

# Filtering rows

## The GRAPH Courses team

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## 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 !

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## 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.

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## 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()`

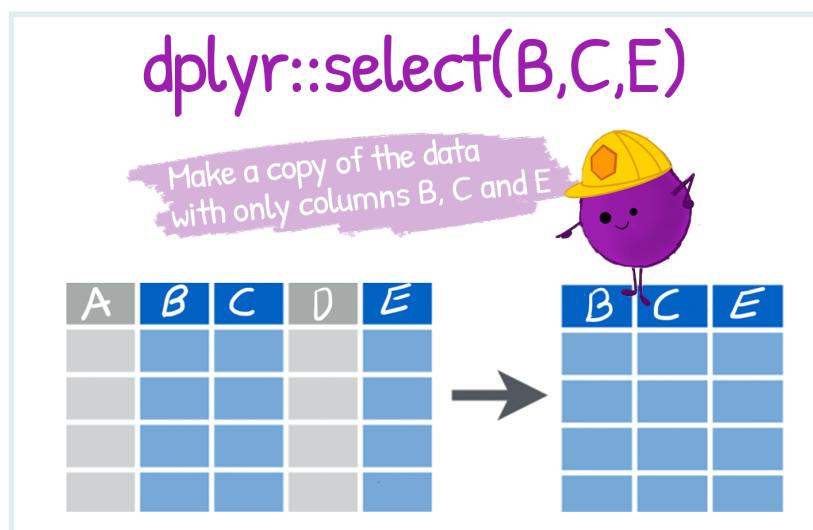


Fig: the `select()` function. (Drawing adapted from Allison Horst).

`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>
## 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

```

**PRACTICE**



- 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...  
##   <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)`

<del>species</del> 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.

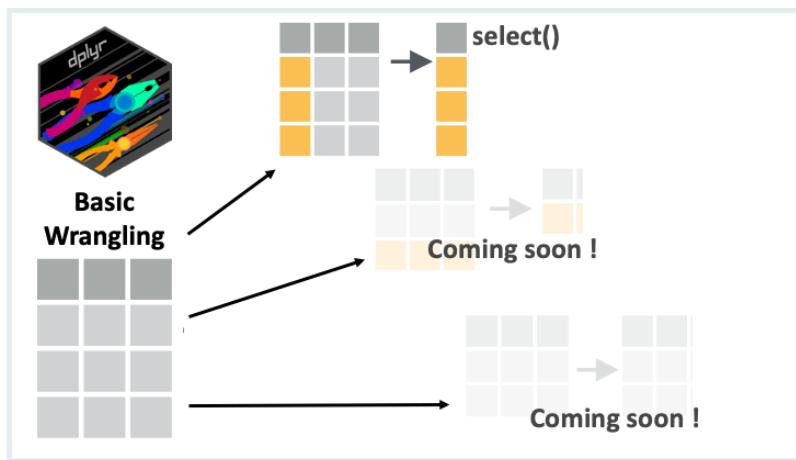


Fig: Basic Data Wrangling Dplyr Verbs.

## Contributors

The following team members contributed to this lesson:



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## 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)