# Econometrics 2 capstone progress report code

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# Importing and cleaning data

Tables used for the progress report:

- Psychology (S10AI)
- Housing: water (S12AI)
- Household background information (S1D)
- Key household information (key_hhld_info)

In order to derive the following variables:

- Binary variable indicating mental health status (1 = likely to have a mental health disorder) (S10AI)
- Binary variable indicating access to basic drinking water services (1 = has access) (S1D)
- Age (S10AI)
- Binary variable indicating sex (1 = female) (S10AI)
- Binary variable indicating religious minority (1 = not Christian) (S1D)
- Binary variable indicating if the person lives in an urban or rural area (1 = in an urban area) (S1D)

Analysis in this markdown document is separated by each data table imported.

# Importing the Pyschology table

```
#####################################################################################
################################# PSYCHOLOGY TABLE ##############################
#####################################################################################

s10ai <- read_csv("data/S10AI.csv") %>%
  select(hhno, hhmid, depression, sex = s1d_1, age = s1d_4i) %>%

  #Creating a new column as our depression_dummy. Kessler scores between 10-19 have a score of one in the data (== "likely to be well"). Anyone with scored higher than this has a score > 1, which classifies them as likely to have at least a mild disorder.
  mutate(depression_dummy = case_when(

    depression > 1 ~ 1, # Depressed
    TRUE ~ 0 # Not depressed

  )) %>%

  # Turning sex into a dummy variable (1 == female)

  mutate(sex = case_when(

    sex == 1 ~ 0,
    sex == 2 ~ 1

  ))


######################## EXTRACTING JUST THE RELEVANT VARIABLES ################

s10ai <- s10ai %>%
  select(hhno, hhmid, depression_dummy, sex_dummy = sex, age)
```

# Importing the housing table

We are importing this table to create a dummy variable for access to basic drinking services.

UNICEF defines a household’s access to water as “basic” if it satisfies the following conditions:

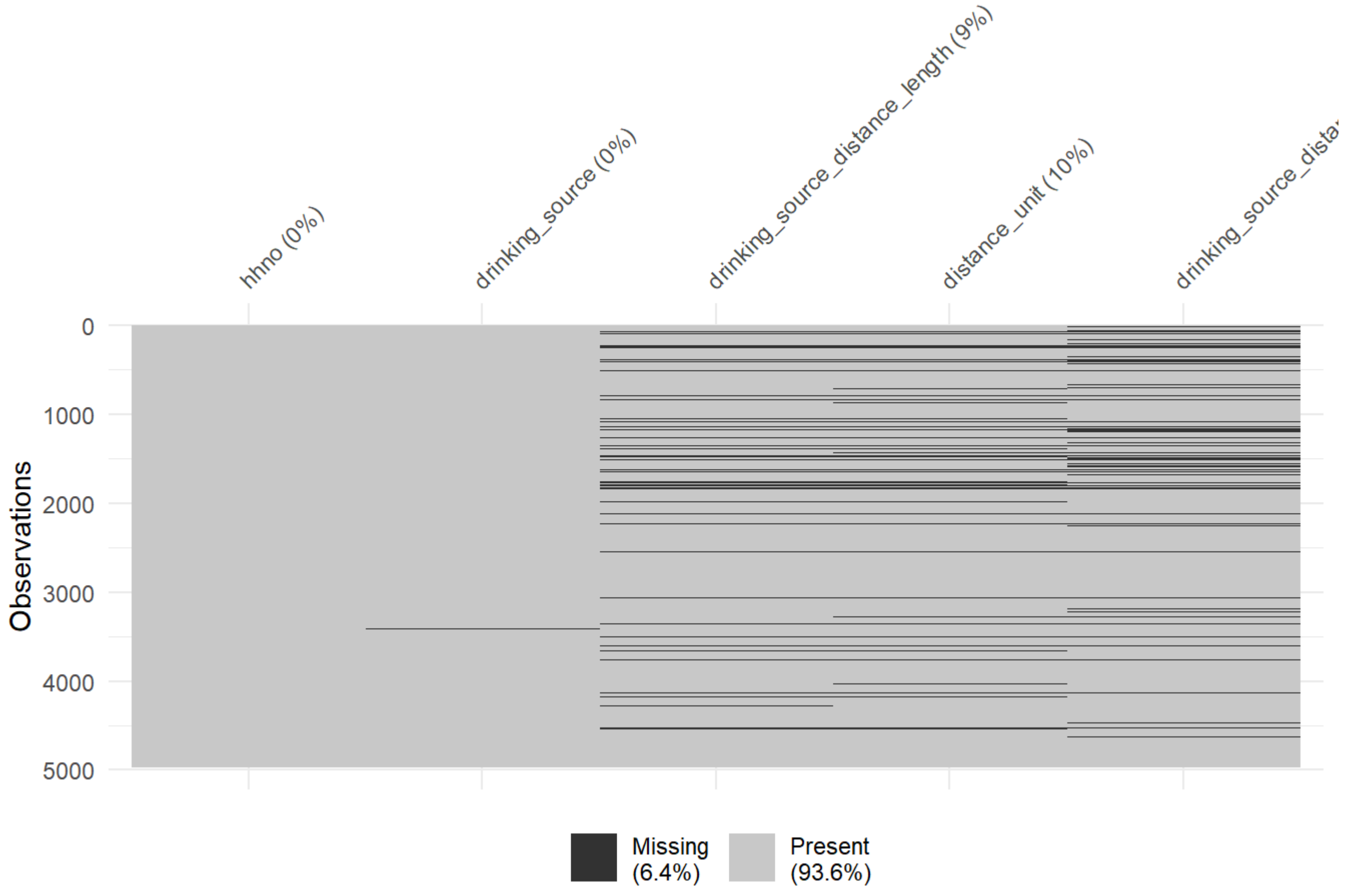
- It’s delivered from one of the following sources: piped water, boreholes, tubewells, protected dug well, protected springs, rainwater and packaged of delivered water.
- A round trip to collect water does not exceed 30 minutes.

```
################################################################################
################################ HOUSING TABLES ################################
################################################################################

################################ WATER TABLE ####################################






s12ai <- read_csv("data/S12AI.csv") %>%
  select(hhno,drinking_source = s12a_9i, drinking_source_distance_length = s12a_10ai, distance_unit = s12a_10aii, drinking_source_distance_mins = s12a_11) %>%

  #Editing the drinking_source_distance cells to make them all the same scale: kilometres.

  mutate(drinking_source_distance_length = case_when(

    distance_unit == 0 ~ 0,  # In house
    distance_unit == 1 ~ as.numeric(drinking_source_distance_length) * 0.0009144,  # Yards to kilometers
    distance_unit == 2 ~ as.numeric(drinking_source_distance_length) / 1000,  # Meters to kilometers
    distance_unit == 3 ~ as.numeric(drinking_source_distance_length),  # Already in kilometers
    distance_unit == 4 ~ as.numeric(drinking_source_distance_length) * 1.609344,  # Miles to kilometers
    TRUE ~ drinking_source_distance_length

  ))
```

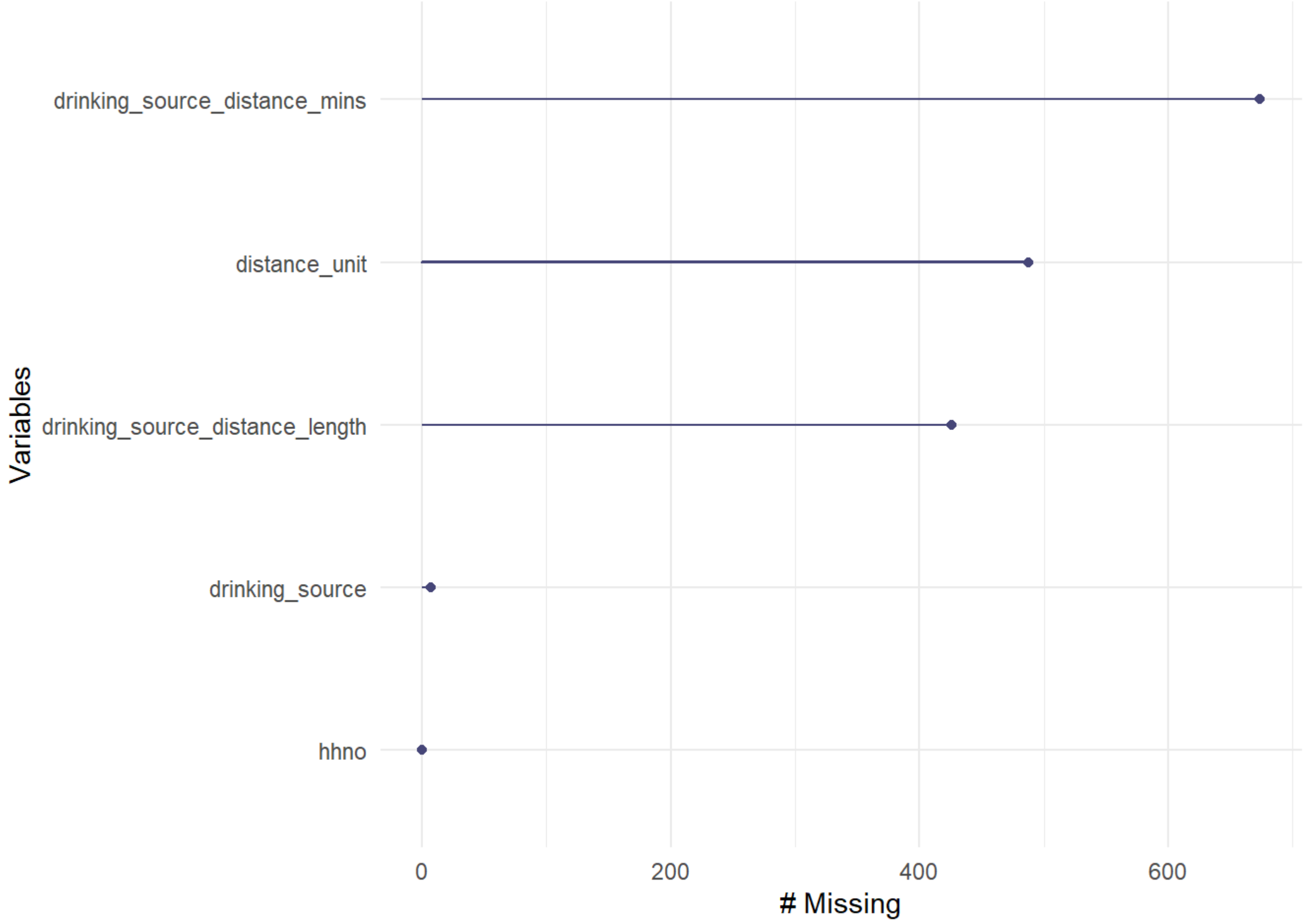
```
## Warning: One or more parsing issues, call `problems()` on your data frame for details,
## e.g.:
##   dat <- vroom(...)
##   problems(dat)
```

```
## Rows: 4972 Columns: 72
## ── Column specification ────────────────────────────────────────────────────────
## Delimiter: ","
## chr  (2): s12a_15, s12a_15i
## dbl (67): id1, id3, id4, id2, s12a_1, s12a_2i, s12a_2ii, s12a_2iii, s12a_3, ...
## lgl  (3): s12a_4i, s12a_4ii, s12a_4iii
##
## 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.
```

```
vis_miss(s12ai)
```



```
gg_miss_var(s12ai)
```



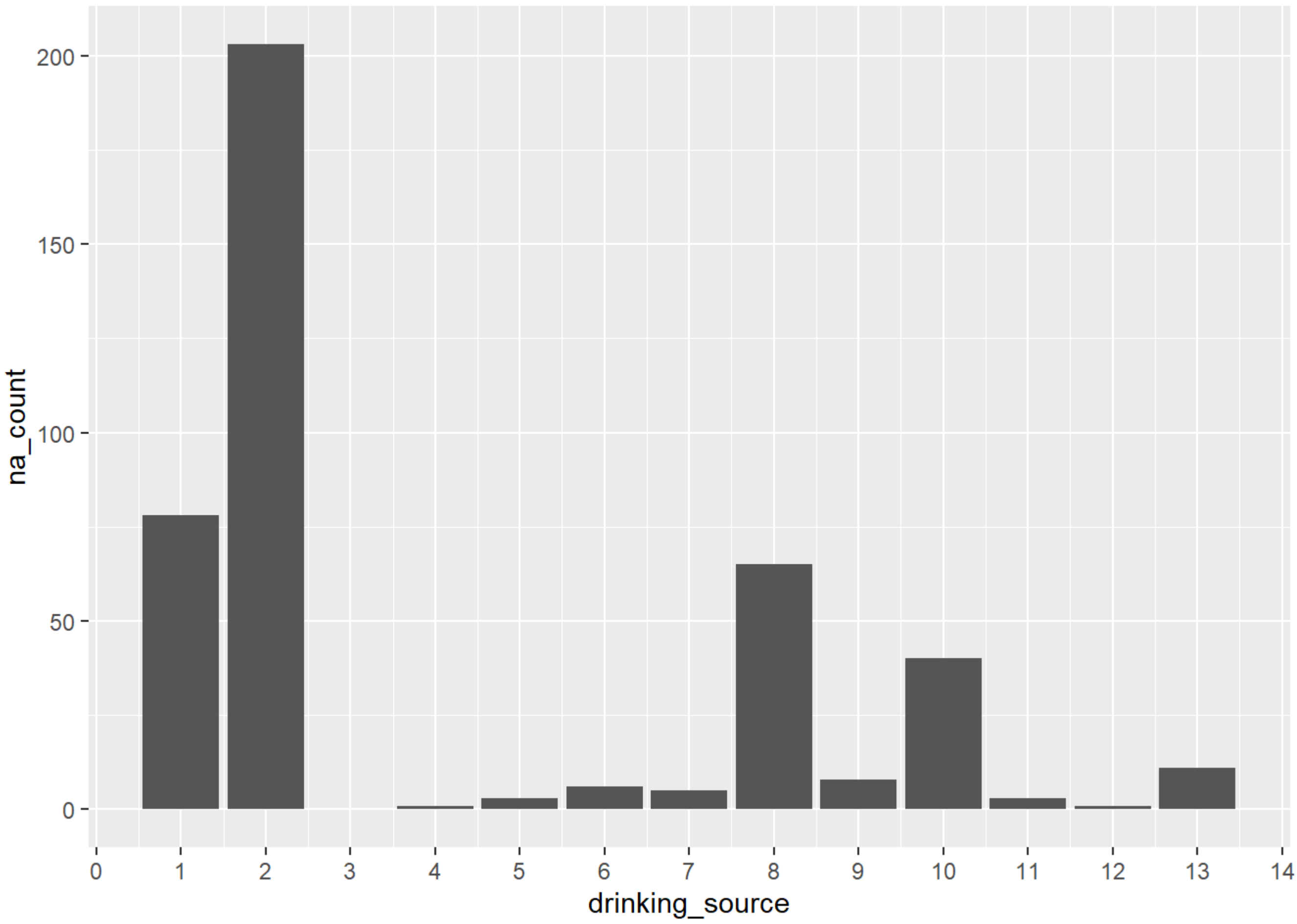
The charts above shows us that there is a lot of missing values for the distance variables in both length and mins. This likely have something todo with the drinking source of each household. I need to collect all the NA data together in order to diagnose the problem.

The charts below show us that:

- Most of the problem is in 1 and 2, which correspond to plumbing in the house. We can change their distances to zero.
- 8 is also a clear problem, which is bottled water. We think its reasonable to assume this botteld water is available at the house, so can change this distance to zero as well.
- 9 and 10 are protected wells and boreholes. Without more information about how far away they are (unavailable) we need to leave these as NAs.

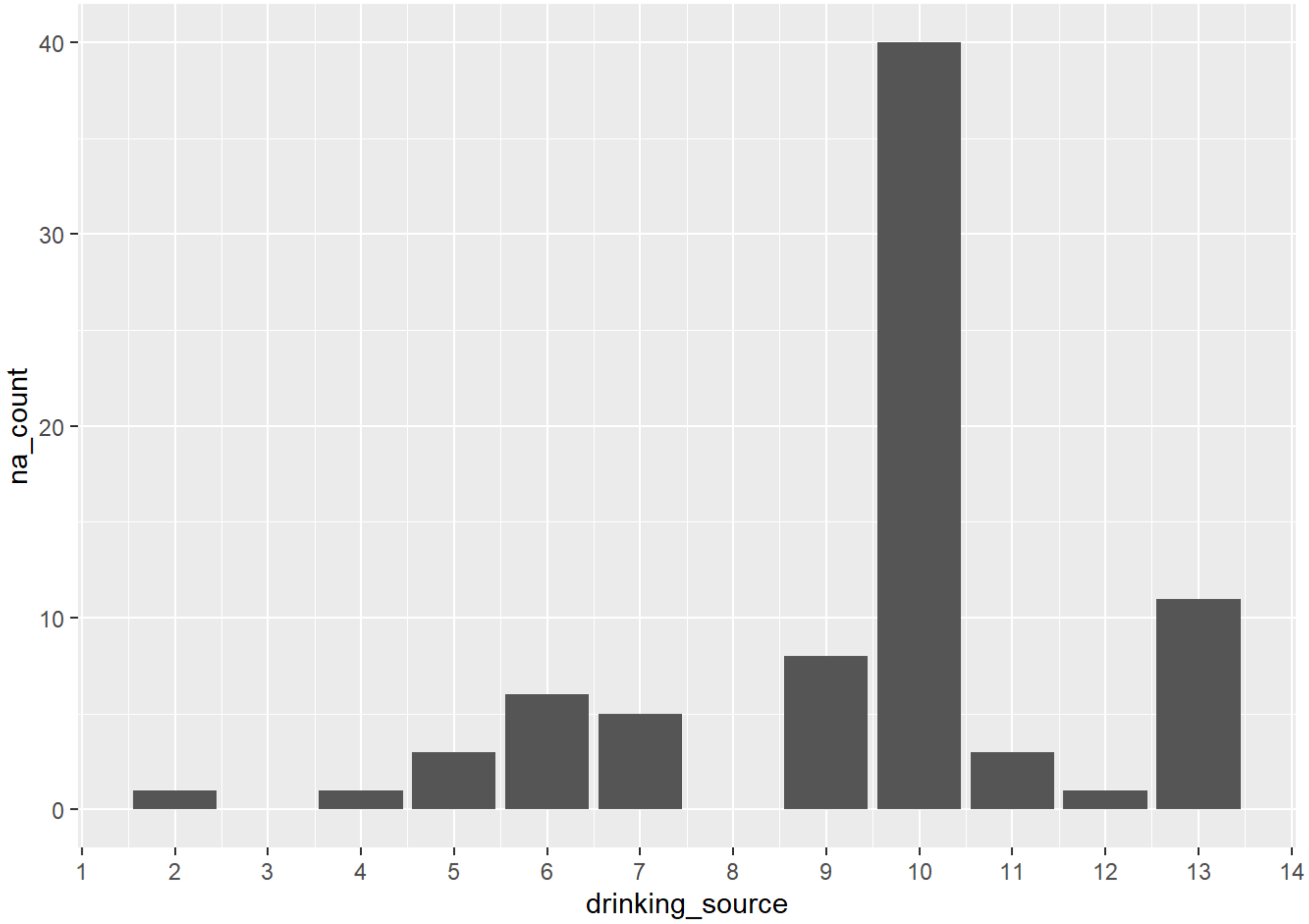
```
# Extracting and charting NA data

na_data <- s12ai %>%
  filter(is.na(drinking_source_distance_length)) %>%
  group_by(drinking_source) %>%
  summarise(na_count = n())

ggplot(na_data, aes(x = drinking_source, y = na_count)) +
  geom_bar(stat = "identity") +
  scale_x_continuous(breaks = scales::pretty_breaks(n = 14))
```

```
## Warning: Removed 1 row containing missing values or values outside the scale range
## (`geom_bar()`).
```

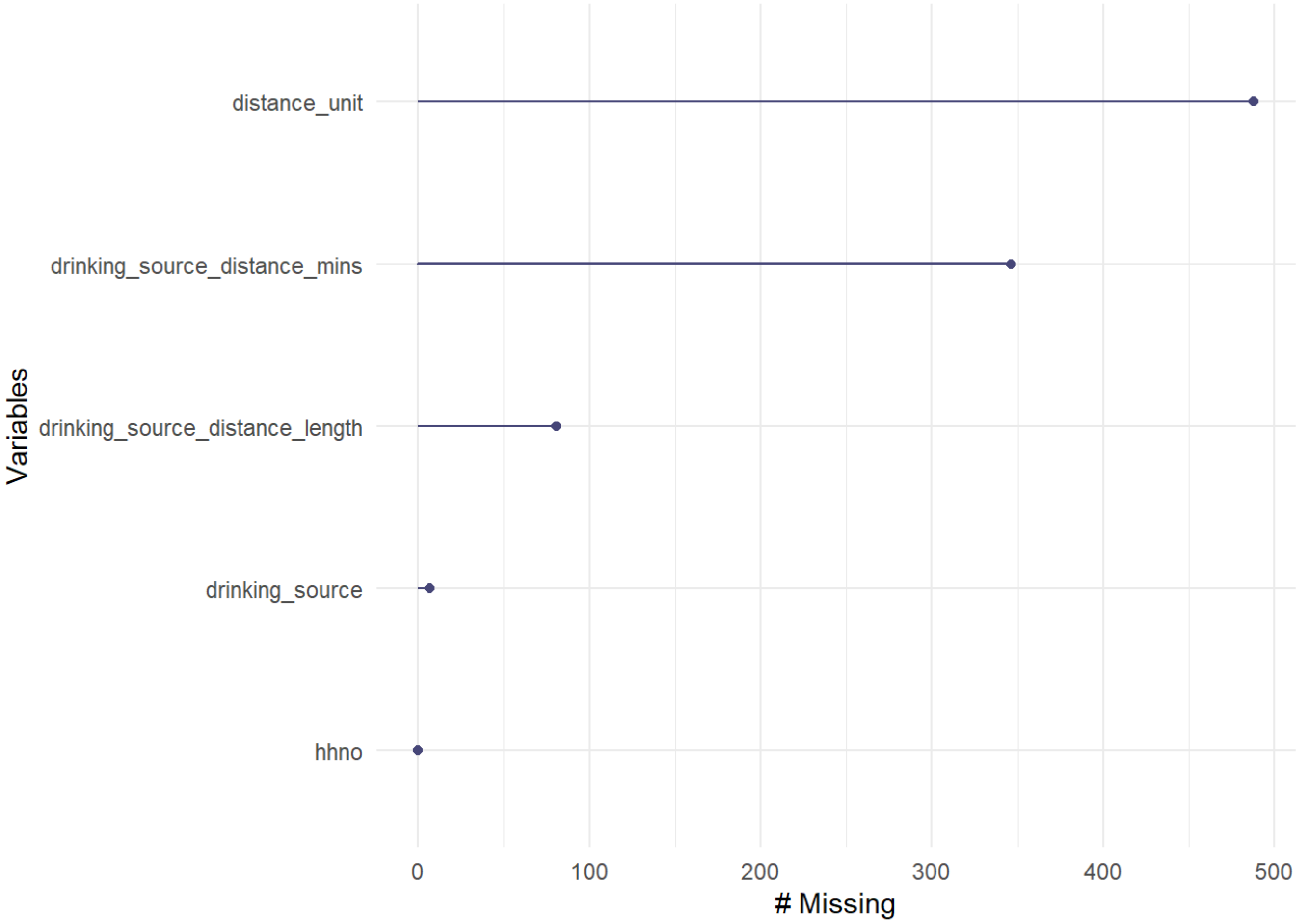


```
# Now I have diagnosed the problem, I need to make the necessary changes to the dataframe suc
h that dirnking_sources with values 1 and 2 have a distance of zero in both length and minute
s. All other NAs remain given data limitations.

s12ai <- s12ai %>%
  mutate(drinking_source_distance_length = case_when(

    is.na(distance_unit) & drinking_source %in% c(1, 2, 8) ~ 0,
    TRUE ~ drinking_source_distance_length
  )) %>%

  mutate(drinking_source_distance_mins = case_when(
        is.na(distance_unit) & drinking_source %in% c(1, 2, 8) ~ 0,
    TRUE ~ drinking_source_distance_mins
  ))



# Repeating the NA value analysis/chart below, the scale are now sufficiently small to contin
ue/we don't have any other information that could help reduce the incidence of NAs.

na_data <- s12ai %>%
  filter(is.na(drinking_source_distance_length)) %>%
  group_by(drinking_source) %>%
  summarise(na_count = n())

ggplot(na_data, aes(x = drinking_source, y = na_count)) +
  geom_bar(stat = "identity") +
  scale_x_continuous(breaks = scales::pretty_breaks(n = 14))
```

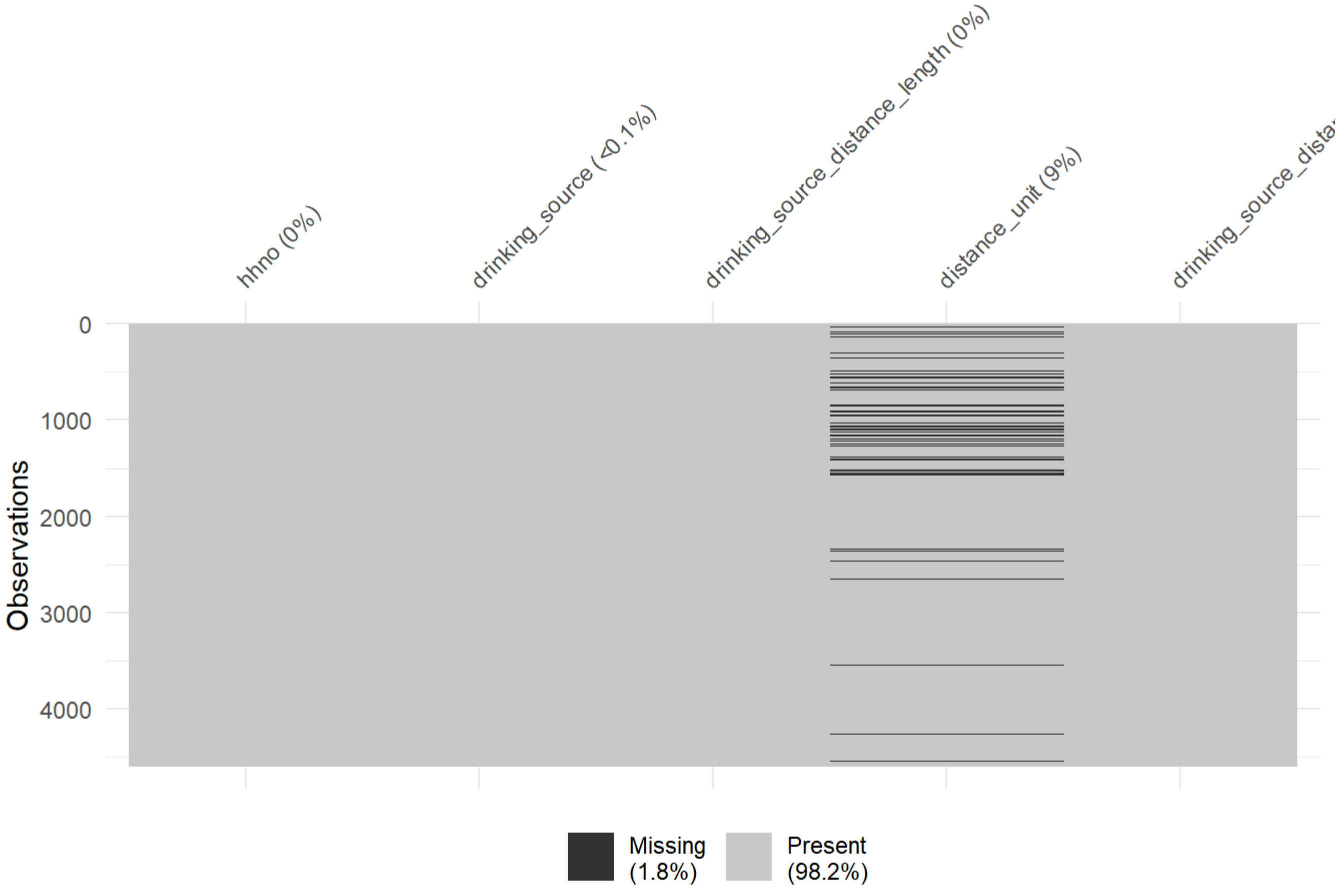
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## (`geom_bar()`).
```



```
gg_miss_var(s12ai)
```



```
# Because we can't deal with the remaining NAs, we exclude them from our analysis. However, we only exclude where NAs appear in the drinking_source_distance_length and drinking_source_distance_mins  variables.

s12ai <- s12ai %>%
  filter(!is.na(drinking_source_distance_length)) %>%
  filter(!is.na(drinking_source_distance_mins))

vis_miss(s12ai)
```



Now we can actually produce our dummy variable for access to “basic drinking services”.

```
s12ai <- s12ai %>%
  mutate(basic_access_dummy = case_when(

    drinking_source_distance_mins <= 30 &
      drinking_source %in% c(1, # Indoor plumbing
                             2, # Inside standpipe
                             5, # Pipe in niehgbouring household
                             6, # Private outside standpipe/tap
                             7, # Public standpipe
                             8, # Sachet/bottled water
                             9, # Borehole
                             10) # Protected well
    ~ 1,
    TRUE ~ 0
  ))
```

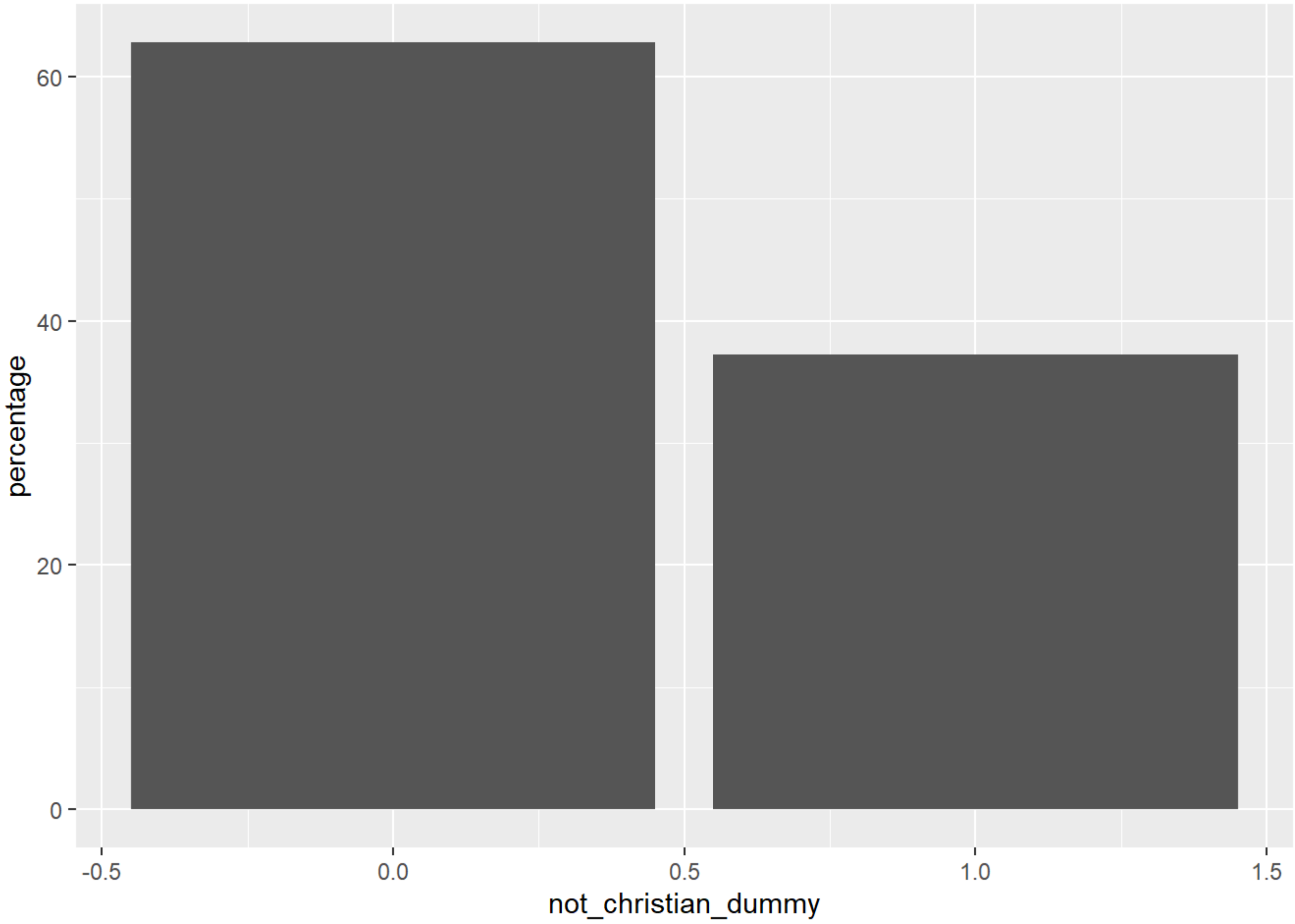
# Importing the hosehold background information table

```
######################### RELIGIOUS MINORITY DUMMY ##############################



s1d <- read_csv("data/S1D.csv") %>%
  select(hhno, hhmid, religion = s1d_13, ethnicity = s1d_16) %>%
  mutate(not_christian_dummy = 0) %>%
  mutate(not_christian_dummy = case_when(

    # The following values of religion correspond with Christianity: 1,2,3,4,5 and 7.

    religion %in% c(1,2,3,4,5,7) ~ 0,
    TRUE ~ 1

  ))
```

```
## Warning: One or more parsing issues, call `problems()` on your data frame for details,
## e.g.:
##   dat <- vroom(...)
##   problems(dat)
```

```
## Rows: 18889 Columns: 48
## ── Column specification ────────────────────────────────────────────────────────
## Delimiter: ","
## dbl (46): id1, id2, id3, id4, hhmid, s1d_1, s1d_2, sid_3i, s1d_3ii, s1d_3iii...
## lgl  (2): s1d_28, s1d_33
##
## 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.
```

```
# Is it reasonable to think of Christian as the relgious majority? The chart below suggest th
ey account for ~ 60% of the population. Therefore, it's reasonable to account for non-Christi
ans are part of the relgious minority in Ghana.

religion_dummy_frequency <- s1d %>%
  group_by(not_christian_dummy) %>%
    summarise(count = n()) %>%
  mutate(percentage = (count / sum(count)) * 100)




ggplot(religion_dummy_frequency, aes(not_christian_dummy, percentage)) + geom_bar(stat = "ide
ntity")
```



```
######################## EXTRACTING JUST THE RELEVANT VARIABLES ################

s1d <- s1d %>%
  select(hhno, hhmid, not_christian_dummy)
```

# Importing key household information

```
key_hhld_info <- read_csv("data/key_hhld_info.csv") %>%
  select(hhno, rural_dummy = urbrur) %>%
  mutate(rural_dummy = case_when(

    rural_dummy == "1" ~ 0,
    TRUE ~ 1

  ))
```

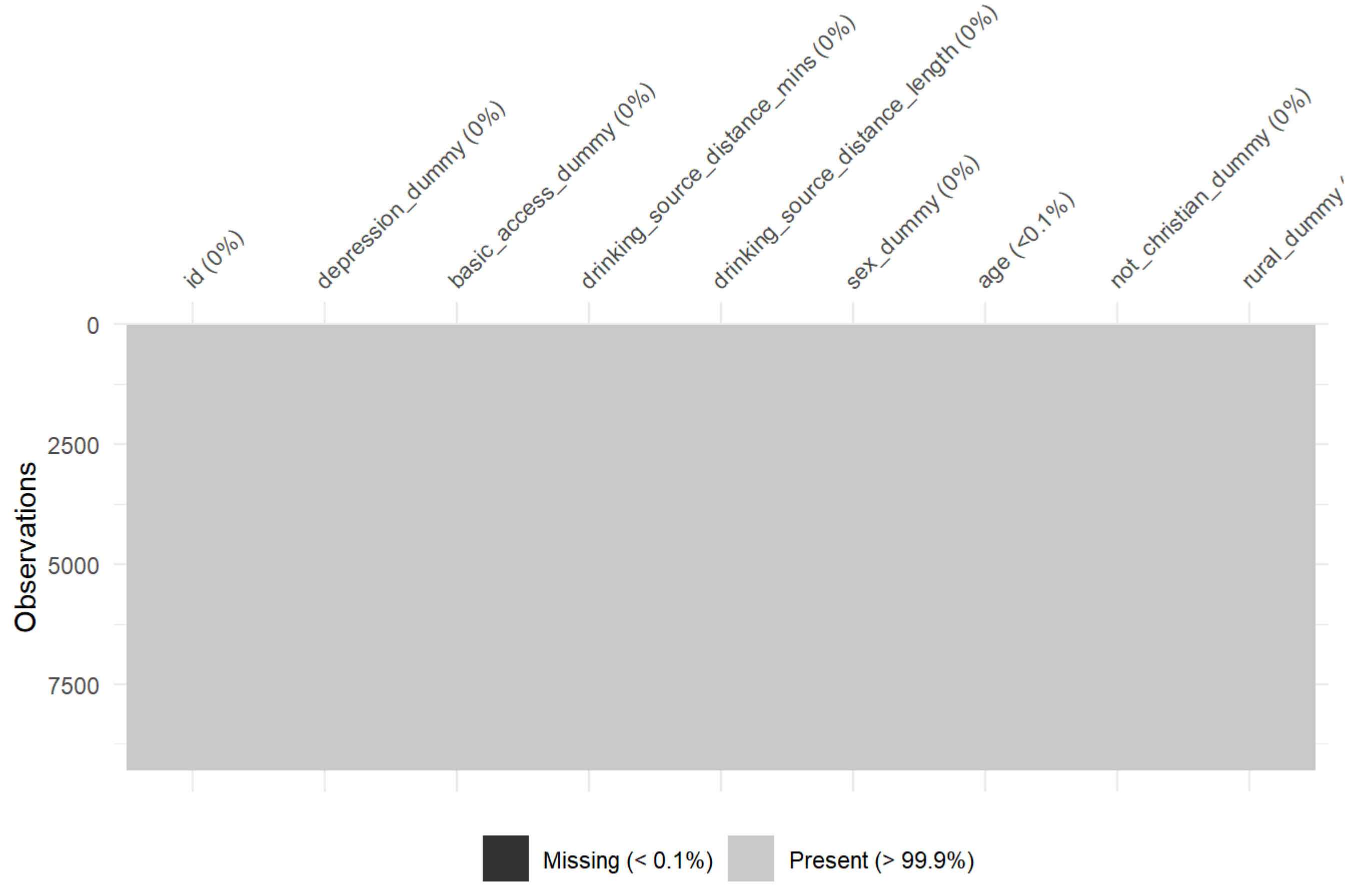
```
## Rows: 5009 Columns: 9
## ── Column specification ────────────────────────────────────────────────────────
## Delimiter: ","
## dbl (9): id1, id2, id3, id4, hhno, urbrur, loc7, hhweight3, ppweight3
##
## ℹ Use `spec()` to retrieve the full column specification for this data.
## ℹ Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

# Joining data

Household data is not provided at the individual level. Therefore, we need to append it to our psychological data.

Doing a quick NA visualisation I can see that there are a few columns with NA values. Given how small they are as proportions, I omit the NA values for depression and drinking_source_distance. I don’t both with distance_unit (its only use was to help us clean the data earlier.)

```
data <- s10ai %>%
  inner_join(s12ai, by = "hhno") %>%
  inner_join(key_hhld_info, by = "hhno") %>%
  inner_join(s1d, by = c("hhno", "hhmid")) %>%  # This data is collected on the individual, therefore we need to join at the sub-household level.

  mutate(id = hhno + hhmid) %>%  # Creating a single hh identifier column

  select(id, depression_dummy, basic_access_dummy, drinking_source_distance_mins, drinking_source_distance_length, sex_dummy, age, not_christian_dummy, rural_dummy) #getting data columns into a helpful order

vis_miss(data)
```



```
# Omitting the very few remaining NA values

data <- data %>%
  na.omit()
```

# Creating summary statistics

```
vars <- colnames(data)[!colnames(data) %in% c("id")]

# Create summary statistics
summary_stats <- data %>%
  summarise(across(all_of(vars),
                   list(
                     mean = ~ mean(.x, na.rm = TRUE),
                     sd = ~ sd(.x, na.rm = TRUE),
                     min = ~ min(.x, na.rm = TRUE),
                     max = ~ max(.x, na.rm = TRUE)
                   ),
                   .names = "{.col}_{.fn}"))

# Reshape to long format
summary_stats <- summary_stats %>%
  pivot_longer(cols = everything(),
               names_to = c("variable", "statistic"),
               names_pattern = "(.*)_(.*)") %>%   # Match everything before the last undersco
re
  mutate(value = round(value,2))


summary_stats <- summary_stats %>%
  pivot_wider(names_from = statistic, values_from = value)

summary_stats$max <- format(summary_stats$max, scientific = FALSE)


print(summary_stats)
```

```
## # A tibble: 8 × 5
##   variable                         mean    sd   min max  
##   <chr>                           <dbl> <dbl> <dbl> <chr>
## 1 depression_dummy                 0.31  0.46     0 "  1"
## 2 basic_access_dummy               0.76  0.43     0 "  1"
## 3 drinking_source_distance_mins   15.6  18.0      0 "240"
## 4 drinking_source_distance_length 11.3  64.4      0 "800"
## 5 sex_dummy                        0.55  0.5      0 "  1"
## 6 age                             39.1  18.7      1 "109"
## 7 not_christian_dummy              0.34  0.47     0 "  1"
## 8 rural_dummy                      0.65  0.48     0 "  1"
```

```
#################################### SAVING OFF DATA ###########################

write_csv(summary_stats, "summary_stats.csv")

write_csv(data, "data.csv")
```

# Producing linear and multiple regressions

```
linear_model <- lm(depression_dummy ~ basic_access_dummy, data = data)

multiple_model <- lm(depression_dummy ~ basic_access_dummy + sex_dummy + age + not_christian_
dummy + rural_dummy, data = data)



tab_model(linear_model, multiple_model,
          pred.labels = c("Intercept", "Access to basic drinking services dummy", "Sex dumm
y", "Age", "Religious minority dummy", "Rural dummy"),
          dv.labels = c("Linear regression model", "Multiple regression model"),
          p.style = "stars",
          digits = 3,
          file = "regression_table.doc")
```

| | **Linear regression model** | | **Multiple regression model** | |
|---|---|---|---|---|
| *Predictors* | *Estimates* | *CI* | *Estimates* | *CI* |
| Intercept | 0.409 $^{***}$ | 0.390 – 0.428 | 0.100 $^{***}$ | 0.066 – 0.134 |
| Access to basic drinking services dummy | -0.134 $^{***}$ | -0.155 – -0.112 | -0.093 $^{***}$ | -0.115 – -0.071 |
| Sex dummy | | | 0.086 $^{***}$ | 0.067 – 0.104 |
| Age | | | 0.004 $^{***}$ | 0.003 – 0.004 |
| Religious minority dummy | | | 0.099 $^{***}$ | 0.079 – 0.118 |
| Rural dummy | | | 0.074 $^{***}$ | 0.054 – 0.094 |
| Observations | 9282 | | 9282 | |
| $R^2$ / $R^2$ adjusted | 0.015 / 0.015 | | 0.066 / 0.065 | |

- $p<0.05$   ** $p<0.01$   *** $p<0.001$