Doctor's Orders: Student Perceptions of Antibiotic Resistance and Authority

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Intro to Antibiotic Resistance (ABR):

- ABR occurs when microbes evolve to be able to resist the effects of antibiotics—rendering treatments ineffective[1]
- An estimated 2,049,442 illnesses and 23,000 deaths in humans have been caused by ABR[2]
- Some diseases considered cured are forming strains resistant to antibiotics. Now, new antibiotics must be developed[3]
- Non-science major students were sampled because they are more representative of the general public and are likely our future politicians, teachers, business people, etc.
- ABR research has yet to evaluate impacts of instruction

Purpose:

Determine impact of instruction on the following in regards to ABR:

1) Student usage of antibiotics
2) Student development of scientifically-informed rationale
3) Student adherence to authority, specifically medical professionals

Methods:

- Three surveys (pre, post, end-of-semester) given to non majors biology course (BIOL 111) spring 2017 (n=364)

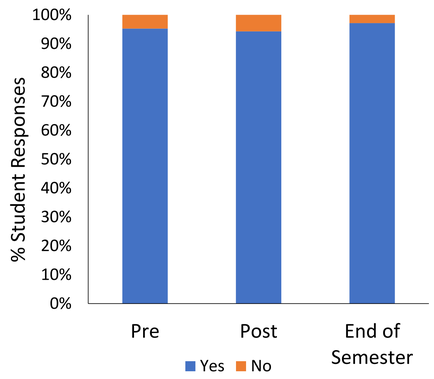
Pre Survey (n=295) Before instruction → Post Survey (n=215) After instruction → End-of-Semester (n=172) 10 weeks later

Instruction:

- Videos: Mechanisms of ABR and Antibiotics
- Case Studies: Interpreting graphs; Making predictions
- Discussions: Creating ABR solutions

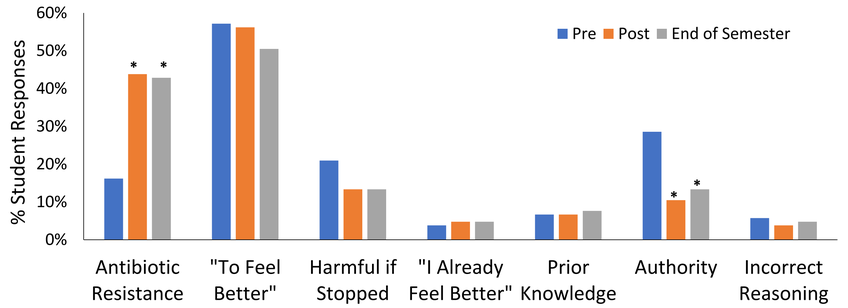
- Two coders initially coded data only for students who completed all three surveys (n=105)
  - Average Cohen's Kappa of 0.77
  - McNemar test statistic used to determine statistical significance ($p<0.05$) for original investigation
  - Matched data was used
- Analysis was then refined to further categorize student rationale, specifically in students' shift from adherence to authority to scientifically informed reasoning
  - Average Cohen's Kappa of 0.82
  - Fischer's exact test used to determine statistical significance ($p<0.05$) for refined data
- Asterisk (*) above post or end-of-semester survey indicates statistical significance in comparison to the pre survey

Students Finish Antibiotic Prescription:



- Survey Question: "You are diagnosed with strep throat, which is caused by the bacteria *Streptococcus pyogenes.* You begin to feel better within 48 hours of taking an antibiotic. Will you continue taking ALL 10 days of the antibiotic as prescribed by your doctor? Why or why not?"
- **Students already had a high likelihood of adhering to prescription length, no change was shown after instruction**

Student Reasoning for Finishing Antibiotic Prescription:



Code:	Student References:
Antibiotic Resistance	Antibiotic resistance or its mechanisms
"To Feel Better"	Taking antibiotics for the prescribed amount of time to ensure the intended effects of "feeling better"
Harmful if Stopped	Harmful not to finish because bacteria would not be eliminated
"I Already Feel Better"	Will not finish because they already "feel better"
Prior Knowledge	Cites prior experience or knowledge for reasoning
Authority	An authority figure told them to finish prescription
Incorrect Reasoning	Incorrect ABR reasoning, such as finishing prescription would increase ABR or using virus instead of bacteria

- **After instruction, student reasoning became more scientifically-informed**
- **After instruction, student reasoning showed an *increase* in antibiotic resistance-based rationale and a *decrease* in authority-based rationale**

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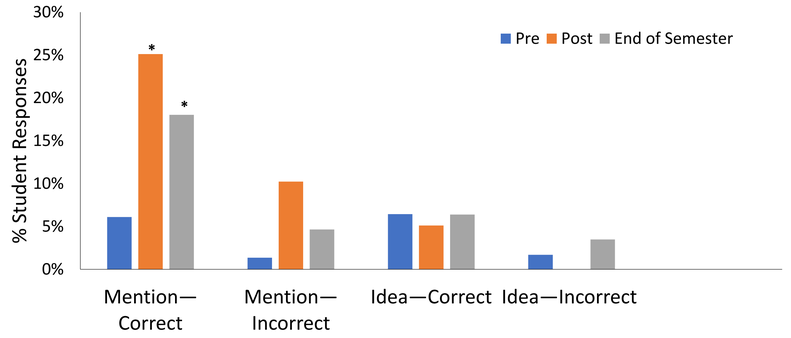
Literature Cited: 1) Antibiotic/Antimicrobial Resistance. (2017, June 12). https:// www. cdc.gov/drugresistance/ index.html. 2) General Background: About Antibiotic Resistance. (2014). http://emerald.tufts.edu/med/apua/ about issue/about antibioticres. shtml 3) Antibiotic resistance. (2016, October). http://www.who.int/mediacentre/ factsheets/antibiotic-resistance/en/

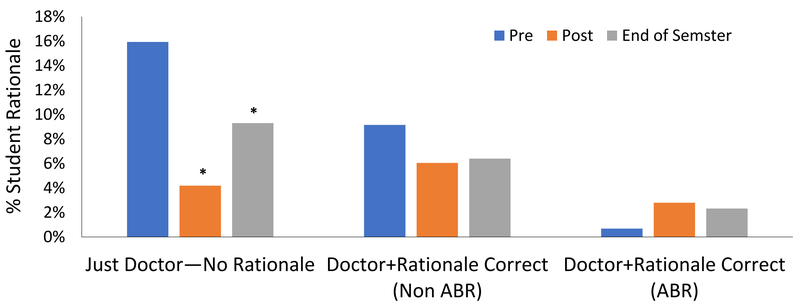
Use of the Term "Antibiotic Resistance":



Code:	Student References:
Mention—Correct	Correct description of ABR and mentions the words "antibiotic resistance"
Mention—Incorrect	Incorrect description of ABR and mentions the words "antibiotic resistance"
Idea—Correct	Correct description of ABR but does not mention the words "antibiotic resistance"
Idea—Incorrect	Incorrect description of ABR but does not mention the words "antibiotic resistance"

- **After instruction, frequency of students who correctly mentioned ABR *increased* and that effect persisted through the end of the semester**
- **Even in the pre-surveys, for both mentions and ideas, there were more correct than incorrect**

Adherence to Authority:



Code:	Student References:
Just Doctor—No Rationale	Adherence to medical professionals' authority. Provides no other rationale other than that they were instructed by their doctor/nurse
Doctor+Rationale Correct (Non ABR)	Adherence to medical professionals' authority AND scientifically accurate information (other than ABR) that informed this decision
Doctor+Rationale Correct (ABR)	Adherence to medical professionals' authority AND scientifically accurate information (about ABR) that informed this decision

- **After instruction, the frequency of students adhering to authority with no other rationale *decreased***
- **After instruction, the frequency of students adhering to their doctor's authority and mentioning scientifically informed rationale *persisted***

Conclusions:

- After instruction, fewer students adhered solely to the authority of medical professionals as the rationale for behaviors regarding antibiotic consumption.
- After instruction, more students correctly incorporated antibiotic resistance-based reasoning into their rationale for decision making
- Impacts of instruction lasted after the instruction period had ended, 10 weeks after instruction
- Future focuses: Instruction should target student preconceptions of antibiotics as synonymous with all medications