KCL code club - Rmarkdown introduction

Adam Brentnall

26th April 2022

Pre-tutorial instructions

Before the tutorial..

- Watch an overview on what R markdown is for (4m)
  - https://youtu.be/ZzDSkBgt9xQ
- Set up an account on RStudio Cloud
  - https://rstudio.cloud
- Download a data file to your PC for use in session
  - http://web.stanford.edu/~hastie/CASI_files/DATA/kidney.txt
- Session assumes you are familiar with R. If not, try two tutorials:
  - http://mybinder.org/v2/gh/brentnall/r-intro-tutorial/master?urlpath=shiny/tutorial1/Intro.Rmd
  - http://mybinder.org/v2/gh/brentnall/r-intro-tutorial/master?urlpath=shiny/tutorial2/DataAnal.Rmd

Tutorial

R Markdown tutorial

- Aim: develop an R markdown document using some data
  - Assume use R already
- Will use RStudio Cloud in this session
  - Create account here: https://rstudio.cloud

Overview

- R markdown: a way to write documents that integrate R code
  - Text written in markdown
  - Stats code in R
- In this session you will do some tasks
  - Introduce in group
  - Then you work on your own (in breakouts for peer support if needed)
  - Review in group, then next task

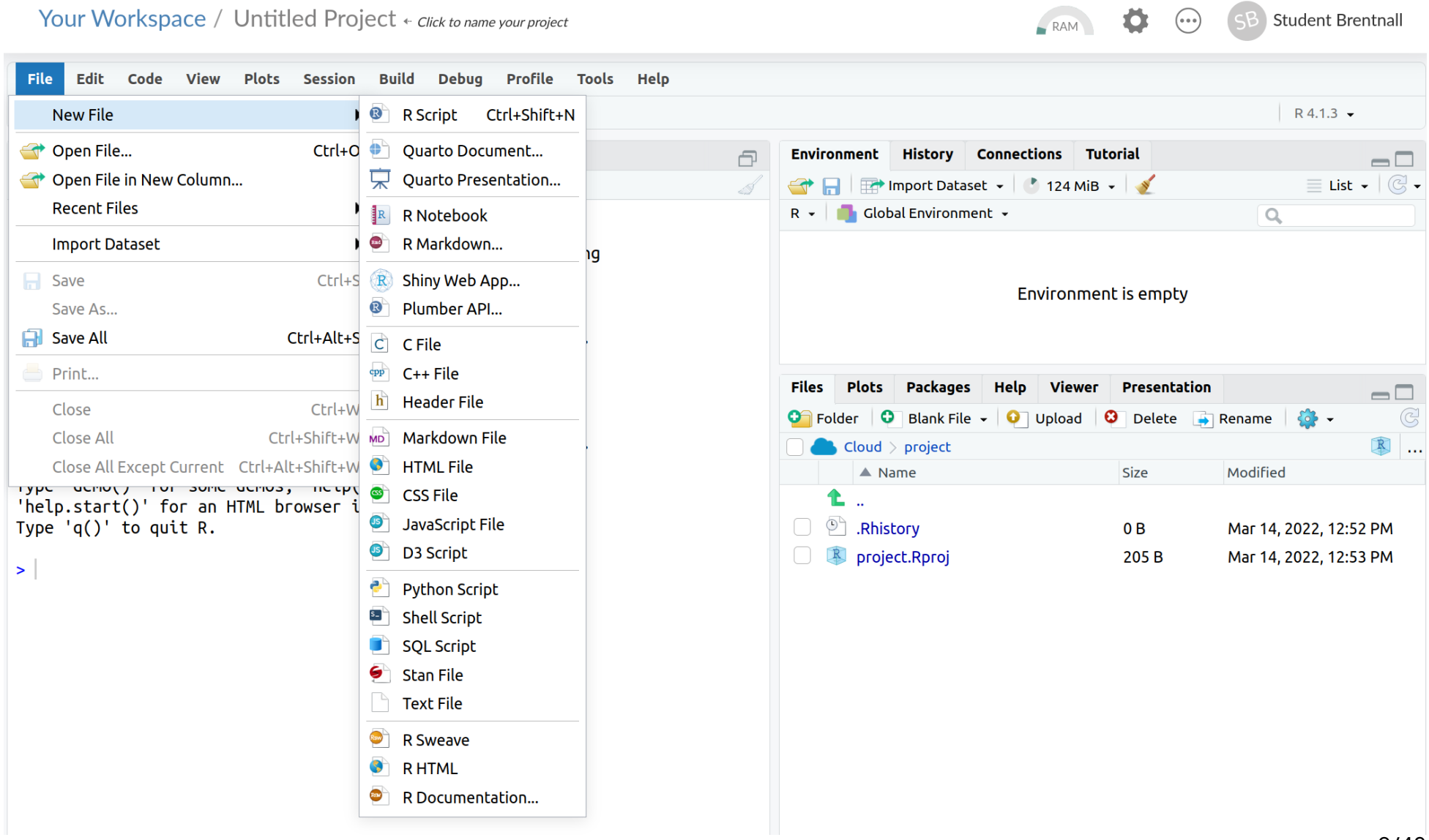
Task 1: create a markdown file and knit it

Step 0: Set up RStudio Cloud

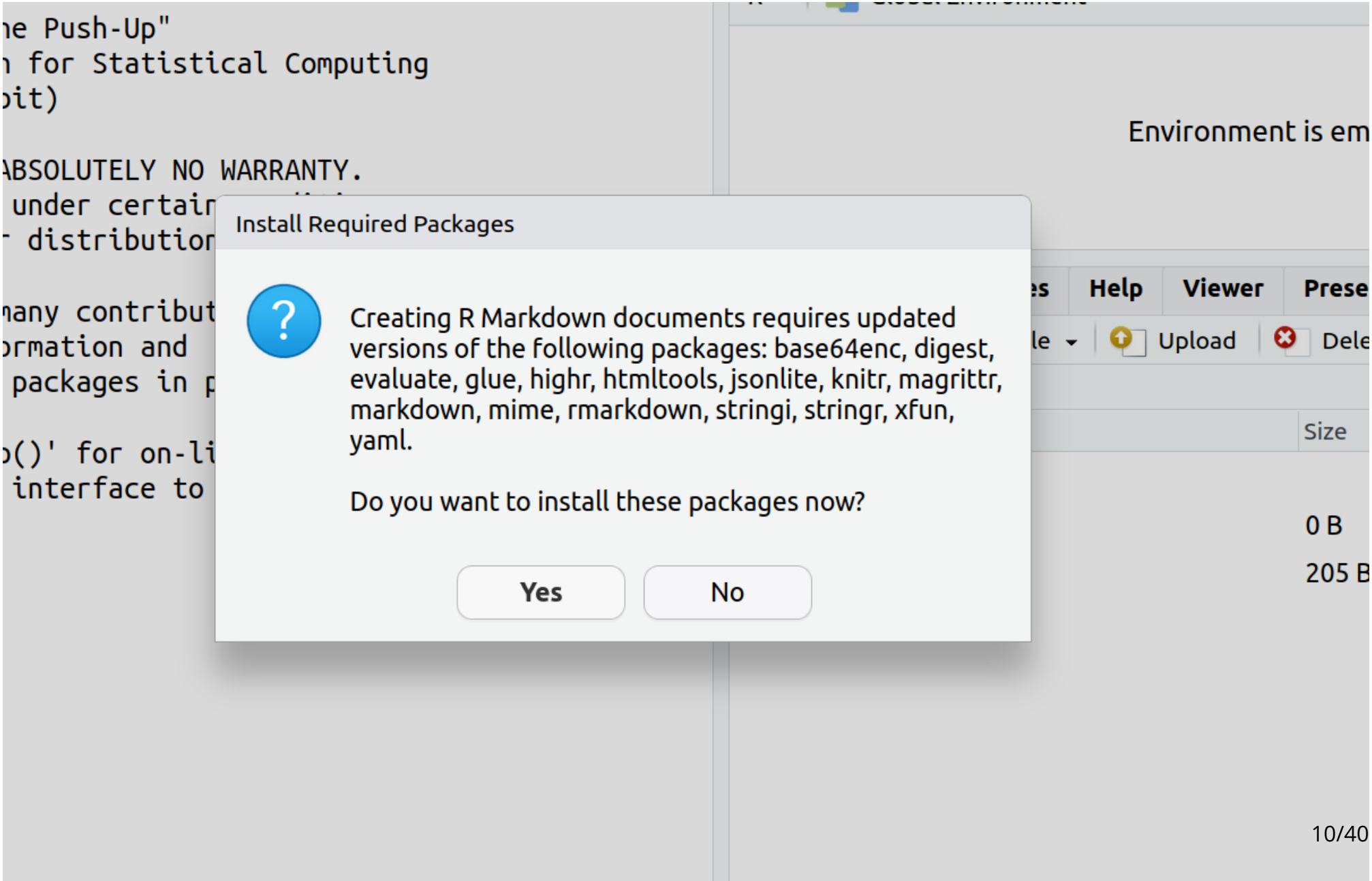
- Go to https://rstudio.cloud
- Create account
- Create new Rstudio project

Step 1: create Rmd file using default from RStudio

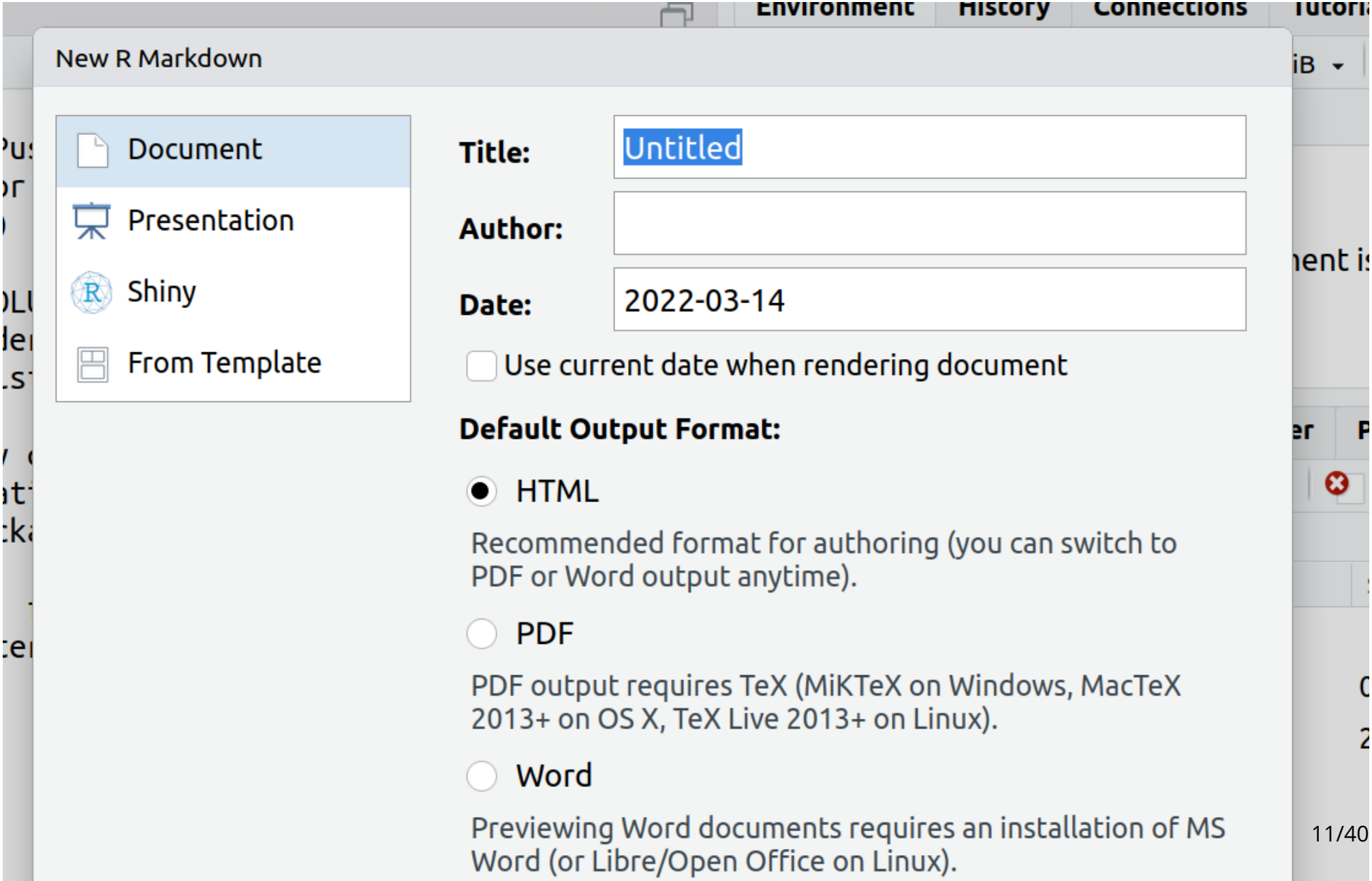
- File > New File > R Markdown



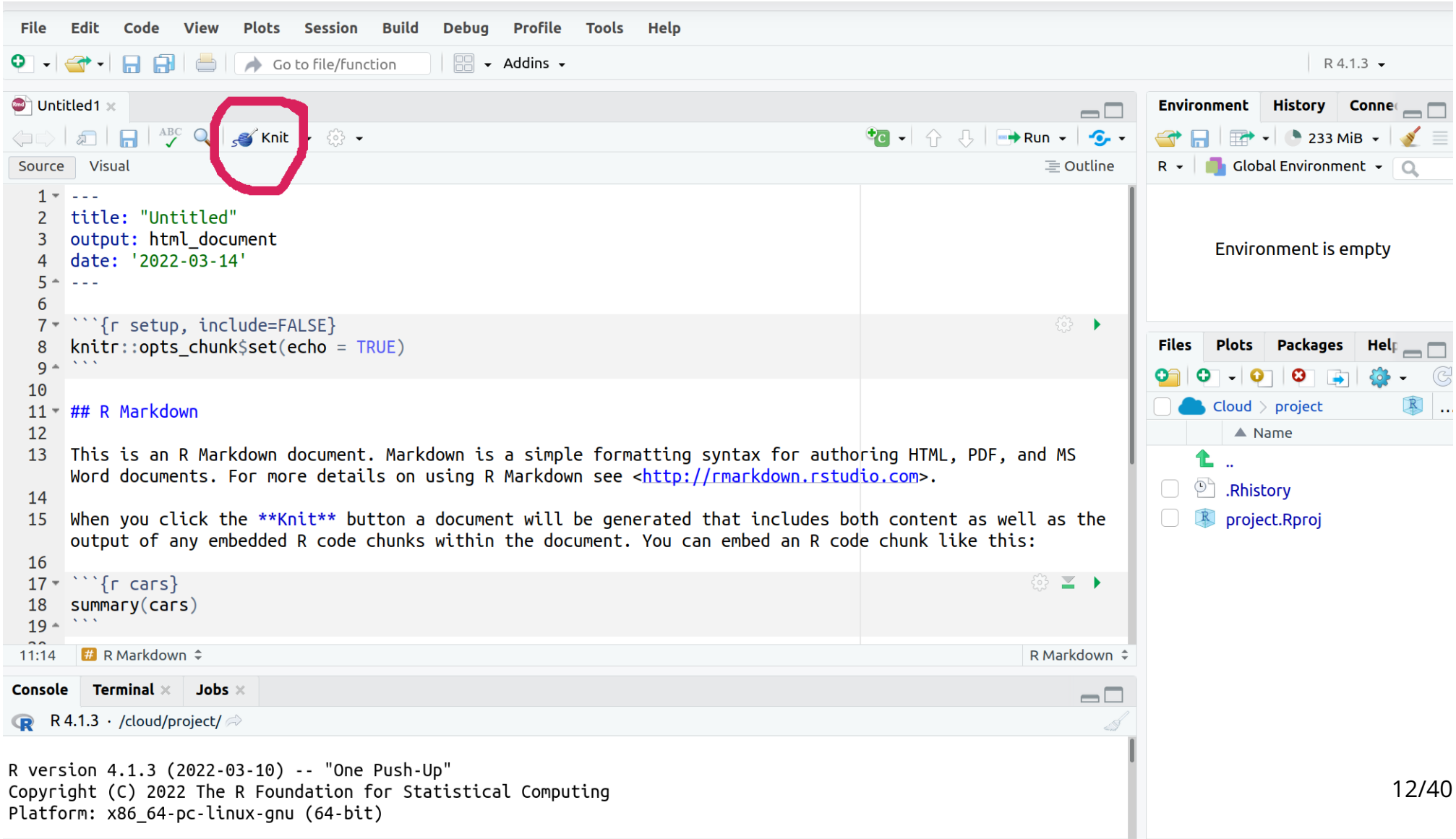
Step 2: install libraries (if asked)



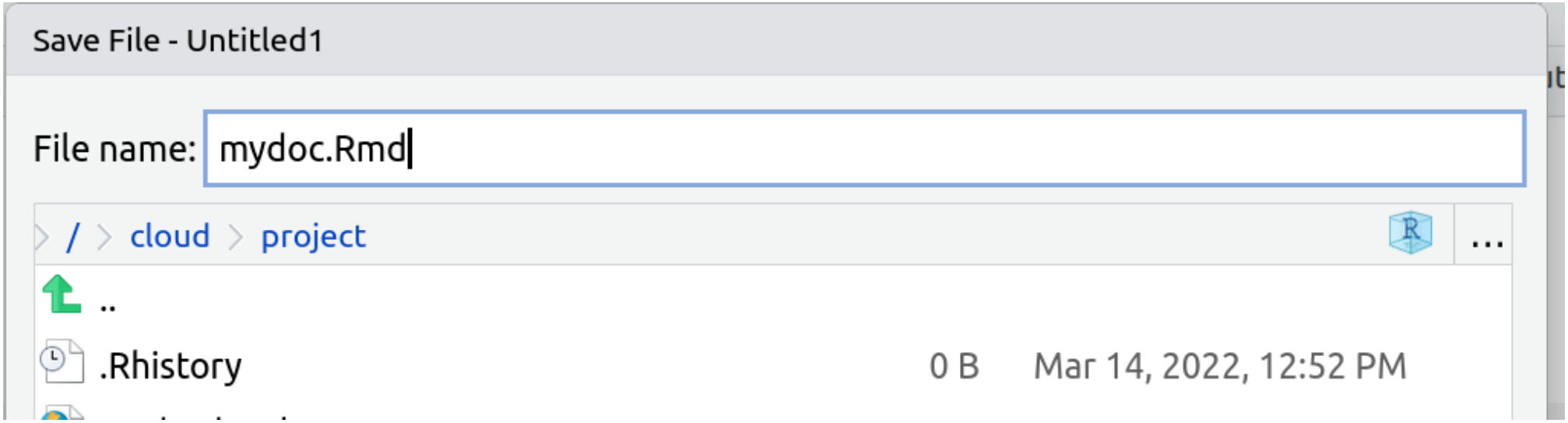
Step 3: choose type (use default)



Step 4: view the markdown file code, and knit it (generate document)



Step 5: after clicking knit, give filename to save (if needed).



Rstudio setup

Step 6: View the rendered document

mydoc

2022-03-14

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:

Step 7: review markdown file vs document

- Hash symbols # in the code define headers;
- R code is in chunks. These always start with ```{r
- The simplest is ```{r} ... ```.
- The R chunks in the document you created include names (eg. ```{r cars} where cars is a name that you can choose. Naming chunks can be useful for debugging

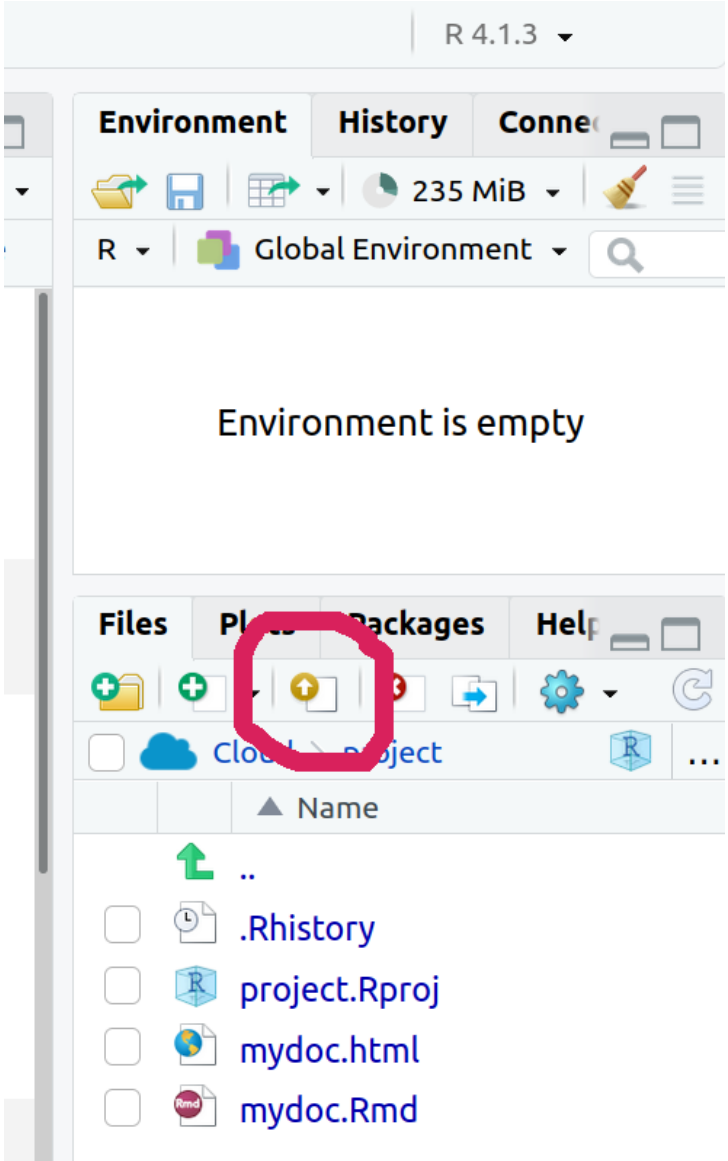
Questions / discussion

Task 2: Load your own data into the markdown document you have created

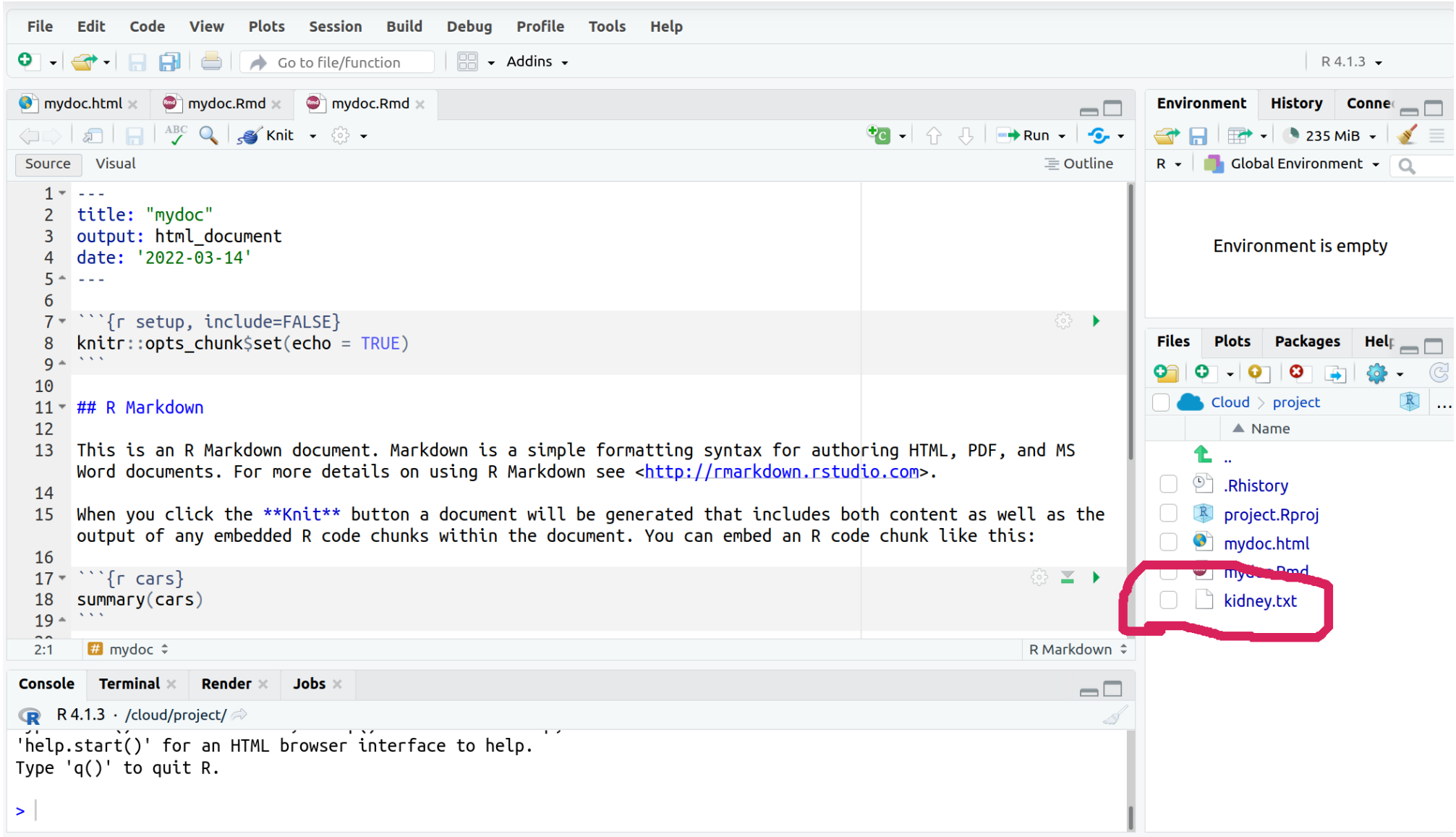
Step 1: Download data to your PC

- Data from the nephrology laboratory of Dr. Brian Myers, Stanford University (http://web.stanford.edu/~hastie/CASI_files/DATA/kidney.txt)
  - download this file to your computer by following link
- Aim to quantify kidney funciton vs age
- 157 healthy volunteers were recruited
- Will generate an Rmarkdown document

Step 2: Load data into RStudio Cloud project (from file you downloaded to your PC)



Step 3: Check the data are loaded



Step 4: Edit your markdown file to load the data and show the first few rows

- To start your document, I suggest to delete all the code ***below*** `## R Markdown` in the code (or add your code below the current code)
- Then create an R segment to load the kidney data using ```` ```{r} ... ``` ````, by including the following R code

```
mydta<-read.csv("kidney.txt", sep=" ") ##load txt file
head(mydta) ##print out first few rows
```

- You may knit the file to view the document

Step 5: Edit your markdown code so that the R commands are not shown in the rendered document

- Can run code without showing it, but displaying the output, by using `echo=FALSE` in the start of the code chunk.
- Task: repeat the code but now show the output but not the code by using ```` ```{r, echo=FALSE} ```` at the start of the chunk (the difference is `echo=FALSE`).

Step 6: Edit your markdown code so that the R commands and R output are hidden in the rendered document

- We can run code without presenting anything in the document by using `include=FALSE` in the start of the code chunk.
- Task: repeat your code to load the data but do not show output or the code by using ```` ```{r, include=FALSE} ```` at the start of the code chunk

Task 2: Questions / discussion

Task 3: Present summary statistics in your markdown document

Step 1: Print out as seen in R

- You may print out to your document R output using a simple ```` ```{r} ... ``` ```` chunk.
- Task: Add the following code below where you loaded the data and knit the document

```
summary(mydta)
```

Step 2: Display a table

- An alternative approach is to format as a table. One function that does this is `kable()`.
- Task: Use the `kable()` function to format the summary statistics as a table, starting the chunk ```` ```{r results='asis'} ````.

```
kable(summary(mydta), caption="", align='r', row.names=FALSE)
```

Step 3: Display a bespoke table

- You can create any table you like in this way.
- Task: Try including the following code and knit your document

```
mytab<-rbind(quantile(mydta$age), quantile(mydta$tot))
rownames(mytab)<-c("Age", "Kidney function")
kable(mytab, caption="Quantile of age and kidney function",
      align='r', row.names=TRUE)
```

- (Recall if you do not wish to display the code in your document then add `echo=FALSE` to the chunk start, eg. ```` ```{r results='asis',echo=FALSE} ````.)

Task 3: Questions / discussion

Task 4: Add some plots to your markdown document

Step 1: Add a scatter plot of age vs kidney function

- Task: add the following command in a plain `r` chunk and render the document

```
plot(mydta$age, mydta$tot, xlab="Age (y)",
     ylab="Measure of kidney function")
```

Step 2: Display a chart or figure by loading a graphics file

- Task A: Save scatter plot as a png file in an `r` chunk

```
png("myplot.png")
plot(mydta$age, mydta$tot, xlab="Age (y)",
     ylab="Measure of kidney function")
dev.off()
```

- Task B: Add the png file as a figure to the markdown text (outside and R code chunk) through

```
![Kidney function vs age](myplot.png)
```

- Knit the document and check it is visible

Task 4: Questions / discussion

Conclusion

Summary

- R Markdown lets you combine your code into a report in a reproducible manner
- Can hide or show what you like in the report
- Can create much more than documents (this presentation done in Rmarkdown too)

Further resources

- Video overview (4m)
  - https://youtu.be/ZzDSkBgt9xQ
- RStudio docs
  - https://rmarkdown.rstudio.com/
- Reference book
  - https://bookdown.org/yihui/rmarkdown
- Cheat sheet
  - https://rmarkdown.rstudio.com/lesson-15.html

Task 5: Homework! Some more analysis

Step 1: Fit a linear model to the data and print out a summary showing R code in your document

- Task: Add the following chunk and knit your document

```
myreg<-lm(tot~age, mydta)
summary(myreg)
```

Step 2: Displaying summary statistics in the text without copying and pasting them

- Task A: calculate and save confidence interval on slope from the linear model in an `r` chunk

```
myci<-format(round( cbind( coef(myreg), confint(myreg)),3), nsmall=3)
mycitxt<-paste0(myci[2,1], " (95%CI", myci[2,2], " to ",
                myci[2,3], ")")
```

- Task B: include the confidence interval in the markdown text by adding

`` `r mycitxt` ``

- Knit the document to check it worked

Step 3: Add some plots from the linear model fit to your report

- Task: Show these plots in your report using techniques shown above

```
## Residuals
plot(myreg,1)
plot(myreg,2)
```