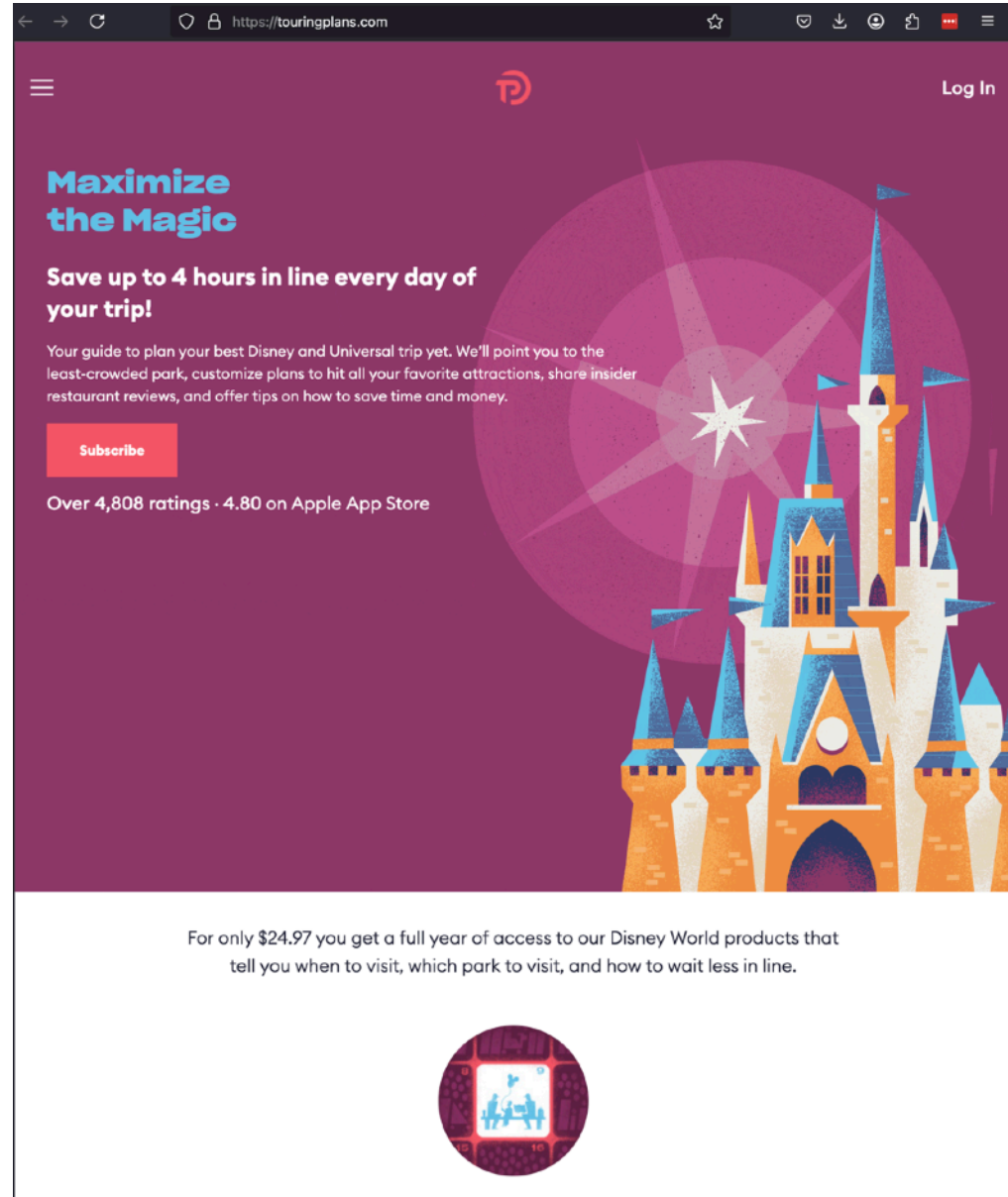


# Causal inference with regression

# Today's case study



- Some days, **one** of the Disney World **theme parks** would open for an **extra morning hour**...
- ...but only for guests staying at the Disney Resort hotels
- What does this do to ride wait times?



From Barrett et al., 2025, *Causal Inference in R*.  
Introduction to the datasets at <https://www.r-causal.org/chapters/07-prep-data>

# Tour of the touringplans dataset

---

<a href="#">alien_saucers</a>	Alien Swirling Saucers Wait Times	<a href="#">rock_n_rollercoaster</a>	Rock n Rollercoaster Wait Times
<a href="#">attractions</a>	Attraction meta data	<a href="#">seven_dwarfs_train</a>	Seven Dwarfs Mine Train Wait Times
<a href="#">attractions_metadata</a>	Metadata about attractions included in datasets	<a href="#">seven_dwarfs_train_2018</a>	Seven Dwarfs Mine Train wait times in 2018
<a href="#">dinosaur</a>	DINOSAUR Wait Times	<a href="#">slinky_dog</a>	Slinky Dog Dash Wait Times
<a href="#">expedition_everest</a>	Expedition Everest Wait Times	<a href="#">soarin</a>	Soarin' Wait Times
<a href="#">flight_of_passage</a>	Avatar Flight of Passage Wait Times	<a href="#">spaceship_earth</a>	Spaceship Earth Wait Times
<a href="#">kilimanjaro_safaris</a>	Kilimanjaro Safaris Wait Times	<a href="#">splash_mountain</a>	Splash Mountain Wait Times
<a href="#">navi_river</a>	Na'vi River Journey Wait Times	<a href="#">touringplans_2018</a>	Reduced data set for Disney World attraction wait times in 2018
<a href="#">parks_metadata_raw</a>	Meta data for Disney Touring Plan Park Data	<a href="#">toy_story_mania</a>	Toy Story Mania! Wait Times
<a href="#">pirates_of_caribbean</a>	Pirates of the Caribbean Wait Times		

# The theme parks

## Embark on a Magical Adventure You'll Remember Forever

Visit all 4 theme parks at Walt Disney World Resort—  
filled with classic attractions, exciting events and  
enchanting entertainment!

> xtabs(~park,attractions)

park

California Adventure

14

Disney's Animal Kingdom

8

Disney's Hollywood Studios

12

Disneyland

25

Epcot

11

Magic Kingdom

25

Share a Family Vacation Filled with Can't-Miss Experiences at All 4 Parks!



Disney's Hollywood Studios

Venture to a place where legendary *Star Wars* stories come to life—and put you in the middle of the action! >



Disney's Animal Kingdom Theme Park

Celebrate the magic of nature with some favorite Disney pals, animal adventures and lively entertainment. >



Magic Kingdom Park

Race through the diamond mine from *Snow White and the Seven Dwarfs* on a swaying family coaster ride. >



EPCOT

Discover worlds of wonder around the globe and set sail to Arendelle on *Frozen Ever After*. >

# Reminder: three criteria for identifiability

---

- **Consistency:**  $Y = Y^{a=i}$  whenever  $A = i$ 
  - Consequence: different individuals' outcomes don't affect each other
  - Consequence: there can be no "multiple versions" of the same treatment  $A$  in terms of their influence on  $Y$
- **Conditional Exchangeability:** for all  $i$ ,  $Y^{a=i} \perp A \mid Z$  for some set of observed variables  $Z$ 
  - Consequence: there can be no "hidden common causes" or "hidden mediators" of  $A$  and  $Y^{a=i}$
- **Positivity:** for all  $i$  and all values of  $Z$ ,  $P(A = i \mid Z) > 0$ 
  - e.g., in our example, it can't be the case that individuals with heart disease are *always* given transplants
- If all three criteria hold, we can estimate causal effects