

case studies hand in

Dr. Sarah's MAT 1010: Introduction to Mathematics

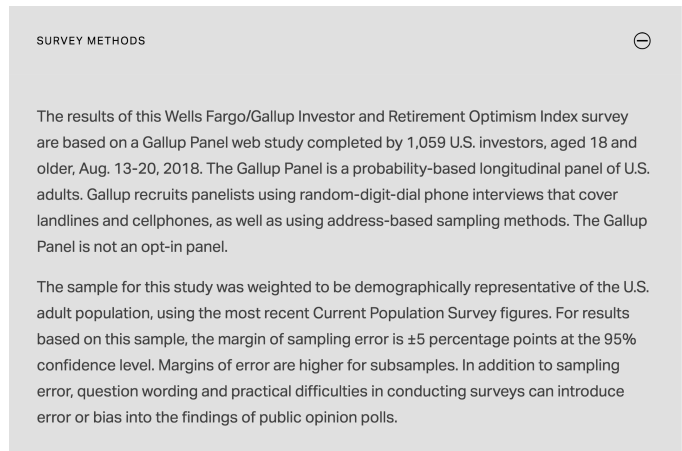
Consumer Statistics and Probability: To recognize misrepresentations of studies and statistical data in the real world by applying statistical techniques and understanding the role of chance and probability

submission instructions: Must be completed on this handout and collated into one single PDF for submission in the case studies hand in assignment

goals:

- critically analyze the role of probability and chance in real world situations
- develop problem solving and analysis skills to work towards becoming logical, flexible, critical thinkers and problem solvers who consider the reasonableness of media and policies.
- communicate statistics and probability information in written documents

Gallup Poll: Go to news.gallup.com, which is a webpage also available from this assignment on ASU Learn. Choose a recent poll that interests you which also has a **Survey Methods** section that includes a **margin of sampling error %**. This is typically found at the end of the article but not all Gallup articles have this—for example, articles that are tagged in Green with Report, Gallup Vault, Polling Matters, Gallup Blog, Gallup Podcast and more do not typically. Many articles that are tagged in Green with topic headers like Economy, Education, Politics, Social & Policy Issues, Well Being, and World are more likely to. So you may need to look around some...



Survey Information and Methods:

- 1) What is the headline or title of the poll?
- 2) What is the overall margin of sampling error Gallup gives? (choose another poll if you can't find one)
- 3) What is the confidence level for the margin of error? (choose another poll if you can't find one)
- 4) What is the total sample size for this poll, if Gallup lists it?

- 5) On what date(s) did Gallup conduct this poll?
- 6) What method did Gallup use to collect the data (face-to-face interviews, phone...)?
- 7) What is the publication date?

Critical Analysis:

- 8) Based on who Gallup surveyed, what do you think is the larger “population” this poll is meant to represent?
- 9) Given the way Gallup chose its sample and collected its data for this poll, do you think they actually managed to get a reasonably representative sample of this population of interest? If yes, why do you think so? If not, what subgroups do you think might not be well-represented?
- 10) If Gallup had taken a completely unbiased simple random sample from the population for this poll, what would be the overall 95% confident margin of error, given the poll’s sample size n as above in 4) and using the conservative estimate of $\frac{1}{\sqrt{n}}$? Show the computation and then convert to an approximate percentage.
- 11) Is Gallup’s margin of error in 2) larger, smaller, or the same as the one you just computed?
- 12) If Gallup’s margin of error is different than your computation, does it generate a wider interval or narrower interval than yours would?

13) Does the title of your poll make any definitive-sounding statements about changes in opinions over time, majority opinion, or differences between groups (e.g., “Record-High Support for Legalizing Marijuana Use in US,” “Slim Majority against Government Pushing Traditional Values,” or “Women Lead Men on Key Workplace Engagement Measures”)? If so, list them. Also look for these kinds of statements inside the article and list them. If you can’t find any, what are the claims of the poll?

14) Assume for this question that Gallup’s sample is indeed representative of the population (e.g., little to no bias and a random sample). If you take into account Gallup’s margin of error when you interpret the poll results, is it statistically valid for the author of the article to make the statements in 13)? Look for data up in the article and take any overlaps into consideration—show them and explain why or why not. For instance, arguments might look something like:

$53\% - 4\% = 49\%$ but the headline makes it sound like a majority

or

$45\% - 5\% = 40\%$ is the lower boundary and may not be highest since 1969 because $38\% + 3\% = 41\%$ from the upper boundary of 1982 may be higher

or other critical analysis. Show your full intervals and analysis here and why the conclusions are supported or why they are not (try to find at least one that is not supported, if it exists).

15) Create a visual representation of at least 2 interval(s) from 14) on a number line. Label with numbers the endpoints of each interval, and list the contextualization of what each interval stands for (i.e. specific year, political party...), and geometrically showcase whether there are overlaps.



Analyzing Probability and Chance in HIV Testing:

Controlled laboratory testing of saliva determined the sensitivity and specificity of the OraQuick Advance HIV test.

- a) Sensitivity: probability the test correctly identifies someone who is HIV+ as positive = $98.4\% = .984$
- b) **False Negative:** HIV+ person who falsely tests negative. The probability is $1 - .984 = .016$
- c) Specificity: probability the test correctly identifies someone who is HIV- as negative = $99.6\% = .996$
- d) **False Positive:** HIV- person who falsely tests positive. The probability is $1 - .996 = .004$

Globally, prevalence of HIV in prisons is between 2 and 50 times the HIV rate of the general population. In 2010, about 20,000 of the 1,570,000 inmates in state and federal prisons in the US were HIV+.

- 16) What is the probability that a prisoner in the US is HIV+ ($20,000/1,570,000$)—leave this as a decimal and round to 4 decimal places?

- 17) What is the probability that a prisoner is HIV-? Leave as a decimal and round to 4 decimal places.

- 18) Suppose we have a prison with 100,000 prisoners. Complete the number of people in each of the 6 cells in the decision matrix below using the above probabilities. Show work and round to whole numbers of people:

	Test +	Test -
Person is HIV+	True positive people multiply your response in 16) by 100,000 for the number of HIV+ people then multiply that number by the probability they correctly test + in a)	False negative people
Person is HIV-	False positive people multiply your response in 17) by 100,000 for the number of HIV- people then multiply that number by the probability they falsely test + in d)	True negative people
Total	Total who test +	Total who test -

- 19) Approximately what percentage of prisoners who test positive is actually HIV+ (i.e. true positive people/total people who test positive)? Show work and round to one decimal place.