Tidying Data

tidyr

2022-03-11

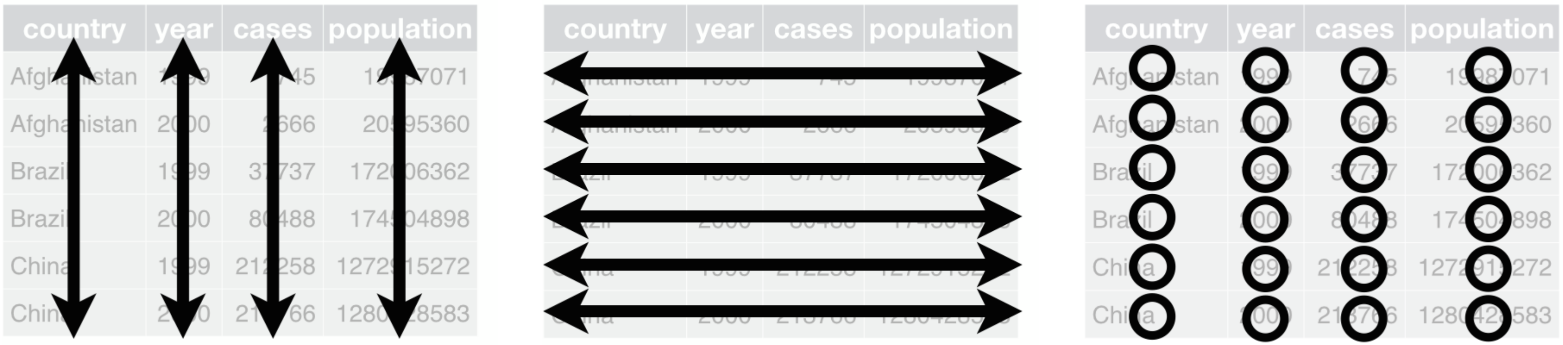
tidyr

Functions for tidying data.

What is tidy data?

> “Tidy datasets are all alike, but every messy dataset is messy in its own way.” –– Hadley Wickham

Tidy Data

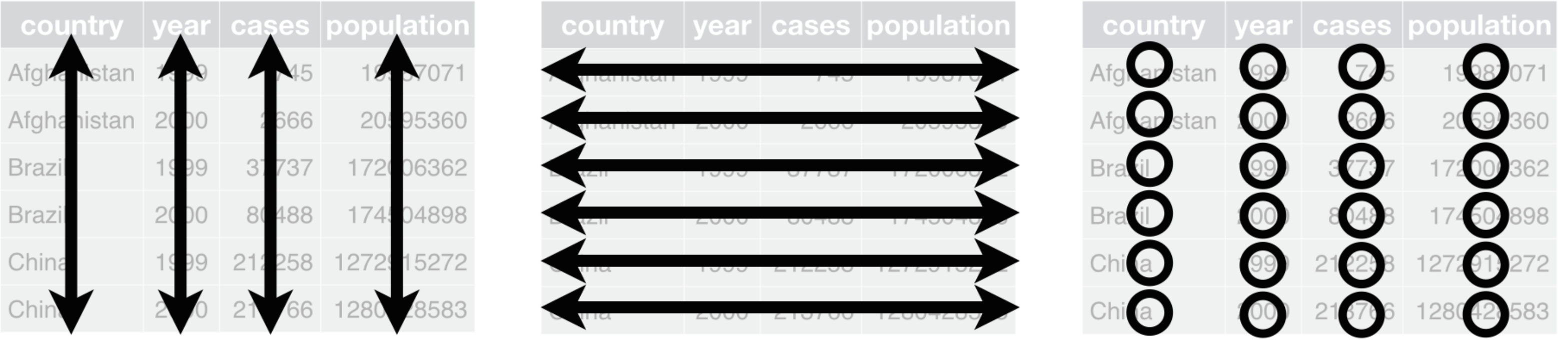


variables

observations

values

Tidy Data



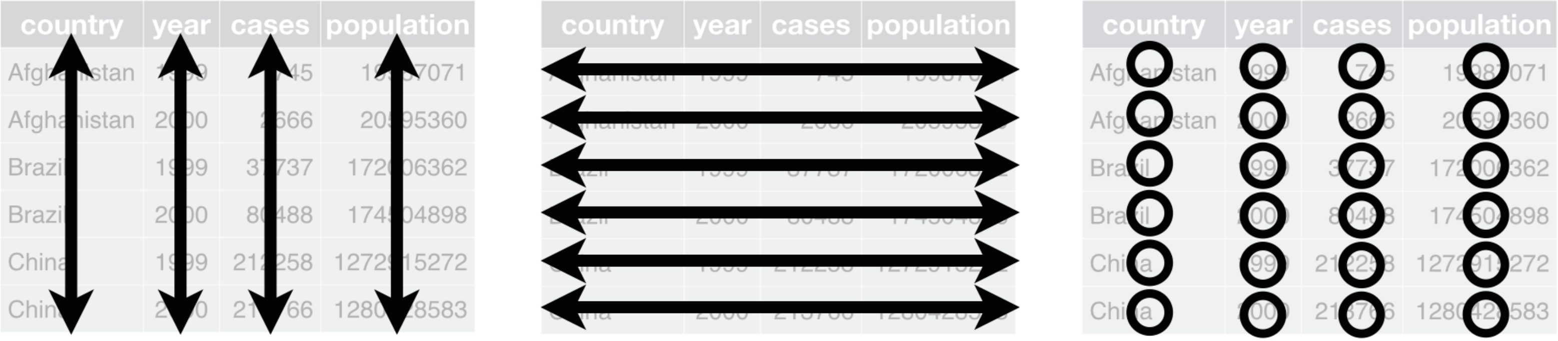
variables

observations

values

Each column is a single variable

Tidy Data



variables

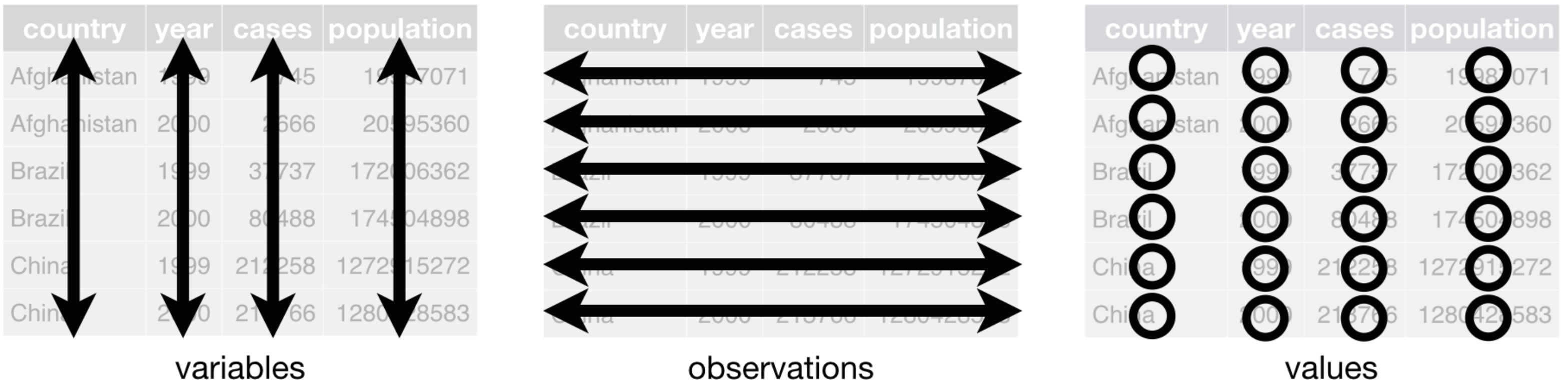
observations

values

Each column is a single variable

Each **row** is a single **observation**

Tidy Data



country	year	cases	population
Afghanistan	1999	745	19987071
Afghanistan	2000	2666	20595360
Brazil	1999	37737	172006362
Brazil	2000	80488	174504898
China	1999	212258	1272915272
China	2000	213766	1280428583

Each column is a single variable

Each row is a single observation

Each cell is a value

pivot_longer()

```
pivot_longer(<DATA>, <NAMES TO>, <VALUES TO>, <VARIABLES>)
```

Lord of the Rings

```
lotr <- tribble(
                         ~film,    ~race, ~female, ~male,
  "The Fellowship Of The Ring",    "Elf",   1229L,  971L,
  "The Fellowship Of The Ring", "Hobbit",     14L, 3644L,
  "The Fellowship Of The Ring",    "Man",      0L, 1995L,
              "The Two Towers",    "Elf",    331L,  513L,
              "The Two Towers", "Hobbit",      0L, 2463L,
              "The Two Towers",    "Man",    401L, 3589L,
      "The Return Of The King",    "Elf",    183L,  510L,
      "The Return Of The King", "Hobbit",      2L, 2673L,
      "The Return Of The King",    "Man",    268L, 2459L
)
```

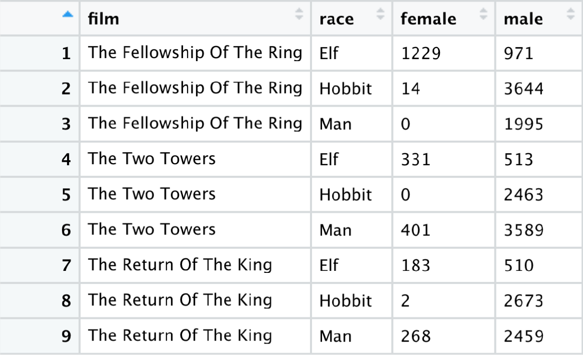
Lord of the Rings

```
lotr
```

```
## # A tibble: 9 × 4
##   film                       race   female  male
##   <chr>                      <chr>   <int> <int>
## 1 The Fellowship Of The Ring Elf      1229   971
## 2 The Fellowship Of The Ring Hobbit     14  3644
## 3 The Fellowship Of The Ring Man         0  1995
## 4 The Two Towers             Elf       331   513
## 5 The Two Towers             Hobbit      0  2463
## 6 The Two Towers             Man       401  3589
## 7 The Return Of The King     Elf       183   510
## 8 The Return Of The King     Hobbit      2  2673
## 9 The Return Of The King     Man       268  2459
```

⚠ new data alert! ⚠

lotr



	film	race	female	male
1	The Fellowship Of The Ring	Elf	1229	971
2	The Fellowship Of The Ring	Hobbit	14	3644
3	The Fellowship Of The Ring	Man	0	1995
4	The Two Towers	Elf	331	513
5	The Two Towers	Hobbit	0	2463
6	The Two Towers	Man	401	3589
7	The Return Of The King	Elf	183	510
8	The Return Of The King	Hobbit	2	2673
9	The Return Of The King	Man	268	2459

Where does it come from?

`exercises.Rmd`

source:

`github.com/jennybc/lotr-tidyr`

How can I use it?

Run the code at the top of exercises.Rmd

```
View(lotr)
```

this saves it in your global environment

pivot_longer()

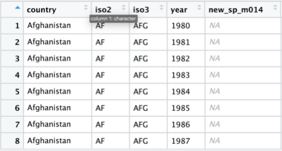
```
lotr %>%
  pivot_longer(
    names_to = "sex",
    values_to = "words",
    cols = female:male
  )
```

```
lotr %>%
  pivot_longer(
    names_to = "sex",
    values_to = "words",
    cols = female:male
  )
```

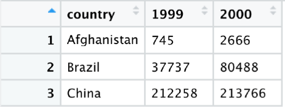
```
## # A tibble: 18 × 4
##    film                       race   sex    words
##    <chr>                      <chr>  <chr>  <int>
##  1 The Fellowship Of The Ring Elf    female  1229
##  2 The Fellowship Of The Ring Elf    male     971
##  3 The Fellowship Of The Ring Hobbit female    14
##  4 The Fellowship Of The Ring Hobbit male    3644
##  5 The Fellowship Of The Ring Man    female     0
##  6 The Fellowship Of The Ring Man    male    1995
##  7 The Two Towers             Elf    female   331
##  8 The Two Towers             Elf    male     513
##  9 The Two Towers             Hobbit female     0
## 10 The Two Towers             Hobbit male    2463
## # … with 8 more rows
```

new data alert!

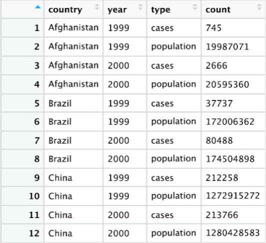
table2, table4a, who



	country	iso2	iso3	year	new_sp_m014
1	Afghanistan	AF	AFG	1980	NA
2	Afghanistan	AF	AFG	1981	NA
3	Afghanistan	AF	AFG	1982	NA
4	Afghanistan	AF	AFG	1983	NA
5	Afghanistan	AF	AFG	1984	NA
6	Afghanistan	AF	AFG	1985	NA
7	Afghanistan	AF	AFG	1986	NA
8	Afghanistan	AF	AFG	1987	NA



	country	1999	2000
1	Afghanistan	745	2666
2	Brazil	37737	80488
3	China	212258	213766



	country	year	type	count
1	Afghanistan	1999	cases	745
2	Afghanistan	1999	population	19987071
3	Afghanistan	2000	cases	2666
4	Afghanistan	2000	population	20595360
5	Brazil	1999	cases	37737
6	Brazil	1999	population	172006362
7	Brazil	2000	cases	80488
8	Brazil	2000	population	174504898
9	China	1999	cases	212258
10	China	1999	population	1272915272
11	China	2000	cases	213766
12	China	2000	population	1280428583

Where does it come from?

`The tidyr R package`

How can I use it?

```
library(tidyr)
View(table2)
View(table4a)
View(who)
```

they're invisible!

Your Turn 1

Use pivot_longer() **to reorganize** table4a **into three columns: country, year, and cases.**

Your Turn 1

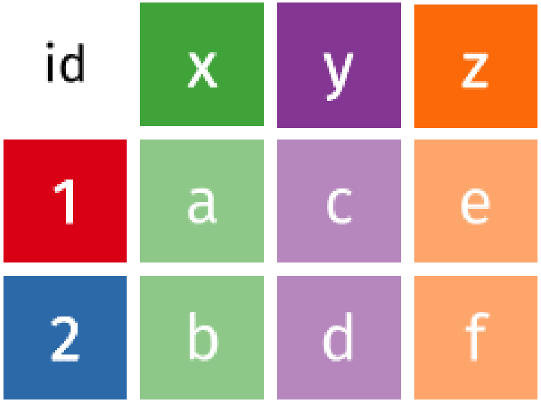
```
table4a %>%
  pivot_longer(
    names_to = "year",
    values_to = "cases",
    cols = -country
  )
```

```
## # A tibble: 6 × 3
##   country     year   cases
##   <chr>       <chr>  <int>
## 1 Afghanistan 1999     745
## 2 Afghanistan 2000    2666
## 3 Brazil      1999   37737
## 4 Brazil      2000   80488
## 5 China       1999  212258
## 6 China       2000  213766
```

pivot_wider()

```
pivot_wider(<DATA>, <NAMES FROM>, <VALUES FROM>)
```

`wide`



id	x	y	z
1	a	c	e
2	b	d	f

Animation by Mara Averick

pivot_wider()

```
lotr %>%
  pivot_longer(
    names_to = "sex",
    values_to = "words",
    cols = female:male
  ) %>%
  pivot_wider(
    names_from = race,
    values_from = words
  )
```

pivot_wider()

```r
lotr %>%
  pivot_longer(
    names_to = "sex",
    values_to = "words",
    cols = female:male
  ) %>%
  pivot_wider(
    names_from = race,
    values_from = words
  )
```

pivot_wider()

```r
lotr %>%
  pivot_longer(
    names_to = "sex",
    values_to = "words",
    cols = female:male
  ) %>%
  pivot_wider(
    names_from = race,
    values_from = words
  )
```

```
## # A tibble: 6 × 5
##   film                       sex      Elf Hobbit   Man
##   <chr>                      <chr>  <int>  <int> <int>
## 1 The Fellowship Of The Ring female  1229     14     0
## 2 The Fellowship Of The Ring male     971   3644  1995
## 3 The Two Towers             female   331      0   401
## 4 The Two Towers             male     513   2463  3589
## 5 The Return Of The King     female   183      2   268
## 6 The Return Of The King     male     510   2673  2459
```

Your Turn 2

Use pivot_wider() **to reorganize** table2 **into four columns: country, year, cases, and population.**

Create a new variable called prevalence **that divides** cases **by** population **multiplied by 100000.**

Pass the data frame to a ggplot. Make a scatter plot with year **on the x axis and** prevalence **on the y axis. Set the color aesthetic (**aes()**) to** country**. Use** size = 2 **for the points. Add a line geom.**

```
table2
```

Your Turn 2

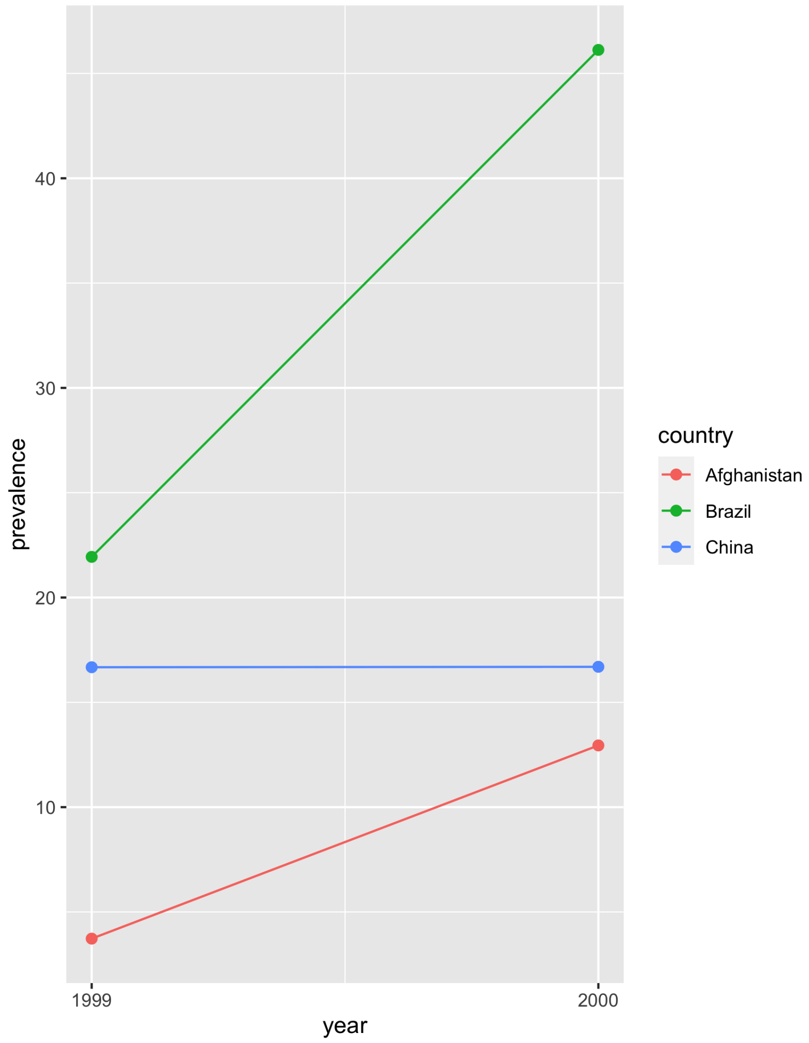
```
table2 %>%
  pivot_wider(
    names_from = type,
    values_from = count
  ) %>%
  mutate(prevalence = (cases / population) * 100000)
```

```
## # A tibble: 6 × 5
##   country      year  cases population prevalence
##   <chr>       <int>  <int>      <int>      <dbl>
## 1 Afghanistan  1999    745   19987071       3.73
## 2 Afghanistan  2000   2666   20595360      12.9 
## 3 Brazil       1999  37737  172006362      21.9 
## 4 Brazil       2000  80488  174504898      46.1 
## 5 China        1999 212258 1272915272      16.7 
## 6 China        2000 213766 1280428583      16.7 
```

Your Turn 2

```r
table2 %>%
  pivot_wider(
    names_from = type,
    values_from = count
  ) %>%
  mutate(prevalence = (cases / population) * 100000) %>%
  ggplot(aes(x = year, y = prevalence, color = country)) +
  geom_point(size = 2) +
  geom_line() +
  scale_x_continuous(breaks = c(1999L, 2000L))
```

Your Turn 2


40
30
20
10
prevalence
1999
2000
year
country
Afghanistan
Brazil
China

Your Turn 3

Pivot the 5th through 60th columns of `who` **so that the names of the columns go into a new variable called** `codes` **and the values go into a new variable called** `n`**. Then select just the** `country`**,** `year`**,** `codes` **and** `n` **variables.**

```
who
```

Your Turn 3

```
who %>%
  pivot_longer(
    names_to = "codes",
    values_to = "n",
    cols = 5:60
  ) %>%
  select(country, year, codes, n)
```

Your Turn 3

```
## # A tibble: 405,440 × 4
##    country      year codes            n
##    <chr>       <int> <chr>        <int>
##  1 Afghanistan  1980 new_sp_m014     NA
##  2 Afghanistan  1980 new_sp_m1524    NA
##  3 Afghanistan  1980 new_sp_m2534    NA
##  4 Afghanistan  1980 new_sp_m3544    NA
##  5 Afghanistan  1980 new_sp_m4554    NA
##  6 Afghanistan  1980 new_sp_m5564    NA
##  7 Afghanistan  1980 new_sp_m65      NA
##  8 Afghanistan  1980 new_sp_f014     NA
##  9 Afghanistan  1980 new_sp_f1524    NA
## 10 Afghanistan  1980 new_sp_f2534    NA
## # … with 405,430 more rows
```

separate()/unite()

```
separate(<DATA>, <VARIABLE>, into = c("<VARIABLE1>", "<VARIABLE2>"))

unite(<DATA>, <VARIABLES>)
```

Your Turn 4

Use the cases **data below. Separate the** sex_age **column into sex and age columns.**

```
cases <- tribble(
   ~id,     ~sex_age,
   "1",    "male_56",
   "2",  "female_77",
   "3",  "female_49"
)
separate(_______, _______, into = c("_______", "_______"))
```

Your Turn 4

```
cases <- tribble(
   ~id,     ~sex_age,
   "1",    "male_56",
   "2",  "female_77",
   "3",  "female_49"
)
separate(cases, sex_age, into = c("sex", "age"))
```

Your Turn 4

```
cases <- tribble(
   ~id,      ~sex_age,
   "1",     "male_56",
   "2",   "female_77",
   "3",   "female_49"
)
separate(cases, sex_age, into = c("sex", "age"))
```

```
## # A tibble: 3 × 3
##   id    sex    age
##   <chr> <chr>  <chr>
## 1 1     male   56
## 2 2     female 77
## 3 3     female 49
```

Your Turn 4

```r
cases <- tribble(
   ~id,     ~sex_age,
   "1",    "male_56",
   "2",  "female_77",
   "3",  "female_49"
)
separate(cases, sex_age, into = c("sex", "age"))
```

```
## # A tibble: 3 × 3
##   id    sex    age  
##   <chr> <chr>  <chr>
## 1 1     male   56   
## 2 2     female 77   
## 3 3     female 49   
```

Your Turn 4

```
cases <- tribble(
   ~id,      ~sex_age,
   "1",     "male_56",
   "2",   "female_77",
   "3",   "female_49"
)
separate(cases, sex_age, into = c("sex", "age"), convert = TRUE)
```

```
## # A tibble: 3 × 3
##   id    sex      age
##   <chr> <chr>  <int>
## 1 1     male      56
## 2 2     female    77
## 3 3     female    49
```

Your Turn 5: Challenge!

There are two CSV files in this folder containing SEER data in breast cancer incidence in white and black women. For both sets of data:

Import the data

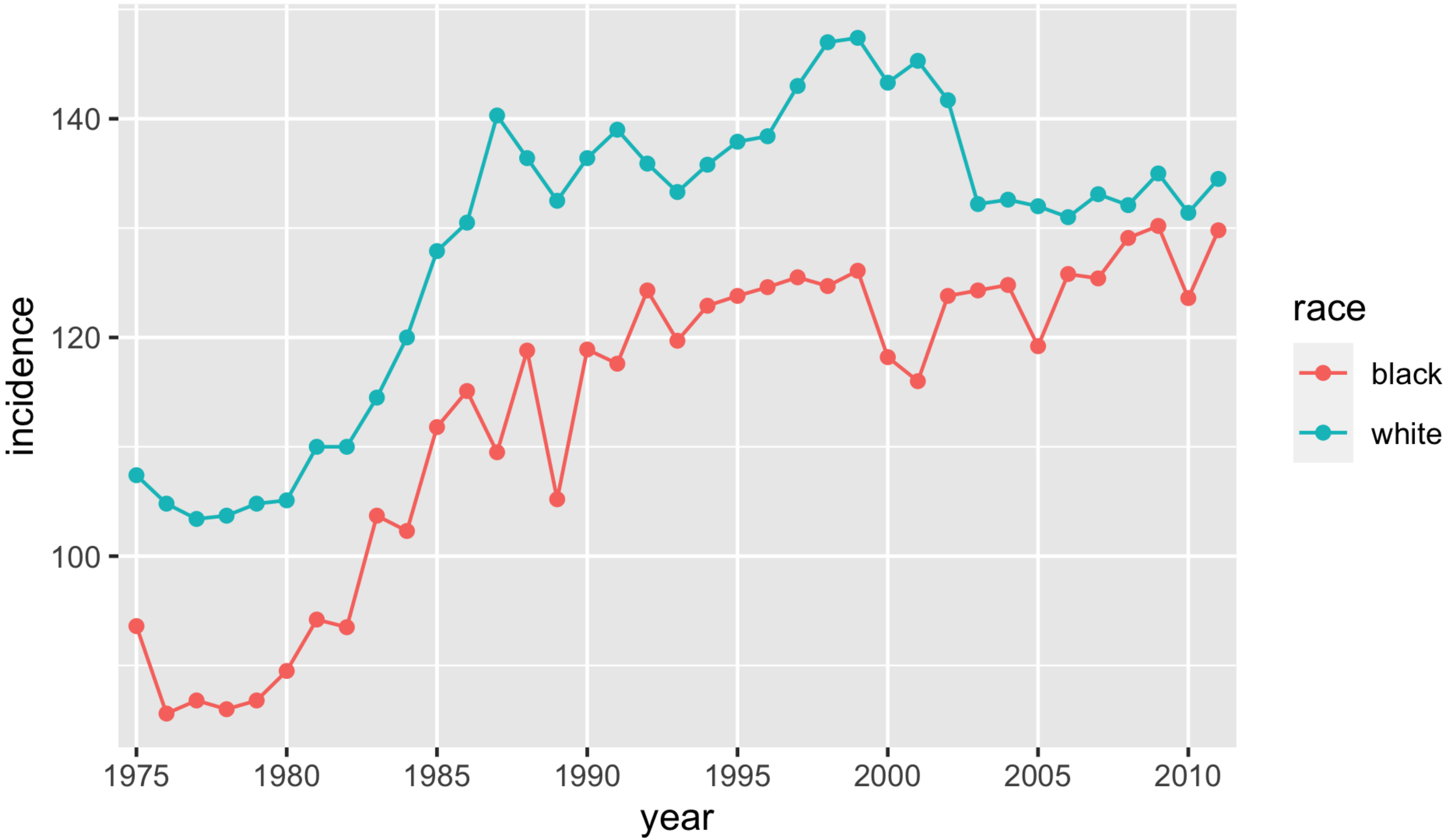
Pivot the columns into 2 new columns called `year` **and** `incidence`

Add a new variable called `race`**. Remember that each data set corresponds to a single race.**

Bind the data sets together using `bind_rows()` **from the dplyr package. Either save it as a new object or pipe the result directly into the ggplot2 code.**

Plot the data using the code below. Fill in the blanks to have `year` **on the x-axis,** `incidence` **on the y-axis, and** `race` **as the color aesthetic.**

Your Turn 5: No solution 😈



Other neat tidyr tools

Uncounting frequency tables

```r
lotr %>%
  pivot_longer(
    names_to = "sex",
    values_to = "count",
    cols = c(female, male)
  ) %>%
  uncount(count)
```

Other neat tidyr tools

Uncounting frequency tables

```
## # A tibble: 21,245 × 3
##    film                       race  sex
##    <chr>                      <chr> <chr>
##  1 The Fellowship Of The Ring Elf   female
##  2 The Fellowship Of The Ring Elf   female
##  3 The Fellowship Of The Ring Elf   female
##  4 The Fellowship Of The Ring Elf   female
##  5 The Fellowship Of The Ring Elf   female
##  6 The Fellowship Of The Ring Elf   female
##  7 The Fellowship Of The Ring Elf   female
##  8 The Fellowship Of The Ring Elf   female
##  9 The Fellowship Of The Ring Elf   female
## 10 The Fellowship Of The Ring Elf   female
## # … with 21,235 more rows
```

Other neat tidyr tools

Work with data frames

crossing() and expand()

nest() and unnest()

Other neat tidyr tools

Work with missing data

`complete()`

`drop_na()` and `replace_na()`

Resources

R for Data Science: A comprehensive but friendly introduction to the tidyverse. Free online.

RStudio Primers: Free interactive courses in the Tidyverse