

# The lazy and easily distracted report writer

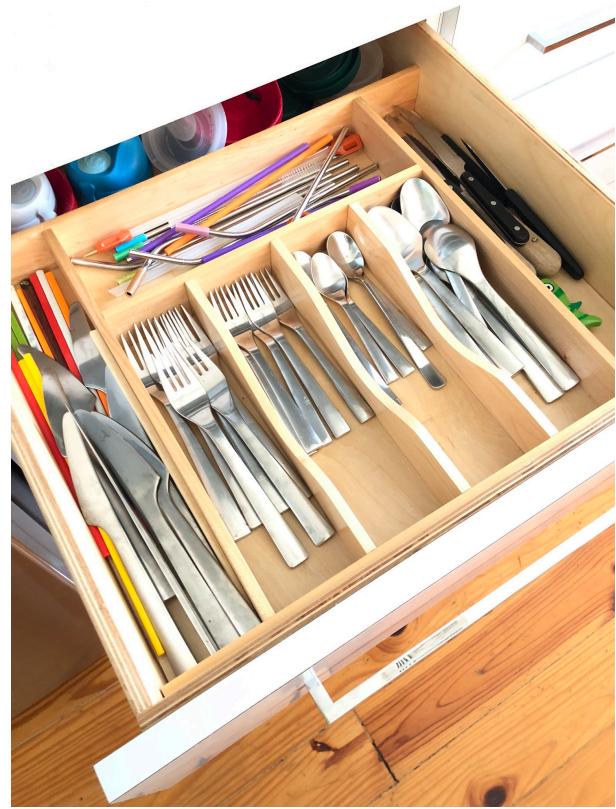
Mike K Smith (Pfizer R&D UK Ltd.)  
@MikeKSmith

RStudio::conf(2019)

# TL;DR & Disclaimer

- I used parameterised rmarkdown notebooks to write up an exploratory analysis which I shared with a drug development team consisting of quantitative and non-quantitative colleagues:
  - Statistician
  - Clinical Pharmacologists (including my manager)
  - Clinician
- The analysis presented here is ***NOT*** that analysis (for confidentiality) but it has similar attributes.

# Cutlery drawers & what they say about YOU



HT: @HadleyWickham, @jimhester\_, @dataandme

# Mine... (sorry / not sorry)



```
CutleryDrawer %>%
  group_by(Type) %>%
  gather( ) %>%
  arrange( )
```

#untidyverse



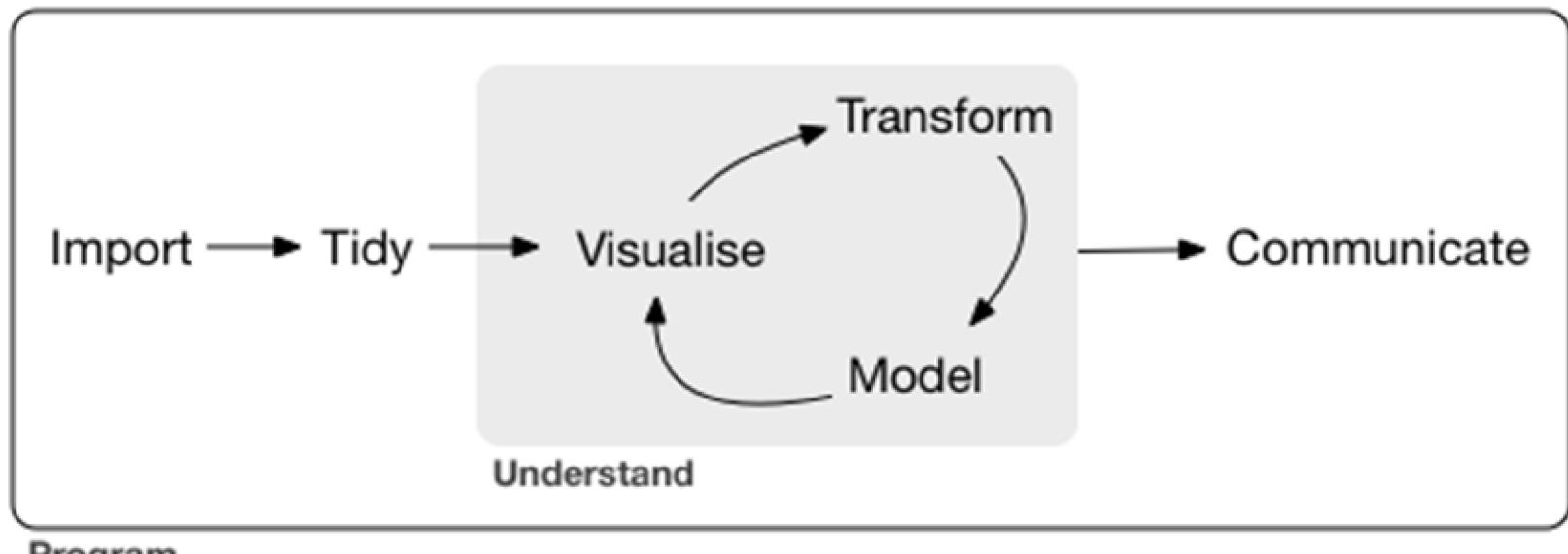
HOME ORGANIZATION TIP:  
JUST GIVE UP.

<https://xkcd.com/1077/>

Your (my) brain is  
lazy, shallow, and  
easily distracted.

<https://www.slideshare.net/CJAtherton/chris-atherton-at-presentation-camp-london>

# Data analysis - THEORY



<https://r4ds.had.co.nz/>

# Data Analysis – In practice....

*(DISCLAIMER: I'm **sure** the experiences recounted here are **unique to me alone.**)*

**Go to email with link to data source...**

*read and respond to 3 other emails...*

**Download and read data into R...**

*stop and answer colleague's question(s)  
about the tidyverse...*

**Wrangle data and plot it...**

# *LUNCH*

*go to an (unrelated) meeting /  
teleconference call.*

# Make better plots.

*follow an interesting link that  
Mara Averick (@dataandme)  
just posted on Twitter*

## Fit preliminary model to data.

## *<Next day>*

Team find problem with data,  
share new version of data.

Change input data and redo analysis.

Check new version against  
previous version.

Discuss findings with my boss.

*file expenses.*

Circulate report.

**DONE!!!**

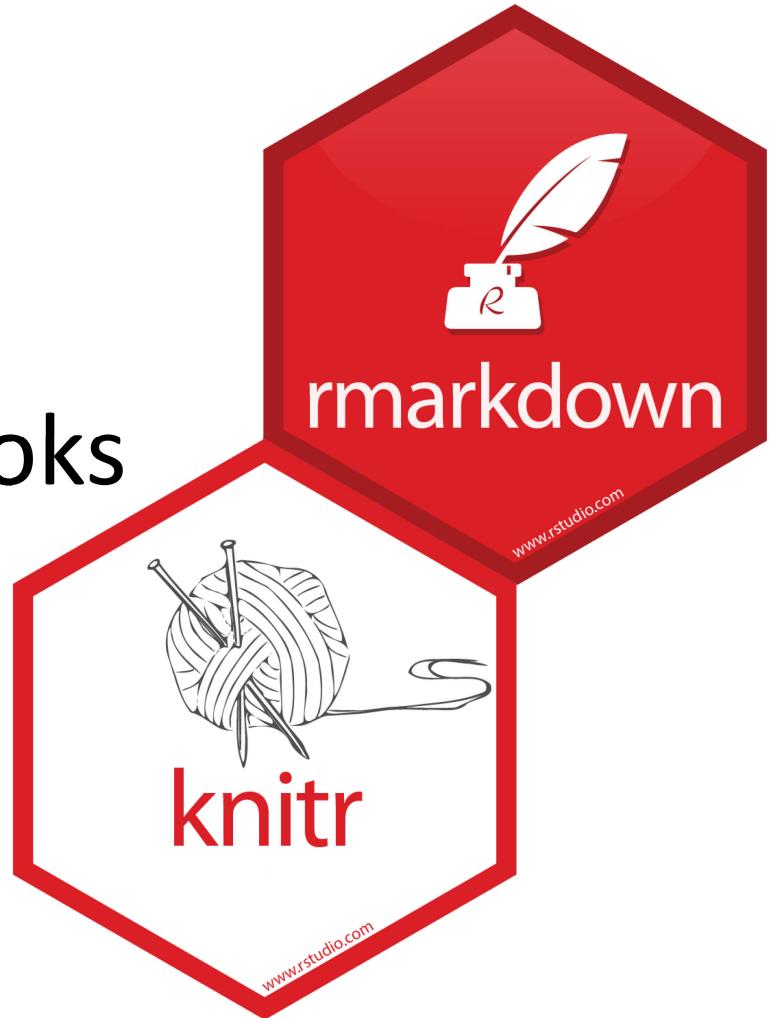
*< 6 months pass >*

Review comments come back...

Wait... Erm... ***WHAT*** was I thinking?

To the rescue...

rmarkdown & notebooks



# Who is your audience?

- Present (distracted) *me*
- Future (6 months later) *me*
- Quantitative colleagues / reviewers
- Decision makers (may not be quantitative)

# Notebooks / markdown **vs** scripts *(for analysis)*



**Mike K Smith** @MikeKSmith · Sep 12

My opinion: If you write more comments (explanation) than code, use rmarkdown. If you write more code than comments, then write more comments and use rmarkdown. [@StatGarrett](#) #earlconf



1



19



101



[Show this thread](#)

BUT, see also: <https://yihui.name/en/2018/09/notebook-war/>

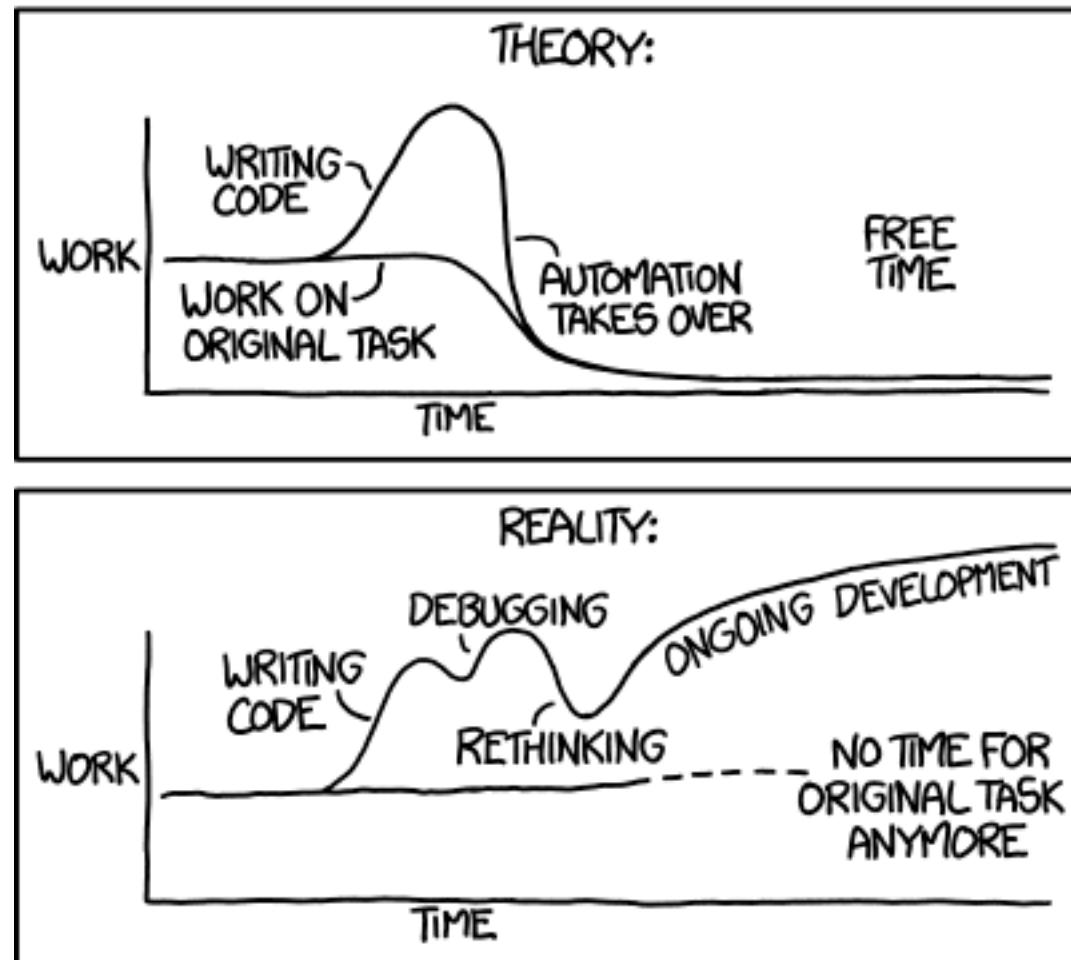
# Also...

I *knew* my manager / other reviewers  
would ask for reports  
on the *THREE* different endpoints.

# Rule of three

- Copy & paste code  $\geq 3$  times?
  - Write and use a function
- Perform analysis across  $\geq 3$  endpoints?
  - Multiple markdown reports?
  - ***NOPE. Parameterised*** reports.

"I SPEND A LOT OF TIME ON THIS TASK.  
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



<https://xkcd.com/1319/>

# YAML header parameters

```
1 ---  
2 title: "Parameterised Report with child documents"  
3 author: "Mike K Smith"  
4 date: "`r format(sys.time(), '%d %B, %Y')`"  
5 params:  
6   endpoint:  
7     value: HAMDTL17  
8     choices:  
9       - HAMDTL17  
10      - HAMATOL  
11      - PGIIMP  
12   quantAudience: FALSE  
13 output:  
14   html_document:  
15     df_print: paged  
16     toc: TRUE  
17     toc_float: TRUE  
18     toc_depth: 4  
19     code_download: TRUE|  
20   pdf_document: default  
21   word_document: default  
22 ---
```

Parameters that can be used in the code / knitr options.

Note that endpoint has only three choices, and a default value (HAMDTL17)

NB. A bit like Shiny inputs

# Render with parameters

The screenshot shows the RStudio interface with a file named "Untitled1.Rmd" open. The code editor displays R Markdown code. A context menu is open over the code at line 6, specifically over the "Knit with Parameters..." option. The menu also includes "Knit to HTML", "Knit to PDF", and "Knit to Word". The RStudio toolbar and menu bar are visible at the top.

```
1 ---  
2 title: "Parameterised report with child documents"  
3 author: "John Doe"  
4 date: "2023-01-01"  
5 params:  
6   quantAudience: FALSE  
7  
8 output:  
9   html_document:  
10    df_print: paged  
11    toc: TRUE  
12    toc_float: TRUE  
13    toc_depth: 4  
14    code_download: TRUE  
15  pdf_document: default  
16  word_document: default  
17 ---  
18 ``{r, echo = FALSE, results = "hide"}  
19 ## Hide code if we're not rendering the report for a quantitative audience.  
20 if(!params$quantAudience)knitr::opts_chunk$set(echo = FALSE)  
21 ``  
22 ---  
23  
24 ---  
25 ---  
26 ---  
27 ---  
28 ---
```

# Render with parameters

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Untitled1\* Parameterised report with child docu... x

Knit Insert Run Addins

```
1 ---  
2 title: "Parameterised Report with child documents"  
3 author: "Mike K Smith"  
4 date: `r format(sys.time(), '%d %B, %Y')`  
5 params:  
6   endpoint:  
7     value: HAMDTL17  
8     choices:  
9       - HAMDTL17  
10      - HAMATOL  
11      - PGIIMP  
12   quantAudience: FALSE  
13 output:  
14   html_document:  
15     df_print: paged  
16     toc: TRUE  
17     toc_float: TRUE  
18     toc_depth: 4  
19     code_download: TRUE  
20   pdf_document: default  
21   word_document: default  
22 ---  
23  
24 ```{r, echo = FALSE, results = 'hide'}  
25 ## Hide code if we're not  
26 if(!params$quantAudience)  
27 ``;  
28  
29  
30 # Aims  
31 This report shows how you  
32 produce reports for multi  
33  
34 ```{r loadTidyverse, warning = FALSE}  
35 library(tidyverse)  
36 library(broom.mixed)  
37 library(nlme)  
38  
39  
40 # Data Source  
41 We're using a publically  
42  
43 * The data is from http://www.ncbi.nlm.nih.gov/geo/  
44 (website accessed 05 June 2018).  
45 * The associated manuscript is  
46  
47 ```{r DataManipulation_sh, eval = TRUE}  
48  
49  
50 ```{r DataManipulation_noshow, eval = !params$quantAudience, message = FALSE, echo = FALSE, results = 'hide'}  
51 knitr::purl("DataManipulation.Rmd")
```

Knit with Parameters

endpoint

HAMDTL17

HAMATOL

PGIIMP

quantAudience

Cancel Knit

params:

endpoint: **HAMDTL17**

quantAudience: FALSE

Parameterised report with child docs : HAMDTL17 - non-quantitative audience

Log In RStudio Connect

Aims  
Data Source  
Outcomes  
Exploratory data analysis  
**Summary Statistics**  
Visualisation  
Analysis  
Appendix 1 - Session information

## Summary Statistics

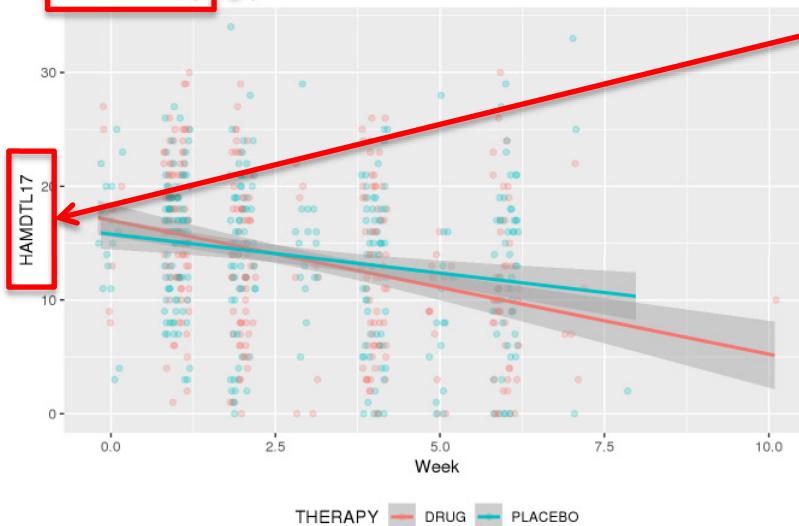
The table below shows mean HAMDTL17 by THERAPY and VISIT.

THERAPY	VISIT	n	mean	sd	range
<chr>	<dbl>	<int>	<dbl>	<dbl>	<chr>
DRUG	4	83	16.72289	6.396099	1 - 30
DRUG	5	76	13.90759	6.911204	0 - 29
DRUG	6	72	11.93056	7.256520	0 - 26
DRUG	7	64	10.46875	7.219833	0 - 30
PLACEBO	4	88	15.68182	5.410473	3 - 27
PLACEBO	5	81	14.30864	7.098665	0 - 34
PLACEBO	6	76	12.73684	6.986403	0 - 29
PLACEBO	7	65	12.00000	7.830230	0 - 33

8 rows

## Visualisation

HAMDTL17 by study week



Using  
**params\$endpoint**  
in markdown text, plot code

```
My Parameterised report with child doc... ModelDiagnostics_text.Rmd DataManipulation_text.Rmd Insert Run Knit ABC
```

```
1 ---  
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3 author: "Mike K Smith"  
4 date: `r format(sys.time(), '%d %B, %Y')`"  
5 params:  
6   endpoint:  
7     value: HAMDTL17  
8     choices:  
9       - HAMDTL17  
10      - HAMATOTL  
11      - PGIIMP  
12   quantAudience: FALSE  
13 output:  
14   html_document:  
15     df_print: paged  
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17     toc_float: TRUE  
18     toc_depth: 4  
19     code_download: TRUE|  
20   pdf_document: default  
21   word_document: default  
22 ---  
23  
24 ```{r, echo = FALSE, results = "hide"}  
25 ## Hide code if we're not rendering the report for a quantitative audience.  
26 if(!params$quantAudience)knitr::opts_chunk$set(echo = FALSE)  
27 ...
```

Knitr options:  
Show code in output **ONLY IF** quantitative audience,

Rename endpoint variable(s) to “outcome” (simplifies later code)

```
```{r DataManipulation, results="hide", message=FALSE, warnings=FALSE}
data <- haven::read_sas("chapter15_example.sas7bdat")

data <- data %>%
  rename_all(funs(
    str_replace(string = ., pattern=params$endpoint, replacement="outcome")
  )) %>%
  bind_cols(data,.) %>%
  drop_na()
````
```

Run this code **ONLY IF** params\$quantAudience = TRUE

```
```{r Show_data, eval = params$quantAudience}
data %>%
  head(10)
````
```

Run **ONLY IF** params\$quantAudience = TRUE, to pull in text *from child document*

```
```{r DataManipulationChildDoc, eval=params$quantAudience,
child="DataManipulation_text.Rmd"}````
```

Content / Parameterised report with child docs : HAMDTL17 - quantitative audience

## Data Source

We're using a publicly available dataset on depression.

- The data is from <https://missingdata.lshtm.ac.uk/category/dia-working-group/example-data-sets/> (Website accessed 05 June 2018).
- The associated manuscript is <https://www.ncbi.nlm.nih.gov/pubmed/15232330>.

```
data <- haven::read_sas("chapter15_example.sas7bdat")

data <- data %>%
  rename_all(funs(
    str_replace(string = ., pattern= params$endpoint, replacement="outcome")
  )) %>%
  bind_cols(data,.) %>%
  drop_na()
```

```
data %>%
  head(10)
```

PATIENT	HAMATOL	PGIIMP	RELDAYS	VISIT	THERAPY	GEND...	POOLINV	basval
1503	21	2	7	4	DRUG	F	006	32
1503	19	2	14	5	DRUG	F	006	32
1503	21	3	28	6	DRUG	F	006	32
1503	17	4	42	7	DRUG	F	006	2
1507	18	3	7	4	PLACEBO	F	006	14
1507	18	2	15	5	PLACEBO	F	006	14
1507	14	3	29	6	PLACEBO	F	006	14
1507	8	2	42	7	PLACEBO	F	006	14
1509	18	3	7	4	DRUG	F	006	21
1509	17	3	14	5	DRUG	F	006	21

1-10 of 10 rows | 1-9 of 22 columns

## Data Manipulations

The data shows post-baseline measurements for subjects on duloxetine and placebo (+paroxetine). Although two doses of duloxetine were given in the study the data has been "anonymised" by randomly sampling from the two different doses.

## Conditional execution of Data Manipulation.

params :

endpoint: HAMDTL17  
quantAudience: TRUE

Code shown

Chunk run

Data shown

Child doc text

Content / Parameterised report with child docs HAMDTL17 - quantitative audience

## Data Source

We're using a publicly available dataset on depression.

- The data is from <https://missingdata.lshtm.ac.uk/category/dia-working-group/example-data-sets/> (Website accessed 05 June 2018).
- The associated manuscript is <https://www.ncbi.nlm.nih.gov/pubmed/15232330>.

```
data <- haven::read_sas("chapter15_example.sas7bdat")

data <- data %>%
  rename_all(funs(
    str_replace(string = ., pattern= params$endpoint, replacement="outcome")
  )) %>%
  bind_cols(data,.) %>%
  drop_na()

data %>%
  head(10)
```

PATIENT	HAMATOTL	PGIIMP	RELDAYS	VISIT	THERAPY	GEND...	POOLINV	basval
1503	21	2	7	4	DRUG	F	006	32
1503	19	2	14	5	DRUG	F	006	32
1503	21	3	28	6	DRUG	F	006	32
1503	17	4	42	7	DRUG	F	006	32
1507	18	3	7	4	PLACEBO	F	006	14
1507	18	2	15	5	PLACEBO	F	006	14
1507	14	3	29	6	PLACEBO	F	006	14
1507	8	2	42	7	PLACEBO	F	006	14
1509	18	3	7	4	DRUG	F	006	21
1509	17	3	14	5	DRUG	F	006	21

1-10 of 10 rows | 1-9 of 22 columns

## Data Manipulations

The data shows post-baseline measurements for subjects on duloxetine and placebo (+paroxetine). Although two doses of duloxetine were given in the study the data has been "anonymised" by randomly sampling from the two different doses.

## Conditional execution of Data Manipulation.

params :

endpoint: **HAMDTL17**

quantAudience: **TRUE**

**RStudio Connect** allows you (or visitor to your page) to specify parameters and render a parameterised report and then to save that report as a named item.

You can then have pre-rendered reports for various audiences ready to go...

# More parameterisation

- Question: Can I pass in parameters from the render command?
  - You betcha! `render(... , params=list( ... ) )`
- Question: how to show correct analysis for non-continuous endpoint?
  - Change analysis type in code depending on `params$endpoint`.
- Question: what to do if something goes wrong in the analysis?
  - Check for errors and handle appropriately using `tryCatch(...)`
  - Insert child document text: “**EMERGENCY!** Something has gone wrong... Contact your data scientist!”

HOW LONG CAN YOU WORK ON MAKING A ROUTINE TASK MORE  
EFFICIENT BEFORE YOU'RE SPENDING MORE TIME THAN YOU SAVE?  
(ACROSS FIVE YEARS)

		HOW OFTEN YOU DO THE TASK					
		50/DAY	5/DAY	DAILY	WEEKLY	MONTHLY	YEARLY
HOW MUCH TIME YOU SHAVE OFF	1 SECOND	1 DAY	2 HOURS	30 MINUTES	4 MINUTES	1 MINUTE	5 SECONDS
	5 SECONDS	5 DAYS	12 HOURS	2 HOURS	21 MINUTES	5 MINUTES	25 SECONDS
	30 SECONDS	4 WEEKS	3 DAYS	12 HOURS	2 HOURS	30 MINUTES	2 MINUTES
	1 MINUTE	8 WEEKS	6 DAYS	1 DAY	4 HOURS	1 HOUR	5 MINUTES
	5 MINUTES	9 MONTHS	4 WEEKS	6 DAYS	21 HOURS	5 HOURS	25 MINUTES
	30 MINUTES		6 MONTHS	5 WEEKS	5 DAYS	1 DAY	2 HOURS
	1 HOUR		10 MONTHS	2 MONTHS	10 DAYS	2 DAYS	5 HOURS
	6 HOURS				2 MONTHS	2 WEEKS	1 DAY
	1 DAY					8 WEEKS	5 DAYS

Feel free to ask  
me questions,  
but remember....

#untidyverse



@MikeKSmith



<https://github.com/MikeKSmith/RStudioConf2019>

