Early Preparation and Inspiration for Careers in the Biomedical Sciences (EPIC)

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Major Goal

To prepare and inspire students to pursue STEM college majors in general, and biomedical research careers in particular through a hypothesis-driven, project-based biomedical research (BR) learning experience
Specific Aims

1. Determine whether interest, motivation and/or preparedness to pursue a biomedical research career are greater among students who participate in the Epi Challenge intervention compared with students who do not.

Design: Randomized Intervention

2. Determine whether adoption of career assessment and planning tools by high school career counselors influences motivation and/or preparedness to pursue a BR career.

Design: Non-Random Intervention

Logic Model for Theory of Change

Students' Career Development Experience

- Assessment of Holland Type and Career Preferences
- Training Session for School Counselors in a Toolkit for Guided Career Planning
- School-Determined Academic and Career Planning

Students' Project-Based Learning Experience

- Developing an Authentic BR Hypothesis
- Participating on a Team
- Working through Challenges
- Project-Based Mentoring in BR
- Presenting to and Networking with Stakeholders

Student Outcomes

- Preparation
- Problem-solving
- Self-efficacy
- Science & Math test scores

Inspiration

- Dual-enrollment courses
- AP courses
- Job shadowing
- Informational interviewing
- Career panels
- Site visits
- Internships

Leads to

- STEM major choice
- BR Research career
Justification for Intervention

- Many experts in science and education believe that high school students should have more opportunities to actually do science.

"...our expectation is that students will themselves engage in the practices and not merely learn about them secondhand. Students cannot comprehend scientific practices, nor fully appreciate the nature of scientific knowledge, without directly experiencing those practices for themselves."

The eight NRC 2012 Practices that "...scientists employ as they investigate and build models and theories about the world."

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. Engaging in argument from evidence
8. Obtaining, evaluating and communicating information

<table>
<thead>
<tr>
<th>Framework Practices for K-12</th>
<th>Epi Challenge Practices</th>
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<tbody>
<tr>
<td>1. Asking questions</td>
<td>Identify a health-related question of genuine relevance to them and formulate a hypothesis</td>
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<td>Develop questions that will allow them to test their hypothesis</td>
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<td>2. Developing and using models</td>
<td>Write a proposal for testing their hypothesis using a cross-sectional epidemiological study design</td>
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<td>3. Planning and carrying out investigations</td>
<td>Complete the National Institutes of Health Protecting Human Research Subjects training</td>
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<td>Ethically test their hypothesis by carrying out their proposal among students in their school district</td>
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<td>4. Analyzing and interpreting data</td>
<td>Analyze data</td>
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<td>5. Using mathematics and computational thinking</td>
<td>Calculate prevalence and prevalence ratios</td>
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<td>6. Constructing explanations</td>
<td>Make justifiable inferences based on the differences or similarities between the prevalence rates</td>
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<td>7. Engaging in argument from evidence</td>
<td>Present the results of their study to public health professionals</td>
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<td>8. Obtaining, evaluating, and communicating information</td>
<td>Present the results of their study to school district stakeholders</td>
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Definition

Epidemiology is the study of populations in order to determine the patterns and causes of health and illness, and to be able to apply what's been learned to control health problems.

Why an Epidemiology Challenge?

- Offers a "real world" experience for high school students to perform scientific research in their school

- Focus on the science of epidemiology
  - Typically not taught in high school
  - Applies key principles of science and math
  - Scientifically explores subject matter relevant to youth
  - Called the science of public health
Timeline

Baseline Assessments

- Fall 2013
- Spring 2014

Follow-up Assessments

- Fall 2016
- Spring 2017

Epi Challenge Project Based Learning

Train Summer 2014

- Project 2014-2015

Capstone Summer 2015

Career Counselor Training

- Implement Spring 2014
- Follow-up Fall 2015
- Follow-up Spring 2017
- Follow-up Fall 2016

Study Design

Baseline Questionnaires

- Science Interest, Literacy, and Proficiency
- Academic and Career Plan
- Career Interests

EPI Challenge Intervention Arm

- Project-based learning (PBL)
- Epi Challenge

Epi Challenge Non-Intervention Arm

- Freshman/Sophomore Years

Stratified random sample with oversampling for STEM minority students
Baseline Assessment and Randomization

- Baseline Science Literacy and Interest Questionnaire:
  - Overall 86% response rate (940/1,094) of all 9th grade students

- 125 Students randomized to the intervention and control groups
  - Stratified by student interest and proficiency in STEM
  - At least half of all strata
    - under-represented science minority or economically disadvantaged
    - female
Method: University-School Partnership

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<th>High Schools</th>
<th>Cedar Cliff</th>
<th>John Harris</th>
<th>Lower Dauphin</th>
<th>Sci Tech</th>
<th>Middletown</th>
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<td>High School Teachers</td>
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<td>Penn State Student Coaches</td>
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<td>Development, Review and Guidance</td>
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<td>Project Staff</td>
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Department of Public Health Sciences

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Project-based Learning Intervention

- **PBL**
  - Team Science
  - Critical Thinking, Collaboration and Communication
- **Target Population**
  - 9th grade 86% response rate (940/1,049)
  - 125 students randomized
- **Epidemiology Challenge 'Epi Challenge'**
  - 40 hours, Epi Boot Camp
  - 10th grade year simulated research projects

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Project-Based Learning

- Critical Thinking
- Collaboration
- Communication

- Team science
- Professional Development

www.youtube.com/watch?v=LMCZyGesRz8

Successes/Challenges

➤ Successes
- Work as a team, constructive criticism, PD, participant rate is steady

➤ Retention of students with a diverse set of skills, learning styles, and educational backgrounds
  - Coaches' model includes both school educator and graduate student coach teams
  - Life Challenges
  - Epi Challenge Schedule
    - In-school versus out-of-school
  - Student Professional Development
  - Dynamics of "Real" Research

Differential adoption of career model among schools
- In-person training of all counselors at one time
- Interactive format to promote peer-to-peer learning
Long Term Goals

- Maintain Penn State-High School partnerships
  - Penn State Public Health Workforce Development Initiative
    (Council on Education for Public Health)
- Identify sustainable sources of funding
  - Community Science Education Partners
- Develop partners at other institutions
- Develop teaching capacity at other schools

Acknowledgements

Research Team

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- Dr. Wency Huebner
  Consultant

High School Partners

- Cedar Cliff
- John Harris
- Lower Dauphin
- Middletown Area
- Sci Tech

Sponsors

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