

Subsetting Data in R

Reminder

Refresh the website and get the latest version of the labs and slides! We are constantly making improvements.

Recap

- Use `<-` to save (assign) values to objects
- Use `c()` to **combine** vectors
- `length()`, `class()`, and `str()` tell you information about an object
- The sequence `seq()` function helps you create numeric vectors (`from`, `to`, `by`, and `length.out` arguments)
- The repeat `rep()` function helps you create vectors with the `each` and `times` arguments
- Reproducible science makes everyone's life easier!
- `readr` has helpful functions like `read_csv()` that can help you import data into R

□ [Cheatsheet](#)

Overview

In this module, we will show you how to:

1. Look at your data in different ways
2. Create a data frame and a tibble
3. Create new variables/make rownames a column
4. Rename columns of a data frame
5. Subset rows of a data frame
6. Subset columns of a data frame
7. Add/remove new columns to a data frame
8. Order the columns of a data frame
9. Order the rows of a data frame

Setup

We will largely focus on the `dplyr` package which is part of the `tidyverse`.



Some resources on how to use `dplyr`:

- <https://dplyr.tidyverse.org/>
- <https://cran.r-project.org/web/packages/dplyr/vignettes/dplyr.html>
- <https://www.opencasestudies.org/>

Why dplyr?



hadley commented on May 26, 2016

Member

...

The d is for dataframes, the plyr is to evoke pliers. Pronounce however you like.



The `dplyr` package is one of the most helpful packages for altering your data to get it into a form that is useful for creating visualizations, summarizing, or more deeply analyzing.

So you can imagine using pliers on your data.



Loading in dplyr and tidyverse

See this website for a list of the packages included in the `tidyverse`:

<https://www.tidyverse.org/packages/>

```
library(tidyverse) # loads dplyr and other packages!
```

Getting data to work with

We will use a dataset from a project we worked on called Open Case Studies.

See <https://www.opencasestudies.org/>.

We have added the specific data to our website.

Getting data to work with

We will load data from one of the case studies about opioid shipments.

See <https://www.opencasestudies.org/ocs-bp-opioid-rural-urban/> about this data.

Import the data

We will work with data called `annualDosage` (number of shipments (count) of either oxycodone or hydrocodone pills (`DOSAGE_UNIT`)).

```
annualDosage <-  
  read_csv("https://jhubdatascience.org/intro_to_r/data/annualDosage.csv")
```

Rows: 27758 Columns: 6

— Column specification —————

Delimiter: ","

chr (3): BUYER_COUNTY, BUYER_STATE, countyfips

dbl (3): year, count, DOSAGE_UNIT

- Use `spec()` to retrieve the full column specification for this data.
- Specify the column types or set `show_col_types = FALSE` to quiet this message

Checking the data `dim()`

The `dim()`, `nrow()`, and `ncol()` functions are good options to check the dimensions of your data before moving forward.

```
dim(annualDosage) # rows, columns
```

```
[1] 27758      6
```

```
nrow(annualDosage) # number of rows
```

```
[1] 27758
```

```
ncol(annualDosage) # number of columns
```

```
[1] 6
```

Checking the data: `glimpse()`

In addition to `head()` and `tail()`, the `glimpse()` function of the `dplyr` package is another great function to look at your data.

```
glimpse(annualDosage)
```

Rows: 27,758

Columns: 6

```
$ BUYER_COUNTY <chr> "ABBEVILLE", "ABBEVILLE", "ABBEVILLE", "ABBEVILLE", "ABBE...  
$ BUYER_STATE  <chr> "SC", "SC", "SC", "SC", "SC", "SC", "SC", "SC", "SC", "LA...  
$ year         <dbl> 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 200...  
$ count        <dbl> 877, 908, 871, 930, 1197, 1327, 1509, 1572, 1558, 5802, 5...  
$ DOSAGE_UNIT  <dbl> 363620, 402940, 424590, 467230, 539280, 566560, 589010, 5...  
$ countyfips   <chr> "45001", "45001", "45001", "45001", "45001", "45001", "45...
```

Checking your data: `slice_sample()`

What if you want to see the middle of your data? You can use the `slice_sample()` function of the `dplyr` package to see a **random** set of rows. You can specify the number of rows with the `n` argument.

```
slice_sample(annualDosage, n = 2)
```

```
# A tibble: 2 × 6
  BUYER_COUNTY BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>        <chr>       <dbl> <dbl>    <dbl> <chr>
1 JESSAMINE     KY          2008  5632    2267280 21113
2 GREELEY       NE          2006   67      13000  31077
```

```
slice_sample(annualDosage, n = 2)
```

```
# A tibble: 2 × 6
  BUYER_COUNTY BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>        <chr>       <dbl> <dbl>    <dbl> <chr>
1 PULASKI      MO          2014  3665    2026020 29169
2 FULTON       OH          2010  3451    1270670 39051
```

Data frames and tibbles

Data frames

An older version of data in tables is called a data frame. The mtcars dataset is an example of this.

```
class(mtcars)
```

```
[1] "data.frame"
```

```
head(mtcars)
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

tibble

Tibbles are a **fancier** version of data frames:

- We don't have to use head to see a preview of it
- We see the dimensions
- We see the data types for each column

annualDosage

```
# A tibble: 27,758 × 6
  BUYER_COUNTY BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>        <chr>      <dbl> <dbl>    <dbl> <chr>
1 ABBEVILLE     SC          2006   877     363620 45001
2 ABBEVILLE     SC          2007   908     402940 45001
3 ABBEVILLE     SC          2008   871     424590 45001
4 ABBEVILLE     SC          2009   930     467230 45001
5 ABBEVILLE     SC          2010  1197     539280 45001
6 ABBEVILLE     SC          2011  1327     566560 45001
7 ABBEVILLE     SC          2012  1509     589010 45001
8 ABBEVILLE     SC          2013  1572     596420 45001
9 ABBEVILLE     SC          2014  1558     641350 45001
10 ACADIA        LA          2006  5802    1969720 22001
# ℹ 27,748 more rows
```

Creating a **tibble**

If we wanted to create a **tibble** ("fancy" data frame), we can use the **tibble()** function on a data frame.

```
tbl_mtcars <- tibble(mtcars)
```

```
tbl_mtcars
```

```
# A tibble: 32 × 11
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
	<dbl>										
1	21	6	160	110	3.9	2.62	16.5	0	1	4	4
2	21	6	160	110	3.9	2.88	17.0	0	1	4	4
3	22.8	4	108	93	3.85	2.32	18.6	1	1	4	1
4	21.4	6	258	110	3.08	3.22	19.4	1	0	3	1
5	18.7	8	360	175	3.15	3.44	17.0	0	0	3	2
6	18.1	6	225	105	2.76	3.46	20.2	1	0	3	1
7	14.3	8	360	245	3.21	3.57	15.8	0	0	3	4
8	24.4	4	147.	62	3.69	3.19	20	1	0	4	2
9	22.8	4	141.	95	3.92	3.15	22.9	1	0	4	2
10	19.2	6	168.	123	3.92	3.44	18.3	1	0	4	4
# 22 more rows											

Note don't necessarily need to use **head()** with tibbles, as they conveniently print a portion of the data.

Summary of tibbles and data frames

We generally recommend using tibbles, but you are likely to run into lots of data frames with your work.

Most functions work for both so you don't need to worry about it much!

It can be helpful to convert data frames to tibbles though just to see more about the data more easily. The `tibble()` function helps us do that.

Data frames vs tibbles - watch out for rownames

Note that this conversion can remove row names - which some data frames have. For example, `mtcars` (part of R) has row names. In this case we would want to make the rownames a new column first before making into a tibble.

```
head(mtcars, n = 2)
```

		mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda	RX4	21	6	160	110	3.9	2.620	16.46	0	1	4	4
Mazda	RX4 Wag	21	6	160	110	3.9	2.875	17.02	0	1	4	4

```
head(tibble(mtcars), n = 2)
```

```
# A tibble: 2 × 11
  mpg   cyl  disp    hp  drat    wt  qsec    vs    am  gear  carb
  <dbl> <dbl>
1   21     6   160   110    3.9   2.62   16.5     0     1     4     4
2   21     6   160   110    3.9   2.88   17.0     0     1     4     4
```

rownames_to_column function

There is a function that specifically helps you do that.

```
head(rownames_to_column(mtcars), n = 2)
```

	rowname	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
1	Mazda RX4	21	6	160	110	3.9	2.620	16.46	0	1	4	4
2	Mazda RX4 Wag	21	6	160	110	3.9	2.875	17.02	0	1	4	4

```
head(tibble(rownames_to_column(mtcars)), n = 2)
```

```
# A tibble: 2 × 12
  rowname      mpg   cyl   disp     hp   drat     wt   qsec     vs     am   gear   carb
  <chr>     <dbl> <dbl>
1 Mazda RX4     21     6    160    110    3.9    2.62    16.5     0     1     4     4
2 Mazda RX4 Wag 21     6    160    110    3.9    2.88    17.0     0     1     4     4
```

Data for now

Let's stick with the tibble annualDosage data for our next lesson

```
head(annualDosage)
```

```
# A tibble: 6 × 6
  BUYER_COUNTY BUYER_STATE year count DOSAGE_UNIT countyfips
  <chr>        <chr>      <dbl> <dbl>    <dbl> <chr>
1 ABBEVILLE    SC          2006   877     363620 45001
2 ABBEVILLE    SC          2007   908     402940 45001
3 ABBEVILLE    SC          2008   871     424590 45001
4 ABBEVILLE    SC          2009   930     467230 45001
5 ABBEVILLE    SC          2010   1197    539280 45001
6 ABBEVILLE    SC          2011   1327    566560 45001
```

Renaming Columns

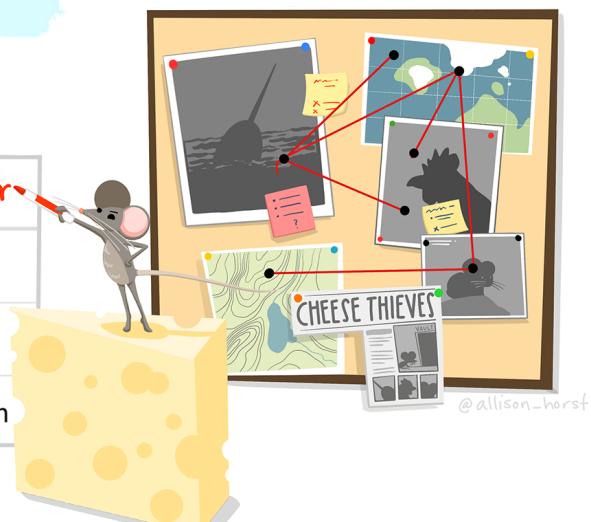
rename function

dplyr::rename()
RENAME COLUMNS*

df %>% rename(lair=site)

species nemesis	status	site lair
narwhal	unknown	ocean
chicken	active	coop
pika	active	mountain

*See `rename_with()` to rename using a function.



"Artwork by @allison_horst". <https://allisonhorst.com/>

Renaming Columns of a data frame or tibble

To rename columns in `dplyr`, you can use the `rename` function.

For example, let's rename `BUYER_COUNTY` to `County`. Notice the new name is listed **first**, similar to how a new object is assigned on the left!

```
# general format! not code!
{data you are creating or changing} <- rename({data you are using},
                                         {New Name} = {Old name})
```

```
renamed_annualDosage<- rename(annualDosage, County = BUYER_COUNTY)
head(renamed_annualDosage)
```

```
# A tibble: 6 × 6
  County    BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>      <chr>     <dbl> <dbl>      <dbl> <chr>
1 ABBEVILLE SC        2006    877      363620 45001
2 ABBEVILLE SC        2007    908      402940 45001
3 ABBEVILLE SC        2008    871      424590 45001
4 ABBEVILLE SC        2009    930      467230 45001
5 ABBEVILLE SC        2010   1197      539280 45001
6 ABBEVILLE SC        2011   1327      566560 45001
```

Take Care with Column Names

When you can, avoid spaces, special punctuation, or numbers in column names, as these require special treatment to refer to them.

See https://jhubdatascience.org/intro_to_r/resources/quotes_vs_backticks.html for more guidance.

```
# this will cause an error
renamed_annualDosage <- rename(annualDosage, County! = BUYER_COUNTY)

# this will work
renamed_annualDosage <- rename(annualDosage, `County!` = BUYER_COUNTY)
head(renamed_annualDosage, 2)

# A tibble: 2 × 6
`County!` BUYER_STATE year count DOSAGE_UNIT countyfips
<chr>      <chr>     <dbl> <dbl>      <dbl> <chr>
1 ABBEVILLE SC        2006    877      363620 45001
2 ABBEVILLE SC        2007    908      402940 45001
```

Unusual Column Names

It's best to avoid unusual column names where possible, as things get tricky later.

We just showed the use of ` backticks `. You may see people use quotes as well.



Other atypical column names are those with:

- spaces
- number without characters
- number starting the name
- other punctuation marks (besides “_” or “.” and not at the beginning)

A solution!

Rename tricky column names so that you don't have to deal with them later!



Be careful about copy pasting code!

Curly quotes will not work!

this will cause an error!

```
renamed_annualDosage <- rename(annualDosage, 'County!' = BUYER_COUNTY)
```

this will work!

```
renamed_annualDosage <- rename(annualDosage, 'County!' = BUYER_COUNTY)
```

Also true for double quotes

this will cause an error!

```
renamed_annualDosage <- rename(annualDosage, "County!" = BUYER_COUNTY)
```

this will work!

```
renamed_annualDosage <- rename(annualDosage, "County!" = BUYER_COUNTY)
```

Rename multiple columns

A comma can separate different column names to change.

```
renamed_annualDosage <- rename(annualDosage,  
                                County = BUYER_COUNTY,  
                                State = BUYER_STATE)  
head(renamed_annualDosage, 3)
```

```
# A tibble: 3 × 6  
  County    State   year count DOSAGE_UNIT countyfips  
  <chr>     <chr> <dbl> <dbl>      <dbl> <chr>  
1 ABBEVILLE SC     2006    877      363620 45001  
2 ABBEVILLE SC     2007    908      402940 45001  
3 ABBEVILLE SC     2008    871      424590 45001
```

Renaming all columns of a data frame: dplyr

To rename all columns you use the `rename_with()`. In this case we will use `toupper()` to make all letters upper case. Could also use `tolower()` function.

```
annualDosage_upper <- rename_with(annualDosage, toupper)
```

```
head(annualDosage_upper, 3)
```

```
# A tibble: 3 × 6
```

	BUYER_COUNTY	BUYER_STATE	YEAR	COUNT	DOSAGE_UNIT	COUNTYFIPS
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>
1	ABBEVILLE	SC	2006	877	363620	45001
2	ABBEVILLE	SC	2007	908	402940	45001
3	ABBEVILLE	SC	2008	871	424590	45001

```
annualDosage_lower<- rename_with(annualDosage, tolower)
```

```
head(annualDosage_lower, 3)
```

```
# A tibble: 3 × 6
```

	buyer_county	buyer_state	year	count	dosage_unit	countyfips
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>
1	ABBEVILLE	SC	2006	877	363620	45001
2	ABBEVILLE	SC	2007	908	402940	45001
3	ABBEVILLE	SC	2008	871	424590	45001

janitor package

If you need to do lots of naming fixes - look into the janitor package!

```
#install.packages("janitor")
library(janitor)
```

janitor `clean_names`

The `clean_names` function can intuit what fixes you might need. Here it makes everything consistent.

```
head(annualDosage, 2)
```

```
# A tibble: 2 × 6
  BUYER_COUNTY BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>        <chr>       <dbl> <dbl>      <dbl> <chr>
1 ABBEVILLE    SC          2006   877      363620 45001
2 ABBEVILLE    SC          2007   908      402940 45001
```

```
clean_AD <- clean_names(annualDosage)
head(clean_AD, 2)
```

```
# A tibble: 2 × 6
  buyer_county buyer_state   year count dosage_unit countyfips
  <chr>        <chr>       <dbl> <dbl>      <dbl> <chr>
1 ABBEVILLE    SC          2006   877      363620 45001
2 ABBEVILLE    SC          2007   908      402940 45001
```

more of clean_names

clean_names can also get rid of spaces and replace them with _.

```
test <- tibble(`col 1` = c(1,2,3), `col 2` = c(2,3,4))  
test
```

```
# A tibble: 3 × 2  
  `col 1` `col 2`  
  <dbl>   <dbl>  
1      1      2  
2      2      3  
3      3      4
```

```
clean_names(test)
```

```
# A tibble: 3 × 2  
  col_1 col_2  
  <dbl> <dbl>  
1      1      2  
2      2      3  
3      3      4
```

GUT CHECK: Which of the following would work well with a column called **counties_of_US_with_population_over_10,000**?

- A. Renaming it using `rename` function to something simpler like `counties_over_10thous`.
- B. Keeping it as is and use backticks around the column name when you use it.
- C. Keeping it as is and use quotes around the column name when you use it.

Summary

- data frames are simpler version of a data table
- tibbles are fancier `tidyverse` version
- tibbles are made with `tibble()`
- if your original data has rownames, you need to use `rownames_to_column` before converting to tibble
- the `rename()` function of `dplyr` can help you rename columns
- avoid using punctuation (except underscores), spaces, and numbers (to start or alone) in column names
- if you must do a nonstandard column name - typically use backticks around it. See https://jhubdatascience.org/intro_to_r/resources/quotes_vs_backticks.html.
- avoid copy and pasting code from other sources - quotation marks will change!
- check out `janitor` if you need to make lots of column name changes

Lab Part 1

- [Class Website](#)
- [Lab](#)
- [Day 3 Cheatsheet](#)
- [Posit's dplyr Cheatsheet # Subsetting Columns](#)

Let's get our data again

This time lets also make it a smaller subset so it is easier for us to see the full dataset as we work through examples.

```
#read_csv("https://jhubdatascience.org/intro_to_r/data/annualDosage.csv")
set.seed(1234)
AD <- slice_sample(annualDosage, n = 30)
```

Subset columns of a data frame - **tidyverse** way:

To grab a vector version (or “pull” out) the year column the **tidyverse** way we can use the `pull` function:

```
pull(AD, year)
```

```
[1] 2006 2014 2013 2012 2009 2010 2010 2010 2009 2012 2010 2006 2007 2010 2011  
[16] 2008 2009 2010 2007 2008 2006 2007 2013 2012 2011 2006 2013 2008 2013 2010
```

Subset columns of a data frame: dplyr

The `select` command from `dplyr` allows you to subset (still a `tibble`!)

```
select(AD, year)
```

```
# A tibble: 30 × 1
```

```
  year
  <dbl>
1 2006
2 2014
3 2013
4 2012
5 2009
6 2010
7 2010
8 2010
9 2009
10 2012
# ... 20 more rows
```

GUT CHECK: What function would be useful for getting a vector version of a column?

- A. `pull()`
- B. `select()`

Select multiple columns

We can use `select` to select for multiple columns.

```
select(AD, year, BUYER_COUNTY)
```

```
# A tibble: 30 × 2
  year BUYER_COUNTY
  <dbl> <chr>
1 2006 EASTLAND
2 2014 FALLS CHURCH CITY
3 2013 DOUGLAS
4 2012 FAYETTE
5 2009 STAFFORD
6 2010 GILES
7 2010 ANDREW
8 2010 LUNENBURG
9 2009 HAWKINS
10 2012 ATCHISON
# ... with 20 more rows
```

Subset columns of a data frame: dplyr

Note that if you want the values (not a `tibble`), use `pull` - as it pulls out the data:

```
pull(AD, year)
```

```
[1] 2006 2014 2013 2012 2009 2010 2010 2010 2009 2012 2010 2006 2007 2010 2011  
[16] 2008 2009 2010 2007 2008 2006 2007 2013 2012 2011 2006 2013 2008 2013 2010
```

pull with select works too!

```
pull(select(AD, year))
```

```
[1] 2006 2014 2013 2012 2009 2010 2010 2010 2009 2012 2010 2006 2007 2010 2011  
[16] 2008 2009 2010 2007 2008 2006 2007 2013 2012 2011 2006 2013 2008 2013 2010
```

Select columns of a data frame: dplyr

The `select` command from `dplyr` allows you to subset columns matching patterns:

```
head(AD, 2)
```

```
# A tibble: 2 × 6
  BUYER_COUNTY     BUYER_STATE   year  count DOSAGE_UNIT countyfips
  <chr>           <chr>        <dbl> <dbl>    <dbl> <chr>
1 EASTLAND         TX            2006  1980    723690 48133
2 FALLS CHURCH CITY VA            2014  1340    531270 51610
```

```
select(AD, starts_with("B"))
```

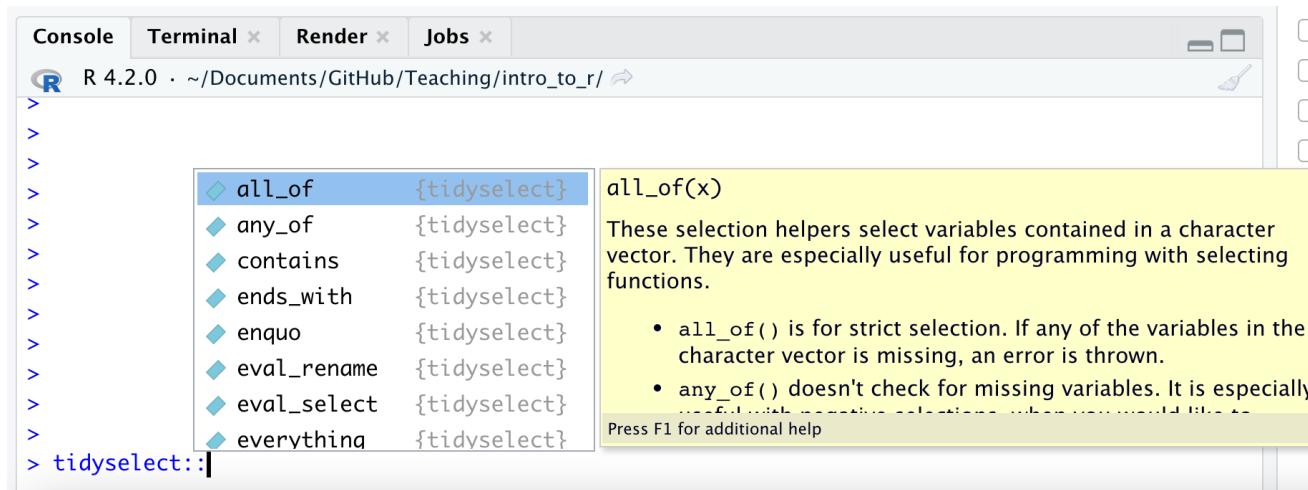
```
# A tibble: 30 × 2
  BUYER_COUNTY     BUYER_STATE
  <chr>           <chr>
1 EASTLAND         TX
2 FALLS CHURCH CITY VA
3 DOUGLAS          CO
4 FAYETTE          GA
5 STAFFORD         VA
6 GILES             TN
7 ANDREW            MO
8 LUNENBURG        VA
9 HAWKINS           TN
10 ATCHISON         MO
# ... 20 more rows
```

See the Select “helpers”

Here are a few:

```
last_col()  
starts_with()  
ends_with()  
contains() # like searching
```

Type `tidyselect::` in the **console** and see what RStudio suggests:



Combining tidyselect helpers with regular selection

```
head(AD, 2)
```

```
# A tibble: 2 × 6
  BUYER_COUNTY     BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>           <chr>        <dbl> <dbl>    <dbl> <chr>
1 EASTLAND         TX            2006  1980    723690 48133
2 FALLS CHURCH CITY VA            2014  1340    531270 51610
```

```
select(AD, starts_with("B"), year)
```

```
# A tibble: 30 × 3
  BUYER_COUNTY     BUYER_STATE   year
  <chr>           <chr>        <dbl>
1 EASTLAND         TX            2006
2 FALLS CHURCH CITY VA            2014
3 DOUGLAS          CO            2013
4 FAYETTE          GA            2012
5 STAFFORD         VA            2009
6 GILES             TN            2010
7 ANDREW            MO            2010
8 LUNENBURG        VA            2010
9 HAWKINS           TN            2009
10 ATCHISON         MO            2012
# ... 20 more rows
```

Multiple tidyselect functions

Follows OR logic.

```
select(AD, starts_with("B"), ends_with("r"))
```

```
# A tibble: 30 × 3
```

```
  BUYER_COUNTY    BUYER_STATE   year
  <chr>          <chr>        <dbl>
1 EASTLAND        TX            2006
2 FALLS CHURCH CITY VA            2014
3 DOUGLAS         CO            2013
4 FAYETTE         GA            2012
5 STAFFORD        VA            2009
6 GILES           TN            2010
7 ANDREW          MO            2010
8 LUNENBURG      VA            2010
9 HAWKINS         TN            2009
10 ATCHISON       MO            2012
# 20 more rows
```

The `where()` function can help select columns of a specific class

`is.character()` and `is.numeric()` are often the most helpful

```
head(AD, 2)
```

```
# A tibble: 2 × 6
  BUYER_COUNTY    BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>          <chr>        <dbl> <dbl>      <dbl> <chr>
1 EASTLAND        TX            2006  1980      723690 48133
2 FALLS CHURCH CITY VA        2014  1340      531270 51610
```

```
select(AD, where(is.numeric))
```

```
# A tibble: 30 × 3
  year count DOSAGE_UNIT
  <dbl> <dbl>      <dbl>
1 2006  1980      723690
2 2014  1340      531270
3 2013  20961     6277640
4 2012  12978     3701320
5 2009  7921      2904600
6 2010  4210      2074530
7 2010  1167      315180
8 2010  763       246130
9 2009  7148      3420480
10 2012  601       204700
# ... 20 more rows
```

Subsetting Rows

Subset rows of a data frame: dplyr

The command in `dplyr` for subsetting rows is `filter`.

```
filter(AD, count > 10000)
```

```
# A tibble: 6 × 6
  BUYER_COUNTY BUYER_STATE   year  count DOSAGE_UNIT countyfips
  <chr>        <chr>       <dbl> <dbl>    <dbl>    <chr>
1 DOUGLAS      CO          2013  20961    6277640  08035
2 FAYETTE     GA          2012  12978    3701320  13113
3 BUTTE        CA          2006  20443    13802710  06007
4 PUEBLO       CO          2008  23932    9386790  08101
5 ROGERS       OK          2008  11150    4499860  40131
6 CABELL       WV          2013  18481    7806600  54011
```

Subset rows of a data frame: dplyr

You can have multiple logical conditions using the following:

- `==` : equals to
- `!=`: not equal to (`!` : not/negation)
- `>` / `<`: greater than / less than
- `>=` or `<=`: greater than or equal to / less than or equal to
- `&` : AND
- `|` : OR

Common error for filter

If you try to filter for a column that does not exist it will not work:

- misspelled column name
- column that was already removed

Remember that filter works by keeping rows with values that match the conditions specified for particular columns.

filter function

dplyr:: filter()

KEEP ROWS THAT
s.a.t.i.s.f.y
your CONDITIONS

keep rows from... this data... ONLY IF... type is "otter" AND site is "bay"

```
filter(df, type == "otter" & site == "bay")
```

type	food	site
otter	urchin	bay
Shark	seal	channel
otter	abalone	bay
otter	crab	wharf

"Artwork by @allison_horst". <https://allisonhorst.com/>

Subset rows of a data frame: dplyr

You can filter by two conditions using & or commas (must meet both conditions):

```
filter(AD, count > 10000, year == 2012)
```

```
filter(AD, count > 10000 & year == 2012) # same result
```

```
# A tibble: 1 × 6
```

```
BUYER COUNTY BUYER STATE  year count DOSAGE UNIT countyfips  
<chr>      <chr>      <dbl> <dbl>      <dbl> <chr>  
1 FAYETTE    GA          2012 12978     3701320 13113
```

Subset rows of a data frame: dplyr

If you want OR statements (meaning the data can meet either condition does not need to meet both), you need to use | between conditions:

```
filter(AD, count > 10000 | year == 2012)
```

```
# A tibble: 8 × 6
  BUYER_COUNTY BUYER_STATE   year  count DOSAGE_UNIT countyfips
  <chr>        <chr>      <dbl> <dbl>    <dbl> <chr>
1 DOUGLAS       CO          2013  20961    6277640 08035
2 FAYETTE       GA          2012  12978    3701320 13113
3 ATCHISON      MO          2012   601     204700  29005
4 BUTTE         CA          2006  20443    13802710 06007
5 PUEBLO        CO          2008  23932    9386790 08101
6 LEE           KY          2012   1654    1196860 21129
7 ROGERS        OK          2008  11150    4499860 40131
8 CABELL        WV          2013  18481    7806600 54011
```

Subset rows of a data frame: dplyr

The `%in%` operator can be used find values from a pre-made list (using `c()`) for a **single column** at a time.

```
filter(AD, BUYER_STATE %in% c("CO", "NM", "GA"))
```

A tibble: 4 × 6

	BUYER COUNTY	BUYER STATE	year	count	DOSAGE UNIT	countyfips
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>
1	DOUGLAS	CO	2013	20961	6277640	08035
2	FAYETTE	GA	2012	12978	3701320	13113
3	LUMPKIN	GA	2007	2239	567260	13187
4	PUEBLO	CO	2008	23932	9386790	08101

```
filter(AD, BUYER_STATE == "CO" | BUYER_STATE == "NM" | BUYER_STATE == "GA") #equivalent
```

A tibble: 4 × 6

	BUYER COUNTY	BUYER STATE	year	count	DOSAGE UNIT	countyfips
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>
1	DOUGLAS	CO	2013	20961	6277640	08035
2	FAYETTE	GA	2012	12978	3701320	13113
3	LUMPKIN	GA	2007	2239	567260	13187
4	PUEBLO	CO	2008	23932	9386790	08101

Subset rows of a data frame: dplyr

The `%in%` operator can be used find values from a pre-made vector (using `c()`) for a **single column** at a time.

```
filter(AD, year %in% c(2012, 2014), BUYER_STATE %in% c("GA", "CO"))
```

```
# A tibble: 1 × 6
  BUYER_COUNTY BUYER_STATE  year count DOSAGE_UNIT countyfips
  <chr>        <chr>      <dbl> <dbl>    <dbl> <chr>
1 FAYETTE     GA          2012 12978    3701320 13113
```

Be careful with column names and **filter**

This will not work the way you might expect! Best to stick with nothing but the column name if it is a typical name.

```
filter(AD, "year" > 2014)
```

```
# A tibble: 30 × 6
  BUYER_COUNTY     BUYER_STATE   year  count DOSAGE_UNIT countyfips
  <chr>           <chr>        <dbl> <dbl>   <dbl>       <chr>
1 EASTLAND         TX            2006  1980    723690  48133
2 FALLS CHURCH CITY VA            2014  1340    531270  51610
3 DOUGLAS          CO            2013  20961   6277640  08035
4 FAYETTE          GA            2012  12978   3701320  13113
5 STAFFORD         VA            2009  7921    2904600  51179
6 GILES             TN            2010  4210    2074530  47055
7 ANDREW            MO            2010  1167    315180   29003
8 LUNENBURG        VA            2010  763     246130   51111
9 HAWKINS           TN            2009  7148    3420480  47073
10 ATCHISON          MO           2012  601     204700   29005
# ℹ 20 more rows
```

Don't use quotes for atypical names

Atypical names are those with punctuation, spaces, start with a number, or are just a number.

```
AD_rename <- rename(AD, `year!` = year)
```

```
filter(AD_rename, "year!" > 2013) # will not work correctly
```

```
# A tibble: 30 × 6
```

	BUYER_COUNTY	BUYER_STATE	`year!`	count	DOSAGE_UNIT	countyfips
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>
1	EASTLAND	TX	2006	1980	723690	48133
2	FALLS CHURCH CITY	VA	2014	1340	531270	51610
3	DOUGLAS	CO	2013	20961	6277640	08035
4	FAYETTE	GA	2012	12978	3701320	13113
5	STAFFORD	VA	2009	7921	2904600	51179
6	GILES	TN	2010	4210	2074530	47055
7	ANDREW	MO	2010	1167	315180	29003
8	LUNENBURG	VA	2010	763	246130	51111
9	HAWKINS	TN	2009	7148	3420480	47073
10	ATCHISON	MO	2012	601	204700	29005
# 20 more rows						

Be careful with column names and **filter**

Using backticks works!

```
filter(AD_rename, `year!` > 2013)
```

```
# A tibble: 1 × 6
  BUYER_COUNTY     BUYER_STATE `year!` count DOSAGE_UNIT countyfips
  <chr>           <chr>        <dbl> <dbl> <dbl> <chr>
1 FALLS CHURCH CITY VA          2014    1340  531270 51610
```

Be careful with column names and **filter**

```
filter(AD, "BUYER_STATE" == "CO") # this will not work  
  
# A tibble: 0 × 6  
#   6 variables: BUYER_COUNTY <chr>, BUYER_STATE <chr>, year <dbl>,  
#     count <dbl>, DOSAGE_UNIT <dbl>, countyfips <chr>
```

Be careful with column names and **filter**

```
filter(AD, BUYER_STATE == "CO")# this works!
```

```
# A tibble: 2 × 6
```

```
BUYER COUNTY BUYER STATE year count DOSAGE UNIT countyfips  
<chr> <chr> <dbl> <dbl> <dbl> <chr>  
1 DOUGLAS CO 2013 20961 6277640 08035  
2 PUEBLO CO 2008 23932 9386790 08101
```

filter() is tricky

Try not use anything special for the column names in `filter()`. This is why it is good to not use atypical column names. Then you can just use the column name!

Always good to check each step!

Did the filter work the way you expected? Did the dimensions change?



<https://media.giphy.com/media/5b5OU7aUekfdSAER5I/giphy.gif>

GUT CHECK: If we want to keep just rows that meet either or two conditions, what code should we use?

- A. `filter()` with `|`
- B. `filter()` with `&`

Summary

- `pull()` to get values out of a data frame/tibble
- `select()` is the tidyverse way to get a tibble with only certain columns
- you can `select()` based on patterns in the column names
- you can also `select()` based on column class with the `where()` function
- you can combine multiple tidyselect functions together like
`select(starts_with("C"), ends_with("state"))`
- you can combine multiple patterns with the `c()` function like
`select(starts_with(c("A", "C"))))` (see extra slides at the end for more info!)
- `filter()` can be used to filter out rows based on logical conditions
- avoid using quotes when referring to column names with `filter()`

Summary 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()`

Lab Part 2

- [Class Website](#)
- [Lab](#)
- [Day 3 Cheatsheet](#)
- [Posit's dplyr Cheatsheet](#)

Get the data

```
#read_csv("https://jhubdatascience.org/intro_to_r/data/annualDosage.csv")
set.seed(1234)
AD <- slice_sample(annualDosage, n = 30)
```

Combining `filter` and `select`

You can combine `filter` and `select` to subset the rows and columns, respectively, of a data frame:

```
select(filter(AD, year > 2012), BUYER_STATE)
```

```
# A tibble: 5 × 1
  BUYER_STATE
  <chr>
1 VA
2 CO
3 TX
4 IA
5 WV
```

Nesting

In R, the common way to perform multiple operations is to wrap functions around each other in a “nested” form.

```
head(select(AD, year, BUYER_STATE), 2)
```

```
# A tibble: 2 × 2
  year BUYER_STATE
  <dbl> <chr>
1 2006 TX
2 2014 VA
```

Nesting can get confusing looking

```
select(filter(AD, year > 2000 & BUYER_STATE == "CO"), year, count)
```

```
# A tibble: 2 × 2
```

```
  year count  
  <dbl> <dbl>  
1 2013 20961  
2 2008 23932
```

Assigning Temporary Objects

One can also create temporary objects and reassign them:

```
AD_CO <- filter(AD, year > 2000 & BUYER_STATE == "CO")
AD_CO <- select(AD_CO, year, count)

head(AD_CO)

# A tibble: 2 × 2
  year count
  <dbl> <dbl>
1 2013 20961
2 2008 23932
```

Using the **pipe** (comes with **dplyr**):

The pipe `%>%` makes this much more readable. It reads left side “pipes” into right side. RStudio CMD/Ctrl + Shift + M shortcut. Pipe AD into `filter`, then pipe that into `select`:

```
AD %>% filter(year > 2000 & BUYER_STATE == "CO") %>% select(year, count)
```

```
# A tibble: 2 × 2
  year  count
  <dbl> <dbl>
1 2013 20961
2 2008 23932
```

Alternative Pipes

There are multiple ways to write a pipe and you might see these (they work the same!):

|>

%>%

Note that %>% is not the same as %in% (which helps you check for a value in a vector).

Adding/Removing Columns

Adding columns to a data frame: dplyr (**tidyverse** way)

The `mutate` function in `dplyr` allows you to add or modify columns of a data frame.

General format - Not the code!

```
{data object to update} <- mutate({data to use},  
                                {new variable name} = {new variable source})
```

```
AD <- mutate(AD, newcol = count * 2)
```

```
head(AD, 4)
```

A tibble: 4 × 7

	BUYER COUNTY	BUYER STATE	year	count	DOSAGE UNIT	countyfips	newcol
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>	<dbl>
1	EASTLAND	TX	2006	1980	723690	48133	3960
2	FALLS CHURCH CITY	VA	2014	1340	531270	51610	2680
3	DOUGLAS	CO	2013	20961	6277640	08035	41922
4	FAYETTE	GA	2012	12978	3701320	13113	25956

Use mutate to modify existing columns

The `mutate` function in `dplyr` allows you to add or modify columns of a data frame.

General format - Not the code!

```
{data object to update} <- mutate({data to use},  
                                {variable name to change} = {variable modification})
```

```
AD <- mutate(AD, newcol = newcol / 2)
```

```
head(AD, 4)
```

A tibble: 4 × 7

	BUYER COUNTY	BUYER STATE	year	count	DOSAGE UNIT	countyfips	newcol
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>	<dbl>
1	EASTLAND	TX	2006	1980	723690	48133	1980
2	FALLS CHURCH CITY	VA	2014	1340	531270	51610	1340
3	DOUGLAS	CO	2013	20961	6277640	08035	20961
4	FAYETTE	GA	2012	12978	3701320	13113	12978

You can pipe data into mutate

```
AD <- AD %>% mutate(newcol = newcol / 2)
head(AD, 4)
```

```
# A tibble: 4 × 7
  BUYER COUNTY BUYER STATE year count DOSAGE UNIT county fips newcol
  <chr>       <chr>      <dbl> <dbl>    <dbl> <chr>      <dbl>
1 EASTLAND     TX        2006  1980    723690 48133      990
2 FALLS CHURCH CITY VA      2014  1340    531270 51610      670
3 DOUGLAS      CO        2013  20961   6277640 08035    10480.
4 FAYETTE     GA        2012  12978   3701320 13113      6489
```

mutate function



"Artwork by @allison_horst". <https://allisonhorst.com/>

Removing columns of a data frame: dplyr

The `NULL` method is still very common.

The `select` function can remove a column with exclamation mark (!) or using the minus sign (-):

```
select(AD, !newcol)
```

```
# A tibble: 6 × 6
  BUYER_COUNTY    BUYER_STATE   year count DOSAGE_UNIT countyfips
  <chr>          <chr>       <dbl> <dbl>      <dbl> <chr>
1 EASTLAND        TX           2006  1980      723690 48133
2 FALLS CHURCH CITY VA        2014  1340      531270 51610
3 DOUGLAS         CO           2013  20961     6277640 08035
4 FAYETTE         GA           2012  12978     3701320 13113
5 STAFFORD        VA           2009  7921      2904600 51179
6 GILES            TN           2010  4210      2074530 47055
```

Or, you can simply select the columns you want to keep, ignoring the ones you want to remove.

Removing columns in a data frame: dplyr

You can use `c()` to list the columns to remove.

Remove `newcol` and `drat`:

```
select(AD, !c(newcol, year))

# A tibble: 30 × 5
  BUYER_COUNTY BUYER_STATE count DOSAGE_UNIT countyfips
  <chr>        <chr>      <dbl>   <dbl>    <chr>
1 EASTLAND     TX          1980    723690  48133
2 FALLS CHURCH CITY VA       1340    531270  51610
3 DOUGLAS      CO          20961   6277640  08035
4 FAYETTE      GA          12978   3701320  13113
5 STAFFORD     VA          7921    2904600  51179
6 GILES         TN          4210    2074530  47055
7 ANDREW        MO          1167    315180   29003
8 LUNENBURG    VA          763     246130   51111
9 HAWKINS       TN          7148    3420480  47073
10 ATCHISON     MO          601     204700   29005
# ℹ 20 more rows
```

Ordering columns

Ordering the columns of a data frame: dplyr

The `select` function can reorder columns.

```
head(AD, 2)
```

```
# A tibble: 2 × 7
  BUYER_COUNTY      BUYER_STATE   year  count DOSAGE_UNIT countyfips newcol
  <chr>            <chr>        <dbl> <dbl>    <dbl> <chr>       <dbl>
1 EASTLAND          TX           2006  1980     723690 48133      990
2 FALLS CHURCH CITY VA           2014  1340     531270 51610      670
```

```
AD %>% select(year, count, BUYER_STATE, BUYER_COUNTY) %>%
head(2)
```

```
# A tibble: 2 × 4
  year  count BUYER_STATE BUYER_COUNTY
  <dbl> <dbl> <chr>        <chr>
1 2006  1980 TX           EASTLAND
2 2014  1340 VA           FALLS CHURCH CITY
```

Ordering the columns of a data frame: dplyr

The `select` function can reorder columns. Put `newcol1` first, then select the rest of columns:

```
select(AD, newcol, everything())
```

```
# A tibble: 3 × 7
  newcol BUYER_COUNTY     BUYER_STATE   year count DOSAGE_UNIT countyfips
  <dbl> <chr>           <chr>        <dbl> <dbl>    <dbl> <chr>
1 990   EASTLAND         TX            2006  1980    723690 48133
2 670   FALLS CHURCH CITY VA            2014  1340    531270 51610
3 10480. DOUGLAS         CO            2013  20961   6277640 08035
```

Ordering the columns of a data frame: dplyr

Put year at the end ("remove, everything, then add back in"):

```
select(AD, !year, everything(), year)
```

A tibble: 3 × 7

	BUYER_COUNTY	BUYER_STATE	count	DOSAGE_UNIT	countyfips	newcol	year
	<chr>	<chr>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>
1	EASTLAND	TX	1980	723690	48133	990	2006
2	FALLS CHURCH CITY	VA	1340	531270	51610	670	2014
3	DOUGLAS	CO	20961	6277640	08035	10480.	2013

Ordering the column names of a data frame: alphabetically

Using the base R `order()` function.

```
order(colnames(AD))
```

```
[1] 1 2 4 6 5 7 3
```

```
AD %>% select(order(colnames(AD)))
```

```
# A tibble: 30 × 7
```

	BUYER_COUNTY	BUYER_STATE	count	countyfips	DOSAGE_UNIT	newcol	year
	<chr>	<chr>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
1	EASTLAND	TX	1980	48133	723690	990	2006
2	FALLS CHURCH CITY	VA	1340	51610	531270	670	2014
3	DOUGLAS	CO	20961	08035	6277640	10480.	2013
4	FAYETTE	GA	12978	13113	3701320	6489	2012
5	STAFFORD	VA	7921	51179	2904600	3960.	2009
6	GILES	TN	4210	47055	2074530	2105	2010
7	ANDREW	MO	1167	29003	315180	584.	2010
8	LUNENBURG	VA	763	51111	246130	382.	2010
9	HAWKINS	TN	7148	47073	3420480	3574	2009
10	ATCHISON	MO	601	29005	204700	300.	2012
# 20 more rows							

Ordering the columns of a data frame: dplyr

In addition to `select` we can also use the `relocate()` function of `dplyr` to rearrange the columns for more complicated moves.

For example, let say we just wanted `year` to be before `BUYER_STATE`.

```
head(AD, 1)
```

```
# A tibble: 1 × 7
  BUYER_COUNTY BUYER_STATE year count DOSAGE_UNIT countyfips newcol
  <chr>        <chr>      <dbl> <dbl>    <dbl> <chr>      <dbl>
1 EASTLAND     TX          2006  1980     723690 48133       990
```

```
tb_carb <- relocate(AD, year, .before = BUYER_STATE)
```

```
head(tb_carb, 1)
```

```
# A tibble: 1 × 7
  BUYER_COUNTY year BUYER_STATE count DOSAGE_UNIT countyfips newcol
  <chr>        <dbl> <chr>      <dbl>    <dbl> <chr>      <dbl>
1 EASTLAND     2006 TX          1980     723690 48133       990
```

Ordering rows

Ordering the rows of a data frame: dplyr

The `arrange` function can reorder rows. By default, `arrange` orders in increasing order:

```
arrange(AD, year)
```

```
# A tibble: 30 × 7
  BUYER_COUNTY BUYER_STATE   year count DOSAGE_UNIT countyfips newcol
  <chr>          <chr>     <dbl> <dbl>    <dbl> <chr>      <dbl>
1 EASTLAND       TX        2006  1980    723690 48133      990
2 BUTTE          CA        2006 20443   13802710 06007    10222.
3 PHELPS         NE        2006   842    165100 31137      421
4 BENTON         IN        2006   314    100370 18007      157
5 NORTHWEST ARCTIC AK        2007     1      240 02188      0.5
6 LUMPKIN        GA        2007  2239    567260 13187     1120.
7 HANCOCK        IA        2007   393    131400 19081      196.
8 OKEECHOBEE     FL        2008  5050    1980520 12093     2525
9 PUEBLO         CO        2008 23932   9386790 08101    11966
10 ROGERS        OK        2008 11150   4499860 40131      5575
# ... 20 more rows
```

Ordering the rows of a data frame: dplyr

Use the `desc` to arrange the rows in descending order:

```
arrange(AD, desc(year))
```

```
# A tibble: 30 × 7
```

	BUYER_COUNTY	BUYER_STATE	year	count	DOSAGE_UNIT	countyfips	newcol
1	FALLS CHURCH CITY	VA	2014	1340	531270	51610	670
2	DOUGLAS	CO	2013	20961	6277640	08035	10480.
3	BROWN	TX	2013	4336	2992140	48049	2168
4	WINNEBAGO	IA	2013	1297	397720	19189	648.
5	CABELL	WV	2013	18481	7806600	54011	9240.
6	FAYETTE	GA	2012	12978	3701320	13113	6489
7	ATCHISON	MO	2012	601	204700	29005	300.
8	LEE	KY	2012	1654	1196860	21129	827
9	SAINT HELENA	LA	2011	320	164300	22091	160
10	POLK	NE	2011	253	73600	31143	126.
# 20 more rows							

Ordering the rows of a data frame: dplyr

You can combine increasing and decreasing orderings:

```
arrange(AD, count, desc(year)) %>% head(n = 2)
```

```
# A tibble: 2 × 7
```

	BUYER_COUNTY	BUYER_STATE	year	count	DOSAGE_UNIT	countyfips	newcol
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>	<dbl>
1	NORTHWEST ARCTIC	AK	2007	1	240	02188	0.5
2	POLK	NE	2011	253	73600	31143	126.

```
arrange(AD, desc(year), count) %>% head(n = 2)
```

```
# A tibble: 2 × 7
```

	BUYER_COUNTY	BUYER_STATE	year	count	DOSAGE_UNIT	countyfips	newcol
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>	<dbl>
1	FALLS CHURCH CITY	VA	2014	1340	531270	51610	670
2	WINNEBAGO	IA	2013	1297	397720	19189	648.

Summary

- `select()` and `filter()` can be combined together
- you can do sequential steps in a few ways:
 1. nesting them inside one another using parentheses ()
 2. creating intermediate data objects in between
 3. using pipes `%>%` (like “then” statements)
- `select()` and `relocate()` can be used to reorder columns
- `arrange()` can be used to reorder rows
- can remove rows with `filter()`
- can remove a column in a few ways:
 1. using `select()` with exclamation mark in front of column name(s)
 2. not selecting it (without exclamation mark)

Summary cont...

- `mutate()` can be used to create new variables or modify them

General format - Not the code!

```
{data object to update} <- mutate({data to use},  
                                {new variable name} = {new variable source})
```

```
AD <- mutate(AD, newcol = count/2.2)
```

A note about base R:

The \$ operator is similar to `pull()`. This is the base R way to do this:

```
AD$year
```

```
[1] 2006 2014 2013 2012 2009 2010 2010 2010 2009 2012 2010 2006 2007 2010 2011  
[16] 2008 2009 2010 2007 2008 2006 2007 2013 2012 2011 2006 2013 2008 2013 2010
```

Although it is easier (for this one task), mixing and matching the \$ operator with tidyverse functions usually doesn't work. Therefore, we want to let you know about it in case you see it, but we suggest that you try working with the tidyverse way.

Adding new columns to a data frame: base R

You can add a new column (or modify an existing one) using the `$` operator instead of `mutate`.

Just want you to be aware of this as it is very common.

```
AD$newcol <- AD$count/2.2  
head(AD, 3)
```

```
# A tibble: 3 × 7  
  BUYER_COUNTY    BUYER_STATE   year count DOSAGE_UNIT countyfips newcol  
  <chr>          <chr>        <dbl> <dbl>      <dbl> <chr>        <dbl>  
1 EASTLAND        TX            2006  1980      723690 48133       900  
2 FALLS CHURCH CITY VA            2014  1340      531270 51610       609.  
3 DOUGLAS         CO            2013 20961      6277640 08035      9528.
```

Even though `$` is easier for creating new columns, `mutate` is really powerful, so it's worth getting used to.

Lab Part 3

- [Class Website](#)
- [Lab](#)
- [Day 3 Cheatsheet](#)
- [Posit's dplyr Cheatsheet](#)



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Extra Slides

Multiple patterns with one tidyselect statement

Need to combine the patterns with the `c()` function.

These do the same thing

```
select(AD, starts_with(c("B", "D")))
select(AD, starts_with("B"), starts_with("D"))
```

Nuances about `filter()`

```
test <- tibble(A = c(1, 2, 3, 4), B = c(1, 2, 3, 4))  
test
```

```
# A tibble: 4 × 2
```

	A	B
	<dbl>	<dbl>
1	1	1
2	2	2
3	3	3
4	4	4

These are technically the same but `>=` is easier to read

Separating can cause issues
`filter(test, B > 2 | B==2)`

```
# A tibble: 3 × 2
```

	A	B
	<dbl>	<dbl>
1	2	2
2	3	3
3	4	4

```
filter(test, B >= 2)
```

```
# A tibble: 3 × 2
```

	A	B
	<dbl>	<dbl>
1	2	2

Order of operations for `filter()`

Order can matter. Think of individual statements separately first.

```
filter(test, A>3 | B==2 & B>2) # A is greater than 3 or B is equal to 2 AND (th
```

```
# A tibble: 1 × 2
  A     B
  <dbl> <dbl>
1     4     4
```

```
filter(test, A>3 & B>2 | B==2) # A is greater than 3 AND B is greater than 2 OR B
```

```
# A tibble: 2 × 2
  A     B
  <dbl> <dbl>
1     2     2
2     4     4
```

which() function

Instead of removing rows like filter, which() simply shows where the values occur if they pass a specific condition. We will see that this can be helpful later when we want to select and filter in more complicated ways.

```
which(select(AD, year) == 2014)
```

```
[1] 2
```

```
select(AD, year) == 2014 %>% head(10)
```

```
      year
[1, ] FALSE
[2, ] TRUE
[3, ] FALSE
[4, ] FALSE
[5, ] FALSE
[6, ] FALSE
[7, ] FALSE
[8, ] FALSE
[9, ] FALSE
[10, ] FALSE
[11, ] FALSE
[12, ] FALSE
[13, ] FALSE
[14, ] FALSE
[15, ] FALSE
[16, ] FALSE
[17, ] FALSE
```

Remove a column in base R

```
AD$year <- NULL
```

Renaming Columns of a data frame: base R

We can use the `colnames` function to extract and/or directly reassign column names of `df`:

```
colnames(AD) # just prints
```

```
[1] "BUYER_COUNTY" "BUYER_STATE"   "year"           "count"          "DOSAGE_UNIT"  
[6] "countyfips"    "newcol"
```

```
colnames(AD)[1:3] <- c("County", "State", "Year") # reassigned  
head(AD)
```

```
# A tibble: 6 × 7
```

	County	State	Year	count	DOSAGE_UNIT	countyfips	newcol
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<chr>	<dbl>
1	EASTLAND	TX	2006	1980	723690	48133	900
2	FALLS CHURCH CITY	VA	2014	1340	531270	51610	609.
3	DOUGLAS	CO	2013	20961	6277640	08035	9528.
4	FAYETTE	GA	2012	12978	3701320	13113	5899.
5	STAFFORD	VA	2009	7921	2904600	51179	3600.
6	GILES	TN	2010	4210	2074530	47055	1914.

Subset rows of a data frame with indices:

Let's select **rows** 1 and 3 from df using brackets:

```
AD[ c(1, 3), ]
```

```
# A tibble: 2 × 7
```

```
  County    State Year count DOSAGE_UNIT countyfips newcol
  <chr>     <chr> <dbl> <dbl>      <dbl> <chr>       <dbl>
1 EASTLAND  TX     2006  1980      723690 48133        900
2 DOUGLAS   CO     2013  20961     6277640 08035       9528.
```

Subset columns of a data frame:

We can also subset a data frame using the bracket [,] subsetting.

For data frames and matrices (2-dimensional objects), the brackets are [rows, columns] subsetting. We can grab the x column using the index of the column or the column name ("year")

```
AD[, 3]
```

```
# A tibble: 30 × 1
```

```
  Year
  <dbl>
1 2006
2 2014
3 2013
4 2012
5 2009
6 2010
7 2010
8 2010
9 2009
10 2012
# ... 20 more rows
```

```
AD[, "count"]
```

```
# A tibble: 30 × 1
```

```
  count
  <dbl>
```

Subset columns of a data frame:

We can select multiple columns using multiple column names:

```
AD[, c("State", "count")]
```

```
# A tibble: 30 × 2
```

```
  State count
```

```
  <chr> <dbl>
```

```
1 TX     1980
```

```
2 VA     1340
```

```
3 CO     20961
```

```
4 GA     12978
```

```
5 VA     7921
```

```
6 TN     4210
```

```
7 MO     1167
```

```
8 VA     763
```

```
9 TN     7148
```

```
10 MO    601
```

```
# ... 20 more rows
```