Menopausal hormone therapy and new-onset asthma in menopausal women

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1. Load Packages

```
library(haven)
library(dplyr)
library(tidyverse)
library(survival)
library(survminer)
library(ggplot2)
library(ggsurvplot)
library(ggpubr)
library(ggsurvplot)
library(survminer)
library(survfit)
library(survdiff)
library(survfit0)
library(survfit0)
library(survfit0)
library(survfit0)
library(survfit0)
library(survfit0)
```

2. Import Dataset

```
# Download Dataset:
# https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USW00094728/detailed/0-20000-0-94728
# 2017-01-01,2017-12-31,"Daily Summaries","Daily Summaries","Daily Summaries","Daily Summaries","Daily Summaries"
# https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USW00094728/detailed/0-20000-0-94728
# Import Dataset
# 1. Import Dataset from "Desktop" folder
# 1. /Users/jack/Desktop/Cardiovascular Disease and Cancer Epidemiology/Cardiovascular Disease and Cancer in Women/Cardiovascular Disease and Cancer in Women Dataset/Cardiovascular Disease and Cancer in Women Dataset.dta
# 2. /Users/jack/Desktop/Cardiovascular Disease and Cancer Epidemiology/Cardiovascular Disease and Cancer in Women/Cardiovascular Disease and Cancer in Women Dataset/Cardiovascular Disease and Cancer in Women Dataset.sas7bdat
# 3. /Users/jack/Desktop/Cardiovascular Disease and Cancer Epidemiology/Cardiovascular Disease and Cancer in Women/Cardiovascular Disease and Cancer in Women Dataset/Cardiovascular Disease and Cancer in Women Dataset.sas7bdat
```

```
# calculate median and 95% posterior interval (Equal-Tailed Interval)
round(exp(quantile(posterior_flat, probs = c(.025, 0.500, 0.975))), 2) # on odds ratio scale

# calculate the probability of regression coefficient >0 (i.e., odds ratio >1)
round(mean(posterior_flat > 0), 3)
```

5.6.5. Plot for prior sensitivity analysis

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```
posterior_all <- as.data.frame(unlist(cbind(
  cbind(
    cbind(
      cbind(data.frame(unlist(as.data.frame(posterior))),
            data.frame(unlist(as.data.frame(posterior_alternative_1)))),
      data.frame(unlist(as.data.frame(posterior_alternative_2)))),
    data.frame(unlist(as.data.frame(posterior_alternative_3)))),
  data.frame(unlist(as.data.frame(posterior_flat))))))

posterior_all$row_number <- 1:nrow(posterior_all)
posterior_all$cat <- ifelse(posterior_all$row_number<=400000*1, "original_prior",
                            ifelse(posterior_all$row_number<=400000*2, "alternative_prior_1",
                                   ifelse(posterior_all$row_number<=400000*3, "alternative_prior_2",
                                          ifelse(posterior_all$row_number<=400000*4, "alternative_prior_3",
                                                 "flat_prior"))))
colnames(posterior_all)[1] <- "value"
str(posterior_all)
posterior_all$cat <- factor(posterior_all$cat, levels = c("flat_prior", "original_prior", "alternative_prior_1",
"alternative_prior_2",
                                                          "alternative_prior_3"))
table(posterior_all$cat)

ggplot(posterior_all, aes(x = value, fill = cat)) +
  geom_density(alpha=0.6) +
  scale_fill_manual(values=c("original_prior"="steelblue",
                             "alternative_prior_1"="lightblue",
                             "alternative_prior_2"="lightyellow",
                             "alternative_prior_3"="grey",
                             "flat_prior"="darkcyan"),
                    labels = c("Original Prior", "Alternative Prior 1", "Alternative Prior 2", "Alternative Prior
3", "Flat Prior")) +
  geom_vline(xintercept = 0, colour = "gray") +
  coord_cartesian(xlim = c(-1.5, 1.5)) +
  scale_y_discrete(expand = expansion(add = c(0, 0.1))) +
  labs(x = "Log Odds Ratio", y = "Probability Density", title = "Prior Sensitivity Analysis",
       subtitle = "For the effect of use of MHT on new-onset asthma") +
  theme(legend.position = "bottom",
        legend.title = element_blank(),
        panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        plot.title = element_text(size = 18, face = "bold"),
        plot.subtitle = element_text(size = 18),
        axis.title.x = element_text(size = 14),
        axis.title.y = element_text(size = 14),
        axis.text = element_text(size = 14),
        legend.text = element_text(size = 12),
        text = element_text(family = "Arial"),
        axis.line = element_line(color='black'))
```

6. Sensitivity Analysis for Residual Confounding

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```
effect.estimate <-  # on odds ratio scale

# if the outcome is relatively rare (< 15% at the end of follow-up)
evalues.OR(est = effect.estimate, rare = TRUE)

# if the outcome is common (>= 15% at the end of follow-up)
evalues.OR(est = effect.estimate, rare = FALSE)
```

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```
# some helper scripts
save.image(file = "Global_Environment_MHT.RData") # save work environment
load(file = "Global_Environment_MHT.RData") # load work environment

# record the versions of R packages used
library(renv)
renv::init()
renv::snapshot() # update renv.lock lockfile
```