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Hospitals Have Microbiomes Too!

Abstract:

The purpose of this guided 6 day unit is to introduce third-year health academy students to the importance of handwashing, bacterial antibiotic resistance, and the ongoing threat of emerging infectious pathogens and antibiotic-resistant organisms that can contribute to hospital acquired infections (HAIs). A hands on project based learning activity will follow each lecture to assess student learning and engagement.

Keywords: *microbiome, resident bacteria, transient bacteria, antibiotic-resistant bacteria, pathogen, hospital acquired infection (HAIs), infection control, infection prevention*

Rationale:

This unit is designed to utilize hands on project based learning activities for third-year health academy students in their understanding of the importance of a clean healthcare environment. The concept of a clean healthcare environment is critical for these students because during their fourth year, students complete year-long clinical rotations in a hospital setting. Third year students must have strong contextual understanding of the hospital microbiome and how it relates to healthcare safety, bacterial resistance, and potential harms to patients, employees, and visitors if preventative measures are not in place to decrease the spread of bacteria. Hands on project based learning activities will allow students various ways to demonstrate their learning in a relevant manner to deal with the real-world issue of infectious and antibiotic-resistant organisms in healthcare facilities.

Intervention

Utilizing primarily hands on project based activities in a unit will be something new to my list of teaching strategies. When I previously taught this unit, I assessed for prior knowledge, lectured, incorporated a poster activity, and concluded with an exam to assess new knowledge. This unit plan will be my sole resource for teaching the importance of a clean healthcare environment to prevent the spread of emerging pathogens. Hands on inquiry learning will allow the students to gain meaningful connections with content (Tharayil, Borrego, Prince, et al., 2018). Active learning strategies attach meaning to learning, and hopefully these students will be able to recall the information at the beginning of their senior year before the start of their clinical rotations. Students will be able to visually see the bacteria on their hands before and after they wash them, utilize laboratory techniques to demonstrate antibiotic resistance, and model a portion of the hospital's microbiome in which they will spend a lot of their time during their senior year.

CTE Standards and Benchmarks	NGSS-Science
19.0 Evaluate and apply the principles of disease transmission and control to real-world scenarios. –The student will be able to:	SC.912.L.14.6 SC.912.L.14.30 SC.912.L.14.32 SC.912.L.14.34 SC.912.L.14.35 SC.912.L.14.44 SC.912.L.14.46 SC.912.L.14.49 SC.912.L.14.52 SC.912.L.15.14 SC.912.L.15.15 SC.912.L.16.2 SC.912.L.16.3 SC.912.L.16.4 SC.912.L.16.5 SC.912.L.16.7 SC.912.L.16.8 SC.912.L.16.9 SC.912.L.16.10 SC.912.L.16.14
19.01 Discuss and explain the direct and indirect transmission of disease.	
19.02 Discuss and apply the principles of the chain of infection to real-world scenarios.	
19.03 Categorize the common microorganisms affecting the human body.	
19.04 Identify and analyze common diseases caused by microorganisms.	
26.0 Recognize and practice infection control procedures. – The student will be able to:	SC.912.L.14.6 SC.912.L.14.52 SC.912.L.17.6 SC.912.L.17.14 SC.912.L.17.16
26.01 Define principles of infection control including standard and transmission based precautions.	
26.02 Demonstrate knowledge of medical asepsis and practice procedures such as hand-washing and isolation.	
26.03 Demonstrate knowledge of surgical asepsis.	
26.04 Describe how to dispose correctly of biohazardous materials according to appropriate government guidelines such as OSHA.	

Data Collection Techniques and Assessments

Classes are 45 minutes in length

Day 1

- Pre-Quiz on Hospital Infection Control (10 minutes)
- Mind Mapping -Paper: Infection Control in Healthcare – Before Unit (35 minutes)

Day 2

- Handwashing Petri Dish Lab and Lab Report (45 minutes)

Day 3

- Handwashing Petri Dish Lab 24hr Observations (10 minutes)
- Pipetting By Design Activity: UF Equipment Locker (35 minutes)

Day 4

- Handwashing Petri Dish Lab 48hr Observations – Lab Complete (10 minutes)
- Antibiotic Resistant Bacteria Lab Part 1: UF Equipment Locker (35 minutes)

Day 5

- Antibiotic Resistant Bacteria Lab Part 2: UF Equipment Locker (10 minutes)
- Hospital Microbiome Map Activity & Discussion (35 minutes)

Day 6

- Post Quiz on Hospital Infection Control (10 minutes)
- Mind Mapping - Paper: Infection Control in Healthcare – Post Unit (35 minutes)

References

Tharayil, S., Borrego, M., Prince, M. et al. IJ STEM Ed (2018) 5: 7. Strategies to mitigate student resistance to active learning, <https://doi.org/10.1186/s40594-018-0102-y>

Budget Justifications – (Total Number of Health Science II Foundations Sections: 4 Classes of approximately 25)

- Microcentrifuge - (UF Equipment Locker)
- Microtube racks - (UF Equipment Locker)
- Pipetting stations (8 sets) - (UF Equipment Locker)
- IsaGene Matrix – \$60.00
- Vortex - (UF Equipment Locker)
- Floating tube holder - \$20.00
- Plate with E. coli colonies (Strain x, y, or z)
- Sterile loops - \$30
- Agar Petri Dishes - \$100.00
- Antibacterial liquid soap - \$10.00
- Hospital Room Microbiome Map Printout - \$40.00

Total estimated cost: \$260.00