

## Math 10 - Homework 5

1. The average number of years of post secondary education of employees in an industry is 1.5. A company claims that this *average* is higher for its employees. A random sample of 16 of its employees has an *mean* of 2.1 years of post secondary education with a *standard deviation* of 0.6 years.
  - a. Find a 95% confidence interval for the **mean** number years of post secondary education for the company's employees. How does this compare with the industry value?
  - b. Find a 95% confidence interval for the **standard deviation** of number years of post secondary education for the company's employees.

2. When polling companies report a margin of error, they are referring to a 95% confidence interval. Go to the website [www.pollingreport.com](http://www.pollingreport.com) and verify the stated margins of error for 2 polls.

**Constructing Confidence Intervals** In Exercises 3 and 4 you are given the sample mean and the sample standard deviation. Assume the random variable is normally distributed and use a t-distribution to construct a 95% confidence interval for the population mean  $\mu$ . What is the margin of error of the confidence interval?

3. **Repair Costs: Microwaves** In a random sample of five microwave ovens, the mean repair cost was \$75.00 and the standard deviation was \$12.50.
4. **Repair Costs: Computers** In a random sample of seven computers, the mean repair cost was \$100.00 and the standard deviation was \$42.50.
5. You did some research on repair costs of microwave ovens and found that the standard deviation is  $\sigma = \$15$ . Repeat Exercise 3, using a **normal distribution** with the appropriate calculations for a standard deviation that is known. Compare the results.
6. **Mini-Soccer Balls** A soccer ball manufacturer wants to estimate the mean circumference of mini-soccer balls within 0.15 inch. Assume that the population of circumferences is normally distributed.
  - (a) Determine the minimum sample size required to construct a 99% confidence interval for the population mean. Assume the population standard deviation is 0.20 inch.
  - (b) Repeat part (a) using a standard deviation of 0.10 inch. Which standard deviation requires a larger sample size? Explain.
  - (c) Repeat part (a) using a confidence level of 95%. Which level of confidence requires a larger sample size? Explain.
7. If all other quantities remain the same, how does the indicated change affect the minimum sample size requirement (Increase, Decrease or No Change)?
  - (a) Increase in the level of confidence
  - (b) Increase in the error tolerance
  - (c) Increase in the standard deviation

8. **Stressful Travel:** In a survey of 3224 U.S. adults, 1515 said flying is the most stressful form of travel. Construct a 95% confidence interval for the proportion of all adults who say flying is the most stressful form of travel.
9. **Accidents and Alcohol:** A study of 2008 traffic fatalities found that 800 of the fatalities were alcohol related. Find a 99% confidence interval for the population proportion and explain what it means.
10. **Happy at Work?** In a survey of 1003 U.S. adults, 662 would be happy spending the rest of their career with their current employer. Construct a 90% confidence interval for the proportion who would be happy staying with their current employer. Does this result surprise you?
11. **Computer Repairs** You wish to estimate, with 95% confidence and within 3.5% of the true population, the proportion of computers that need repairs or have problems by the time the product is three years old
  - a. No preliminary estimate is available. Find the minimum sample size needed.
  - b. Find the minimum sample size needed, using a prior study that found that 19% of computers needed repairs or had problems by the time the product was three years old.
  - c. Compare the results from parts (a) and (b).
12. **Lawn Mower** A lawn mower manufacturer is trying to determine the **standard deviation** of the life of one of its lawn mower models. To do this, it randomly selects 12 lawn mowers that were sold several years ago and finds that the sample standard deviation is 3.25 years. Use a 99% level of confidence to find a confidence interval for **standard deviation**.
13. **Monthly Income** The monthly incomes of 20 randomly selected individuals who have recently graduated with a bachelor's degree in social science have a sample standard deviation of \$107. Use a 95% level of confidence to find a confidence interval for **standard deviation**.
14. Read the attached article on the CBS News poll regarding the birth control pill.
  - a. What would the point estimator be for the proportion of adults who believe the pill has made women's lives better.
  - b. What is the sample size for this study?
  - c. What is the margin of error for this poll as reported in the article. Assuming a 95% level of confidence, verify this poll by calculation.

15. What are the two types of hypotheses used in a hypothesis test? How are they related?

16. Describe the two types of error possible in a hypothesis test decision.

***True or False?***

In Exercises 17-22, determine whether each statement is true or false. If it is false, rewrite it as a true statement.

17. In a hypothesis test, you assume the alternative hypothesis is true.

18. A statistical hypothesis is a statement about a sample.

19. If you decide to reject the null hypothesis, you can support the alternative hypothesis.

20. The level of significance is the maximum probability you allow for rejecting a null hypothesis when it is actually true.

21. A large P-value in a test will favor a rejection of the null hypothesis.

22. If you want to support a claim, write it as your null hypothesis.

***Stating Hypotheses***

In Exercises 23-28, use the given statement to represent a claim. Write its complement and state which is  $H_0$  and which is  $H_a$ .

23.  $p > .65$

24.  $\mu \leq 128$

25.  $\sigma^2 \neq 5$

26.  $\mu = 1.2$

27.  $p \geq 0.45$

28.  $\sigma < 0.21$

*Think* about the context of the claim. *Determine* whether you want to support or reject the claim.

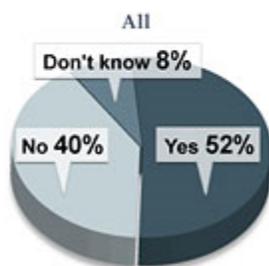
- a. State the null and alternative hypotheses in words.
  - b. Write the null and alternative hypotheses in appropriate symbols
  - c. Describe in words Type I error (the consequence of rejecting a true null hypothesis.)
  - d. Describe in words Type II error (the consequence of failing to reject a false null hypothesis.)
29. You represent a chemical company that is being sued for paint damage to automobiles. You want to support the claim that the mean repair cost per automobile is not \$650. How would you write the null and alternative hypotheses?
30. You are on a research team that is investigating the mean temperature of adult humans. The commonly accepted claim is that the mean temperature is about 98.6°F. You want to show that this claim is false. How would you write the null and alternative hypotheses?
31. A light bulb manufacturer claims that the mean life of a certain type of light bulb is at least 750 hours. You are skeptical of this claim and want to refute it.
32. As stated by a company's shipping department, the number of shipping errors per million shipments has a standard deviation that is less than 3. Can you support this claim?
33. A research organization reports that 33% of the residents in Ann Arbor, Michigan are college students. You want to reject this claim.
34. The results of a recent study show that the proportion of people in the western United States who use seat belts when riding in a car or truck is under 84%. You want to support this claim.

May 7, 2010

# Poll: Most Say The Pill Improved Women's Lives

## Most Americans Consider "The Pill" One of the Most Significant Medical Advances of the Last 50 Years, a CBS News Poll Finds

HAS THE BIRTH CONTROL PILL BEEN ONE OF THE COUNTRY'S MOST SIGNIFICANT MEDICAL DEVELOPMENTS?



(CBS)

(CBS) *Poll analysis by Jennifer De Pinto.*

More than half the public -- including most women -- believes the birth control pill has been one of the most significant medical developments of the last half century, a new CBS News poll finds.

Most Americans say "the pill" has had an impact on American society and on women's lives in particular, and credit it with helping women enter the work force.

The birth control pill was approved by the Food and Drug Administration in 1960. Today, 52 percent of Americans say it has been one of the most significant medical developments of the last 50 years, according to the poll, conducted on May 4th and 5th.

Four in five Americans think the birth control pill has had at least some effect on American society overall, including 41 percent who say it's had a great deal of impact.

Even more, 54 percent, think the birth control pill has had a great deal of impact on women's lives in particular.

### The Pill: Women's Lives Made Better

Most Americans say women's lives were changed for the better because of the birth control pill. Only a quarter think it made no difference, and even fewer say the pill made women's lives worse.

Men (59 percent), women (54 percent), and women who have ever taken the pill (54 percent) say that women's lives were improved as a result of the birth control pill.

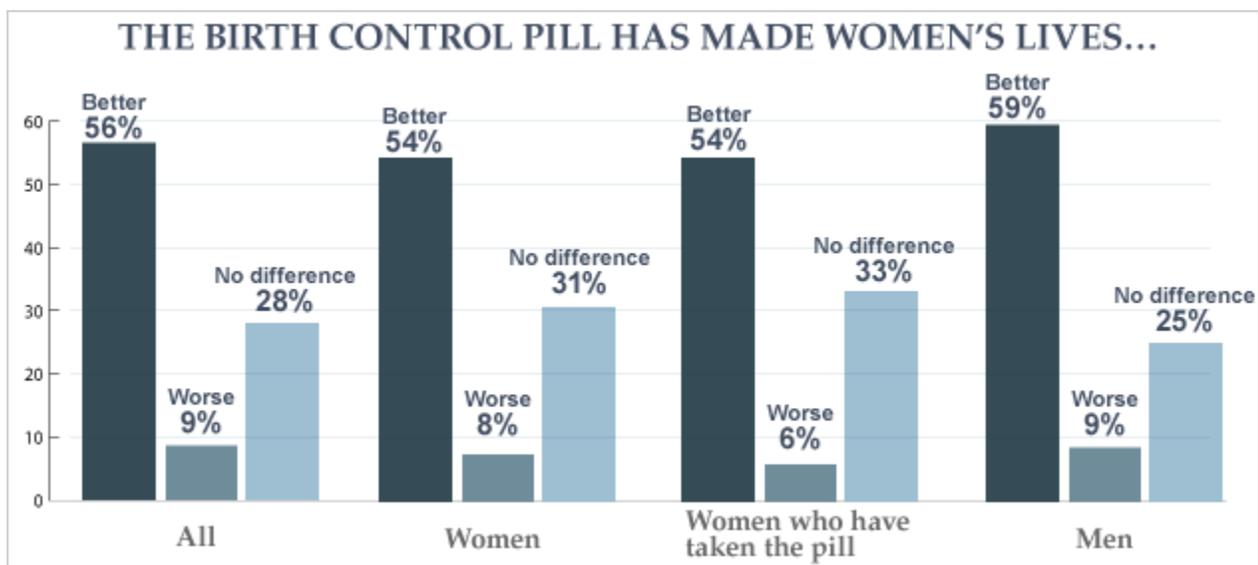
More specifically, Americans think the birth control pill helped women enter the work force: 57

percent say the pill made it easier for women to have jobs and careers outside the home.

That number rises to 69 percent among Americans age 45 and over -- an age group more likely to have felt the impact of the pill when it was first developed and put on the market. Among women age 45 and older that figure is 64 percent.

By contrast, 53 percent of younger Americans say the birth control pill had no effect on the ability of women to work outside the home.

Among working women, 55 percent say the birth control pill has made it easier for women to enter the workforce.



(CBS)

### Family Life and Attitudes Toward Sex

Roughly half of Americans say the birth control pill has improved American family life, while a third doesn't think it has had much effect.

Religion has some impact on these views. Among Catholics, whose church opposes non-natural forms of birth control, just 38 percent believe the birth control pill has improved American family life. That figure is 52 percent among Protestants.

Eight in ten Americans think the birth control pill has affected Americans' attitudes toward sex, including 51 percent who say it impacted those attitudes a great deal.

### The Pill: Safety and Effectiveness

The poll finds public concerns about the safety of the birth control pill have diminished over time.

In 1966, six years after the pill was approved by the FDA, fewer than half of Americans - 43 percent - told a Gallup Poll that birth control pills could be used safely without danger to a person's health.

That number has risen to 64 percent today.

Among women, 58 percent now think the birth control pill can be used safely, as do a similar percentage of women who have ever taken it.

Nearly half of women think the birth control pill is just as safe as other forms of birth control, and another 20 percent believe the pill is safer. Still, one in five thinks it is less safe. Views are similar among women who have ever taken birth control pills.

More than eight in 10 Americans (including 82 percent of women) say birth control pills are effective. In a 1966 Gallup Poll, a smaller number of Americans (though still a 61 percent majority) thought the birth control pill was effective.

Some medical research has been done on a contraceptive for men similar to that of the birth control pill. A majority of women do *not* think most men would take birth control pills if they were available.

In contrast, two-thirds of men think most men would take the pill if it were available.

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*This poll was conducted among a random sample of 591 adults nationwide, interviewed by telephone May 4-5, 2010. Phone numbers were dialed from random digit dial samples of both standard land-line and cell phones. The error due to sampling for results based on the entire sample could be plus or minus four percentage points. The error for subgroups is higher.*

*This poll release conforms to the Standards of Disclosure of the National Council on Public Polls.*

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