# Intro to R

## Manipulating Data in R

# Recap of Subsetting

- `pull()` to get values out of a data frame
- `select()` creates a smaller data frame with only certain columns
- you can `select()` based on patterns in the column names using tidyselect functions
- you can combine multiple tidyselect functions together like `select(starts_with("C"), ends_with("state"))`
- `filter()` can be used to filter out rows based on logical conditions
- avoid using quotes when referring to column names with `filter()`

# Recap Subsetting Continued

- `==` is the same as equivalent to
- `&` means both conditions must be met to remain after `filter()`
- `|` means either conditions needs to be met to remain after `filter()`

# Recap of Data Cleaning

- `count()` can help determine if we have `NA` values
- `filter()` automatically removes `NA` values - can't confirm or deny if condition is met (need `| is.na()` to keep them)
- `drop_na()` can help you remove `NA` values from a variable or an entire data frame
- `NA` values can change your calculation results
- think about what `NA` values represent

# Recap of Data Cleaning

- `recode()` can help with simple recoding values of a variable (needs to be inside the `mutate` function)

Cheatsheet

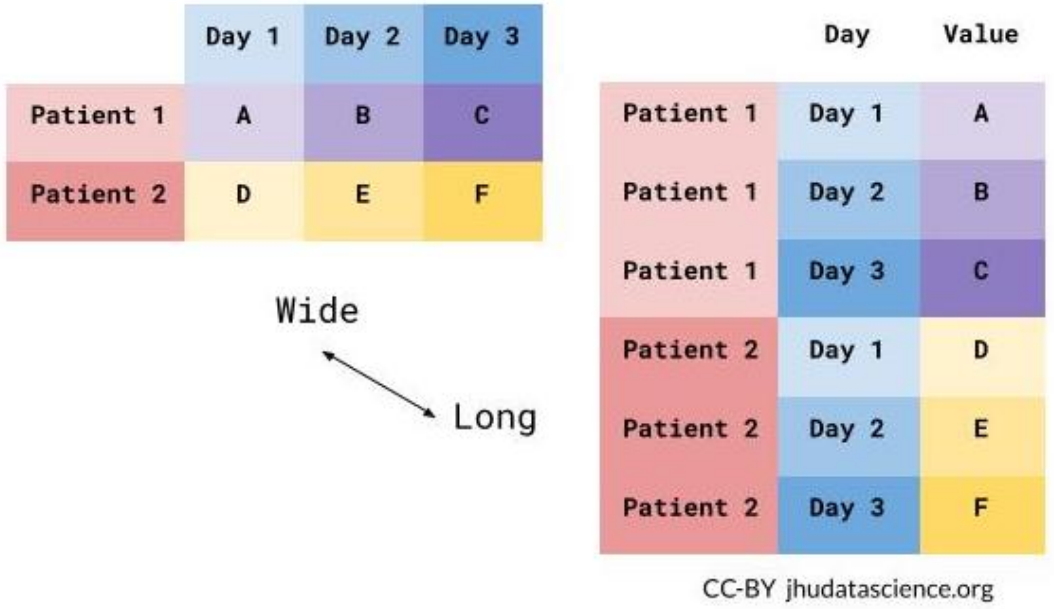
# Manipulating Data

In this module, we will show you how to:

1. The two major forms of data (long and wide)
2. Reshape data from wide to long for data analysis and visualization

## What is wide/long data?

# Data is wide or long **with respect** to certain variables.



# What is wide/long data?

Data is stored *differently* in the tibble.

Wide: has many columns

```
# A tibble: 1 × 4
  State   June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>            <dbl>         <dbl>           <dbl>
1 Alabama          0.516         0.514           0.511
```

Long: column names become data

```
# A tibble: 3 × 3
  State   name            value
  <chr>   <chr>           <dbl>
1 Alabama June_vacc_rate  0.516
2 Alabama May_vacc_rate   0.514
3 Alabama April_vacc_rate 0.511
```

# What is wide/long data?

Wide: multiple columns per individual, values spread across multiple columns

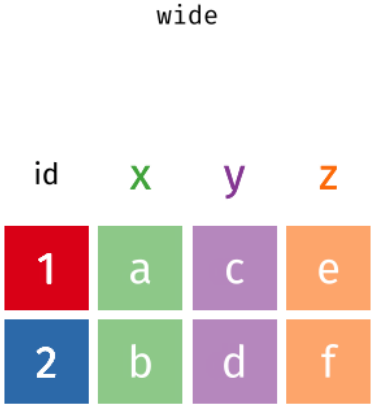
```
# A tibble: 2 × 4
  State   June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>            <dbl>         <dbl>           <dbl>
1 Alabama          0.516         0.514           0.511
2 Alaska           0.627         0.626           0.623
```

Long: multiple rows per observation, a single column contains the values

```
# A tibble: 6 × 3
  State   name            value
  <chr>   <chr>           <dbl>
1 Alabama June_vacc_rate  0.516
2 Alabama May_vacc_rate   0.514
3 Alabama April_vacc_rate 0.511
4 Alaska  June_vacc_rate  0.627
5 Alaska  May_vacc_rate   0.626
6 Alaska  April_vacc_rate 0.623
```

# What is wide/long data?

https://github.com/gadenbuie/tidyexplain/blob/main/images/tidyr-pivoting.gif



# Why do we need to switch between wide/long data?

Wide: **Easier for humans to read**

```
# A tibble: 2 × 4
  State   June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>            <dbl>         <dbl>           <dbl>
1 Alabama          0.516         0.514           0.511
2 Alaska           0.627         0.626           0.623
```

Long: **Easier for R to make plots & do analysis**

```
# A tibble: 6 × 3
  State   name            value
  <chr>   <chr>           <dbl>
1 Alabama June_vacc_rate  0.516
2 Alabama May_vacc_rate   0.514
3 Alabama April_vacc_rate 0.511
4 Alaska  June_vacc_rate  0.627
5 Alaska  May_vacc_rate   0.626
6 Alaska  April_vacc_rate 0.623
```

## Pivoting using `tidyr` package

`tidyr` allows you to "tidy" your data. We will be talking about:

- `pivot_longer` - make multiple columns into variables, (wide to long)

# pivot_longer...

# Reshaping data from **wide to long**

`pivot_longer()` - puts column data into rows (`tidyr` package)

- First describe which columns we want to “pivot_longer”

```
{long_data} <- {wide_data} %>% pivot_longer(cols = {columns to pivot})
```

# Reshaping data from **wide to long**

```
wide_data
```

```
# A tibble: 1 × 3
  June_vacc_rate May_vacc_rate April_vacc_rate
           <dbl>          <dbl>           <dbl>
1          0.516          0.514           0.511
```

```
long_data
```

```
# A tibble: 3 × 2
  name            value
  <chr>           <dbl>
1 June_vacc_rate  0.516
2 May_vacc_rate   0.514
3 April_vacc_rate 0.511
```

# Reshaping data from **wide to long**

`pivot_longer()` - puts column data into rows (`tidyr` package)

- First describe which columns we want to “pivot_longer”
- `names_to =` gives a new name to the pivoted columns
- `values_to =` gives a new name to the values that used to be in those columns

```
{long_data} <- {wide_data} %>% pivot_longer(cols = {columns to pivot},
                                            names_to = {New column name: contains old column names},
                                            values_to = {New column name: contains cell values})
```

# Reshaping data from **wide to long**

```
wide_data
```

```
# A tibble: 1 × 3
  June_vacc_rate May_vacc_rate April_vacc_rate
           <dbl>         <dbl>            <dbl>
1          0.516         0.514            0.511
```

```
long_data <- wide_data %>% pivot_longer(cols = everything(),
                                        names_to = "Month",
                                        values_to = "Rate")
long_data
```

```
# A tibble: 3 × 2
  Month            Rate
  <chr>           <dbl>
1 June_vacc_rate  0.516
2 May_vacc_rate   0.514
3 April_vacc_rate 0.511
```

Newly created column names are enclosed in quotation marks.

# Data used: Charm City Circulator

https://hutchdatascience.org/SeattleStatSummer_R/data/Charm_City_Circulator_Rider

```
circ <- read_csv("https://hutchdatascience.org/SeattleStatSummer_R/data/Charm_
head(circ, 5)
```

```
# A tibble: 5 × 15
  day       date  orangeBoardings orangeAlightings orangeAverage purpleBoardin
  <chr>     <chr>           <dbl>            <dbl>         <dbl>           <db
1 Monday    01/1…             877             1027           952
2 Tuesday   01/1…             777              815           796
3 Wednesday 01/1…            1203             1220          1212.
4 Thursday  01/1…            1194             1233          1214.
5 Friday    01/1…            1645             1643          1644
# … with 9 more variables: purpleAlightings <dbl>, purpleAverage <dbl>,
#   greenBoardings <dbl>, greenAlightings <dbl>, greenAverage <dbl>,
#   bannerBoardings <dbl>, bannerAlightings <dbl>, bannerAverage <dbl>,
#   daily <dbl>
```

# Mission: Taking the averages by line

Let's imagine we want to create a table of average ridership by route/line. Results should look something like:

```
example <- tibble(line = c("orange","purple","green","banner"),
                  avg = c("600(?)", "700(?)", "500(?)", "400(?)")
)
example
```

```
# A tibble: 4 × 2
  line   avg
  <chr>  <chr>
1 orange 600(?)
2 purple 700(?)
3 green  500(?)
4 banner 400(?)
```

# Reshaping data from **wide to long**

```
long <- circ %>%
  pivot_longer(
            cols = starts_with(c("orange","purple","green","banner")),
         names_to = "bus_type",
         values_to = "number_of_individuals")
long
```

```
# A tibble: 13,752 × 5
   day    date       daily bus_type          number_of_individuals
   <chr>  <chr>      <dbl> <chr>                             <dbl>
 1 Monday 01/11/2010   952 orangeBoardings                     877
 2 Monday 01/11/2010   952 orangeAlightings                   1027
 3 Monday 01/11/2010   952 orangeAverage                       952
 4 Monday 01/11/2010   952 purpleBoardings                      NA
 5 Monday 01/11/2010   952 purpleAlightings                     NA
 6 Monday 01/11/2010   952 purpleAverage                        NA
 7 Monday 01/11/2010   952 greenBoardings                       NA
 8 Monday 01/11/2010   952 greenAlightings                      NA
 9 Monday 01/11/2010   952 greenAverage                         NA
10 Monday 01/11/2010   952 bannerBoardings                      NA
# … with 13,742 more rows
```

# `pivot_wider()`...

# Reshaping data from **long to wide**

`pivot_wider()` - spreads row data into columns (`tidyr` package)

- `names_from =` the old column whose contents will be spread into multiple new column names.
- `values_from =` the old column whose contents will fill in the values of those new columns.

```
{wide_data} <- {long_data} %>%
  pivot_wider(names_from = {Old column name: contains new column names},
              values_from = {Old column name: contains new cell values})
```

# Reshaping data from long to wide

```
long_data
```

```
# A tibble: 3 × 2
  Month            Rate
  <chr>           <dbl>
1 June_vacc_rate  0.516
2 May_vacc_rate   0.514
3 April_vacc_rate 0.511
```

```
wide_data <- long_data %>% pivot_wider(names_from = "Month",
                                       values_from = "Rate")
wide_data
```

```
# A tibble: 1 × 3
  June_vacc_rate May_vacc_rate April_vacc_rate
           <dbl>         <dbl>           <dbl>
1          0.516         0.514           0.511
```

# Reshaping Charm City Circulator

long

```
# A tibble: 13,752 × 5
   day    date       daily bus_type         number_of_individuals
   <chr>  <chr>      <dbl> <chr>                            <dbl>
 1 Monday 01/11/2010   952 orangeBoardings                    877
 2 Monday 01/11/2010   952 orangeAlightings                  1027
 3 Monday 01/11/2010   952 orangeAverage                      952
 4 Monday 01/11/2010   952 purpleBoardings                    NA
 5 Monday 01/11/2010   952 purpleAlightings                   NA
 6 Monday 01/11/2010   952 purpleAverage                      NA
 7 Monday 01/11/2010   952 greenBoardings                     NA
 8 Monday 01/11/2010   952 greenAlightings                    NA
 9 Monday 01/11/2010   952 greenAverage                       NA
10 Monday 01/11/2010   952 bannerBoardings                    NA
# … with 13,742 more rows
```

# Reshaping Charm City Circulator

```
wide <- long %>% pivot_wider(names_from = "bus_type",
                             values_from = "number_of_individuals")
wide
```

```
# A tibble: 1,146 × 15
   day       date       daily orangeBoardings orangeAlightings orangeAverage
   <chr>     <chr>      <dbl>            <dbl>             <dbl>         <dbl>
 1 Monday    01/11/2010  952              877              1027          952 
 2 Tuesday   01/12/2010  796              777               815          796 
 3 Wednesday 01/13/2010 1212.            1203              1220         1212.
 4 Thursday  01/14/2010 1214.            1194              1233         1214.
 5 Friday    01/15/2010 1644             1645              1643         1644 
 6 Saturday  01/16/2010 1490.            1457              1524         1490.
 7 Sunday    01/17/2010  888.             839               938          888.
 8 Monday    01/18/2010 1000.             999              1000         1000.
 9 Tuesday   01/19/2010 1035             1023              1047         1035 
10 Wednesday 01/20/2010 1396.            1375              1416         1396.
# … with 1,136 more rows, and 9 more variables: purpleBoardings <dbl>,
#   purpleAlightings <dbl>, purpleAverage <dbl>, greenBoardings <dbl>,
#   greenAlightings <dbl>, greenAverage <dbl>, bannerBoardings <dbl>,
#   bannerAlightings <dbl>, bannerAverage <dbl>
```

## Summary

- `pivot_longer()` goes from wide -> long
  - Specify columns you want to pivot
  - Specify `names_to =` and `values_to =` for custom naming
- `pivot_wider()` goes from long -> wide
  - Specify `names_from =` and `values_from =`

Workshop Website