STAT 218 – Handout – Week 6 Lecture 1 – Difference of Two Proportions

Part 1: Prenatal vitamins and Autism

Researchers studying the link between prenatal vitamin use and autism surveyed the mothers of a random sample of children aged 24 - 60 months with autism and conducted another separate random sample for children with typical development. The table below shows the number of mothers in each group who did and did not use prenatal vitamins during the three months before pregnancy (periconceptional period).

		Periconceptional prenatal vitamin		
		Vitamin	No Vitamin	Total
Autism	Autism	143	111	254
	Typical Development	159	70	229
	Total	302	181	483

1. **Identify the observational unit *(singular, not plural)* and variables and classify the variable as quantitative or categorical.**

2. **Which would you consider the explanatory variable in this study? Which is the response?**

3. **Describe in words the relevant parameter of interest in this study. What symbol would you use to represent it?**

4. **Calculate the relevant statistic in this study. What symbol would you use to represent it?**

5. **State appropriate null and alternative hypotheses to test the association between use of prenatal vitamins during the three months before pregnancy and autism.**

6. **Let's use simulation-based approach to see if there is any association between use of prenatal vitamins during the three months before pregnancy and autism. Report your simulation-based p value.**

7. **Can we use theory-based inference in this example? Verify any necessary validity conditions for the theory-based inference.**

8. **Use Theory-based inference Applet to find standardized statistic, standard error, theory-based p-value and 95% confidence interval for the parameter $\pi_1 - \pi_2$. Report them below.**

REMEMBER! When the validity conditions are satisfied, the simulation-based and theory-based approaches will produce very similar results and lead to the same conclusions.

That's because:

- The **Central Limit Theorem** ensures the sampling distribution is approximately normal.
- Simulation-based methods empirically approximate that same distribution.

However, if the validity conditions are not met, the simulation-based approach can be reported because simulation-based methods are more robust when theoretical assumptions fail (e.g., small samples, skewed data).

9. **Interpret hypothesis testing results and confidence interval and state an appropriate conclusion.**

10. **New York Times article reporting on this study was titled "Prenatal Vitamins May Ward Off Autism". Do you find the title of this article to be appropriate? Explain your answer.**

11. **Propose an alternative title.**

Part 2: Prenatal vitamins and Autism - Relative Risk

Definition: ***Relative risk*** is the ratio of two conditional proportions. It indicates how many times greater the risk of an outcome is for one group compared to the risk for the other group.

12. Calculate the relative risk of developing autism by dividing the proportion of autism cases among children whose mothers did not take prenatal vitamins before pregnancy by the proportion of autism cases among children whose mothers took prenatal vitamins. Use the table below to find these proportions.

		Periconceptional prenatal vitamin		
		Vitamin	No Vitamin	Total
Autism	Autism	143 **(47.4%)**	111 **(61.3%)**	254
	Typical Development	159 **(52.6%)**	70 **(38.7%)**	229
	Total	302 **(100.0%)**	181 **(100%)**	483

13. Write a sentence interpreting this ratio value. Does the value of this ratio strike you as noteworthy?