Standard Precautions for the Laboratory

Course
Medical Microbiology

Unit II
Laboratory Safety and Infection Control

Essential Question
How do we prevent illness while handling microbes?

TEKS
130.207(c)1A, 2FG

Prior Student Learning
-History of Microbiology
-Intro to Microorganisms

Estimated time
Key Points and Term Review: 40-60 min

Lab: 30 min initial, 24-48 hr growth and 30 min follow up.

Total: 2-4 hrs

Rationale
Standard precautions and good safety techniques must be practiced by all health care professionals to prevent the spread of disease.

Objectives
Upon completion of this lesson, the student will be able to:
- Comply with standard precaution measures
- Demonstrate safe practices in laboratory investigations and fieldwork

Engage
Show the attached sneeze photo on the page below or at the following link.
http://phil.cdc.gov/phil/details.asp?pid=11161
Ask students to describe some ways we can limit the spread of communicable (or infectious) diseases? (Record responses on the board.)
Now think about some of the ways we will be handling microorganisms in our classroom lab this year. Often times we will handle organisms that are in a more concentrated form than the sneeze you see pictured here. Today we are going to learn some basics called, Standard Precautions, to help keep us safe and limit unnecessarily spreading bacteria and other organisms.

Key Points
I. Key terms
   A. Asepsis: the state of being free of living pathogenic microorganisms or the process of removing pathogenic microorganisms or protecting against infection by such organisms
   B. Standard precautions: guidelines recommended by the Centers for Disease Control and Prevention for reducing the risk of transmission of blood-borne and other pathogens in hospitals
   C. Biohazard: anything that is a risk to organisms, such as ionizing radiation or harmful bacteria or viruses
   D. Carriers // fomites: an inanimate object or material on which disease-producing agents may be conveyed
   E. Nosocomial infection: an infection that can be acquired in a hospital that maybe evident up to 72 hours after leaving the hospital

II. Standard precautions have been established as infection control guidelines to prevent the spread of infection and to ensure the safety of health care professionals.
   A. They are guidelines recommended by the Centers for Disease Control and Prevention for reducing the risk of transmission of blood-borne and other pathogens in hospitals. The standard

precautions synthesize the major features of universal precautions (designed to reduce the risk of transmission of blood borne pathogens) and body substance isolation (designed to reduce the risk of pathogens from moist body substances) and apply them to all patients receiving care in hospitals regardless of their diagnosis or presumed infection status.

1. Standard precautions apply to
   a. blood
   b. all body fluids, secretions, and excretions *except sweat,* regardless of whether or not they contain blood;
   c. non-intact skin
   d. mucous membranes
2. The precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospital

B. Universal Precautions are the method of infection control — recommended by the CDC — in which all human blood, certain body fluids, as well as fresh tissues and cells of human origin are handled as if they are known to be infected with HIV, HBV, and/or other blood-borne pathogens

III. Safety practices in laboratory investigations include the proper handling of medical equipment, supplies, and bio hazardous materials and their proper disposal.

A. There are four main disposal options in the microbiology lab.
   1. Biohazard Sharps containers – used for anything that could puncture a plastic bag that has been visibly soiled
   2. Biohazard Bag s– or ‘red’ bags – used for anything visibly soiled with blood, body fluids, or soiled with microorganisms; locations pay for disposal and autoclaving of sharps, biohazard bags and tissue samples; check with local labs to see if they have more specific rules for what is discarded in these containers
   3. “Regular” trash – any normal trash or things that are not visibly soiled, i.e., gloves or masks used but not soiled; some labs put anything in contact with microorganisms into the biohazard bag
   4. Reusable supplies – often sent through an autoclave under very high temperature and pressure from steam to sterilize; some items may be laundered in high temperatures to properly disinfect them

B. What would you do to properly dispose of the following supplies?
   1. used phlebotomy (to draw blood) needle
   2. used gram stain glass slide
   3. disposable gloves visibly soiled
   4. disposable mask used by a lab tech for 1 day
   5. cloth lab coat used in microbiology for a week

6. metal forceps used to place discs on agar plates of bacteria
7. papers used last week in the micro lab that are no longer needed
8. (key: a-sharps, b-sharps, c-red bag, d-trash, e-laundered, f-autoclaved, g-trash)

C. Give students several possible situations and have them brain storm solutions that are both safe and cost effective. Some ideas may include how to clean an operating room after a procedure, how to dispose of used lab supplies, how to dispose of linens from a patient room that had a contact precaution, or how to properly dispose of tissue samples after testing is complete. (We will go into detail of autoclaving and disinfecting in the following lesson: Analysis of Current Infection Control Measures)

D. **Teacher Note:** Ask a local hospital or hospital lab for a copy of some of their safety protocols and biohazard disposal practices

IV. Federal and state regulatory agencies have established guidelines for the prevention of disease transmission.

A. Occupational Safety and Health Administration (OSHA), www.osha.gov With the Occupational Safety and Health Act of 1970, Congress created the Occupational Safety and Health Administration (OSHA) to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. See the following link, http://www.osha.gov/dsg/topics/safetyhealth/index.html, for their Injury and Illness Prevention Programs with links to state specific programs. Texas linked program is at, www.tdi.texas.gov/oshcon/index

B. Centers for Disease Control (CDC), http://www.cdc.gov Collaborating to create the expertise, information, and tools that people and communities need to protect their health – through health promotion, prevention of disease, injury and disability, and preparedness for new health threats. CDC seeks to accomplish its mission by working with partners throughout the nation and the world to monitor health, detect and investigate health problems, conduct research to enhance prevention, develop and advocate sound public health policies, implement prevention strategies, promote healthy behaviors, foster safe and healthful environments, provide leadership and training. See notes above about the CDC safety practices specifically in the standard and universal precautions. More information on different levels of transmission based precautions at the following link: http://www.cdc.gov/HAI/settings/outpatient/basic-infection-control-prevention-plan-2011/transmission-based-precautions.html

C. Environmental Protection Agency (EPA), www.epa.gov Their mission is to protect human health and the environment. Learn more about the issues of health and safety at this link: http://www.epa.gov/gateway/learn/health.html

D. Texas Department of Health, http://www.dshs.state.tx.us/ Vision**:** A Healthy Texas; Mission**:** To improve health and well-being in Texas. Source for local health support, questions and surveillance. See the following link for week by week updates of Texas Flu cases. http://www.dshs.state.tx.us/idcu/disease/influenza/surveillance/2013/

E. U.S. Department of Health, http://www.hhs.gov/ The Department of Health and Human Services is the principal agency for protecting the health of all Americans. It is comprised of the Office of the Secretary (18 Staff Divisions) and 11 Operating Divisions

F. Local Health Department, to find your local health department try this link: http://www.dshs.state.tx.us/regions/lhds.shtm or contact your local authorities.

G. Others you may want to include: World Health Organization (WHO) http://www.who.int/en/ or the Food and Drug Administration (FDA) http://www.fda.gov/

Activity

I. Have students take samples of the lab or classroom work surfaces where bacteria may already be present. Send trustworthy students to gather swabs at different places on campus that they think of as 'clean.' Have students inoculate agar plates with swabs; be sure to label location swab was taken. Allow to grow over night and analyze the next day. See student sheet below. (Great transition into the next lesson of Analysis of Current Infection Control Measures.)

II. Optional class trip: Predict the laboratory policies and procedures expected to be employed in a clinical lab. Visit the clinical laboratory of a local hospital and observe the laboratory environment and lab personnel. Compare and contrast predictions with the procedures observed in the laboratory.

III. Research and report on the roles of the following agencies regarding the safety of health care professionals:

- OSHA
- CDC
- State Health Dept.
- EPA
- U.S. Dept. of Public Health
- WHO, and/or FDA

V. Create a multimedia presentation to promote laboratory safety.

Assessment
Writing Rubric
Multimedia Rubric

Materials
Sterile swabs
Nutrient agar plates
Incubator
Permanent Markers
http://www.nsta.org./handbook/liability.asp

Accommodations for Learning Differences
For reinforcement, the student will design a chart outlining standard precautions in the laboratory.

For enrichment, the student will create an occupational exposure control plan for clinical laboratory workers.

National and State Education Standards
National Health Science Cluster Standards
HLC06.01
Health care workers will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.
HLC06.02
Health care workers will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among their clients.

TEKS
130.207(c)(1)(A) demonstrate safe practices during laboratory and field investigations;
130.207(c)(2)(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;
130.207(c)(2)(G) analyze, evaluate, make inferences, and predict trends from data;

Texas College and Career Readiness Standards
English Language Arts
II. B. Understand new vocabulary and concepts and use them accurately in

reading writing and speaking.
III. B. Develop effective speaking styles for both group and one on one situations.
IV. A. Apply listening skills as an individual and as a member of a group in a variety of settings.
Science
1.E.1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.
1.E.2. Use essential vocabulary of the discipline being studied.
3.A.1. Use correct applications of writing practices in scientific communication.

http://phil.cdc.gov/phil/details.asp?pid=11161

Classroom or Campus Swab Survey

Objective: to demonstrate why safe lab practices are needed and in place by identifying bacterial growth from common areas.

1. Gather the following supplies:
    - Sterile inoculation swabs
    - Agar plates
    - Permanent Marker
    - Gloves (optional)

2. With your lab partner, brainstorm locations that are often touched or used that would be easy to collect a sample swab of. Get approval from your instructor to test your selected location(s).
3. At your selected location remove a sterile swab from the package without touching the cotton end. Swab the selected area with the cotton end multiple times in a rolling motion. Return the swab to the wrapper and label it with the location. Note the appearance of the location below.
4. Back at your lab station inoculate your agar plate with the used cotton swab in a rolling motion. Be sure to label your plate bottom with the date, location, and partner initials.
5. After 24-48 hrs of growth remove your plates from the incubator and examine what has grown from each location. Record your observations below. Be sure to observe your classmate's results too. Then write what your conclusion is based on your observations.

Selected location:	Describe site appearance	Describe growth appearance, quantity, variety, and texture.
1.		
2.		
3.		

Conclusion from observations:

Multimedia Rubric

Student: _____ Class: _____

Title:_____ Other Group Members: _____

Date:_____ _____

Scoring criteria	5 Excellent	4 Good	3 Needs Some Improvement	2 Needs Much Improvement	1 N/A
Clearly and effectively communicates an introduction of the theme/objective of the project.					
Clearly and effectively communicates the content throughout the presentation.					
Integrated a variety of multimedia resources to create a professional presentation (transition, graphics).					
Presentation holds audience attention and relates a clear message.					
Timing between slides is beneficial for the viewer to read or observe content.					
Each image and font size is legible to entire audience.					

Scale:
26-30 A Excellent
21-25 B Good
16-20 C Needs Some Improvement
11-15 D Needs Much Improvement
6-10 F Not Appropriate
TOTAL=
Comments

Writing Rubric

Student: _____ Date: _____

Scoring criteria	4. Excellent	3. Good	2. Needs Some Improvement	1. Needs Much Improvement	N/A
The writing has all required parts from introduction to conclusion in smooth transition.					
The writing is interesting, supportive, and complete.					
The writing demonstrates that the writer comprehends the writing process.					
Accurate spelling, grammar, punctuation.					
Content of paragraphs emphasizes appropriate points.					
The writer shows an understanding of sentence structure, paragraphing, and punctuation.					
All sources and references are clearly and accurately documented.					

NOTE: N/A represents a response to the performance which is "not appropriate."