Reading in data with readr and haven

Session 6

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Statistical Horizons, April 2021

Load the packages, as always

```
library(here)      # manage file paths
```

```
## here() starts at /Users/kjhealy/Documents/courses/data_wrangling
```

```
library(socviz)    # data and some useful functions
```

```
##
## Attaching package: 'socviz'
```

```
## The following object is masked from 'package:kjhutils':
##
##     %nin%
```

```
library(tidyverse) # your friend and mine
```

```
## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.0 ──
```

```
## ✓ ggplot2 3.3.3     ✓ purrr   0.3.4
## ✓ tibble  3.1.0     ✓ dplyr   1.0.5
## ✓ tidyr   1.1.3     ✓ stringr 1.4.0
## ✓ readr   1.4.0     ✓ forcats 0.5.1
```

```
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## x dplyr::filter()  masks stats::filter()
## x purrr::is_null() masks testthat::is_null()
## x dplyr::lag()     masks stats::lag()
## x dplyr::matches() masks tidyr::matches(), testthat::matches()
```

```
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

Data we want to get into R

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Nice, clean CSV files.

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Nice, clean CSV files.

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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()`

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Base R has `read.csv()`

As is often the case, the tidyverse has a corresponding "underscored" version, `read_csv()`. It is *much* 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")
```

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")
```

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
## ├── README.Rmd
## ├── README.md
## ├── agile-pike_reprex.R
## ├── agile-pike_reprex.md
## ├── cocky-doe_reprex.R
## ├── cocky-doe_reprex.md
## ├── code
## ├── course_notes.Rmd
## ├── course_notes.html
## ├── data
## ├── data_wrangling.Rproj
## ├── docs
## ├── office
## ├── pdf_slides
## ├── r_code
## ├── scratch.Rmd
## ├── scratch.docx
## ├── scratch.html
## ├── scratch.log
## ├── scratch.pdf
## ├── scratch.tex
## └── slides
```

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 x 21
##    country  year donors   pop pop.dens   gdp gdp.lag health health.lag pubhealth
##    <chr>   <dbl>  <dbl> <dbl>    <dbl> <dbl>   <dbl>  <dbl>      <dbl>     <dbl>
##  1 Austra…    NA  NA    17065    0.220 16774   16591   1300       1224       4.8
##  2 Austra…  1991  12.1  17284    0.223 17171   16774   1379       1300       5.4
##  3 Austra…  1992  12.4  17495    0.226 17914   17171   1455       1379       5.4
##  4 Austra…  1993  12.5  17667    0.228 18883   17914   1540       1455       5.4
##  5 Austra…  1994  10.2  17855    0.231 19849   18883   1626       1540       5.4
##  6 Austra…  1995  10.2  18072    0.233 21079   19849   1737       1626       5.5
##  7 Austra…  1996  10.6  18311    0.237 21923   21079   1846       1737       5.6
##  8 Austra…  1997  10.3  18518    0.239 22961   21923   1948       1846       5.7
##  9 Austra…  1998  10.5  18711    0.242 24148   22961   2077       1948       5.9
## 10 Austra…  1999   8.67 18926    0.244 25445   24148   2231       2077       6.1
## # … with 228 more rows, and 11 more variables: roads <dbl>, cerebvas <dbl>,
## #   assault <dbl>, external <dbl>, txp.pop <dbl>, world <chr>, opt <chr>,
## #   consent.law <chr>, consent.practice <chr>, consistent <chr>, ccode <chr>
```

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 `,`

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

`read_csv2()` Field separator is `,`

```
# 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()` and `read_table2()`

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 x 21
##    country  year donors   pop pop.dens   gdp gdp.lag health health.lag pubhealth
##    <chr>   <dbl>  <dbl> <dbl>    <dbl> <dbl>   <dbl>  <dbl>      <dbl>     <dbl>
##  1 Austra…    NA  NA    17065    0.220 16774   16591   1300       1224       4.8
##  2 Austra…  1991  12.1  17284    0.223 17171   16774   1379       1300       5.4
##  3 Austra…  1992  12.4  17495    0.226 17914   17171   1455       1379       5.4
##  4 Austra…  1993  12.5  17667    0.228 18883   17914   1540       1455       5.4
##  5 Austra…  1994  10.2  17855    0.231 19849   18883   1626       1540       5.4
##  6 Austra…  1995  10.2  18072    0.233 21079   19849   1737       1626       5.5
##  7 Austra…  1996  10.6  18311    0.237 21923   21079   1846       1737       5.6
##  8 Austra…  1997  10.3  18518    0.239 22961   21923   1948       1846       5.7
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## # … with 228 more rows, and 11 more variables: roads <dbl>, cerebvas <dbl>,
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## #   consent.law <chr>, consent.practice <chr>, consistent <chr>, ccode <chr>
```

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

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
```

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

engmort
```

```
## # A tibble: 222 x 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
```

Pay attention 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.

Pay attention to the column specification

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

```
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## cols(
##   Year = col_double(),
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##   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.

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

Pay attention 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 x 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
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## # … with 212 more rows
```

Normalizing names and recoding

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

```
## # A tibble: 222 x 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
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##  7  1841 6     0.0109  0.0112  0.0110
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## 10  1841 9     0.00577 0.00605 0.00591
## # … 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 x 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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##  6  1841     5 0.0140  0.0143  0.0141
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Normalizing names and recoding

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##     year   age  female    male   total
##    <dbl> <int>   <dbl>   <dbl>   <dbl>
##  1  1841     0 0.136   0.169   0.153
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##  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
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##  9  1841     8 0.00686 0.00725 0.00705
## 10  1841     9 0.00577 0.00605 0.00591
## # … with 212 more rows
```
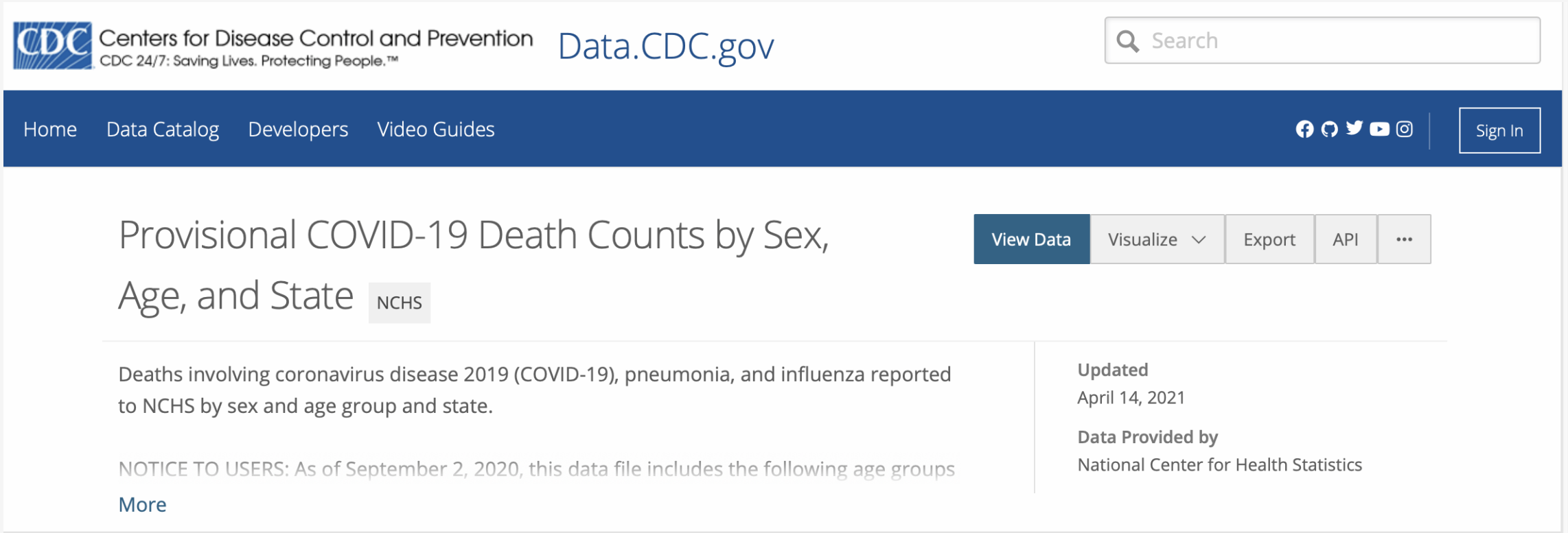

The `janitor` package is very handy!

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

Let's try to load it

```
problems(nchs)
```

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

```
problems(nchs)
```

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

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 x 16
##   `Data As Of` `Start Date` `End Date` Group Year  Month State Sex   `Age Group`
##   <chr>        <chr>        <chr>      <chr> <lgl> <lgl> <chr> <chr> <chr>
## 1 04/07/2021   01/01/2020   04/03/2021 By T… NA    NA    Unit… All … All Ages
## 2 04/07/2021   01/01/2020   04/03/2021 By T… NA    NA    Unit… All … Under 1 ye…
## 3 04/07/2021   01/01/2020   04/03/2021 By T… NA    NA    Unit… All … 0-17 years
## 4 04/07/2021   01/01/2020   04/03/2021 By T… NA    NA    Unit… All … 1-4 years
## 5 04/07/2021   01/01/2020   04/03/2021 By T… NA    NA    Unit… All … 5-14 years
## 6 04/07/2021   01/01/2020   04/03/2021 By T… NA    NA    Unit… All … 15-24 years
## # … with 7 more variables: 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 tail()

```
tail(nchs)
```

```
## # A tibble: 6 x 16
##   `Data As Of` `Start Date` `End Date` Group Year  Month State Sex   `Age Group`
##   <chr>        <chr>        <chr>      <chr> <lgl> <lgl> <chr> <chr> <chr>
## 1 04/07/2021   04/01/2021   04/03/2021 By M… NA    NA    Puer… Fema… 45-54 years
## 2 04/07/2021   04/01/2021   04/03/2021 By M… NA    NA    Puer… Fema… 50-64 years
## 3 04/07/2021   04/01/2021   04/03/2021 By M… NA    NA    Puer… Fema… 55-64 years
## 4 04/07/2021   04/01/2021   04/03/2021 By M… NA    NA    Puer… Fema… 65-74 years
## 5 04/07/2021   04/01/2021   04/03/2021 By M… NA    NA    Puer… Fema… 75-84 years
## 6 04/07/2021   04/01/2021   04/03/2021 By M… NA    NA    Puer… Fema… 85 years a…
## # … with 7 more variables: 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_sample()

```
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   01/01/2021   01/31/2021 By Month NA    TRUE  Maine       Female
##  2 04/07/2021   01/01/2020   01/31/2020 By Month NA    TRUE  New York    Female
##  3 04/07/2021   01/01/2021   04/03/2021 By Year  NA    NA    Maine       Male
##  4 04/07/2021   12/01/2020   12/31/2020 By Month NA    NA    Mississippi All Se…
##  5 04/07/2021   03/01/2021   03/31/2021 By Month NA    NA    New York C… All Se…
##  6 04/07/2021   04/01/2020   04/30/2020 By Month NA    NA    Colorado    All Se…
##  7 04/07/2021   06/01/2020   06/30/2020 By Month NA    NA    Iowa        Male
##  8 04/07/2021   09/01/2020   09/30/2020 By Month NA    NA    Texas       All Se…
##  9 04/07/2021   01/01/2021   01/31/2021 By Month NA    TRUE  Washington  Male
## 10 04/07/2021   05/01/2020   05/31/2020 By Month NA    NA    Alabama     All Se…
## # … 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>
```

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 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 Total NA    NA    Puerto Rico Female
##  2 04/07/2021   01/01/2020   04/03/2021 By Total NA    NA    Puerto Rico Female
##  3 04/07/2021   01/01/2020   04/03/2021 By Total NA    NA    Puerto Rico Female
##  4 04/07/2021   01/01/2020   04/03/2021 By Total NA    NA    Puerto Rico Female
##  5 04/07/2021   01/01/2020   04/03/2021 By Total NA    NA    Puerto Rico Female
##  6 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    United Sta… All Se…
##  7 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    United Sta… All Se…
##  8 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    United Sta… All Se…
##  9 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    United Sta… All Se…
## 10 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    United Sta… All Se…
## 11 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    United Sta… All Se…
## # … 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()

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

```
## # A tibble: 11 x 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 x 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 x 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 x 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 Death
##  [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,All Ages,539723,4161167,466437,263147,9037,7
##  [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
## [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
## [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
## [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
## [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 little 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
## [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
## [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 little 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 <- 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 <- 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 <- 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 x 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 x 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.

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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 x 15
##    data_as_of start_date end_date   group  year  month state    sex    ag
##    <date>     <date>     <date>     <chr>  <chr> <chr> <chr>    <chr>  <c
##  1 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… Al
##  2 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… Un
##  3 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 0-
##  4 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 1-
##  5 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 5-
##  6 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 15
##  7 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 18
##  8 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 25
##  9 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 30
## 10 2021-04-07 2020-01-01 2021-04-03 By To… <NA>  <NA>  United … All S… 35
## # … with 52,316 more rows, and 6 more variables: covid_19_deaths <int>,
## #   total_deaths <int>, pneumonia_deaths <int>,
## #   pneumonia_and_covid_19_deaths <int>, influenza_deaths <int>,
## #   pneumonia_influenza_or_covid_19_deaths <int>
```

If we wanted to ...

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

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

```
## # A tibble: 52,326 x 10
##    group  state   sex    age_group covid_19_deaths total_deaths pneumonia
##    <chr>  <chr>   <chr>  <chr>               <int>        <int>
##  1 By To… United… All S… All ages           539723      4161167
##  2 By To… United… All S… Under 1 …              59        22626
##  3 By To… United… All S… 0-17 yea…             251        39620
##  4 By To… United… All S… 1-4 years              31         4069
##  5 By To… United… All S… 5-14 yea…              89         6578
##  6 By To… United… All S… 15-24 ye…             804        42596
##  7 By To… United… All S… 18-29 ye…            1996        75339
##  8 By To… United… All S… 25-34 ye…            3543        88196
##  9 By To… United… All S… 30-39 ye…            5792       107348
## 10 By To… United… All S… 35-44 ye…            9259       126848
## # … with 52,316 more rows, and 3 more variables:
## #   pneumonia_and_covid_19_deaths <int>, influenza_deaths <int>,
## #   pneumonia_influenza_or_covid_19_deaths <int>
```

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_deaths,
               names_to = "outcome",
               values_to = "n")
```

```
## # A tibble: 313,956 x 6
##    group    state       sex      age_group   outcome
##    <chr>    <chr>       <chr>    <chr>       <chr>
##  1 By Total United Sta… All Sex… All ages    covid_19_deaths
##  2 By Total United Sta… All Sex… All ages    total_deaths
##  3 By Total United Sta… All Sex… All ages    pneumonia_deaths
##  4 By Total United Sta… All Sex… All ages    pneumonia_and_covid_19_deat…
##  5 By Total United Sta… All Sex… All ages    influenza_deaths
##  6 By Total United Sta… All Sex… All ages    pneumonia_influenza_or_covi…
##  7 By Total United Sta… All Sex… Under 1 ye… covid_19_deaths
##  8 By Total United Sta… All Sex… Under 1 ye… total_deaths
##  9 By Total United Sta… All Sex… Under 1 ye… pneumonia_deaths
## 10 By Total United Sta… All Sex… Under 1 ye… pneumonia_and_covid_19_deat…
## # … 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_deaths,
               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-19"))
```

```
## # A tibble: 313,956 x 6
##    group    state       sex      age_group   outcome
##    <chr>    <chr>       <chr>    <chr>       <chr>
##  1 By Total United Sta… All Sex… All ages    COVID-19 deaths
##  2 By Total United Sta… All Sex… All ages    Total deaths
##  3 By Total United Sta… All Sex… All ages    Pneumonia deaths
##  4 By Total United Sta… All Sex… All ages    Pneumonia and COVID-19 deat…
##  5 By Total United Sta… All Sex… All ages    Influenza deaths
##  6 By Total United Sta… All Sex… All ages    Pneumonia influenza or COVI…
##  7 By Total United Sta… All Sex… Under 1 ye… COVID-19 deaths
##  8 By Total United Sta… All Sex… Under 1 ye… Total deaths
##  9 By Total United Sta… All Sex… Under 1 ye… Pneumonia deaths
## 10 By Total United Sta… All Sex… Under 1 ye… Pneumonia and COVID-19 deat…
## # … 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_deaths,
               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-19"))
```

```
## # A tibble: 313,956 x 6
##    group    state       sex      age_group   outcome
##    <chr>    <chr>       <chr>    <chr>       <chr>
##  1 By Total United Sta… All Sex… All ages    COVID-19 deaths
##  2 By Total United Sta… All Sex… All ages    Total deaths
##  3 By Total United Sta… All Sex… All ages    Pneumonia deaths
##  4 By Total United Sta… All Sex… All ages    Pneumonia and COVID-19 deat…
##  5 By Total United Sta… All Sex… All ages    Influenza deaths
##  6 By Total United Sta… All Sex… All ages    Pneumonia influenza or COVI…
##  7 By Total United Sta… All Sex… Under 1 ye… COVID-19 deaths
##  8 By Total United Sta… All Sex… Under 1 ye… Total deaths
##  9 By Total United Sta… All Sex… Under 1 ye… Pneumonia deaths
## 10 By Total United Sta… All Sex… Under 1 ye… Pneumonia and COVID-19 deat…
## # … 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 x 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 x 1
##   group
##   <chr>
## 1 By Total
## 2 By Year
## 3 By Month
```

Cleaned up (but not tidy)

```
nchs_fmt %>%
  distinct(group)
```

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

```
nchs_fmt %>%
  distinct(age_group)
```

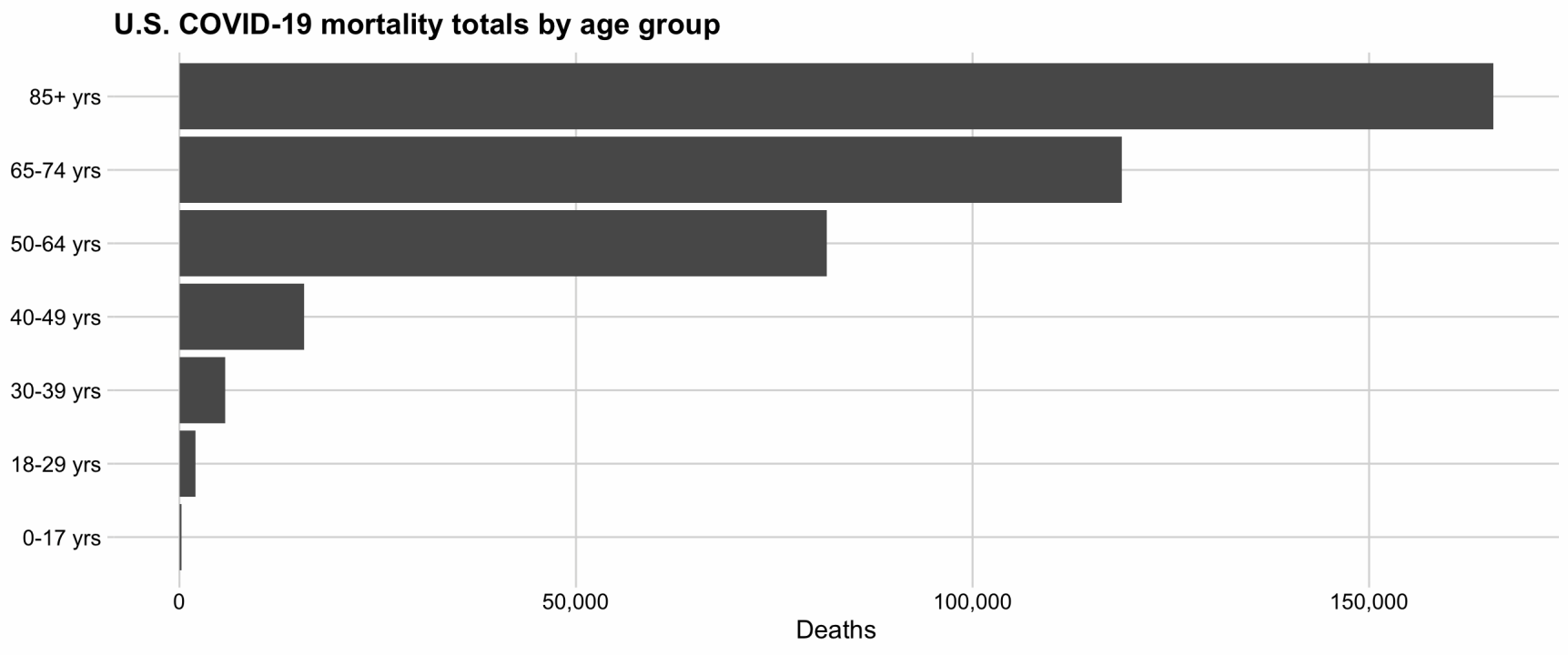
```
## # A tibble: 17 x 1
##    age_group
##    <chr>
##  1 All ages
##  2 Under 1 year
##  3 0-17 years
##  4 1-4 years
##  5 5-14 years
##  6 15-24 years
##  7 18-29 years
##  8 25-34 years
##  9 30-39 years
## 10 35-44 years
## 11 40-49 years
## 12 45-54 years
## 13 50-64 years
## 14 55-64 years
##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

```
print(p_out)
```



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 x 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

```
# 1 Write it yourself
df %>%
  filter(complete.cases(.))
```

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

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

```
## # A tibble: 1 x 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(!(is.na(.))) # Pronoun
```

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

Read `.` as "the thing we're looking at" or "the thing 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 x 5
##    SEGMENT         DESCRIPTION                                    R     F     M
##    <chr>           <chr>                                          <chr> <chr> <chr>
##  1 <NA>            <NA>                                           <NA>  <NA>  <NA>
##  2 Champions       Bought recently, buy often and spend the m…    4– 5  4– 5  4– 5
##  3 <NA>            <NA>                                           <NA>  <NA>  <NA>
##  4 Loyal Customers Spend good money. Responsive to promotions     2– 5  3– 5  3– 5
##  5 <NA>            <NA>                                           <NA>  <NA>  <NA>
##  6 Potential Loya… Recent customers, spent good amount, bough…    3– 5  1– 3  1– 3
##  7 <NA>            <NA>                                           <NA>  <NA>  <NA>
##  8 New Customers   Bought more recently, but not often             4– 5  <= 1  <= 1
##  9 <NA>            <NA>                                           <NA>  <NA>  <NA>
## 10 Promising       Recent shoppers, but haven’t spent much        3– 4  <= 1  <= 1
## # … with 13 more rows
```

Cleaning a table

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

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

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.)))   #<<
```

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

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.))) %>%
  pivot_longer(cols = r:m)
```

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

Cleaning a table

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

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

Cleaning a table

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

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

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.))) %>%
  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 x 8
##    segment      description                  lo_r  lo_f  lo_m  hi_r  hi_f  hi_m
##    <chr>        <chr>                       <int> <int> <int> <int> <int> <int>
##  1 Champions    Bought recently, buy often …     4     4     4     5     5     5
##  2 Loyal Custo… Spend good money. Responsiv…     2     3     3     5     5     5
##  3 Potential L… Recent customers, spent goo…     3     1     1     5     3     3
##  4 New Custome… Bought more recently, but n…     4    NA    NA     5     1     1
##  5 Promising    Recent shoppers, but haven'…     3    NA    NA     4     1     1
##  6 Need Attent… Above average recency, freq…     2     2     2     3     3     3
##  7 About To Sl… Below average recency, freq…     2    NA    NA     3     2     2
##  8 At Risk      Spent big money, purchased …    NA     2     2     2     5     5
##  9 Can't Lose … Made big purchases and ofte…    NA     4     4     1     5     5
## 10 Hibernating  Low spenders, low frequency…     1     1     1     2     2     2
## 11 Lost         Lowest recency, frequency &…    NA    NA    NA     2     2     2
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.))) %>%
  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_if(is.integer, replace_na, 0)
```

```
## # A tibble: 11 x 8
##    segment      description                  lo_r  lo_f  lo_m  hi_r  hi_f  hi_m
##    <chr>        <chr>                       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1 Champions    Bought recently, buy often …     4     4     4     5     5     5
##  2 Loyal Custo… Spend good money. Responsiv…     2     3     3     5     5     5
##  3 Potential L… Recent customers, spent goo…     3     1     1     5     3     3
##  4 New Custome… Bought more recently, but n…     4     0     0     5     1     1
##  5 Promising    Recent shoppers, but haven'…     3     0     0     4     1     1
##  6 Need Attent… Above average recency, freq…     2     2     2     3     3     3
##  7 About To Sl… Below average recency, freq…     2     0     0     3     2     2
##  8 At Risk      Spent big money, purchased …     0     2     2     2     5     5
##  9 Can't Lose … Made big purchases and ofte…     0     4     4     1     5     5
## 10 Hibernating  Low spenders, low frequency…     1     1     1     2     2     2
## 11 Lost         Lowest recency, frequency &…     0     0     0     2     2     2
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.))) %>%
  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_if(is.integer, replace_na, 0) %>%
  select(segment,
         lo_r, hi_r,
         lo_f, hi_f,
         lo_m, hi_m,
         description)
```

```
## # A tibble: 11 x 8
##    segment       lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>        <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions        4     5     4     5     4     5 Bought recently, buy often …
##  2 Loyal Custo…     2     5     3     5     3     5 Spend good money. Responsiv…
##  3 Potential L…     3     5     1     3     1     3 Recent customers, spent goo…
##  4 New Custome…     4     5     0     1     0     1 Bought more recently, but n…
##  5 Promising        3     4     0     1     0     1 Recent shoppers, but haven'…
##  6 Need Attent…     2     3     2     3     2     3 Above average recency, freq…
##  7 About To Sl…     2     3     0     2     0     2 Below average recency, freq…
##  8 At Risk          0     2     2     5     2     5 Spent big money, purchased …
##  9 Can't Lose …     0     1     4     5     4     5 Made big purchases and ofte…
## 10 Hibernating      1     2     1     2     1     2 Low spenders, low frequency…
## 11 Lost             0     2     0     2     0     2 Lowest recency, frequency &…
```

Maybe a candidate for rowwise?

```
rfm_table
```

```
## # A tibble: 11 x 8
##    segment       lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>        <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions        4     5     4     5     4     5 Bought recently, buy often …
##  2 Loyal Custo…     2     5     3     5     3     5 Spend good money. Responsiv…
##  3 Potential L…     3     5     1     3     1     3 Recent customers, spent goo…
##  4 New Custome…     4     5     0     1     0     1 Bought more recently, but n…
##  5 Promising        3     4     0     1     0     1 Recent shoppers, but haven'…
##  6 Need Attent…     2     3     2     3     2     3 Above average recency, freq…
##  7 About To Sl…     2     3     0     2     0     2 Below average recency, freq…
##  8 At Risk          0     2     2     5     2     5 Spent big money, purchased …
##  9 Can't Lose …     0     1     4     5     4     5 Made big purchases and ofte…
## 10 Hibernating      1     2     1     2     1     2 Low spenders, low frequency…
## 11 Lost             0     2     0     2     0     2 Lowest recency, frequency &…
```

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 x 10
##    segment   sum_lo sum_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>      <dbl>  <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions     12     15     4     5     4     5     4     5 Bought recently,…
##  2 Loyal Cu…      8     15     2     5     3     5     3     5 Spend good money…
##  3 Potentia…      5     11     3     5     1     3     1     3 Recent customers…
##  4 New Cust…      4      7     4     5     0     1     0     1 Bought more rece…
##  5 Promising      3      6     3     4     0     1     0     1 Recent shoppers,…
##  6 Need Att…      6      9     2     3     2     3     2     3 Above average re…
##  7 About To…      2      7     2     3     0     2     0     2 Below average re…
##  8 At Risk        4     12     0     2     2     5     2     5 Spent big money,…
##  9 Can't Lo…      8     11     0     1     4     5     4     5 Made big purchas…
## 10 Hibernat…      3      6     1     2     1     2     1     2 Low spenders, lo…
## 11 Lost           0      6     0     2     0     2     0     2 Lowest recency, …
```

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 x 10
##    segment   sum_lo sum_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>      <dbl>  <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions     55    105     4     5     4     5     4     5 Bought recently,…
##  2 Loyal Cu…     55    105     2     5     3     5     3     5 Spend good money…
##  3 Potentia…     55    105     3     5     1     3     1     3 Recent customers…
##  4 New Cust…     55    105     4     5     0     1     0     1 Bought more rece…
##  5 Promising     55    105     3     4     0     1     0     1 Recent shoppers,…
##  6 Need Att…     55    105     2     3     2     3     2     3 Above average re…
##  7 About To…     55    105     2     3     0     2     0     2 Below average re…
##  8 At Risk       55    105     0     2     2     5     2     5 Spent big money,…
##  9 Can't Lo…     55    105     0     1     4     5     4     5 Made big purchas…
## 10 Hibernat…     55    105     1     2     1     2     1     2 Low spenders, lo…
## 11 Lost          55    105     0     2     0     2     0     2 Lowest recency, …
```

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 x 10
##    segment   mean_lo mean_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>       <dbl>   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions    1.67    3.18     4     5     4     5     4     5 Bought recentl…
##  2 Loyal Cu…    1.67    3.18     2     5     3     5     3     5 Spend good mon…
##  3 Potentia…    1.67    3.18     3     5     1     3     1     3 Recent custome…
##  4 New Cust…    1.67    3.18     4     5     0     1     0     1 Bought more re…
##  5 Promising    1.67    3.18     3     4     0     1     0     1 Recent shopper…
##  6 Need Att…    1.67    3.18     2     3     2     3     2     3 Above average …
##  7 About To…    1.67    3.18     2     3     0     2     0     2 Below average …
##  8 At Risk      1.67    3.18     0     2     2     5     2     5 Spent big mone…
##  9 Can't Lo…    1.67    3.18     0     1     4     5     4     5 Made big purch…
## 10 Hibernat…    1.67    3.18     1     2     1     2     1     2 Low spenders, …
## 11 Lost         1.67    3.18     0     2     0     2     0     2 Lowest recency…
```

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 x 10
## # Rowwise:
##    segment   mean_lo mean_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>       <dbl>   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions   4        5        4     5     4     5     4     5 Bought recentl…
##  2 Loyal Cu…   2.67     5        2     5     3     5     3     5 Spend good mon…
##  3 Potentia…   1.67     3.67     3     5     1     3     1     3 Recent custome…
##  4 New Cust…   1.33     2.33     4     5     0     1     0     1 Bought more re…
##  5 Promising   1        2        3     4     0     1     0     1 Recent shopper…
##  6 Need Att…   2        3        2     3     2     3     2     3 Above average …
##  7 About To…   0.667    2.33     2     3     0     2     0     2 Below average …
##  8 At Risk     1.33     4        0     2     2     5     2     5 Spent big mone…
##  9 Can't Lo…   2.67     3.67     0     1     4     5     4     5 Made big purch…
## 10 Hibernat…   1        2        1     2     1     2     1     2 Low spenders, …
## 11 Lost        0        2        0     2     0     2     0     2 Lowest recency…
```

Rowwise operations aren'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 x 10
## # Groups:   segment [11]
##    segment   mean_lo mean_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>       <dbl>   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions   4        5        4     5     4     5     4     5 Bought recentl…
##  2 Loyal Cu…   2.67     5        2     5     3     5     3     5 Spend good mon…
##  3 Potentia…   1.67     3.67     3     5     1     3     1     3 Recent custome…
##  4 New Cust…   1.33     2.33     4     5     0     1     0     1 Bought more re…
##  5 Promising   1        2        3     4     0     1     0     1 Recent shopper…
##  6 Need Att…   2        3        2     3     2     3     2     3 Above average …
##  7 About To…   0.667    2.33     2     3     0     2     0     2 Below average …
##  8 At Risk     1.33     4        0     2     2     5     2     5 Spent big mone…
##  9 Can't Lo…   2.67     3.67     0     1     4     5     4     5 Made big purch…
## 10 Hibernat…   1        2        1     2     1     2     1     2 Low spenders, …
## 11 Lost        0        2        0     2     0     2     0     2 Lowest recency…
```

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 x 10
## # Groups:   segment [11]
##    segment   sum_lo sum_hi  lo_r  hi_r  lo_f  hi_f  lo_m  hi_m description
##    <chr>      <dbl>  <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
##  1 Champions     12     15     4     5     4     5     4     5 Bought recently,…
##  2 Loyal Cu…      8     15     2     5     3     5     3     5 Spend good money…
##  3 Potentia…      5     11     3     5     1     3     1     3 Recent customers…
##  4 New Cust…      4      7     4     5     0     1     0     1 Bought more rece…
##  5 Promising      3      6     3     4     0     1     0     1 Recent shoppers,…
##  6 Need Att…      6      9     2     3     2     3     2     3 Above average re…
##  7 About To…      2      7     2     3     0     2     0     2 Below average re…
##  8 At Risk        4     12     0     2     2     5     2     5 Spent big money,…
##  9 Can't Lo…      8     11     0     1     4     5     4     5 Made big purchas…
## 10 Hibernat…      3      6     1     2     1     2     1     2 Low spenders, lo…
## 11 Lost           0      6     0     2     0     2     0     2 Lowest recency, …
```

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 x 2,757
##    firstyear  firstid  year    id   vpsu vstrat adults  ballot dateintv   famgen
##        <dbl> <dbl+lb> <dbl> <dbl> <dbl+> <dbl+> <dbl+> <dbl+l> <dbl+lb> <dbl+lb>
##  1      2006        9  2006     9      2   1957      1 3 [BAL…      709 1 [1 GE…
##  2      2006        9  2008  3001     NA     NA      2 3 [BAL…      503 1 [1 GE…
##  3      2006        9  2010  6001  NA(i)     NA      2 3 [BAL…      508 1 [1 GE…
##  4      2006       10  2010  6002  NA(i)     NA      1 1 [BAL…      408 1 [1 GE…
##  5      2006       10  2006    10      2   1957      2 1 [BAL…      630 2 [2 GE…
##  6      2006       10  2008  3002     NA     NA      2 1 [BAL…      426 2 [2 GE…
##  7      2006       11  2008  3003     NA     NA      2 3 [BAL…      718 4 [2 GE…
##  8      2006       11  2010  6003  NA(i)     NA  NA(n) 3 [BAL…      518 2 [2 GE…
##  9      2006       11  2006    11      2   1957      2 3 [BAL…      630 4 [2 GE…
## 10      2006       12  2010  6004  NA(i)     NA      4 1 [BAL…      324 2 [2 GE…
## # … with 14,600 more rows, and 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>, wtss <dbl+lbl>, wtssall <dbl+lbl>, wtssnr <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 x 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 x 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 x 2,757
##    firstyear firstid  year    id  vpsu vstrat adults ballot dateintv famgen
##        <dbl>   <dbl> <dbl> <dbl> <dbl>  <dbl>  <dbl>  <dbl>    <dbl>  <dbl>
##  1      2006       9  2006     9     2   1957      1      3      709      1
##  2      2006       9  2008  3001    NA     NA      2      3      503      1
##  3      2006       9  2010  6001    NA     NA      2      3      508      1
##  4      2006      10  2010  6002    NA     NA      1      1      408      1
##  5      2006      10  2006    10     2   1957      2      1      630      2
##  6      2006      10  2008  3002    NA     NA      2      1      426      2
##  7      2006      11  2008  3003    NA     NA      2      3      718      4
##  8      2006      11  2010  6003    NA     NA     NA      3      518      2
##  9      2006      11  2006    11     2   1957      2      3      630      4
## 10      2006      12  2010  6004    NA     NA      4      1      324      2
## # … with 14,600 more rows, and 2,747 more variables: form <dbl>, 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>, hefinfo <dbl>, wrkstat <dbl>, racecen1 <dbl>, marital <dbl>,
## #   phone <dbl>, comprend <dbl>, coop <dbl>, feeused <dbl>, hhrace <dbl>,
## #   lngthinv <dbl>, educ <dbl>, childs <dbl>, ethnum <dbl>, age <dbl>,
## #   cohort <dbl>, intrace1 <dbl>, attend <dbl>, inthisp <dbl>, hhtype <dbl>,
## #   hhtype1 <dbl>, earnrs <dbl>, whoelse6 <dbl>, whoelse1 <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 x 19
##     year    id    ballot    age     tvhours     race      sex    degree    relig
##    <dbl> <dbl> <dbl+lbl> <dbl+>   <dbl+lbl> <dbl+lb> <dbl+lb> <dbl+lbl> <dbl+lb>
##  1  2006     9 3 [BALLO…     23 NA(a) [iap] 2 [blac… 2 [fema… 3 [bache… 4 [none]
##  2  2008  3001 3 [BALLO…     25 NA(i)       3 [othe… 2 [fema… 3 [bache… 4 [none]
##  3  2010  6001 3 [BALLO…     27 NA(i)       2 [blac… 2 [fema… 3 [bache… 4 [none]
##  4  2010  6002 1 [BALLO…     36     3       1 [whit… 2 [fema… 4 [gradu… 4 [none]
##  5  2006    10 1 [BALLO…     32     3       3 [othe… 2 [fema… 4 [gradu… 4 [none]
##  6  2008  3002 1 [BALLO…     34     3       3 [othe… 2 [fema… 4 [gradu… 4 [none]
##  7  2008  3003 3 [BALLO…     83 NA(i)       2 [blac… 2 [fema… 0 [LT HI… 1 [prot…
##  8  2010  6003 3 [BALLO…     85 NA(i)       2 [blac… 2 [fema… 0 [LT HI… 1 [prot…
##  9  2006    11 3 [BALLO…     81 NA(a) [iap] 2 [blac… 2 [fema… 0 [LT HI… 1 [prot…
## 10  2010  6004 1 [BALLO…     51    10       3 [othe… 1 [male] 1 [HIGH … 2 [cath…
## # … 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` .panel2-gss1-auto[

```
## # A tibble: 14,610 x 19
##     year    id    ballot    age     tvhours     race      sex    degree    relig
##    <dbl> <dbl> <dbl+lbl> <dbl+>   <dbl+lbl> <dbl+lb> <dbl+lb> <dbl+lbl> <dbl+lb>
##  1  2006     9 3 [BALLO…     23 NA(a) [iap] 2 [blac… 2 [fema… 3 [bache… 4 [none]
##  2  2008  3001 3 [BALLO…     25 NA(i)       3 [othe… 2 [fema… 3 [bache… 4 [none]
##  3  2010  6001 3 [BALLO…     27 NA(i)       2 [blac… 2 [fema… 3 [bache… 4 [none]
##  4  2010  6002 1 [BALLO…     36     3       1 [whit… 2 [fema… 4 [gradu… 4 [none]
##  5  2006    10 1 [BALLO…     32     3       3 [othe… 2 [fema… 4 [gradu… 4 [none]
##  6  2008  3002 1 [BALLO…     34     3       3 [othe… 2 [fema… 4 [gradu… 4 [none]
##  7  2008  3003 3 [BALLO…     83 NA(i)       2 [blac… 2 [fema… 0 [LT HI… 1 [prot…
##  8  2010  6003 3 [BALLO…     85 NA(i)       2 [blac… 2 [fema… 0 [LT HI… 1 [prot…
##  9  2006    11 3 [BALLO…     81 NA(a) [iap] 2 [blac… 2 [fema… 0 [LT HI… 1 [prot…
## 10  2010  6004 1 [BALLO…     51    10       3 [othe… 1 [male] 1 [HIGH … 2 [cath…
## # … 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))
```

.panel2-gss1-auto[

```
## # A tibble: 14,610 x 19
##     year    id   ballot    age  tvhours    race     sex  degree   relig   income
##    <dbl> <dbl> <dbl+lb> <dbl+> <dbl+lb> <dbl+l> <dbl+l> <dbl+l> <dbl+l> <dbl+lb>
##  1  2006     9 3 [BALL…     23       NA 2 [bla… 2 [fem… 3 [bac… 4 [non… 12 [$25…
##  2  2008  3001 3 [BALL…     25       NA 3 [oth… 2 [fem… 3 [bac… 4 [non… 12 [$25…
##  3  2010  6001 3 [BALL…     27       NA 2 [bla… 2 [fem… 3 [bac… 4 [non… 12 [$25…
##  4  2010  6002 1 [BALL…     36        3 1 [whi… 2 [fem… 4 [gra… 4 [non… 12 [$25…
##  5  2006    10 1 [BALL…     32        3 3 [oth… 2 [fem… 4 [gra… 4 [non… NA
##  6  2008  3002 1 [BALL…     34        3 3 [oth… 2 [fem… 4 [gra… 4 [non… 12 [$25…
##  7  2008  3003 3 [BALL…     83       NA 2 [bla… 2 [fem… 0 [LT … 1 [pro… 11 [$20…
##  8  2010  6003 3 [BALL…     85       NA 2 [bla… 2 [fem… 0 [LT … 1 [pro… NA
##  9  2006    11 3 [BALL…     81       NA 2 [bla… 2 [fem… 0 [LT … 1 [pro… NA
## 10  2010  6004 1 [BALL…     51       10 3 [oth… 1 [mal… 1 [HIG… 2 [cat…  1 [LT …
## # … with 14,600 more rows, and 9 more variables: 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))
```

.panel2-gss1-auto[

```
## # A tibble: 14,610 x 19
##     year    id   ballot    age  tvhours    race     sex  degree   relig   income
##    <dbl> <dbl> <dbl+lb> <dbl+> <dbl+lb> <dbl+l> <dbl+l> <dbl+l> <dbl+l> <dbl+lb>
##  1  2006     9 3 [BALL…     23       NA 2 [bla… 2 [fem… 3 [bac… 4 [non… 12 [$25…
##  2  2008  3001 3 [BALL…     25       NA 3 [oth… 2 [fem… 3 [bac… 4 [non… 12 [$25…
##  3  2010  6001 3 [BALL…     27       NA 2 [bla… 2 [fem… 3 [bac… 4 [non… 12 [$25…
##  4  2010  6002 1 [BALL…     36        3 1 [whi… 2 [fem… 4 [gra… 4 [non… 12 [$25…
##  5  2006    10 1 [BALL…     32        3 3 [oth… 2 [fem… 4 [gra… 4 [non… NA
##  6  2008  3002 1 [BALL…     34        3 3 [oth… 2 [fem… 4 [gra… 4 [non… 12 [$25…
##  7  2008  3003 3 [BALL…     83       NA 2 [bla… 2 [fem… 0 [LT … 1 [pro… 11 [$20…
##  8  2010  6003 3 [BALL…     85       NA 2 [bla… 2 [fem… 0 [LT … 1 [pro… NA
##  9  2006    11 3 [BALL…     81       NA 2 [bla… 2 [fem… 0 [LT … 1 [pro… NA
## 10  2010  6004 1 [BALL…     51       10 3 [oth… 1 [mal… 1 [HIG… 2 [cat…  1 [LT …
## # … with 14,600 more rows, and 9 more variables: polviews <dbl+lbl>,
## #   fefam <dbl+lbl>, vpsu <dbl>, vstrat <dbl>, oversamp <dbl>, formwt <dbl>,
## #   wtssall <dbl>, sampcode <dbl>, sample <dbl>
```

]

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))
```

.panel2-gss1-auto[

```
## # A tibble: 14,610 x 19
##     year    id ballot   age tvhours     race      sex   degree   relig    inc
##    <int> <int>  <int> <int>   <int> <dbl+lb> <dbl+lb> <dbl+lb> <dbl+l> <dbl+lbl>
##  1  2006     9      3    23      NA 2 [blac… 2 [fema… 3 [bach… 4 [non… 12 [$250…
##  2  2008  3001      3    25      NA 3 [othe… 2 [fema… 3 [bach… 4 [non… 12 [$250…
##  3  2010  6001      3    27      NA 2 [blac… 2 [fema… 3 [bach… 4 [non… 12 [$250…
##  4  2010  6002      1    36       3 1 [whit… 2 [fema… 4 [grad… 4 [non… 12 [$250…
##  5  2006    10      1    32       3 3 [othe… 2 [fema… 4 [grad… 4 [non… NA
##  6  2008  3002      1    34       3 3 [othe… 2 [fema… 4 [grad… 4 [non… 12 [$250…
##  7  2008  3003      3    83      NA 2 [blac… 2 [fema… 0 [LT H… 1 [pro… 11 [$200…
##  8  2010  6003      3    85      NA 2 [blac… 2 [fema… 0 [LT H… 1 [pro… NA
##  9  2006    11      3    81      NA 2 [blac… 2 [fema… 0 [LT H… 1 [pro… NA
## 10  2010  6004      1    51      10 3 [othe… 1 [male] 1 [HIGH… 2 [cat…  1 [LT $…
## # … with 14,600 more rows, and 9 more variables: polviews <dbl+lbl>,
## #   fefam <dbl+lbl>, vpsu <dbl>, vstrat <dbl>, oversamp <dbl>, formwt <dbl>,
## #   wtssall <dbl>, sampcode <dbl>, sample <dbl>
```

]

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))
```

```
## # A tibble: 14,610 x 19
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <fct>   <fct>
##  1  2006     9      3    23      NA black female bachel… none  $25000… conserva…
##  2  2008  3001      3    25      NA other female bachel… none  $25000… EXTREMEL…
##  3  2010  6001      3    27      NA black female bachel… none  $25000… EXTREMEL…
##  4  2010  6002      1    36       3 white female gradua… none  $25000… liberal
##  5  2006    10      1    32       3 other female gradua… none  <NA>    SLIGHTLY…
##  6  2008  3002      1    34       3 other female gradua… none  $25000… moderate
##  7  2008  3003      3    83      NA black female LT HIG… prot… $20000… liberal
##  8  2010  6003      3    85      NA black female LT HIG… prot… <NA>    moderate
##  9  2006    11      3    81      NA black female LT HIG… prot… <NA>    moderate
## 10  2010  6004      1    51      10 other male   HIGH S… cath… LT $10… liberal
## # … with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>
```

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, to
```

```
## # A tibble: 14,610 x 19
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <fct>   <fct>
##  1  2006     9      3    23      NA black female bachel… none  $25000… conserva…
##  2  2008  3001      3    25      NA other female bachel… none  $25000… extremel…
##  3  2010  6001      3    27      NA black female bachel… none  $25000… extremel…
##  4  2010  6002      1    36       3 white female gradua… none  $25000… liberal
##  5  2006    10      1    32       3 other female gradua… none  <NA>    slightly…
##  6  2008  3002      1    34       3 other female gradua… none  $25000… moderate
##  7  2008  3003      3    83      NA black female lt hig… prot… $20000… liberal
##  8  2010  6003      3    85      NA black female lt hig… prot… <NA>    moderate
##  9  2006    11      3    81      NA black female lt hig… prot… <NA>    moderate
## 10  2010  6004      1    51      10 other male   high s… cath… lt $10… liberal
## # … with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>
```

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, tol
  mutate(across(all_of(cat_vars), fct_relabel, too
```

```
## # A tibble: 14,610 x 19
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <fct>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>
```

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, tol
  mutate(across(all_of(cat_vars), fct_relabel, too
  mutate(income = stringr::str_replace(income, "
```

```
## # A tibble: 14,610 x 19
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>
```

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 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 x 19
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>
```

The GSS panel: more recoding

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

```
## # A tibble: 14,610 x 20
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 9 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>
```

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_agegrp))
```

```
## # A tibble: 14,610 x 20
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 9 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>
```

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_agegrp)) %>%
    mutate(year_f = droplevels(factor(year)))
```

```
## # A tibble: 14,610 x 21
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 10 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>, year_f <fct>
```

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_agegrp)) %>%
    mutate(year_f = droplevels(factor(year))) %>%
    mutate(young = ifelse(age < 26, "Yes", "No"))
```

```
## # A tibble: 14,610 x 22
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 11 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>
```

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_agegrp)) %>%
    mutate(year_f = droplevels(factor(year))) %>%
    mutate(young = ifelse(age < 26, "Yes", "No")) %>%
    mutate(fefam_d = fct_recode(fefam,
                                Agree = "Strongly Agree",
                                Disagree = "Strongly Disagree"))
```

```
## # A tibble: 14,610 x 23
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <fct>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 12 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d <fct>
```

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_agegrp)) %>%
    mutate(year_f = droplevels(factor(year))) %>%
    mutate(young = ifelse(age < 26, "Yes", "No")) %>%
    mutate(fefam_d = fct_recode(fefam,
                                Agree = "Strongly Agree",
                                Disagree = "Strongly Disagree"))
    mutate(degree = factor(degree,
                           levels = levels(gss_sub$degree),  #<<
                           ordered = TRUE))  #<<
```

```
## # A tibble: 14,610 x 23
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <ord>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 12 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d <fct>
```

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
```

```
## # A tibble: 14,610 x 23
##     year    id ballot   age tvhours race  sex    degree  relig income  polviews
##    <int> <int>  <int> <int>   <int> <fct> <fct>  <ord>   <fct> <chr>   <fct>
##  1  2006     9      3    23      NA Black Female Bachel… None  $25000… Conserva…
##  2  2008  3001      3    25      NA Other Female Bachel… None  $25000… Extremel…
##  3  2010  6001      3    27      NA Black Female Bachel… None  $25000… Extremel…
##  4  2010  6002      1    36       3 White Female Gradua… None  $25000… Liberal
##  5  2006    10      1    32       3 Other Female Gradua… None  <NA>    Slightly…
##  6  2008  3002      1    34       3 Other Female Gradua… None  $25000… Moderate
##  7  2008  3003      3    83      NA Black Female Lt Hig… Prot… $20000… Liberal
##  8  2010  6003      3    85      NA Black Female Lt Hig… Prot… <NA>    Moderate
##  9  2006    11      3    81      NA Black Female Lt Hig… Prot… <NA>    Moderate
## 10  2010  6004      1    51      10 Other Male   High S… Cath… Lt $10… Liberal
## # … with 14,600 more rows, and 12 more variables: fefam <fct>, vpsu <dbl>,
## #   vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## #   sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d <fct>
```

GSS Panel

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

```
## # A tibble: 6 x 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 x 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 x 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 x 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"
```

```
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
```

More on factors

Relevel manually

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

gss_sub %>%
  count(degree_by_race)
```

```
## # A tibble: 16 x 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 x 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 x 2
##   degree_o           n
##   <ord>          <int>
## 1 Lt High School  1850
## 2 High School     7274
## 3 Other           5484
## 4 <NA>               2
```