Making tidy easier

Data Wrangling, Session 8

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Code Horizons

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Making it easier to be tidy

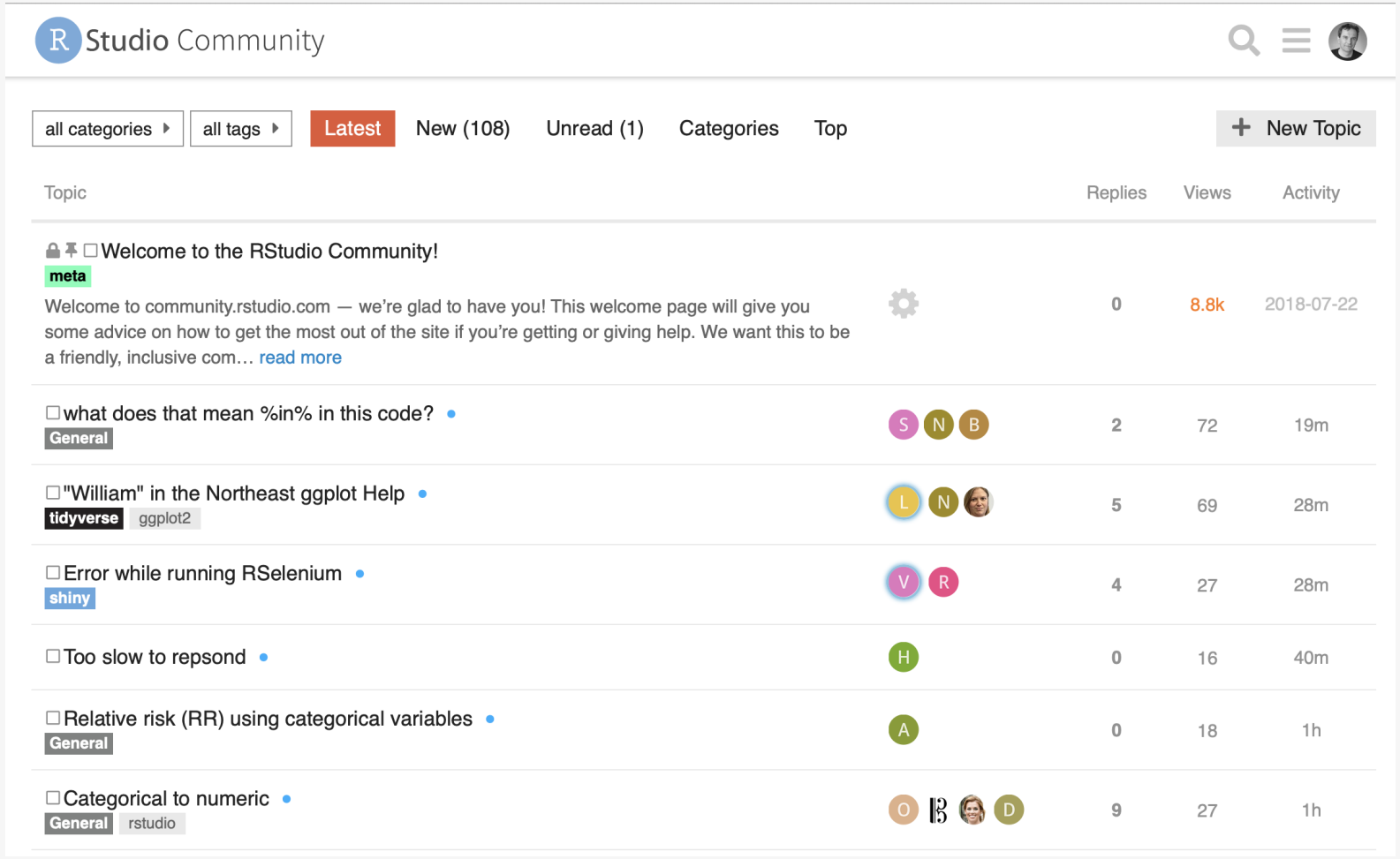
Load the packages, as always

```
library(here)      # manage file paths
library(socviz)    # data and some useful functions
library(tidyverse) # your friend and mine
library(haven)     # for Stata, SAS, and SPSS files

library(broom)     # tidy model summaries
```

Moving ahead

Some helpful things

The RStudio Community



The reprex package

reprex part of the tidyverse 2.0.0.9000

Reference Articles News

Overview

Prepare reprexes for posting to GitHub issues, StackOverflow, in Slack messages or snippets, or even to paste into PowerPoint or Keynote slides. What is a `reprex`? It's a **repr**oducible **ex**ample, as coined by Romain Francois.

Given R code on the clipboard, selected in RStudio, as an expression (quoted or not), or in a file …

- run it via `rmarkdown::render()`,
- with deliberate choices re: `render()` arguments, knitr options, and Pandoc options.

Get resulting runnable code + output as

- Markdown, suitable for GitHub or Stack Overflow or Slack, or as
- R code, augmented with commented output, or as
- Plain HTML or (experimental) Rich Text

The result is returned invisibly, written to a file and, if possible, placed on the clipboard. Preview an HTML version in RStudio viewer or default browser.

Installation

Links

Download from CRAN at https://cloud.r-project.org/package=reprex

Browse source code at https://github.com/tidyverse/reprex/

Report a bug at https://github.com/tidyverse/reprex/issues

License

Full license

MIT + file LICENSE

Community

Contributing guide

Code of conduct

Developers

Best demonstrated live

When asking for help, make a **reproducible example**

```
library(reprex)
```

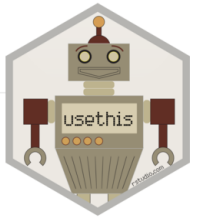
```
library(tidyverse)

starwars ▷
  count(homeworld, species) ▷
  mutate(pct = n / sum(n) * 100) ▷
  arrange(desc(pct))
```

```
# A tibble: 57 × 4
   homeworld species      n   pct
   <chr>     <chr>    <int> <dbl>
 1 Tatooine  Human        8  9.20
 2 <NA>      Human        6  6.90
 3 Naboo     Human        5  5.75
 4 Alderaan  Human        3  3.45
 5 Naboo     Gungan       3  3.45
 6 <NA>      Droid        3  3.45
 7 Corellia  Human        2  2.30
 8 Coruscant Human        2  2.30
 9 Kamino    Kaminoan     2  2.30
10 Kashyyyk  Wookiee      2  2.30
# ℹ 47 more rows
```

The usethis package

usethis 2.0.1.9000 | Setup | Reference | Articles | News | Search...

usethis



usethis is a workflow package: it automates repetitive tasks that arise during project setup and development, both for R packages and non-package projects.

Installation

Install the released version of usethis from CRAN:

```
install.packages("usethis")
```

Or install the development version from GitHub with:

```
# install.packages("devtools")
devtools::install_github("r-lib/usethis")
```

Usage

Most `use_*()` functions operate on the *active project*: literally, a directory on your computer. If you've just used usethis to create a new package or project, that will be the active project. Otherwise, usethis verifies that current working directory is or is below a valid project directory and that becomes the active project. Use `proj_get()` or `proj_sitrep()` to manually query the project and read more in the docs.

A few usethis functions have no strong connections to projects and will expect you to provide a path.

Links

Download from CRAN at https://cloud.r-project.org/package=usethis

Browse source code at https://github.com/r-lib/usethis/

Report a bug at https://github.com/r-lib/usethis/issues

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Community

Contributing guide

Code of conduct

Developers

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Author

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Author, maintainer

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Author

Quarto

religion	Northeast	Midwest	South	West
Protestant	158	325	650	238
Catholic	162	172	160	155
Jewish	27	3	11	10
None	112	157	170	180
Other	28	33	50	48
NA	1	5	11	1

Tables, tables, tables

The **gtsummary** package is very powerful. There are a number of other very good tidy table-making options too.

```
library(gtsummary)

trial
```

```
# A tibble: 200 × 8
   trt      age marker stage grade response death ttdeath
   <chr>  <dbl>  <dbl> <fct> <fct>    <int> <int>   <dbl>
 1 Drug A    23  0.16  T1    II           0     0    24
 2 Drug B     9  1.11  T2    I            1     0    24
 3 Drug A    31  0.277 T1    II           0     0    24
 4 Drug A    NA  2.07  T3    III          1     1    17.6
 5 Drug A    51  2.77  T4    III          1     1    16.4
 6 Drug B    39  0.613 T4    I            0     1    15.6
 7 Drug A    37  0.354 T1    II           0     0    24
 8 Drug A    32  1.74  T1    I            0     1    18.4
 9 Drug A    31  0.144 T1    II           0     0    24
10 Drug B    34  0.205 T3    I            0     1    10.5
# ℹ 190 more rows
```

Tables, tables, tables

The **gtsummary** package is very powerful. There are a number of other very good tidy table-making options too.

```
trial |>
  tbl_summary(
    include = c(age, grade, response),
    by = trt, # split table by group
    missing = "no" # don't list missing data separately
  ) |>
  add_n() |> # add column with total number of non-missing observations
  add_p()
```

Tables, tables, tables

Characteristic	N	Drug A N = 98 [1]	Drug B N = 102 [1]	p-value
Age	189	46 (37, 60)	48 (39, 56)	
Grade	200			
I		35 (36%)	33 (32%)	
II		32 (33%)	36 (35%)	
III		31 (32%)	33 (32%)	
Tumor Response	193	28 (29%)	33 (34%)	

[1] Median (Q1, Q3); n (%)

Tables, tables, tables

`gtsummary()` straight out of the box:

```
gss_sm ▷
  select(race, degree, marital) ▷
  drop_na() ▷
  tbl_summary(
    by = race, # split table by group
    missing = "no" # don't list missing data separately
  ) ▷
  bold_labels()
```

Tables, tables, tables

Characteristic	White N = 2,096 [1]	Black N = 487 [1]	Other N = 276 [1]
degree			
Lt High School	197 (9.4%)	60 (12%)	71 (26%)
High School	1,057 (50%)	292 (60%)	112 (41%)
Junior College	166 (7.9%)	33 (6.8%)	17 (6.2%)
Bachelor	426 (20%)	71 (15%)	39 (14%)
Graduate	250 (12%)	31 (6.4%)	37 (13%)
marital			
Married	979 (47%)	121 (25%)	110 (40%)
Widowed	196 (9.4%)	35 (7.2%)	18 (6.5%)
Divorced	363 (17%)	93 (19%)	39 (14%)
Separated	55 (2.6%)	27 (5.5%)	20 (7.2%)
Never Married	503 (24%)	211 (43%)	89 (32%)

[1] n (%)

Tables, tables, tables

With a bit more work ...

```
trial |>
  select(trt, age, marker) |>
  tbl_summary(
    by = trt,
    type = all_continuous() ~ "continuous2",
    statistic = all_continuous() ~ c("{N_nonmiss}",
                                     "{mean} ({sd})",
                                     "{median} ({p25}, {p75})",
                                     "{min}, {max}"),
    missing = "no") |>
  italicize_levels()
```

Tables, tables, tables

Characteristic	Drug A N = 98	Drug B N = 102
Age		
N Non-missing	91	98
Mean (SD)	47 (15)	47 (14)
Median (Q1, Q3)	46 (37, 60)	48 (39, 56)
Min, Max	6, 78	9, 83
Marker Level (ng/mL)		
N Non-missing	92	98
Mean (SD)	1.02 (0.89)	0.82 (0.83)
Median (Q1, Q3)	0.84 (0.23, 1.60)	0.52 (0.18, 1.21)
Min, Max	0.00, 3.87	0.01, 3.64

The power of lists

Similar to earlier, but simpler:

```
library(gapminder)

## Fit as a function, for clarity
fit_ols ← function(df) {
    lm(lifeExp ~ log(gdpPercap), data = df)
}



out_le ← gapminder ▷
  filter(continent %nin% "Oceania") ▷
  group_by(continent) ▷
  nest() ▷
  mutate(model = map(data, fit_ols),
         mod_sum = map(model, glance),
         mod_terms = map(model, tidy, conf.int = TRUE),
         ) ▷
  unnest(cols = c(mod_terms))
```

The power of lists

```
out_le
```

```
# A tibble: 8 × 11
# Groups:   continent [4]
  continent data     model mod_sum  term  estimate std.error statistic   p.value
  <fct>     <list>   <lis> <list>   <chr>    <dbl>     <dbl>     <dbl>     <dbl>
1 Asia      <tibble> <lm>  <tibble> (Int…     9.58     2.71       3.54 4.46e-  4
2 Asia      <tibble> <lm>  <tibble> log(…     6.25     0.331     18.9  3.73e- 57
3 Europe    <tibble> <lm>  <tibble> (Int…    13.0      1.92       6.76 5.52e- 11
4 Europe    <tibble> <lm>  <tibble> log(…     6.31     0.205     30.8  8.06e-103
5 Africa    <tibble> <lm>  <tibble> (Int…     7.60     2.63       2.89 4.03e-  3
6 Africa    <tibble> <lm>  <tibble> log(…     5.69     0.361     15.8  1.86e- 47
7 Americas  <tibble> <lm>  <tibble> (Int…   -19.1      4.82      -3.95 9.65e-  5
8 Americas  <tibble> <lm>  <tibble> log(…     9.72     0.558     17.4  2.51e- 47
# ℹ 2 more variables: conf.low <dbl>, conf.high <dbl>
```

The power of lists

```
## Nice formatting of the numbers
## There are many convenience packages
## like this; it's not too hard to write your own, either
# remotes::install_github("tjmahr/printy")

text_ready ← out_le ▷
  mutate(
    across(c(estimate, conf.low, conf.high),
           printy::fmt_fix_digits, 2),
    se = printy::fmt_fix_digits(std.error, 3),
    ci = glue::glue("[{conf.low}, {conf.high}]")
  ) ▷
  select(continent, term, estimate, se, ci)
```

The `printy` package is by T.J. Mahr

The power of lists

```
text_ready
```

```
# A tibble: 8 × 5
# Groups:   continent [4]
  continent term           estimate se    ci
  <fct>     <chr>          <chr>    <chr> <glue>
1 Asia      (Intercept)    9.58     2.706 [4.26, 14.90]
2 Asia      log(gdpPercap) 6.25     0.331 [5.60, 6.90]
3 Europe    (Intercept)    12.97    1.917 [9.19, 16.74]
4 Europe    log(gdpPercap) 6.31     0.205 [5.91, 6.71]
5 Africa    (Intercept)    7.60     2.632 [2.43, 12.77]
6 Africa    log(gdpPercap) 5.69     0.361 [4.98, 6.40]
7 Americas  (Intercept)    -19.07   4.824 [-28.56, -9.58]
8 Americas  log(gdpPercap) 9.72     0.558 [8.62, 10.82]
```

The power of lists

Now ...

```
stats ← text_ready ▷
  mutate(term = janitor::make_clean_names(term)) ▷
  printy::super_split(continent, term) # Thanks again, TJ Mahr
```

The power of lists

Why are we doing this?

```
stats
```

```
$Africa
$Africa$intercept
# A tibble: 1 × 5
# Groups:   continent [1]
  continent term      estimate se    ci
  <fct>     <chr>     <chr>    <chr> <glue>
1 Africa    intercept 7.60     2.632 [2.43, 12.77]

$Africa$log_gdp_percap
# A tibble: 1 × 5
# Groups:   continent [1]
  continent term           estimate se    ci
  <fct>     <chr>          <chr>    <chr> <glue>
1 Africa    log_gdp_percap 5.69     0.361 [4.98, 6.40]


$Americas
$Americas$intercept
# A tibble: 1 × 5
```

The power of lists

```
The Intercept term for Africa was 'r stats$Africa$intercept$estimate' 'r
stats$Africa$intercept$ci'.

For Europe it was 'r stats$Europe$intercept$estimate' 'r stats$Europe$intercept$ci'
```

The Intercept term for Africa was 7.60 [2.43, 12.77].

For Europe it was 12.97 [9.19, 16.74].

For more, see this post by TJ Mahr:

https://www.tjmahr.com/lists-knitr-secret-weapon/

Test the output of your functions

```
countries ← read_csv(here("data", "countries.csv"))

countries
```

```
# A tibble: 213 × 4
   cname       iso3  iso2  continent
   <chr>       <chr> <chr> <chr>
 1 Afghanistan AFG   AF    Asia
 2 Algeria     DZA   DZ    Africa
 3 Armenia     ARM   AM    Asia
 4 Australia   AUS   AU    Oceania
 5 Austria     AUT   AT    Europe
 6 Azerbaijan  AZE   AZ    Asia
 7 Bahrain     BHR   BH    Asia
 8 Belarus     BLR   BY    Europe
 9 Belgium     BEL   BE    Europe
10 Brazil      BRA   BR    South America
# ℹ 203 more rows
```

Test the output of your functions

```r
get_stmf ← function(url = "https://www.mortality.org/File/GetDocument/Public/STMF/Outputs",
                    fname = "stmf",
                    date = lubridate::today(),
                    ext = "csv",
                    dest = "data-raw/data",
                    save_file = c("n", "y"),
                    ...) {
  save_file ← match.arg(save_file)
  target ←  fs::path(url, fname, ext = ext)
  message("target: ", target)

  destination ← fs::path(here::here("data-raw/data"),
                         paste0(fname, "_", date), ext = ext)

  tf ← tempfile(fileext = ext)
  curl::curl_download(target, tf)

  switch(save_file,
         y = fs::file_copy(tf, destination),
         n = NULL)

  janitor::clean_names(read_csv(tf, ...))
```

Test the output of your functions

```
stmf_raw ← read_csv(here("data", "stmf.csv"), skip = 2) ▷
  janitor::clean_names() ▷
  rename(deaths_total = d_total, rate_total = r_total) ▷
  select(country_code:sex, deaths_total, rate_total, split:forecast, everything()) ▷
  pivot_longer(
    cols = d0_14:r85p,
    names_to = c("measure", "age_group"),
    names_pattern = "(r|d)(.*)"
  ) ▷
  pivot_wider(names_from = measure,
              values_from = value) ▷
  mutate(age_group = stringr::str_replace(age_group, "_", "-"),
         age_group = stringr::str_replace(age_group, "p", "+")) ▷
  rename(death_count = d, death_rate = r) ▷
  mutate(approx_date = paste0(year, "-", "W",
                              stringr::str_pad(week, width = 2, pad = "0"), "-", "7"),
         approx_date = ISOweek::ISOweek2date(approx_date)) ▷
  select(country_code:sex, split:forecast, approx_date,
         age_group:death_rate, deaths_total, rate_total) ▷
  mutate(country_code = replace(country_code, country_code == "AUS2", "AUS"),
         country_code = replace(country_code, country_code == "NZL_NP", "NZL"))
```

Test the output of your functions

```
stmf_raw
```

```
# A tibble: 576,840 × 13
   country_code  year  week sex   split split_sex forecast approx_date age_group
   <chr>        <dbl> <dbl> <chr> <dbl>     <dbl>    <dbl> <date>      <chr>
 1 AUS           2015     1 m         1         0        0 2015-01-04  0-14
 2 AUS           2015     1 m         1         0        0 2015-01-04  15-64
 3 AUS           2015     1 m         1         0        0 2015-01-04  65-74
 4 AUS           2015     1 m         1         0        0 2015-01-04  75-84
 5 AUS           2015     1 m         1         0        0 2015-01-04  85+
 6 AUS           2015     1 f         1         0        0 2015-01-04  0-14
 7 AUS           2015     1 f         1         0        0 2015-01-04  15-64
 8 AUS           2015     1 f         1         0        0 2015-01-04  65-74
 9 AUS           2015     1 f         1         0        0 2015-01-04  75-84
10 AUS           2015     1 f         1         0        0 2015-01-04  85+
# ℹ 576,830 more rows
# ℹ 4 more variables: death_count <dbl>, death_rate <dbl>, deaths_total <dbl>,
#   rate_total <dbl>
```

Test the output of your functions

```
md_ccodes ← tibble(country_code = unique(stmf_raw$country_code)) ▷
  left_join(countries, by = c("country_code" = "iso3")) ▷
  mutate(cname = replace(cname, country_code == "DEUTNP", "Germany"),
         iso2 = replace(iso2, country_code == "DEUTNP", "DE"),
         continent = replace(continent, country_code == "DEU", "Europe"),
         cname = replace(cname, country_code == "FRATNP", "France"),
         iso2 = replace(iso2, country_code == "FRATNP", "FR"),
         continent = replace(continent, country_code == "FRA", "Europe"),
         cname = replace(cname, country_code == "GBRTENW", "England and Wales"),
         cname = replace(cname, country_code == "GBR_SCO", "Scotland"),
         cname = replace(cname, country_code == "GBR_NIR", "Northern Ireland"),
         continent = replace(continent, country_code %in% c("GBRTENW", "GBR_SCO", "GBR_NIR"), "Euro
         ) ▷
  left_join(countries)


stmf ← left_join(stmf_raw, md_ccodes) ▷
  select(country_code, cname:iso3, everything()) ▷
  mutate(iso3 = replace(iso3, iso2 == "DE", "DEU"),
         iso3 = replace(iso3, iso2 == "FR", "FRA"))
```

Test the output of your functions

```
stmf
```

```
# A tibble: 576,840 × 17
   country_code cname    iso2  continent iso3   year  week sex   split split_sex
   <chr>        <chr>    <chr> <chr>     <chr> <dbl> <dbl> <chr> <dbl>     <dbl>
 1 AUS          Austral… AU    Oceania   AUS    2015     1 m         1         0
 2 AUS          Austral… AU    Oceania   AUS    2015     1 m         1         0
 3 AUS          Austral… AU    Oceania   AUS    2015     1 m         1         0
 4 AUS          Austral… AU    Oceania   AUS    2015     1 m         1         0
 5 AUS          Austral… AU    Oceania   AUS    2015     1 m         1         0
 6 AUS          Austral… AU    Oceania   AUS    2015     1 f         1         0
 7 AUS          Austral… AU    Oceania   AUS    2015     1 f         1         0
 8 AUS          Austral… AU    Oceania   AUS    2015     1 f         1         0
 9 AUS          Austral… AU    Oceania   AUS    2015     1 f         1         0
10 AUS          Austral… AU    Oceania   AUS    2015     1 f         1         0
# ℹ 576,830 more rows
# ℹ 7 more variables: forecast <dbl>, approx_date <date>, age_group <chr>,
#   death_count <dbl>, death_rate <dbl>, deaths_total <dbl>, rate_total <dbl>
```

For example, manually

```
## stmf
stmf_colnames ← c("country_code", "cname", "iso2", "continent", "iso3", "year",
                  "week", "sex", "split", "split_sex", "forecast", "approx_date",
                  "age_group", "death_count", "death_rate", "deaths_total", "rate_total")

all.equal(colnames(stmf), stmf_colnames)
```

```
[1] TRUE
```

Imagine how you might build up a set of tests and checks

But you don’t have to manage this manually

Use testthat to check things

```
## countries
test_that("countries conforms to spec", {
  countries_colnames <- c("cname", "iso3", "iso2", "continent")
  expect_equal(colnames(countries), countries_colnames)
})


## stmf
test_that("stmf conforms to spec", {
  stmf_colnames <- c("country_code", "cname", "iso2", "continent", "iso3", "year",
                     "week", "sex", "split", "split_sex", "forecast", "approx_date",
                     "age_group", "death_count", "death_rate", "deaths_total", "rate_total")
  expect_equal(colnames(stmf), stmf_colnames)
})
```

Use testthat to check things

```
testthat::test_dir(here("tests", "testthat"))

## √ |  OK F W S | Context
##
## - |   0       | stmf
## - |   0       | Validating package data objects
## √ |   2       | Validating package data objects
##
## == Results =====================================================================
## [ FAIL 0 | WARN 0 | SKIP 0 | PASS 2 ]
```

testthat in practice

Oriented towards package development

Consider packaging your datasets! Benefits to documentation/codebooks etc

One-table example: uscenpops

More extensive: covdata

How R packages work: Wickham & Bryan

Summarizing your wrangling with skimr

We might want to make a codebook of our data

```
library(skimr)
```

Summarize with skimr

We might want to make a codebook of our data

```
library(skimr)
organdata ← read_csv(here("data", "organdonation.csv"))
```

Summarize with skimr

```
organdata ▷ skim(where(is.numeric)) ▷ partition()
```

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p1(
year	34	0.86	1996.50	3.46	1991.00	1993.75	1996.50	1999.25	2002.(
donors	34	0.86	16.48	5.11	5.20	13.00	15.10	19.60	33.(
pop	17	0.93	39921.29	62219.22	3514.00	6938.00	15531.00	57301.00	288369.(
pop.dens	17	0.93	12.00	11.09	0.22	1.94	9.49	19.11	38.(
gdp	17	0.93	22986.18	4665.92	12917.00	19546.00	22756.00	26180.00	36554.(
gdp.lag	0	1.00	22574.92	4790.71	11434.00	19034.25	22158.00	25886.50	36554.(
health	0	1.00	2073.75	733.59	791.00	1581.00	1956.00	2407.50	5665.(
health.lag	0	1.00	1972.99	699.24	727.00	1542.00	1850.50	2290.25	5267.(
pubhealth	21	0.91	6.19	0.92	4.30	5.50	6.00	6.90	8.(
roads	17	0.93	113.04	36.33	58.21	83.46	111.22	139.57	232.(
cerebvas	17	0.93	610.80	144.45	300.00	500.00	604.00	698.00	957.(
assault	17	0.93	16.53	17.33	4.00	9.00	11.00	16.00	103.(
external	17	0.93	450.06	118.19	258.00	367.00	421.00	534.00	853.(
txp.pop	17	0.93	0.72	0.20	0.22	0.63	0.71	0.83	1.

Summarize with skimr

```
organdata ▷ skim(!where(is.numeric)) ▷ partition()
```

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
country	0	1.00	5	14	0	17	0
world	14	0.94	6	11	0	3	0
opt	28	0.88	2	3	0	2	0
consent.law	0	1.00	8	8	0	2	0
consent.practice	0	1.00	8	8	0	2	0
consistent	0	1.00	2	3	0	2	0
ccode	0	1.00	2	4	0	17	0

Custom Summaries

```
stmf_country_years ← function(df = stmf) {

  df ▷
    dplyr::select(cname, year) ▷
    dplyr::group_by(cname, year) ▷
    dplyr::tally() ▷
    dplyr::mutate(n = as.character(n),
           n = dplyr::recode(n, "0" = "-", .default = "Y")) ▷
    dplyr::group_by(year, cname) ▷
    dplyr::arrange(year) ▷
    tidyr::pivot_wider(names_from = year, values_from = n) ▷
    dplyr::mutate(dplyr::across(where(is.character), dplyr::recode, .missing = "-")) ▷
    dplyr::arrange(cname)
}
```

Custom Summaries

```
knitr::kable(stmf_country_years())
```

cname	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2
Australia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Austria	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Belgium	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Bulgaria	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Croatia	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y
Czech Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
England and Wales	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Finland	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
France	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Germany	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Greece	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-