Harmonisation Template for Cohort B

My Name

2025-03-10

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Preface

Here is the documentation of the data harmonisation step generated using Quarto. To learn more about Quarto books visit https://quarto.org/docs/books.

File Structure

Here is the file structure of the project used to generate the document.

```
harmonisation/                              # Root of the project template.
|
   .quarto/ (not in repository)            # Folder to keep intermediate
files/folders
|                                           # generated when Quarto renders
the files.
|
   archive/                                # Folder to keep previous books
and harmonised data.
|   |
       reports/                            # Folder to keep previous versions
of
|   |   |                                   # data harmonisation
documentation.
|   |   |
|   |      {some_date}_batch/              # Folder to keep {some_date}
version of
|   |   |                                   # data harmonisation
documentation.
|   |   |
|   |      Flowchart.xlsx                  # Flowchart sheet to record
version control.
|   |
|      harmonised/                         # Folder to keep previous version
of harmonised data.
|       |
|          {some_date}_batch/              # Folder to keep {some_date}
version of
|       |                                   # harmonised data.
|       |
|         Flowchart.xlsx                # Flowchart sheet to record
version control.
|
  codes/                                # Folder to keep R/Quarto scripts
|   |                                     # to run data harmonisation.
|   |
      {cohort name}/                    # Folder to keep Quarto scripts to
run
|   |   |                                 # data cleaning, harmonisation
|   |   |                                 # and output them for each
cohort.
|   |   |
|   |      preprocessed_data/           # Folder to keep preprocessed
data.
|   |
      harmonisation_summary/            # Folder to keep Quarto scripts to
create
|   |                                     # data harmonisation summary
report.
|   |
      output/                           # Folder to keep harmonised data.
|   |
|      cohort_harmonisation_script.R    # R script to render each {cohort
name}/ folder.
|   |                                     # folder into html, pdf and word
document.
|   |
|      harmonisation_summary_script.R   # R script to render the
{harmonisation_summary}/
|                                         # folder into word document.

  data-raw/                             # Folder to keep cohort raw data
(.csv, .xlsx, etc.)
|   |
      {cohort name}/                    # Folder to keep cohort raw data.
|   |   |
|   |      {data_dictionary}            # Data dictionary file that
correspond to the
|   |   |                                 # cohort raw data. Can be one
from the
|   |   |                                 # collaborator provide or
provided by us.
|   |   |
|   |      Flowchart.xlsx               # Flowchart sheet to record
version control.
|   |
|      data-dictionary/                 # Folder to keep data dictionary
|   |   |                                 # used for harmonising data.
|   |   |
|   |      Flowchart.xlsx               # Flowchart sheet to record
version control.
|   |
|      data-input/                      # Folder to keep data input file
|       |                                 # for collaborators to fill in.
|       |
|          Flowchart.xlsx               # Flowchart sheet to record
version control.
|
   docs/                                # Folder to keep R functions
documentation
|                                         # generated using
pkgdown:::build_site_external().
|
   inst/                                # Folder to keep arbitrary
additional files
|   |                                     # to include in the project.
|   |
|      WORDLIST                         # File generated by
spelling::update_wordlist()
|
   man/                                 # Folder to keep R functions
documentation
|   |                                     # generated using
devtools::document().
|   |
      {fun-demo}.Rd                    # Documentation of the demo R
function.
|   |
      harmonisation-template.Rd        # High-level documentation.
|
   R/                                   # Folder to keep R functions.
|   |
      {fun-demo}.R                     # Script with R functions.
|   |
      harmonisation-package.R          # Dummy R file for high-level
documentation.

   renv/ (not in repository)            # Folder to keep all packages
|                                         # installed in the renv
environment.
|
   reports/                                 # Folder to keep the most recent
data harmonisation
|                                             # documentation.
|
   templates/                               # Folder to keep template files
needed to generate
|    |                                        # data harmonisation
documentation efficiently.
|    |
|       quarto-yaml/                        # Folder to keep template files to
generate
|    |    |                                   # data harmonisation
documentation structure
|    |    |                                   # in Quarto.
|    |    |
    |       _quarto_{cohort name}.yml      # Quarto book template data
harmonisation documentation
|    |    |                                   # for {cohort name}.
|    |    |
|    |       _quarto_summary.yml            # Quarto book template data
harmonisation summary.
|    |
|       index-qmd/                          # Folder to keep template files to
generate
|         |                                   # the preface page of the data
harmonisation
|         |                                   # documentation.
|         |
|            _index_report.qmd              # Preface template for each cohort
data harmonisation
|         |                                   # report.
|         |
|            _index_summary.qmd             # Preface template for data
harmonisation
|                                             # summary report.
|
   tests/                                   # Folder to keep test unit files.
|                                             # Files will be used by R package
testthat.
|
   .Rbuildignore                            # List of files/folders to be
ignored while
                                             # checking/installing the package.

|
   .Renviron (not in repository)            # File to set environment
variables.
```

```
|
   .Rprofile (not in repository)         # R code to be run when R starts
up.
|                                         # It is run after the .Renviron
file is sourced.
|
   .Rhistory (not in repository)         # File containing R command
history.
|
   .gitignore                            # List of files/folders to be
ignored while
                                          # using the git workflow.

|
   .lintr                                # Configuration for linting
|                                         # R projects and packages using
linter.
|
   .renvignore                           # List of files/folders to be
ignored when
                                          # renv is doing its snapshot.

|
   DESCRIPTION[*]                        # Overall metadata of the project.
|
   LICENSE                               # Content of the MIT license
generated via
|                                         # usethis::use_mit_license().
|
   LICENSE.md                            # Content of the MIT license
generated via
|                                         # usethis::use_mit_license().
|
   NAMESPACE                             # List of functions users can use
or imported
|                                         # from other R packages. It is
generated
|                                         # by devtools::document().

   README.md                             # GitHub README markdown file
generated by Quarto.
|
   README.qmd                            # GitHub README quarto file used
to generate README.md.
|
   _pkgdown.yml                          # Configuration for R package
documentation
```

```
|                                          # using
pkgdown:::build_site_external().
|
  _quarto.yml                             # Configuration for Quarto book
generation.
|                                          # It is also the project
configuration file.
|
  csl_file.csl                            # Citation Style Language (CSL)
file to ensure
|                                          # citations follows the Lancet
journal.
|
  custom-reference.docx                   # Microsoft word template for data
harmonisation
|                                          # documentation to Word.
|
  harmonisation_template.Rproj            # RStudio project file.
|
  index.qmd                               # Preface page of Quarto book
content.
|
  references.bib                          # Bibtex file for Quarto book.
|
  renv.lock                               # Metadata of R packages installed
generated
                                           # using renv::snapshot().

[*] These files are automatically created but user needs to manually add
some information.
```

Part I

Cohort B Cleaning

1 R Package And Environment

1.1 R Packages Used

Here are the R packages used in this analysis.

```r
harmonisation::get_r_package_info() |>
  knitr::kable()
```

package	version	date	source
dplyr	1.1.4	2023-11-17	RSPM (R 4.5.0)
fontawesome	0.5.3	2024-11-16	RSPM (R 4.5.0)
forcats	1.0.0	2023-01-29	RSPM (R 4.5.0)
glue	1.8.0	2024-09-30	RSPM (R 4.5.0)
harmonisation	1.0.0.0	2025-05-20	local
here	1.0.1	2020-12-13	RSPM (R 4.5.0)
htmltools	0.5.8.1	2024-04-04	RSPM (R 4.5.0)
lubridate	1.9.4	2024-12-08	RSPM (R 4.5.0)
magrittr	2.0.3	2022-03-30	RSPM (R 4.5.0)
openxlsx	4.2.8	2025-01-25	RSPM (R 4.5.0)
pointblank	0.12.2	2024-10-23	RSPM (R 4.5.0)
purrr	1.0.4	2025-02-05	RSPM (R 4.5.0)
quarto	1.4.4	2024-07-20	RSPM (R 4.5.0)
reactable	0.4.4	2023-03-12	RSPM (R 4.5.0)
sessioninfo	1.2.2	2021-12-06	CRAN (R 4.5.0)
stringr	1.5.1	2023-11-14	RSPM (R 4.5.0)
testthat	3.2.3	2025-01-13	RSPM (R 4.5.0)
tibble	3.2.1	2023-03-20	RSPM (R 4.5.0)
tidyr	1.3.1	2024-01-24	RSPM (R 4.5.0)
vroom	1.6.5	2023-12-05	RSPM (R 4.5.0)

1.2 R Platform Information

Here are the R platform environment used in this analysis.

```r
harmonisation::get_r_platform_info() |>
  knitr::kable()
```

setting	value
version	R version 4.5.0 (2025-04-11 ucrt)
os	Windows 11 x64 (build 26100)
system	x86_64, mingw32
ui	RTerm
language	(EN)
collate	English_Singapore.utf8
ctype	English_Singapore.utf8
tz	Asia/Singapore
date	2025-05-31
pandoc	3.4 @ C:/Program Files/RStudio/resources/app/bin/quarto/bin/tools/ (via rmarkdown)
quarto	1.7.30 @ C:/Program Files/Quarto/bin/quarto.exe/ (via quarto)
knitr	1.49 from RSPM (R 4.5.0)

1.3 Data dictionary

Check to see if the data dictionary 20250310_data_dictionary.xlsx exists.

```r
dict_relative_path <- fs::path(
  "data-raw",
  "data_dictionary",
  params$data_dictionary
)


dict_path <- here::here(dict_relative_path)

if (!file.exists(dict_path)) {
  stop(glue::glue("Input data dictionary {dict_path} cannot be found"))
}
```

2 Read Cohort B Data

2.1 Read Data

We read the file `data_to_harmonise_age_issue.csv` using `vroom::vroom`

```
cohort_B_data <- vroom::vroom(
  file = here::here("data-raw",
                    "Cohort_B",
                    "data_to_harmonise_age_issue.csv"),
  delim = ",",
  col_select = 1:2,
  show_col_types = FALSE,
  col_types = list(
    ID = vroom::col_character(),
    Age = vroom::col_integer()
    )
  ) |>
  dplyr::rename(cohort_unique_id = "ID") |>
  # Remove rows when the ID value is NA
  dplyr::filter(!is.na(.data[["cohort_unique_id"]])) |>
  # Remove white spaces in column names
  dplyr::rename_all(stringr::str_trim) |>
  # Check if cohort id is unique
  pointblank::rows_distinct(
    columns = "cohort_unique_id",
  )
```

To safeguard a csv file with issues, we can use the function `vroom::problems`

If there are issues with the data, the output of `vroom::problems` will be a tibble.

```
cohort_B_data |>
  vroom::problems()
```

```
# A tibble: 3 x 5
    row   col expected   actual  file
  <int> <int> <chr>      <chr>   <chr>
```

```
1     4     2 an integer missing
D:/Jeremy/PortableR/RPortableWorkDirectory/har~
2    10     2 an integer missing
D:/Jeremy/PortableR/RPortableWorkDirectory/har~
3    17     2 an integer missing
D:/Jeremy/PortableR/RPortableWorkDirectory/har~
```

To check for this in an automatically, we can use `pointblank::expect_row_count_match`

```
cohort_B_data |>
  vroom::problems() |>
  pointblank::expect_row_count_match(count = 0)
```

```
Error: Row counts for the two tables did not match.
The `expect_row_count_match()` validation failed beyond the absolute
threshold level (1).
* failure level (1) >= failure threshold (1)
```

Suppose we have a csv file with no issues, we can safeguard it with the following code.

```
cohort_B_data <- vroom::vroom(
  file = here::here("data-raw",
                    "Cohort_B",
                    "data_to_harmonise.csv"),
  delim = ",",
  col_select = 1:8,
  show_col_types = FALSE,
  col_types = list(
    ID = vroom::col_character(),
    Age = vroom::col_integer(),
    Sex = vroom::col_character(),
    Height = vroom::col_double(),
    Weight = vroom::col_double(),
    `Smoke History` = vroom::col_character(),
    `Chest Pain Character` = vroom::col_character(),
    Dyspnea = vroom::col_character()
    )
  ) |>
  dplyr::rename(cohort_unique_id = "ID") |>
  # Remove rows when the ID value is NA
  dplyr::filter(!is.na(.data[["cohort_unique_id"]])) |>
  # Remove white spaces in column names
  dplyr::rename_all(stringr::str_trim) |>
  # Check if cohort id is unique
  pointblank::rows_distinct(
    columns = "cohort_unique_id",
  )

cohort_B_data |>
  vroom::problems() |>
  pointblank::expect_row_count_match(count = 0)
```

2.2 Write Preprocessed File

We output data to be used for the next session.

```
cohort_B_data |>
  fst::write_fst(
    path = here::here(params$analysis_folder,
                      params$harmonisation_folder,
                      params$preprocessing_folder,
                      "01_Cohort_B_cleaned.fst")
)
```

3 Extract Demographic

3.1 Read Preprocessed File

We read output data from the previous section.

3.2 Demographics and Behavioral parameters

3.2.1 Age and Sex

`age_years` will be mapped from the column `Age`.

`sex` is grouped as follows:

Sex	sex
Female	0
Male	1

```r
age_gender_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id",
                  "Age",
                  "Sex")) |>
  pointblank::col_vals_expr(
    expr = ~ harmonisation::is_integer_vector(
      cohort_A_data[["age"]],
      allow_na = TRUE)
  ) |>
  dplyr::mutate(
    # Convert age to type integer
    age_years = as.integer(.data[["Age"]]),
    # Convert categorical columns to factors
    sex = dplyr::case_when(
      .data[["Sex"]] == "Female" ~ "0",
      .data[["Sex"]] == "Male" ~ "1",
      .default = NA_character_
    ),
    `Sex` = forcats::fct_relevel(
      .data[["Sex"]],
      c("Female", "Male")
    ),
    sex = forcats::fct_relevel(
      .data[["sex"]],
      c("0", "1")),
  ) |>
  dplyr::relocate(
    "sex",
    .before = "Sex"
  ) |>
  dplyr::relocate(
    "age_years",
    .after = "Age"
  ) |>
  pointblank::col_vals_in_set(
    columns = "sex",
    set = c("0", "1")
  ) |>
  pointblank::col_vals_between(
    columns = "age_years",
    left = 0,
    right = 100,
    inclusive = c(FALSE, TRUE),
    na_pass = TRUE
  )
```

Remove unnecessary columns so that we can merge with the other fields.

```
age_gender_data <- age_gender_data |>
  dplyr::select(-c("Age", "Sex"))
```

3.2.2 Height, Weight, BMI and BSA

`height_cm` will be mapped from the column `Height`. `weight_kg` will be mapped from the column `Weight`.

`bsa_m2` in m^2 will be calculated as sqrt([Height(cm) x Weight(kg)]/3600) `bmi` will be calculated as Weight(kg)/((Height(m))^2)

All values are then converted to two decimal places.

```
body_measurement_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id",
                  "Height", "Weight")) |>
  dplyr::mutate(
    height_cm = .data[["Height"]],
    weight_kg = .data[["Weight"]],
    bsa_m2 = sqrt((.data[["height_cm"]] * .data[["weight_kg"]]) / 3600),
    bsa_m2 = harmonisation::round_to_nearest_digit(.data[["bsa_m2"]],
     ↪  digits = 2),
    bmi = .data[["weight_kg"]] / ((.data[["height_cm"]] / 100)^2),
    bmi = harmonisation::round_to_nearest_digit(.data[["bmi"]], digits =
     ↪  2),
    height_cm = harmonisation::round_to_nearest_digit(.data[["height_cm"]],
     ↪  digits = 2),
    weight_kg = harmonisation::round_to_nearest_digit(.data[["weight_kg"]],
     ↪  digits = 2)
  ) |>
  pointblank::col_vals_between(
    columns = "bmi",
    left = 10,
    right = 50,
    inclusive = c(TRUE, TRUE),
    na_pass = TRUE
  )
```

Remove unnecessary columns so that we can merge with the other fields.

```
body_measurement_data <- body_measurement_data |>
  dplyr::select(-c("Height", "Weight"))
```

3.2.3 Smoking History

`smoke_current` is grouped as follows:

Smoke History	smoke_current
non-smoker	0
past smoker	0
current smoker	1
NA	-1

`smoke_past` is grouped as follows:

Smoke History	smoke_past
non-smoker	0
past smoker	1
current smoker	0
NA	-1

We do a check to ensure that we can only have these scenarios

- `smoke_current` as 1 and `smoke_past` as 0 for current smokers
- `smoke_current` as 0 and `smoke_past` as 1 for past smokers
- `smoke_current` as 0 and `smoke_past` as 0 for non-smokers
- `smoke_current` as -1 and `smoke_past` as -1 for unknown

```r
smoking_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id",
                  "Smoke History")) |>
  dplyr::mutate(
    smoke_current = dplyr::case_when(
      is.na(.data[["Smoke History"]]) ~ "-1",
      .data[["Smoke History"]] == "non-smoker" ~ "0",
      .data[["Smoke History"]] == "past smoker" ~ "0",
      .data[["Smoke History"]] == "current smoker" ~ "1",
      .default = NA_character_
    ),
    smoke_current = forcats::fct_relevel(
      .data[["smoke_current"]],
      c("0", "1")),
    smoke_past = dplyr::case_when(
      is.na(.data[["Smoke History"]]) ~ "-1",
      .data[["Smoke History"]] == "non-smoker" ~ "0",
      .data[["Smoke History"]] == "past smoker" ~ "1",
      .data[["Smoke History"]] == "current smoker" ~ "0",
      .default = NA_character_
    ),
    smoke_past = forcats::fct_relevel(
      .data[["smoke_past"]],
      c("0", "1")),
    `Smoke History` = forcats::fct(
      .data[["Smoke History"]]
    )
  ) |>
  pointblank::col_vals_in_set(
    columns = c("smoke_current", "smoke_past"),
    set = c("0", "1", "-1")
  ) |>
  pointblank::col_vals_expr(
    expr = pointblank::expr(
      (.data[["smoke_current"]] == "1" & .data[["smoke_past"]] == "0") |
      (.data[["smoke_current"]] == "-1" & .data[["smoke_past"]] == -"1") |
      (.data[["smoke_current"]] == "0" & .data[["smoke_past"]] %in% c("0",
 ↪  "1"))
    )
  )
```

```
if (params$show_table) {
  smoking_data |>
    dplyr::distinct(.data[["Smoke History"]],
                    .keep_all = TRUE) |>
    knitr::kable()
}
```

cohort_unique_id	Smoke History	smoke_current	smoke_past
B001	non-smoker	0	0
B002	current smoker	1	0
B004	past smoker	0	1
B017	NA	-1	-1

Remove unnecessary columns so that we can merge with the other fields.

```
smoking_data <- smoking_data |>
  dplyr::select(-c("Smoke History"))
```

3.2.4 Chest Pain

3.2.4.1 Shortness of Breath

`have_sob` is grouped as follows:

Dyspnea	have_sob
no	0
yes	1

```r
shortness_of_breath_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id", "Dyspnea")) |>
  dplyr::mutate(
    have_sob = dplyr::case_when(
      .data[["Dyspnea"]] == "no" ~ "0",
      .data[["Dyspnea"]] == "yes" ~ "1",
      .default = NA_character_
    ),
    have_sob = forcats::fct_relevel(
      as.character(.data[["have_sob"]]),
      c("0", "1")),
    Dyspnea = forcats::fct_relevel(
      as.character(.data[["Dyspnea"]]),
      c("no", "yes")),
  ) |>
  pointblank::col_vals_in_set(
    columns = c("have_sob"),
    set = c("0", "1", "-1")
  )
```

Remove unnecessary columns so that we can merge with the other fields.

```r
shortness_of_breath_data <- shortness_of_breath_data |>
  dplyr::select(-c("Dyspnea"))
```

3.2.4.2 Have chest pain or not

`have_chest_pain` is grouped as follows:

Chest Pain Character	have_chest_pain
no chest pain	0
typical, atypical or nonanginal	1

```r
have_chest_pain_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id", "Chest Pain Character")) |>
  dplyr::mutate(
    have_chest_pain = dplyr::case_when(
      .data[["Chest Pain Character"]] %in% c("no chest pain") ~ "0",
      .data[["Chest Pain Character"]] %in% c("typical", "atypical",
↪   "nonanginal") ~ "1",
      .default = NA_character_
    ),
    have_chest_pain = forcats::fct_relevel(
      .data[["have_chest_pain"]],
      c("0", "1")
    ),
    `Chest Pain Character` = forcats::fct_relevel(
      as.character(.data[["Chest Pain Character"]]),
      c("no chest pain", "typical", "atypical", "nonanginal")
    )
  ) |>
  pointblank::col_vals_in_set(
    columns = c("have_chest_pain"),
    set = c("0", "1")
  )
```

Remove unnecessary columns so that we can merge with the other fields.

```
have_chest_pain_data <- have_chest_pain_data |>
  dplyr::select(-c("Chest Pain Character"))
```

3.2.4.3 Symptomatic or Asymptomatic

`symptoms` is grouped as follows:

have_sob	have_chest_pain	symptoms
-1	-1	-1
0	0	0
0 or 1	1	1
1	0	2

```
symptoms_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id")) |>
  dplyr::inner_join(shortness_of_breath_data,
                    by = dplyr::join_by("cohort_unique_id"),
                    unmatched = "error",
                    relationship = "one-to-one") |>
  dplyr::inner_join(have_chest_pain_data,
                    by = dplyr::join_by("cohort_unique_id"),
                    unmatched = "error",
                    relationship = "one-to-one") |>
  dplyr::mutate(
    symptoms = dplyr::case_when(
      (.data[["have_chest_pain"]] == "-1" &
       .data[["have_sob"]] == "-1"
      ) ~ "-1",
      (.data[["have_chest_pain"]] == "0" &
       .data[["have_sob"]] == "0"
      ) ~ "0",
      (.data[["have_chest_pain"]] == "1" &
       .data[["have_sob"]] %in% c("0", "1")
      ) ~ "1",
      (.data[["have_chest_pain"]] == "0" &
       .data[["have_sob"]] == "1"
      ) ~ "2",
      .default = NA_character_
    ),
    symptoms = forcats::fct_relevel(
      .data[["symptoms"]],
      c("0", "1", "2"))
  ) |>
  pointblank::col_vals_in_set(
    columns = c("symptoms"),
    set = c("0", "1", "2")
  )
```

Remove unnecessary columns so that we can merge with the other fields.

```
symptoms_data <- symptoms_data |>
  dplyr::select(-c("have_chest_pain", "have_sob"))
```

3.2.4.4 Chest Pain Type

`chest_pain_type` is grouped as follows:

Dyspnea	Chest Pain Character	chest_pain_type
no	no chest pain	0
no or yes	typical	1
no or yes	atypical	2
no or yes	nonanginal	3
yes	no chest pain	4

```
chest_pain_type_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id", "Chest Pain Character", "Dyspnea"))
↪   |>
```

```r
  dplyr::mutate(
    chest_pain_type = dplyr::case_when(
      (.data[["Chest Pain Character"]] == "no chest pain" &
       .data[["Dyspnea"]] == "no"
      ) ~ "0",
      (.data[["Chest Pain Character"]] == "typical" &
       .data[["Dyspnea"]] %in% c("no", "yes")
      ) ~ "1",
      (.data[["Chest Pain Character"]] == "atypical" &
       .data[["Dyspnea"]] %in% c("no", "yes")
      ) ~ "2",
      (.data[["Chest Pain Character"]] == "nonanginal" &
       .data[["Dyspnea"]] %in% c("no", "yes")
      ) ~ "3",
      (.data[["Chest Pain Character"]] == "no chest pain" &
       .data[["Dyspnea"]] == "yes"
      ) ~ "4",
      .default = NA_character_
    ),
    `Chest Pain Character` = forcats::fct_relevel(
      as.character(.data[["Chest Pain Character"]]),
      c("no chest pain", "typical", "atypical", "nonanginal")
    ),
    `Dyspnea` = forcats::fct_relevel(
      as.character(.data[["Dyspnea"]]),
      c("no", "yes")
    ),
    chest_pain_type = forcats::fct_relevel(
      .data[["chest_pain_type"]],
      c("0", "1", "2", "3"))
  ) |>
  dplyr::relocate(
    "Chest Pain Character",
    .after = "cohort_unique_id"
  ) |>
  pointblank::col_vals_in_set(
    columns = c("chest_pain_type"),
    set = c("0", "1", "2", "3", "4")
  )
```

Remove unnecessary columns so that we can merge with the other fields.

```r
chest_pain_type_data <- chest_pain_type_data |>
  dplyr::select(-c("Dyspnea", "Chest Pain Character"))
```

3.2.4.5 Combined chest pain related tables

We combine all chest related tables together

```r
join_specification <- dplyr::join_by("cohort_unique_id")

chest_pain_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id")) |>
  dplyr::inner_join(have_chest_pain_data,
                    by = join_specification,
                    unmatched = "error",
                    relationship = "one-to-one") |>
  dplyr::inner_join(chest_pain_type_data,
                    by = join_specification,
                    unmatched = "error",
                    relationship = "one-to-one") |>
  dplyr::inner_join(shortness_of_breath_data,
                    by = join_specification,
                    unmatched = "error",
                    relationship = "one-to-one") |>
  dplyr::inner_join(symptoms_data,
                    by = join_specification,
                    unmatched = "error",
                    relationship = "one-to-one")

testthat::expect_true(
  pointblank::has_columns(
    chest_pain_data,
    columns = c("have_sob", "have_chest_pain", "symptoms",
     ↪  "chest_pain_type")
  )
)

testthat::expect_equal(
  ncol(chest_pain_data), 5
)
```

3.2.5 Combine Demographics

We combine all the data to give the `demo_behave_data`.

```r
join_specification <- dplyr::join_by("cohort_unique_id")

demo_behave_data <- cohort_B_data |>
  dplyr::select(c("cohort_unique_id")) |>
  dplyr::inner_join(age_gender_data,
                   by = join_specification,
                   unmatched = "error",
                   relationship = "one-to-one") |>
  dplyr::inner_join(body_measurement_data,
                   by = join_specification,
                   unmatched = "error",
                   relationship = "one-to-one") |>
  dplyr::inner_join(smoking_data,
                   by = join_specification,
                   unmatched = "error",
                   relationship = "one-to-one") |>
  dplyr::inner_join(chest_pain_data,
                   by = join_specification,
                   unmatched = "error",
                   relationship = "one-to-one") |>
  dplyr::relocate(c("bsa_m2", "bmi"),
                  .after = "sex")


testthat::expect_true(
  pointblank::has_columns(
    demo_behave_data,
    columns = c(
      "age_years", "sex",
      "height_cm", "weight_kg", "bsa_m2", "bmi",
      "smoke_current", "smoke_past",
      "have_sob", "have_chest_pain",
      "symptoms", "chest_pain_type"
    )
  )
)

testthat::expect_equal(
  ncol(demo_behave_data), 13
)
```

3.3 Write Preprocessed File

We output data to be used for the next session.

```r
demo_behave_data |>
  fst::write_fst(
    path = here::here(
      params$analysis_folder,
      params$harmonisation_folder,
      params$preprocessing_folder,
      "02_demographic_data.fst"),
)
```

4 Export To Excel

```r
out_type <- knitr::opts_chunk$get("rmarkdown.pandoc.to")
```

4.1 Read all tabular data

We read all tabular data from the previous section.

4.2 Export Data as Excel

We export the standardised data to an excel file called harmonised_Cohort_B.xlsx

```r
# Create a new workbook
my_workbook <- openxlsx::createWorkbook()

sheet_name = c("demographics")

output_data = list(demo_behave_data)  |>
  purrr::map(
    .f = harmonisation::add_cohort_name,
    cohort_name = params$cohort_name,
    cohort_name_column = "cohort_name"
  )

purrr::walk2(
    .x = sheet_name,
    .y = output_data,
    .f = harmonisation::write_to_sheet,
    workbook = my_workbook
)

# Save workbook
openxlsx::saveWorkbook(
  wb = my_workbook,
  file = here::here(params$analysis_folder,
                    params$output_folder,
                     params$cleaned_folder,
                     params$output_excel_file),
  overwrite = TRUE
)
```