Supplementary R script: All results were generated from following R codes. All the functions used in this script can be found at https://github.com/upulcooray/Social-participation/tree/main/R

```r
library(targets)
library(upulR) # personal R package for creating Table-1

library(future)
library(future.callr)



# Define custom functions and other global objects -------------------
source("R/functions.R")
source("R/helper_functions.R")



base_cov <- c("Age","Sex","L0_inc", "Y0_any","L0_den", "L0_mari","L0_srh")
l1_cov <- c("L1_inc", "L1_den", "L1_mari", "L1_srh")
expo <- c("A0_teeth","A1_teeth")
out <- "Y2"


d0 <-  NULL

d1 <-  function(data, trt) {
  (data[[trt]]==1)*data[[trt]]+ (data[[trt]]!=1)* 1
}

d2 <-  function(data, trt) {
  (data[[trt]]==2)*data[[trt]]+ (data[[trt]]!=2)* 2
}

d3 <-  function(data, trt) {
  (data[[trt]]==3)*data[[trt]]+ (data[[trt]]!=3)* 3
}

d4 <-  function(data, trt) {
  (data[[trt]]==4)*data[[trt]]+ (data[[trt]]!=4)* 4
}
```

```
# Set target-specific options such as packages----------------------
tar_option_set(packages = c("tidyverse", "haven",
                            "Gmisc", "htmlTable",
                            "flextable", "EValue",
                            "lmtp","mice", "upulR"))


plan(callr)

# Starting the list of targets--------------------------------------
list(
  tar_target(df_file,
             "data/selected",
             format = "file")
  ,
  # Working data ----------------------------------------------------
  tar_target(working_df,
             readRDS(file=df_file))
  ,

  # create a dataset for descriptive analysis-----------------------
  tar_target(descriptive_data,
             get_descriptive_data(working_df))

  ,

  tar_target(imp_data,
             get_mice_data(descriptive_data ,
                           mice_cars= c(expo[1],base_cov),
                           imp_only_vars= c(expo[2],l1_cov, out),
                           m=5))

  ,




  # plot distribution of missing covariates -------------------------
  tar_target(mis_by_outcome2,
             plot_missing(descriptive_data,
                          by_var = "Y2",
                          x_lab = "Social participation in 2016 (Outcome)") %>%
               ggplot2::ggsave(filename = "figures/missing_outcome.svg",
                               width = 12,height = 10 ),
             format= "file")
```

```
,
tar_target(mis_by_exposure2,
           plot_missing(descriptive_data,
                        by_var = "A0_teeth",
                        x_lab = "Number of teeth at baseline") %>%
             ggplot2::ggsave(filename = "figures/missing_exposure.svg",
                             width = 12,height = 10 ),
           format= "file")


,
# Flow of participants (Add connecting arrows using Inkscape)
tar_target(sample_flowchart2,
           flow_chart_imp(df= descriptive_data ,
                      expo,out,base_cov,l1_cov))
,

# Table 1 ------------------------------------------------------
tar_target(tab1_data2,
           get_tab1_data(descriptive_data),
           format= "rds")
,

tar_target(table_1_2,
           upulR::create_table1(df = tab1_data2,
                        headvar = out,
                        rowvars = c(expo[1],base_cov),
                        headvar_na_level = "Censored",
                        file_name = "tables/table_1",
                        header = "Social participation in 2016"))
,


tar_target(dropouts_comparison2,
           get_dropout_comparison(df=tab1_data2,
                                  rowvars= c(expo[1],base_cov)))

,


# get a tmle ready data set-------------------------------------
# dummify all categorical variables/ all variables as numeric

tar_target(tmle_data2,
           get_tmle_data(imp_data),
           format= "rds")
```

```
,


# Set-up TMLE ----------------------------------------------------
tar_target(a, expo)  # time varying exposure (2010 & 2013)
,

tar_target(y, out)   # Outcome (2016)
,
# Time-invariant covariates
tar_target(w, colnames(tmle_data2 %>% select(Age,Sex,contains("Y0"))))


,
# time-varying covariates
tar_target(tv, list(colnames(tmle_data2 %>% select(contains("L0"))),
                    colnames(tmle_data2 %>% select(contains("L1")))))
,

tar_target(cens, c("c1","c2"))
,

tar_target(sl_lib, c("SL.glm", "SL.xgboost", "SL.nnet"))

,

tar_target(params,
           list(trt = a,
                outcome = y ,
                baseline = w ,
                time_vary=tv,
                outcome_type = "binomial",
                cens = cens,
                k=0
                # ,
                # learners_outcome = sl_lib,
                # learners_trt = sl_lib
           ))
,


# Run TMLE -------------------------------------------------

tar_target(tmle_res_m1_noSL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                                       c(params, list(data= tmle_data2 %>% filter(.imp==1),
```

```
                                        shift= eval(as.symbol(x))))
                    )))
,

tar_target(tmle_res_m1_SL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==1),
                                        learners_outcome = sl_lib,
                                        learners_trt = sl_lib,
                                        shift= eval(as.symbol(x))))
                    )))
,
tar_target(tmle_res_m2_noSL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==2),
                                        shift= eval(as.symbol(x))))
                    )))
,

tar_target(tmle_res_m2_SL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==2),
                                        learners_outcome = sl_lib,
                                        learners_trt = sl_lib,
                                        shift= eval(as.symbol(x))))
                    )))
,

tar_target(tmle_res_m3_noSL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==3),
                                        shift= eval(as.symbol(x))))
                    )))
,

tar_target(tmle_res_m3_SL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==3),
                                        learners_outcome = sl_lib,
                                        learners_trt = sl_lib,
                                        shift= eval(as.symbol(x))))
```

```
                    )))
,
tar_target(tmle_res_m4_noSL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==4),
                                          shift= eval(as.symbol(x))))
                    )))
,

tar_target(tmle_res_m4_SL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==4),
                                          learners_outcome = sl_lib,
                                          learners_trt = sl_lib,
                                          shift= eval(as.symbol(x))))
                    )))
,
tar_target(tmle_res_m5_noSL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==5),
                                          shift= eval(as.symbol(x))))
                    )))
,

tar_target(tmle_res_m5_SL,
           lapply(paste0("d",0:4) ,
                  function (x) do.call(run_lmtp,
                           c(params, list(data= tmle_data2 %>% filter(.imp==5),
                                          learners_outcome = sl_lib,
                                          learners_trt = sl_lib,
                                          shift= eval(as.symbol(x))))
                    )))
,


# contrast & pool ref=d0, est= "sl" -----

tar_target(res_d0_sl,
           get_pooled_results(tmle_res_m1_SL,
                              tmle_res_m2_SL,
                              tmle_res_m3_SL,
                              tmle_res_m4_SL,
                              tmle_res_m5_SL,
```

```
                                est= "sl",
                                ref_d = 0L))

,

# contrast & pool ref=d1, est= "sl" -----

tar_target(res_d1_sl,
           get_pooled_results(tmle_res_m1_SL,
                              tmle_res_m2_SL,
                              tmle_res_m3_SL,
                              tmle_res_m4_SL,
                              tmle_res_m5_SL,
                              est= "sl",
                              ref_d = 1L))

,


# contrast & pool ref=d0, est= "glm" -----

tar_target(res_d0_glm,
           get_pooled_results(tmle_res_m1_noSL,
                              tmle_res_m2_noSL,
                              tmle_res_m3_noSL,
                              tmle_res_m4_noSL,
                              tmle_res_m5_noSL,
                              est= "glm",
                              ref_d = 0L))

,

# contrast & pool ref=d1, est= "glm" -----

tar_target(res_d1_glm,
           get_pooled_results(tmle_res_m1_noSL,
                              tmle_res_m2_noSL,
                              tmle_res_m3_noSL,
                              tmle_res_m4_noSL,
                              tmle_res_m5_noSL,
                              est= "glm",
                              ref_d = 1L))

,
```

```
  # combine pooled results -----

  tar_target(pooled_estimates,
             rbind(res_d0_sl,res_d1_sl,
                   res_d0_glm,res_d1_glm))
  ,


  tar_target(table_2,
             get_table2(pooled_estimates),
             format= "file")
  ,

  tar_target(figure_2,
             get_figure2(pooled_estimates),
             format = "file")



)
```

The R session information (including the OS info, R version and all packages used):

```
sessionInfo()
```

```
R version 4.1.2 (2021-11-01)
Platform: x86_64-pc-linux-gnu (64-bit)
Running under: Ubuntu 21.10

Matrix products: default
BLAS:   /usr/lib/x86_64-linux-gnu/blas/libblas.so.3.9.0
LAPACK: /usr/lib/x86_64-linux-gnu/lapack/liblapack.so.3.9.0

locale:
 [1] LC_CTYPE=en_US.UTF-8       LC_NUMERIC=C               LC_TIME=en_US.UTF-8
 [4] LC_COLLATE=en_US.UTF-8     LC_MONETARY=ja_JP.UTF-8    LC_MESSAGES=en_US.UTF-8
 [7] LC_PAPER=ja_JP.UTF-8       LC_NAME=C                  LC_ADDRESS=C
[10] LC_TELEPHONE=C             LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
```

```
[1] future.callr_0.7.0 future_1.24.0      upulR_0.1.0        stringr_1.4.0
[5] targets_0.10.0     devtools_2.4.3     usethis_2.1.5

loaded via a namespace (and not attached):
 [1] colorspace_2.0-2    ellipsis_0.3.2      visdat_0.5.3        lmtp_1.0.0
 [5] rprojroot_2.0.2     ggstance_0.3.5      flextable_0.6.10    htmlTable_2.4.0
 [9] base64enc_0.1-3     fs_1.5.2            rstudioapi_0.13     mice_3.14.0
 [13] listenv_0.8.0       remotes_2.4.2       fansi_1.0.2         lubridate_1.8.0
 [17] xml2_1.3.3          codetools_0.2-18    splines_4.1.2       cachem_1.0.6
 [21] knitr_1.37          pkgload_1.2.4       Formula_1.2-4       naniar_0.6.1
 [25] broom_0.7.11        cluster_2.1.2       png_0.1-7           compiler_4.1.2
 [29] backports_1.4.1     assertthat_0.2.1    Matrix_1.4-0        fastmap_1.1.0
 [33] survey_4.1-1        cli_3.2.0           htmltools_0.5.2     prettyunits_1.1.1
 [37] tools_4.1.2         igraph_1.2.11       gtable_0.3.0        glue_1.6.2
 [41] dplyr_1.0.7         tinytex_0.36        Rcpp_1.0.8          SuperLearner_2.0-28
 [45] vctrs_0.3.8         progressr_0.10.0    iterators_1.0.13    xfun_0.30
 [49] globals_0.14.0      ps_1.6.0            brio_1.1.3          testthat_3.1.2
 [53] lifecycle_1.0.1     XML_3.99-0.9        scales_1.1.1        parallel_4.1.2
 [57] RColorBrewer_1.1-2  yaml_2.3.5          memoise_2.0.1       gridExtra_2.3
 [61] ggplot2_3.3.5       gdtools_0.2.3       rpart_4.1-15        glueformula_0.1.0
 [65] gam_1.20            latticeExtra_0.6-29 stringi_1.7.6       highr_0.9
 [69] desc_1.4.1          fastDummies_1.6.3   foreach_1.5.1       checkmate_2.0.0
 [73] pkgbuild_1.3.1      zip_2.2.0           rlang_1.0.2         pkgconfig_2.0.3
 [77] systemfonts_1.0.3   evaluate_0.15       lattice_0.20-45     purrr_0.3.4
 [81] htmlwidgets_1.5.4   processx_3.5.2      tidyselect_1.1.1    parallelly_1.30.0
 [85] magrittr_2.0.2      R6_2.5.1            generics_0.1.1      nnls_1.4
 [89] Hmisc_4.6-0         base64url_1.4       DBI_1.1.2           pillar_1.7.0
 [93] foreign_0.8-82      withr_2.5.0         Gmisc_3.0.0         forestplot_2.0.1
 [97] survival_3.2-13     abind_1.4-5         nnet_7.3-17         tibble_3.1.6
[101] crayon_1.5.0        uuid_1.0-3          utf8_1.2.2          rmarkdown_2.11
[105] officer_0.4.1       jpeg_0.1-9          arsenal_3.6.3       grid_4.1.2
[109] data.table_1.14.2   callr_3.7.0         forcats_0.5.1       digest_0.6.29
[113] tidyr_1.1.4         munsell_0.5.0       mitools_2.4         sessioninfo_1.2.2
```