| Title of Lesson | Rates and Averages |
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| Lesson Planner | Clay Shonkwiler<br>shonkwil@math.upenn.edu |
| Objectives | 1. Refresh students' memories on how to compute mean, median, mode.<br>2. Arrive at better understanding of which "average" is appropriate in which situations.<br>3. Introduce rate (per 100,000, say) as a useful way to present data.<br>4. Teach students about chlamydia and chlamydia infection rates, especially among Philadelphia high school students.<br>5. Understand that different rates are useful in different contexts, develop a sense for which to use when. |
| Materials | 1. Height and weight data from MI science |
| Clinical Skill Taught | None |
| Class Outline | 1. Discuss what an average is (review)<br>Possible small group activity; suggest thinking about mean, median, mode. In what situations would different "averages" be applicable? Heterogeneous/Homogeneous populations and other issues (i.e. mean height of males in a high school class is probably a reasonable average, but median would be a better measure of the "average age" of a person at Sayre and mean and median don't even make sense if we're talking about non- numerical data like ethnicity)<br>2. Familiarization activities:<br>i. Compute mean and median height/weight/BMI from class data (see heights and weights spreadsheet)<br>ii. Why are mean and median household incomes (from 2002 Census data) so different? Which is a "better" average?<br>3. Rates: Often data is presented as a rate per 1000 (or 100 or whatever). How do we compute these rates given some data? (Compare with percentages) Why is this a useful way to present data? |

4. Familiarization Activity:
   In 2003, 21,000 Philadelphia high school students were screened for STDs. Of the 10,108 females screened, 820 tested positive for chlamydia; of the 10,892 males screened, 292 tested positive for chlamydia. Determine the rate (per 100,000, which is the usual rate for reporting such data) of chlamydia infection for female and male high school students in Philadelphia, as well as the overall infection rate for all high school students.
   Compare to overall infection rate for all 15-19 year-olds: 10,256 per 100k for females, 3103 per 100k for males (in Philadelphia). National rates: 2687 for females, 423 for males (overall); 8523 for females, 1731 for males (African-American)
   Sources:
   - http://www.phila.gov/health/units/ddc/assets/applets/Annual_report_2003_FinalV2.pdf
   - http://www.cdc.gov/std/stats/tableschlam.htm

   **Chlamydia facts**:
   - Transmitted by *Chlamydia trachomatis*
   - Biggest preventable cause of blindness
   - Easily treatable by antibiotics if detected early
   - Half of women with untreated Chlamydia get Pelvic Inflammatory Disease (PID)
   - Often asymptomatic, but symptoms may include vaginal bleeding/discharge, abdominal pain, painful sexual intercourse, fever, painful urination (women); burning sensation while urinating, unusual discharge, swollen testicles, fever (men)
   - Can cause sterility in men
   - Can cause Reiter's syndrome, especially in young men
   - Can induce miscarriage and premature birth
   - Half of all infants born to mothers with chlamydia are born with the disease. Chlamydia can cause blindness and pneumonia in infants
5. Discussion/Group activity: Different rates for different statistics.
   - According to the National Institute of Health, of the roughly 200 million Americans over age 20,

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| | 129 million are overweight (BMI ≥ 25). What's the best way of communicating this statistic? (Multiple possible answers; rate per 10 or 100 probably good, note that "percentage" is just Latin for "per 100")<br>• Pollution often reported as "parts per million" or even "parts per billion"<br>Nitrogen dioxide levels in Philadelphia are roughly 0.03 parts per million (source: http://www.phila.gov/health/units/ams/1999.AQReport.pdf )<br>**Nitrogen dioxide facts**<br>• Light brown gase<br>• Important contributor to urban haze<br>• Lung irritant; can reduce resistance to respiratory infections like influenza<br>• Important precursor to both acid rain and ozone<br>• Precursor to fine particulates, which can cause pulmonary disease and decreased lung function<br>• Prolonged exposure to Nitrogen dioxide in concentrations above 0.04 ppm is believed to cause health risks.<br>• Outdoor pollutant exposure is often much less important than indoor exposure.<br>6. Familiarization Exercise:<br>At sea level and at 20˚C, 1 cubic meter of air weighs 1.2 kg. Using this estimate of the density of air and given that the highest recorded concentration of lead in Philadelphia's air in 2003 was 0.04 $\mu g/m^3$, determine an upper bound for lead ppm in Philadelphia in 2003. |
| Homework Assignment (title and description) | |
| Assessment (description) | |