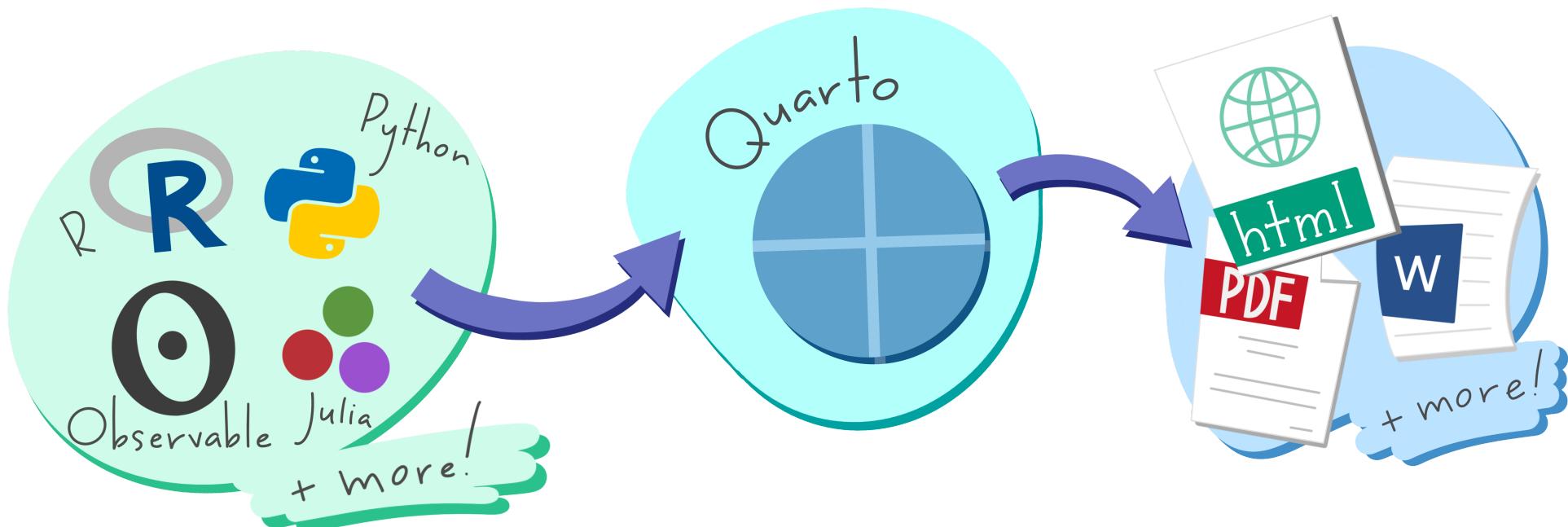


Dynamic documents in R reproducible research with Quarto

2025-08-09



Artwork from “Hello, Quarto” keynote by Julia Lowndes and Mine Çetinkaya-Rundel, presented at RStudio Conference 2022. Illustrated by Allison Horst.

```
---
```

```
title: "ggplot2 demo"
author: "Norah Jones"
date: "5/22/2021"
format:
  html:
    fig-width: 8
    fig-height: 4
    code-fold: true
```

```
---
```

Air Quality

```
@fig-airquality further explores the impact of
temperature on ozone level.
```

```
```{r}
#| label: fig-airquality
#| fig-cap: Temperature and ozone level.
#| warning: false
```

```
library(ggplot2)
```

```
ggplot(airquality, aes(Temp, Ozone)) +
 geom_point() +
 geom_smooth(method = "loess")
```
``
```

Source

ggplot2 demo

Norah Jones
May 22nd, 2021

Output

Air Quality

[Figure 1](#) further explores the impact of temperature on ozone level.

► Code

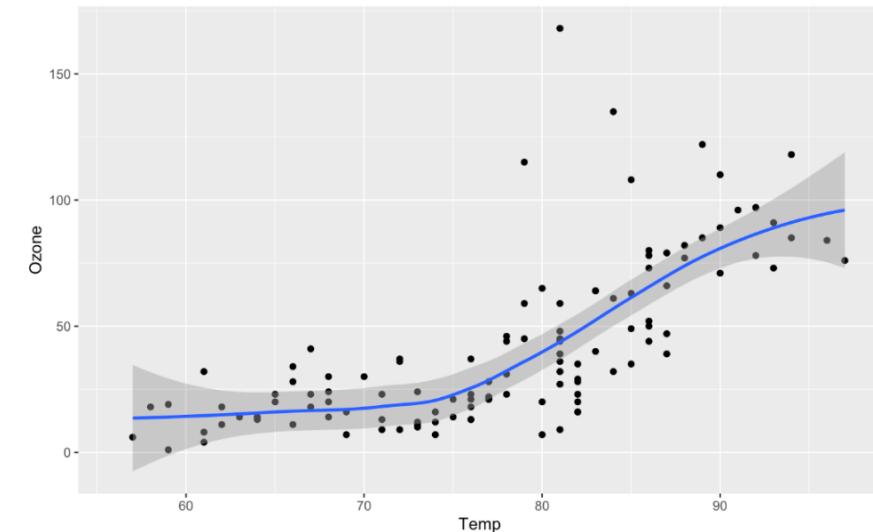
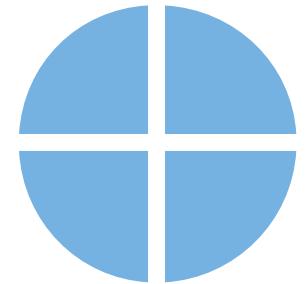


Figure 1: Temperature and ozone level.

Quarto

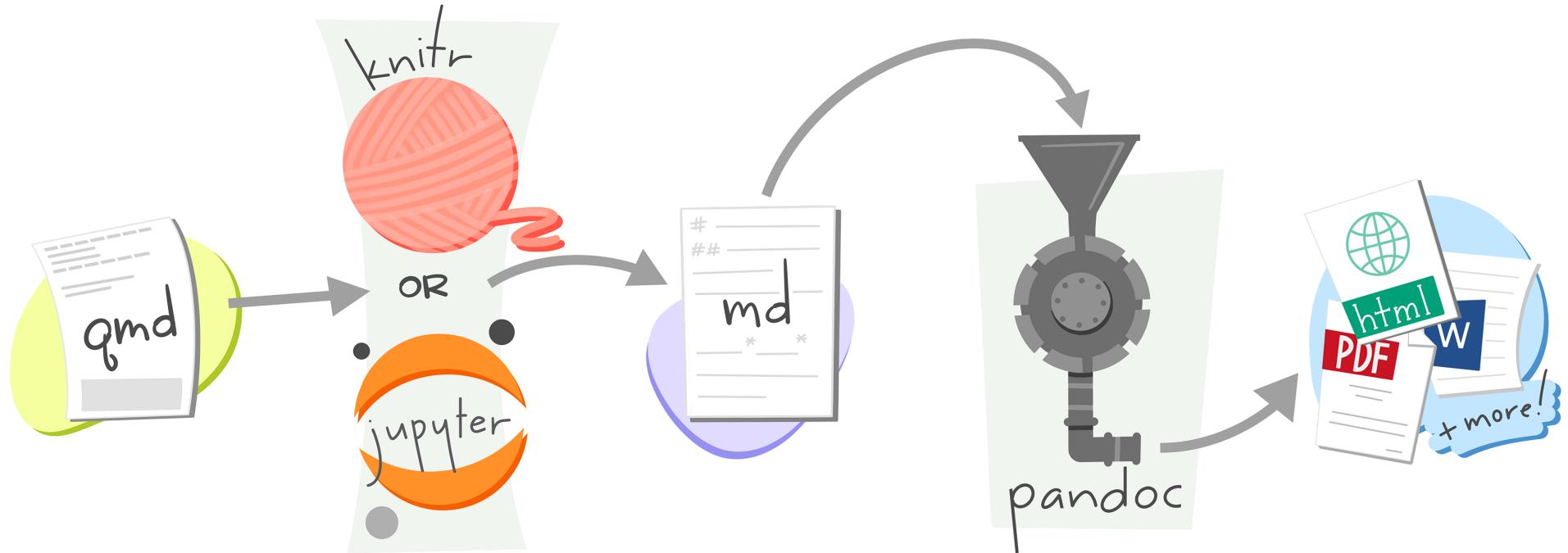


Dynamic: code and text in same document

Reproducible: re-run your analysis, re-render your document

Flexible: output to different formats easily

Rendering



Your Turn 1

Create a new Quarto file. Go to File > New File > Quarto Document. Press OK. Save the file and press the “Render” button.



Render

```
1 ---  
2 title: "Untitled" ← document metadata  
3 format: html  
4 ---  
5  
6 ## Quarto  
7  
8 Quarto enables you to weave together content and executable code into a  
finished document.  
9 To learn more about Quarto see <https://quarto.org>.  
10  
11 ## Running Code  
12  
13 When you click the **Render** button a document will be generated that includes  
both content and the output of embedded code.  
14 You can embed code like this:  
15  
16 ```{r}  
17 1 + 1  
18 ````  
19  
20 You can add options to executable code like this  
21  
22 ```{r}  
23 #| echo: false  
24 2 * 2  
25 ````  
26  
27 The `echo: false` option disables the printing of code (only output is  
displayed).  
28
```

The image shows a code block from a Quarto document with several annotations:

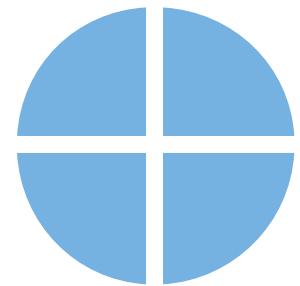
- A blue arrow points from the text "← document metadata" to the line "title: 'Untitled'".
- A green arrow points from the text "plain text" to the line "To learn more about Quarto see <<https://quarto.org>>".
- An orange arrow points from the text "code chunks" to the line "1 + 1".
- An orange arrow points from the text "executable code options" to the line "#| echo: false".

Quarto

Prose

Code

Metadata

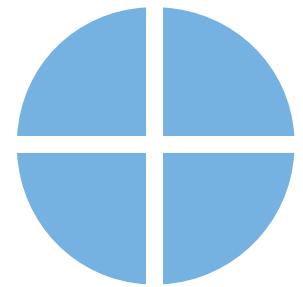


Quarto

Prose = *Markdown*

Code

Metadata



the Visual Editor

relational-data.qmd x

Source Visual B I Normal Format Insert Table Outline #filtering_joins ...

Filtering Joins

Filtering joins match observations in the same way as [mutating joins](#), but affect the observations, not the variables. There are two types:

| | | |
|-----------------|----------------------|--|
| semi_join(x, y) | $x \ltimes y$ | Keeps all observations in x that have a match in y |
| anti_join(x, y) | $x \triangleright y$ | Drops all observations in x that have a match in y |

Graphically, a semi-join looks like this:

```
{r.join-semi}~  
#| echo: false~  
#| out-width: "6"~  
~  
knitr::include_graphics("diagrams/join-semi.png")~
```

| key | val_x |
|-----|-------|
| 1 | x1 |
| 2 | x2 |

Only the existence of a match is important; it doesn't matter which observation is matched. This means that filtering joins never duplicate rows like mutating joins do:

Chunk 1: join-semi Quarto

Basic Markdown Syntax

italic **bold**

italic __bold__

Basic Markdown Syntax

Header 1

Header 2

Header 3

Basic Markdown Syntax

<http://example.com>

[linked phrase] (http://example.com)

*Learn more about Markdown Syntax with the
ten-twenty minute tutorial on markdown at
<https://commonmark.org/help/tutorial>.*

Your Turn 2 (open exercises.qmd)

Read this short introduction to the Visual Editor:

<https://quarto.org/docs/visual-editor/>

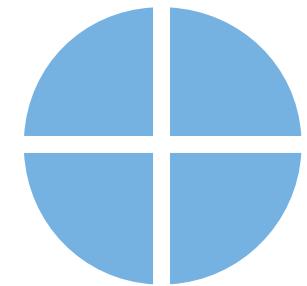
Use the Visual Editor to stylize the text from the Gapminder website below. Experiment with bolding, italicizing, making lists, etc.

Quarto

Prose

Code = *R code chunks*

Metadata



Code chunks

```
```{r}
#| label: howl
#| echo: false
my_generation |>
 select(best_minds) |>
 filter(destroyed == "by madness")
```
```

Code chunks



Code chunks

```
chunk options
```{r}
#| label: howl
#| echo: false
my_generation |>
 select(best_minds) |>
 filter(destroyed == "by madness")
```
option values
```

Code chunks

code chunk comments

```
```{r}
#| label: howl
#| echo: false
my_generation |>
 select(best_minds) |>
 filter(destroyed == "by madness")
```
```

Chunk options

| Option | Effect |
|----------------------------------|--|
| <code>include: false</code> | run the code but don't print it or results |
| <code>eval: false</code> | don't evaluate the code |
| <code>echo: false</code> | run the code and output but don't print code |
| <code>message: false</code> | don't print messages (e.g. from a function) |
| <code>warning: false</code> | don't print warnings |
| <code>fig.cap: "Figure 1"</code> | caption output plot with "Figure 1" |

See the Quarto documentation

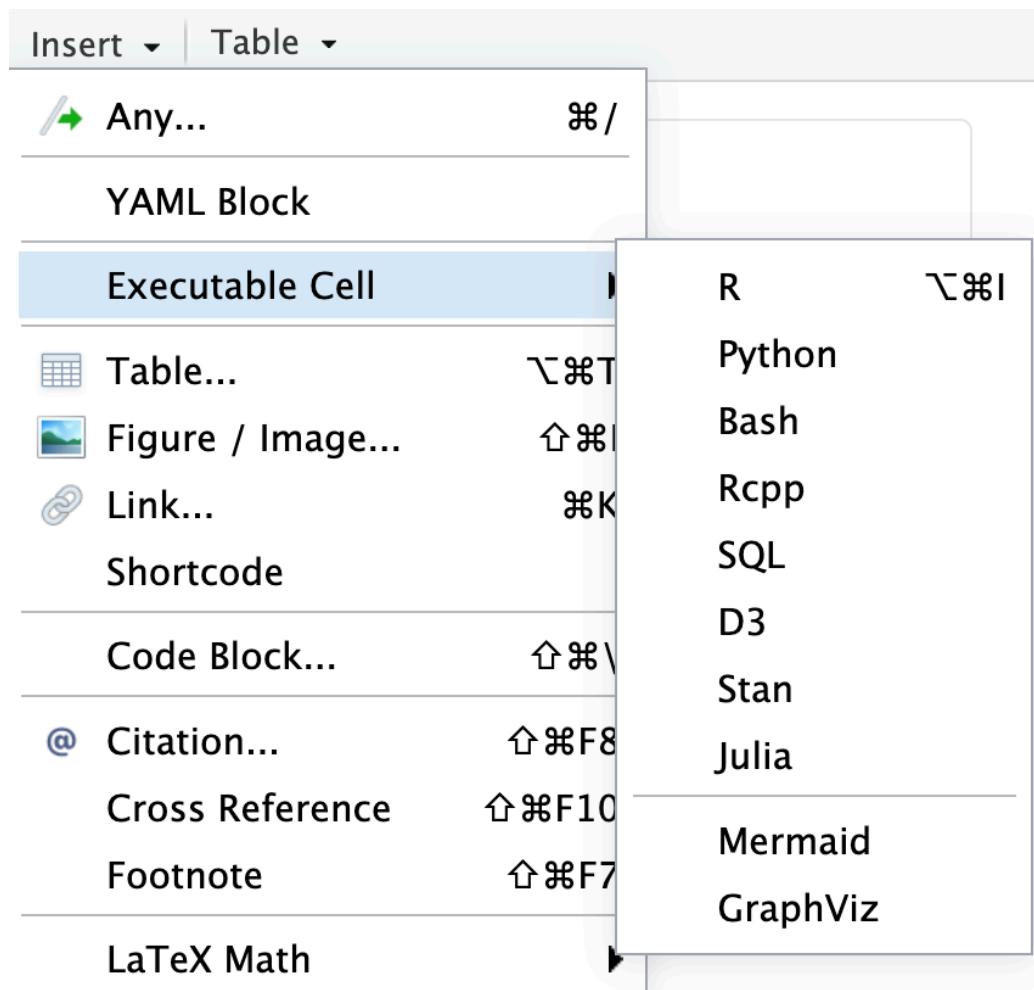
Other languages

First-class support for Python, Julia, and
Observable JS

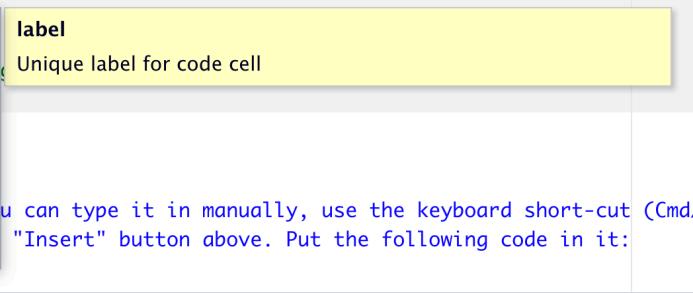
Supports Jupyter notebooks

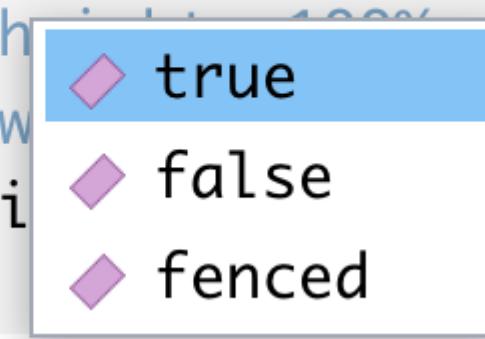
57 knitr engines

Insert code chunks with cmd/ctrl + alt/option + I or Visual Editor



Press **tab** to autocomplete chunk options

```
```{r}
#| echo: false
#|
knitr::label()
#| classes:
#| cache:
#| cache-vars:
#| cache-globals:
#| cache-lazy:
#| cache-rebuild:
#| cache-comments:
```

```

```
```{r}
#| echo:
#| out.h:
#| out.w:
knitr:::i
```

```

Your Turn 3

Create a code chunk. You can type it in manually, use the keyboard short-cut (Cmd/Ctrl + Option/Alt + I), or use the “Insert” button above. Put the following code in it:

```
1 gapminder |>
2   slice(1:5) |>
3     gt()
```

Render the document

Your Turn 4

Add `echo: false` to the code chunk you created and re-render. What's the difference in the output?

Inline Code

who wept at the romance of the
streets with their pushcarts full of
onions and bad music,
who sat in boxes breathing in the
darkness under the bridge, and rose
up to build `r select(instruments,
harpsichord)` in their lofts,
who coughed on the `r length(floors)`
floor of Harlem crowned with flame
under the tubercular sky surrounded
by orange crates of theology,
who scribbled all night rocking and
rolling over lofty incantations which
in the yellow morning were stanzas of
gibberish,

Inline Code

who wept at the romance of the
streets with their pushcarts full of
onions and bad music,
who sat in boxes breathing in the
darkness under the bridge, and rose
up to build `r select(instruments,
single
backtick + r harpsichord)` in their lofts,
who coughed on the `r length(floors)`
floor of Harlem crowned with flame
under the tubercular sky surrounded
by orange crates of theology,
who scribbled all night rocking and
rolling over lofty incantations which
in the yellow morning were stanzas of
gibberish,

any R code



Your Turn 5

Remove `eval: false` so that Quarto evaluates the code.

Use `summarize()` and `n_distinct()` to get the the number of unique years in gapminder and save the results as `n_years`.

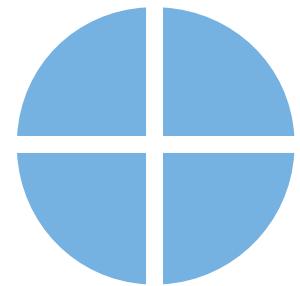
Use inline code to describe the data set in the text below the code chunk and re-render.

Quarto

Prose

Code

Metadata = YAML



YAML Metadata

```
1 ---  
2 title: "Howl"  
3 author: "Allen Ginsberg"  
4 date: "March 18, 1956"  
5 format:  
6   html: default  
7   pdf:  
8     toc: true  
9     number-sections: true  
10 ---
```

Output formats

| Format | Outputs |
|----------|--------------------------|
| html | HTML |
| pdf | PDF |
| word | Word .docx |
| odt | OpenOffice .odt |
| gfm | GitHub-flavored Markdown |
| revealjs | Reveal Slides (HTML) |
| beamer | Beamer Slides (PDF) |
| pptx | Powerpoint Slides |

Your Turn 6

Set figure chunk options to the code chunk below, such as `dpi`, `fig.width`, and `fig.height`. Run `knitr::opts_chunk$get()` in the console to see the defaults.

Add your name to the YAML header using `author: Your Name`.

Change `format: html` to use the `toc: true` and `code-fold: true` options and re-render

Parameters

```
1 ---  
2 params:  
3   param1: x  
4   param2: y  
5   data: df  
6 ---
```

Calling parameters in R

```
1 params$param1  
2 params$param2  
3 params$data
```

From the Console

```
1 quarto::quarto_render(  
2   "document.qmd",  
3   execute_params = list(param1 = 0.2, param2 = 0.3)  
4 )
```

Your Turn 7

Change the `params` option in the YAML header to use a different continent. Re-render.

```
1 gapminder |>
2   filter(continent == params$continent) |>
3   ggplot(aes(x = year, y = lifeExp, group = country, color = country)) +
4   geom_line(lwd = 1, show.legend = FALSE) +
5   scale_color_manual(values = country_colors) +
6   theme_minimal(14) +
7   theme(strip.text = element_text(size = rel(1.1))) +
8   ggtitle(paste("Continent:", params$continent))
```

Bibliographies and citations

Bibliography files: .bib, Zotero, others

Citation styles: .csl

[@citation-label]

Visual Editor's citation wizard can help!

Including bibliography files in YAML

```
1 ...
2 bibliography: file.bib
3 csl: file.csl
4 ...
```

the Visual Editor can also manage this for you.

Your turn 8

Cite Causal Inference in text below. Using the citation wizard, find the right citation under My sources > Bibliography.

Add the American Journal of Epidemiology CSL to the YAML using csl: `aje.csl`

Re-render

Make cool stuff in Quarto!

- Books
- Blogs
- These slides!

See the Gallery for inspiration

Resources

Quarto Documentation: A comprehensive but friendly introduction to Quarto. Written in Quarto!

R for Data Science: A comprehensive but friendly introduction to the tidyverse. Free online. Written in Quarto!

Posit Recipes: Common code patterns in R (with some comparisons to SAS)