

The background of the slide is a dense, colorful illustration of various microscopic organisms. It includes blue and purple rod-shaped bacteria, some with flagella, and others with spores. There are also pinkish, oval-shaped structures, possibly fungi or protozoa, and some more complex, multi-segmented organisms. The overall style is a hand-drawn, cartoonish scientific illustration.

Practice Formula Problems

Disease Detectives Meeting 5

Problem 1

You are assigned to investigate an outbreak on a cruise ship; there has been an outbreak of salmonella from a buffet-style dinner. 50 people attended the dinner, and 25 people got sick. 15 people ate the sandwiches; 7 got sick. 12 people ate the croissants; none got sick. 14 people ate the ribeye steaks; 11 got sick. 6 people ate the shrimp dish; 4 got sick. 3 people ate the salad; 3 got sick.

Which of the foods has the highest attack rate for the exposed population?

What is the attack rate?



Problem 1 -- Answer

Which of the foods has the highest attack rate for the exposed population?

The salad had the highest exposed attack rate.

What is the attack rate?

The attack rate is 100%

	Sick	Not	
Exposed	3	0	= 3
Not	25 - 3 = 22	25	= 47
	= 25	(+) = 25	= 50

Food-specific attack rate = $\frac{\text{\# of people who ate the food and got sick}}{\text{\# of people who ate the food in total}}$

$$= 3/3 = 1.00 = 100\%$$

***Quick check: All of the people who ate it got sick.**



Problem 2

You are assigned to investigate an outbreak on a cruise ship; there has been an outbreak of salmonella from a buffet-style dinner. 50 people attended the dinner, and 25 people got sick. 15 people ate the sandwiches; 7 got sick. 12 people ate the croissants; none got sick. 14 people ate the ribeye steaks; 11 got sick. 6 people ate the shrimp dish; 4 got sick. 3 people ate the salad; 3 got sick.

Which of the foods has the highest attack rate for the unexposed population?

What is the attack rate?



Problem 2 -- Answer

Which of the foods has the highest attack rate for the unexposed population?

The croissants had the highest unexposed attack rate.

What is the attack rate?

The attack rate is 65.789%

	Sick	Not	
Exposed	0	12	= 12
Not	25	25 - 12 = 13	= 38
	= 25	(+) = 25	= 50

Attack rate = $\frac{\text{\# of people who didn't eat the food and got sick}}{\text{\# of people who didn't eat the food in total}}$

$$= 25/(25+13) = 25/38 \approx 0.65789 \approx 65.789\%$$

***Quick check: None of the people who ate it got sick.**



Problem 3

You are assigned to investigate an outbreak on a cruise ship; there has been an outbreak of salmonella from a buffet-style dinner. 50 people attended the dinner, and 25 people got sick. 15 people ate the sandwiches; 7 got sick. 12 people ate the croissants; none got sick. 14 people ate the ribeye steaks; 11 got sick. 6 people ate the shrimp dish; 4 got sick. 3 people ate the salad; 3 got sick.

What is the risk ratio for the ribeye steaks?

What does this risk ratio indicate?



Problem 3 -- Answer

	Sick	Not	
Exposed	11	$14 - 11 = 3$	$= 14$
Not	$25 - 11 = 14$	$25 - 3 = 22$	$= 36$
	$= 25$	$(+) = 25$	$= 50$

What is the risk ratio for the ribeye steaks? **The risk ratio is roughly 2.02.**

Risk ratio = attack rate for exposed/attack rate for unexposed =

$$= \frac{\text{\# of people who ate the food and got sick}}{\text{\# of people who ate the food in total}} \bigg/ \frac{\text{\# of people who didn't eat the food and got sick}}{\text{\# of people who didn't eat the food in total}}$$

$$= (11/14) / (14/(14+22)) = (11/14) / (14/36) = (11/14) * (36/14) = (11*36)/(14*14) =$$

$$= 396/196 = 2.020408163 \approx 2.02$$

What does this risk ratio indicate?

People who ate the steak are 2.02 times more likely to become ill than people who did not eat the steak.

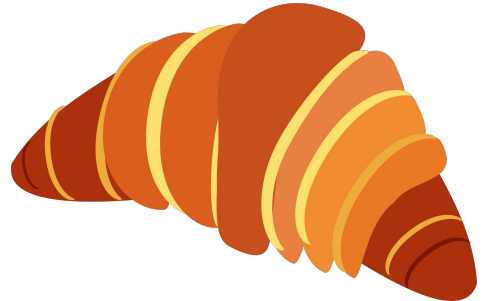


Problem 4

You are assigned to investigate an outbreak on a cruise ship; there has been an outbreak of salmonella from a buffet-style dinner. 50 people attended the dinner, and 25 people got sick. 15 people ate the sandwiches; 7 got sick. 12 people ate the croissants; none got sick. 14 people ate the ribeye steaks; 11 got sick. 6 people ate the shrimp dish; 4 got sick. 3 people ate the salad; 3 got sick.

What is the attributable risk for the croissants?

What does this mean?



Problem 4 -- Answer

What is the attributable risk for the croissants? **The attributable risk is -65.789%.**

Attributable risk = attack rate for exposed - attack rate for unexposed =

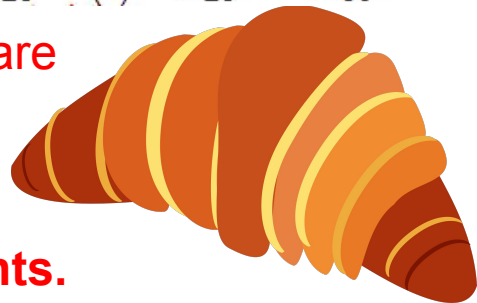
$$= \frac{\text{\# of people who ate the food and got sick}}{\text{\# of people who ate the food in total}} - \frac{\text{\# of people who didn't eat the food and got sick}}{\text{\# of people who didn't eat the food in total}}$$

$$= 0/(0+12) - 65.789\% = 0 - 65.789\% = -65.789\%$$

What does this mean?

	Sick	Not	
Exposed	0	12	= 12
Not	25	25 - 12 = 13	= 38
	= 25	(+) = 25	= 50

AR is the expected reduction in the disease if the croissants are removed. Removing -65.789% of cases would actually mean an increase of 65.789% in cases if there were no croissants.



Problem 5

There has been an increase of cases of kidney failure in the town of Ding Dong, Texas. Local authorities are looking into grain from a local grain bank as the culprit, as the grain from that specific grain bank has been found to have citrinin (a mycotoxin that affects the kidneys) in it; they decide to conduct a case-control study. Of the 800 reported cases of kidney failure that are included in the study, 550 have been exposed to the contaminated grain. To balance this, 800 people without kidney failure are included in the study; 650 of them have not been exposed to the contaminated grain.

What is the odds ratio for the people in this study?

What does this mean?



Problem 5 -- Answer

	Case	Control
Exposed	550	$800 - 650 = 150$
Not	$800 - 550 = 250$	650
	= 800	= 800

What is the odds ratio for the people in this study?

The odds ratio for people in this study is roughly 9.533

Odds ratio = cross-product ratio = take the boxes at diagonals from each other and multiply them by each other, then divide the result

$$(\uparrow\text{left} * \downarrow\text{right}) / (\uparrow\text{right} * \downarrow\text{left}) = (550 * 650) / (150 * 250) = 357500 / 37500 \approx 9.533$$

What does this mean?

Those exposed to the contaminated grain are 9.533 times more likely to get sick than those who were not exposed.

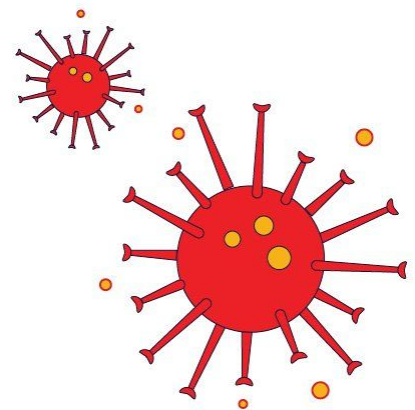


Problem 6

A coronavirus testing laboratory in Maryland is having some issues. The lab's tests are not 100% accurate, and the lab technicians are trying to figure out just how much of an issue this is. Of the 2,000 people the lab has tested, 1,300 tested negative, but 450 of those tests were incorrect. Additionally, there were 600 true positive cases in the 2,000 people tested by the lab.

What is the sensitivity of the lab's coronavirus testing?

What does this mean?



Problem 6 -- Answer

	Tested true	tested false
Real true	600	450
Real false	$700 - 600 = 100$	$1300 - 450 = 850$
	$2000 - 1300 = 700 (+)$	1300
		$= 2000$

What is the sensitivity of the lab's coronavirus testing?

The sensitivity of the lab's coronavirus testing is roughly 57.143%.

**Sensitivity = true positive/(true positive + false negative) = $600/(600 + 450) =$
 $= 600/1050 = 0.5714285714 \approx 57.143\%$**

What does this mean?

**Since this sensitivity is rather high, it means that the test
is broader criteria-wise; it is 57.143% able to detect true cases.**

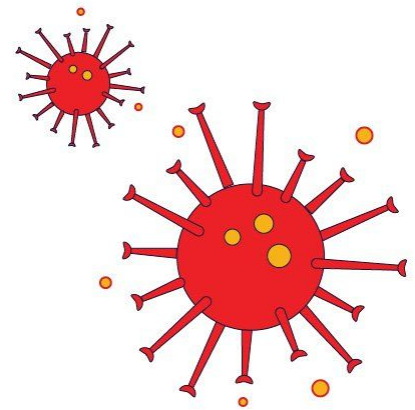


Problem 7

A coronavirus testing laboratory in Maryland is having some issues. The lab's tests are not 100% accurate, and the lab technicians are trying to figure out just how much of an issue this is. Of the 2,000 people the lab has tested, 1,300 tested negative, but 450 of those tests were incorrect. Additionally, there were 600 true positive cases in the 2,000 people tested by the lab.

What is the specificity of the lab's coronavirus testing?

What does this mean?



Problem 7 -- Answer

	Tested true	tested false
Real true	600	450
Real false	$700 - 600 = 100$	$1300 - 450 = 850$
	$2000 - 1300 = 700 (+)$	1300
		$= 2000$

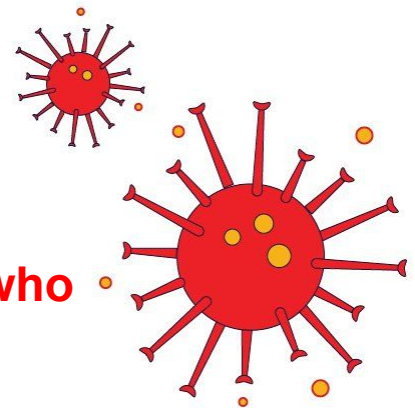
What is the specificity of the lab's coronavirus testing?

The specificity of the lab's coronavirus testing is roughly 89.474%.

Specificity = true negative / (true negative + false positive) = $850 / (850 + 100) =$
 $= 850 / 950 = 0.8947368421 \approx 89.474\%$

What does this mean?

This test is more specific but not perfect, as the specificity is high but not 100%. It is 89.474% able to exclude people who don't have the disease.

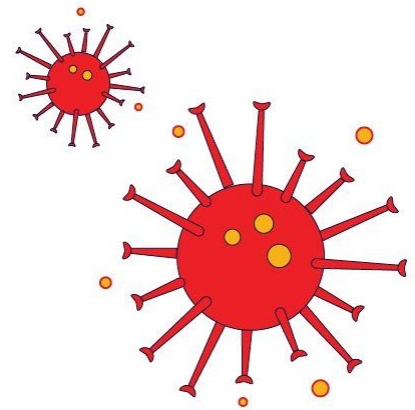


Problem 8

A coronavirus testing laboratory in Maryland is having some issues. The lab's tests are not 100% accurate, and the lab technicians are trying to figure out just how much of an issue this is. Of the 2,000 people the lab has tested, 1,300 tested negative, but 450 of those tests were incorrect. Additionally, there were 600 true positive cases in the 2,000 people tested by the lab.

What is the positive predictive value of the lab's testing?

What does this mean?



Problem 8 -- Answer

	Tested true	tested false
Real true	600	450
Real false	$700 - 600 = 100$	$1300 - 450 = 850$
	$2000 - 1300 = 700 (+)$	1300
		= 2000

What is the positive predictive value of the lab's testing?

The positive predictive value of the lab's testing is roughly 85.714%.

Positive predictive value = true positive / (true positive + false positive) =

$$= 600 / (600 + 100) = 600 / 700 = 0.8571428571 \approx 85.714\%$$

What does this mean?

This means that out of the lab's positive tests, 85.714% were true cases of the disease.

