Análisis Demográfico con R

Universidad de la República - Facultad de Ciencias Sociales - Doctorado en Ciencias Sociales

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Sobre el curso

1. Docente

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Profesora de tiempo completo en la Facultad de Ciencias Políticas y Sociales, UNAM. Doctora en Estudios de Población por El Colegio de México y cuenta con nivel I en el Sistema Nacional de Investigadores.

2. Descripción del curso

La demografía utiliza diferentes fuentes de información para el análisis demográfico y los estudios de población. La consulta, la limpieza y la evaluación de los datos demográficos se realiza con distintos softwares, entre los cuales destaca R. Desde el software *R*, la comunidad de usuarios ha creado paquetes y códigos replicables y de fácil acceso que tienen un uso cada vez más extendido en la disciplina. En este curso se utilizarán estos insumos para el caso específico de América Latina y de Uruguay. Es decir, el objetivo general del curso es que el estudiantado sea capaz de aplicar conceptos demográficos y estadísticosm fuentes de información latinoamericana y mundiales, y sobre todo, actuales utilizando *R*.

Para ello, la mecánica del curso consistirá en lo siguiente:

1. La exposición de la facilitadora. Durante la primera parte de la sesión, se expondrán los comandos necesarios para trabajar cada tema. Se dará una introducción sobre la temática y se presentarán ejemplos concretos para facilitar el aprendizaje. Se espera que las personas asistentes expongan sus dudas o comentarios a lo largo de la explicación.

2. Realización de ejercicios prácticos. Al final de cada sesión, corresponderá al estudiantado realizar individualmente o en parejas un ejercicio relacionado con lo visto en la primera parte de la clase.

3. Consulta autónoma de material. Tanto la exposición como los ejercicios serán acompañados de material de consulta preparadopara el curso, de tal manera que el estudiantado pueda volver a los códigos y a las explicaciones posteriormente.

3. Carga horaria

15 horas

4. Créditos

3 (tres)

5. Estructura del curso

Día 1

1. Introducción a R y Rstudio (1 hora)

Objetivo*: que el estudiantado se familiarice con la interfase de trabajo y la programación por objetos, y sea capaz de realizar tareas básicas como crear un script, un proyecto, objetos, ambientes e instalar paqueterías.*

2. Importación de información y primera revisión de fuentes demográficas (2 horas)

a. Importación de información a R en diferentes formatos

b. Importación de información de proyecciones de población utilizando {wppExplorer}

c. Consulta y descarga de información con paquetes como {IPUMSr}, {WDI} y otras API

Objetivo: *que el estudiantado sea capaz de: importar información desde diferentes formatos (.txt, .csv, .xlsx, .dta, .dbf) a R, así como de exportar sus resultados en estos formatos; revisar de manera preliminar los objetos de tipo "data.frame", funciones "glimpse()", "skim() de {skimr}; manejar etiquetas; hacer subconjuntos de información, y consultas.*

Día 2

3. Evaluación de información (1.5 horas)

a. Tipo de de errores en las fuentes de información

b. Evaluación de la calidad de información en fuentes de stock

c. Suavizamiento de datos

Objetivo: *Que el estudiantado pueda identificar los errores en el levantamiento de información y su naturaleza, adquiriendo capacidades para corregir y suavizar datos para el análisis estadístico con el paquete {DemoTools} y otras aplicaciones.*

4. Pirámides y diagramas de Lexis (1.5 horas)

a. Pirámides de población: crear una función

b. Hacer múltiples pirámides y automatización

c. Diagramas Lexis

Objetivo: *que el estudiantado sea capaz de crear y utilizar funciones específicas para el análisis demográfico, crear pirámides y la colocar eventos en el diagrama de Lexis*

<u>Día 3</u>

5. Crecimiento y tasas (3 horas)

a. Estandarización de tasas y gráficos de crecimiento, manejo de series de tiempo

b. Cálculos automatizados de población media

c. Cálculo de tasas de natalidad y mortalidad

d. Descomposición del cambio de tasas de natalidad y mortalidad según Kitagawa

Objetivo: *que el estudiantado sea capaz de calcular tasas brutas, tasas específicas y descomponerlas utilizando R.*

<u>Día 4</u>

6. Tasa de fecundidad con datos de encuestas (1.5 horas)

Objetivo: *que el estudiantado sea capaz de calcular tasas brutas y específicas de fecundidad con encuestas de hogares.*

7. Visualización de flujos migratorios (1.5 horas)

Objetivo: *que el estudiantado sea capaz de hacer gráficos de flujos con el paquete {migest} y gráficos aluviales.*

<u>Día 5</u>

8. Tablas de vida y esperanza de vida (3 horas)

a. Construcción de tabla de vida a "mano"

b. Construcción con {DemoTools}

Objetivo: *que el estudiantado sea capaz de calcular la tabla de vida con utilizando el paquete DemoTools*

6. Evaluación

· Entrega de un trabajo final que reúna lo trabajado en la instancia de práctica a lo largo de las cinco sesiones.

· La asistencia al 80% de las sesiones prácticas.

7. Bibliografía

El material guía construido por la facilitadora, que estará en este sitio web, será la bibliografía principal. Además se listan algunos insumos:

CEPAL, NU. 2014. "Los datos demográficos: alcances, limitaciones y métodos de evaluación".

Escoto, Ana. 2019. "Lexis en R". 2019.https://rstudio-pubs-static.s3.amazonaws.com/473169_a1348dd47070497a80fb2c0dc89e86e9.html.

Escoto Castillo, Ana Ruth. (2022) 2022. "aniuxa/paquetes_demogRaficos". R.https://github.com/aniuxa/paquetes_demogRaficos.

Moultrie, Tom, Rob Dorrington, Allan Hill, Kenneth Hill, Lan Timaeus, y Basia Zaba. 2013. *Tools for Demographic Estimation*. France: International Union for the Scientific Study of Population (IUSSP).

Poston, Dudley L., y Michael Micklin, eds. 2005. *Handbook of population*. Handbooks of sociology and social research. New York: Kluwer Academic/Plenum.

"PPgp/wpp2022". (2022) 2024. R. Probabilistic Projections Group.https://github.com/PPgp/wpp2022.

Pressat, Roland. 2000. *El análisis demográfico: métodos, resultados, aplicaciones*. Traducido por Tatiana Sule Hernández. México: Fondo de Cultura Económica.

Preston, Samuel H., Patrick Heuveline, y Michel Guillot. 2001. *Demography: measuring and modeling population processes*. Malden, MA: Blackwell Publishers.

Pujol, José Miguel. 1985. "Nuevas metodologías para evaluar y ajustar datos demográficos", diciembre.https://repositorio.cepal.org/handle/11362/12578.

Riffe, Tim. (2017) 2024. "timriffe/DemoTools". R.https://github.com/timriffe/DemoTools.

Rodríguez, Germán. s/f. "Demographic Methods".https://grodri.github.io/demography/.

Sevcikova, Hana, Adrian Raftery, y Thomas Buettner. 2023. "bayesPop: Probabilistic Population Projection".https://cran.r-project.org/web/packages/bayesPop/index.html.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the Tidyverse". *Journal of Open Source Software* 4 (43): 1686.https://doi.org/10.21105/joss.01686.

Wickham, Hadley, y Garrett Grolemund. 2016. *R for data science: import, tidy, transform, visualize, and model data.* O'Reilly Media, Inc.

Instalación de R y Rstudio

Introducción a R

https://youtu.be/YkN5urybh2A

Instalación en OS

1. Necesito que instalen la versión más nueva de R: Download R-4.4.0 of MAC. *The R-project for statistical computing.* https://cran.r-project.org/bin/macosx/

Elije la versión de acuerdo a tu procesador, intel o ARM.

2. Instalar también las herramientas Quartz, xcode y fortran

- https://www.xquartz.org/
- https://developer.apple.com/xcode/resources/
- https://mac.r-project.org/tools/gfortran-12.2-universal.pkg

3. Después de eso instalar el Rstudio, que hoy se encuentra alojado en el sitio posit, que vaya acorde con MAC

https://posit.co/download/rstudio-desktop/

Algunas indicaciones en video, pero son algo viejitas y pueden cambiar las versiones de R.

https://youtu.be/icWV8jzYOtA

Algunas indicaciones en video, pero son algo viejitas y pueden cambiar las versiones de R.

Instalación en PC

1. Necesito que instalen la versión más nueva de R: Download R-4.4.0 for Windows. *The R-project for statistical computing.* https://cran.r-project.org/bin/windows/base/
2. Instalar también la herramienta RTools https://cran.r-project.org/bin/windows/Rtools/rtools44/rtools.html
3. Después de eso instalar el Rstudio, que hoy se encuentra alojado en el sitio posit, que vaya acorde con Windows https://posit.co/download/rstudio-desktop/

Algunas indicaciones en video, pero son algo viejitas y pueden cambiar las versiones de R.

https://youtu.be/TNSQikMfgJI

Ojo

Desde octubre de 2022, RStudio se volvió **"Posit"**

1 Introducción a R y Rstudio

1.1 Primer acercamiento al uso del programa

Usaremos la IDE RStudio — pronto habrá *positron*

En RStudio de *posit* podemos tener varias ventanas que nos permiten tener más control de nuestro "ambiente", el historial, los *scripts¨ o códigos que escribimos y por supuesto, tenemos nuestra consola, que también tiene el símbolo `>`

Podemos pedir operaciones básicas

```
2+5
```

```
[1] 7
```

```
5*3
```

```
[1] 15
```

```
#Para escribir comentarios y que no los lea como operaciones ponemos el símbolo de gato
## Lo podemos hacer para un comentario en una línea o la par de una instrucción
1:5                ## Secuencia 1-5
```

```
[1] 1 2 3 4 5
```

```
seq(1, 10, 0.5)    ## Secuencia con incrementos diferentes a 1
```

```
 [1]  1.0  1.5  2.0  2.5  3.0  3.5  4.0  4.5  5.0  5.5  6.0  6.5  7.0  7.5  8.0
[16]  8.5  9.0  9.5 10.0
```

```
c('a','b','c')  ## Vector con caracteres
```

```
[1] "a" "b" "c"
```

```r
1:7              ## Entero
```

```
[1] 1 2 3 4 5 6 7
```

```r
40<80            ## Valor logico
```

```
[1] TRUE
```

```r
2+2 == 5         ## Valor logico
```

```
[1] FALSE
```

```r
T == TRUE        ## T expresion corta de verdadero
```

```
[1] TRUE
```

R es un lenguaje de programación por objetos. Por lo cual vamos a tener objetos a los que se les asigna su contenido. Si usamos una flechita `<-` o `->` le estamos asignando algo al objeto que apunta la flecha.

```r
x <- 24          ## Asignacion de valor 24 a la variable x para su uso posterior (OBJETO)
x/2              ## Uso posterior de variable u objeto x
```

```
[1] 12
```

```r
x                ## Imprime en pantalla el valor de la variable u objeto
```

```
[1] 24
```

```r
x <- TRUE        ## Asigna el valor logico TRUE a la variable x OJO: x toma el ultimo valor
x
```

```
[1] TRUE
```

1.1.1 Vectores

Los vectores son uno de los objetos más usados en R.

```r
y <- c( 2, 4, 6)      ## Vector numerico
y <- c('Primaria', 'Secundaria') ## Vector caracteres
```

Dado que poseen elementos, podemos también observar y hacer operaciones con sus elementos, usando `[ ]` para acceder a ellos

```r
y[2]              ## Acceder al segundo valor del vector y
```

```
[1] "Secundaria"
```

```r
y[3] <- 'Preparatoria y más' ## Asigna valor a la tercera componente del vector
sex <-1:2         ## Asigna a la variable sex los valores 1 y 2
names(sex) <- c("Femenino", "Masculino") ## Asigna nombres al vector de elementos sexo
sex[2]            ## Segundo elemento del vector sex
```

```
Masculino
        2
```

1.1.2 Funciones

Algunas funciones básicas son las siguientes. Vamos a ir viendo más funciones, pero para entender cómo *funcionan*, haremos unos ejemplos y cómo pedir ayuda sobre ellas.

```r
sum( 10, 20, 30)    ## Función suma
```

```
[1] 60
```

```r
rep( 'R',  times=3) ## Repite la letra R el numero de veces que se indica
```

```
[1] "R" "R" "R"
```

```r
sqrt(9)           ## Raiz cuadrada de 9
```

```
[1] 3
```

1.1.3 Indentación

En otros paquetes la indentación es muy importante (i.e. Python). En R no es necesario

```r
sum( 10, 20, 30)
```

```
[1] 60
```

```r
sum(10,
    20,
    30)
```

```
[1] 60
```

1.1.4 Ayuda

Pedir ayuda es indispensable para aprender a escribir nuestros códigos. A prueba y error, es el mejor sistema para aprender. Podemos usar la función help, example y ?

```r
help(sum)     ## Ayuda sobre función sum
?sum()        ## ídem
example(sum) ## Ejemplo de función sum
```

```
sum> ## Pass a vector to sum, and it will add the elements together.
sum> sum(1:5)
[1] 15

sum> ## Pass several numbers to sum, and it also adds the elements.
sum> sum(1, 2, 3, 4, 5)
[1] 15

sum> ## In fact, you can pass vectors into several arguments, and everything gets added.
sum> sum(1:2, 3:5)
[1] 15

sum> ## If there are missing values, the sum is unknown, i.e., also missing, ....
sum> sum(1:5, NA)
[1] NA
```

```
sum> ## ... unless  we exclude missing values explicitly:
sum> sum(1:5, NA, na.rm = TRUE)
[1] 15
```

1.1.5 Mi ambiente

Todos los objetos que hemos declarado hasta ahora son parte de nuestro "ambiente" (environment). Para saber qué está en nuestro ambiente usamos el comando

```
ls()
```

```
[1] "has_annotations" "pandoc_dir"      "quarto_bin_path" "sex"
[5] "x"               "y"
```

```
gc()           ## Garbage collection, reporta memoria en uso
```

```
          used (Mb) gc trigger (Mb) limit (Mb) max used (Mb)
Ncells  628439 33.6    1354192 72.4         NA  1354192 72.4
Vcells 1176937  9.0    8388608 64.0      16384  1962707 15.0
```

Para borrar todos nuestros objetos, usamos el siguiente comando, que equivale a usar la escobita de la venta de environment

```
rm(list=ls())  ## Borrar objetos actuales
```

1.2 Directorio de trabajo

Es muy útil saber dónde estamos trabajando y donde queremos trabajar. Por eso podemos utilizar los siguientes comandos para saberlo

Ojo, checa, si estás desdes una PC, cómo cambian las " " por"/" o por "\"

```
getwd()           # Directorio actual
```

```
[1] "/Users/anaescoto/Dropbox/2024/R_UY/r_demo_uy"
```

```r
list.files()      # Lista de archivos en ese directorio
```

```
 [1] "LICENSE"                 "Mi_Exportación.xlsx"    "MiprimerAmbiente.RData"
 [4] "P1.html"                 "P1.qmd"                 "P1.rmarkdown"
 [7] "P1_files"                "P2.qmd"                 "README.md"
[10] "_quarto.yml"             "códigos"                "datos"
[13] "docs"                    "index.html"             "index.qmd"
[16] "instala.html"            "instala.qmd"            "ipums.R"
[19] "ipumsi_00016.R"          "ipumsi_00016.dat.gz"    "ipumsi_00016.xml"
[22] "otros.qmd"               "r_demo_uy.Rproj"        "r_demo_uy2"
[25] "site_libs"
```

1.3 Proyectos

Pero… a veces preferimos trabajar en proyectos, sobre todo porque nos da más control.

Hay gente que lo dice mejor que yo, como Hadley Wickham: https://es.r4ds.hadley.nz/08-workflow-projects.html

Hagamos un proyecto. Este proyecto debe tener **adentro** una carpeta que se llame datos.

Descarga algunos de los datos que usaremos en el curso acá

1.4 Instalación de paquetes

Los paquetes son útiles para realizar funciones especiales. La especialización de paquetes es más rápida en R que en otros programas por ser un software libre.

```r
#install.packages("foreign", dependencies = TRUE)
#install.packages("haven", dependencies = TRUE)
```

Este proceso no hay que hacerlo siempre. Si no sólo la primera vez. Una vez instalado un paquete, lo llamamos con el comando `library()`

```r
library(foreign)
library(haven)
```

`{foreing}` nos permite leer archivos en formato de dBase, con extensión `.dbf`. Si bien no es un formato muy común para los investigadores, sí para los que generan la información, puesto que dBase es uno de los principales programas de administración de bases de datos.

He puesto un ejemplo de una base de datos mexicana en dbf, en este formato.

```
ejemplo_dbf<-foreign::read.dbf("datos/ejemplo_dbf.DBF") #checa cómo nos vamos adentro de n
```

1.5 Paquete {pacman}

En general, cuando hacemos nuestro código querremos verificar que nuestras librerías estén instaladas. Si actualizamos nuestro R y Rstudio es probable (sobre todo en MAC) que hayamos perdido alguno.

Este es un ejemplo de un código. Y vamos a introducir un paquete muy útil llamado "pacman"

```
if (!require("pacman")) install.packages("pacman") # instala pacman si se requiere
```

```
Cargando paquete requerido: pacman
```

```
pacman::p_load(tidyverse,
               readxl,
               writexl,
               haven,
               sjlabelled,
               foreign,
               WDI,
               remotes)
```

1.6 Instalación de paquetes en desarrollo

Además de los paquetes que están en CRAN, hay otros repositorios desde los cuáles podemos instalar el código. Un paquete que utilizaremos mucho, es el paquete {wpp2022}

```
remotes::install_github("PPgp/wpp2022")
```

```
Skipping install of 'wpp2022' from a github remote, the SHA1 (a45518ac) has not changed sinc
  Use `force = TRUE` to force installation
```

1.7 Dataframes con el paquete {WDI}

Instalamos anteriormente el paquete {WDI} que nos da acceso a un grupo amplio de bases de datos que nos ayudaran a revisar y analizar algunas técnicas sencillas.

> El Banco Mundial pone a disposición una gran cantidad de datos excelentes de los Indicadores de Desarrollo Mundial a través de su API web. El paquete WDI para R facilita la búsqueda y descarga de series de datos desde WDI".

Para saber un poco más de esta librería:

- https://cran.r-project.org/web/packages/WDI/WDI.pdf
- https://www.r-project.org/nosvn/pandoc/WDI.html
- https://databank.worldbank.org/reports.aspx?source=2&country=ARE

```r
WDI::WDIsearch('gender')
```

```
                                   indicator
169                              2.3_GIR.GPI
172                              2.6_PCR.GPI
709                         5.51.01.07.gender
1573                    BI.EMP.PWRK.PB.FE.ZS
1575                    BI.EMP.PWRK.PB.MA.ZS
1587                    BI.EMP.TOTL.PB.FE.ZS
1589                    BI.EMP.TOTL.PB.MA.ZS
1712                       BI.WAG.PREM.PB.FE
1716                       BI.WAG.PREM.PB.FM
1717                    BI.WAG.PREM.PB.FM.ED
1718                    BI.WAG.PREM.PB.FM.HE
1719                    BI.WAG.PREM.PB.FM.PA
1723                       BI.WAG.PREM.PB.MA
1735                    BI.WAG.PREM.PV.FM.ED
1736                    BI.WAG.PREM.PV.FM.HE
1737                       BI.WAG.PRVS.ED.FM
1740                       BI.WAG.PRVS.HE.FM
1744                       BI.WAG.PUBS.ED.FM
1747                       BI.WAG.PUBS.HE.FM
1748                       BI.WAG.PUBS.PA.FM
2202                             CC.ESG.AGFE
2203                             CC.ESG.AGMA
2204                             CC.ESG.CMFE
```

2205	CC.ESG.CMMA
2206	CC.ESG.CNFE
2207	CC.ESG.CNMA
2208	CC.ESG.EUFE
2209	CC.ESG.EUMA
2210	CC.ESG.FBFE
2211	CC.ESG.FBMA
2212	CC.ESG.INFE
2213	CC.ESG.INMA
2214	CC.ESG.MAFE
2215	CC.ESG.MAMA
2216	CC.ESG.MIFE
2217	CC.ESG.MIMA
2218	CC.ESG.OSFE
2219	CC.ESG.OSMA
2220	CC.ESG.PAFE
2221	CC.ESG.PAMA
2222	CC.ESG.PSFE
2223	CC.ESG.PSMA
2224	CC.ESG.SEFE
2225	CC.ESG.SEMA
2226	CC.ESG.TCFE
2227	CC.ESG.TCMA
2296	CC.ISG.FFFE
2297	CC.ISG.FFMA
2298	CC.ISG.NAFE
2299	CC.ISG.NAMA
2300	CC.ISG.NBFE
2301	CC.ISG.NBMA
6251	FB.FCP.BREG.PR.DI.SC
8632	IC.REG.PRRT.LNDADM.GEN.XD.030.DB1719.DFRN
8904	IQ.CPA.GNDR.XQ
9755	JI.WAG.GNDR
9756	JI.WAG.GNDR.HE
9757	JI.WAG.GNDR.LE
9758	JI.WAG.GNDR.OL
9759	JI.WAG.GNDR.RU
9760	JI.WAG.GNDR.UR
9761	JI.WAG.GNDR.YG
14651	PRJ.MYS.15UP.GPI
14667	PRJ.MYS.25UP.GPI
15164	SE.ADT.1524.LT.FM.ZS
15175	SE.ENR.PRIM.FM.ZS

15177	SE.ENR.PRSC.FM.ZS
15178	SE.ENR.SECO.FM.ZS
15180	SE.ENR.TERT.FM.ZS
15998	SG.LAW.CRDD.GR
16011	SG.LAW.NODC.HR
16027	SG.NOD.CONS
17766	SPI.D3.5.GEND
18119	UIS.AIR.1.GLAST.GPIA
18120	UIS.AIR.2.GPV.GLAST.GPIA
18129	UIS.CR.1.GPIA
18137	UIS.CR.1.Q1.GPIA
18144	UIS.CR.1.Q2.GPIA
18151	UIS.CR.1.Q3.GPIA
18158	UIS.CR.1.Q4.GPIA
18165	UIS.CR.1.Q5.GPIA
18172	UIS.CR.1.RUR.GPIA
18177	UIS.CR.1.RUR.Q1.GPIA
18181	UIS.CR.1.RUR.Q2.GPIA
18185	UIS.CR.1.RUR.Q3.GPIA
18189	UIS.CR.1.RUR.Q4.GPIA
18193	UIS.CR.1.RUR.Q5.GPIA
18199	UIS.CR.1.URB.GPIA
18204	UIS.CR.1.URB.Q1.GPIA
18208	UIS.CR.1.URB.Q2.GPIA
18212	UIS.CR.1.URB.Q3.GPIA
18216	UIS.CR.1.URB.Q4.GPIA
18220	UIS.CR.1.URB.Q5.GPIA
18228	UIS.CR.2.GPIA
18236	UIS.CR.2.Q1.GPIA
18243	UIS.CR.2.Q2.GPIA
18250	UIS.CR.2.Q3.GPIA
18257	UIS.CR.2.Q4.GPIA
18264	UIS.CR.2.Q5.GPIA
18271	UIS.CR.2.RUR.GPIA
18276	UIS.CR.2.RUR.Q1.GPIA
18280	UIS.CR.2.RUR.Q2.GPIA
18284	UIS.CR.2.RUR.Q3.GPIA
18288	UIS.CR.2.RUR.Q4.GPIA
18292	UIS.CR.2.RUR.Q5.GPIA
18298	UIS.CR.2.URB.GPIA
18303	UIS.CR.2.URB.Q1.GPIA
18307	UIS.CR.2.URB.Q2.GPIA
18311	UIS.CR.2.URB.Q3.GPIA

18315	UIS.CR.2.URB.Q4.GPIA
18319	UIS.CR.2.URB.Q5.GPIA
18327	UIS.CR.3.GPIA
18335	UIS.CR.3.Q1.GPIA
18342	UIS.CR.3.Q2.GPIA
18349	UIS.CR.3.Q3.GPIA
18356	UIS.CR.3.Q4.GPIA
18363	UIS.CR.3.Q5.GPIA
18370	UIS.CR.3.RUR.GPIA
18375	UIS.CR.3.RUR.Q1.GPIA
18379	UIS.CR.3.RUR.Q2.GPIA
18383	UIS.CR.3.RUR.Q3.GPIA
18387	UIS.CR.3.RUR.Q4.GPIA
18391	UIS.CR.3.RUR.Q5.GPIA
18397	UIS.CR.3.URB.GPIA
18402	UIS.CR.3.URB.Q1.GPIA
18406	UIS.CR.3.URB.Q2.GPIA
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18414	UIS.CR.3.URB.Q4.GPIA
18418	UIS.CR.3.URB.Q5.GPIA
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18473	UIS.EA.3T8.AG25T99.GPIA
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18493	UIS.EA.6T8.AG25T99.GPIA
18500	UIS.EA.7T8.AG25T99.GPIA
18504	UIS.EA.8.AG25T99.GPIA
18517	UIS.EA.S1T8.AG25T99.GPIA
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18528	UIS.ESG.LOWERSEC.GPIA
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18536	UIS.ESG.LOWERSEC.NCOG.ENJO.GPI
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18584	UIS.GAR.5T8.Q2.GPIA
18591	UIS.GAR.5T8.Q3.GPIA
18598	UIS.GAR.5T8.Q4.GPIA
18605	UIS.GAR.5T8.Q5.GPIA
18612	UIS.GAR.5T8.RUR.GPIA
18617	UIS.GAR.5T8.RUR.Q1.GPIA

18621	UIS.GAR.5T8.RUR.Q2.GPIA
18625	UIS.GAR.5T8.RUR.Q3.GPIA
18629	UIS.GAR.5T8.RUR.Q4.GPIA
18633	UIS.GAR.5T8.RUR.Q5.GPIA
18639	UIS.GAR.5T8.URB.GPIA
18644	UIS.GAR.5T8.URB.Q1.GPIA
18648	UIS.GAR.5T8.URB.Q2.GPIA
18652	UIS.GAR.5T8.URB.Q3.GPIA
18656	UIS.GAR.5T8.URB.Q4.GPIA
18660	UIS.GAR.5T8.URB.Q5.GPIA
18667	UIS.GCS.LOWERSEC.COG.GPIA
18670	UIS.GCS.LOWERSEC.GPIA
18674	UIS.GCS.LOWERSEC.NCOG.FREE.GPI
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18678	UIS.GCS.LOWERSEC.NCOG.GEQU.GPI
18679	UIS.GCS.LOWERSEC.NCOG.GEQU.M
18682	UIS.GCS.LOWERSEC.NCOG.GLOC.GPI
18686	UIS.GCS.LOWERSEC.NCOG.MULT.GPI
18690	UIS.GCS.LOWERSEC.NCOG.PEAC.GPI
18694	UIS.GCS.LOWERSEC.NCOG.SDEV.GPI
18698	UIS.GCS.LOWERSEC.NCOG.SJUS.GPI
18702	UIS.GER.0.GPIA
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18708	UIS.GER.02.GPIA
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18717	UIS.GER.1T6.GPI
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18742	UIS.ICTSKILLATTACH.GPIA
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18762	UIS.ICTSKILLFORMULA.GPIA
18766	UIS.ICTSKILLPROGLANG.GPIA
18770	UIS.ICTSKILLSOFTWARE.GPIA
18774	UIS.ICTSKILLTRANSFERFILE.GPIA
18793	UIS.LR.AG15T24.GPIA
18798	UIS.LR.AG15T24.RUR.GPIA

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18825	UIS.LR.AG25T64.RUR.GPIA
18829	UIS.LR.AG25T64.URB.GPIA
18835	UIS.LR.AG65T99.GPIA
18840	UIS.LR.AG65T99.RUR.GPIA
18844	UIS.LR.AG65T99.URB.GPIA
18848	UIS.MATH.G2T3.GPIA
18864	UIS.MATH.LOWERSEC.GPIA
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18907	UIS.NARA.AGM1.GPIA
18915	UIS.NARA.AGM1.Q1.GPIA
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18936	UIS.NARA.AGM1.Q4.GPIA
18943	UIS.NARA.AGM1.Q5.GPIA
18950	UIS.NARA.AGM1.RUR.GPIA
18955	UIS.NARA.AGM1.RUR.Q1.GPIA
18959	UIS.NARA.AGM1.RUR.Q2.GPIA
18963	UIS.NARA.AGM1.RUR.Q3.GPIA
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18971	UIS.NARA.AGM1.RUR.Q5.GPIA
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18986	UIS.NARA.AGM1.URB.Q2.GPIA
18990	UIS.NARA.AGM1.URB.Q3.GPIA
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19042	UIS.NART.1.Q5.GPIA
19049	UIS.NART.1.RUR.GPIA
19054	UIS.NART.1.RUR.Q1.GPIA
19058	UIS.NART.1.RUR.Q2.GPIA
19062	UIS.NART.1.RUR.Q3.GPIA
19066	UIS.NART.1.RUR.Q4.GPIA
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19076	UIS.NART.1.URB.GPIA
19081	UIS.NART.1.URB.Q1.GPIA
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19089	UIS.NART.1.URB.Q3.GPIA
19093	UIS.NART.1.URB.Q4.GPIA
19097	UIS.NART.1.URB.Q5.GPIA
19105	UIS.NART.2.GPIA
19113	UIS.NART.2.Q1.GPIA
19120	UIS.NART.2.Q2.GPIA
19127	UIS.NART.2.Q3.GPIA
19134	UIS.NART.2.Q4.GPIA
19141	UIS.NART.2.Q5.GPIA
19148	UIS.NART.2.RUR.GPIA
19153	UIS.NART.2.RUR.Q1.GPIA
19157	UIS.NART.2.RUR.Q2.GPIA
19161	UIS.NART.2.RUR.Q3.GPIA
19165	UIS.NART.2.RUR.Q4.GPIA
19169	UIS.NART.2.RUR.Q5.GPIA
19175	UIS.NART.2.URB.GPIA
19180	UIS.NART.2.URB.Q1.GPIA
19184	UIS.NART.2.URB.Q2.GPIA
19188	UIS.NART.2.URB.Q3.GPIA
19192	UIS.NART.2.URB.Q4.GPIA
19196	UIS.NART.2.URB.Q5.GPIA
19204	UIS.NART.3.GPIA
19212	UIS.NART.3.Q1.GPIA
19219	UIS.NART.3.Q2.GPIA
19226	UIS.NART.3.Q3.GPIA
19233	UIS.NART.3.Q4.GPIA
19240	UIS.NART.3.Q5.GPIA
19247	UIS.NART.3.RUR.GPIA
19252	UIS.NART.3.RUR.Q1.GPIA
19256	UIS.NART.3.RUR.Q2.GPIA
19260	UIS.NART.3.RUR.Q3.GPIA
19264	UIS.NART.3.RUR.Q4.GPIA
19268	UIS.NART.3.RUR.Q5.GPIA
19274	UIS.NART.3.URB.GPIA
19279	UIS.NART.3.URB.Q1.GPIA
19283	UIS.NART.3.URB.Q2.GPIA
19287	UIS.NART.3.URB.Q3.GPIA
19291	UIS.NART.3.URB.Q4.GPIA
19295	UIS.NART.3.URB.Q5.GPIA
19301	UIS.NERA.AGM1.GPIA.CP

19305	UIS.NERT.1.GPI
19309	UIS.NERT.2.GPI
19313	UIS.NERT.3.GPI
19317	UIS.OAEPG.1.GPIA
19321	UIS.OAEPG.2.GPV.GPIA
19346	UIS.ONTRACK.THREE.DOMAINS.GPIA
19350	UIS.PER.11T15.BULLIED.GPIA
19363	UIS.POSTIMUENV.GPIA
19378	UIS.PRYA.12MO.GPI
19392	UIS.QUTP.02.GPIA
19396	UIS.QUTP.1.GPIA
19400	UIS.QUTP.2.GPIA
19404	UIS.QUTP.2T3.GPIA
19408	UIS.QUTP.3.GPIA
19463	UIS.READ.G2T3.GPIA
19479	UIS.READ.LOWERSEC.GPIA
19495	UIS.READ.PRIMARY.GPIA
19553	UIS.ROFST.1.GPIA.CP
19557	UIS.ROFST.1T2.GPIA.CP
19561	UIS.ROFST.1T3.GPIA.CP
19565	UIS.ROFST.2.GPIA.CP
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19577	UIS.ROFST.AGM1.GPIA.CP
19583	UIS.ROFST.H.1.GPIA
19591	UIS.ROFST.H.1.Q1.GPIA
19598	UIS.ROFST.H.1.Q2.GPIA
19605	UIS.ROFST.H.1.Q3.GPIA
19612	UIS.ROFST.H.1.Q4.GPIA
19619	UIS.ROFST.H.1.Q5.GPIA
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19631	UIS.ROFST.H.1.RUR.Q1.GPIA
19635	UIS.ROFST.H.1.RUR.Q2.GPIA
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19643	UIS.ROFST.H.1.RUR.Q4.GPIA
19647	UIS.ROFST.H.1.RUR.Q5.GPIA
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19662	UIS.ROFST.H.1.URB.Q2.GPIA
19666	UIS.ROFST.H.1.URB.Q3.GPIA
19670	UIS.ROFST.H.1.URB.Q4.GPIA
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19725	UIS.ROFST.H.2.RUR.GPIA
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19860	UIS.ROFST.H.3.URB.Q2.GPIA
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19925	UIS.SLE.02.GPI
19929	UIS.SLE.1.GPI
19936	UIS.SLE.123.GPI
19938	UIS.SLE.1T2.GPI
19939	UIS.SLE.1T6.GPI
19942	UIS.SLE.23.GPI
19946	UIS.SLE.4.GPI
19950	UIS.SLE.56.GPI

19954	UIS.SR.1.G4.GPI
19956	UIS.SR.1.G5.GPI
19957	UIS.SR.1.GLAST.GPI
19979	UIS.TATTRR.02.GPIA
19982	UIS.TATTRR.1.GPIA
19986	UIS.TATTRR.2.GPIA
19991	UIS.TATTRR.2T3.GPIA
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20014	UIS.TRTP.02.GPIA
20016	UIS.TRTP.1.GPIA
20019	UIS.TRTP.2.GPIA
20021	UIS.TRTP.2T3.GPIA
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```r
WDI::WDI(country = "UY",
    indicator = "SP.POP.TOTL",
    start = 2000,
    end = 2023,
    extra = FALSE,
    cache = NULL)
```

```
   country iso2c iso3c year SP.POP.TOTL
1  Uruguay    UY   URY 2023     3423108
2  Uruguay    UY   URY 2022     3422794
3  Uruguay    UY   URY 2021     3426260
4  Uruguay    UY   URY 2020     3429086
5  Uruguay    UY   URY 2019     3428409
6  Uruguay    UY   URY 2018     3427042
7  Uruguay    UY   URY 2017     3422200
8  Uruguay    UY   URY 2016     3413766
9  Uruguay    UY   URY 2015     3402818
10 Uruguay    UY   URY 2014     3391662
11 Uruguay    UY   URY 2013     3381180
12 Uruguay    UY   URY 2012     3371133
13 Uruguay    UY   URY 2011     3361637
14 Uruguay    UY   URY 2010     3352651
15 Uruguay    UY   URY 2009     3344156
16 Uruguay    UY   URY 2008     3336126
17 Uruguay    UY   URY 2007     3328651
18 Uruguay    UY   URY 2006     3322282
19 Uruguay    UY   URY 2005     3317665
20 Uruguay    UY   URY 2004     3313801
21 Uruguay    UY   URY 2003     3310202
```

```
22 Uruguay    UY    URY 2002      3306441
23 Uruguay    UY    URY 2001      3300939
24 Uruguay    UY    URY 2000      3292224
```

Esta información la podemos guardar en un objeto. En este caso mejor pediremos un solo país:

```
pop <- WDI::WDI(country = "UY",
               indicator = "SP.POP.TOTL",
               start = 1990,
               end = 2023)
```

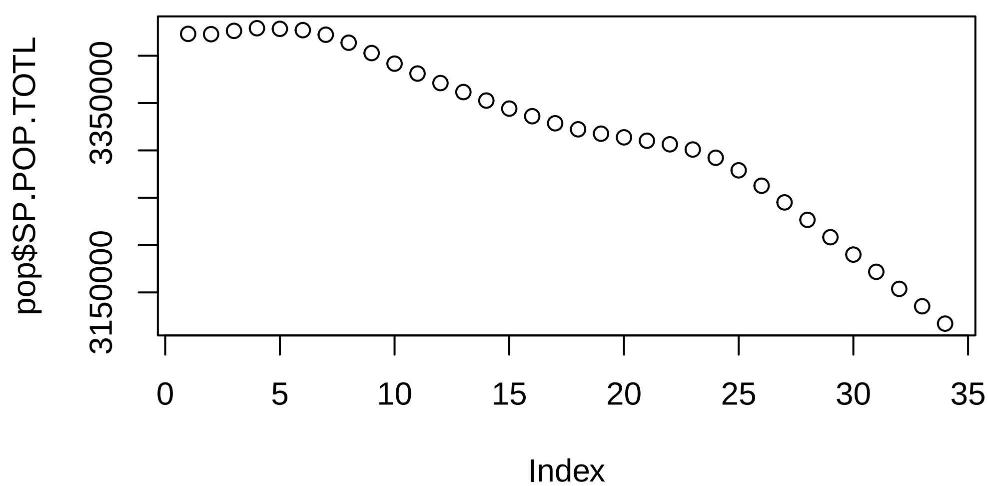
Vamos a revisar nuestro objeto:

```
class(pop)
```

```
[1] "data.frame"
```

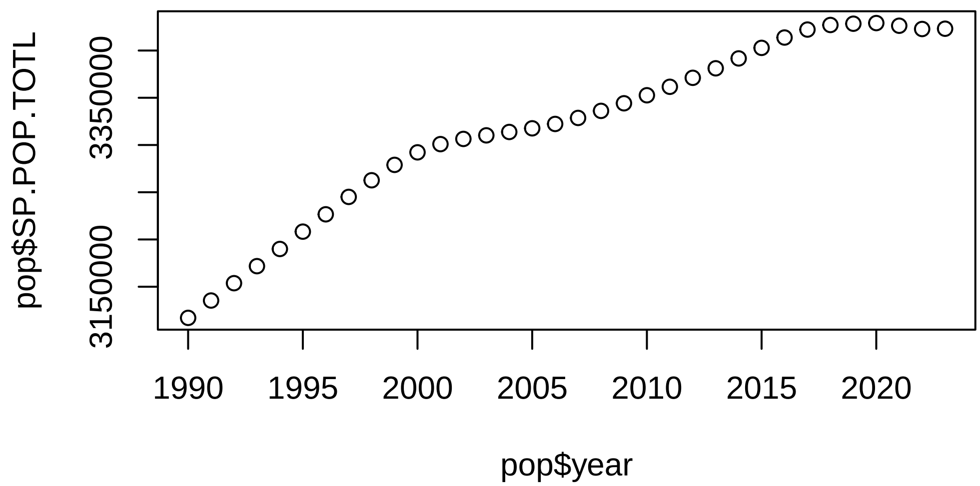
Veamos y conozcamos la función `plot()`

```
plot(pop$SP.POP.TOTL)
```



Este no es el mejor gráfico.

```
plot(pop$year, pop$SP.POP.TOTL)
```



Las matrices por lo general sólo almacenan un tipo de datos mientras que las data frames puede almacenar varios tipos de datos.

1.8 Importación de datos

1.8.1 Desde Excel

El paquete más compatible con RStudio es `{readxl}`. Como su nombre dice "lee" los archivos de excel

```
ejemploxl <- readxl::read_excel("datos/ejemplo_xlsx.xlsx")
```

https://catalogodatos.gub.uy/dataset/mides-indicador-10829/resource/3f5356a2-b6dc-4827-8a8e-e34285ef54ba

Como el nombre de paquete lo indica, sólo lee. Para "escribir" en este formato, recomiendo el paquete `{writexl}`. Lo instalamos anteriormente.

Si quisiéramos exportar un objeto a Excel, se hace de la siguiente forma:

```
writexl::write_xlsx(ejemploxl, path = "Mi_Exportación.xlsx")
```

1.8.2 Desde STATA y SPSS

Si bien también se puede realizar desde el paquete `{foreign}` Pero este no importa algunas características como las etiquetas y tampoco funciona con las versiones más nuevas de STATA. Vamos a instalar otro paquete, compatible con el mundo `{tidyverse}`.

Recuerda que no hay que instalarlo (viene adentro de `{tidyverse}`).

```
encuesta_generacion <- haven::read_dta("datos/GGSII_Wave1_UY_V_1_3.dta")
```

!Importante, a R no le gustan los objetos con nombres que empiezan en números

El paquete haven sí exporta información.

```
haven::write_dta(encuesta_generacion,
                 "datos/mi_exportación.dta",
                 version = 12)
```

Con SSPS es muy parecido. Dentro de `{haven}` hay una función específica para ello.

Checa que en todas las exportaciones en los nombres hay que incluir la extensión del programa. Si quieres guardar en un lugar diferente al directorio del trabajo, hay que escribir toda la ruta dentro de la computadora.

1.8.3 Desde archivos de texto y de una url

Desde el portal https://catalogodatos.gub.uy/ tenemos acceso a directo a varias fuentes de información, al ser datos abiertos, los archivos de texto son muy comunes.

Leeremos parte de esa información, específicamente de la actividad docente

```
docente2019 <- read.csv("https://catalogodatos.gub.uy/dataset/e5b78d49-1707-4f50-9b3b-f2db
names(docente2019)
```

```
[1] "Id.persona"
[2] "Sexo"
[3] "Rol"
[4] "Departamento"
```

```
 [5] "Subsistema"
 [6] "Año.lectivo"
 [7] "Cantidad.de.días.ingreso.a.CREA"
 [8] "Cantidad.de.Comentarios.posteados"
 [9] "Cantidad.de.Acciones.totales"
[10] "Cantidad.de.días.de.ingreso.a.Biblioteca"
[11] "Cantidad.de.préstamos.en.biblioteca"
```

```
docente2019 <- readr::read_csv("https://catalogodatos.gub.uy/dataset/e5b78d49-1707-4f50-9b
```

```
Rows: 51370 Columns: 11
-- Column specification --------------------------------------------------------
Delimiter: ","
chr (4): Sexo, Rol, Departamento, Subsistema
dbl (7): Id persona, Año lectivo, Cantidad de días ingreso a CREA, Cantidad ...

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
names(docente2019)
```

```
 [1] "Id persona"
 [2] "Sexo"
 [3] "Rol"
 [4] "Departamento"
 [5] "Subsistema"
 [6] "Año lectivo"
 [7] "Cantidad de días ingreso a CREA"
 [8] "Cantidad de Comentarios posteados"
 [9] "Cantidad de Acciones totales"
[10] "Cantidad de días de ingreso a Biblioteca"
[11] "Cantidad de préstamos en biblioteca"
```

1.9 Revisión de nuestro conjunto de datos

1.9.1 con base

Vamos a revisar la base, brevemente la base

```r
class(encuesta_generacion) # tipo de objeto
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

```r
names(encuesta_generacion) # lista las variables
```

```
  [1] "country"            "region"             "respid"            
  [4] "intid"              "mode"               "weight"            
  [7] "instrument"         "intdatem"           "intdatey"          
 [10] "dem01"              "dem02m"             "dem02y"            
 [13] "dem03"              "dem04a"             "dem04biso"         
 [16] "dem05m"             "dem05y"             "dem06"             
 [19] "dem07"              "dem07isced"         "dem08m"            
 [22] "dem08y"             "dem09"              "dem10m"            
 [25] "dem10y"             "dem11"              "dem12"             
 [28] "dem14"              "dem15"              "dem17"             
 [31] "dem18"              "dem19"              "dem20"             
 [34] "dem21"              "dem22a"             "dem22m"            
 [37] "dem22y"             "dem23"              "dem24a"            
 [40] "dem24biso"          "dem24em"            "dem24ey"           
 [43] "dem25"              "dem25isced"         "dem26"             
 [46] "dem27"              "dem28a"             "dem28bm"           
 [49] "dem28by"            "dem28c"             "dem30a"            
 [52] "dem30bm"            "dem30by"            "dem30c"            
 [55] "dem30d"             "dem31m"             "dem31y"            
 [58] "dem32a"             "dem32b"             "dem32c"            
 [61] "dem32d"             "dem33"              "dem33am"           
 [64] "dem33ay"            "dem34m"             "dem34y"            
 [67] "dem35"              "dem36a"             "dem36au"           
 [70] "dem36b"             "dem36bu"            "dem37"             
 [73] "dem38a"             "dem38b"             "dem38c"            
 [76] "dem38d"             "dem38e"             "dem38f"            
 [79] "dem38g"             "dem39a"             "dem39b"            
 [82] "dem39c"             "dem39d"             "dem40"             
 [85] "dem41"              "dem42"              "dem43"             
 [88] "dem44"              "dem45"              "dem46"             
 [91] "lhi01"              "lhi02"              "lhi04_m1"          
 [94] "lhi04_m2"           "lhi04_m3"           "lhi04_m4"          
 [97] "lhi04_m5"           "lhi04_m6"           "lhi04_m7"          
[100] "lhi04_m8"           "lhi04_m9"           "lhi04_m10"         
```

```
[103] "lhi04_m11"     "lhi04_m12"     "lhi04_m13"
[106] "lhi04_m14"     "lhi04_m15"     "lhi04_m16"
[109] "lhi04_m17"     "lhi04_m18"     "lhi04_m19"
[112] "lhi04_m20"     "lhi04_y1"      "lhi04_y2"
[115] "lhi04_y3"      "lhi04_y4"      "lhi04_y5"
[118] "lhi04_y6"      "lhi04_y7"      "lhi04_y8"
[121] "lhi04_y9"      "lhi04_y10"     "lhi04_y11"
[124] "lhi04_y12"     "lhi04_y13"     "lhi04_y14"
[127] "lhi04_y15"     "lhi04_y16"     "lhi04_y17"
[130] "lhi04_y18"     "lhi04_y19"     "lhi04_y20"
[133] "lhi04a_1"      "lhi04a_2"      "lhi04a_3"
[136] "lhi04a_4"      "lhi04a_5"      "lhi04a_6"
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[151] "lhi04a_19"     "lhi04a_20"     "lhi05a_1"
[154] "lhi05a_2"      "lhi05a_3"      "lhi05a_4"
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[163] "lhi05a_11"     "lhi05a_12"     "lhi05a_13"
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[169] "lhi05a_17"     "lhi05a_18"     "lhi05a_19"
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[196] "lhi05b_y4"     "lhi05b_y5"     "lhi05b_y6"
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[208] "lhi05b_y16"    "lhi05b_y17"    "lhi05b_y18"
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[226] "lhi06_m14"     "lhi06_m15"     "lhi06_m16"
[229] "lhi06_m17"     "lhi06_m18"     "lhi06_m19"
```

```
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[235] "lhi06_y3"           "lhi06_y4"           "lhi06_y5"
[238] "lhi06_y6"           "lhi06_y7"           "lhi06_y8"
[241] "lhi06_y9"           "lhi06_y10"          "lhi06_y11"
[244] "lhi06_y12"          "lhi06_y13"          "lhi06_y14"
[247] "lhi06_y15"          "lhi06_y16"          "lhi06_y17"
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```

```
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[475] "lhi15b_y3"        "lhi15b_y4"        "lhi15b_y5"
[478] "lhi15b_y6"        "lhi15b_y7"        "lhi15b_y8"
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```

```
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[529] "lhi17_17"          "lhi17_18"          "lhi17_19"
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[535] "lhi20"             "lhi21"             "lhi22"
[538] "lhi23"             "lhi25_1"           "lhi25_2"
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[610] "lhi28_12"          "lhi28_13"          "lhi28_14"
[613] "lhi28_15"          "lhi28_16"          "lhi28_17"
[616] "lhi28_18"          "lhi28_19"          "lhi28_20"
```

```
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[622] "lhi29_m4"    "lhi29_m5"    "lhi29_m6"
[625] "lhi29_m7"    "lhi29_m8"    "lhi29_m9"
[628] "lhi29_m10"   "lhi29_m11"   "lhi29_m12"
[631] "lhi29_m13"   "lhi29_m14"   "lhi29_m15"
[634] "lhi29_m16"   "lhi29_m17"   "lhi29_m18"
[637] "lhi29_m19"   "lhi29_m20"   "lhi29_y1"
[640] "lhi29_y2"    "lhi29_y3"    "lhi29_y4"
[643] "lhi29_y5"    "lhi29_y6"    "lhi29_y7"
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[691] "lhi30_y13"   "lhi30_y14"   "lhi30_y15"
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[1579] "wel11a"           "wel11b"          "wel11c"
[1582] "wel11d"           "wel11e"          "wel14a_4001"
[1585] "wel14b_4001"      "wel14c_4001"     "wel14d_4001"
[1588] "wel14e_4001"      "wel14f_4001"     "wel14g_4001"
[1591] "wel16a_4001"      "wel16b_4001"     "wel16c_1_4001"
[1594] "wel16c_2_4001"    "wel16c_3_4001"   "wel16c_4_4001"
[1597] "wel16c_5_4001"    "wel16c_6_4001"   "wel16c_7_4001"
[1600] "wel16c_8_4001"    "wel16c_9_4001"   "wel16c_10_4001"
[1603] "wel16c_11_4001"   "wel16c_12_4001"  "wel16c_13_4001"
[1606] "wel16c_14_4001"   "wel16c_15_4001"  "wel16c_16_4001"
[1609] "wel16c_17_4001"   "wel16c_18_4001"  "wel16c_19_4001"
[1612] "wel16c_20_4001"   "wel16d_m1_4001"  "wel16d_m2_4001"
[1615] "wel16d_m3_4001"   "wel16d_m4_4001"  "wel16d_m5_4001"
[1618] "wel16d_m6_4001"   "wel16d_m7_4001"  "wel16d_m8_4001"
[1621] "wel16d_m9_4001"   "wel16d_m10_4001" "wel16d_m11_4001"
[1624] "wel16d_m12_4001"  "wel16d_m13_4001" "wel16d_m14_4001"
[1627] "wel16d_m15_4001"  "wel16d_m16_4001" "wel16d_m17_4001"
[1630] "wel16d_m18_4001"  "wel16d_m19_4001" "wel16d_m20_4001"
[1633] "wel16d_y1_4001"   "wel16d_y2_4001"  "wel16d_y3_4001"
[1636] "wel16d_y4_4001"   "wel16d_y5_4001"  "wel16d_y6_4001"
[1639] "wel16d_y7_4001"   "wel16d_y8_4001"  "wel16d_y9_4001"
[1642] "wel16d_y10_4001"  "wel16d_y11_4001" "wel16d_y12_4001"
[1645] "wel16d_y13_4001"  "wel16d_y14_4001" "wel16d_y15_4001"
[1648] "wel16d_y16_4001"  "wel16d_y17_4001" "wel16d_y18_4001"
```

```
[1651] "wel16d_y19_4001"   "wel16d_y20_4001"   "wel16a_1_4002"
[1654] "wel16a_2_4002"     "wel16a_3_4002"     "wel16a_4_4002"
[1657] "wel16a_5_4002"     "wel16a_6_4002"     "wel16a_7_4002"
[1660] "wel16a_8_4002"     "wel16a_9_4002"     "wel16a_10_4002"
[1663] "wel16a_11_4002"    "wel16a_12_4002"    "wel16a_13_4002"
[1666] "wel16a_14_4002"    "wel16a_15_4002"    "wel16a_16_4002"
[1669] "wel16a_17_4002"    "wel16a_18_4002"    "wel16a_19_4002"
[1672] "wel16a_20_4002"    "wel16b_1_4002"     "wel16b_2_4002"
[1675] "wel16b_3_4002"     "wel16b_4_4002"     "wel16b_5_4002"
[1678] "wel16b_6_4002"     "wel16b_7_4002"     "wel16b_8_4002"
[1681] "wel16b_9_4002"     "wel16b_10_4002"    "wel16b_11_4002"
[1684] "wel16b_12_4002"    "wel16b_13_4002"    "wel16b_14_4002"
[1687] "wel16b_15_4002"    "wel16b_16_4002"    "wel16b_17_4002"
[1690] "wel16b_18_4002"    "wel16b_19_4002"    "wel16b_20_4002"
[1693] "wel16c_1_4002"     "wel16c_2_4002"     "wel16c_3_4002"
[1696] "wel16c_4_4002"     "wel16c_5_4002"     "wel16c_6_4002"
[1699] "wel16c_7_4002"     "wel16c_8_4002"     "wel16c_9_4002"
[1702] "wel16c_10_4002"    "wel16c_11_4002"    "wel16c_12_4002"
[1705] "wel16c_13_4002"    "wel16c_14_4002"    "wel16c_15_4002"
[1708] "wel16c_16_4002"    "wel16c_17_4002"    "wel16c_18_4002"
[1711] "wel16c_19_4002"    "wel16c_20_4002"    "wel16d_1_4002"
[1714] "wel16d_2_4002"     "wel16d_3_4002"     "wel16d_4_4002"
[1717] "wel16d_5_4002"     "wel16d_6_4002"     "wel16d_7_4002"
[1720] "wel16d_8_4002"     "wel16d_9_4002"     "wel16d_10_4002"
[1723] "wel16d_11_4002"    "wel16d_12_4002"    "wel16d_13_4002"
[1726] "wel16d_14_4002"    "wel16d_15_4002"    "wel16d_16_4002"
[1729] "wel16d_17_4002"    "wel16d_18_4002"    "wel16d_19_4002"
[1732] "wel16d_20_4002"    "wel16e_1_4002"     "wel16e_2_4002"
[1735] "wel16e_3_4002"     "wel16e_4_4002"     "wel16e_5_4002"
[1738] "wel16e_6_4002"     "wel16e_7_4002"     "wel16e_8_4002"
[1741] "wel16e_9_4002"     "wel16e_10_4002"    "wel16e_11_4002"
[1744] "wel16e_12_4002"    "wel16e_13_4002"    "wel16e_14_4002"
[1747] "wel16e_15_4002"    "wel16e_16_4002"    "wel16e_17_4002"
[1750] "wel16e_18_4002"    "wel16e_19_4002"    "wel16e_20_4002"
[1753] "wel16f_1_4002"     "wel16f_2_4002"     "wel16f_3_4002"
[1756] "wel16f_4_4002"     "wel16f_5_4002"     "wel16f_6_4002"
[1759] "wel16f_7_4002"     "wel16f_8_4002"     "wel16f_9_4002"
[1762] "wel16f_10_4002"    "wel16f_11_4002"    "wel16f_12_4002"
[1765] "wel16f_13_4002"    "wel16f_14_4002"    "wel16f_15_4002"
[1768] "wel16f_16_4002"    "wel16f_17_4002"    "wel16f_18_4002"
[1771] "wel16f_19_4002"    "wel16f_20_4002"    "wel16g_1_4002"
[1774] "wel16g_2_4002"     "wel16g_3_4002"     "wel16g_4_4002"
[1777] "wel16g_5_4002"     "wel16g_6_4002"     "wel16g_7_4002"
```

```
[1780] "wel16g_8_4002"      "wel16g_9_4002"      "wel16g_10_4002"
[1783] "wel16g_11_4002"     "wel16g_12_4002"     "wel16g_13_4002"
[1786] "wel16g_14_4002"     "wel16g_15_4002"     "wel16g_16_4002"
[1789] "wel16g_17_4002"     "wel16g_18_4002"     "wel16g_19_4002"
[1792] "wel16g_20_4002"     "wrk01"              "wrk02"
[1795] "wrk03m"             "wrk03y"             "wrk04"
[1798] "wrk04isco"          "wrk06"              "wrk07"
[1801] "wrk08"              "wrk09"              "wrk10"
[1804] "wrk11"              "wrk12"              "wrk13"
[1807] "wrk14"              "wrk15a"             "wrk15b"
[1810] "wrk15c"             "wrk15d"             "wrk16a"
[1813] "wrk16b"             "wrk17"              "wrk18"
[1816] "wrk20"              "wrk21"              "wrk22"
[1819] "wrk23"              "wrk24"              "wrk25"
[1822] "wrk26"              "wrk27"              "wrk27isco"
[1825] "wrk28"              "wrk30"              "wrk30am"
[1828] "wrk30ay"            "wrk31"              "wrk32"
[1831] "wrk34"              "wrk34isco"          "wrk35"
[1834] "wrk36"              "wrk37"              "wrk38"
[1837] "wrk39"              "wrk40"              "wrk41"
[1840] "wrk42"              "wrk43"              "wrk44"
[1843] "wrk46"              "wrk47"              "wrk48"
[1846] "wrk49"              "wrk50"              "wrk51_4001"
[1849] "wrk51_4002"         "wrk51_4003"         "wrk51_4004"
[1852] "wrk51a_4005"        "wrk51b_4005"        "wrk51_4006"
[1855] "wrk51a_4007"        "wrk51b_4007"        "wrk51a_4008"
[1858] "wrk51b_4008"        "wrk51_4009"         "wrk51_4010"
[1861] "wrk51a_4011"        "wrk51b_4011"        "wrk51_4012"
[1864] "wrk51_4013"         "wrk51_4014"         "wrk51_4015"
[1867] "inc01"              "inc03"              "inc05"
[1870] "inc06"              "inc08_1"            "inc08_2"
[1873] "inc08_3"            "inc08_4"            "inc08_5"
[1876] "inc08_6"            "inc08_7"            "inc08_8"
[1879] "inc08_9"            "inc08_10"           "inc08_11"
[1882] "inc08_12"           "inc09_1"            "inc09_2"
[1885] "inc09_3"            "inc09_4"            "inc09_5"
[1888] "inc09_6"            "inc09_7"            "inc09_8"
[1891] "inc09_9"            "inc09_10"           "inc09_11"
[1894] "inc11_1"            "inc11_2"            "inc11_3"
[1897] "inc11_4"            "inc11_5"            "inc11_6"
[1900] "inc11_7"            "inc11_8"            "inc11_9"
[1903] "inc11_10"           "inc11_11"           "inc12"
[1906] "inc13"              "inc14_1"            "inc14_2"
```

```
[1909] "inc14_3"          "inc14_4"          "inc14_5"
[1912] "inc14_6"          "inc14_7"          "inc14_8"
[1915] "inc14_9"          "inc14_10"         "inc14_11"
[1918] "inc14_12"         "inc14_13"         "inc14_14"
[1921] "inc14_15"         "inc14_16"         "inc14_17"
[1924] "inc14_18"         "inc14_19"         "inc14_20"
[1927] "inc14_21"         "inc14_22"         "inc15"
[1930] "att01"            "att02"            "att03a"
[1933] "att03b"           "att03d"           "att03e"
[1936] "att03g"           "att03h"           "att03i"
[1939] "att03j"           "att05b"           "att06a"
[1942] "att06b"           "att07a"           "att07b"
[1945] "att07c"           "att07d"           "att07g"
[1948] "att08"            "att09"            "att09u"
[1951] "att10"            "att11b"           "att11d"
[1954] "att13a_4001"      "att13b_4001"      "att13c_4001"
[1957] "att13d_4001"      "att13e_4001"      "att13f_4001"
[1960] "att13g_4001"      "att13h_4001"      "att13_4002"
[1963] "att13_4003"       "att13_4004"       "att13_4005"
[1966] "att13_1_4006"     "att13_2_4006"     "att13_3_4006"
[1969] "att13_4_4006"     "att13_5_4006"     "att13_6_4006"
[1972] "att13_7_4006"     "att13_8_4006"     "att13_9_4006"
[1975] "att13_4007"       "att19a_4001"      "att19b_4001"
[1978] "att19c_4001"      "rep01"            "rep02"
[1981] "rep03_1"          "rep03_2"          "rep03_3"
[1984] "rep03_4"          "rep04"            "rep05"
[1987] "rep06"            "flag1"            "localitysize_4001"
[1990] "department_4001"  "city_4001"
```

```
head(encuesta_generacion) # muestra las primeras 6 líneas
```

```
# A tibble: 6 x 1,991
  country    region     respid intid mode    weight instrument intdatem intdatey
  <dbl+lbl>  <dbl+lbl>  <chr>  <chr> <dbl+l>  <dbl> <chr>      <dbl+lb>    <dbl>
1 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  1.37  GGP UY     11 [Nov~     2021
2 40 [Urugu~   NA       URAA0~ ""    2 [Web] NA     GGP UY     12 [Dec~     2021
3 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.522 GGP UY     12 [Dec~     2021
4 40 [Urugu~ 4001 [Mon~ URAA0~ ""    2 [Web]  1.17  GGP UY     12 [Dec~     2021
5 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.636 GGP UY      2 [Feb~     2022
6 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.200 GGP UY      2 [Feb~     2022
# i 1,982 more variables: dem01 <dbl+lbl>, dem02m <dbl+lbl>, dem02y <dbl+lbl>,
```

```
#   dem03 <dbl+lbl>, dem04a <dbl+lbl>, dem04biso <dbl+lbl>, dem05m <dbl+lbl>,
#   dem05y <dbl+lbl>, dem06 <dbl+lbl>, dem07 <dbl+lbl>, dem07isced <dbl+lbl>,
#   dem08m <dbl+lbl>, dem08y <dbl+lbl>, dem09 <dbl+lbl>, dem10m <dbl+lbl>,
#   dem10y <dbl+lbl>, dem11 <dbl+lbl>, dem12 <dbl+lbl>, dem14 <dbl+lbl>,
#   dem15 <dbl+lbl>, dem17 <dbl+lbl>, dem18 <dbl+lbl>, dem19 <dbl+lbl>,
#   dem20 <dbl+lbl>, dem21 <dbl+lbl>, dem22a <dbl+lbl>, dem22m <dbl+lbl>, ...
```

```
table(encuesta_generacion$dem01) # un tabulado simple
```

```
   1    2 4001
2608 4575    9
```

1.9.2 Revisión con {skimr}

Esto se puede tardar un poquito

```
skimr::skim(encuesta_generacion[, 1:20])
```

Table 1.1: Data summary

Name	encuesta_generacion[, 1:2...
Number of rows	7192
Number of columns	20
Column type frequency:	
character	3
numeric	17
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
respid	0	1	9	9	0	7192	0
intid	0	1	0	9	981	593	0
instrument	0	1	6	6	0	1	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
country	0	1.00	40.00	0.00	40.0	40.00	40.00	40.00	40	
region	99	0.99	4002.37	2.04	4001.0	4001.00	4001.00	4003.00	4007	
mode	0	1.00	1.14	0.34	1.0	1.00	1.00	1.00	2	
weight	174	0.98	1.00	0.80	0.2	0.45	0.79	1.27	5	
intdatem	0	1.00	8.15	2.94	1.0	6.00	8.00	11.00	12	
intdatey	0	1.00	2021.80	0.40	2021.0	2022.00	2022.00	2022.00	2022	
dem01	0	1.00	6.64	141.40	1.0	1.00	2.00	2.00	4001	
dem02m	21	1.00	6.57	3.39	1.0	4.00	7.00	9.00	12	
dem02y	0	1.00	1972.60	16.83	1942.0	1958.00	1972.00	1987.00	2004	
dem03	0	1.00	1.03	0.18	1.0	1.00	1.00	1.00	2	
dem04a	245	0.97	4009.81	4.08	4001.0	4009.00	4010.00	4011.00	4019	
dem04biso	6953	0.03	289.11	323.40	32.0	32.00	76.00	600.00	862	
dem05m	7006	0.03	6.03	3.69	1.0	3.00	6.00	9.00	12	
dem05y	6956	0.03	1994.95	23.30	1921.0	1980.75	1998.50	2017.00	2022	
dem06	10	1.00	4.04	2.47	1.0	2.00	3.00	6.00	12	
dem07	24	1.00	2.90	1.77	0.0	2.00	3.00	4.00	8	
dem07isced	24	1.00	2.90	1.77	0.0	2.00	3.00	4.00	8	

1.10 Un poquito de `{dplyr}` y limpieza

1.10.1 Primero, los pipes

R utiliza dos pipes el nativo `|>` y el pipe que está en `{dplyr}` `%>%`. Algunas de las diferencias las puedes checar acá https://eliocamp.github.io/codigo-r/2021/05/r-pipa-nativa/

Aquí hay un *tuit*, o *post de x.com* que lo explica bien.

https://x.com/ArthurWelle/status/1535429654760284161

En estas prácticas utilizaremos el segundo, son muy parecidos y así esta instructora pueda reciclar algunos de sus códigos viejos. Pero funcionan igual:

```
encuesta_generacion|> #pipe nativo, no necesita instalación
  head()
```

```
# A tibble: 6 x 1,991
  country     region      respid intid mode     weight instrument intdatem intdatey
  <dbl+lbl>   <dbl+lbl>   <chr>  <chr> <dbl+l>  <dbl>  <chr>      <dbl+lb>    <dbl>
```

```
1 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  1.37  GGP UY     11 [Nov~     2021
2 40 [Urugu~   NA       URAA0~ ""    2 [Web] NA     GGP UY     12 [Dec~     2021
3 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.522 GGP UY     12 [Dec~     2021
4 40 [Urugu~ 4001 [Mon~ URAA0~ ""    2 [Web]  1.17  GGP UY     12 [Dec~     2021
5 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.636 GGP UY      2 [Feb~     2022
6 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.200 GGP UY      2 [Feb~     2022
# i 1,982 more variables: dem01 <dbl+lbl>, dem02m <dbl+lbl>, dem02y <dbl+lbl>,
#   dem03 <dbl+lbl>, dem04a <dbl+lbl>, dem04biso <dbl+lbl>, dem05m <dbl+lbl>,
#   dem05y <dbl+lbl>, dem06 <dbl+lbl>, dem07 <dbl+lbl>, dem07isced <dbl+lbl>,
#   dem08m <dbl+lbl>, dem08y <dbl+lbl>, dem09 <dbl+lbl>, dem10m <dbl+lbl>,
#   dem10y <dbl+lbl>, dem11 <dbl+lbl>, dem12 <dbl+lbl>, dem14 <dbl+lbl>,
#   dem15 <dbl+lbl>, dem17 <dbl+lbl>, dem18 <dbl+lbl>, dem19 <dbl+lbl>,
#   dem20 <dbl+lbl>, dem21 <dbl+lbl>, dem22a <dbl+lbl>, dem22m <dbl+lbl>, ...
```

```r
encuesta_generacion %>%  #pipe de dplyr, necesita instalación de dplyr en tidyverse
  head()
```

```
# A tibble: 6 x 1,991
  country    region     respid intid mode    weight instrument intdatem intdatey
  <dbl+lbl>  <dbl+lbl>  <chr>  <chr> <dbl+l>  <dbl> <chr>      <dbl+lb>    <dbl>
1 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  1.37  GGP UY     11 [Nov~     2021
2 40 [Urugu~   NA       URAA0~ ""    2 [Web] NA     GGP UY     12 [Dec~     2021
3 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.522 GGP UY     12 [Dec~     2021
4 40 [Urugu~ 4001 [Mon~ URAA0~ ""    2 [Web]  1.17  GGP UY     12 [Dec~     2021
5 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.636 GGP UY      2 [Feb~     2022
6 40 [Urugu~ 4001 [Mon~ URAA0~ "URU~ 1 [Fac~  0.200 GGP UY      2 [Feb~     2022
# i 1,982 more variables: dem01 <dbl+lbl>, dem02m <dbl+lbl>, dem02y <dbl+lbl>,
#   dem03 <dbl+lbl>, dem04a <dbl+lbl>, dem04biso <dbl+lbl>, dem05m <dbl+lbl>,
#   dem05y <dbl+lbl>, dem06 <dbl+lbl>, dem07 <dbl+lbl>, dem07isced <dbl+lbl>,
#   dem08m <dbl+lbl>, dem08y <dbl+lbl>, dem09 <dbl+lbl>, dem10m <dbl+lbl>,
#   dem10y <dbl+lbl>, dem11 <dbl+lbl>, dem12 <dbl+lbl>, dem14 <dbl+lbl>,
#   dem15 <dbl+lbl>, dem17 <dbl+lbl>, dem18 <dbl+lbl>, dem19 <dbl+lbl>,
#   dem20 <dbl+lbl>, dem21 <dbl+lbl>, dem22a <dbl+lbl>, dem22m <dbl+lbl>, ...
```

1.10.2 Limpieza de nombres con `{janitor}`

Este paso también nos permitirá enseñar otro *pipe* que está en el paquete `{magrittr}`.

Los nombres de una base de datos son los nombres de las columnas.

```r
names(encuesta_generacion)
```

```
  [1] "country"         "region"          "respid"
  [4] "intid"           "mode"            "weight"
  [7] "instrument"      "intdatem"        "intdatey"
 [10] "dem01"           "dem02m"          "dem02y"
 [13] "dem03"           "dem04a"          "dem04biso"
 [16] "dem05m"          "dem05y"          "dem06"
 [19] "dem07"           "dem07isced"      "dem08m"
 [22] "dem08y"          "dem09"           "dem10m"
 [25] "dem10y"          "dem11"           "dem12"
 [28] "dem14"           "dem15"           "dem17"
 [31] "dem18"           "dem19"           "dem20"
 [34] "dem21"           "dem22a"          "dem22m"
 [37] "dem22y"          "dem23"           "dem24a"
 [40] "dem24biso"       "dem24em"         "dem24ey"
 [43] "dem25"           "dem25isced"      "dem26"
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[1699] "wel16c_7_4002"      "wel16c_8_4002"      "wel16c_9_4002"
[1702] "wel16c_10_4002"     "wel16c_11_4002"     "wel16c_12_4002"
[1705] "wel16c_13_4002"     "wel16c_14_4002"     "wel16c_15_4002"
[1708] "wel16c_16_4002"     "wel16c_17_4002"     "wel16c_18_4002"
[1711] "wel16c_19_4002"     "wel16c_20_4002"     "wel16d_1_4002"
[1714] "wel16d_2_4002"      "wel16d_3_4002"      "wel16d_4_4002"
[1717] "wel16d_5_4002"      "wel16d_6_4002"      "wel16d_7_4002"
[1720] "wel16d_8_4002"      "wel16d_9_4002"      "wel16d_10_4002"
[1723] "wel16d_11_4002"     "wel16d_12_4002"     "wel16d_13_4002"
[1726] "wel16d_14_4002"     "wel16d_15_4002"     "wel16d_16_4002"
[1729] "wel16d_17_4002"     "wel16d_18_4002"     "wel16d_19_4002"
[1732] "wel16d_20_4002"     "wel16e_1_4002"      "wel16e_2_4002"
[1735] "wel16e_3_4002"      "wel16e_4_4002"      "wel16e_5_4002"
[1738] "wel16e_6_4002"      "wel16e_7_4002"      "wel16e_8_4002"
[1741] "wel16e_9_4002"      "wel16e_10_4002"     "wel16e_11_4002"
[1744] "wel16e_12_4002"     "wel16e_13_4002"     "wel16e_14_4002"
[1747] "wel16e_15_4002"     "wel16e_16_4002"     "wel16e_17_4002"
[1750] "wel16e_18_4002"     "wel16e_19_4002"     "wel16e_20_4002"
[1753] "wel16f_1_4002"      "wel16f_2_4002"      "wel16f_3_4002"
[1756] "wel16f_4_4002"      "wel16f_5_4002"      "wel16f_6_4002"
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[1762] "wel16f_10_4002"     "wel16f_11_4002"     "wel16f_12_4002"
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[1771] "wel16f_19_4002"     "wel16f_20_4002"     "wel16g_1_4002"
[1774] "wel16g_2_4002"      "wel16g_3_4002"      "wel16g_4_4002"
[1777] "wel16g_5_4002"      "wel16g_6_4002"      "wel16g_7_4002"
[1780] "wel16g_8_4002"      "wel16g_9_4002"      "wel16g_10_4002"
[1783] "wel16g_11_4002"     "wel16g_12_4002"     "wel16g_13_4002"
[1786] "wel16g_14_4002"     "wel16g_15_4002"     "wel16g_16_4002"
[1789] "wel16g_17_4002"     "wel16g_18_4002"     "wel16g_19_4002"
[1792] "wel16g_20_4002"     "wrk01"              "wrk02"
[1795] "wrk03m"             "wrk03y"             "wrk04"
[1798] "wrk04isco"          "wrk06"              "wrk07"
[1801] "wrk08"              "wrk09"              "wrk10"
[1804] "wrk11"              "wrk12"              "wrk13"
```

```
[1807] "wrk14"        "wrk15a"       "wrk15b"
[1810] "wrk15c"       "wrk15d"       "wrk16a"
[1813] "wrk16b"       "wrk17"        "wrk18"
[1816] "wrk20"        "wrk21"        "wrk22"
[1819] "wrk23"        "wrk24"        "wrk25"
[1822] "wrk26"        "wrk27"        "wrk27isco"
[1825] "wrk28"        "wrk30"        "wrk30am"
[1828] "wrk30ay"      "wrk31"        "wrk32"
[1831] "wrk34"        "wrk34isco"    "wrk35"
[1834] "wrk36"        "wrk37"        "wrk38"
[1837] "wrk39"        "wrk40"        "wrk41"
[1840] "wrk42"        "wrk43"        "wrk44"
[1843] "wrk46"        "wrk47"        "wrk48"
[1846] "wrk49"        "wrk50"        "wrk51_4001"
[1849] "wrk51_4002"   "wrk51_4003"   "wrk51_4004"
[1852] "wrk51a_4005"  "wrk51b_4005"  "wrk51_4006"
[1855] "wrk51a_4007"  "wrk51b_4007"  "wrk51a_4008"
[1858] "wrk51b_4008"  "wrk51_4009"   "wrk51_4010"
[1861] "wrk51a_4011"  "wrk51b_4011"  "wrk51_4012"
[1864] "wrk51_4013"   "wrk51_4014"   "wrk51_4015"
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[1870] "inc06"        "inc08_1"      "inc08_2"
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[1882] "inc08_12"     "inc09_1"      "inc09_2"
[1885] "inc09_3"      "inc09_4"      "inc09_5"
[1888] "inc09_6"      "inc09_7"      "inc09_8"
[1891] "inc09_9"      "inc09_10"     "inc09_11"
[1894] "inc11_1"      "inc11_2"      "inc11_3"
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[1900] "inc11_7"      "inc11_8"      "inc11_9"
[1903] "inc11_10"     "inc11_11"     "inc12"
[1906] "inc13"        "inc14_1"      "inc14_2"
[1909] "inc14_3"      "inc14_4"      "inc14_5"
[1912] "inc14_6"      "inc14_7"      "inc14_8"
[1915] "inc14_9"      "inc14_10"     "inc14_11"
[1918] "inc14_12"     "inc14_13"     "inc14_14"
[1921] "inc14_15"     "inc14_16"     "inc14_17"
[1924] "inc14_18"     "inc14_19"     "inc14_20"
[1927] "inc14_21"     "inc14_22"     "inc15"
[1930] "att01"        "att02"        "att03a"
[1933] "att03b"       "att03d"       "att03e"
```

```
[1936] "att03g"          "att03h"          "att03i"
[1939] "att03j"          "att05b"          "att06a"
[1942] "att06b"          "att07a"          "att07b"
[1945] "att07c"          "att07d"          "att07g"
[1948] "att08"           "att09"           "att09u"
[1951] "att10"           "att11b"          "att11d"
[1954] "att13a_4001"     "att13b_4001"     "att13c_4001"
[1957] "att13d_4001"     "att13e_4001"     "att13f_4001"
[1960] "att13g_4001"     "att13h_4001"     "att13_4002"
[1963] "att13_4003"      "att13_4004"      "att13_4005"
[1966] "att13_1_4006"    "att13_2_4006"    "att13_3_4006"
[1969] "att13_4_4006"    "att13_5_4006"    "att13_6_4006"
[1972] "att13_7_4006"    "att13_8_4006"    "att13_9_4006"
[1975] "att13_4007"      "att19a_4001"     "att19b_4001"
[1978] "att19c_4001"     "rep01"           "rep02"
[1981] "rep03_1"         "rep03_2"         "rep03_3"
[1984] "rep03_4"         "rep04"           "rep05"
[1987] "rep06"           "flag1"           "localitysize_4001"
[1990] "department_4001" "city_4001"
```

```
names(ejemploxl)
```

```
[1] "Causa" "año"   "valor"
```

Como vemos en las bases hay mayúsculas, caracteres especiales y demás. Esto lo podemos cambiar

```
ejemploxl<-ejemploxl %>%
  janitor::clean_names()

names(ejemploxl)
```

```
[1] "causa" "ano"   "valor"
```

Si quisiéramos que la acción quedará en una sola operación, podemos usar un pipe diferente:

```
pacman::p_load(magrittr)

encuesta_generacion %<>% # este es otro pipe
```

```r
  janitor::clean_names()

names(encuesta_generacion)
```

```
  [1] "country"           "region"            "respid"
  [4] "intid"             "mode"              "weight"
  [7] "instrument"        "intdatem"          "intdatey"
 [10] "dem01"             "dem02m"            "dem02y"
 [13] "dem03"             "dem04a"            "dem04biso"
 [16] "dem05m"            "dem05y"            "dem06"
 [19] "dem07"             "dem07isced"        "dem08m"
 [22] "dem08y"            "dem09"             "dem10m"
 [25] "dem10y"            "dem11"             "dem12"
 [28] "dem14"             "dem15"             "dem17"
 [31] "dem18"             "dem19"             "dem20"
 [34] "dem21"             "dem22a"            "dem22m"
 [37] "dem22y"            "dem23"             "dem24a"
 [40] "dem24biso"         "dem24em"           "dem24ey"
 [43] "dem25"             "dem25isced"        "dem26"
 [46] "dem27"             "dem28a"            "dem28bm"
 [49] "dem28by"           "dem28c"            "dem30a"
 [52] "dem30bm"           "dem30by"           "dem30c"
 [55] "dem30d"            "dem31m"            "dem31y"
 [58] "dem32a"            "dem32b"            "dem32c"
 [61] "dem32d"            "dem33"             "dem33am"
 [64] "dem33ay"           "dem34m"            "dem34y"
 [67] "dem35"             "dem36a"            "dem36au"
 [70] "dem36b"            "dem36bu"           "dem37"
 [73] "dem38a"            "dem38b"            "dem38c"
 [76] "dem38d"            "dem38e"            "dem38f"
 [79] "dem38g"            "dem39a"            "dem39b"
 [82] "dem39c"            "dem39d"            "dem40"
 [85] "dem41"             "dem42"             "dem43"
 [88] "dem44"             "dem45"             "dem46"
 [91] "lhi01"             "lhi02"             "lhi04_m1"
 [94] "lhi04_m2"          "lhi04_m3"          "lhi04_m4"
 [97] "lhi04_m5"          "lhi04_m6"          "lhi04_m7"
[100] "lhi04_m8"          "lhi04_m9"          "lhi04_m10"
[103] "lhi04_m11"         "lhi04_m12"         "lhi04_m13"
[106] "lhi04_m14"         "lhi04_m15"         "lhi04_m16"
[109] "lhi04_m17"         "lhi04_m18"         "lhi04_m19"
[112] "lhi04_m20"         "lhi04_y1"          "lhi04_y2"
```

```
[115] "lhi04_y3"     "lhi04_y4"     "lhi04_y5"
[118] "lhi04_y6"     "lhi04_y7"     "lhi04_y8"
[121] "lhi04_y9"     "lhi04_y10"    "lhi04_y11"
[124] "lhi04_y12"    "lhi04_y13"    "lhi04_y14"
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[130] "lhi04_y18"    "lhi04_y19"    "lhi04_y20"
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[238] "lhi06_y6"     "lhi06_y7"     "lhi06_y8"
[241] "lhi06_y9"     "lhi06_y10"    "lhi06_y11"
```

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[247] "lhi06_y15"          "lhi06_y16"          "lhi06_y17"
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[499] "lhi16_7"           "lhi16_8"           "lhi16_9"
```

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[1354] "hhd36_10"         "hhd36_11"         "hhd36_12"
[1357] "hhd36_13"         "hhd36_14"         "hhd36_15"
[1360] "hhd36_16"         "hhd36_17"         "hhd36_18"
[1363] "hhd36_19"         "hhd36_20"         "hhd36_21"
[1366] "hhd36_22"         "gen01"            "gen02"
[1369] "gen03"            "gen09m"           "gen09y"
[1372] "gen10m"           "gen10y"           "gen11"
[1375] "gen12iso"         "gen15a"           "gen15au"
[1378] "gen15b"           "gen15bu"          "gen16"
[1381] "gen23m"           "gen23y"           "gen24m"
[1384] "gen24y"           "gen25"            "gen26iso"
[1387] "gen29a"           "gen29au"          "gen29b"
[1390] "gen29bu"          "gen30"            "gen37a"
[1393] "gen37m"           "gen37y"           "gen38a"
[1396] "gen38bm"          "gen38by"          "gen39a"
[1399] "gen39b"           "gen40"            "gen41a"
[1402] "gen41a_4001"      "gen41b"           "gen41b_4001"
```

```
[1405] "gen42"        "gen43"        "gen44aiso"
[1408] "gen44b"       "gen45"        "gen46"
[1411] "gen47"        "gen48"        "gen48isco"
[1414] "gen49"        "gen49isced"   "gen50"
[1417] "gen50isco"    "gen51"        "gen51isced"
[1420] "gen52"        "gen52am"      "gen52ay"
[1423] "gen53"        "gen54"        "gen55"
[1426] "gen56"        "gen57m"       "gen57y"
[1429] "gen58"        "gen59"        "gen60_1"
[1432] "gen60_2"      "gen60_3"      "gen60_4"
[1435] "gen60_5"      "gen60_6"      "gen60_7"
[1438] "gen60_8"      "gen60_9"      "gen60_10"
[1441] "gen60_11"     "gen60_12"     "gen60_13"
[1444] "gen60_14"     "gen60_15"     "gen60_16"
[1447] "gen60_17"     "gen60_18"     "gen60_19"
[1450] "gen60_20"     "gen60_21"     "gen60_22"
[1453] "gen63"        "gen66"        "gen67_1"
[1456] "gen67_2"      "gen67_3"      "gen67_4"
[1459] "gen67_5"      "gen67_6"      "gen67_7"
[1462] "gen67_8"      "gen67_9"      "gen67_10"
[1465] "gen67_11"     "gen67_12"     "gen67_13"
[1468] "gen67_14"     "gen67_15"     "gen67_16"
[1471] "gen67_17"     "gen67_18"     "gen67_19"
[1474] "gen67_20"     "gen67_21"     "gen67_22"
[1477] "gen68"        "gen69_1"      "gen69_2"
[1480] "gen69_3"      "gen69_4"      "gen69_5"
[1483] "gen69_6"      "gen69_7"      "gen69_8"
[1486] "gen69_9"      "gen69_10"     "gen69_11"
[1489] "gen69_12"     "gen69_13"     "gen69_14"
[1492] "gen69_15"     "gen69_16"     "gen69_17"
[1495] "gen69_18"     "gen69_19"     "gen69_20"
[1498] "gen69_21"     "gen69_22"     "gen70"
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[1504] "gen71_4"      "gen71_5"      "gen71_6"
[1507] "gen71_7"      "gen71_8"      "gen71_9"
[1510] "gen71_10"     "gen71_11"     "gen71_12"
[1513] "gen71_13"     "gen71_14"     "gen71_15"
[1516] "gen71_16"     "gen71_17"     "gen71_18"
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[1522] "gen71_22"     "wel01"        "wel02"
[1525] "wel02a"       "wel03_1"      "wel03_2"
[1528] "wel03_3"      "wel03_4"      "wel03_5"
[1531] "wel03_6"      "wel03_7"      "wel03_8"
```

```
[1534] "wel03_9"           "wel03_10"          "wel03_11"
[1537] "wel03_12"          "wel03_13"          "wel03_14"
[1540] "wel03_15"          "wel03_16"          "wel03_17"
[1543] "wel03_18"          "wel03_19"          "wel03_20"
[1546] "wel04"             "wel05"             "wel06"
[1549] "wel07"             "wel08"             "wel09a"
[1552] "wel09b"            "wel09c"            "wel09d"
[1555] "wel09e"            "wel09f"            "wel10_1"
[1558] "wel10_2"           "wel10_3"           "wel10_4"
[1561] "wel10_5"           "wel10_6"           "wel10_7"
[1564] "wel10_8"           "wel10_9"           "wel10_10"
[1567] "wel10_11"          "wel10_12"          "wel10_13"
[1570] "wel10_14"          "wel10_15"          "wel10_16"
[1573] "wel10_17"          "wel10_18"          "wel10_19"
[1576] "wel10_20"          "wel10_21"          "wel10_22"
[1579] "wel11a"            "wel11b"            "wel11c"
[1582] "wel11d"            "wel11e"            "wel14a_4001"
[1585] "wel14b_4001"       "wel14c_4001"       "wel14d_4001"
[1588] "wel14e_4001"       "wel14f_4001"       "wel14g_4001"
[1591] "wel16a_4001"       "wel16b_4001"       "wel16c_1_4001"
[1594] "wel16c_2_4001"     "wel16c_3_4001"     "wel16c_4_4001"
[1597] "wel16c_5_4001"     "wel16c_6_4001"     "wel16c_7_4001"
[1600] "wel16c_8_4001"     "wel16c_9_4001"     "wel16c_10_4001"
[1603] "wel16c_11_4001"    "wel16c_12_4001"    "wel16c_13_4001"
[1606] "wel16c_14_4001"    "wel16c_15_4001"    "wel16c_16_4001"
[1609] "wel16c_17_4001"    "wel16c_18_4001"    "wel16c_19_4001"
[1612] "wel16c_20_4001"    "wel16d_m1_4001"    "wel16d_m2_4001"
[1615] "wel16d_m3_4001"    "wel16d_m4_4001"    "wel16d_m5_4001"
[1618] "wel16d_m6_4001"    "wel16d_m7_4001"    "wel16d_m8_4001"
[1621] "wel16d_m9_4001"    "wel16d_m10_4001"   "wel16d_m11_4001"
[1624] "wel16d_m12_4001"   "wel16d_m13_4001"   "wel16d_m14_4001"
[1627] "wel16d_m15_4001"   "wel16d_m16_4001"   "wel16d_m17_4001"
[1630] "wel16d_m18_4001"   "wel16d_m19_4001"   "wel16d_m20_4001"
[1633] "wel16d_y1_4001"    "wel16d_y2_4001"    "wel16d_y3_4001"
[1636] "wel16d_y4_4001"    "wel16d_y5_4001"    "wel16d_y6_4001"
[1639] "wel16d_y7_4001"    "wel16d_y8_4001"    "wel16d_y9_4001"
[1642] "wel16d_y10_4001"   "wel16d_y11_4001"   "wel16d_y12_4001"
[1645] "wel16d_y13_4001"   "wel16d_y14_4001"   "wel16d_y15_4001"
[1648] "wel16d_y16_4001"   "wel16d_y17_4001"   "wel16d_y18_4001"
[1651] "wel16d_y19_4001"   "wel16d_y20_4001"   "wel16a_1_4002"
[1654] "wel16a_2_4002"     "wel16a_3_4002"     "wel16a_4_4002"
[1657] "wel16a_5_4002"     "wel16a_6_4002"     "wel16a_7_4002"
[1660] "wel16a_8_4002"     "wel16a_9_4002"     "wel16a_10_4002"
```

```
[1663] "wel16a_11_4002"    "wel16a_12_4002"    "wel16a_13_4002"
[1666] "wel16a_14_4002"    "wel16a_15_4002"    "wel16a_16_4002"
[1669] "wel16a_17_4002"    "wel16a_18_4002"    "wel16a_19_4002"
[1672] "wel16a_20_4002"    "wel16b_1_4002"     "wel16b_2_4002"
[1675] "wel16b_3_4002"     "wel16b_4_4002"     "wel16b_5_4002"
[1678] "wel16b_6_4002"     "wel16b_7_4002"     "wel16b_8_4002"
[1681] "wel16b_9_4002"     "wel16b_10_4002"    "wel16b_11_4002"
[1684] "wel16b_12_4002"    "wel16b_13_4002"    "wel16b_14_4002"
[1687] "wel16b_15_4002"    "wel16b_16_4002"    "wel16b_17_4002"
[1690] "wel16b_18_4002"    "wel16b_19_4002"    "wel16b_20_4002"
[1693] "wel16c_1_4002"     "wel16c_2_4002"     "wel16c_3_4002"
[1696] "wel16c_4_4002"     "wel16c_5_4002"     "wel16c_6_4002"
[1699] "wel16c_7_4002"     "wel16c_8_4002"     "wel16c_9_4002"
[1702] "wel16c_10_4002"    "wel16c_11_4002"    "wel16c_12_4002"
[1705] "wel16c_13_4002"    "wel16c_14_4002"    "wel16c_15_4002"
[1708] "wel16c_16_4002"    "wel16c_17_4002"    "wel16c_18_4002"
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[1714] "wel16d_2_4002"     "wel16d_3_4002"     "wel16d_4_4002"
[1717] "wel16d_5_4002"     "wel16d_6_4002"     "wel16d_7_4002"
[1720] "wel16d_8_4002"     "wel16d_9_4002"     "wel16d_10_4002"
[1723] "wel16d_11_4002"    "wel16d_12_4002"    "wel16d_13_4002"
[1726] "wel16d_14_4002"    "wel16d_15_4002"    "wel16d_16_4002"
[1729] "wel16d_17_4002"    "wel16d_18_4002"    "wel16d_19_4002"
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[1735] "wel16e_3_4002"     "wel16e_4_4002"     "wel16e_5_4002"
[1738] "wel16e_6_4002"     "wel16e_7_4002"     "wel16e_8_4002"
[1741] "wel16e_9_4002"     "wel16e_10_4002"    "wel16e_11_4002"
[1744] "wel16e_12_4002"    "wel16e_13_4002"    "wel16e_14_4002"
[1747] "wel16e_15_4002"    "wel16e_16_4002"    "wel16e_17_4002"
[1750] "wel16e_18_4002"    "wel16e_19_4002"    "wel16e_20_4002"
[1753] "wel16f_1_4002"     "wel16f_2_4002"     "wel16f_3_4002"
[1756] "wel16f_4_4002"     "wel16f_5_4002"     "wel16f_6_4002"
[1759] "wel16f_7_4002"     "wel16f_8_4002"     "wel16f_9_4002"
[1762] "wel16f_10_4002"    "wel16f_11_4002"    "wel16f_12_4002"
[1765] "wel16f_13_4002"    "wel16f_14_4002"    "wel16f_15_4002"
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[1771] "wel16f_19_4002"    "wel16f_20_4002"    "wel16g_1_4002"
[1774] "wel16g_2_4002"     "wel16g_3_4002"     "wel16g_4_4002"
[1777] "wel16g_5_4002"     "wel16g_6_4002"     "wel16g_7_4002"
[1780] "wel16g_8_4002"     "wel16g_9_4002"     "wel16g_10_4002"
[1783] "wel16g_11_4002"    "wel16g_12_4002"    "wel16g_13_4002"
[1786] "wel16g_14_4002"    "wel16g_15_4002"    "wel16g_16_4002"
[1789] "wel16g_17_4002"    "wel16g_18_4002"    "wel16g_19_4002"
```

```
[1792] "wel16g_20_4002"    "wrk01"              "wrk02"
[1795] "wrk03m"            "wrk03y"             "wrk04"
[1798] "wrk04isco"         "wrk06"              "wrk07"
[1801] "wrk08"             "wrk09"              "wrk10"
[1804] "wrk11"             "wrk12"              "wrk13"
[1807] "wrk14"             "wrk15a"             "wrk15b"
[1810] "wrk15c"            "wrk15d"             "wrk16a"
[1813] "wrk16b"            "wrk17"              "wrk18"
[1816] "wrk20"             "wrk21"              "wrk22"
[1819] "wrk23"             "wrk24"              "wrk25"
[1822] "wrk26"             "wrk27"              "wrk27isco"
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[1828] "wrk30ay"           "wrk31"              "wrk32"
[1831] "wrk34"             "wrk34isco"          "wrk35"
[1834] "wrk36"             "wrk37"              "wrk38"
[1837] "wrk39"             "wrk40"              "wrk41"
[1840] "wrk42"             "wrk43"              "wrk44"
[1843] "wrk46"             "wrk47"              "wrk48"
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[1855] "wrk51a_4007"       "wrk51b_4007"        "wrk51a_4008"
[1858] "wrk51b_4008"       "wrk51_4009"         "wrk51_4010"
[1861] "wrk51a_4011"       "wrk51b_4011"        "wrk51_4012"
[1864] "wrk51_4013"        "wrk51_4014"         "wrk51_4015"
[1867] "inc01"             "inc03"              "inc05"
[1870] "inc06"             "inc08_1"            "inc08_2"
[1873] "inc08_3"           "inc08_4"            "inc08_5"
[1876] "inc08_6"           "inc08_7"            "inc08_8"
[1879] "inc08_9"           "inc08_10"           "inc08_11"
[1882] "inc08_12"          "inc09_1"            "inc09_2"
[1885] "inc09_3"           "inc09_4"            "inc09_5"
[1888] "inc09_6"           "inc09_7"            "inc09_8"
[1891] "inc09_9"           "inc09_10"           "inc09_11"
[1894] "inc11_1"           "inc11_2"            "inc11_3"
[1897] "inc11_4"           "inc11_5"            "inc11_6"
[1900] "inc11_7"           "inc11_8"            "inc11_9"
[1903] "inc11_10"          "inc11_11"           "inc12"
[1906] "inc13"             "inc14_1"            "inc14_2"
[1909] "inc14_3"           "inc14_4"            "inc14_5"
[1912] "inc14_6"           "inc14_7"            "inc14_8"
[1915] "inc14_9"           "inc14_10"           "inc14_11"
[1918] "inc14_12"          "inc14_13"           "inc14_14"
```

```
[1921] "inc14_15"         "inc14_16"         "inc14_17"
[1924] "inc14_18"         "inc14_19"         "inc14_20"
[1927] "inc14_21"         "inc14_22"         "inc15"
[1930] "att01"            "att02"            "att03a"
[1933] "att03b"           "att03d"           "att03e"
[1936] "att03g"           "att03h"           "att03i"
[1939] "att03j"           "att05b"           "att06a"
[1942] "att06b"           "att07a"           "att07b"
[1945] "att07c"           "att07d"           "att07g"
[1948] "att08"            "att09"            "att09u"
[1951] "att10"            "att11b"           "att11d"
[1954] "att13a_4001"      "att13b_4001"      "att13c_4001"
[1957] "att13d_4001"      "att13e_4001"      "att13f_4001"
[1960] "att13g_4001"      "att13h_4001"      "att13_4002"
[1963] "att13_4003"       "att13_4004"       "att13_4005"
[1966] "att13_1_4006"     "att13_2_4006"     "att13_3_4006"
[1969] "att13_4_4006"     "att13_5_4006"     "att13_6_4006"
[1972] "att13_7_4006"     "att13_8_4006"     "att13_9_4006"
[1975] "att13_4007"       "att19a_4001"      "att19b_4001"
[1978] "att19c_4001"      "rep01"            "rep02"
[1981] "rep03_1"          "rep03_2"          "rep03_3"
[1984] "rep03_4"          "rep04"            "rep05"
[1987] "rep06"            "flag1"            "localitysize_4001"
[1990] "department_4001"  "city_4001"
```

2 Evaluación de información y pirámides

2.1 Paquetes

```r
if (!require("pacman")) install.packages("pacman") # instala pacman si se requiere
```

```
Cargando paquete requerido: pacman
```

```r
pacman::p_load(tidyverse,
               readxl,
               writexl,
               haven,
               sjlabelled,
               foreign,
               janitor,
               remotes,
               wppExplorer,
               apyramid,
               fmsb)
```

2.2 Instalación de paquetes en desarrollo, reprisse

Esto puede tardar un ratito

```r
install.packages("rstan", repos = c("https://mc-stan.org/r-packages/", getOption("repos"))
remotes::install_github("timriffe/DemoTools")

library("DemoTools")

remotes::install_github("PPgp/wpp2022")
```

- Si pide actualizar darle 1, de "All

- o 2 de "CRAN only"

```
Cargando paquete requerido: Rcpp

Cargando paquete requerido: data.table


Adjuntando el paquete: 'data.table'

The following objects are masked from 'package:lubridate':

    hour, isoweek, mday, minute, month, quarter, second, wday, week,
    yday, year

The following objects are masked from 'package:dplyr':

    between, first, last

The following object is masked from 'package:purrr':

    transpose
```

2.3 Datos

2.3.1 `{wpp2022}`

Vamos a utilizar datos del paquete `{wpp2022}` . Revisemos la viñeta del paquete que está aquí

Todas los *data.frames* están en el paquete y si lo tenemos cargados podemos consultarlo con el comando data()

```
data("popAge5dt")
data("popprojAge5dt")
```

** En caso que no tengas disponible, puedes descargar la información de la carpeta datos

```
load("datos/wpp2022.RData")
```

Aquí están todos los países, revisemos un poco

```r
popAge5dt %>%
  dplyr::select(country_code, name) %>%
  unique()
```

```
   country_code                               name
          <int>                             <char>
  1:        900                              World
  2:       1834                 Sub-Saharan Africa
  3:       1833 Northern Africa and Western Asia
  4:       1831        Central and Southern Asia
  5:       1832   Eastern and South-Eastern Asia
 ---
281:        882                              Samoa
282:        772                            Tokelau
283:        776                              Tonga
284:        798                             Tuvalu
285:        876        Wallis and Futuna Islands
```

Podemos hacer búsquedas:

```r
popAge5dt %>%
  mutate(uy=stringr::str_detect(name, "Uruguay")) %>%
  filter(uy) %>%
  select(country_code, name)
```

```
   country_code    name
          <int>  <char>
  1:        858 Uruguay
  2:        858 Uruguay
  3:        858 Uruguay
  4:        858 Uruguay
  5:        858 Uruguay
 ---
311:        858 Uruguay
312:        858 Uruguay
313:        858 Uruguay
314:        858 Uruguay
315:        858 Uruguay
```

Vamos a hacer el ejercicio con Uruguay pero pueden buscar cualquier otro país y la región

```
# Países:
# uy: 858
# sv: 222
# gt: 320
# hn: 340
# mx: 484
# CA: 916
# LAC: 1830

popAge1dt<- popAge1dt %>%
  filter(country_code%in%c(858,1830))
```

También, tengo datos de algunos censos, descargados de ipums

2.4 De IPUMS

```
readxl::read_excel("datos/censos_p2.xlsx",
                   sheet = "El Salvador 1992" ) %>% #ojo con este argumento
  head() %>%
  janitor::clean_names() # checa qué hace
```

```
# A tibble: 6 x 4
  age    male female unknown
  <chr> <dbl>  <dbl>   <dbl>
1 0      6093   6113       0
2 1      6089   5795       0
3 2      6805   6737       0
4 3      7028   6699       0
5 4      7294   6965       0
6 5      6628   6408       0
```

Usaremos esta tabla de datos agregados para **crear variables**. Esto se hace con el comando `dplyr::mutate()`

```
sv1992<-readxl::read_excel("datos/censos_p2.xlsx") %>%
  janitor::clean_names() %>% #
  dplyr::mutate(total=male + female) %>% # ojo
  dplyr::mutate(age=as.numeric(age)) #ojo
```

2.5 {fmsb} Atracción digital

Este paquete tiene cosas muy interesantes. Es un paquete no sólo para demografía pero permite ajustar algunas funciones demográficas

Limitantes: como que está en japonés :P

Un ejemplo con el índice de Whipple, que mide la atracción digital. Necesitamos datos en edades singulares:

Tenemos un archivo en datos con varios censos, para evaluar su información a través de la atracción digital. Revisemos los datos del censo de 1992.

Para ver los totales podemos agregar una fila muy simple con `janitor::adorn_totals(where="row")`

```
sv1992 %>%
  janitor::adorn_totals(where="row")
```

```
 age   male  female unknown  total
   0  34677  33056       0  67733
   1  33975  32532       0  66507
   2  34209  32768       0  66977
   3  32886  31872       0  64758
   4  33270  32142       0  65412
   5  34431  33186       0  67617
   6  34498  33185       0  67683
   7  33990  33281       0  67271
   8  33948  32703       0  66651
   9  34451  33000       0  67451
  10  36054  34806       0  70860
  11  34694  33754       0  68448
  12  35262  33354       0  68616
  13  34022  33667       0  67689
  14  37766  35975       0  73741
  15  36152  35668       0  71820
  16  35151  34324       0  69475
  17  34692  34342       0  69034
  18  35626  35214       0  70840
  19  35681  35479       0  71160
  20  34434  34184       0  68618
  21  31682  32490       0  64172
  22  31753  32113       0  63866
  23  31518  32471       0  63989
```

24	31746	32462	0	64208
25	30354	31796	0	62150
26	29549	30501	0	60050
27	29886	30447	0	60333
28	31449	32310	0	63759
29	30614	31847	0	62461
30	31998	33524	0	65522
31	30504	32079	0	62583
32	29674	30984	0	60658
33	29204	30810	0	60014
34	27498	28938	0	56436
35	28041	29299	0	57340
36	25792	27148	0	52940
37	25652	26733	0	52385
38	25285	26629	0	51914
39	24659	25725	0	50384
40	24542	25781	0	50323
41	22611	23587	0	46198
42	21913	23362	0	45275
43	21080	22483	0	43563
44	20982	22286	0	43268
45	21950	23319	0	45269
46	21141	22694	0	43835
47	21187	22586	0	43773
48	20846	22088	0	42934
49	20188	21516	0	41704
50	20870	22721	0	43591
51	19367	20836	0	40203
52	19234	20692	0	39926
53	19407	20739	0	40146
54	18920	20347	0	39267
55	18476	20036	0	38512
56	18028	19631	0	37659
57	17785	19492	0	37277
58	17496	19038	0	36534
59	16774	18620	0	35394
60	17200	19295	0	36495
61	15412	16933	0	32345
62	14865	17193	0	32058
63	14290	16123	0	30413
64	13512	15429	0	28941
65	13477	16028	0	29505
66	12171	14284	0	26455

```
   67   11515   13632         0   25147
   68   10653   12952         0   23605
   69   10043   12361         0   22404
   70   10376   13176         0   23552
   71    8954   11598         0   20552
   72    8319   10801         0   19120
   73    7734   10764         0   18498
   74    7361   10284         0   17645
   75    7200   10368         0   17568
   76    6436    9251         0   15687
   77    6161    9149         0   15310
   78    6006    9154         0   15160
   79    5552    8797         0   14349
   80    5154    8710         0   13864
   81    4366    7319         0   11685
   82    3778    6992         0   10770
   83    3296    6111         0    9407
   84    3000    5663         0    8663
   85    2501    5071         0    7572
   86    2083    4366         0    6449
   87    1709    3613         0    5322
   88    1376    3094         0    4470
   89    1075    2586         0    3661
   90     868    2285         0    3153
   91     610    1544         0    2154
   92     437    1188         0    1625
   93     320     977         0    1297
   94     288     678         0     966
   95     141     544         0     685
   96     107     364         0     471
   97      69     292         0     361
   98      56     188         0     244
   99      28     122         0     150
  100      74     217         0     291
  999       0       0         0       0
Total 1928097 2038148         0 3966245
```

```
sv1992<-readxl::read_excel("datos/censos_p2.xlsx") %>%
  janitor::clean_names() %>% #
  dplyr::mutate(total= male + female) %>%
  dplyr::mutate(age=as.numeric(age))
```

El índice de Whipple

```
sv1992 %>%
  dplyr::filter(!age>64) %>% # Este filtro es importante
  dplyr::count(age, wt=total) %>%  # necesitamos siempre una tabla que se ve así
  head()
```

```
# A tibble: 6 x 2
    age     n
  <dbl> <dbl>
1     0 67733
2     1 66507
3     2 66977
4     3 64758
5     4 65412
6     5 67617
```

```
sv1992 %>%
  dplyr::filter(!age>64) %>% # Este filtro es importante
  dplyr::count(age, wt=male) %>%
 with(
    fmsb::WhipplesIndex(n) # se llama n por la segunda columa de la tabla anterior
    )
```

```
$WI
[1] 102.4858

$JUDGE
[1] "highly accurate"
```

2.5.1 Momento de práctica

** Importa cualquier otro censo y encuentra el índice de Whipple

2.6 {DemoTools}

Con este paquete también podemos hacer evaluaciones, pero podemos hacer índices más complejos.

Trabaja con vectores individuales.

2.6.1 Whipple

```
check_heaping_whipple(Value=sv1992$total,
                      Age= sv1992$age,
                      ageMin = 25,
                      ageMax = 60,
                      digit = c(0, 5))
```

```
[1] 1.027454
```

2.6.2 Noumbissi

```
check_heaping_noumbissi(sv1992$male,
                        Age=sv1992$age,
                        ageMin = 30,
                        ageMax = 60,
                        digit = 0)
```

```
[1] 1.038527
```

Mayor a 1, el dígito atrae; menor que 1, el índice "repele"

Vamos a hacer un "loop"

```
# Para todos los dígitos

for(i in 0:2){
  Ni<-check_heaping_noumbissi(sv1992$total,
                              sv1992$age,
                              ageMin = 30+i, # ojo
                              ageMax = 60+i,
                              digit = i)
  names(Ni)<-i
  print(Ni)
}
```

```
       0
1.041897
       1
```

```
0.9862813
        2
0.9914849
```

```
for(i in 3:9) {
  Ni<-check_heaping_noumbissi(sv1992$total,
                              sv1992$age,
                              ageMin = 20+i, #ojo
                              ageMax = 50+i,
                              digit = i)
  names(Ni)<-i
  print(Ni)
}
```

```
       3
1.001463
        4
0.9975687
       5
1.013907
        6
0.9823982
       7
0.992047
       8
1.006642
        9
0.9933094
```

2.6.3 Spoorrenberg

```
check_heaping_spoorenberg(sv1992$total,
                          sv1992$age,
                          ageMin = 23,
                          ageMax = 62)
```

```
[1] 0.1208199
```

2.6.4 Indice de Myers

```
check_heaping_myers(Value = sv1992$total,
                    Age = sv1992$age,
                    ageMin = 23,
                    ageMax = 82,
                    method = "pasex")
```

```
[1] 1.075925
```

2.7 Pirámides

as pirámides son parte esencial de lo que llamamos *Demografía estática*, nos cuentan un siglo de historia de las poblaciones

2.7.1 Con grupos quinquenales

Si queremos hacerlo como gráficos de barra, seguramente queremos cortar la variable de edad. Igual este paso es esencial en la vida demográfica:

```
pob_uy<- popAge1dt %>%
  dplyr::filter(name=="Uruguay") %>%
  dplyr::mutate(eda5=cut(age, # la variable a cortar
                  breaks=seq(0,110, # El rango válido
                             by=5), # El ancho del intervalo
                  include.lowest=T, # para que incluya el valor más bajo dentro del interv
                  right=F)) # indica si el intervalo irá abierto en la derecha, ponemos un
```

Veamos esta variable:

```
pob_uy %>%
  count(eda5, wt=pop)
```

```
        eda5         n
      <fctr>     <num>
 1:    [0,5) 18515.960
 2:   [5,10) 18288.987
 3:  [10,15) 17935.920
```

```
 4:    [15,20) 17453.353
 5:    [20,25) 16764.673
 6:    [25,30) 15926.536
 7:    [30,35) 15076.952
 8:    [35,40) 14368.985
 9:    [40,45) 13648.200
10:    [45,50) 12754.619
11:    [50,55) 11801.696
12:    [55,60) 10726.383
13:    [60,65)  9461.974
14:    [65,70)  8026.193
15:    [70,75)  6481.370
16:    [75,80)  4815.778
17:    [80,85)  3121.340
18:    [85,90)  1673.401
19:    [90,95)   702.236
20:   [95,100)   215.386
21:  [100,105)    52.330
          eda5         n
```

Para que funcione mejor, necesitamos que sexo sea una variable y una columna.

Vamos a utilizar `tidyr::pivot_longer()` para hacer "larga" nuestro data.frame

```
pob_uy %>%
  tidyr::pivot_longer(cols = popM:pop,
                      values_to = "poblacion",
                      names_to = "sexo")
```

```
# A tibble: 22,119 x 7
   country_code name     year   age eda5  sexo  poblacion
          <int> <chr>   <int> <int> <fct> <chr>     <dbl>
 1          858 Uruguay  1949     0 [0,5) popM       22.3
 2          858 Uruguay  1949     0 [0,5) popF       21.4
 3          858 Uruguay  1949     0 [0,5) pop        43.7
 4          858 Uruguay  1949     1 [0,5) popM       21.8
 5          858 Uruguay  1949     1 [0,5) popF       21.3
 6          858 Uruguay  1949     1 [0,5) pop        43.1
 7          858 Uruguay  1949     2 [0,5) popM       21.8
 8          858 Uruguay  1949     2 [0,5) popF       21.5
 9          858 Uruguay  1949     2 [0,5) pop        43.3
10          858 Uruguay  1949     3 [0,5) popM       21.3
```

```
# i 22,109 more rows
```

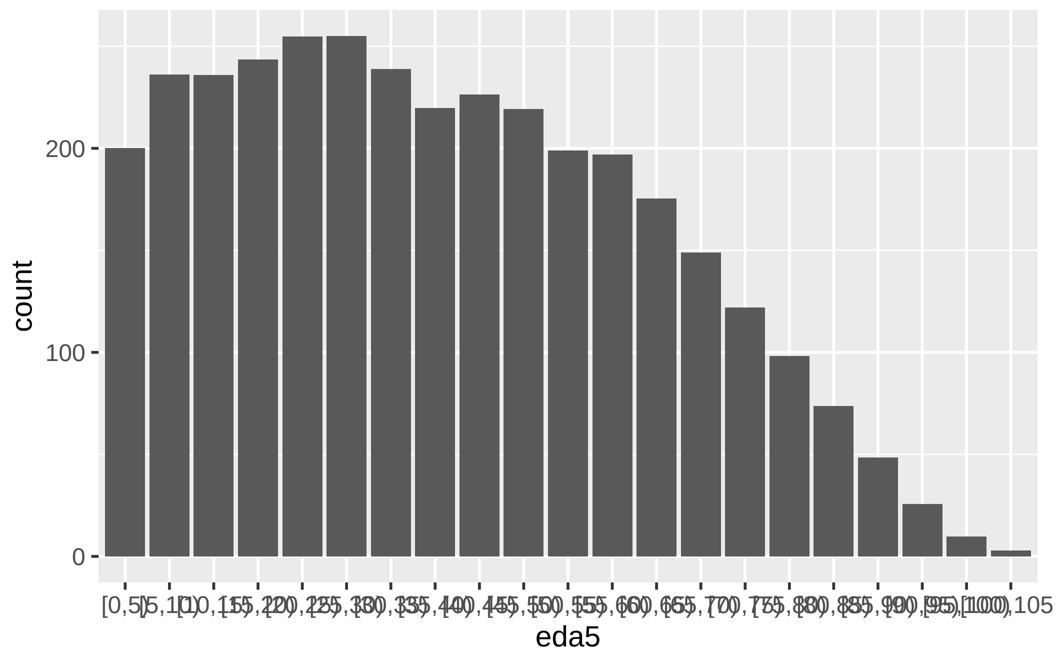
```
pob_uy_long<-pob_uy %>%
  tidyr::pivot_longer(cols = popM:popF,
                      values_to = "poblacion",
                      names_to = "sexo") %>%
  dplyr::select(-pop) # checa este tipo de "anti-selección"
```

2.7.2 Momento de práctica

popAge son los datos históricos, piensa cómo volverías *long* la base de proyecciones *popprojAge*. ¡Checa que hay tipos de proyecciones!

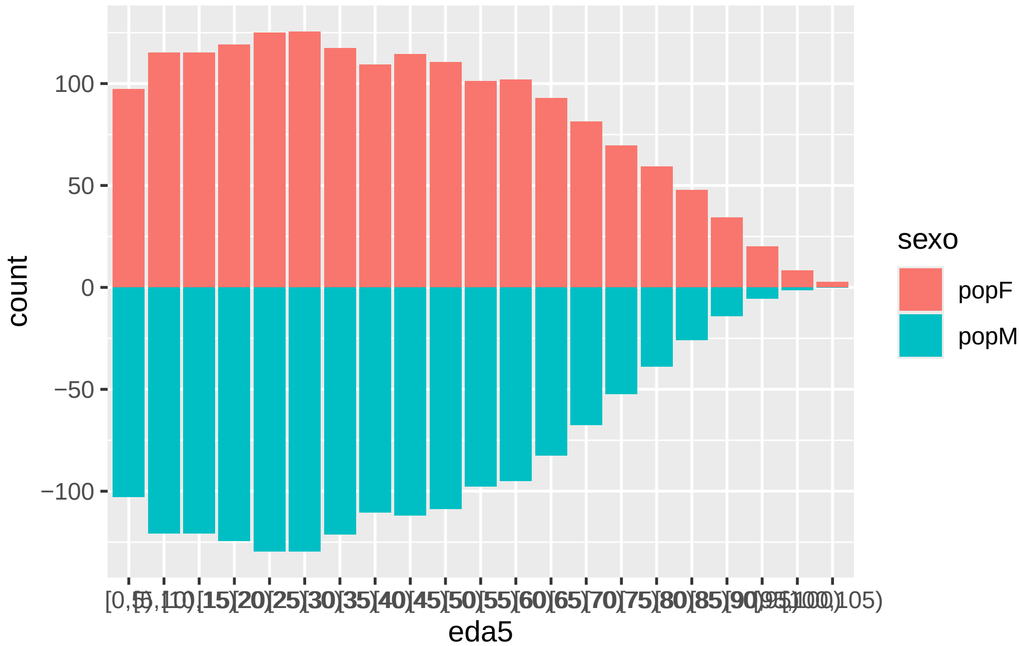
2.7.3 Pirámide en {ggplot2}

```
### gráfico de barras de edades quinquenales
pob_uy_long %>%
  dplyr::filter(year==2020) %>%
  ggplot2::ggplot() +
  aes(x=eda5, weight=poblacion) +
  geom_bar() # dibuja la geometría de barra
```



Una pirámide es un doble histograma por **sexo**, donde el valor de los hombres es negativo:

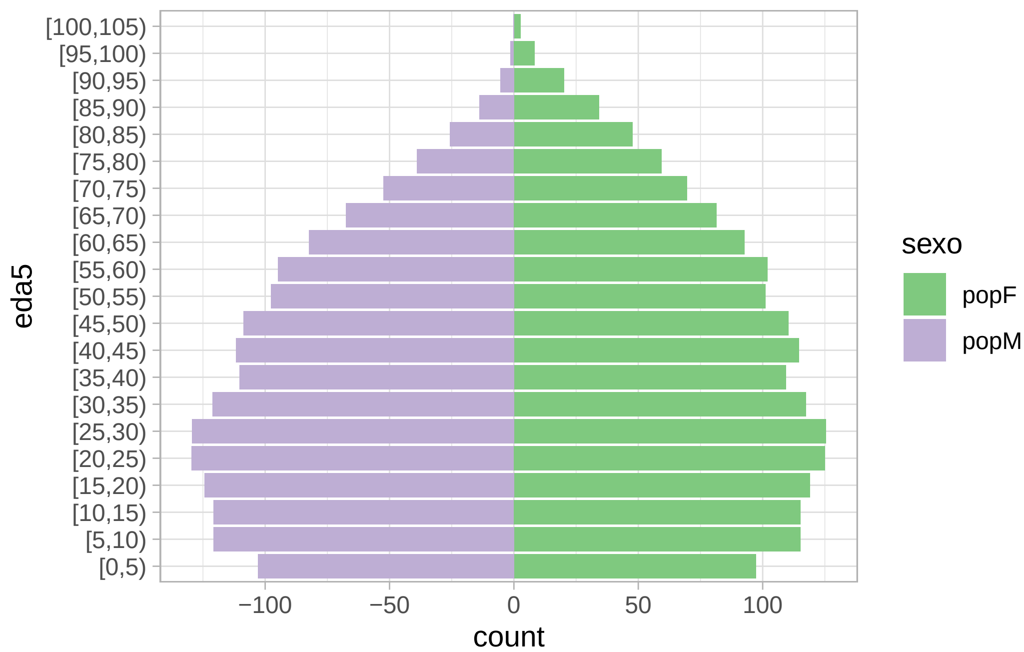
```
pob_uy_long %>%
  dplyr::filter(year==2020) %>%
  dplyr::mutate(poblacion2=if_else(sexo=="popM", -poblacion, poblacion)) %>%
  ggplot2::ggplot() +
  aes(eda5, fill=sexo, weight=poblacion2)+
  geom_bar() # dibuja la geometría de barra
```



Podemos darle la vuelta y cambiarle los colores

```
pob_uy_long <-  pob_uy_long %>%
  mutate(poblacion2=if_else(sexo=="popM", -poblacion, poblacion))


pob_uy_long %>%
  filter(year==2020) %>%
  ggplot(aes(eda5, fill=sexo, weight=poblacion2)) +
  geom_bar() + coord_flip() +
  scale_fill_brewer(palette = "Accent") +
  theme_light()
```



Como que las escalas tampoco están muy perfectas y no queremos las negativa.¡Los hombres no son personas negativas!

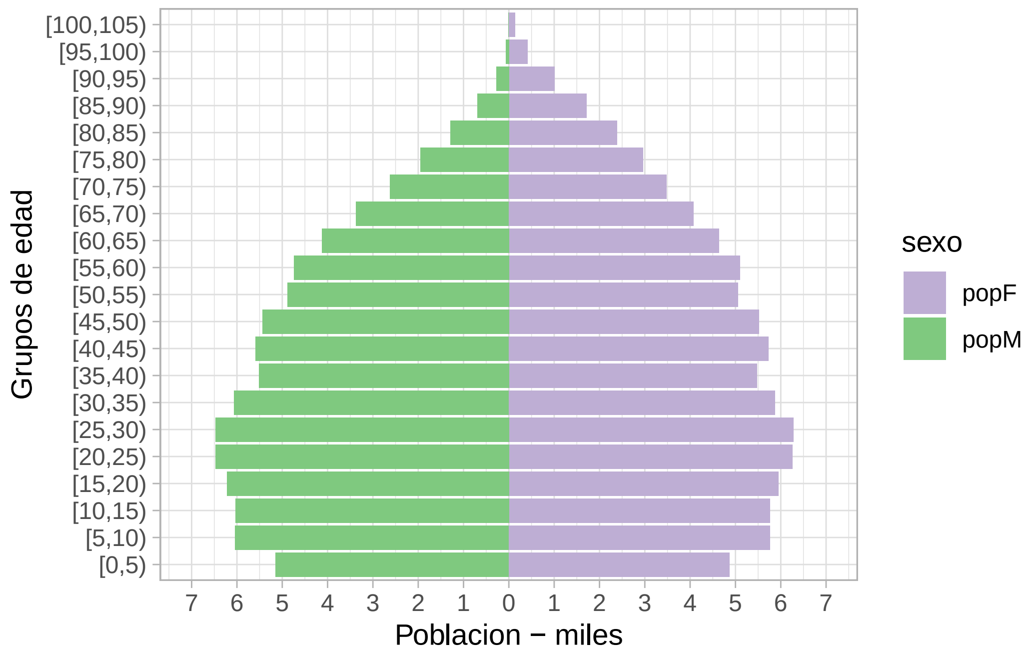
Veamos un poco cómo se comporta esa variable:

```
pob_uy_long %>%
  filter(year==2020) %>%
  count(eda5, sexo, wt=poblacion2) %>%
  summarise(max=max(n), min=min(n))
```

```
# A tibble: 1 x 2
    max   min
  <dbl> <dbl>
1  125. -130.
```

```
pob_uy_long %>%
  filter(year==2020) %>%
  ggplot() +
  aes(eda5, fill=sexo, weight=poblacion2)+
  geom_bar() + coord_flip() +
   scale_y_continuous(breaks = seq(-140, 140, by=20), # cuántos
                      limits = c(-140,140),
```

```
                        labels = paste0(
                         as.character(c(7:0,# sustituye negativos
                           1:7) # Para lo positivo
                           )
                         )
                        )+
  labs(y="Poblacion - miles", x="Grupos de edad") +
  scale_fill_brewer(palette = "Accent", direction = -1) +
  theme_light()
```



Esto es para el volumen de la población ¿Cómo podemos hacer una pirámide que sea en términos de proporciones?

Vamos a necesitar el total de la población:

```
pob_uy_long<- pob_uy_long %>%
  mutate(p_edo=sum(poblacion), .by = year)

head(pob_uy_long)
```

```
# A tibble: 6 x 9
```

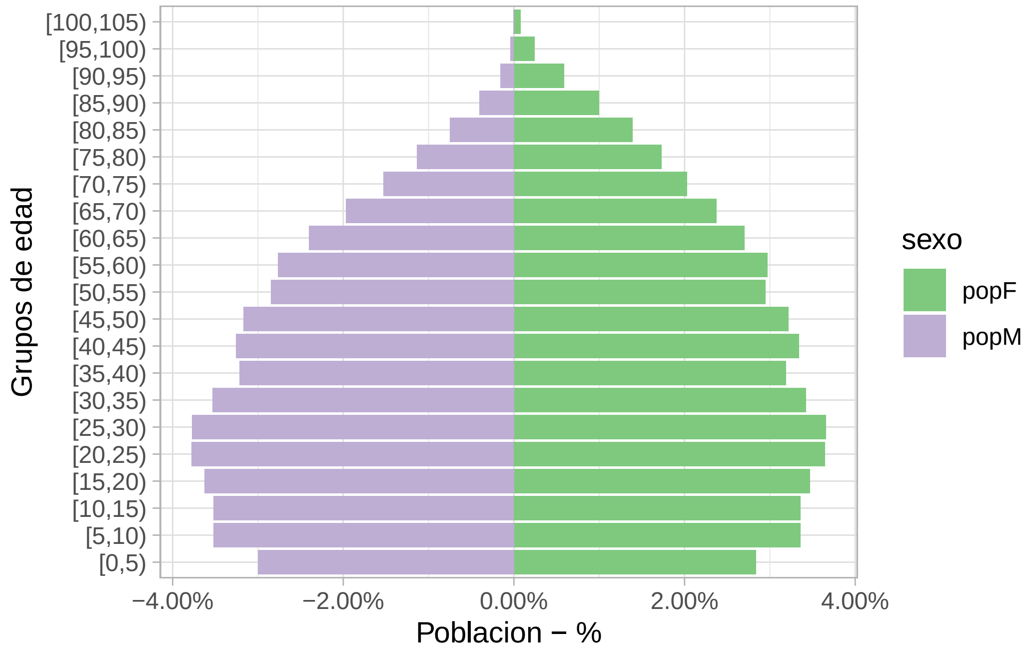
```
  country_code name     year   age eda5  sexo  poblacion poblacion2 p_edo
         <int> <chr>   <int> <int> <fct> <chr>     <dbl>      <dbl> <dbl>
1          858 Uruguay  1949     0 [0,5) popM       22.3      -22.3 2224.
2          858 Uruguay  1949     0 [0,5) popF       21.4       21.4 2224.
3          858 Uruguay  1949     1 [0,5) popM       21.8      -21.8 2224.
4          858 Uruguay  1949     1 [0,5) popF       21.3       21.3 2224.
5          858 Uruguay  1949     2 [0,5) popM       21.8      -21.8 2224.
6          858 Uruguay  1949     2 [0,5) popF       21.5       21.5 2224.
```

Hoy sí haremos lo mismo pero para las proporciones:

```
pob_uy_long <- pob_uy_long %>%
  mutate(poblacion3=if_else(sexo=="popM",
                            -poblacion/p_edo,
                            poblacion/p_edo))
```

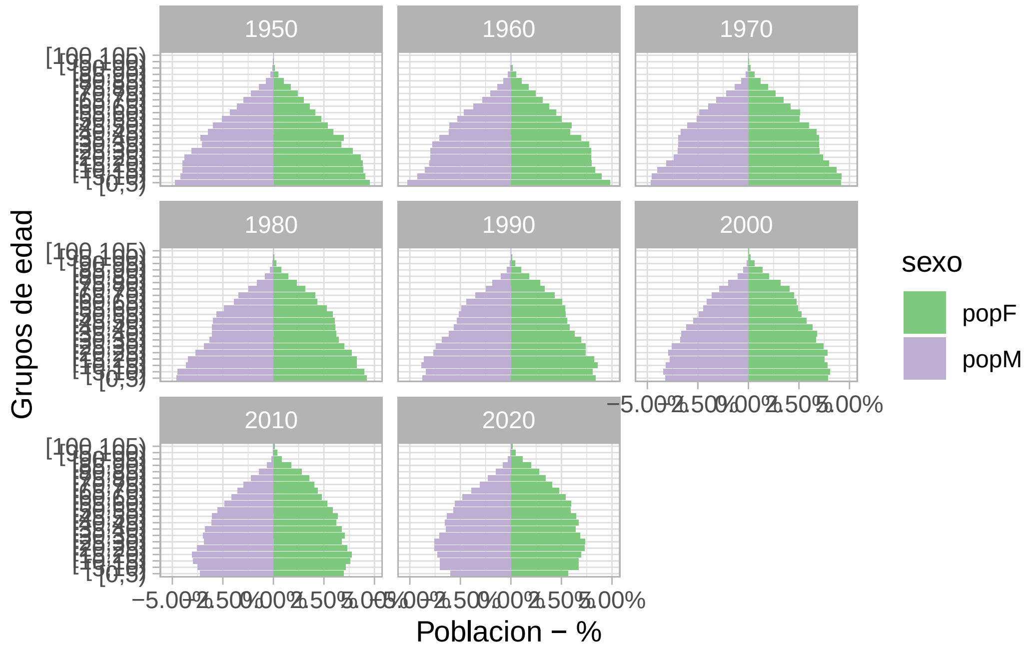
Una vez que ya tenemos nuestra variable proporcional:

```
pob_uy_long%>%
  filter(year==2020) %>%
  ggplot(aes(eda5, fill=sexo, weight=poblacion3))+
    geom_bar() + coord_flip() +
   scale_y_continuous(labels = scales::percent_format(accuracy=0.01))+
  labs(y="Poblacion - %", x="Grupos de edad") +
  scale_fill_brewer(palette = "Accent") +
  theme_light()
```



Podemos hacer varias pirámides aplicando *facets* o *grids*:

```
pob_uy_long %>%
  filter(year %in% seq(1950,2020, by=10)) %>%
  ggplot() +
  aes(eda5, fill=sexo, weight=poblacion3)+
  geom_bar() + coord_flip() +
  scale_y_continuous(labels = scales::percent_format(accuracy=0.01)) +
  labs(y="Poblacion - %", x="Grupos de edad") +
  scale_fill_brewer(palette = "Accent") +
  theme_light() +
  facet_wrap(~year)
```



2.8 Paquete {apyramid}

- Necesita que tengamos los datos quinquenales.
- No acepta funciones en las variables edad y sexo

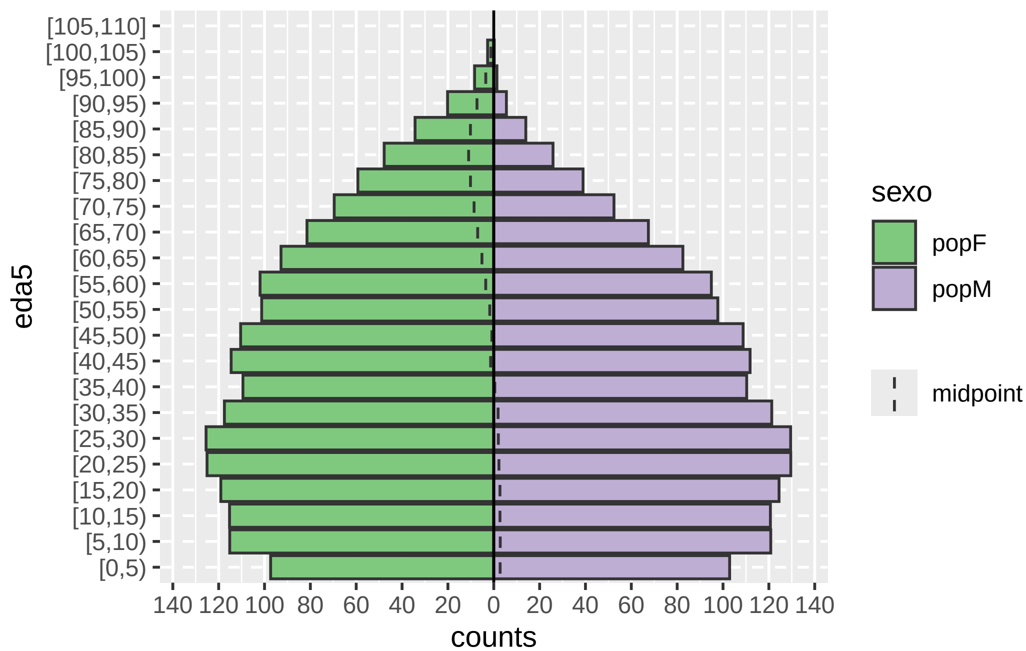
```
pob_uy_long %>%
  filter(year==2020) %>%
  count(eda5, sexo, wt=poblacion)
```

```
# A tibble: 42 x 3
   eda5    sexo      n
   <fct>   <chr> <dbl>
 1 [0,5)   popF   97.3
 2 [0,5)   popM  103.
 3 [5,10)  popF  115.
 4 [5,10)  popM  121.
 5 [10,15) popF  115.
 6 [10,15) popM  121.
 7 [15,20) popF  119.
 8 [15,20) popM  124.
```

```
 9 [20,25) popF  125.
10 [20,25) popM  130.
# i 32 more rows
```

```r
pob_uy_long %>%
  filter(year==2020) %>%
  count(eda5, sexo, wt=poblacion) %>%
  apyramid::age_pyramid(age_group = eda5,
                        split_by = sexo,
                        count = n)
```

```
Warning: Removed 1 row containing missing values or values outside the scale
range.
```



Nos ahorra un par de pasos, pero siempre tenemos que solucionar algunos elemetnos

Veamos como hacemos un *loop* para hacer varias pirámides, pero antes tenemos que arreglar un poco esa base que bajamos de WPP

```r
library(magrittr)
```

```
Adjuntando el paquete: 'magrittr'


The following object is masked from 'package:purrr':

    set_names


The following object is masked from 'package:tidyr':

    extract
```

```r
popAge5dt  %<>% # checa esto
  mutate(edad=parse_number(age)) %>%
  mutate(edad_factor=as.factor(edad))



popAge5dt %<>%
  pivot_longer(cols=popM:pop,
               names_to = "sex",
               values_to = "poblacion") %>%
  mutate(sex=str_replace_all(sex,"popF", "Mujeres")) %>%
  mutate(sex=str_replace_all(sex,"popM", "Hombres")) %>%
  mutate(sex=str_replace_all(sex,"pop", "Total"))
```

El loop:

```r
anios<-unique(popAge5dt$year)
pais<-c(858, 222, 320, 340, 484, 1830)
# uy: 858
# sv: 222
# gt: 320
# hn: 340
# mx: 484
# CA: 916
# LAC: 1830)

# Este es el loop donde reemplaza por i cada código de país
for (i in pais){

  popAge5dt %>%
```

```
    mutate(poblacion=poblacion/1000) %>%
    filter(country_code==i) %>%
    filter(!sex=="Total") %>%
    filter(year==2020) %>%
    age_pyramid(edad_factor, # edad
                split_by = sex,
                count=poblacion)+
    labs(x="edad",
         y="millones de personas",
         title = paste0(popAge5dt[popAge5dt$country_code==i,]$name),
         fill="Sexo")->g

   ggsave(plot=g,
          filename=paste0("pira",i,".png", sep=""),
          width=9,
          height=7)

  g
  assign(paste0("pira",i, sep=""), g)

}
```

2.8.1 Momento de práctica

Haz un loop para hacer las pirámides de las proyecciones de uruguay, una para cada año.

Ligas y más

Códigos, proyecto, datos...

Si necesitas descargar el proyecto, el proyecto *vivo* está acá

Los códigos de las sesiones están en esta carpeta

La carpeta de datos

Otros cursos de la misma profe

Estos tienen videos, además.

- R para el análisis estadístico de datos
- Inferencia e introducción a los modelos estadísticos con R