Reading in data with readr and haven

Data Wrangling: Session 6

Kieran Healy
Statistical Horizons, December 2022

Load the packages, as always

```
library(here)      # manage file paths
library(socviz)    # data and some useful functions
library(tidyverse) # your friend and mine
library(haven)     # for Stata, SAS, and SPSS files
```

We've put a lot of pieces in place at this point

Including several things we haven't fully exploited yet

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Other plain-text formats.

Foreign formats, like Stata.

Quite messy things like tables on web pages.

… and more besides.

Reading in CSV files

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Base R has `read.csv()`

Corresponding tidyverse "underscored" version: `read_csv()`.

It is pickier and more talkative than the Base R version.

Where's the data? Using here()

If we're loading a file, it's coming from *somewhere*.

If it's on our local disk somewhere, we will need to interact with the file system. We should try to do this in a way that avoids *absolute* file paths.

```
# This is not portable
df <- read_csv("/Users/kjhealy/Documents/data/misc/project/data/mydata.csv")
```

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If it's on our local disk somewhere, we will need to interact with the file system. We should try to do this in a way that avoids *absolute* file paths.

```
# This is not portable
df <- read_csv("/Users/kjhealy/Documents/data/misc/project/data/mydata.csv")
```

We should also do it in a way that is *platform independent*.

This makes it easier to share your work, move it around, etc. Projects should be self-contained.

Where's the data? Using here()

The `here` package, and `here()` function builds paths relative to the top level of your R project.

```
here() # this path will be different for you
```

```
## [1] "/Users/kjhealy/Documents/courses/data_wrangling"
```

Where's the data? Using here()

This seminar's files all live in an RStudio project. It looks like this:

```
## /Users/kjhealy/Documents/courses/data_wrangling
## ├── LICENSE
## ├── Makefile
## ├── README.Rmd
## ├── README.md
## ├── code
## ├── course_notes.Rmd
## ├── data
## ├── data-raw
## ├── data_wrangling.Rproj
## ├── office
## ├── pdf_slides
## ├── scratch.Rmd
## ├── slides
## └── tests
```

I want to load files from the `data` folder, but I also want *you* to be able to load them. I'm writing this from somewhere deep in the `slides` folder, but you won't be there. Also, I'm on a Mac, but you may not be.

Where's the data? Using here()

So:

```
## Load the file relative to the path from the top of the project, without separators, etc
organs <- read_csv(file = here("data", "organdonation.csv"))
```

Where's the data? Using here()

So:

```
## Load the file relative to the path from the top of the project, without separators, etc
organs <- read_csv(file = here("data", "organdonation.csv"))
```

```
organs
```

```
## # A tibble: 238 × 21
##    country  year donors   pop pop.d…¹   gdp gdp.lag health healt…² pubhe…³ roads
##    <chr>   <dbl>  <dbl> <dbl>   <dbl> <dbl>   <dbl>  <dbl>   <dbl>   <dbl> <dbl>
##  1 Austra…    NA  NA    17065   0.220 16774   16591   1300    1224     4.8 137.
##  2 Austra…  1991  12.1  17284   0.223 17171   16774   1379    1300     5.4 122.
##  3 Austra…  1992  12.4  17495   0.226 17914   17171   1455    1379     5.4 113.
##  4 Austra…  1993  12.5  17667   0.228 18883   17914   1540    1455     5.4 111.
##  5 Austra…  1994  10.2  17855   0.231 19849   18883   1626    1540     5.4 108.
##  6 Austra…  1995  10.2  18072   0.233 21079   19849   1737    1626     5.5 112.
##  7 Austra…  1996  10.6  18311   0.237 21923   21079   1846    1737     5.6 108.
##  8 Austra…  1997  10.3  18518   0.239 22961   21923   1948    1846     5.7  95.4
##  9 Austra…  1998  10.5  18711   0.242 24148   22961   2077    1948     5.9  93.8
## 10 Austra…  1999   8.67 18926   0.244 25445   24148   2231    2077     6.1  93.2
## # … with 228 more rows, 10 more variables: cerebvas <dbl>, assault <dbl>,
## #   external <dbl>, txp.pop <dbl>, world <chr>, opt <chr>, consent.law <chr>,
## #   consent.practice <chr>, consistent <chr>, ccode <chr>, and abbreviated
## #   variable names ¹pop.dens, ²health.lag, ³pubhealth
```

And there it is.

Where's the data? Using here()

Get in the habit of putting this at the top of your files:

```
here::i_am("analysis.Rmd") # or whatever your Rmd or R file is called
```

See the `here` project page for more details.

`read_csv()` comes in different varieties

`read_csv()` Field separator is a comma: `,`

```
organs <- read_csv(file = here("data", "organdonation.csv"))
```

`read_csv2()` Field separator is a semicolon: `;`

```
# Example only
my_data <- read_csv2(file = here("data", "my_euro_file.csv))
```

Both are special cases of `read_delim()`

Other species are also catered to

`read_tsv()` Tab separated.

`read_fwf()` Fixed-width files.

`read_log()` Log files (i.e. computer log files).

`read_lines()` Just read in lines, without trying to parse them.

Also often useful ...

`read_table()`

Data that's separated by one (or more) columns of space.

You can read files remotely, too

You can give all of these functions local files, or they can point to URLs.

Compressed files will be automatically uncompressed.

(Be careful what you download from remote locations!)

```
organ_remote <- read_csv("http://kjhealy.co/organdonation.csv")

organ_remote
```

```
## # A tibble: 238 × 21
##    country  year donors   pop pop.d…¹   gdp gdp.lag health healt…² pubhe…³ roads
##    <chr>   <dbl>  <dbl> <dbl>   <dbl> <dbl>   <dbl>  <dbl>   <dbl>   <dbl> <dbl>
##  1 Austra…    NA  NA    17065   0.220 16774   16591   1300    1224     4.8 137.
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## #   consent.practice <chr>, consistent <chr>, ccode <chr>, and abbreviated
## #   variable names ¹pop.dens, ²health.lag, ³pubhealth
```

An example: `read_table()`

```
England and Wales, Total Population, Death rates (period 1x1),  Last modified: 02 Apr
2018;  Methods Protocol: v6 (2017)

  Year          Age            Female            Male           Total
  1841            0          0.136067        0.169189        0.152777
  1841            1          0.059577        0.063208        0.061386
  1841            2          0.036406        0.036976        0.036689
  1841            3          0.024913        0.026055        0.025480
  1841            4          0.018457        0.019089        0.018772
  1841            5          0.013967        0.014279        0.014123
  1841            6          0.010870        0.011210        0.011040
  1841            7          0.008591        0.008985        0.008788
  1841            8          0.006860        0.007246        0.007053
  1841            9          0.005772        0.006050        0.005911
  1841           10          0.005303        0.005382        0.005343
  1841           11          0.005114        0.005002        0.005057
  1841           12          0.005145        0.004856        0.004999
  1841           13          0.005455        0.004955        0.005202
```

```
  1841          105          0.576967        1.727848        0.700373
  1841          106          0.677711        6.000000        0.795287
  1841          107          0.900000               .        0.900000
  1841          108          1.388430               .        1.388430
  1841          109                 .               .               .
  1841         110+                 .               .               .
  1842            0          0.148491        0.184007        0.166481
  1842            1          0.063038        0.066596        0.064818
  1842            2          0.035203        0.035854        0.035527
```

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  1841           8          0.006860       0.007246       0.007053
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  1841         105          0.576967       1.727848       0.700373
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  1841         109                 .              .              .
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  1842           0          0.148491       0.184007       0.166481
  1842           1          0.063038       0.066596       0.064818
  1842           2          0.035203       0.035854       0.035527
```

```
engmort <- read_table(here("data", "mortality.txt"),
                      skip = 2, na = ".")

engmort
```

```
## # A tibble: 222 × 5
##     Year Age    Female    Male   Total
##    <dbl> <chr>   <dbl>   <dbl>   <dbl>
##  1  1841 0      0.136   0.169   0.153
##  2  1841 1      0.0596  0.0632  0.0614
##  3  1841 2      0.0364  0.0370  0.0367
##  4  1841 3      0.0249  0.0261  0.0255
##  5  1841 4      0.0185  0.0191  0.0188
##  6  1841 5      0.0140  0.0143  0.0141
##  7  1841 6      0.0109  0.0112  0.0110
##  8  1841 7      0.00859 0.00898 0.00879
##  9  1841 8      0.00686 0.00725 0.00705
## 10  1841 9      0.00577 0.00605 0.00591
## # … with 212 more rows
```

Attend to the column specification

```
engmort <- read_table(here("data", "mortality.txt"),
                      skip = 2, na = ".")
```

```
##
## ── Column specification ────────────────────────────────────────────────────────
## cols(
##   Year = col_double(),
##   Age = col_character(),
##   Female = col_double(),
##   Male = col_double(),
##   Total = col_double()
## )
```

The column specification tells you what the read function did. That is, how it interpreted each of the columns. It will also report if things don't go as expected.

Attend to the column specification

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engmort <- read_table(here("data", "mortality.txt"),
                      skip = 2, na = ".")
```

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## ── Column specification ────────────────────────────────────────────────────────
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```

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Why is `age` imported in `character` format?

Attend to the column specification

Absent you giving them a column specification, the `read_` functions try to *guess* what the type of each column is. They do this by looking at the first thousand rows of each column.

They may guess incorrectly!

Normalizing names and recoding

```
read_table(here("data", "mortality.txt"),
           skip = 2, na = ".")
```

```
## # A tibble: 222 × 5
##     Year Age    Female    Male   Total
##    <dbl> <chr>   <dbl>   <dbl>   <dbl>
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Normalizing names and recoding

```
read_table(here("data", "mortality.txt"),
           skip = 2, na = ".") |>
  janitor::clean_names()
```

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## # A tibble: 222 × 5
##     year age    female    male   total
##    <dbl> <chr>   <dbl>   <dbl>   <dbl>
##  1  1841 0      0.136   0.169   0.153
##  2  1841 1      0.0596  0.0632  0.0614
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## # … with 212 more rows
```

Normalizing names and recoding

```
read_table(here("data", "mortality.txt"),
           skip = 2, na = ".") |>
  janitor::clean_names() |>
  mutate(age = as.integer(recode(age, "110+" = "110")))
```

```
## # A tibble: 222 × 5
##     year   age  female    male   total
##    <dbl> <int>   <dbl>   <dbl>   <dbl>
##  1  1841     0 0.136   0.169   0.153
##  2  1841     1 0.0596  0.0632  0.0614
##  3  1841     2 0.0364  0.0370  0.0367
##  4  1841     3 0.0249  0.0261  0.0255
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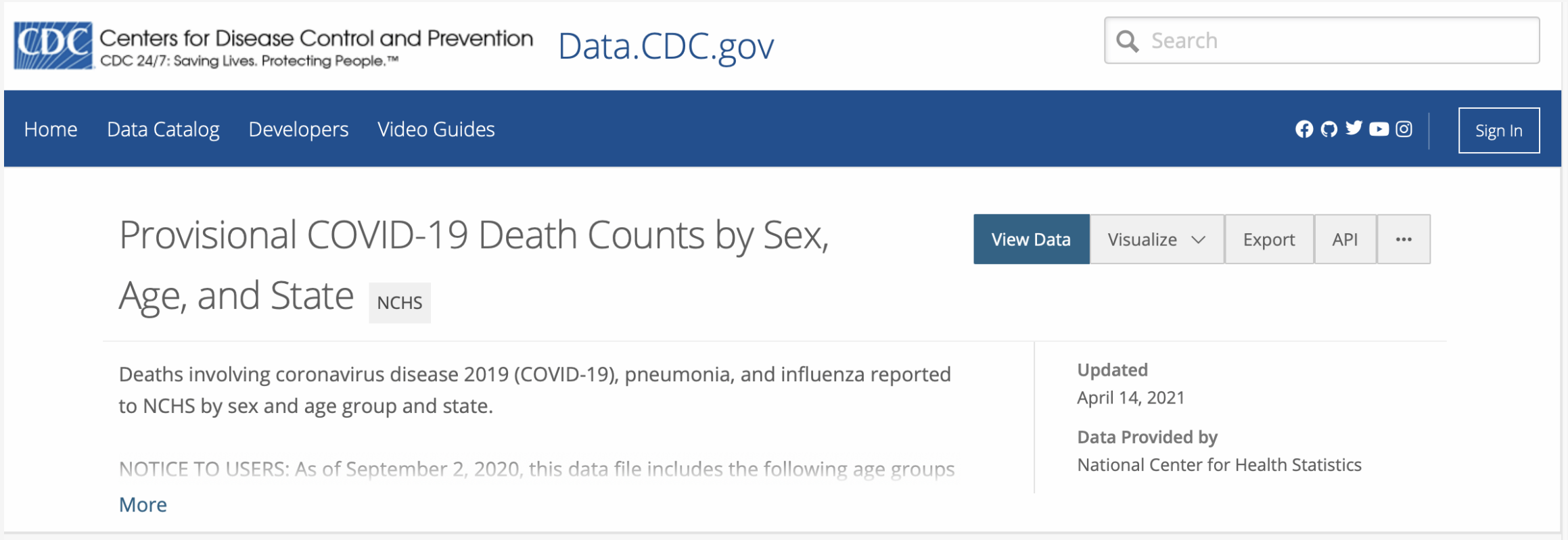
```

The `janitor` package is very handy!

The main cost of normalizing names comes with, e.g., data where there is a codebook you need to consult. But in general it's worth it.

More on column specifications

CDC/NCHS data: Provisional COVID-19 Death Counts by Sex, Age, and State



More on column specifications

What's in this Dataset?

Rows	Columns
52.3K	16

Columns in this Dataset

Column Name	Description	Type
Data As Of	Date of analysis	Date & Time
Start Date	First date of data period	Date & Time
End Date	Last date of data period	Date & Time
Group	Indicator of whether data measured by Month, by Year, or ...	Plain Text
Year	Year in which death occurred	Number
Month	Month in which death occurred	Number

Let's try to load it

```
nchs <- with_edition(1, read_csv(here("data", "SAS_on_2021-04-13.csv")))
```

```
## Warning: 88128 parsing failures.
##  row  col           expected actual                                                                                file
## 2755 Year 1/0/T/F/TRUE/FALSE   2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2756 Year 1/0/T/F/TRUE/FALSE   2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2757 Year 1/0/T/F/TRUE/FALSE   2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2758 Year 1/0/T/F/TRUE/FALSE   2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2759 Year 1/0/T/F/TRUE/FALSE   2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## .... .... ................... ...... ............................................................................
## See problems(...) for more details.
```

Let's try to load it

```
problems(nchs)
```

```
## # A tibble: 88,128 × 5
##      row col   expected           actual file
##    <int> <chr> <chr>              <chr>  <chr>
##  1  2755 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  2  2756 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  3  2757 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  4  2758 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  5  2759 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  6  2760 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  7  2761 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  8  2762 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  9  2763 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
## 10  2764 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
## # … with 88,118 more rows
```

Let's try to load it

```
problems(nchs)
```

```
## # A tibble: 88,128 × 5
##      row col   expected           actual file
##    <int> <chr> <chr>              <chr>  <chr>
##  1  2755 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  2  2756 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  3  2757 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
##  4  2758 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
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## # … with 88,118 more rows
```

Problems are stored as an attribute of the `nchs` object, so we can revisit them.

Let's try to load it

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problems(nchs)
```

```
## # A tibble: 88,128 × 5
##      row col   expected           actual file
##    <int> <chr> <chr>              <chr>  <chr>
##  1  2755 Year  1/0/T/F/TRUE/FALSE 2020   '/Users/kjhealy/Documents/courses/data…
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```

Problems are stored as an attribute of the `nchs` object, so we can revisit them.

Parsing failures tend to cascade. Our data only has 56k rows but we got 88k failures.

Take a look with head()

```
head(nchs)
```

```
## # A tibble: 6 × 16
##   Data A…¹ Start…² End D…³ Group Year  Month State Sex   Age G…⁴ COVID…⁵ Total…⁶
##   <chr>    <chr>   <chr>   <chr> <lgl> <lgl> <chr> <chr> <chr>     <dbl>   <dbl>
## 1 04/07/2… 01/01/… 04/03/… By T… NA    NA    Unit… All … All Ag…  539723 4161167
## 2 04/07/2… 01/01/… 04/03/… By T… NA    NA    Unit… All … Under …      59   22626
## 3 04/07/2… 01/01/… 04/03/… By T… NA    NA    Unit… All … 0-17 y…     251   39620
## 4 04/07/2… 01/01/… 04/03/… By T… NA    NA    Unit… All … 1-4 ye…      31    4069
## 5 04/07/2… 01/01/… 04/03/… By T… NA    NA    Unit… All … 5-14 y…      89    6578
## 6 04/07/2… 01/01/… 04/03/… By T… NA    NA    Unit… All … 15-24 …     804   42596
## # … with 5 more variables: `Pneumonia Deaths` <dbl>,
## #   `Pneumonia and COVID-19 Deaths` <dbl>, `Influenza Deaths` <dbl>,
## #   `Pneumonia, Influenza, or COVID-19 Deaths` <dbl>, Footnote <chr>, and
## #   abbreviated variable names ¹`Data As Of`, ²`Start Date`, ³`End Date`,
## #   ⁴`Age Group`, ⁵`COVID-19 Deaths`, ⁶`Total Deaths`
```

Take a look with `tail()`

```
tail(nchs)
```

```
## # A tibble: 6 × 16
##   Data A…¹ Start…² End D…³ Group Year  Month State Sex   Age G…⁴ COVID…⁵ Total…⁶
##   <chr>    <chr>   <chr>   <chr> <lgl> <lgl> <chr> <chr> <chr>     <dbl>   <dbl>
## 1 04/07/2… 04/01/… 04/03/… By M… NA    NA    Puer… Fema… 45-54 …       0      NA
## 2 04/07/2… 04/01/… 04/03/… By M… NA    NA    Puer… Fema… 50-64 …       0      NA
## 3 04/07/2… 04/01/… 04/03/… By M… NA    NA    Puer… Fema… 55-64 …       0       0
## 4 04/07/2… 04/01/… 04/03/… By M… NA    NA    Puer… Fema… 65-74 …       0       0
## 5 04/07/2… 04/01/… 04/03/… By M… NA    NA    Puer… Fema… 75-84 …      NA      NA
## 6 04/07/2… 04/01/… 04/03/… By M… NA    NA    Puer… Fema… 85 yea…       0       0
## # … with 5 more variables: `Pneumonia Deaths` <dbl>,
## #   `Pneumonia and COVID-19 Deaths` <dbl>, `Influenza Deaths` <dbl>,
## #   `Pneumonia, Influenza, or COVID-19 Deaths` <dbl>, Footnote <chr>, and
## #   abbreviated variable names ¹`Data As Of`, ²`Start Date`, ³`End Date`,
## #   ⁴`Age Group`, ⁵`COVID-19 Deaths`, ⁶`Total Deaths`
```

Take a look with `slice_sample()`

```
nchs |>
  slice_sample(n = 10)
```

```
## # A tibble: 10 × 16
##    Data …¹ Start…² End D…³ Group Year  Month State Sex   Age G…⁴ COVID…⁵ Total…⁶
##    <chr>   <chr>   <chr>   <chr> <lgl> <lgl> <chr> <chr> <chr>     <dbl>   <dbl>
##  1 04/07/… 01/01/… 04/03/… By Y… NA    NA    Verm… All … 5-14 y…       0       0
##  2 04/07/… 01/01/… 01/31/… By M… NA    TRUE  Idaho Male  65-74 …      34     178
##  3 04/07/… 06/01/… 06/30/… By M… NA    NA    Iowa  All … All Ag…     158    2505
##  4 04/07/… 01/01/… 01/31/… By M… NA    TRUE  Arka… Male  65-74 …       0     360
##  5 04/07/… 10/01/… 10/31/… By M… NA    NA    Miss… Male  Under …       0      NA
##  6 04/07/… 08/01/… 08/31/… By M… NA    NA    Kent… All … 30-39 …      NA     161
##  7 04/07/… 01/01/… 04/03/… By T… NA    NA    New … Male  25-34 …     107    1469
##  8 04/07/… 04/01/… 04/03/… By M… NA    NA    Idaho All … 75-84 …       0      NA
##  9 04/07/… 02/01/… 02/29/… By M… NA    NA    Wash… Fema… 75-84 …       0     576
## 10 04/07/… 04/01/… 04/30/… By M… NA    NA    Kans… Male  15-24 …       0      11
## # … with 5 more variables: `Pneumonia Deaths` <dbl>,
## #   `Pneumonia and COVID-19 Deaths` <dbl>, `Influenza Deaths` <dbl>,
## #   `Pneumonia, Influenza, or COVID-19 Deaths` <dbl>, Footnote <chr>, and
## #   abbreviated variable names ¹`Data As Of`, ²`Start Date`, ³`End Date`,
## #   ⁴`Age Group`, ⁵`COVID-19 Deaths`, ⁶`Total Deaths`
```

Aside: one that happened earlier ...

```
nchs %>%
  slice_sample(n = 10)
```

```
## # A tibble: 10 x 16
##    `Data As Of` `Start Date` `End Date` Group   Year  Month State        Sex
##    <chr>        <chr>        <chr>      <chr>   <lgl> <lgl> <chr>        <chr>
##  1 04/07/2021   01/01/2020   04/03/2021 By Tot… NA    NA    Minnesota    Male
##  2 04/07/2021   02/01/2020   02/29/2020 By Mon… NA    NA    Georgia      Male
##  3 04/07/2021   02/01/2021   02/28/2021 By Mon… NA    NA    Maine        Male
##  4 04/07/2021   11/01/2020   11/30/2020 By Mon… NA    NA    New Jersey   Female
##  5 04/07/2021   01/01/2020   12/31/2020 By Year NA    NA    Rhode Island All Se…
##  6 04/07/2021   01/01/2020   01/31/2020 By Mon… NA    TRUE  New York     All Se…
##  7 04/07/2021   05/01/2020   05/31/2020 By Mon… NA    NA    District of… Male
##  8 04/07/2021   04/01/2021   04/03/2021 By Mon… NA    NA    North Carol… Female
##  9 04/07/2021   03/01/2021   03/31/2021 By Mon… NA    NA    Kentucky     Male
## 10 04/07/2021   04/01/2021   04/03/2021 By Mon… NA    NA    New Mexico   Female
## # … with 8 more variables: Age Group <chr>, COVID-19 Deaths <dbl>,
## #   Total Deaths <dbl>, Pneumonia Deaths <dbl>,
## #   Pneumonia and COVID-19 Deaths <dbl>, Influenza Deaths <dbl>,
## #   Pneumonia, Influenza, or COVID-19 Deaths <dbl>, Footnote <chr>
```

Take a look with `slice()`

Let's look at the rows `read_csv()` complained about.

```
nchs |>
  slice(2750:2760)
```

```
## # A tibble: 11 × 16
##    Data …¹ Start…² End D…³ Group Year  Month State Sex   Age G…⁴ COVID…⁵ Total…⁶
##    <chr>   <chr>   <chr>   <chr> <lgl> <lgl> <chr> <chr> <chr>     <dbl>   <dbl>
##  1 04/07/… 01/01/… 04/03/… By T… NA    NA    Puer… Fema… 50-64 …     157    1696
##  2 04/07/… 01/01/… 04/03/… By T… NA    NA    Puer… Fema… 55-64 …     123    1341
##  3 04/07/… 01/01/… 04/03/… By T… NA    NA    Puer… Fema… 65-74 …     203    2650
##  4 04/07/… 01/01/… 04/03/… By T… NA    NA    Puer… Fema… 75-84 …     234    4274
##  5 04/07/… 01/01/… 04/03/… By T… NA    NA    Puer… Fema… 85 yea…     222    6164
##  6 04/07/… 01/01/… 12/31/… By Y… NA    NA    Unit… All … All Ag…  380949 3372967
##  7 04/07/… 01/01/… 12/31/… By Y… NA    NA    Unit… All … Under …      48   19356
##  8 04/07/… 01/01/… 12/31/… By Y… NA    NA    Unit… All … 0-17 y…     189   33808
##  9 04/07/… 01/01/… 12/31/… By Y… NA    NA    Unit… All … 1-4 ye…      25    3504
## 10 04/07/… 01/01/… 12/31/… By Y… NA    NA    Unit… All … 5-14 y…      66    5605
## 11 04/07/… 01/01/… 12/31/… By Y… NA    NA    Unit… All … 15-24 …     598   35796
## # … with 5 more variables: `Pneumonia Deaths` <dbl>,
## #   `Pneumonia and COVID-19 Deaths` <dbl>, `Influenza Deaths` <dbl>,
## #   `Pneumonia, Influenza, or COVID-19 Deaths` <dbl>, Footnote <chr>, and
## #   abbreviated variable names ¹`Data As Of`, ²`Start Date`, ³`End Date`,
## #   ⁴`Age Group`, ⁵`COVID-19 Deaths`, ⁶`Total Deaths`
```

Take a look with `slice()`

```
nchs |>
  slice(2750:2760) |>
  select(Year, Month, State)
```

```
## # A tibble: 11 × 3
##    Year  Month State
##    <lgl> <lgl> <chr>
##  1 NA    NA    Puerto Rico
##  2 NA    NA    Puerto Rico
##  3 NA    NA    Puerto Rico
##  4 NA    NA    Puerto Rico
##  5 NA    NA    Puerto Rico
##  6 NA    NA    United States
##  7 NA    NA    United States
##  8 NA    NA    United States
##  9 NA    NA    United States
## 10 NA    NA    United States
## 11 NA    NA    United States
```

Hm, something to do with the transition to national numbers maybe?

Take a look with `select()` and `filter()`

```
nchs |>
  select(Year, Month, State) |>
  filter(State == "New York")
```

```
## # A tibble: 969 × 3
##    Year  Month State
##    <lgl> <lgl> <chr>
##  1 NA    NA    New York
##  2 NA    NA    New York
##  3 NA    NA    New York
##  4 NA    NA    New York
##  5 NA    NA    New York
##  6 NA    NA    New York
##  7 NA    NA    New York
##  8 NA    NA    New York
##  9 NA    NA    New York
## 10 NA    NA    New York
## # … with 959 more rows
```

Take a look with `is.na()`

```
nchs |>
  select(Year, Month, State) |>
  filter(!is.na(Year))
```

```
## # A tibble: 0 × 3
## # … with 3 variables: Year <lgl>, Month <lgl>, State <chr>
```

It really has been read in as a completely empty column.

That doesn't seem like it can be right.

Take a look with `distinct()`

```
nchs |>
  select(Year) |>
  distinct(Year)
```

```
## # A tibble: 1 × 1
##   Year
##   <lgl>
## 1 NA
```

Again, it's been read in as a completely empty column.

Take a look with `read_lines()`

Time to reach for a different kitchen knife.

```
read_lines(here("data", "SAS_on_2021-04-13.csv"), n_max = 10)
```

```
##  [1] "Data As Of,Start Date,End Date,Group,Year,Month,State,Sex,Age Group,COVID-19 Deaths,Total Deaths,Pneumonia Deaths,Pneumoni
##  [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,All Ages,539723,4161167,466437,263147,9037,750804,"
##  [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,Under 1 year,59,22626,246,10,21,316,"
##  [4] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,0-17 years,251,39620,667,46,179,1051,"
##  [5] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,1-4 years,31,4069,137,5,61,224,"
##  [6] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,5-14 years,89,6578,195,19,76,341,"
##  [7] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,15-24 years,804,42596,930,317,81,1493,"
##  [8] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,18-29 years,1996,75339,2184,884,150,3434,"
##  [9] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,25-34 years,3543,88196,3493,1617,237,5638,"
## [10] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,30-39 years,5792,107348,5276,2658,318,8706,"
```

We can get the whole thing this way

```
raw_file <- read_lines(here("data", "SAS_on_2021-04-13.csv"))
```

This imports the data as a long, long character vector, with each element being a line.

```
# reminder: indexing 1D vectors
letters[5:6]
```

```
## [1] "e" "f"
```

Now we're just looking at lines in a file

```
# This is not a tibble; we have to index it the basic way
raw_file[2753:2758]
```

```
## [1] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,65-74 years,203,2650,410,151,,466,One or more data cells hav
## [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,75-84 years,234,4274,656,154,16,751,"
## [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,85 years and over,222,6164,795,136,29,909,"
## [4] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,All Ages,380949,3372967,349667,178222,8779,560025,"
## [5] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,Under 1 year,48,19356,224,9,21,284,"
## [6] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,0-17 years,189,33808,598,35,178,930,"
```

Now we're just looking at lines in a file

```
# This is not a tibble; we have to index it the basic way
raw_file[2753:2758]
```

```
## [1] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,65-74 years,203,2650,410,151,,466,One or more data cells hav
## [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,75-84 years,234,4274,656,154,16,751,"
## [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,85 years and over,222,6164,795,136,29,909,"
## [4] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,All Ages,380949,3372967,349667,178222,8779,560025,"
## [5] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,Under 1 year,48,19356,224,9,21,284,"
## [6] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,0-17 years,189,33808,598,35,178,930,"
```

There you are, you bastard.

Now we're just looking at lines in a file

```
# This is not a tibble; we have to index it the basic way
raw_file[2753:2758]
```

```
## [1] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,65-74 years,203,2650,410,151,,466,One or more data cells hav
## [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,75-84 years,234,4274,656,154,16,751,"
## [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,85 years and over,222,6164,795,136,29,909,"
## [4] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,All Ages,380949,3372967,349667,178222,8779,560025,"
## [5] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,Under 1 year,48,19356,224,9,21,284,"
## [6] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,0-17 years,189,33808,598,35,178,930,"
```

There you are, you bastard.

In this case, this is due to the kind of data this is, mixing multiple reporting levels and totals. That is, it's not a mistake in the *data*, but rather in the *parsing*.

OK, let's go back to the colspec!

```
nchs <- with_edition(1, read_csv(here("data", "SAS_on_2021-04-13.csv")))
```

```
##
## ── Column specification ────────────────────────────────────────────────────────
## cols(
##   `Data As Of` = col_character(),
##   `Start Date` = col_character(),
##   `End Date` = col_character(),
##   Group = col_character(),
##   Year = col_logical(),
##   Month = col_logical(),
##   State = col_character(),
##   Sex = col_character(),
##   `Age Group` = col_character(),
##   `COVID-19 Deaths` = col_double(),
##   `Total Deaths` = col_double(),
##   `Pneumonia Deaths` = col_double(),
##   `Pneumonia and COVID-19 Deaths` = col_double(),
##   `Influenza Deaths` = col_double(),
##   `Pneumonia, Influenza, or COVID-19 Deaths` = col_double(),
##   Footnote = col_character()
## )
```

We can just copy it from the console output! It's valid code.

We use it with col_types

```
nchs <- with_edition(1, read_csv(here("data", "SAS_on_2021-04-13.csv"),
           col_types = cols(
  `Data As Of` = col_character(),
  `Start Date` = col_character(),
  `End Date` = col_character(),
  Group = col_character(),
  Year = col_logical(),
  Month = col_logical(),
  State = col_character(),
  Sex = col_character(),
  `Age Group` = col_character(),
  `COVID-19 Deaths` = col_double(),
  `Total Deaths` = col_double(),
  `Pneumonia Deaths` = col_double(),
  `Pneumonia and COVID-19 Deaths` = col_double(),
  `Influenza Deaths` = col_double(),
  `Pneumonia, Influenza, or COVID-19 Deaths` = col_double(),
  Footnote = col_character()
)))
```

But we know we need to make some adjustments.

Fixes

```
# Date format
us_style <-  "%m/%d/%Y"

nchs <- with_edition(1, read_csv(
  here("data", "SAS_on_2021-04-13.csv"),
  col_types = cols(
    `Data As Of` = col_date(format = us_style),
    `Start Date` = col_date(format = us_style),
    `End Date` = col_date(format = us_style),
    Group = col_character(),
    Year = col_character(),
    Month = col_character(),
    State = col_character(),
    Sex = col_character(),
    `Age Group` = col_character(),
    `COVID-19 Deaths` = col_integer(),
    `Total Deaths` = col_integer(),
    `Pneumonia Deaths` = col_integer(),
    `Pneumonia and COVID-19 Deaths` = col_integer(),
    `Influenza Deaths` = col_integer(),
    `Pneumonia, Influenza, or COVID-19 Deaths` = col_integer(),
    Footnote = col_character()
  )) |>
  janitor::clean_names() |>
  select(-footnote) |>
  mutate(age_group = stringr::str_to_sentence(age_group)) |>
  filter(!stringr::str_detect(state, "Total"))
)
```

Now let's look again

```
dim(nchs)
```

```
## [1] 52326    15
```

```
nchs |>
  select(year, month, state) |>
  filter(!is.na(year))
```

```
## # A tibble: 49,572 × 3
##    year  month state
##    <chr> <chr> <chr>
##  1 2020  <NA>  United States
##  2 2020  <NA>  United States
##  3 2020  <NA>  United States
##  4 2020  <NA>  United States
##  5 2020  <NA>  United States
##  6 2020  <NA>  United States
##  7 2020  <NA>  United States
##  8 2020  <NA>  United States
##  9 2020  <NA>  United States
## 10 2020  <NA>  United States
## # … with 49,562 more rows
```

Now let's look again

```
nchs |>
  distinct(year)
```

```
## # A tibble: 3 × 1
##   year
##   <chr>
## 1 <NA>
## 2 2020
## 3 2021
```

Lessons learned

Lessons learned

I said at the start that it was no fun, but also weirdly satisfying.

Lessons learned

I said at the start that it was no fun, but also weirdly satisfying.

When `read_csv()` warns you of a parsing failure, **don't ignore it**.

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When `read_csv()` warns you of a parsing failure, **don't ignore it**.

`read_lines()` lets you get the file in a nearly unprocessed form.

Lessons learned

I said at the start that it was no fun, but also weirdly satisfying.

When `read_csv()` warns you of a parsing failure, **don't ignore it**.

`read_lines()` lets you get the file in a nearly unprocessed form.

The `colspec` output is your friend.

If we wanted to ...

```r
library(stringr)  # it's back!
```

If we wanted to ...

```
library(stringr)  # it's back!

nchs
```

```
## # A tibble: 52,326 × 15
##    data_as_of start_date end_date   group    year  month state
##    <date>     <date>     <date>     <chr>    <chr> <chr> <chr>
##  1 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  2 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  3 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  4 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  5 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  6 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  7 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  8 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
##  9 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
## 10 2021-04-07 2020-01-01 2021-04-03 By Total <NA>  <NA>  United
## # … with 52,316 more rows, 6 more variables: covid_19_deaths <i
## #   total_deaths <int>, pneumonia_deaths <int>,
## #   pneumonia_and_covid_19_deaths <int>, influenza_deaths <int>
## #   pneumonia_influenza_or_covid_19_deaths <int>, and abbreviat
## #   ¹age_group
```

If we wanted to ...

```
library(stringr)  # it's back!

nchs |>
  select(!(c(data_as_of:end_date, year, month)))
```

```
## # A tibble: 52,326 × 10
##    group    state  sex   age_g…¹ covid…² total…³ pneum…⁴ pneum…
##    <chr>    <chr>  <chr> <chr>     <int>   <int>   <int>   <int
##  1 By Total Unite… All … All ag…  539723 4161167  466437  26314
##  2 By Total Unite… All … Under …      59   22626     246       1
##  3 By Total Unite… All … 0-17 y…     251   39620     667       4
##  4 By Total Unite… All … 1-4 ye…      31    4069     137
##  5 By Total Unite… All … 5-14 y…      89    6578     195       1
##  6 By Total Unite… All … 15-24 …     804   42596     930      31
##  7 By Total Unite… All … 18-29 …    1996   75339    2184      88
##  8 By Total Unite… All … 25-34 …    3543   88196    3493     161
##  9 By Total Unite… All … 30-39 …    5792  107348    5276     265
## 10 By Total Unite… All … 35-44 …    9259  126848    8203     436
## # … with 52,316 more rows, and abbreviated variable names ¹age_
## #   ²covid_19_deaths, ³total_deaths, ⁴pneumonia_deaths,
## #   ⁵pneumonia_and_covid_19_deaths, ⁶influenza_deaths,
## #   ⁷pneumonia_influenza_or_covid_19_deaths
```

If we wanted to ...

```
library(stringr)  # it's back!

nchs |>
  select(!(c(data_as_of:end_date, year, month))) |>
  pivot_longer(covid_19_deaths:pneumonia_influenza_or_covid_19
               names_to = "outcome",
               values_to = "n")
```

```
## # A tibble: 313,956 × 6
##    group    state         sex       age_group    outcome
##    <chr>    <chr>         <chr>     <chr>        <chr>
##  1 By Total United States All Sexes All ages     covid_19_death
##  2 By Total United States All Sexes All ages     total_deaths
##  3 By Total United States All Sexes All ages     pneumonia_deat
##  4 By Total United States All Sexes All ages     pneumonia_and_
##  5 By Total United States All Sexes All ages     influenza_deat
##  6 By Total United States All Sexes All ages     pneumonia_infl
##  7 By Total United States All Sexes Under 1 year covid_19_death
##  8 By Total United States All Sexes Under 1 year total_deaths
##  9 By Total United States All Sexes Under 1 year pneumonia_deat
## 10 By Total United States All Sexes Under 1 year pneumonia_and_
## # … with 313,946 more rows
```

If we wanted to ...

```
library(stringr)  # it's back!

nchs |>
  select(!(c(data_as_of:end_date, year, month))) |>
  pivot_longer(covid_19_deaths:pneumonia_influenza_or_covid_19
               names_to = "outcome",
               values_to = "n") |>
  mutate(outcome = str_to_sentence(outcome),
         outcome = str_replace_all(outcome, "_", " "),
         outcome = str_replace(outcome, "(C|c)ovid 19", "COVID
```

```
## # A tibble: 313,956 × 6
##    group    state         sex       age_group    outcome
##    <chr>    <chr>         <chr>     <chr>        <chr>
##  1 By Total United States All Sexes All ages     COVID-19 death
##  2 By Total United States All Sexes All ages     Total deaths
##  3 By Total United States All Sexes All ages     Pneumonia deat
##  4 By Total United States All Sexes All ages     Pneumonia and
##  5 By Total United States All Sexes All ages     Influenza deat
##  6 By Total United States All Sexes All ages     Pneumonia infl
##  7 By Total United States All Sexes Under 1 year COVID-19 death
##  8 By Total United States All Sexes Under 1 year Total deaths
##  9 By Total United States All Sexes Under 1 year Pneumonia deat
## 10 By Total United States All Sexes Under 1 year Pneumonia and
## # … with 313,946 more rows
```

If we wanted to ...

```
library(stringr)  # it's back!

nchs |>
  select(!(c(data_as_of:end_date, year, month))) |>
  pivot_longer(covid_19_deaths:pneumonia_influenza_or_covid_19
               names_to = "outcome",
               values_to = "n") |>
  mutate(outcome = str_to_sentence(outcome),
         outcome = str_replace_all(outcome, "_", " "),
         outcome = str_replace(outcome, "(C|c)ovid 19", "COVID
```

```
## # A tibble: 313,956 × 6
##    group    state         sex       age_group    outcome
##    <chr>    <chr>         <chr>     <chr>        <chr>
##  1 By Total United States All Sexes All ages     COVID-19 death
##  2 By Total United States All Sexes All ages     Total deaths
##  3 By Total United States All Sexes All ages     Pneumonia deat
##  4 By Total United States All Sexes All ages     Pneumonia and
##  5 By Total United States All Sexes All ages     Influenza deat
##  6 By Total United States All Sexes All ages     Pneumonia infl
##  7 By Total United States All Sexes Under 1 year COVID-19 death
##  8 By Total United States All Sexes Under 1 year Total deaths
##  9 By Total United States All Sexes Under 1 year Pneumonia deat
## 10 By Total United States All Sexes Under 1 year Pneumonia and
## # … with 313,946 more rows
```

Put this in `nchs_fmt`

… we could make a table or graph

```
nchs_fmt |>
  select(state, age_group, outcome, n)
```

```
## # A tibble: 313,956 × 4
##    state         age_group    outcome                                    n
##    <chr>         <chr>        <chr>                                  <int>
##  1 United States All ages     COVID-19 deaths                       539723
##  2 United States All ages     Total deaths                         4161167
##  3 United States All ages     Pneumonia deaths                      466437
##  4 United States All ages     Pneumonia and COVID-19 deaths         263147
##  5 United States All ages     Influenza deaths                        9037
##  6 United States All ages     Pneumonia influenza or COVID-19 deaths  750804
##  7 United States Under 1 year COVID-19 deaths                           59
##  8 United States Under 1 year Total deaths                           22626
##  9 United States Under 1 year Pneumonia deaths                         246
## 10 United States Under 1 year Pneumonia and COVID-19 deaths             10
## # … with 313,946 more rows
```

Cleaned up (but not tidy)

```
nchs_fmt |>
  distinct(group)
```

```
## # A tibble: 3 × 1
##   group
##   <chr>
## 1 By Total
## 2 By Year
## 3 By Month
```

Cleaned up (but not tidy)

```
nchs_fmt |>
  distinct(group)
```

```
## # A tibble: 3 × 1
##   group
##   <chr>
## 1 By Total
## 2 By Year
## 3 By Month
```

```
nchs_fmt |>
  distinct(age_group)
```

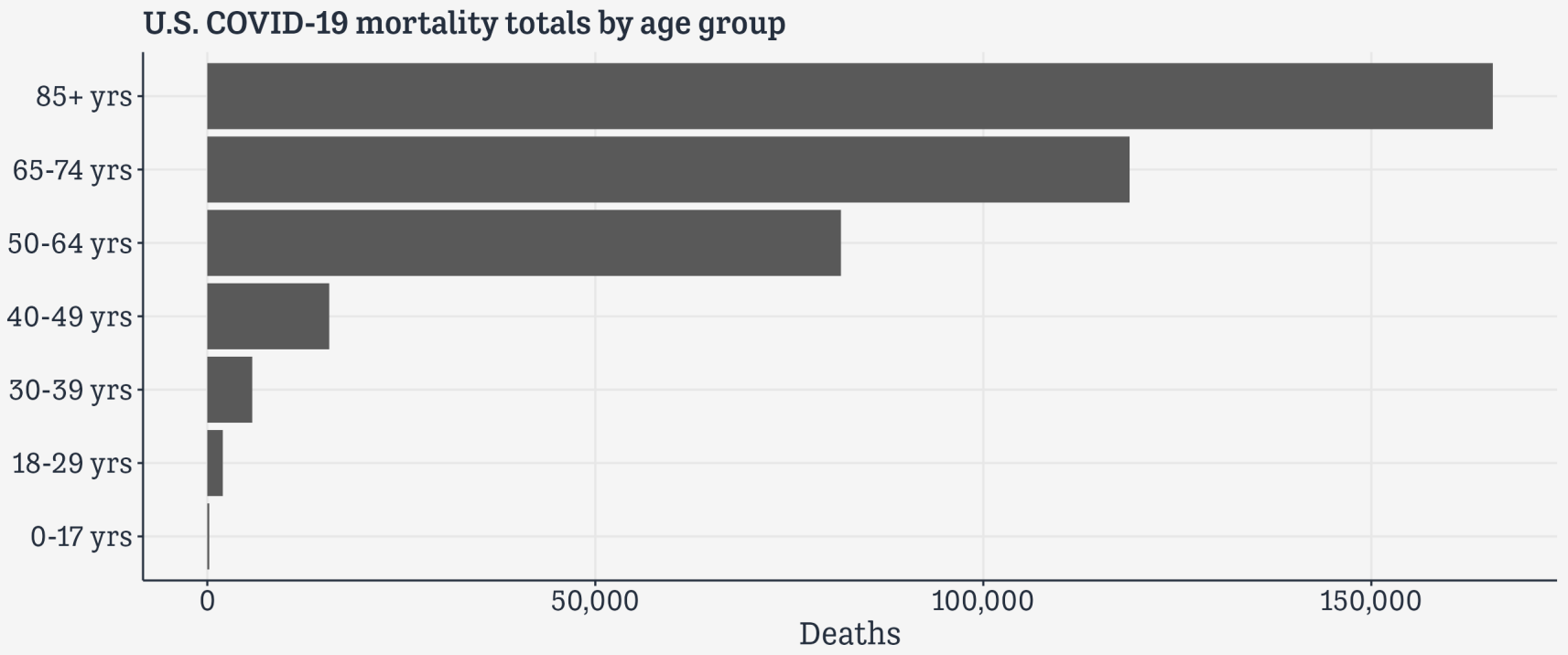
```
## # A tibble: 17 × 1
##    age_group
##    <chr>
##  1 All ages
##  2 Under 1 year
##  3 0-17 years
##  4 1-4 years
##  5 5-14 years
##  6 15-24 years
##  7 18-29 years
##  8 25-34 years
##  9 30-39 years
## 10 35-44 years
## 11 40-49 years
## 12 45-54 years
## 13 50-64 years
## 14 55-64 years
## 15 65-74 years
## 16 75-84 years
## 17 85 years and over
```

Make our plot

```
p_out <- nchs_fmt |>
  filter(group %in% "By Total",
         sex %in% "All Sexes",
         state %in% "United States",
         age_group %in% c("0-17 years",
                          "18-29 years",
                          "30-39 years",
                          "40-49 years",
                          "50-64 years",
                          "65-74 years",
                          "85 years and over"),
         outcome %in% "COVID-19 deaths") |>
  mutate(age_group = str_replace(age_group, "years", "yrs"),
         age_group = str_replace(age_group, " and over", ""),
         age_group = str_replace(age_group, "85", "85+")) |>
  ggplot(mapping = aes(x = n, y = age_group)) +
  geom_col() + scale_x_continuous(labels = scales::comma) +
  labs(x = "Deaths", y = NULL, title = "U.S. COVID-19 mortality totals by age group")
```

Result

```
p_out
```


U.S. COVID-19 mortality totals by age group
85+ yrs
65-74 yrs
50-64 yrs
40-49 yrs
30-39 yrs
18-29 yrs
0-17 yrs
0
50,000
100,000
150,000
Deaths

Every dataset is different

Dropping missing values: a quick demo

```
df <- tribble(
  ~a, ~b, ~c,
  1, NA, 2,
  NA, NA, NA,
  2, 2, 2
)

df
```

```
## # A tibble: 3 × 3
##       a     b     c
##   <dbl> <dbl> <dbl>
## 1     1    NA     2
## 2    NA    NA    NA
## 3     2     2     2
```

Dropping missing values: a quick demo

```
# 2 Convenience function
df |>
  drop_na()
```

```
## # A tibble: 1 × 3
##       a     b     c
##   <dbl> <dbl> <dbl>
## 1     2     2     2
```

Both drop all rows with *any* missing cases.

Dropping missing values: a quick demo

What if we only want to drop all rows with *all* missing cases?

```
# 3
df |>
  filter(!if_all(everything(), ~ is.na(.x))) # Pronoun
```

```
## # A tibble: 2 × 3
##       a     b     c
##   <dbl> <dbl> <dbl>
## 1     1    NA     2
## 2     2     2     2
```

```
# 4 Convenience function from janitor
df |>
  janitor::remove_empty("rows")
```

```
## # A tibble: 2 × 3
##       a     b     c
##   <dbl> <dbl> <dbl>
## 1     1    NA     2
## 2     2     2     2
```

Read `.x` as "the column we're looking at" or "the variable we're computing on right now".

Cleaning a table

With that in mind ... Some marketing data

SEGMENT	DESCRIPTION	R	F	M
Champions	Bought recently, buy often and spend the most	4– 5	4– 5	4– 5
Loyal Customers	Spend good money. Responsive to promotions	2– 5	3– 5	3– 5
Potential Loyalist	Recent customers, spent good amount, bought more than once	3– 5	1– 3	1– 3
New Customers	Bought more recently, but not often	4– 5	<= 1	<= 1
Promising	Recent shoppers, but haven’t spent much	3– 4	<= 1	<= 1
Need Attention	Above average recency, frequency & monetary values	2– 3	2– 3	2– 3
About To Sleep	Below average recency, frequency & monetary values	2– 3	<= 2	<= 2
At Risk	Spent big money, purchased often but long time ago	<= 2	2– 5	2– 5
Can’t Lose Them	Made big purchases and often, but long time ago	<= 1	4– 5	4– 5
Hibernating	Low spenders, low frequency, purchased long time ago	1– 2	1– 2	1– 2
Lost	Lowest recency, frequency & monetary scores	<= 2	<= 2	<= 2

Cleaning a table

```
read_csv(here("data", "rfm_table.csv"))
```

```
## # A tibble: 23 × 5
##    SEGMENT            DESCRIPTION                                   R     F     M
##    <chr>              <chr>                                         <chr> <chr> <
##  1 <NA>               <NA>                                          <NA>  <NA>  <
##  2 Champions          Bought recently, buy often and spend th…      4- 5  4- 5  4
##  3 <NA>               <NA>                                          <NA>  <NA>  <
##  4 Loyal Customers    Spend good money. Responsive to promoti…      2- 5  3- 5  3
##  5 <NA>               <NA>                                          <NA>  <NA>  <
##  6 Potential Loyalist Recent customers, spent good amount, bo…      3- 5  1- 3  1
##  7 <NA>               <NA>                                          <NA>  <NA>  <
##  8 New Customers      Bought more recently, but not often           4- 5  <= 1  <
##  9 <NA>               <NA>                                          <NA>  <NA>  <
## 10 Promising          Recent shoppers, but haven't spent much       3- 4  <= 1  <
## # … with 13 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names()
```

```
## # A tibble: 23 × 5
##    segment            description                                    r     f     r
##    <chr>              <chr>                                          <chr> <chr> <
##  1 <NA>               <NA>                                           <NA>  <NA>  <
##  2 Champions          Bought recently, buy often and spend th…       4- 5  4- 5  4
##  3 <NA>               <NA>                                           <NA>  <NA>  <
##  4 Loyal Customers    Spend good money. Responsive to promoti…       2- 5  3- 5  3
##  5 <NA>               <NA>                                           <NA>  <NA>  <
##  6 Potential Loyalist Recent customers, spent good amount, bo…       3- 5  1- 3  1
##  7 <NA>               <NA>                                           <NA>  <NA>  <
##  8 New Customers      Bought more recently, but not often            4- 5  <= 1  <
##  9 <NA>               <NA>                                           <NA>  <NA>  <
## 10 Promising          Recent shoppers, but haven't spent much        3- 4  <= 1  <
## # … with 13 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows")
```

```
## # A tibble: 11 × 5
##    segment            description                                    r     f     m
##    <chr>              <chr>                                          <chr> <chr> <
##  1 Champions          Bought recently, buy often and spend th…       4- 5  4- 5  4
##  2 Loyal Customers    Spend good money. Responsive to promoti…       2- 5  3- 5  3
##  3 Potential Loyalist Recent customers, spent good amount, bo…       3- 5  1- 3  1
##  4 New Customers      Bought more recently, but not often            4- 5  <= 1  <
##  5 Promising          Recent shoppers, but haven't spent much        3- 4  <= 1  <
##  6 Need Attention     Above average recency, frequency & mone…       2- 3  2- 3  2
##  7 About To Sleep     Below average recency, frequency & mone…       2- 3  <= 2  <
##  8 At Risk            Spent big money, purchased often but lo…       <= 2  2- 5  2
##  9 Can't Lose Them    Made big purchases and often, but long …       <= 1  4- 5  4
## 10 Hibernating        Low spenders, low frequency, purchased …       1- 2  1- 2  1
## 11 Lost               Lowest recency, frequency & monetary sc…       <= 2  <= 2  <
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows") |>
  pivot_longer(cols = r:m)
```

```
## # A tibble: 33 × 4
##    segment            description                                    name  v
##    <chr>              <chr>                                          <chr> <
##  1 Champions          Bought recently, buy often and spend the most  r     4
##  2 Champions          Bought recently, buy often and spend the most  f     4
##  3 Champions          Bought recently, buy often and spend the most  m     4
##  4 Loyal Customers    Spend good money. Responsive to promotions     r     2
##  5 Loyal Customers    Spend good money. Responsive to promotions     f     3
##  6 Loyal Customers    Spend good money. Responsive to promotions     m     3
##  7 Potential Loyalist Recent customers, spent good amount, bought m… r     3
##  8 Potential Loyalist Recent customers, spent good amount, bought m… f     1
##  9 Potential Loyalist Recent customers, spent good amount, bought m… m     1
## 10 New Customers      Bought more recently, but not often            r     4
## # … with 23 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows") |>
  pivot_longer(cols = r:m) |>
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left")
```

```
## # A tibble: 33 × 6
##    segment            description                          name  value    lo
##    <chr>              <chr>                                <chr> <chr> <int> <
##  1 Champions          Bought recently, buy often and sp… r     4- 5      4
##  2 Champions          Bought recently, buy often and sp… f     4- 5      4
##  3 Champions          Bought recently, buy often and sp… m     4- 5      4
##  4 Loyal Customers    Spend good money. Responsive to p… r     2- 5      2
##  5 Loyal Customers    Spend good money. Responsive to p… f     3- 5      3
##  6 Loyal Customers    Spend good money. Responsive to p… m     3- 5      3
##  7 Potential Loyalist Recent customers, spent good amou… r     3- 5      3
##  8 Potential Loyalist Recent customers, spent good amou… f     1- 3      1
##  9 Potential Loyalist Recent customers, spent good amou… m     1- 3      1
## 10 New Customers      Bought more recently, but not oft… r     4- 5      4
## # … with 23 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows") |>
  pivot_longer(cols = r:m) |>
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") |>
  select(-value)
```

```
## # A tibble: 33 × 5
##    segment            description                                    name     lo
##    <chr>              <chr>                                          <chr> <int> <
##  1 Champions          Bought recently, buy often and spend th… r          4
##  2 Champions          Bought recently, buy often and spend th… f          4
##  3 Champions          Bought recently, buy often and spend th… m          4
##  4 Loyal Customers    Spend good money. Responsive to promoti… r          2
##  5 Loyal Customers    Spend good money. Responsive to promoti… f          3
##  6 Loyal Customers    Spend good money. Responsive to promoti… m          3
##  7 Potential Loyalist Recent customers, spent good amount, bo… r          3
##  8 Potential Loyalist Recent customers, spent good amount, bo… f          1
##  9 Potential Loyalist Recent customers, spent good amount, bo… m          1
## 10 New Customers      Bought more recently, but not often      r          4
## # … with 23 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows") |>
  pivot_longer(cols = r:m) |>
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") |>
  select(-value) |>
  pivot_wider(names_from = name,
              values_from = lo:hi)
```

```
## # A tibble: 11 × 8
##    segment            description              lo_r  lo_f  lo_m  hi_r  hi_f
##    <chr>              <chr>                   <int> <int> <int> <int> <int>
##  1 Champions          Bought recently, buy …      4     4     4     5     5
##  2 Loyal Customers    Spend good money. Res…      2     3     3     5     5
##  3 Potential Loyalist Recent customers, spe…      3     1     1     5     3
##  4 New Customers      Bought more recently,…      4    NA    NA     5     1
##  5 Promising          Recent shoppers, but …      3    NA    NA     4     1
##  6 Need Attention     Above average recency…      2     2     2     3     3
##  7 About To Sleep     Below average recency…      2    NA    NA     3     2
##  8 At Risk            Spent big money, purc…     NA     2     2     2     5
##  9 Can't Lose Them    Made big purchases an…     NA     4     4     1     5
## 10 Hibernating        Low spenders, low fre…      1     1     1     2     2
## 11 Lost               Lowest recency, frequ…     NA    NA    NA     2     2
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows") |>
  pivot_longer(cols = r:m) |>
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") |>
  select(-value) |>
  pivot_wider(names_from = name,
              values_from = lo:hi) |>
  mutate(across(where(is.integer), replace_na, 0))
```

```
## # A tibble: 11 × 8
##    segment            description              lo_r  lo_f  lo_m  hi_r  hi_f
##    <chr>              <chr>                   <int> <int> <int> <int> <int>
##  1 Champions          Bought recently, buy …      4     4     4     5     5
##  2 Loyal Customers    Spend good money. Res…      2     3     3     5     5
##  3 Potential Loyalist Recent customers, spe…      3     1     1     5     3
##  4 New Customers      Bought more recently,…      4     0     0     5     1
##  5 Promising          Recent shoppers, but …      3     0     0     4     1
##  6 Need Attention     Above average recency…      2     2     2     3     3
##  7 About To Sleep     Below average recency…      2     0     0     3     2
##  8 At Risk            Spent big money, purc…      0     2     2     2     5
##  9 Can't Lose Them    Made big purchases an…      0     4     4     1     5
## 10 Hibernating        Low spenders, low fre…      1     1     1     2     2
## 11 Lost               Lowest recency, frequ…      0     0     0     2     2
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) |>
  janitor::clean_names() |>
  janitor::remove_empty("rows") |>
  pivot_longer(cols = r:m) |>
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") |>
  select(-value) |>
  pivot_wider(names_from = name,
              values_from = lo:hi) |>
  mutate(across(where(is.integer), replace_na, 0)) |>
  select(segment,
         lo_r, hi_r,
         lo_f, hi_f,
         lo_m, hi_m,
         description)
```

```
## # A tibble: 11 × 8
##    segment              lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>               <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions               4     5     4     5     4     5 Bought recently, b
##  2 Loyal Customers         2     5     3     5     3     5 Spend good money.
##  3 Potential Loyalist      3     5     1     3     1     3 Recent customers,
##  4 New Customers           4     5     0     1     0     1 Bought more recent
##  5 Promising               3     4     0     1     0     1 Recent shoppers, b
##  6 Need Attention          2     3     2     3     2     3 Above average rece
##  7 About To Sleep          2     3     0     2     0     2 Below average rece
##  8 At Risk                 0     2     2     5     2     5 Spent big money, p
##  9 Can't Lose Them         0     1     4     5     4     5 Made big purchases
## 10 Hibernating             1     2     1     2     1     2 Low spenders, low
## 11 Lost                    0     2     0     2     0     2 Lowest recency, fr
```

Maybe a candidate for `rowwise()`?

```
rfm_table
```

```
## # A tibble: 11 × 8
##    segment             lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>              <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions              4     5     4     5     4     5 Bought recently, buy …
##  2 Loyal Customers        2     5     3     5     3     5 Spend good money. Res…
##  3 Potential Loyalist     3     5     1     3     1     3 Recent customers, spe…
##  4 New Customers          4     5     0     1     0     1 Bought more recently,…
##  5 Promising              3     4     0     1     0     1 Recent shoppers, but …
##  6 Need Attention         2     3     2     3     2     3 Above average recency…
##  7 About To Sleep         2     3     0     2     0     2 Below average recency…
##  8 At Risk                0     2     2     5     2     5 Spent big money, purc…
##  9 Can't Lose Them        0     1     4     5     4     5 Made big purchases an…
## 10 Hibernating            1     2     1     2     1     2 Low spenders, low fre…
## 11 Lost                   0     2     0     2     0     2 Lowest recency, frequ…
```

Maybe a candidate for `rowwise()`?

This does what we expect:

```
rfm_table |>
  mutate(sum_lo = lo_r + lo_f + lo_m,
         sum_hi = hi_r + hi_f + hi_m) |>
  select(segment, sum_lo, sum_hi, everything())
```

```
## # A tibble: 11 × 10
##    segment            sum_lo sum_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m descri…¹
##    <chr>               <int>  <int> <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions              12     15     4     5     4     5     4     5 Bought …
##  2 Loyal Customers         8     15     2     5     3     5     3     5 Spend g…
##  3 Potential Loyalist      5     11     3     5     1     3     1     3 Recent …
##  4 New Customers           4      7     4     5     0     1     0     1 Bought …
##  5 Promising               3      6     3     4     0     1     0     1 Recent …
##  6 Need Attention          6      9     2     3     2     3     2     3 Above a…
##  7 About To Sleep          2      7     2     3     0     2     0     2 Below a…
##  8 At Risk                 4     12     0     2     2     5     2     5 Spent b…
##  9 Can't Lose Them         8     11     0     1     4     5     4     5 Made bi…
## 10 Hibernating             3      6     1     2     1     2     1     2 Low spe…
## 11 Lost                    0      6     0     2     0     2     0     2 Lowest …
## # … with abbreviated variable name ¹description
```

This adds each column, elementwise.

Maybe a candidate for `rowwise()`?

But this does not:

```
rfm_table |>
  mutate(sum_lo = sum(lo_r, lo_f, lo_m),
         sum_hi = sum(hi_r, hi_f, hi_m)) |>
  select(segment, sum_lo, sum_hi, everything())
```

```
## # A tibble: 11 × 10
##    segment            sum_lo sum_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m descri…¹
##    <chr>               <int>  <int> <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions              55    105     4     5     4     5     4     5 Bought …
##  2 Loyal Customers        55    105     2     5     3     5     3     5 Spend g…
##  3 Potential Loyalist     55    105     3     5     1     3     1     3 Recent …
##  4 New Customers          55    105     4     5     0     1     0     1 Bought …
##  5 Promising              55    105     3     4     0     1     0     1 Recent …
##  6 Need Attention         55    105     2     3     2     3     2     3 Above a…
##  7 About To Sleep         55    105     2     3     0     2     0     2 Below a…
##  8 At Risk                55    105     0     2     2     5     2     5 Spent b…
##  9 Can't Lose Them        55    105     0     1     4     5     4     5 Made bi…
## 10 Hibernating            55    105     1     2     1     2     1     2 Low spe…
## 11 Lost                   55    105     0     2     0     2     0     2 Lowest …
## # … with abbreviated variable name ¹description
```

Sum is taking all the columns, adding them up (into a single mumber), and putting that result in each row.

Maybe a candidate for `rowwise()`?

Similarly, this will not give the answer we probably expect:

```
rfm_table |>
  mutate(mean_lo = mean(c(lo_r, lo_f, lo_m)),
         mean_hi = mean(c(hi_r, hi_f, hi_m))) |>
  select(segment, mean_lo, mean_hi, everything())
```

```
## # A tibble: 11 × 10
##    segment           mean_lo mean_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m descr…¹
##    <chr>               <dbl>   <dbl> <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions            1.67    3.18     4     5     4     5     4     5 Bought…
##  2 Loyal Customers      1.67    3.18     2     5     3     5     3     5 Spend …
##  3 Potential Loyali…    1.67    3.18     3     5     1     3     1     3 Recent…
##  4 New Customers        1.67    3.18     4     5     0     1     0     1 Bought…
##  5 Promising            1.67    3.18     3     4     0     1     0     1 Recent…
##  6 Need Attention       1.67    3.18     2     3     2     3     2     3 Above …
##  7 About To Sleep       1.67    3.18     2     3     0     2     0     2 Below …
##  8 At Risk              1.67    3.18     0     2     2     5     2     5 Spent …
##  9 Can't Lose Them      1.67    3.18     0     1     4     5     4     5 Made b…
## 10 Hibernating          1.67    3.18     1     2     1     2     1     2 Low sp…
## 11 Lost                 1.67    3.18     0     2     0     2     0     2 Lowest…
## # … with abbreviated variable name ¹description
```

Maybe a candidate for `rowwise()`?

But this will:

```
rfm_table |>
  rowwise() |>
  mutate(mean_lo = mean(c(lo_r, lo_f, lo_m)),
         mean_hi = mean(c(hi_r, hi_f, hi_m))) |>
  select(segment, mean_lo, mean_hi, everything())
```

```
## # A tibble: 11 × 10
## # Rowwise:
##    segment            mean_lo mean_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m descr…¹
##    <chr>                <dbl>   <dbl> <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions            4        5        4     5     4     5     4     5 Bought…
##  2 Loyal Customers      2.67     5        2     5     3     5     3     5 Spend …
##  3 Potential Loyali…    1.67     3.67     3     5     1     3     1     3 Recent…
##  4 New Customers        1.33     2.33     4     5     0     1     0     1 Bought…
##  5 Promising            1        2        3     4     0     1     0     1 Recent…
##  6 Need Attention       2        3        2     3     2     3     2     3 Above …
##  7 About To Sleep       0.667    2.33     2     3     0     2     0     2 Below …
##  8 At Risk              1.33     4        0     2     2     5     2     5 Spent …
##  9 Can't Lose Them      2.67     3.67     0     1     4     5     4     5 Made b…
## 10 Hibernating          1        2        1     2     1     2     1     2 Low sp…
## 11 Lost                 0        2        0     2     0     2     0     2 Lowest…
## # … with abbreviated variable name ¹description
```

Rowwise isn't very efficient

In general, you'll want to see if some vectorized ("operating on columns, but elementwise") function exists, as it'll be faster.

And most of the time, R and the tidyverse "wants" you to work in vectorized, columnar terms ... hence your first move will often be to pivot the data into long format.

So, `rowwise()` is not likely to see a whole lot of further development.

You probably want `group_by()` instead

```
rfm_table |>
  group_by(segment) |>
  mutate(mean_lo = mean(c(lo_r, lo_f, lo_m)),
         mean_hi = mean(c(hi_r, hi_f, hi_m))) |>
  select(segment, mean_lo, mean_hi, everything())
```

```
## # A tibble: 11 × 10
## # Groups:   segment [11]
##    segment           mean_lo mean_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m descr…¹
##    <chr>               <dbl>   <dbl> <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions           4        5        4     5     4     5     4     5 Bought…
##  2 Loyal Customers     2.67     5        2     5     3     5     3     5 Spend …
##  3 Potential Loyali…   1.67     3.67     3     5     1     3     1     3 Recent…
##  4 New Customers       1.33     2.33     4     5     0     1     0     1 Bought…
##  5 Promising           1        2        3     4     0     1     0     1 Recent…
##  6 Need Attention      2        3        2     3     2     3     2     3 Above …
##  7 About To Sleep      0.667    2.33     2     3     0     2     0     2 Below …
##  8 At Risk             1.33     4        0     2     2     5     2     5 Spent …
##  9 Can't Lose Them     2.67     3.67     0     1     4     5     4     5 Made b…
## 10 Hibernating         1        2        1     2     1     2     1     2 Low sp…
## 11 Lost                0        2        0     2     0     2     0     2 Lowest…
## # … with abbreviated variable name ¹description
```

You probably want `group_by()` instead

```
rfm_table |>
  group_by(segment) |>
  mutate(sum_lo = sum(lo_r, lo_f, lo_m),
         sum_hi = sum(hi_r, hi_f, hi_m)) |>
  select(segment, sum_lo, sum_hi, everything())
```

```
## # A tibble: 11 × 10
## # Groups:   segment [11]
##    segment            sum_lo sum_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m descri…¹
##    <chr>               <int>  <int> <int> <int> <int> <int> <int> <int> <chr>
##  1 Champions              12     15     4     5     4     5     4     5 Bought …
##  2 Loyal Customers         8     15     2     5     3     5     3     5 Spend g…
##  3 Potential Loyalist      5     11     3     5     1     3     1     3 Recent …
##  4 New Customers           4      7     4     5     0     1     0     1 Bought …
##  5 Promising               3      6     3     4     0     1     0     1 Recent …
##  6 Need Attention          6      9     2     3     2     3     2     3 Above a…
##  7 About To Sleep          2      7     2     3     0     2     0     2 Below a…
##  8 At Risk                 4     12     0     2     2     5     2     5 Spent b…
##  9 Can't Lose Them         8     11     0     1     4     5     4     5 Made bi…
## 10 Hibernating             3      6     1     2     1     2     1     2 Low spe…
## 11 Lost                    0      6     0     2     0     2     0     2 Lowest …
## # … with abbreviated variable name ¹description
```

What about Stata?

Using haven

Haven is the Tidyverse's package for reading and managing files from Stata, SPSS, and SAS. You should prefer it to the older Base R package `foreign`, which has similar functionality.

We're going to import a General Social Survey dataset that's in Stata's `.dta` format.

```
library(haven)

# This will take a moment
gss_panel <- read_stata(here("data", "gss_panel_long.dta"))
```

We'll do some of the common recoding and reorganizing tasks that accompany this.

The GSS panel

The data:

```
gss_panel
```

```
## # A tibble: 14,610 × 2,757
##    firstyear firstid    year    id vpsu    vstrat adults ballot  datei…[1] famgen
##        <dbl> <dbl+lbl> <dbl> <dbl> <dbl+l> <dbl+> <dbl+> <dbl+l> <dbl+l> <dbl+l>
##  1      2006  9         2006     9     2   1957        1  3 [BAL… 709     1 [1 G…
##  2      2006  9         2008  3001    NA     NA        2  3 [BAL… 503     1 [1 G…
##  3      2006  9         2010  6001 NA(i)     NA        2  3 [BAL… 508     1 [1 G…
##  4      2006 10         2010  6002 NA(i)     NA        1  1 [BAL… 408     1 [1 G…
##  5      2006 10         2006    10     2   1957        2  1 [BAL… 630     2 [2 G…
##  6      2006 10         2008  3002    NA     NA        2  1 [BAL… 426     2 [2 G…
##  7      2006 11         2008  3003    NA     NA        2  3 [BAL… 718     4 [2 G…
##  8      2006 11         2010  6003 NA(i)     NA   NA(n)  3 [BAL… 518     2 [2 G…
##  9      2006 11         2006    11     2   1957        2  3 [BAL… 630     4 [2 G…
## 10      2006 12         2010  6004 NA(i)     NA        4  1 [BAL… 324     2 [2 G…
## # … with 14,600 more rows, 2,747 more variables: form <dbl+lbl>, formwt <dbl>,
## #   gender1 <dbl+lbl>, hompop <dbl+lbl>, intage <dbl+lbl>, intid <dbl+lbl>,
## #   intyrs <dbl+lbl>, mode <dbl+lbl>, oversamp <dbl>, phase <dbl+lbl>,
## #   race <dbl+lbl>, reg16 <dbl+lbl>, region <dbl+lbl>, relate1 <dbl+lbl>,
## #   relhh1 <dbl+lbl>, relhhd1 <dbl+lbl>, respnum <dbl+lbl>, rvisitor <dbl+lbl>,
## #   sampcode <dbl+lbl>, sample <dbl+lbl>, sex <dbl+lbl>, size <dbl+lbl>,
## #   spaneng <dbl+lbl>, srcbelt <dbl+lbl>, version <dbl>, visitors <dbl+lbl>, …
```

The GSS panel

Many variables.

Stata's missing value types are preserved

Data types are things like `dbl+lbl` indicating that Stata's numeric values and variable labels have been preserved.

The GSS panel

You can see the labeling system at work:

```
gss_panel |>
  select(degree) |>
  group_by(degree) |>
  tally()
```

```
## # A tibble: 6 × 2
##   degree                    n
##   <dbl+lbl>             <int>
## 1     0 [LT HIGH SCHOOL]  1850
## 2     1 [HIGH SCHOOL]     7274
## 3     2 [JUNIOR COLLEGE]  1161
## 4     3 [bachelor]        2767
## 5     4 [graduate]        1556
## 6 NA(d)                      2
```

The GSS panel

Values get pivoted, not labels, though.

```
gss_panel |>
  select(sex, degree) |>
  group_by(sex, degree) |>
  tally() |>
  pivot_wider(names_from = sex, values_from = n)
```

```
## # A tibble: 6 × 3
##   degree                    `1`   `2`
##   <dbl+lbl>               <int> <int>
## 1     0 [LT HIGH SCHOOL]   814  1036
## 2     1 [HIGH SCHOOL]     3131  4143
## 3     2 [JUNIOR COLLEGE]   440   721
## 4     3 [bachelor]        1293  1474
## 5     4 [graduate]         696   860
## 6 NA(d)                     NA     2
```

The GSS panel

Option 1: Just drop all the labels.

```
gss_panel |>
  zap_missing() |>
  zap_labels()
```

```
## # A tibble: 14,610 × 2,757
##    firstyear firstid  year    id  vpsu vstrat adults ballot datei…¹ famgen  form
##        <dbl>   <dbl> <dbl> <dbl> <dbl>  <dbl>  <dbl>  <dbl>   <dbl>  <dbl> <dbl>
##  1      2006       9  2006     9     2   1957      1      3     709      1     2
##  2      2006       9  2008  3001    NA     NA      2      3     503      1     2
##  3      2006       9  2010  6001    NA     NA      2      3     508      1     2
##  4      2006      10  2010  6002    NA     NA      1      1     408      1     1
##  5      2006      10  2006    10     2   1957      2      1     630      2     1
##  6      2006      10  2008  3002    NA     NA      2      1     426      2     1
##  7      2006      11  2008  3003    NA     NA      2      3     718      4     2
##  8      2006      11  2010  6003    NA     NA     NA      3     518      2     2
##  9      2006      11  2006    11     2   1957      2      3     630      4     2
## 10      2006      12  2010  6004    NA     NA      4      1     324      2     2
## # … with 14,600 more rows, 2,746 more variables: formwt <dbl>, gender1 <dbl>,
## #   hompop <dbl>, intage <dbl>, intid <dbl>, intyrs <dbl>, mode <dbl>,
## #   oversamp <dbl>, phase <dbl>, race <dbl>, reg16 <dbl>, region <dbl>,
## #   relate1 <dbl>, relhh1 <dbl>, relhhd1 <dbl>, respnum <dbl>, rvisitor <dbl>,
## #   sampcode <dbl>, sample <dbl>, sex <dbl>, size <dbl>, spaneng <dbl>,
## #   srcbelt <dbl>, version <dbl>, visitors <dbl>, wtss <dbl>, wtssall <dbl>,
## #   wtssnr <dbl>, xnorcsiz <dbl>, hispanic <dbl>, rplace <dbl>, degree <dbl>, …
```

The GSS panel

Option 2: Convert the labels

Let's focus on a few measures of interest, and do some recoding.

```
## Categorical vars
cat_vars <- c("race", "sex", "degree", "relig", "income", "polviews", "fefam")

## Integer vars
int_vars <- c("year", "id", "ballot", "age", "tvhours")


## Survey design
wt_vars <- c("vpsu",
             "vstrat",
             "oversamp",
             "formwt",              # weight to deal with experimental randomization
             "wtssall",             # weight variable
             "sampcode",            # sampling error code
             "sample")              # sampling frame and method


my_gss_vars <- c(int_vars, cat_vars, wt_vars)
```

Now we're ready to go ...

Cut down the dataset

```
gss_sub <- gss_panel |>
  select(all_of(my_gss_vars))

gss_sub
```

```
## # A tibble: 14,610 × 19
##     year    id ballot       age      tvhours     race    sex     degree  relig
##    <dbl> <dbl> <dbl+lbl>    <dbl+lb> <dbl+lbl>   <dbl+l> <dbl+l> <dbl+l> <dbl+l>
##  1  2006     9 3 [BALLOT C] 23       NA(a) [iap] 2 [bla… 2 [fem… 3 [bac… 4 [non…
##  2  2008  3001 3 [BALLOT C] 25       NA(i)       3 [oth… 2 [fem… 3 [bac… 4 [non…
##  3  2010  6001 3 [BALLOT C] 27       NA(i)       2 [bla… 2 [fem… 3 [bac… 4 [non…
##  4  2010  6002 1 [BALLOT A] 36           3       1 [whi… 2 [fem… 4 [gra… 4 [non…
##  5  2006    10 1 [BALLOT A] 32           3       3 [oth… 2 [fem… 4 [gra… 4 [non…
##  6  2008  3002 1 [BALLOT A] 34           3       3 [oth… 2 [fem… 4 [gra… 4 [non…
##  7  2008  3003 3 [BALLOT C] 83       NA(i)       2 [bla… 2 [fem… 0 [LT … 1 [pro…
##  8  2010  6003 3 [BALLOT C] 85       NA(i)       2 [bla… 2 [fem… 0 [LT … 1 [pro…
##  9  2006    11 3 [BALLOT C] 81       NA(a) [iap] 2 [bla… 2 [fem… 0 [LT … 1 [pro…
## 10  2010  6004 1 [BALLOT A] 51          10       3 [oth… 1 [mal… 1 [HIG… 2 [cat…
## # … with 14,600 more rows, and 10 more variables: income <dbl+lbl>,
## #   polviews <dbl+lbl>, fefam <dbl+lbl>, vpsu <dbl+lbl>, vstrat <dbl+lbl>,
## #   oversamp <dbl>, formwt <dbl>, wtssall <dbl+lbl>, sampcode <dbl+lbl>,
## #   sample <dbl+lbl>
```

The GSS Panel: Recoding

```
gss_sub |>
  mutate(across(everything(), zap_missing)) |>
  mutate(across(all_of(wt_vars), as.numeric)) |>
  mutate(across(all_of(int_vars), as.integer)) |>
  mutate(across(all_of(cat_vars), as_factor)) |>
  mutate(across(all_of(cat_vars), fct_relabel, tolower)) |>
  mutate(across(all_of(cat_vars), fct_relabel, tools::toTitleCase)) |>
  mutate(income = stringr::str_replace(income, " - ", "-"))
```

```
## # A tibble: 14,610 × 19
##     year    id ballot   age tvhours race  sex    degree     relig income polvi…¹
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <chr>  <fct>
##  1  2006     9      3    23      NA Black Female Bachelor   None  $2500… Conser…
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $2500… Extrem…
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $2500… Extrem…
##  4  2010  6002      1    36       3 White Female Graduate   None  $2500… Liberal
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA>   Slight…
##  6  2008  3002      1    34       3 Other Female Graduate   None  $2500… Modera…
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $2000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA>   Modera…
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA>   Modera…
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt $1… Liberal
## # … with 14,600 more rows, 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, and abbreviated variable name ¹polviews
```

How we'd actually write this

```
gss_sub <- gss_sub |>
  mutate(across(everything(), zap_missing),
         across(all_of(wt_vars), as.numeric),
         across(all_of(int_vars), as.integer),
         across(all_of(cat_vars), as_factor),
         across(all_of(cat_vars), fct_relabel, tolower),
         across(all_of(cat_vars), fct_relabel, tools::toTitleCase),
         income = stringr::str_replace(income, " - ", "-"))
```

The GSS panel: more recoding

Age quintiles: find the cutpoints

```
# seq can make all kinds of sequences
seq(from = 0, to = 1, by = 0.2)
```

```
## [1] 0.0 0.2 0.4 0.6 0.8 1.0
```

```
age_quintiles <- quantile(as.numeric(gss_panel$age),
                      probs = seq(0, 1, 0.2),
                      na.rm = TRUE)

## These are the quintile cutpoints
age_quintiles
```

```
##   0%  20%  40%  60%  80% 100%
##   18   33   43   53   65   89
```

The GSS panel: more recoding

Age quintiles: create the quintile variable

```
## Apply the cut
gss_sub |>
  mutate(agequint = cut(x = age,
                        breaks = unique(age_quintiles),
                        include.lowest = TRUE)) |>
  pull(agequint) |> # grab a column and make it an ordinary vector
  table()
```

```
##
## [18,33] (33,43] (43,53] (53,65] (65,89]
##    3157    2680    2851    3057    2720
```

We'll need to clean up those labels.

The GSS panel: more recoding

I told you that regexp stuff would pay off.

```
convert_agegrp <- function(x){
    x <- stringr::str_remove(x, "\\(")  # Remove open paren
    x <- stringr::str_remove(x, "\\[")  # Remove open bracket
    x <- stringr::str_remove(x, "\\]")  # Remove close bracket
    x <- stringr::str_replace(x, ",", "-") # Replace comma with dash
    x <- stringr::str_replace(x, "-89", "+") # Replace -89 with +
    regex <- "^(.*$)" # Matches everything in string to end of line
    x <- stringr::str_replace(x, regex, "Age \\1") # Preface string with "Age"
    x
}
```

The GSS panel: more recoding

```
gss_sub
```

```
## # A tibble: 14,610 × 19
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, and abbreviated variable name ¹polviews
```

The GSS panel: more recoding

```
gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE))
```

```
## # A tibble: 14,610 × 20
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 9 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, agequint <fct>, and abbreviated variable name ¹polv
```

The GSS panel: more recoding

```
gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE)) |>
    mutate(agequint = fct_relabel(agequint, convert_ageq
```

```
## # A tibble: 14,610 × 20
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 9 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, agequint <fct>, and abbreviated variable name ¹polv
```

The GSS panel: more recoding

```
gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE)) |>
    mutate(agequint = fct_relabel(agequint, convert_agec
    mutate(year_f = droplevels(factor(year)))
```

```
## # A tibble: 14,610 × 21
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 10 more variables: fefam <fct>, vpsu <dbl>
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, agequint <fct>, year_f <fct>, and abbreviated varia
## #   ¹polviews
```

The GSS panel: more recoding

```
gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE)) |>
    mutate(agequint = fct_relabel(agequint, convert_ageq
    mutate(year_f = droplevels(factor(year))) |>
    mutate(young = ifelse(age < 26, "Yes", "No"))
```

```
## # A tibble: 14,610 × 22
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 11 more variables: fefam <fct>, vpsu <dbl>
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, and abbr
## #   variable name ¹polviews
```

The GSS panel: more recoding

```
gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE)) |>
    mutate(agequint = fct_relabel(agequint, convert_ageq
    mutate(year_f = droplevels(factor(year))) |>
    mutate(young = ifelse(age < 26, "Yes", "No")) |>
    mutate(fefam_d = fct_recode(fefam,
                                Agree = "Strongly Agree"
                                Disagree = "Strongly Dis
```

```
## # A tibble: 14,610 × 23
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 12 more variables: fefam <fct>, vpsu <dbl>
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d
## #   abbreviated variable name ¹polviews
```

The GSS panel: more recoding

```
gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles)
                          include.lowest = TRUE)) |>
    mutate(agequint = fct_relabel(agequint, convert_ageg
    mutate(year_f = droplevels(factor(year))) |>
    mutate(young = ifelse(age < 26, "Yes", "No")) |>
    mutate(fefam_d = fct_recode(fefam,
                                Agree = "Strongly Agree"
                                Disagree = "Strongly Dis
    mutate(degree = factor(degree,
                           levels = levels(gss_sub$degre
                           ordered = TRUE))  #<<
```

```
## # A tibble: 14,610 × 23
##     year    id ballot   age tvhours race  sex    degree     relig inc
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <ord>      <fct> <ch
##  1  2006     9      3    23      NA Black Female Bachelor   None  $25
##  2  2008  3001      3    25      NA Other Female Bachelor   None  $25
##  3  2010  6001      3    27      NA Black Female Bachelor   None  $25
##  4  2010  6002      1    36       3 White Female Graduate   None  $25
##  5  2006    10      1    32       3 Other Female Graduate   None  <NA
##  6  2008  3002      1    34       3 Other Female Graduate   None  $25
##  7  2008  3003      3    83      NA Black Female Lt High S… Prot… $20
##  8  2010  6003      3    85      NA Black Female Lt High S… Prot… <NA
##  9  2006    11      3    81      NA Black Female Lt High S… Prot… <NA
## 10  2010  6004      1    51      10 Other Male   High Scho… Cath… Lt
## # … with 14,600 more rows, 12 more variables: fefam <fct>, vpsu <dbl>
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampco
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d
## #   abbreviated variable name ¹polviews
```

How we'd actually write this

```
gss_sub <- gss_sub |>
      mutate(agequint = cut(x = age,
                            breaks = unique(age_quintiles),
                            include.lowest = TRUE),
             agequint = fct_relabel(agequint, convert_agegrp),
             year_f = droplevels(factor(year)),
             young = ifelse(age < 26, "Yes", "No"),
             fefam_d = fct_recode(fefam,
                                  Agree = "Strongly Agree",
                                  Disagree = "Strongly Disagree"),
             degree = factor(degree,
                             levels = levels(gss_sub$degree),
                             ordered = TRUE))
```

How we'd actually write this

```
gss_sub <- gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE),
           agequint = fct_relabel(agequint, convert_agegrp),
           year_f = factor(year),
           young = ifelse(age < 26, "Yes", "No"),
           fefam_d = fct_recode(fefam,
                                Agree = "Strongly Agree",
                                Disagree = "Strongly Disagree"),
           degree = factor(degree,
                           levels = levels(gss_sub$degree),
                           ordered = TRUE))
```

How we'd actually write this

```
gss_sub <- gss_sub |>
    mutate(agequint = cut(x = age,
                          breaks = unique(age_quintiles),
                          include.lowest = TRUE),
           agequint = fct_relabel(agequint, convert_agegrp),
           year_f = droplevels(factor(year)),
           young = ifelse(age < 26, "Yes", "No"),
           fefam_d = fct_recode(fefam,
                                Agree = "Strongly Agree",
                                Disagree = "Strongly Disagree"),
           degree = factor(degree,
                           levels = levels(gss_sub$degree),
                           ordered = TRUE))
```

GSS Panel

```
gss_sub |>
  select(sex, year, year_f, age, young, fefam, fefam_d) |>
  sample_n(15)
```

```
## # A tibble: 15 × 7
##    sex     year year_f   age young fefam          fefam_d
##    <fct>  <int> <fct>  <int> <chr> <fct>          <fct>
##  1 Female  2010 2010      49 No    Disagree       Disagree
##  2 Female  2010 2010      32 No    Disagree       Disagree
##  3 Male    2006 2006      21 Yes   Disagree       Disagree
##  4 Female  2010 2010      46 No    <NA>           <NA>
##  5 Female  2008 2008      53 No    <NA>           <NA>
##  6 Male    2006 2006      25 Yes   Disagree       Disagree
##  7 Male    2010 2010      41 No    Agree          Agree
##  8 Female  2006 2006      40 No    Disagree       Disagree
##  9 Female  2008 2008      61 No    <NA>           <NA>
## 10 Male    2010 2010      22 Yes   Disagree       Disagree
## 11 Female  2006 2006      NA <NA>  <NA>           <NA>
## 12 Female  2010 2010      62 No    Agree          Agree
## 13 Male    2010 2010      21 Yes   Disagree       Disagree
## 14 Male    2010 2010      50 No    <NA>           <NA>
## 15 Female  2008 2008      44 No    Strongly Agree Agree
```

GSS Panel

```
gss_sub |>
  select(sex, degree) |>
  group_by(sex, degree) |>
  tally() |>
  pivot_wider(names_from = sex, values_from = n)
```

```
## # A tibble: 6 × 3
##   degree          Male Female
##   <ord>          <int>  <int>
## 1 Lt High School   814   1036
## 2 High School     3131   4143
## 3 Junior College   440    721
## 4 Bachelor        1293   1474
## 5 Graduate         696    860
## 6 <NA>              NA      2
```

More on factors

We've already seen `fct_relabel()` and `fct_recode()` from forcats.

There are numerous other convenience functions for factors.

More on factors

We've already seen `fct_relabel()` and `fct_recode()` from forcats.

There are numerous other convenience functions for factors.

```
gss_sub |>
  count(degree)
```

```
## # A tibble: 6 × 2
##   degree             n
##   <ord>          <int>
## 1 Lt High School  1850
## 2 High School     7274
## 3 Junior College  1161
## 4 Bachelor        2767
## 5 Graduate        1556
## 6 <NA>               2
```

```
levels(gss_sub$degree)
```

```
## [1] "Lt High School" "High School"    "Junior College" "Bachelor"
## [5] "Graduate"
```

More on factors

Make the NA values an explicit level

```
gss_sub |>
  mutate(degree_na = fct_explicit_na(degree)) |>
  count(degree_na)
```

```
## # A tibble: 6 × 2
##   degree_na          n
##   <ord>          <int>
## 1 Lt High School  1850
## 2 High School     7274
## 3 Junior College  1161
## 4 Bachelor        2767
## 5 Graduate        1556
## 6 (Missing)          2
```

More on factors

Relevel by frequency

```
gss_sub |>
  mutate(degree_freq = fct_infreq(degree)) |>
  count(degree_freq)
```

```
## # A tibble: 6 × 2
##   degree_freq        n
##   <ord>          <int>
## 1 High School     7274
## 2 Bachelor        2767
## 3 Lt High School  1850
## 4 Graduate        1556
## 5 Junior College  1161
## 6 <NA>               2
```

More on factors

Relevel manually

```
is.ordered(gss_sub$sex)
```

```
## [1] FALSE
```

```
levels(gss_sub$sex)
```

```
## [1] "Male"   "Female"
```

More on factors

```
summary(lm(age ~ sex, data = gss_sub))
```

```
##
## Call:
## lm(formula = age ~ sex, data = gss_sub)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -31.431 -13.972  -0.431  12.569  40.028
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  48.9720     0.2149 227.846   <2e-16 ***
## sexFemale     0.4594     0.2864   1.604    0.109
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 17.08 on 14463 degrees of freedom
##   (145 observations deleted due to missingness)
## Multiple R-squared:  0.0001779,    Adjusted R-squared:  0.0001088
## F-statistic: 2.573 on 1 and 14463 DF,  p-value: 0.1087
```

More on factors

Relevel manually

```
gss_sub <- gss_sub |>
  mutate(sex = fct_relevel(sex, "Female"))

levels(gss_sub$sex)
```

```
## [1] "Female" "Male"
```

More on factors

Relevel manually

```
gss_sub <- gss_sub |>
  mutate(sex = fct_relevel(sex, "Female"))

levels(gss_sub$sex)
```

```
## [1] "Female" "Male"
```

```
summary(lm(age ~ sex, data = gss_sub))
```

```
##
## Call:
## lm(formula = age ~ sex, data = gss_sub)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -31.431 -13.972  -0.431  12.569  40.028
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  49.4313     0.1892 261.233   <2e-16 ***
## sexMale      -0.4594     0.2864  -1.604    0.109
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 17.08 on 14463 degrees of freedom
##   (145 observations deleted due to missingness)
## Multiple R-squared:  0.0001779,    Adjusted R-squared:  0.0001088
## F-statistic: 2.573 on 1 and 14463 DF,  p-value: 0.1087
```

More on factors

Interact or cross factors

```
gss_sub <- gss_sub |>
  mutate(degree_by_race = fct_cross(race, degree))

gss_sub |>
  count(degree_by_race)
```

```
## # A tibble: 16 × 2
##    degree_by_race           n
##    <fct>                <int>
##  1 White:Lt High School  1188
##  2 Black:Lt High School   379
##  3 Other:Lt High School   283
##  4 White:High School     5548
##  5 Black:High School     1180
##  6 Other:High School      546
##  7 White:Junior College   885
##  8 Black:Junior College   206
##  9 Other:Junior College    70
## 10 White:Bachelor        2334
## 11 Black:Bachelor         233
## 12 Other:Bachelor         200
## 13 White:Graduate        1293
## 14 Black:Graduate         116
## 15 Other:Graduate         147
## 16 <NA>                     2
```

More on factors

Relevel manually by lumping ... the least frequent n

```
gss_sub |>
  mutate(degree_n = fct_lump_n(degree, n = 3)) |>
  count(degree_n)
```

```
## # A tibble: 5 × 2
##   degree_n           n
##   <ord>          <int>
## 1 Lt High School  1850
## 2 High School     7274
## 3 Bachelor        2767
## 4 Other           2717
## 5 <NA>               2
```

More on factors

Relevel manually by lumping ...to other, manually

```
gss_sub |>
  mutate(degree_o = fct_other(degree,
                              keep = c("Lt High School",
                                       "High School"))) |>
  count(degree_o)
```

```
## # A tibble: 4 × 2
##   degree_o           n
##   <ord>          <int>
## 1 Lt High School  1850
## 2 High School     7274
## 3 Other           5484
## 4 <NA>               2
```