Math 107

Hypothesis Tests: Randomization Samples and p-values

Warm Up

For each of the following state whether the quantity is a parameter or a statistic, and state the notation that would be used.

1. The proportion of all residents in a county who voted in the last presidential election.
2. The mean number of extracurricular activities from a random sample of 50 LU students.
3. The mean GPA of all students at LU.
4. The difference in the proportion of respondents who have ever smoked cigarettes, between a sample of 500 people who are 60 years old and a sample of 200 people who are 25 years old.

Sleep vs Caffeine

- Students were given words to memorize, then randomly assigned to either take a 90 min. nap or a caffeine pill.
- 2.5 hours later, they were tested on their recall ability
- Explanatory variable: sleep or caffeine
- Response variable: # words recalled
- Research question: is sleep or caffeine better?

Mednick, Cai, Kanady, and Drumond (2008). "Comparing the benefits of caffeine, naps, and placebo on verbal, motor, and perceptual memory," *Behavioural Brain Research,* 193, 79-86.

Sleep vs Caffeine

What is the parameter of interest in this experiment?

(a) proportion

(b) difference in proportions

(c) mean

(d) difference in means

(e) correlation

Sleep vs Caffeine

- Let μ_s and μ_c be the mean # of words recalled after sleeping and after taking a caffeine pill, respectively.
- What are the null and alternative hypotheses?

More Hypotheses

- Does the proportion of people who support Donald Trump differ between men and women?
- What are the null and alternative hypotheses?

Difference in proportions

Cocaine Addiction

- A study in the Archives of General Psychiatry (Gawin et al., 1989) compared the effectiveness of Desipramine (a new drug) and Lithium (an existing drug) in the treatment of cocaine addiction to determine whether Desipramine is more effective.

- The researchers randomly assigned 48 outpatient cocaine abusers who met DSM-III-R dependence criteria for cocaine but not for other substance abuse.

- All of the subjects were similar in history of cocaine and other substance abuse, cocaine craving, socio-demographics, and other psychiatric comorbidity.

- The 48 subjects were randomly assigned to take either Desipramine or Lithium, and the researchers tracked the subjects to determine whether or not they relapsed.

Your Turn

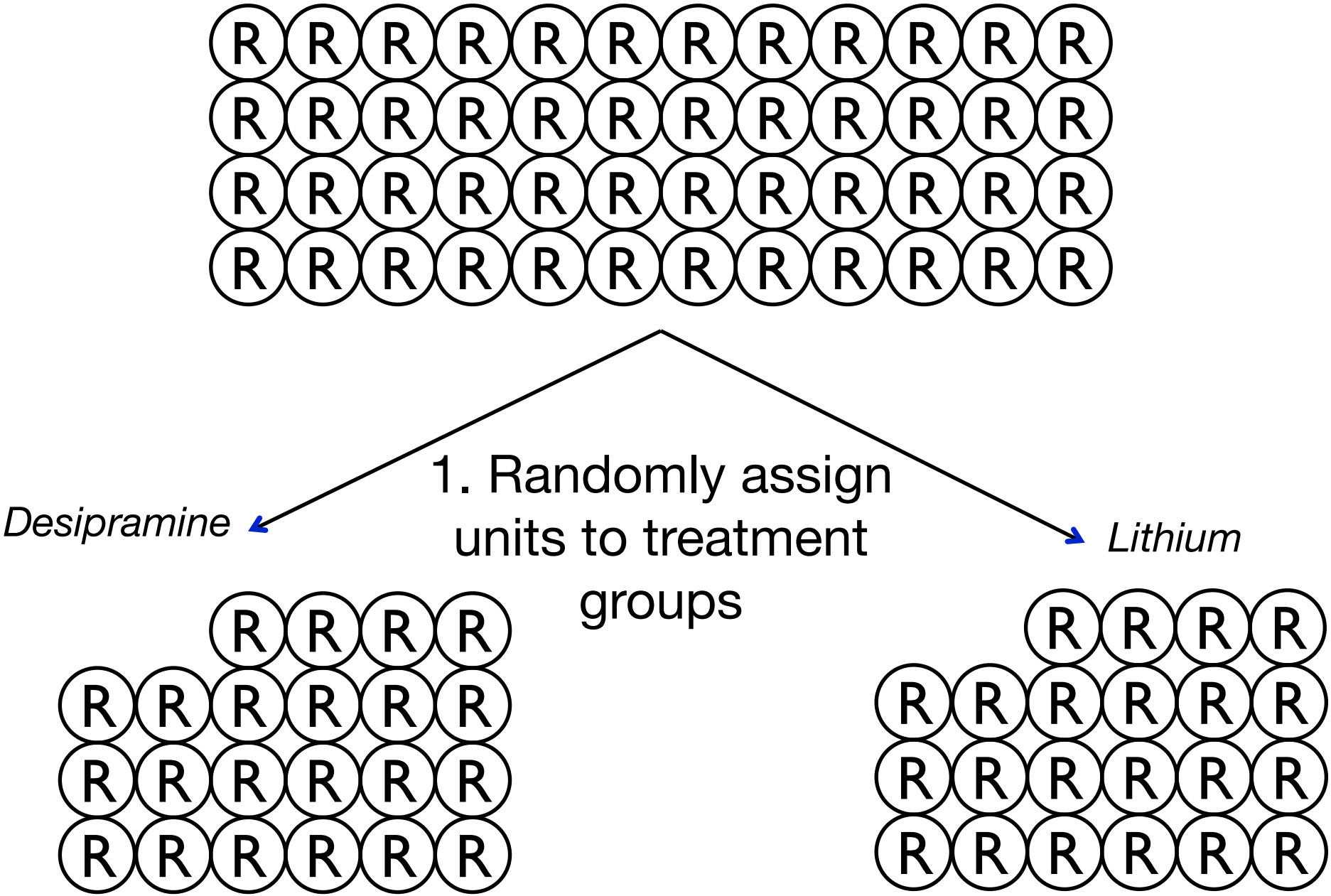
Is this an observational study or an experiment? Justify your answer.

Your Turn

Why did the researchers use random assignment to determine which subjects were assigned to the Desipramine group and which to the Lithium group?

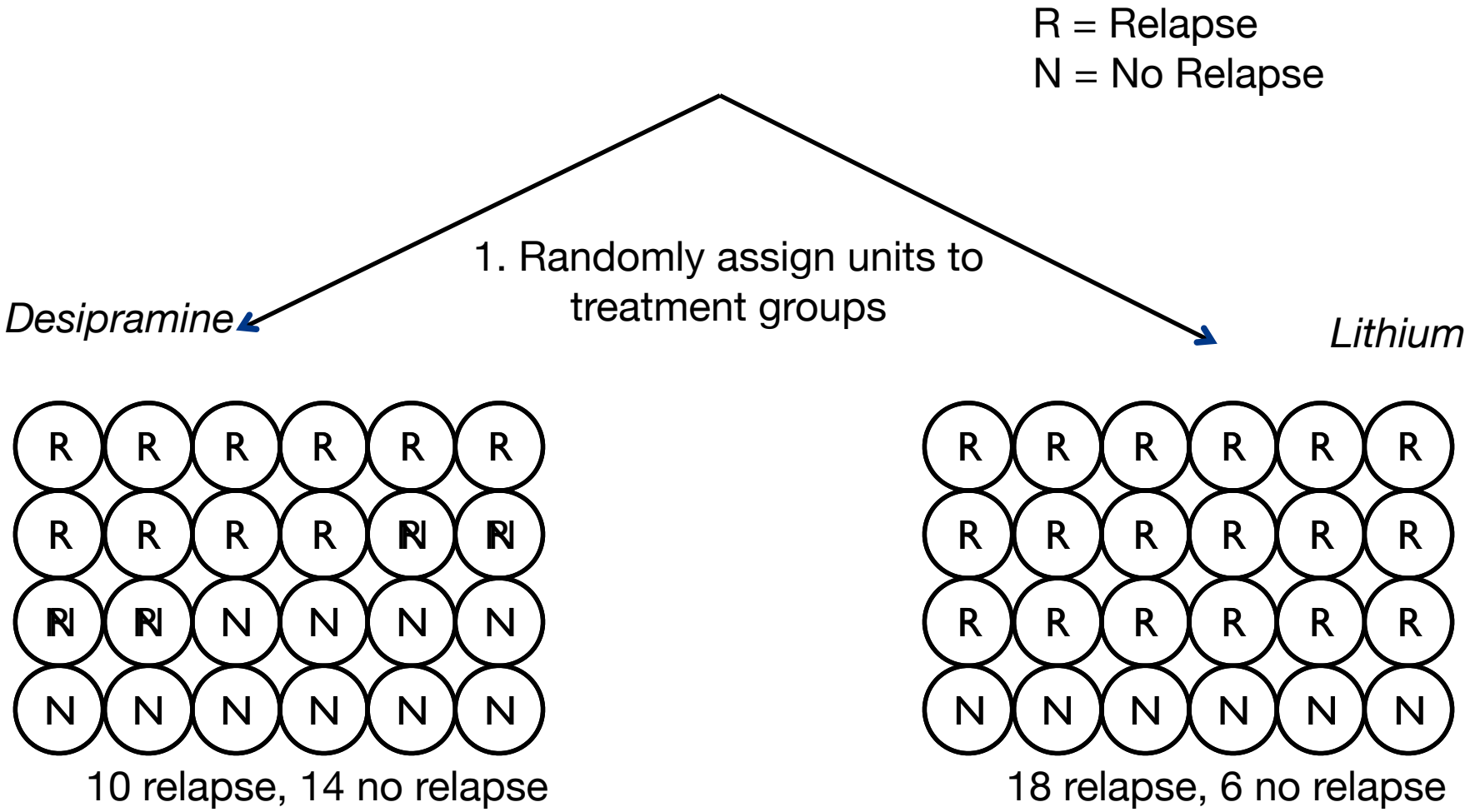
Your Turn

What are the null and alternative hypotheses?


1. Randomly assign units to treatment groups
Desipramine
Lithium

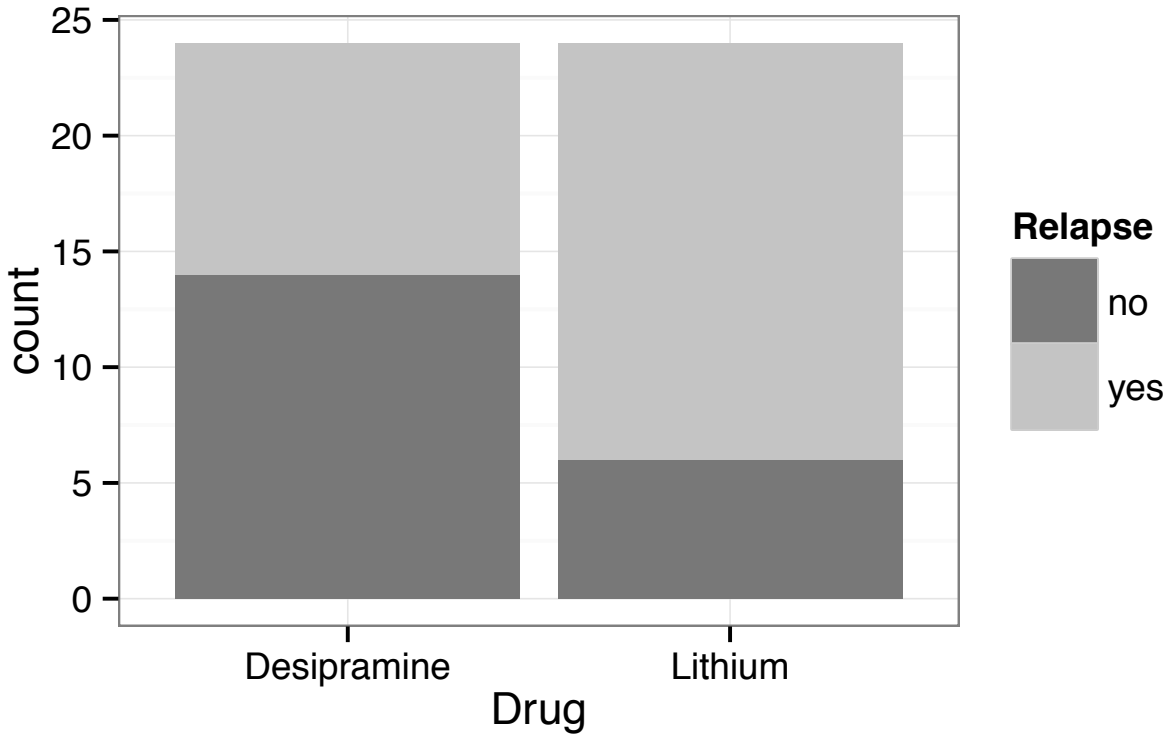
2. Conduct experiment

3. Observe relapse counts in each group



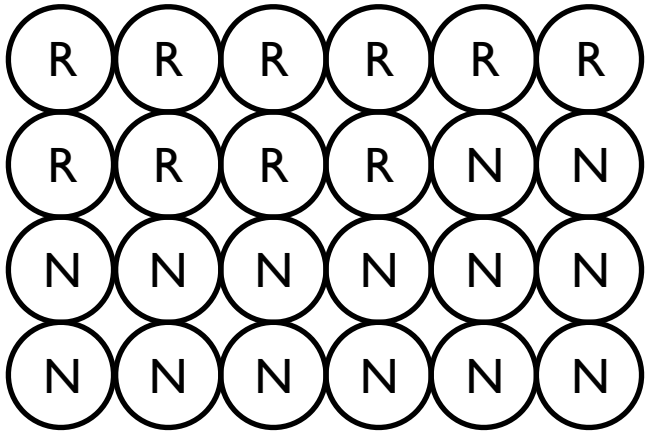
Your Turn

Do these data provide much evidence that desipramine is a better treatment of cocaine addiction?

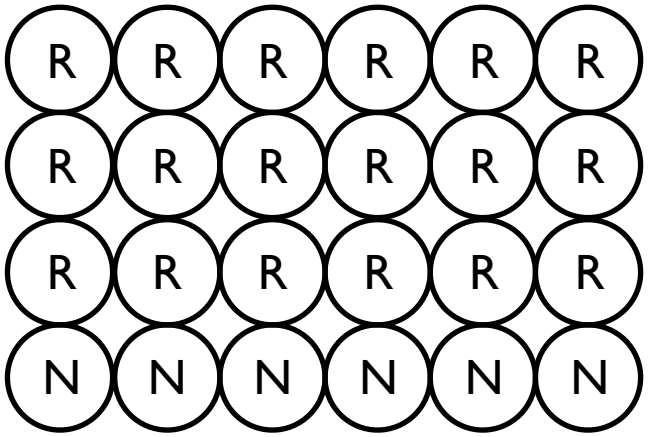


Your Turn

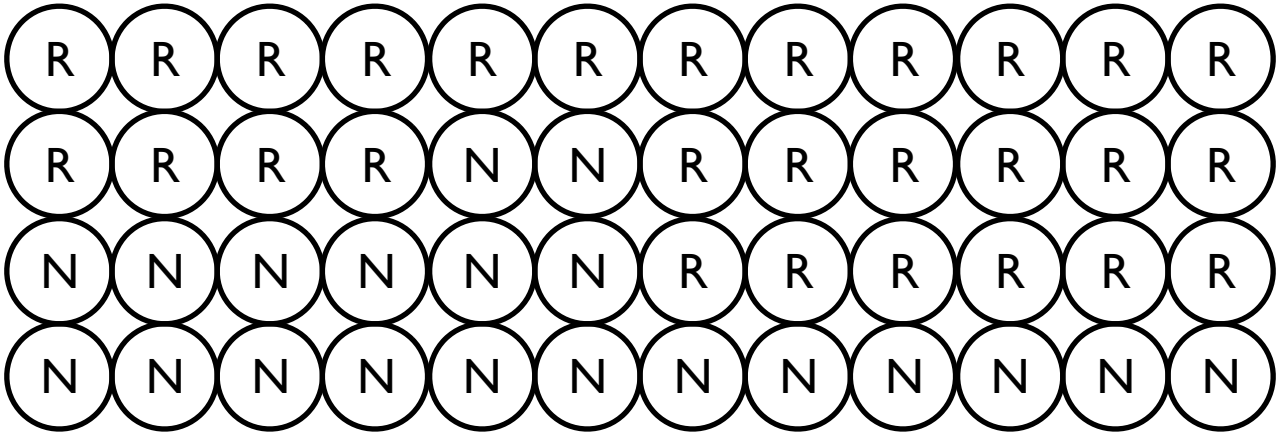
How might we compute a randomization sample for these data?



10 relapse, 14 no relapse

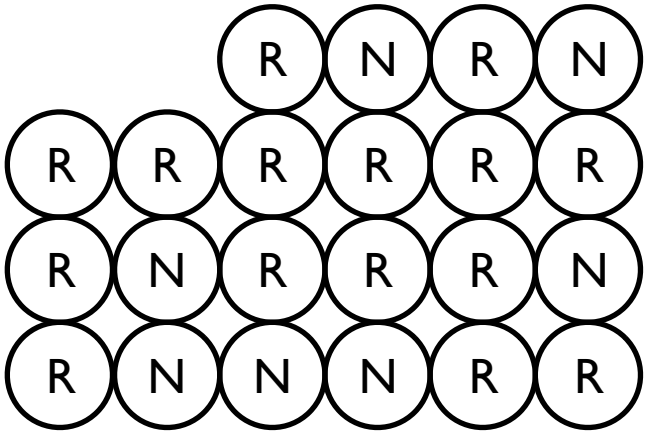


18 relapse, 6 no relapse



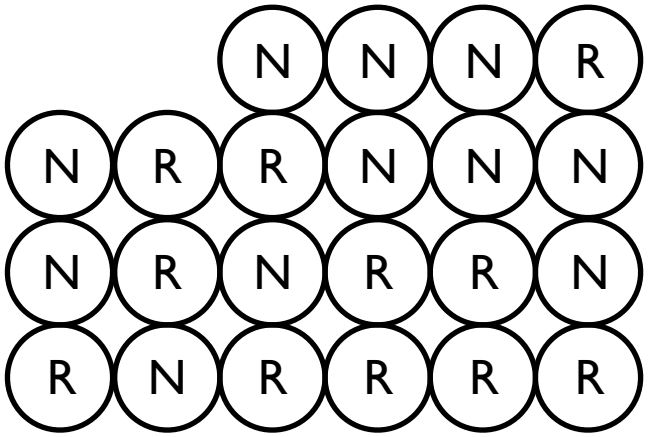
Simulate another randomization

Desipramine

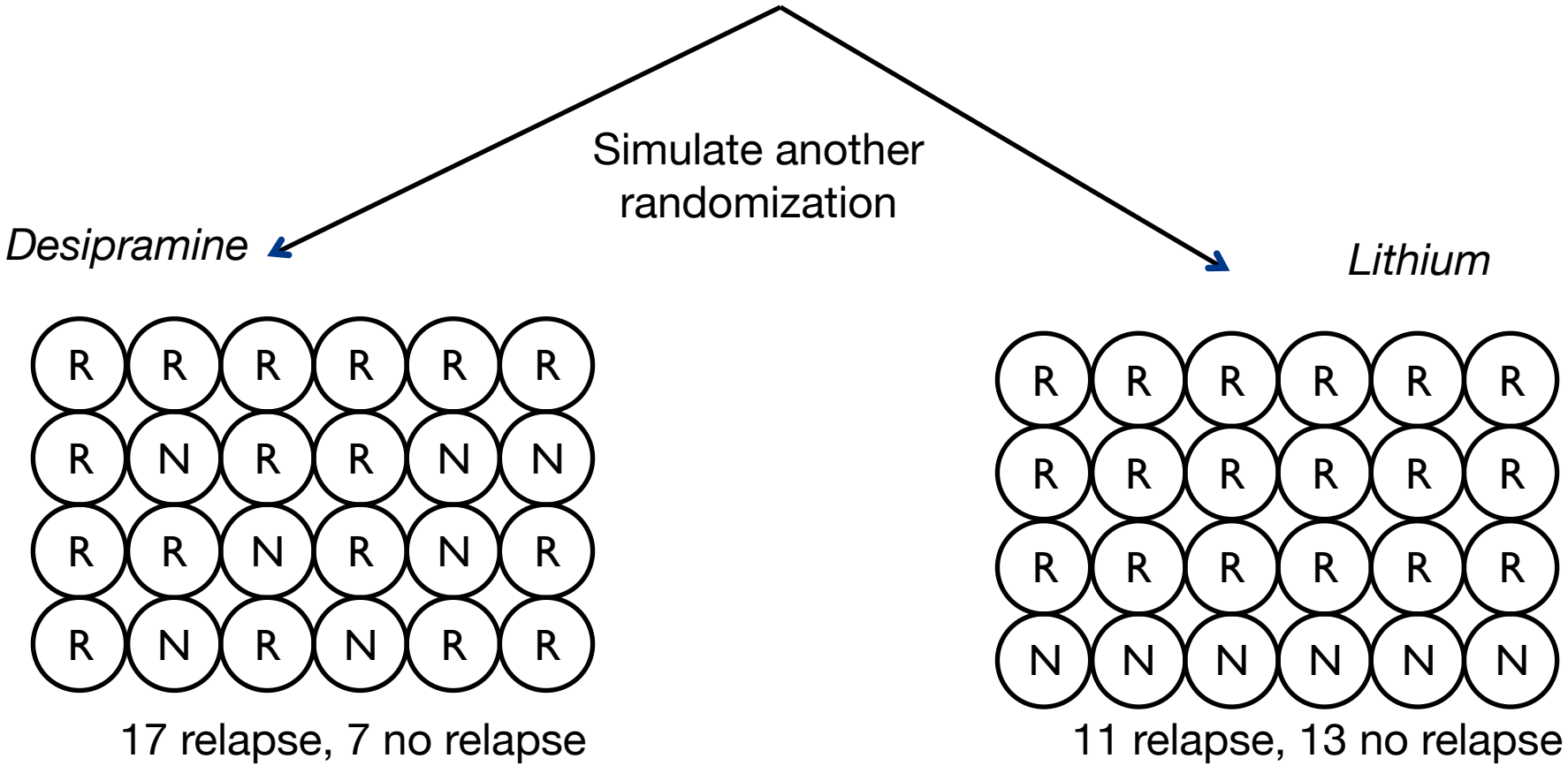


16 relapse, 8 no relapse

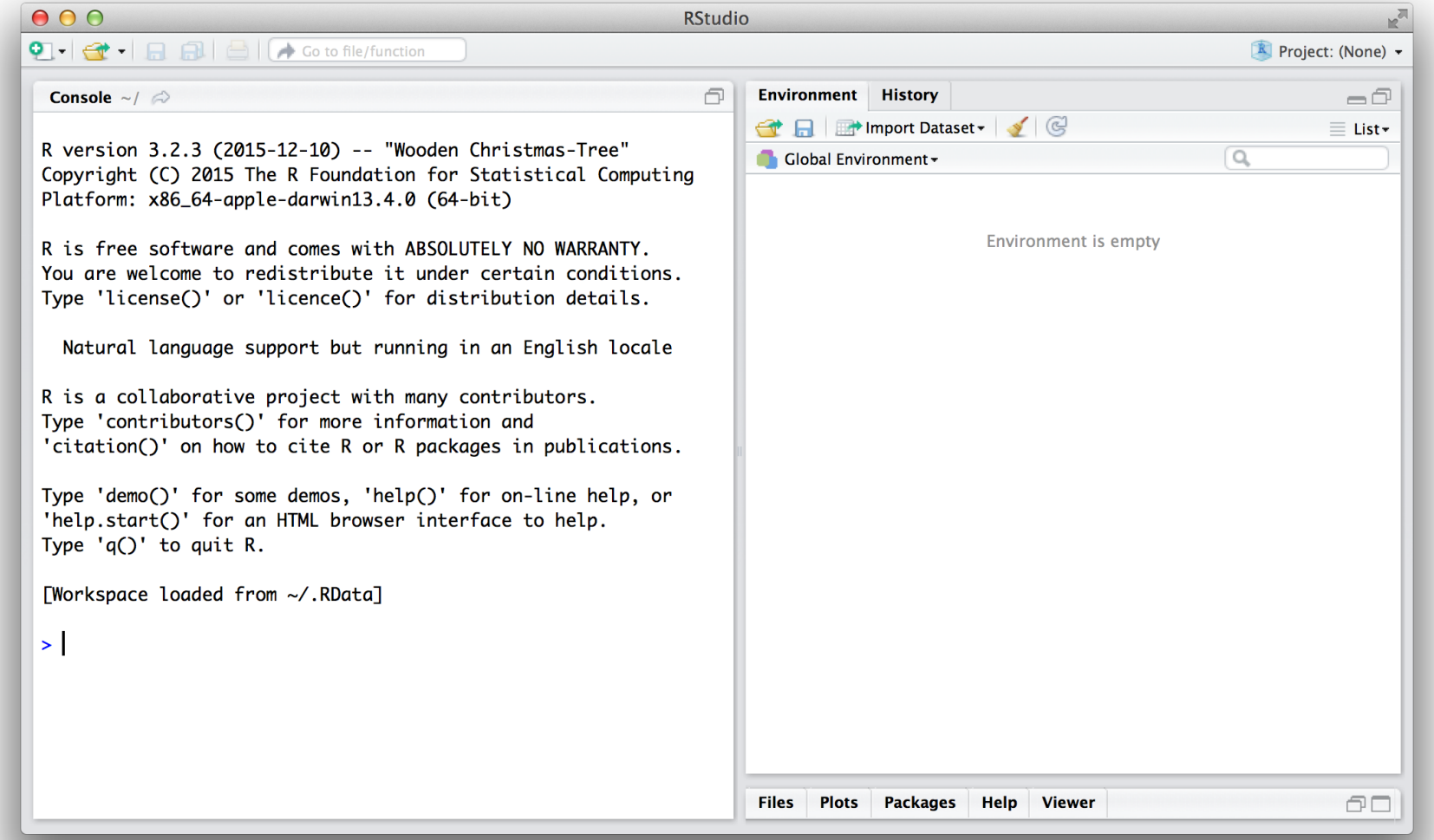
Lithium



12 relapse, 12 no relapse


Simulate another randomization
Desipramine
Lithium
R R R R R R
R N R R N N
R R N R N R
R N R N R R
17 relapse, 7 no relapse
R R R R R R
R R R R R R
R R R R R R
N N N N N N
11 relapse, 13 no relapse

R Demo


RStudio
Go to file/function
Project: (None)
Console ~/
R version 3.2.3 (2015-12-10) -- "Wooden Christmas-Tree"
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Platform: x86_64-apple-darwin13.4.0 (64-bit)
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