intervals.
2. Perform statistical calculations on data sets.
3. Discuss data distributions and the Central Limit Theorem.

Course Outcome(s):

D. Explain the use of quality assurance and control in the medical laboratory.

Objective(s):

1. Define standards, controls, reagents, and calibrators.
2. Compare and contrast quality assurance and quality control.
3. Differentiate between internal and external quality control programs.
4. Describe proficiency testing conducted in the laboratory.
5. Explain competency-based training.
6. Identify the three testing phases and describe common errors associated within each phase.
7. Identify the two different types of errors.
8. Describe common sources of laboratory error, apply root cause analysis to identify their origins, and discuss common troubleshooting techniques.
9. List and describe the three grades of water used in the clinical laboratory.
10. Discuss corrective actions and their importance in the laboratory.
11. Describe the concept of continuous improvement in quality assurance.

Course Outcome(s):

E. Demonstrate critical thinking and problem-solving skills to identify, analyze, and resolve quality assurance and control issues.

Objective(s):

1. Define critical thinking, problem-solving, and decision-making.
2. Describe the importance of evidence-based reasoning and data analysis.
3. Explain Root Cause Analysis (RCA) and use it in problem-solving.
4. Describe and explain how to use the PDCA cycle.
5. Demonstrate the ability to identify the source of problems.
6. Discuss effective solutions to address identified problems using the PDCA cycle.
7. Apply critical thinking skills to evaluate the outcomes of problem-solving strategies.
8. Analyze and compare different courses of action, considering their potential impact on quality, patient safety, and laboratory efficiency.
9. Select and rationalize an appropriate solution to a problem based on evidence and sound reasoning.
10. Communicate the analysis and proposed solutions effectively to colleagues.
11. Identify common barriers and challenges to effective problem-solving.
12. Discuss the importance of collaboration and seeking diverse perspectives in problem-solving.

Course Outcome(s):

F. Create Levy-Jennings charts and apply the Westgard Multirules to determine quality control.

Objective(s):

1. Explain how Levy-Jennings charts are created and used in laboratory quality control.
2. Create Levy-Jennings charts using control data.
3. Identify patterns on Levy-Jennings charts.
4. List and define the Westgard Multirules for both 2 and 3 levels of control.
5. Correlate shifts and trends to sources of error.
6. Apply the appropriate Westgard Multirules to Levey Jennings Charts to determine if quality control runs are acceptable.
7. Troubleshoot common control issues in both automated and manual testing, identifying potential causes and explaining the appropriate corrective actions to implement.

Course Outcome(s):

G. Demonstrate comprehension and understanding of standard operating procedures (SOPs) by accurately interpreting them to perform various laboratory techniques safely and effectively.

Objective(s):

1. Demonstrate comprehension and understanding of standard operating procedures (SOPs) by accurately interpreting them.
2. Identify key regulatory and safety guidelines relevant to SOP development and implementation in the laboratory setting.
3. Explain the importance of SOPs in standardizing laboratory practices, ensuring consistency, and minimizing errors.
4. Discuss the value of SOPs in promoting a safe and efficient laboratory environment for both patients and laboratory personnel.

Methods of Evaluation:

1. Written assignments
2. Projects
3. Discussions
4. Case studies
5. Quizzes
6. Exams

Course Content Outline:

1. Systems of measurements
    a. Metric
    b. Standard
    c. US customary
    d. Conversions
    e. Dimensional analysis
2. Concentrations
    a. Reagent grade waters
    b. Solutions
    c. Solvent
    d. Solute
    e. Concentration
    f. Diluent
    g. Dilution
        i. Tube dilution
        ii. Serial dilution
    h. Ratio
    i. Molarity
    j. Molality
    k. Normality
    l. Percent
3. Statistics
    a. Mean
    b. Median
    c. Mode

   d. Standard deviation
   e. Coefficient of the variable
   f. Variance
   g. Correlation coefficient
   h. Confidence limits
   i. Reference intervals
   j. Gaussian Distribution
   k. Central limit theorem
   l. Graphs
   m. Charts
4. Quality Assurance
   a. Competency-based training
   b. Corrective action
   c. Validation
   d. Implementation
   e. Process improvement
   f. Look back
5. Quality Control
   a. Standards
   b. Controls
   c. Calibrators
   d. Internal quality control
      i. Calibration
      ii. Maintenance
      iii. Traceability
      iv. Audits
      v. Inspections
   e. External quality control
      i. Proficiency testing
   f. Testing phase errors
      i. Preanalytical
      ii. Analytical
      iii. Postanalytical
   g. Common error types
      i. Random
      ii. Systemic
   h. Common sources of errors
   i. Error prevention
   j. Corrective action
6. Problem-solving
   a. Critical thinking
      i. Data
      ii. Biases
      iii. Logic
   b. Root Cause Analysis (RCA)
   c. Plan, Do, Check, Act (PDCA)
   d. Decision making
      i. Collaboration
      ii. Communication
      iii. Matrices
      iv. Trees
      v. Cost-benefit analysis
      vi. Impact analysis
   e. Levey Jennings charts
      i. Construction
      ii. Patterns
   f. Westgard multirules

i. Applications
ii. Shifts
iii. Trends

7. Standard Operating Procedures (SOP)
   a. Standardization
   b. Regulatory
   c. Safety
   d. Efficiency
   e. Reproducibility
   f. Interpretation

Resources

Boss, Judith A. *Think: Critical Thinking and Logic Skills for Everyday Life*. 5th ed. New York City:McGraw-Hill Education, 2020.

Bowell, T., Cowan, R., & Kemp, G. *Critical thinking: A concise guide*. 5th ed. London:Routledge, 2019.

Doucette, Lorraine. *Mathematics for the Clinical Laboratory*. 4th ed. St. Louis, MO:Elsevier, 2020.

Harmening, Denise M. *Laboratory Management, Principles and Processes*. 4th Ed. St. Louis, MO: D.H. Publishing & Consulting, 2020.

Turgeon, Mary Louise. *Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications*. 9th ed. St. Louis: Elsevier, 2022.

Resources Other

Westgard, James. 2023. Westgard QC. 9 Sept. 2024 http://www.westgard.com/

ASCP. July 2023. Medical Laboratory Technician, MLT(ASCP) Examination Content Guideline. 9 Sept. 2024. https://www.ascp.org/content/board-of-certification#

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