

1. It is often argued that victims of violence exhibit more violent behavior toward others. To study this hypothesis a researcher searched court records to find 908 individuals who had been victims of abuse as children (11 years or younger). She then found 667 individuals, with similar demographic characteristics, who had not been abused as children. Based on a search through subsequent years of court records, she was able to determine how many in each of these groups became involved in violent crimes, as shown in the the following table. (Data from C. S. Widom, "The Cycle of Violence," *Science* 244 (1989), problem from Ramsey & Schafer, *The Statistical Sleuth*, chp 18, pg 547.)

	Violent Crime?	
	Yes	No
Abuse Victim	102	806
Control	53	614

- (a) Comment on the experimental design of the study (exper vs. obs study; prospective vs. retrospective; how the participants were chosen)
- (b) Consider the population of abused victims and controls from which these samples were selected. Let Y be a binary response variable taking the value 1 if an individual became involved in violent crime and 0 if not in each of these populations. If p_1 and p_2 are the means of Y in the two populations, what is the variance of Y in each population?
- (c) What is the sampling distribution of $\hat{p}_1 - \hat{p}_2$?
- (d) With respect to the data above, there are many ways of wording an odds ratio statement. For example:
- i. The odds of Yes among victims relative to controls.
 - ii. The odds of Yes among controls relative to victims.
 - iii. The odds of No among victims relative to controls.
 - iv. The odds of No among controls relative to victims.
 - v. The odds of victims among Yes relative to No.
 - vi. The odds of victims among No relative to Yes.
 - vii. The odds of controls among Yes relative to No.
 - viii. The odds of controls among No relative to Yes.
 - ix. The odds of victims among Yes relative to controls.

Which, if any, of the above are the same? Do all of them make sense? Explain.

- (e) Use the sample OR to make inference about the relationship between childhood abuse and violent crime.
 - (f) Use the sample proportions to make inference about the relationship between childhood abuse and violent crime.
 - (g) Use a χ^2 test to make inference about the relationship between childhood abuse and violent crime.
 - (h) Do significant results from the above data lead us to believe that abuse as children leads to violent crime?
2. Consider the following two *null* hypotheses:
- $H_0 : p_1 - p_2 = 0$
 $H_0 : \text{OR} = 1$
- (a) Argue that the two null hypotheses are either: always different, sometimes different, or always identical.
 - (b) Does your answer to part (a) mean that we can always estimate the difference: $p_1 - p_2$?
3. In a 1962 social experiment, 123 3- and 4-year-old children from poverty-level families in Ypsilanti, Michigan, were randomly assigned either to a treatment group receiving 2 years of preschool instruction or to a control group receiving no preschool. The participants were followed into their adult years. The following table shows how many in each group were arrested for some crime by the time they were 19 years old. (Data reported in *Time*, July 29, 1991; problem from Ramsey & Schafer, *The Statistical Sleuth*, chp 18, pg 546.)

	Arrested for some crime?	
	Yes	No
Preschool	19	42
Control	32	30

- (a) Use one method we've discussed to report on the significance of the relationship.
- (b) Is it possible to use these data to see whether preschool instruction can *cause* a lower rate of criminal arrest for some population?
- (c) Is this a retrospective or a prospective study?