



## **Practice Exercises: Lesson 1.4**

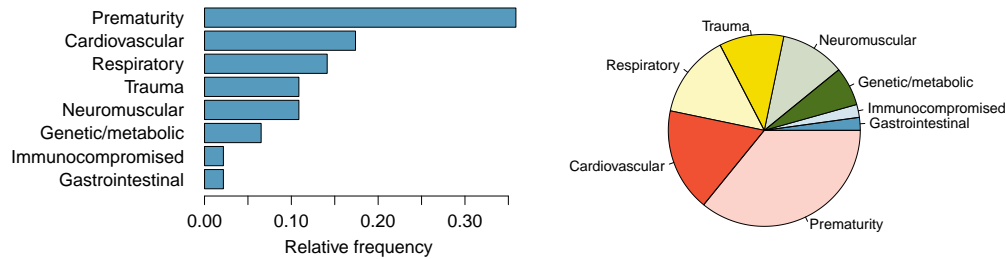
Diez, D. M., Çetinkaya-Rundel, M., Barr, C. D. (2019). OpenIntro Statistics (4th ed.). OpenIntro.  
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STAT 1201  
Introduction to Probability and Statistics

ONLINE AND DISTANCE EDUCATION

## Exercises

**2.21 Antibiotic use in children.** The bar plot and the pie chart below show the distribution of pre-existing medical conditions of children involved in a study on the optimal duration of antibiotic use in treatment of tracheitis, which is an upper respiratory infection.



- What features are apparent in the bar plot but not in the pie chart?
- What features are apparent in the pie chart but not in the bar plot?
- Which graph would you prefer to use for displaying these categorical data?

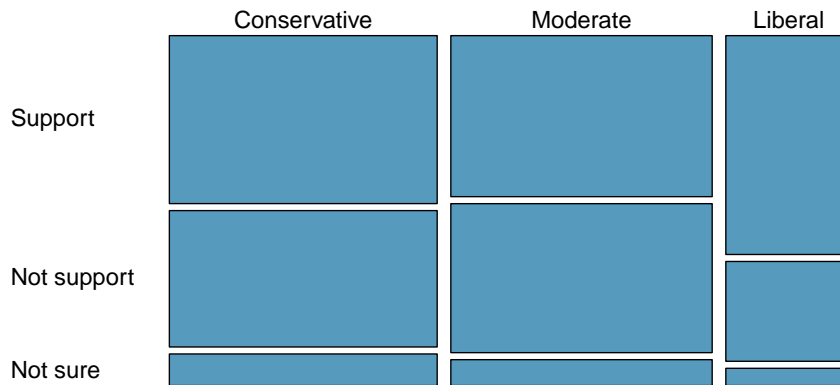
**2.22 Views on immigration.** 910 randomly sampled registered voters from Tampa, FL were asked if they thought workers who have illegally entered the US should be (i) allowed to keep their jobs and apply for US citizenship, (ii) allowed to keep their jobs as temporary guest workers but not allowed to apply for US citizenship, or (iii) lose their jobs and have to leave the country. The results of the survey by political ideology are shown below.<sup>22</sup>

		<i>Political ideology</i>			Total
		Conservative	Moderate	Liberal	
<i>Response</i>	(i) Apply for citizenship	57	120	101	278
	(ii) Guest worker	121	113	28	262
	(iii) Leave the country	179	126	45	350
	(iv) Not sure	15	4	1	20
	Total	372	363	175	910

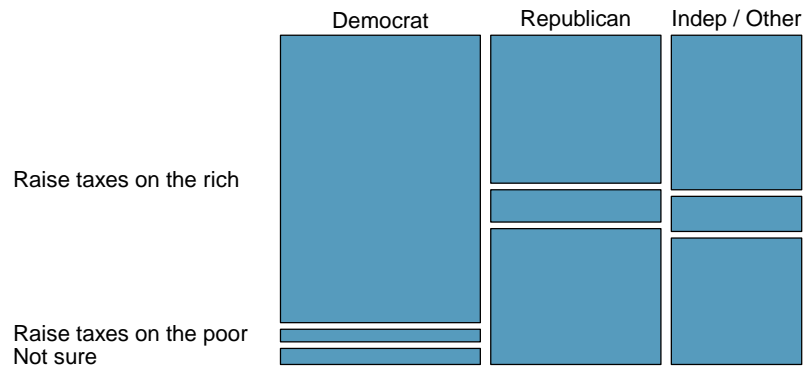
- What percent of these Tampa, FL voters identify themselves as conservatives?
- What percent of these Tampa, FL voters are in favor of the citizenship option?
- What percent of these Tampa, FL voters identify themselves as conservatives and are in favor of the citizenship option?
- What percent of these Tampa, FL voters who identify themselves as conservatives are also in favor of the citizenship option? What percent of moderates share this view? What percent of liberals share this view?
- Do political ideology and views on immigration appear to be independent? Explain your reasoning.

<sup>22</sup>SurveyUSA, News Poll #18927, data collected Jan 27-29, 2012.

**2.23 Views on the DREAM Act.** A random sample of registered voters from Tampa, FL were asked if they support the DREAM Act, a proposed law which would provide a path to citizenship for people brought illegally to the US as children. The survey also collected information on the political ideology of the respondents. Based on the mosaic plot shown below, do views on the DREAM Act and political ideology appear to be independent? Explain your reasoning.<sup>23</sup>



**2.24 Raise taxes.** A random sample of registered voters nationally were asked whether they think it's better to raise taxes on the rich or raise taxes on the poor. The survey also collected information on the political party affiliation of the respondents. Based on the mosaic plot shown below, do views on raising taxes and political affiliation appear to be independent? Explain your reasoning.<sup>24</sup>



<sup>23</sup>SurveyUSA, News Poll #18927, data collected Jan 27-29, 2012.

<sup>24</sup>Public Policy Polling, Americans on College Degrees, Classic Literature, the Seasons, and More, data collected Feb 20-22, 2015.

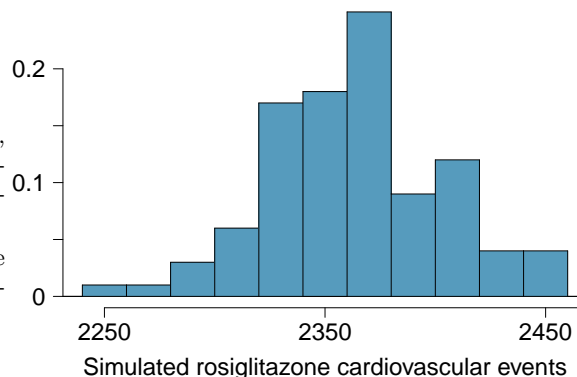
## Exercises

**2.25 Side effects of Avandia.** Rosiglitazone is the active ingredient in the controversial type 2 diabetes medicine Avandia and has been linked to an increased risk of serious cardiovascular problems such as stroke, heart failure, and death. A common alternative treatment is pioglitazone, the active ingredient in a diabetes medicine called Actos. In a nationwide retrospective observational study of 227,571 Medicare beneficiaries aged 65 years or older, it was found that 2,593 of the 67,593 patients using rosiglitazone and 5,386 of the 159,978 using pioglitazone had serious cardiovascular problems. These data are summarized in the contingency table below.<sup>29</sup>

	Cardiovascular problems		Total
	Yes	No	
Treatment			
Rosiglitazone	2,593	65,000	67,593
Pioglitazone	5,386	154,592	159,978
Total	7,979	219,592	227,571

- (a) Determine if each of the following statements is true or false. If false, explain why. *Be careful:* The reasoning may be wrong even if the statement's conclusion is correct. In such cases, the statement should be considered false.
- Since more patients on pioglitazone had cardiovascular problems (5,386 vs. 2,593), we can conclude that the rate of cardiovascular problems for those on a pioglitazone treatment is higher.
  - The data suggest that diabetic patients who are taking rosiglitazone are more likely to have cardiovascular problems since the rate of incidence was  $(2,593 / 67,593 = 0.038)$  3.8% for patients on this treatment, while it was only  $(5,386 / 159,978 = 0.034)$  3.4% for patients on pioglitazone.
  - The fact that the rate of incidence is higher for the rosiglitazone group proves that rosiglitazone causes serious cardiovascular problems.
  - Based on the information provided so far, we cannot tell if the difference between the rates of incidences is due to a relationship between the two variables or due to chance.
- (b) What proportion of all patients had cardiovascular problems?
- (c) If the type of treatment and having cardiovascular problems were independent, about how many patients in the rosiglitazone group would we expect to have had cardiovascular problems?
- (d) We can investigate the relationship between outcome and treatment in this study using a randomization technique. While in reality we would carry out the simulations required for randomization using statistical software, suppose we actually simulate using index cards. In order to simulate from the independence model, which states that the outcomes were independent of the treatment, we write whether or not each patient had a cardiovascular problem on cards, shuffled all the cards together, then deal them into two groups of size 67,593 and 159,978. We repeat this simulation 1,000 times and each time record the number of people in the rosiglitazone group who had cardiovascular problems. Use the relative frequency histogram of these counts to answer (i)-(iii).

- What are the claims being tested?
- Compared to the number calculated in part (b), which would provide more support for the alternative hypothesis, *more* or *fewer* patients with cardiovascular problems in the rosiglitazone group?
- What do the simulation results suggest about the relationship between taking rosiglitazone and having cardiovascular problems in diabetic patients?



<sup>29</sup>D.J. Graham et al. "Risk of acute myocardial infarction, stroke, heart failure, and death in elderly Medicare patients treated with rosiglitazone or pioglitazone". In: *JAMA* 304.4 (2010), p. 411. ISSN: 0098-7484.