

Grouping operations on other verbs

The GRAPH Courses team

October 2022

This document serves as an accompaniment for a lesson found on <https://thegraphcourses.org>.

The GRAPH Courses is a project of the Global Research and Analyses for Public Health (GRAPH) Network, with the support of the World Health Organization (WHO) and other partners

Introduction
Learning objectives
The Yaounde COVID-19 dataset
Introducing <code>select()</code>
Selecting column ranges with :
Excluding columns with !
Helper functions for <code>select()</code>
<code>starts_with()</code> and <code>ends_with()</code>
<code>contains()</code>
<code>everything()</code>
Change column names with <code>rename()</code>
Rename within <code>select()</code>
Wrap Up !

Introduction

Today we will begin our exploration of the `{dplyr}` package! Our first verb on the list is `select` which allows to keep or drop variables from your dataframe. Choosing your variables is the first step in cleaning your data.



Fig: the `select()` function.

Let's go !

Learning objectives

- You can keep or drop columns from a dataframe using the `dplyr::select()` function from the `{dplyr}` package.

- You can select a range or combination of columns using operators like the colon (:), the exclamation mark (!), and the `c()` function.
- You can select columns based on patterns in their names with helper functions like `starts_with()`, `ends_with()`, `contains()`, and `everything()`.
- You can use `rename()` and `select()` to change column names.

The Yaounde COVID-19 dataset

In this lesson, we analyse results from a COVID-19 serological survey conducted in Yaounde, Cameroon in late 2020. The survey estimated how many people had been infected with COVID-19 in the region, by testing for IgG and IgM antibodies. The full dataset can be obtained from [Zenodo](#), and the paper can be viewed [here](#).

Spend some time browsing through this dataset. Each line corresponds to one patient surveyed. There are some demographic, socio-economic and COVID-related variables. The results of the IgG and IgM antibody tests are in the columns `igg_result` and `igm_result`.

```
yaounde <- read_csv(here::here("data/yaounde_data.csv"))
yaounde
```

```
## # A tibble: 971 × 53
##   id                  date_surveyed    age age_category age_category_3
##   <chr>                <date>        <dbl> <chr>          <chr>
## 1 BRIQUETERIE_000_0001 2020-10-22     45  45 - 64      Adult
## 2 BRIQUETERIE_000_0002 2020-10-24     55  45 - 64      Adult
## 3 BRIQUETERIE_000_0003 2020-10-24     23  15 - 29      Adult
## 4 BRIQUETERIE_002_0001 2020-10-22     20  15 - 29      Adult
## 5 BRIQUETERIE_002_0002 2020-10-22     55  45 - 64      Adult
## # ... with 966 more rows, and 48 more variables: sex <chr>,
## #   highest_education <chr>, occupation <chr>, weight_kg <dbl>, ...
```



Left: the Yaounde survey team. Right: an antibody test being administered.

Introducing `select()`

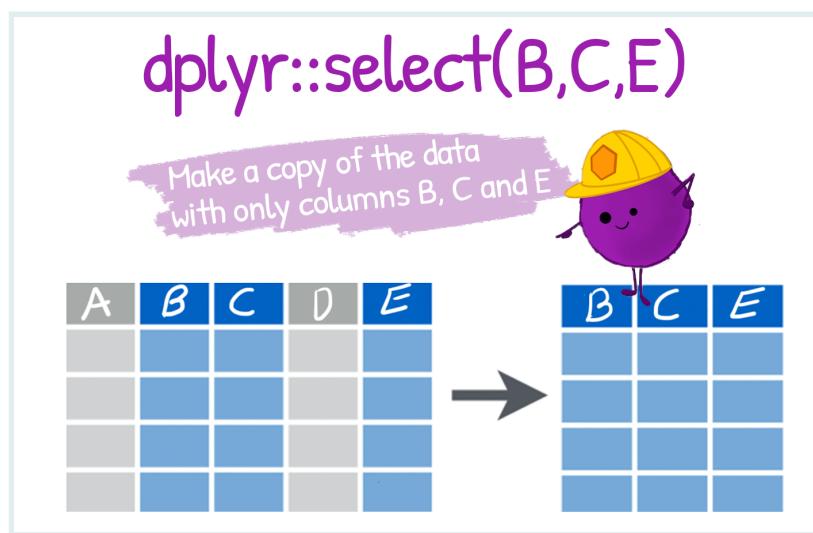


Fig: the `select()` function. (Drawing adapted from Allison Horst).

`dplyr::select()` lets us pick which columns (variables) to keep or drop.

We can select a column **by name**:

```
yaounde %>% select(age)
```

```
## # A tibble: 971 × 1
##       age
##   <dbl>
## 1     45
## 2     55
## 3     23
## 4     20
## 5     55
## # ... with 966 more rows
```

Or we can select a column **by position**:

```
yaounde %>% select(3) # `age` is the 3rd column
```

```
## # A tibble: 971 × 1
##       age
##   <dbl>
## 1     45
## 2     55
## 3     23
## 4     20
## 5     55
## # ... with 966 more rows
```

To select **multiple variables**, we separate them with commas:

```
yaounde %>% select(age, sex, igg_result)
```

```
## # A tibble: 971 × 3
##       age   sex   igg_result
##   <dbl> <chr> <chr>
## 1     45 Female Negative
## 2     55 Male   Positive
## 3     23 Male   Negative
## 4     20 Female Positive
## 5     55 Female Positive
## # ... with 966 more rows
```



- Select the weight and height variables in the `yaounde` data frame. Store the result in `q1`.
- Select the 16th and 22nd columns in the `yaounde` data frame. Store the result in `q2`.

For the next part of the tutorial, let's create a smaller subset of the data, called `yao`.

```
yao <-  
  yaounde %>% select(age,  
                      sex,  
                      highest_education,  
                      occupation,  
                      is_smoker,  
                      is_pregnant,  
                      igg_result,  
                      igm_result)  
yao  
  
## # A tibble: 971 × 8  
##   age   sex   highest_education occupation      is_smoker  
##   <dbl> <chr> <chr>           <chr>          <chr>  
## 1    45 Female Secondary       Informal worker Non-smoker  
## 2    55 Male   University     Salaried worker Ex-smoker  
## 3    23 Male   University     Student        Smoker  
## 4    20 Female Secondary       Student        Non-smoker  
## 5    55 Female Primary        Trader--Farmer Non-smoker  
## # ... with 966 more rows, and 3 more variables: is_pregnant <chr>,  
## #   igg_result <chr>, igm_result <chr>
```

Selecting column ranges with :

The `:` operator selects a **range of consecutive variables**:

```
yao %>% select(age:occupation) # Select all columns from `age` to `occupation`
```

```
## # A tibble: 971 × 4  
##   age   sex   highest_education occupation  
##   <dbl> <chr> <chr>           <chr>  
## 1    45 Female Secondary       Informal worker  
## 2    55 Male   University     Salaried worker  
## 3    23 Male   University     Student  
## 4    20 Female Secondary       Student  
## 5    55 Female Primary        Trader--Farmer  
## # ... with 966 more rows
```

We can also specify a range with column numbers:

```
yao %>% select(1:4) # Select columns 1 to 4
```

```
## # A tibble: 971 × 4  
##   age   sex   highest_education occupation  
##   <dbl> <chr> <chr>           <chr>  
## 1    45 Female Secondary       Informal worker
```

```

## 2    55 Male   University      Salaried worker
## 3    23 Male   University      Student
## 4    20 Female Secondary      Student
## 5    55 Female Primary       Trader--Farmer
## # ... with 966 more rows

```



- With the `yaounde` data frame, select the columns between `symptoms` and `sequelae`, inclusive. (“Inclusive” means you should also include `symptoms` and `sequelae` in the selection.)

Excluding columns with !

The **exclamation point** negates a selection:

```
yao %>% select(!age) # Select all columns except `age`
```

```

## # A tibble: 971 × 7
##   sex   highest_education occupation      is_smoker  is_pregnant
##   <chr>  <chr>          <chr>          <chr>        <chr>
## 1 Female Secondary      Informal worker Non-smoker No
## 2 Male   University     Salaried worker Ex-smoker  <NA>
## 3 Male   University     Student        Smoker      <NA>
## 4 Female Secondary      Student        Non-smoker No
## 5 Female Primary       Trader--Farmer Non-smoker No
## # ... with 966 more rows, and 2 more variables: igg_result <chr>,
## #   igm_result <chr>

```

To drop a range of consecutive columns, we use, for example, `!age:occupation`:

```
yao %>% select(!age:occupation) # Drop columns from `age` to `occupation`
```

```

## # A tibble: 971 × 4
##   is_smoker  is_pregnant igg_result igm_result
##   <chr>        <chr>      <chr>      <chr>
## 1 Non-smoker No         Negative  Negative
## 2 Ex-smoker  <NA>        Positive  Negative
## 3 Smoker     <NA>        Negative  Negative
## 4 Non-smoker No         Positive  Negative
## 5 Non-smoker No         Positive  Negative
## # ... with 966 more rows

```

To drop several non-consecutive columns, place them inside `!c()`:

```
yao %>% select(!c(age, sex, igg_result))
```

```

## # A tibble: 971 × 5
##   highest_education occupation      is_smoker  is_pregnant igm_result
##   <chr>            <chr>          <chr>       <chr>        <chr>
## 1 Secondary        Informal worker Non-smoker  No           Negative
## 2 University       Salaried worker Ex-smoker   <NA>        Negative
## 3 University       Student         Smoker     <NA>        Negative
## 4 Secondary        Student         Non-smoker  No           Negative
## 5 Primary          Trader--Farmer Non-smoker  No           Negative
## # ... with 966 more rows

```



- From the `yaounde` data frame, remove all columns between `highest_education` and `consultation`, inclusive.

Helper functions for `select()`

`dplyr` has a number of helper functions to make selecting easier by using patterns from the column names. Let's take a look at some of these.

`starts_with()` and `ends_with()`

These two helpers work exactly as their names suggest!

```
yao %>% select(starts_with("is_")) # Columns that start with "is"
```

```

## # A tibble: 971 × 2
##   is_smoker  is_pregnant
##   <chr>       <chr>
## 1 Non-smoker No
## 2 Ex-smoker  <NA>
## 3 Smoker     <NA>
## 4 Non-smoker No
## 5 Non-smoker No
## # ... with 966 more rows

```

```
yao %>% select(ends_with("_result")) # Columns that end with "result"
```

```

## # A tibble: 971 × 2
##   igg_result igm_result
##   <chr>       <chr>
## 1 Negative   Negative

```

```
## 2 Positive    Negative
## 3 Negative    Negative
## 4 Positive    Negative
## 5 Positive    Negative
## # ... with 966 more rows
```

contains()

contains() helps select columns that contain a certain string:

```
yao %>% select(contains("drug")) # Columns that contain the string "drug"
```

```
## # A tibble: 971 × 12
##   drugsource      is_drug_parac is_drug_antibio is_drug_hydrocortis...¹
##   <chr>           <dbl>        <dbl>          <dbl>
## 1 Self or familial     1            0              0
## 2 <NA>             NA           NA             NA
## 3 <NA>             NA           NA             NA
## 4 Self or familial     0            1              0
## 5 <NA>             NA           NA             NA
## # ... with 966 more rows, 8 more variables:
## #   is_drug_other_anti_inflam <dbl>, is_drug_antiviral <dbl>, ...
```

everything()

Another helper function, everything(), matches all variables that have not yet been selected.

```
# First, `is_pregnant`, then every other column.
yao %>% select(is_pregnant, everything())
```

```
## # A tibble: 971 × 8
##   is_pregnant    age sex   highest_education occupation
##   <chr>       <dbl> <chr> <chr>           <chr>
## 1 No            45 Female Secondary      Informal worker
## 2 <NA>          55 Male   University    Salaried worker
## 3 <NA>          23 Male   University    Student
## 4 No            20 Female Secondary      Student
## 5 No            55 Female Primary       Trader--Farmer
## # ... with 966 more rows, and 3 more variables: is_smoker <chr>,
## #   igg_result <chr>, igm_result <chr>
```

It is often useful for establishing the order of columns.

Say we wanted to bring the is_pregnant column to the start of the yao data frame, we could type out all the column names manually:

```
yao %>% select(is_pregnant,
  age,
  sex,
  highest_education,
  occupation,
  is_smoker,
  igg_result,
  igm_result)
```

```
## # A tibble: 971 × 8
##   is_pregnant    age   sex highest_education occupation
##   <chr>        <dbl> <chr>      <chr>           <chr>
## 1 No             45 Female Secondary Informal worker
## 2 <NA>          55 Male   University Salaried worker
## 3 <NA>          23 Male   University Student
## 4 No             20 Female Secondary Student
## 5 No             55 Female Primary Trader--Farmer
## # ... with 966 more rows, and 3 more variables: is_smoker <chr>,
## #   igg_result <chr>, igm_result <chr>
```

But this would be painful for larger data frames, such as our original `yaounde` data frame. In such a case, we can use `everything()`:

```
# Bring `is_pregnant` to the front of the data frame
yaounde %>% select(is_pregnant, everything())
```

```
## # A tibble: 971 × 53
##   is_pregnant id                  date_surveyed    age age_category
##   <chr>        <chr>              <date>        <dbl> <chr>
## 1 No          BRIQUETERIE_000_0001 2020-10-22     45 45 - 64
## 2 <NA>       BRIQUETERIE_000_0002 2020-10-24     55 45 - 64
## 3 <NA>       BRIQUETERIE_000_0003 2020-10-24     23 15 - 29
## 4 No          BRIQUETERIE_002_0001 2020-10-22     20 15 - 29
## 5 No          BRIQUETERIE_002_0002 2020-10-22     55 45 - 64
## # ... with 966 more rows, and 48 more variables: age_category_3 <chr>,
## #   sex <chr>, highest_education <chr>, occupation <chr>, ...
```

This helper can be combined with many others.

```
# Bring columns that start with "is" to the front of the data frame
yaounde %>% select(ends_with("result"), everything())
```

```
## # A tibble: 971 × 53
##   igg_result igm_result id                  date_surveyed    age
##   <chr>      <chr>     <chr>              <date>        <dbl>
## 1 Negative  Negative  BRIQUETERIE_000_0001 2020-10-22     45
## 2 Positive   Negative BRIQUETERIE_000_0002 2020-10-24     55
## 3 Negative  Negative BRIQUETERIE_000_0003 2020-10-24     23
## 4 Positive   Negative BRIQUETERIE_002_0001 2020-10-22     20
```

```
## 5 Positive    Negative    BRIQUETERIE_002_0002 2020-10-22      55
## # ... with 966 more rows, and 48 more variables: age_category <chr>,
## #   age_category_3 <chr>, sex <chr>, highest_education <chr>, ...
```



- Select all columns in the `yaounde` data frame that start with "is_".
- Move the columns that start with "is_" to the beginning of the `yaounde` data frame.

Change column names with `rename()`

RENAME COLUMNS

`dplyr::rename(enemies = species)`

species enemies	status	diet
Dog	active	carnivore
House cat		carnivore
Osprey		carnivore



Fig: the `rename()` function. (Drawing adapted from Allison Horst)

`dplyr::rename()` is used to change column names:

```
# Rename `age` and `sex` to `patient_age` and `patient_sex`  
yaounde %>%  
  rename(patient_age = age,  
         patient_sex = sex)
```

```
## # A tibble: 971 × 53  
##   id                  date_surveyed patient_age age_category  
##   <chr>                <date>           <dbl> <chr>  
## 1 BRIQUETERIE_000_0001 2020-10-22        45 45 - 64  
## 2 BRIQUETERIE_000_0002 2020-10-24        55 45 - 64
```

```
## 3 BRIQUETERIE_000_0003 2020-10-24          23 15 - 29
## 4 BRIQUETERIE_002_0001 2020-10-22          20 15 - 29
## 5 BRIQUETERIE_002_0002 2020-10-22          55 45 - 64
## # ... with 966 more rows, and 49 more variables: age_category_3 <chr>,
## #   patient_sex <chr>, highest_education <chr>, occupation <chr>, ...
```

WATCH OUT



The fact that the new name comes first in the function (`rename(NEWNAME = OLDNAME)`) is sometimes confusing. You should get used to this with time.

Rename within `select()`

You can also rename columns while selecting them:

```
# Select `age` and `sex`, and rename them to `patient_age` and `patient_sex`
yaounde %>%
  select(patient_age = age,
         patient_sex = sex)
```

```
## # A tibble: 971 × 2
##   patient_age patient_sex
##       <dbl> <chr>
## 1        45 Female
## 2        55 Male
## 3        23 Male
## 4        20 Female
## 5        55 Female
## # ... with 966 more rows
```

Wrap Up!

I hope this first lesson has allowed you to see how intuitive and useful the `{dplyr}` verbs are! This is the first of a series of basic data wrangling verbs: see you in the next lesson to learn more.

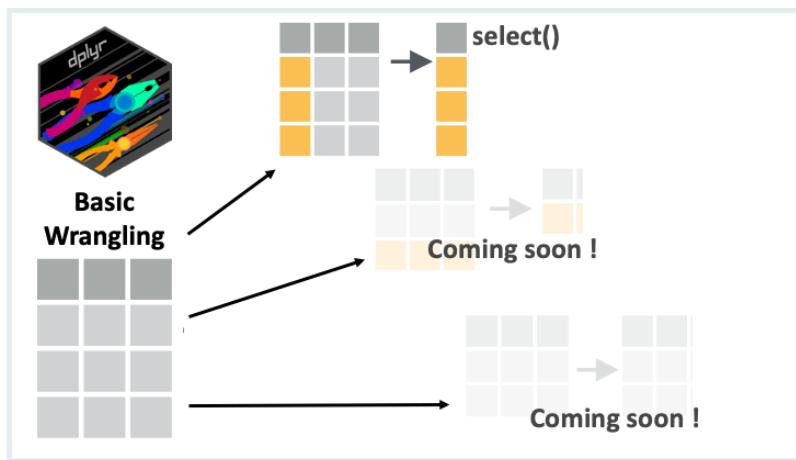


Fig: Basic Data Wrangling Dplyr Verbs.

Contributors

The following team members contributed to this lesson:



LAURE VANCAUWENBERGHE

Data analyst, the GRAPH Network
A firm believer in science for good, striving to ally programming, health and education



ANDREE VALLE CAMPOS

R Developer and Instructor, the GRAPH Network
Motivated by reproducible science and education



KENE DAVID NWOSU

Data analyst, the GRAPH Network
Passionate about education

References

Some material in this lesson was adapted from the following sources:

- Horst, A. (2021). *Dplyr-learnr*. <https://github.com/allisonhorst/dplyr-learnr> (Original work published 2020)

- *Subset columns using their names and types—Select.* (n.d.). Retrieved 31 December 2021, from <https://dplyr.tidyverse.org/reference/select.html>

Artwork was adapted from:

- Horst, A. (2021). *R & stats illustrations* by Allison Horst. <https://github.com/allisonhorst/stats-illustrations> (Original work published 2018)