The goal of this lab is to familiarize you with descriptive analysis for categorical variables.

Throughout the lab, please refer to our Minitab Users Guide for instructions on how to create graphs and calculate statistics.

NOTE: There will be a graded clicker quiz at the end of this lab, graded 75% for participation and 25% for accuracy, so we recommend you record the answers to the questions (with question numbers) so you can easily find the answer during the quiz.

The Data

Prescription errors are a serious problem in medicine. In this lab we’ll analyze data from a study comparing error rates between written and electronic prescriptions\(^1\). The study looked at 30 different providers from 12 different adult primary care practices in the Hudson Valley region of New York. The data was collected between 2005 and 2007. None of the doctors were affiliated with an academic medical center.

Here a prescription error only includes an error in the prescribing process, not errors in dispensing, administering, or other medication error not related to the prescription itself. The study did not look at actual errors (as actual errors are almost certainly underreported), but instead had a physician, trained nurse, and pharmacist reviewers reviewed past prescriptions for errors (multiple people reviewed each prescription). Minor rule violations that would not cause any harm were not counted as errors. If you are interested in more details, you can look at the paper.

One Categorical Variable

We’ll first look at data exploring the prescription error rates at baseline, which were all paper-based and before any intervention. The study analyzed 3684 paper-based prescriptions (from 30 different providers), and found 1473 errors.

1. Create a frequency table for the data (you don’t need Minitab to do this)
2. What proportion of prescriptions had an error of some kind? (Minitab not needed)
3. Create a bar chart and a pie chart of the data, using Minitab. Which do you prefer?
4. Can these results be generalized to the population of all prescriptions? Why or why not?

Two Categorical Variables

The 30 providers in the study had the option to either continue with paper-based prescriptions or adopt a new electronic prescribing tool.

5. Is this an observational study or a randomized experiment? Can we use the results to make conclusions about causality?

6. Do you expect any baseline differences between the adopters of the electronic tool and the non-adopters who chose to continue using paper? Why or why not?

7. Here are some data on baseline variables for the providers, comparing adopters to non-adopters. Do you see any differences that might be concerning?

Table 1

Characteristics of Healthcare Providers

<table>
<thead>
<tr>
<th></th>
<th>All providers</th>
<th>Non-adopters&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Adopters&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 30</td>
<td>N = 15</td>
<td>N = 15</td>
</tr>
<tr>
<td>Female</td>
<td>12 (40%)</td>
<td>5 (33%)</td>
<td>7 (47%)</td>
</tr>
<tr>
<td>Years since graduation mean (SD)</td>
<td>18 (8)</td>
<td>20 (10)</td>
<td>15 (6)</td>
</tr>
<tr>
<td>Degree</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MD or DO</td>
<td>24 (80%)</td>
<td>12 (80%)</td>
<td>12 (80%)</td>
</tr>
<tr>
<td>Nurse practitioner</td>
<td>2 (7%)</td>
<td>1 (7%)</td>
<td>1 (7%)</td>
</tr>
<tr>
<td>Physician assistant</td>
<td>4 (13%)</td>
<td>2 (13%)</td>
<td>2 (13%)</td>
</tr>
<tr>
<td>Specialty (for MD or DO)</td>
<td>N = 24</td>
<td>N = 12</td>
<td>N = 12</td>
</tr>
<tr>
<td>Internist</td>
<td>9 (38%)</td>
<td>5 (42%)</td>
<td>4 (33%)</td>
</tr>
<tr>
<td>Family practitioner</td>
<td>15 (63%)</td>
<td>7 (58%)</td>
<td>8 (67%)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Represents characteristics of providers who did not adopt e-prescribing

<sup>b</sup>Represents characteristics of providers who did adopt e-prescribing
It’s also good to compare baseline prescription error rates between adopters and non-adopters, looking at their error rates before any intervention (so looking at paper error rates for both groups). The non-adopters had errors in 665 out of 1783 prescriptions written, and the adopters had errors in 808 out of 1901 prescriptions written.

8. Calculate the error rate (proportion of errors) for each group. Which group had a higher error rate?

9. Create a two-way table for this data (Minitab can’t help you with this – it can only do this for you when you give it a dataset).

10. Visualize the relationship between the two variables, using both a side-by-side (cluster) bar chart and a segmented (stacked) bar chart (using Minitab).

11. Does there appear to be a baseline difference in error rates between the two groups? (Note: this is purely an informal assessment, and there is not a right/wrong answer yet. We’ll learn later in the course how to formally assess whether a significant difference exists).

And now to the main result! The punch line of the study was comparing error rates between the electronic prescriptions (all completed by the adopters) and the paper-based prescriptions (all completed by the non-adopters). There were 151 errors out of 2305 electronic prescriptions and 592 errors out of 1543 paper-based prescriptions.

12. Repeat steps 8 – 10 for these results.

13. Calculate the relevant difference in proportions and the odds ratio.

14. Does there appear to be a difference in error rates for the group giving electronic prescriptions and the group giving paper-based prescriptions?

15. What have you learned about prescription error rates for electronic versus paper-based prescriptions?

If you have time and/or are interested, Table 4 in the paper gives results by type of error. Feel free to investigate if you are curious!