

Activity 8: Teen Hearing Loss

Shargorodsky, Curhan, Curhan, and Eavey (2010) examined hearing loss data for 1771 participants from the National Health and Nutrition Examination Survey (NHANES, 2005-6), aged 12-19 years. (“NHANES provides nationally representative cross-sectional data on the health status of the civilian, non-institutionalized U.S. population.”) A standardized health exam was given along with the survey and through audiometric measurements, 333 teens were found to have at least some level of hearing loss (average hearing threshold level at least 15 dB in either ear). News of this study spread quickly, many blaming the prevalence of hearing loss on the higher use of ear buds by teens. These data were compared to results from 2928 teens from NHANES III (1988-1994), with 480 showing some level of hearing loss.

(a) When we have two samples for a binary categorical variable, it is often useful to organize the data using a two-way table. Complete the following 2×2 table of *counts*.

	1988-1994	2005-2006	Total
Some hearing loss	480	333	
No hearing loss			
Total	2928	1771	

(b) Explain why it does not make sense to conclude that hearing loss was more prevalent in 1988-1994 than in 2005-2006 based only on the comparison that $480 > 333$.

(c) Suggest a better way to compare the prevalence of hearing loss between the two studies. Calculate *one number* as the statistic for this study (what symbols are you using?). Does your statistic seem large enough to convince you that there has been an increase in hearing loss?

(d) Use technology to create numerical and graphical summaries for these summarized data. Write a sentence or two comparing the distributions of hearing loss between these two studies. Be sure to report an appropriate statistic.

(e) Do these data convince you that there is a difference in the population proportions? If not, what could be another explanation for the difference you see in these numerical and graphical summaries for these two samples?



(f) State appropriate null and alternative hypotheses in symbols and in words.

(g) Explain how you would design a simulation to answer this research question.

(h) Go to www.rossmanchance.com/applets and select an appropriate applet. Carry out the simulation and summarize your results.

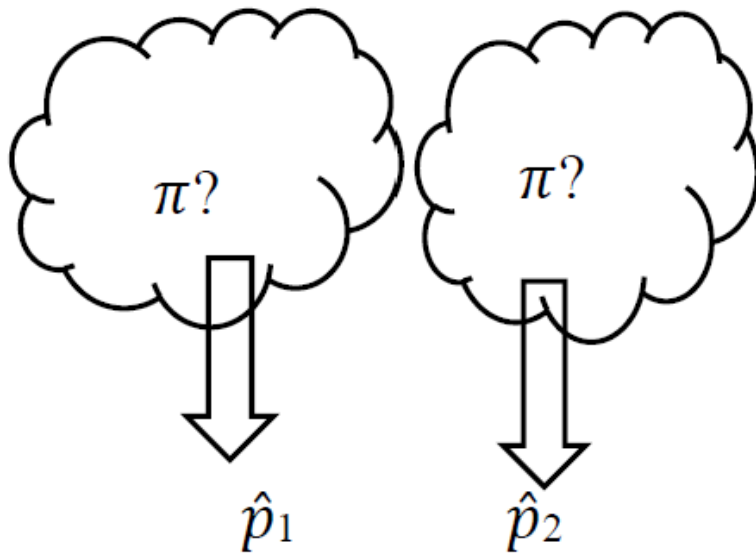
(i) Does the normal distribution appear to be an appropriate mathematical model for this null distribution?

(j) Suggest a rough 95% confidence interval. Provide a one-sentence interpretation of this interval in context.

Study Conclusions: We have moderate evidence against the null hypothesis (p -value ≈ 0.02 , meaning we would get a difference in sample proportions $\hat{p}_1 - \hat{p}_2$ as small as -0.024 or smaller in about 1.7% of random samples from two populations with $\pi_1 = \pi_2$). We are 95% confident that the population proportion with some hearing loss is between 0.0015 and 0.047 higher “now” than ten years ago. We feel comfortable drawing these conclusions about the populations the NHANES samples were selected from as they were random samples from each population (and there was no overlap in the populations between these two time periods). However, there are many things that have changed during this time period, and it would not be reasonable to attribute this increase in hearing loss exclusively to the use of ear buds.



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