BRFSS New

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For reference, here is the data aggregation process.

```
library(haven)

# intersect col 1993 to 2023
all_year_col <- c( "_STATE",   "_STSTR",   "_PSU",     "IDATE" , "IYEAR"  ,  "DISPCODE" , "GENHLTH",  "
"MARITAL" , "EDUCA"  , "PREGNANT", "_AGEG5YR") # "EXEROFT1" "EXERHMM1" "EXEROFT2", "EXERHMM2"

# more col
more_col <- c("_AGE80", "AGE", "_AGE", "SEX", "_SEX", "_IMPAGE", "_LLCPWT")

# file list
brfss_year_to_file <- read_csv(here("big_data/BRFSS/BRFSS_year_file_key.csv"))

# data_brfss_1993 <- read_xpt(here("big_data/BRFSS/CDBRFS93.XPT"))

file_paths <- brfss_year_to_file %>%
  filter(!(brfss_year %in% 1990:1992)) %>%
  pull(file_name)


# Not all variables are in every year
safe_select <- function(df, cols) {
  # 1. Identify which columns from cols are missing in df
  missing_cols <- setdiff(cols, names(df))
  # 2. Create those missing columns in df filled with NA
  if (length(missing_cols) > 0) {
    df[missing_cols] <- NA
  }
  # 3. Finally, select and return only the columns in col_list  (now we are assured they exist, even if
  df %>% select(all_of(cols))
}

# columns of interest
col_list <- vctrs::vec_c(all_year_col, more_col)

# create an empty list to store processed data frames
all_dfs <- vector("list", length = length(file_paths))

# get data from files
for (i in seq_along(file_paths)) {

  tmp_df <- read_xpt(paste0(here("big_data/BRFSS/"), file_paths[i], ".XPT"))
```

```
  # Safely select our columns of interest (any columns not in tmp_df will be NA)
  tmp_df_selected <- safe_select(tmp_df, col_list)

  # Store processed data frame
  all_dfs[[i]] <- tmp_df_selected
}

data_brfss_raw <- bind_rows(all_dfs)

# write_csv(data_brfss_raw, here("big_data/BRFSS/brfss_selected_not_recoded_20230111.csv"))
```

Load data

```
data_brfss_raw <- read_csv(here("big_data/BRFSS/brfss_selected_not_recoded_20230111.csv"))
```

```
## Rows: 10436579 Columns: 24
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (1): IDATE
## dbl (22): _STATE, _STSTR, _PSU, IYEAR, DISPCODE, GENHLTH, PHYSHLTH, MENTHLTH...
## lgl  (1): _AGE
##
## 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.
```

```
data_brfss <- data_brfss_raw %>%
  filter(GENHLTH <= 5) %>%
  mutate(srh = 6 - GENHLTH) %>% # recode for intuitive order
  mutate(srh_cat = factor(
    srh,
    levels = 1:5,
    labels = c(
      "Poor",
      "Fair",
      "Good",
      "Very Good",
      "Excellent"
    ))) %>%
  filter(`_AGEG5YR` != 14) %>%  # 14 = unknown
  mutate(
    # 1) age_5yr_cat: ordered factor with intuitive labels
    age_5yr_cat = factor(
      `_AGEG5YR`,
      levels = 1:13,  # Must match all possible codes
      labels = c(
        "18-24",    # 1
        "25-29",    # 2
        "30-34",    # 3
        "35-39",    # 4
        "40-44",    # 5
        "45-49",    # 6
        "50-54",    # 7
        "55-59",    # 8
```

```
      "60-64",    # 9
      "65-69",    # 10
      "70-74",    # 11
      "75-79",    # 12
      "80+" # 13
    ),
    ordered = TRUE  # Make it an ordered factor
  ),

  # 2) age_5yr_num: a numeric version based on the midpoint of each age band
  #    (or NA for unknown/refused)
  age_5yr_num = case_when(
    `_AGEG5YR` == 1  ~ (18 + 24)/2,   # 21
    `_AGEG5YR` == 2  ~ (25 + 29)/2,   # 27
    `_AGEG5YR` == 3  ~ (30 + 34)/2,   # 32
    `_AGEG5YR` == 4  ~ (35 + 39)/2,   # 37
    `_AGEG5YR` == 5  ~ (40 + 44)/2,   # 42
    `_AGEG5YR` == 6  ~ (45 + 49)/2,   # 47
    `_AGEG5YR` == 7  ~ (50 + 54)/2,   # 52
    `_AGEG5YR` == 8  ~ (55 + 59)/2,   # 57
    `_AGEG5YR` == 9  ~ (60 + 64)/2,   # 62
    `_AGEG5YR` == 10 ~ (65 + 69)/2,   # 67
    `_AGEG5YR` == 11 ~ (70 + 74)/2,   # 72
    `_AGEG5YR` == 12 ~ (75 + 79)/2,   # 77
    `_AGEG5YR` == 13 ~ (80 + 99)/2,   # 89.5 (if your codebook upper bound is 99)
    `_AGEG5YR` == 14 ~ NA_real_       # Unknown
  ),

  # 3) age_decade_cat: ordered factor collapsing adjacent age_5yr codes
  #    into ~10-year bands (plus "80+" and "Unknown")
  age_decade_cat = case_when(
    `_AGEG5YR` %in% c(1,2)   ~ "18-29",
    `_AGEG5YR` %in% c(3,4)   ~ "30-39",
    `_AGEG5YR` %in% c(5,6)   ~ "40-49",
    `_AGEG5YR` %in% c(7,8)   ~ "50-59",
    `_AGEG5YR` %in% c(9,10)  ~ "60-69",
    `_AGEG5YR` %in% c(11,12) ~ "70-79",
    `_AGEG5YR` == 13         ~ "80+",
    `_AGEG5YR` == 14         ~ NA
  )
) %>%
mutate(
  # Convert the decade-level variable to an ordered factor
  age_decade_cat = factor(
    age_decade_cat,
    levels = c("18-29", "30-39", "40-49", "50-59",
               "60-69", "70-79", "80+", "Unknown"),
    ordered = TRUE
  )
) %>%
mutate(year = case_when(
  IYEAR == 93 ~ 1993,
  IYEAR == 94 ~ 1994,
```

```
    IYEAR == 95 ~ 1995,
    IYEAR == 96 ~ 1996,
    IYEAR == 97 ~ 1997,
    IYEAR == 98 ~ 1998,
    TRUE ~ IYEAR
    ))

# # ---- Sanity checks ----
# # 1) Check that all categories are present and coded as expected:
# table(data_brfss$`_AGEG5YR`, useNA = "always")
# table(data_brfss$age_5yr_cat, useNA = "always")
# table(data_brfss$age_decade_cat, useNA = "always")
#
# # 2) Brief check of numeric distribution:
# summary(data_brfss$age_5yr_num)
#
# # 3) Look at a cross-tab to confirm consistency across new variables:
# with(data_brfss, table(age_5yr_cat, age_decade_cat))




# If want mental, physical, and activities health recoded

data_brfss <- data_brfss %>%
  mutate(mental_health_good_days = case_when( # Now thinking about your mental health, which includes s
    MENTHLTH == 88 ~ 31,  # 88 = No bad days
    MENTHLTH <= 30 ~ 31 - MENTHLTH, # MENTHLTH is number of bad mental health days in past 30 days
    MENTHLTH == 77 ~ NA_real_, # 77 = Don't Know / Not Sure
    MENTHLTH == 99 ~ NA_real_, # 99 = Refused
    TRUE ~ NA_real_
  )) %>%
mutate(mental_health =  case_when(
  MENTHLTH == 88 ~ 3,
  MENTHLTH >= 1 & MENTHLTH <= 14 ~ 2,
  MENTHLTH > 14 & MENTHLTH <= 30 ~ 1,
  MENTHLTH == 99 ~ NA,
  TRUE ~ NA)) %>%
mutate(physical_health_good_days = case_when( # Now thinking about your physical health, which includes
    PHYSHLTH == 88 ~ 31,  # 88 = No bad days
    PHYSHLTH <= 30 ~ 31 - PHYSHLTH, # MENTHLTH is number of bad mental health days in past 30 days
    PHYSHLTH == 77 ~ NA_real_, # 77 = Don't Know / Not Sure
    PHYSHLTH == 99 ~ NA_real_, # 99 = Refused
    TRUE ~ NA_real_
  )) %>%
mutate(physical_health =  case_when(
  PHYSHLTH == 88 ~ 3,
  PHYSHLTH >= 1 & PHYSHLTH <= 14 ~ 2,
  PHYSHLTH > 14 & PHYSHLTH <= 30 ~ 1,
  PHYSHLTH == 99 ~ NA,
  TRUE ~ NA)) %>%
mutate(usual_activities_health_good_days = case_when( #During the past 30 days, for about how many days
    POORHLTH == 88 ~ 31,  # 88 = No bad days
```

```
    POORHLTH <= 30 ~ 31 - POORHLTH, # MENTHLTH is number of bad mental health days in past 30 days
    POORHLTH == 77 ~ NA_real_, # 77 = Don't Know / Not Sure
    POORHLTH == 99 ~ NA_real_, # 99 = Refused
    TRUE ~ NA
  )) %>%
mutate(usual_activities_health =  case_when(
  POORHLTH == 88 ~ 3,
  POORHLTH >= 1 & POORHLTH <= 14 ~ 2,
  POORHLTH > 14 & POORHLTH <= 30 ~ 1,
  POORHLTH == 99 ~ NA,
  TRUE ~ NA))

#

with(data_brfss, table(MENTHLTH, mental_health))
```

```
##         mental_health
## MENTHLTH       1       2       3
##       1        0  323615       0
##       2        0  522693       0
##       3        0  304020       0
##       4        0  152649       0
##       5        0  367458       0
##       6        0   41318       0
##       7        0  148796       0
##       8        0   29316       0
##       9        0    4680       0
##       10       0  263285       0
##       11       0    1753       0
##       12       0   18594       0
##       13       0    2273       0
##       14       0   57576       0
##       15  246930       0       0
##       16    3725       0       0
##       17    2838       0       0
##       18    4314       0       0
##       19     662       0       0
##       20  142354       0       0
##       21   10977       0       0
##       22    2550       0       0
##       23    1581       0       0
##       24    1789       0       0
##       25   49078       0       0
##       26    1944       0       0
##       27    3613       0       0
##       28   14474       0       0
##       29    8864       0       0
##       30  538026       0       0
##       77       0       0       0
##       88       0       0 6694159
##       99       0       0       0
```

```r
with(data_brfss, table(PHYSHLTH, physical_health))
```

```
##         physical_health
## PHYSHLTH       1       2       3
##       1        0  429755       0
##       2        0  567167       0
##       3        0  328803       0
##       4        0  170617       0
##       5        0  287332       0
##       6        0   47905       0
##       7        0  189305       0
##       8        0   31978       0
##       9        0    7271       0
##       10       0  203364       0
##       11       0    2597       0
##       12       0   20050       0
##       13       0    2549       0
##       14       0  106206       0
##       15  186544       0       0
##       16    4616       0       0
##       17    3441       0       0
##       18    5746       0       0
##       19    1006       0       0
##       20  114070       0       0
##       21   25512       0       0
##       22    2759       0       0
##       23    1954       0       0
##       24    2449       0       0
##       25   45650       0       0
##       26    2646       0       0
##       27    4219       0       0
##       28   16688       0       0
##       29    7950       0       0
##       30  752692       0       0
##       77       0       0       0
##       88       0       0 6358416
##       99       0       0       0
```

```r
with(data_brfss, table(POORHLTH, usual_activities_health))
```

```
##         usual_activities_health
## POORHLTH       1       2       3
##       1        0  268953       0
##       2        0  302427       0
##       3        0  184793       0
##       4        0  102320       0
##       5        0  193529       0
##       6        0   31689       0
##       7        0  105627       0
##       8        0   25029       0
##       9        0    4844       0
##       10       0  154239       0
##       11       0    1833       0
##       12       0   15361       0
```

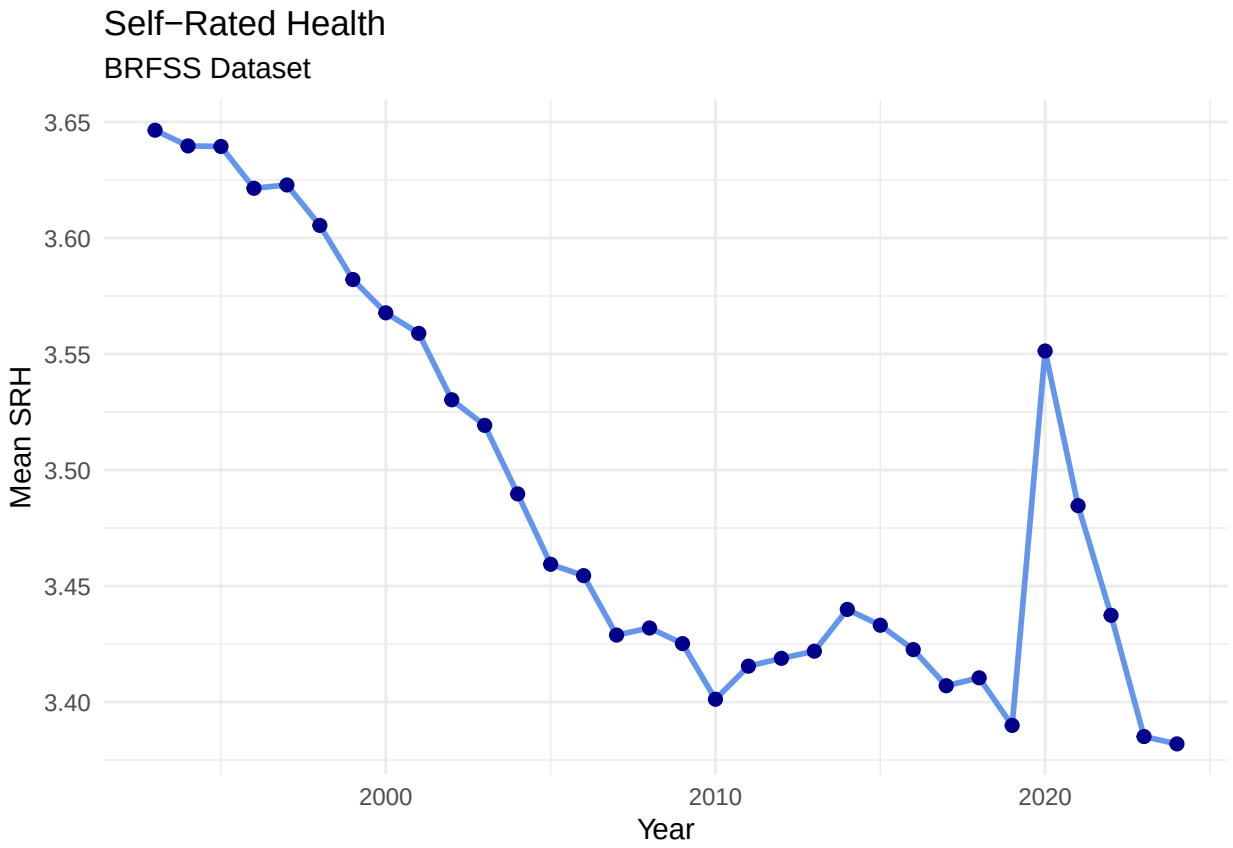
```
##        13        0    1962        0
##        14        0   56002        0
##        15   163089       0        0
##        16     3208       0        0
##        17     2588       0        0
##        18     4127       0        0
##        19      736       0        0
##        20   100782       0        0
##        21    15172       0        0
##        22     2183       0        0
##        23     1422       0        0
##        24     1764       0        0
##        25    38607       0        0
##        26     1838       0        0
##        27     2669       0        0
##        28     8888       0        0
##        29     3418       0        0
##        30   427011       0        0
##        77        0       0        0
##        88        0       0  3034512
##        99        0       0        0
```

```
#  select(!(MENTHLTH %in% c(77, 88, 99))) %>%
#  mutate(mental_health_good_days = 31 - MENTHLTH) # MENTLHLTH is number of bad mental health days in m

rm(data_brfss_raw)
```

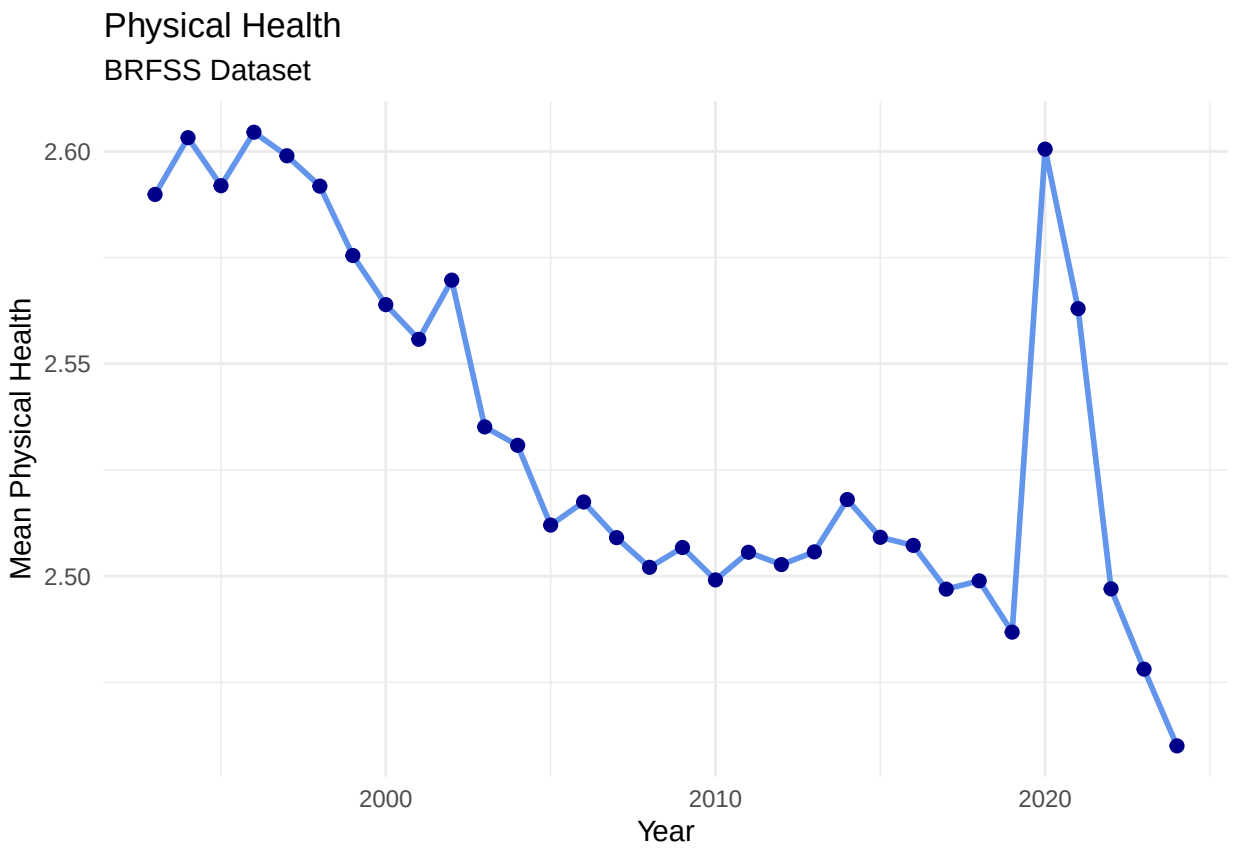
Unweighted

```
data_brfss %>%
  group_by(year) %>%
  summarize(
    mean_health = mean(srh, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  ggplot(aes(x = year, y = mean_health)) +
  geom_line(size = 1, color = "cornflowerblue") +
  geom_point(size = 2, color = "darkblue") +
  labs(
    title = "Self-Rated Health",
    x = "Year",
    y = "Mean SRH",
    subtitle = "BRFSS Dataset"
  ) +
  theme_minimal()
```

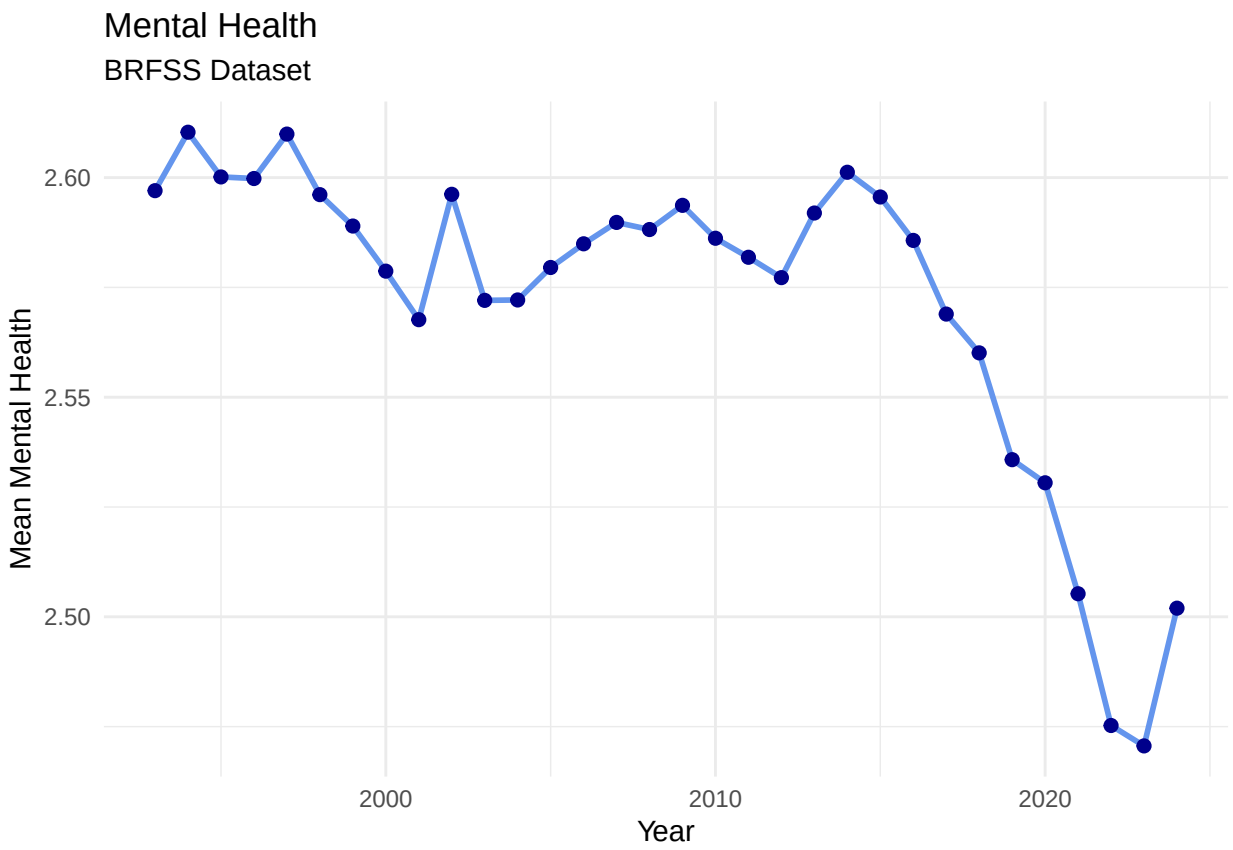
```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```



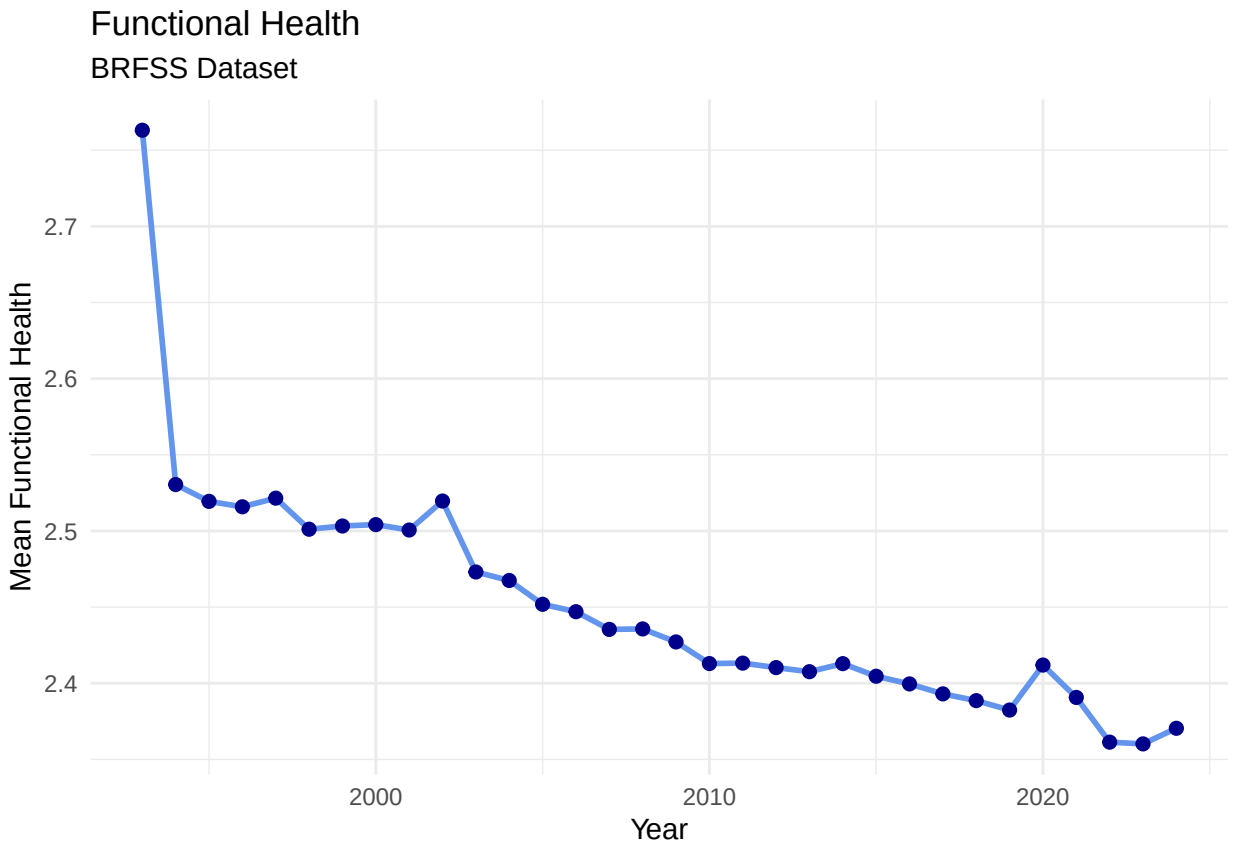

```
data_brfss %>%
  group_by(year) %>%
  summarize(
    mean_health = mean(physical_health, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  ggplot(aes(x = year, y = mean_health)) +
  geom_line(size = 1, color = "cornflowerblue") +
  geom_point(size = 2, color = "darkblue") +
  labs(
    title = "Physical Health",
    x = "Year",
    y = "Mean Physical Health",
    subtitle = "BRFSS Dataset"
  ) +
  theme_minimal()
```




```
data_brfss %>%
  group_by(year) %>%
  summarize(
    mean_health = mean(mental_health, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  ggplot(aes(x = year, y = mean_health)) +
  geom_line(size = 1, color = "cornflowerblue") +
  geom_point(size = 2, color = "darkblue") +
  labs(
    title = "Mental Health",
    x = "Year",
    y = "Mean Mental Health",
    subtitle = "BRFSS Dataset"
  ) +
  theme_minimal()
```

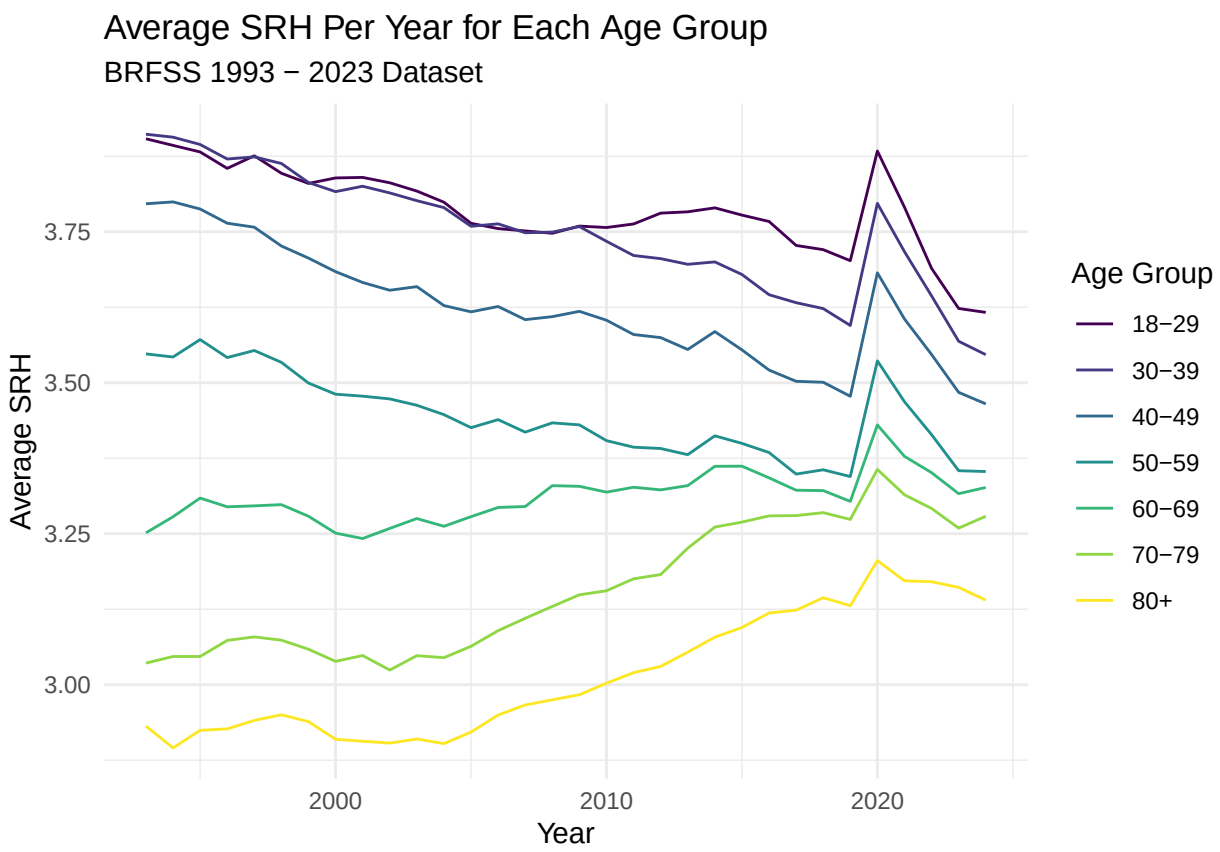



```
data_brfss %>%
  group_by(year) %>%
  summarize(
    mean_health = mean(usual_activities_health, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  ggplot(aes(x = year, y = mean_health)) +
  geom_line(size = 1, color = "cornflowerblue") +
  geom_point(size = 2, color = "darkblue") +
  labs(
    title = "Functional Health",
    x = "Year",
    y = "Mean Functional Health",
    subtitle = "BRFSS Dataset"
  ) +
  theme_minimal()
```



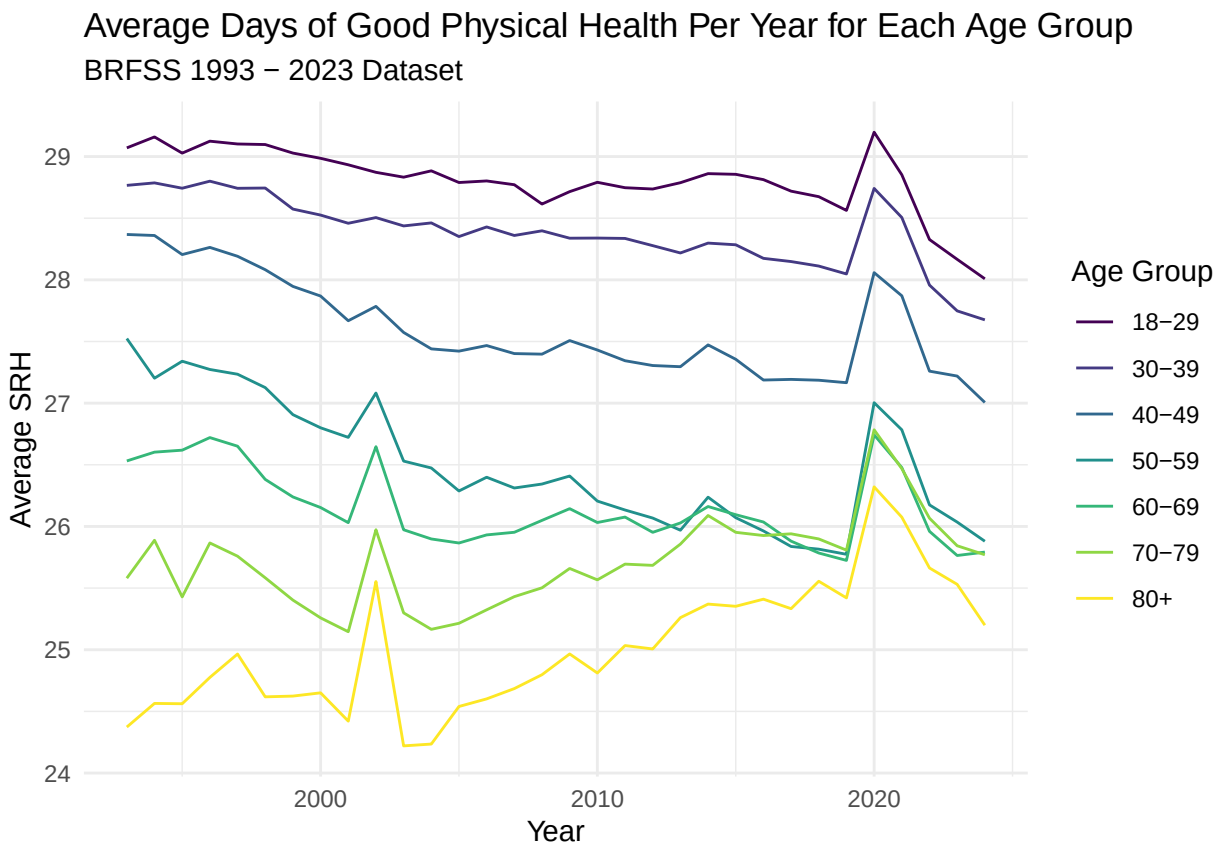

```
data_brfss %>%
  group_by(age_decade_cat, year) %>%
  summarize(mean_health = mean(srh, na.rm = TRUE)) %>%
  ggplot(aes(x = year, y = mean_health, color = age_decade_cat)) +
  geom_line() +
  labs(title = "Average SRH Per Year for Each Age Group",
       subtitle = "BRFSS 1993 - 2023 Dataset",
       y = "Average SRH",
       x = "Year",
       color = "Age Group") +
  theme_minimal() #+
```

```
## `summarise()` has grouped output by 'age_decade_cat'. You can override using
## the `.groups` argument.
```



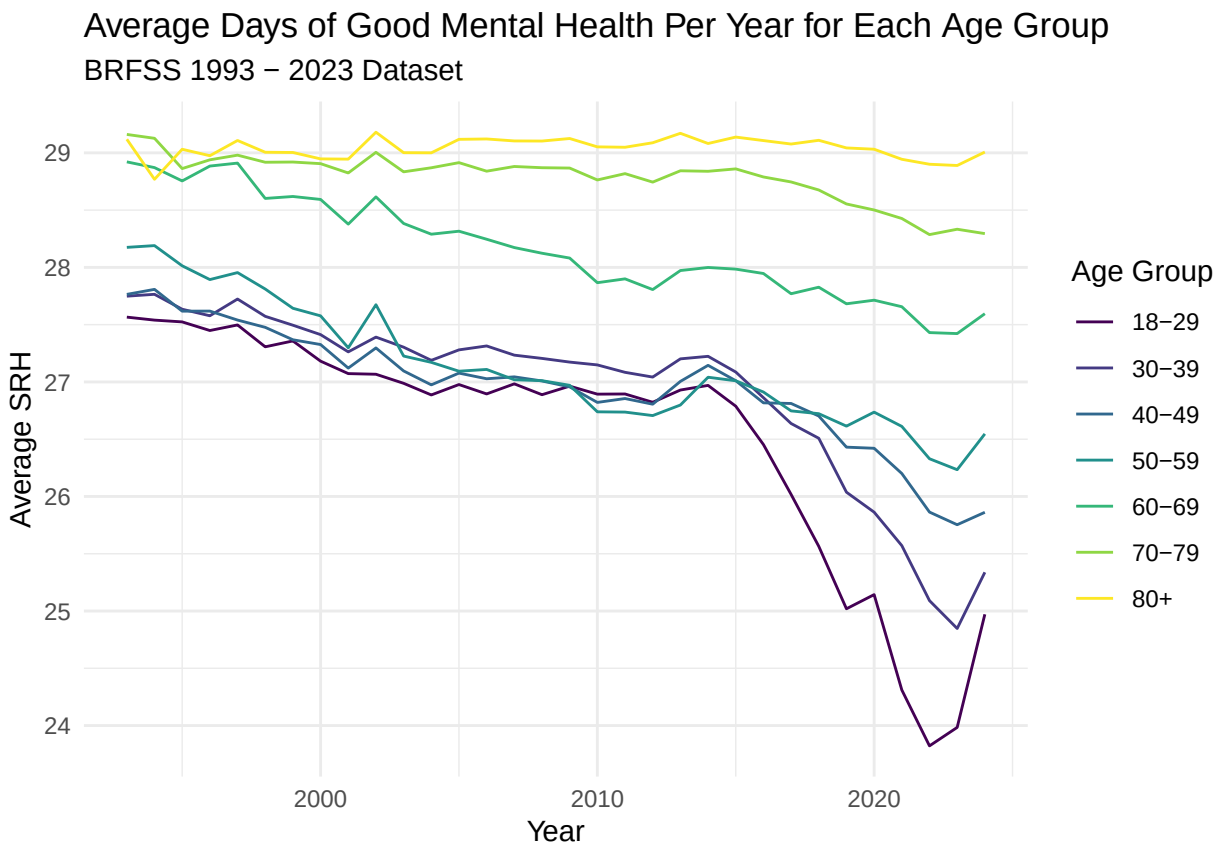

```
#  scale_color_brewer(palette = "Set2")

data_brfss %>%
  group_by(age_decade_cat, year) %>%
  summarize(mean_health = mean(physical_health_good_days, na.rm = TRUE)) %>%
  ggplot(aes(x = year, y = mean_health, color = age_decade_cat)) +
  geom_line() +
  labs(title = "Average Days of Good Physical Health Per Year for Each Age Group",
       subtitle = "BRFSS 1993 - 2023 Dataset",
       y = "Average SRH",
       x = "Year",
       color = "Age Group") +
  theme_minimal()
```

```
## `summarise()` has grouped output by 'age_decade_cat'. You can override using
## the `.groups` argument.
```



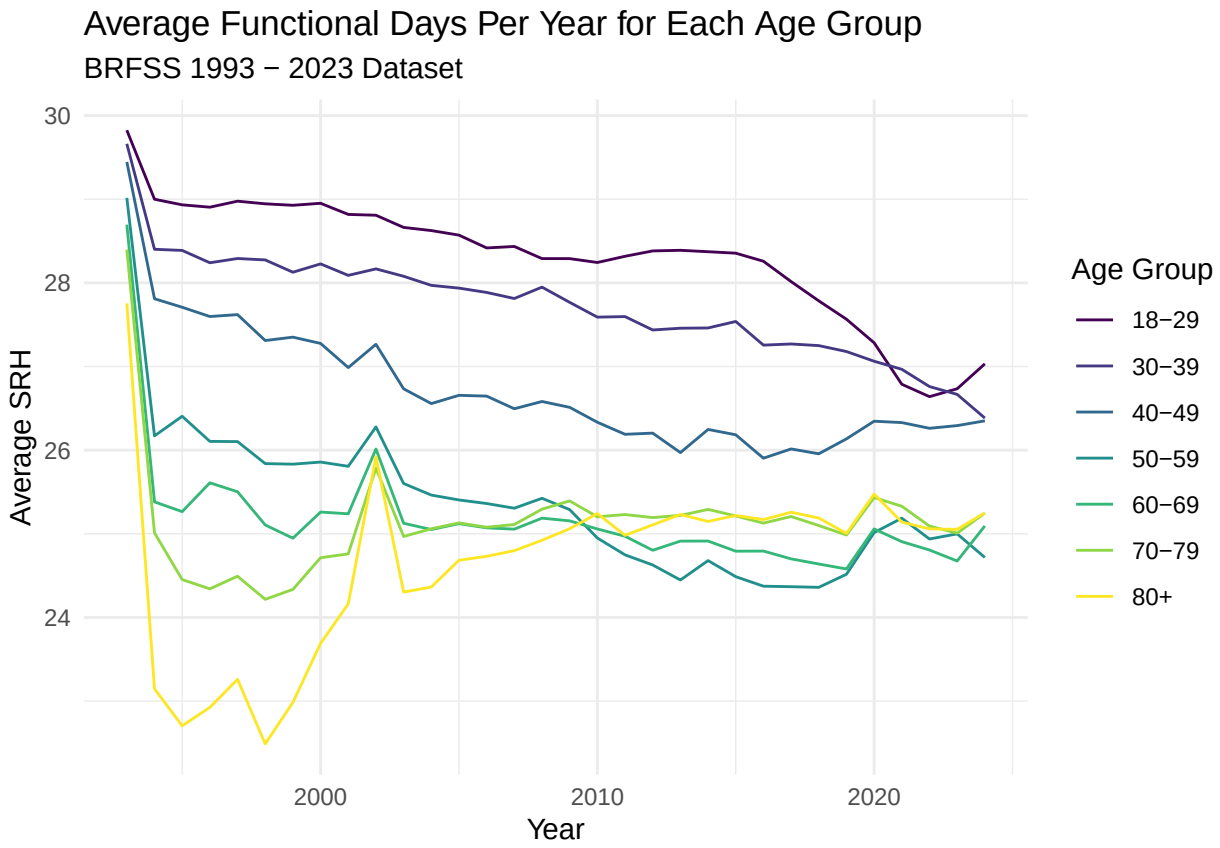

```
data_brfss %>%
  group_by(age_decade_cat, year) %>%
  summarize(mean_health = mean(mental_health_good_days, na.rm = TRUE)) %>%
  ggplot(aes(x = year, y = mean_health, color = age_decade_cat)) +
  geom_line() +
  labs(title = "Average Days of Good Mental Health Per Year for Each Age Group",
       subtitle = "BRFSS 1993 - 2023 Dataset",
       y = "Average SRH",
       x = "Year",
       color = "Age Group") +
  theme_minimal()
```

```
## `summarise()` has grouped output by 'age_decade_cat'. You can override using
## the `.groups` argument.
```




```
data_brfss %>%
  group_by(age_decade_cat, year) %>%
  summarize(mean_health = mean(usual_activities_health_good_days, na.rm = TRUE)) %>%
  ggplot(aes(x = year, y = mean_health, color = age_decade_cat)) +
  geom_line() +
  labs(title = "Average Functional Days Per Year for Each Age Group",
       subtitle = "BRFSS 1993 - 2023 Dataset",
       y = "Average SRH",
       x = "Year",
       color = "Age Group") +
  theme_minimal()
```

```
## `summarise()` has grouped output by 'age_decade_cat'. You can override using
## the `.groups` argument.
```



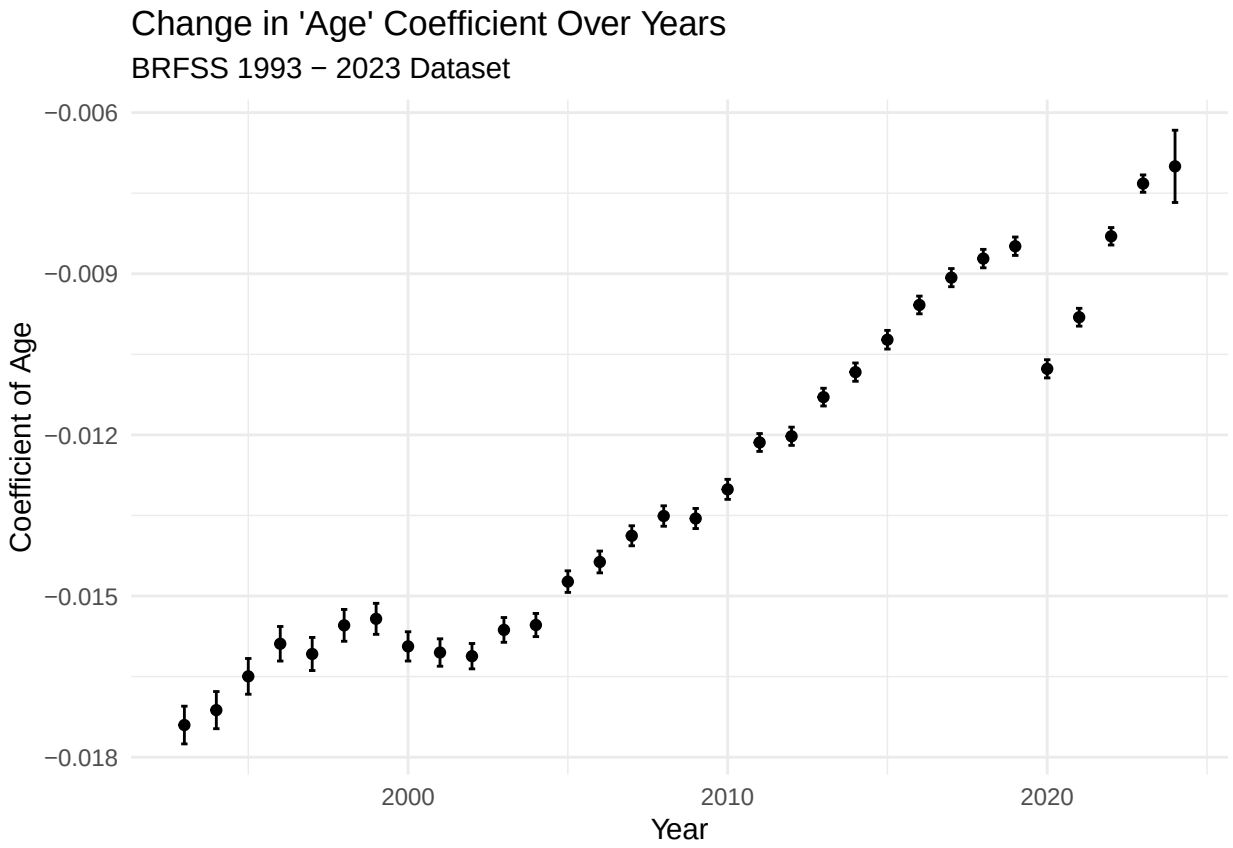

```
lm_health_v_age_0 <- data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ age_5yr_num, data = .), conf.int = TRUE)) %>%  # Add conf.int = TRUE for CIs
  filter(term == "age_5yr_num") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =

# View the results with confidence intervals, se, t statistic, and p value
# print(lm_health_v_age_0)
knitr::kable(lm_health_v_age_0,
             caption = "BRFSS 1993 - 2023 Dataset")
```

Table 1: BRFSS 1993 - 2023 Dataset

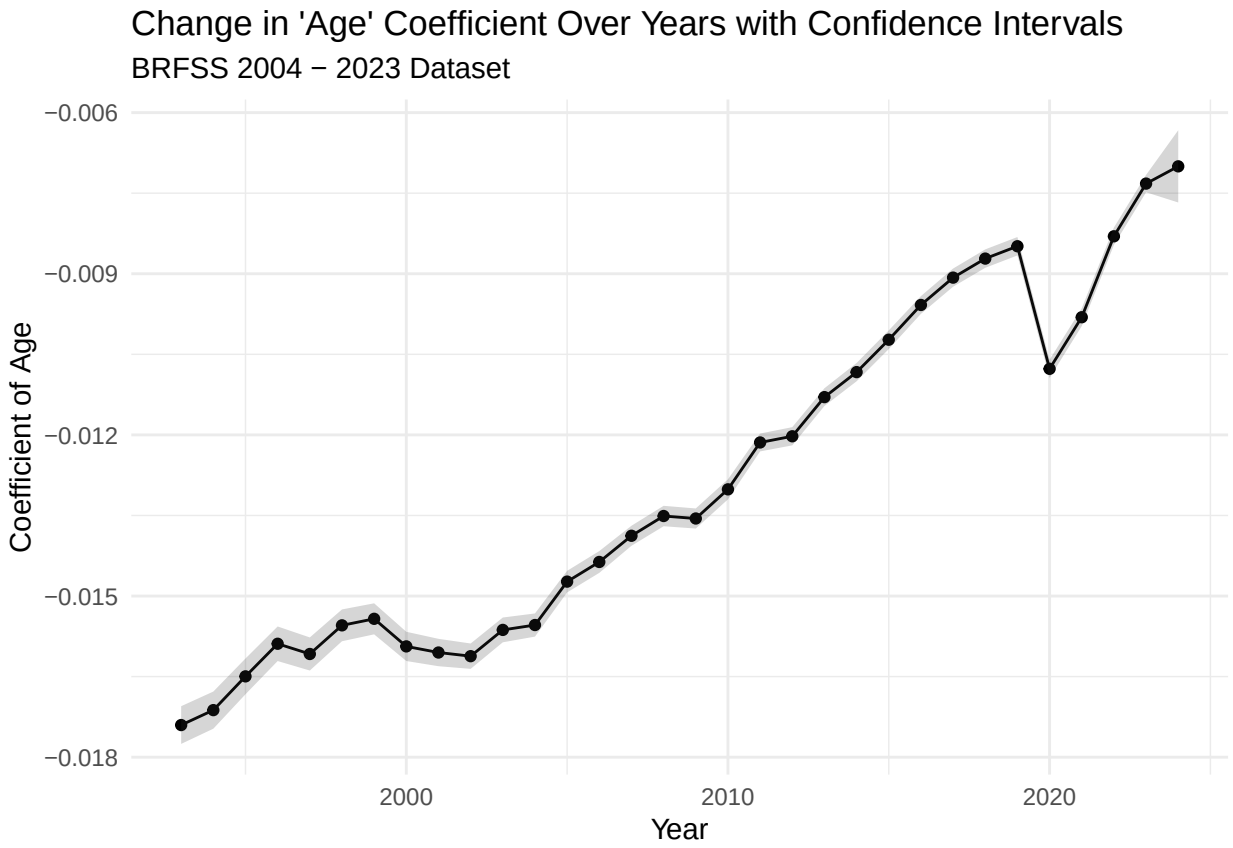
year	coef	conf.low	conf.high	se	t_statistic	p_value
1993	-0.0174020	-0.0177531	-0.0170510	0.0001791	-97.15212	0
1994	-0.0171244	-0.0174702	-0.0167786	0.0001764	-97.06080	0
1995	-0.0164956	-0.0168284	-0.0161629	0.0001698	-97.15894	0
1996	-0.0158887	-0.0162106	-0.0155667	0.0001643	-96.72744	0
1997	-0.0160790	-0.0163871	-0.0157708	0.0001572	-102.26575	0
1998	-0.0155460	-0.0158422	-0.0152497	0.0001512	-102.84509	0
1999	-0.0154243	-0.0157133	-0.0151353	0.0001475	-104.60405	0
2000	-0.0159376	-0.0162098	-0.0156654	0.0001389	-114.74750	0
2001	-0.0160517	-0.0163065	-0.0157969	0.0001300	-123.47918	0
2002	-0.0161196	-0.0163557	-0.0158836	0.0001204	-133.83301	0
2003	-0.0156308	-0.0158615	-0.0154001	0.0001177	-132.79473	0
2004	-0.0155400	-0.0157557	-0.0153243	0.0001100	-141.22558	0
2005	-0.0147317	-0.0149324	-0.0145310	0.0001024	-143.86934	0

year	coef	conf.low	conf.high	se	t_statistic	p_value
2006	-0.0143657	-0.0145684	-0.0141630	0.0001034	-138.90348	0
2007	-0.0138783	-0.0140647	-0.0136920	0.0000951	-145.94056	0
2008	-0.0135105	-0.0137005	-0.0133204	0.0000970	-139.33641	0
2009	-0.0135567	-0.0137440	-0.0133694	0.0000956	-141.86013	0
2010	-0.0130137	-0.0132003	-0.0128272	0.0000952	-136.75918	0
2011	-0.0121411	-0.0123076	-0.0119747	0.0000849	-142.95360	0
2012	-0.0120256	-0.0121953	-0.0118559	0.0000866	-138.88719	0
2013	-0.0112968	-0.0114622	-0.0111314	0.0000844	-133.86671	0
2014	-0.0108315	-0.0110017	-0.0106612	0.0000869	-124.67535	0
2015	-0.0102282	-0.0104020	-0.0100544	0.0000887	-115.34269	0
2016	-0.0095811	-0.0097464	-0.0094158	0.0000843	-113.61832	0
2017	-0.0090723	-0.0092413	-0.0089033	0.0000862	-105.22508	0
2018	-0.0087176	-0.0088893	-0.0085460	0.0000876	-99.54027	0
2019	-0.0084877	-0.0086591	-0.0083162	0.0000875	-97.01912	0
2020	-0.0107699	-0.0109393	-0.0106005	0.0000864	-124.59307	0
2021	-0.0098093	-0.0099751	-0.0096436	0.0000846	-115.98216	0
2022	-0.0083026	-0.0084652	-0.0081400	0.0000830	-100.05762	0
2023	-0.0073217	-0.0074834	-0.0071601	0.0000825	-88.79818	0
2024	-0.0070005	-0.0076733	-0.0063278	0.0003432	-20.39526	0

```r
# Plot coefficients
ggplot(lm_health_v_age_0, aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Age' Coefficient Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Age"
  ) +
  theme_minimal()
```

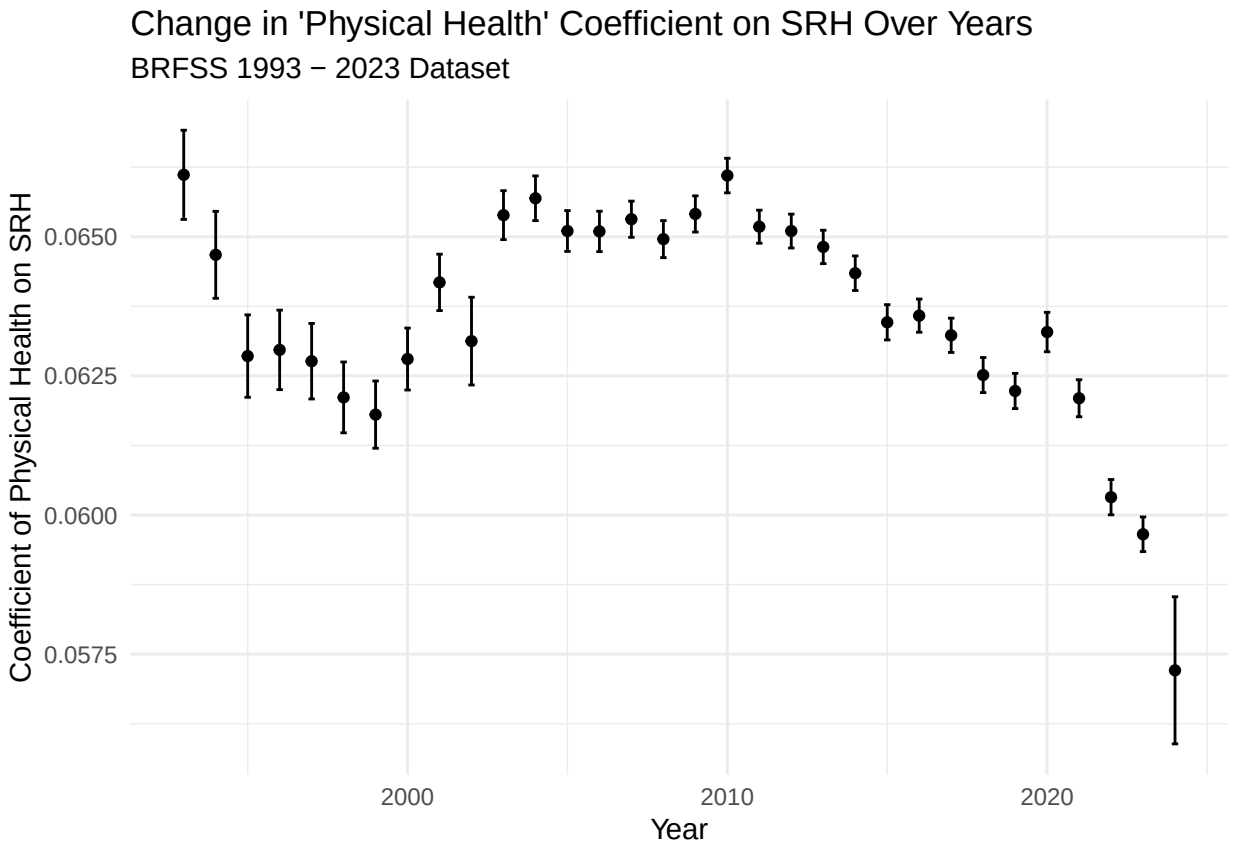



```r
# Plot coefficients with CI
ggplot(lm_health_v_age_0, aes(x = year, y = coef)) +
  geom_line() +
  geom_point() +
  geom_ribbon(aes(ymin = conf.low, ymax = conf.high), alpha = 0.2) +  # Add shaded area for confidence
  labs(
    title = "Change in 'Age' Coefficient Over Years with Confidence Intervals",
    subtitle = "BRFSS 2004 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Age"
  ) +
  theme_minimal()
```

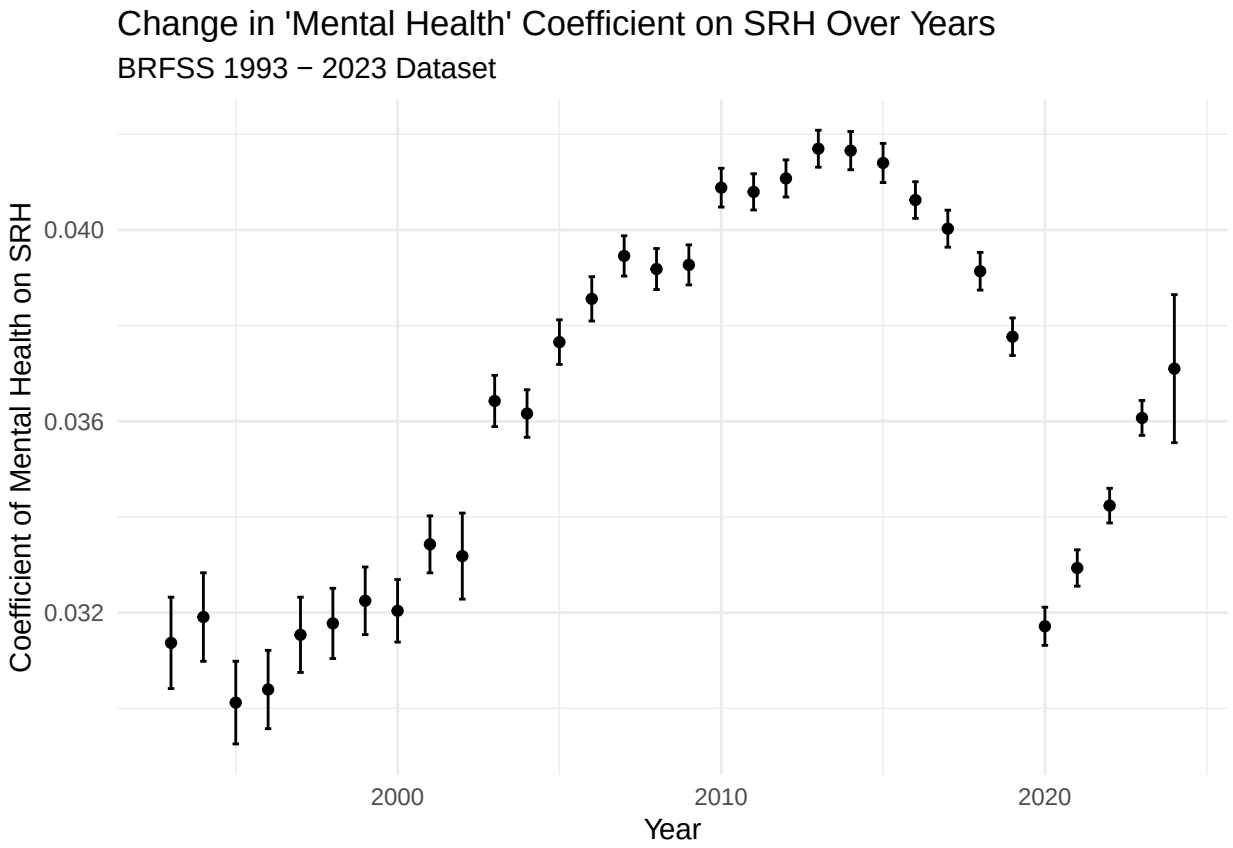



```
# Perform linear regression of 'coef' (age coefficient) vs 'year'
lm_coef_vs_year <- lm(coef ~ year, data = lm_health_v_age_0)
```

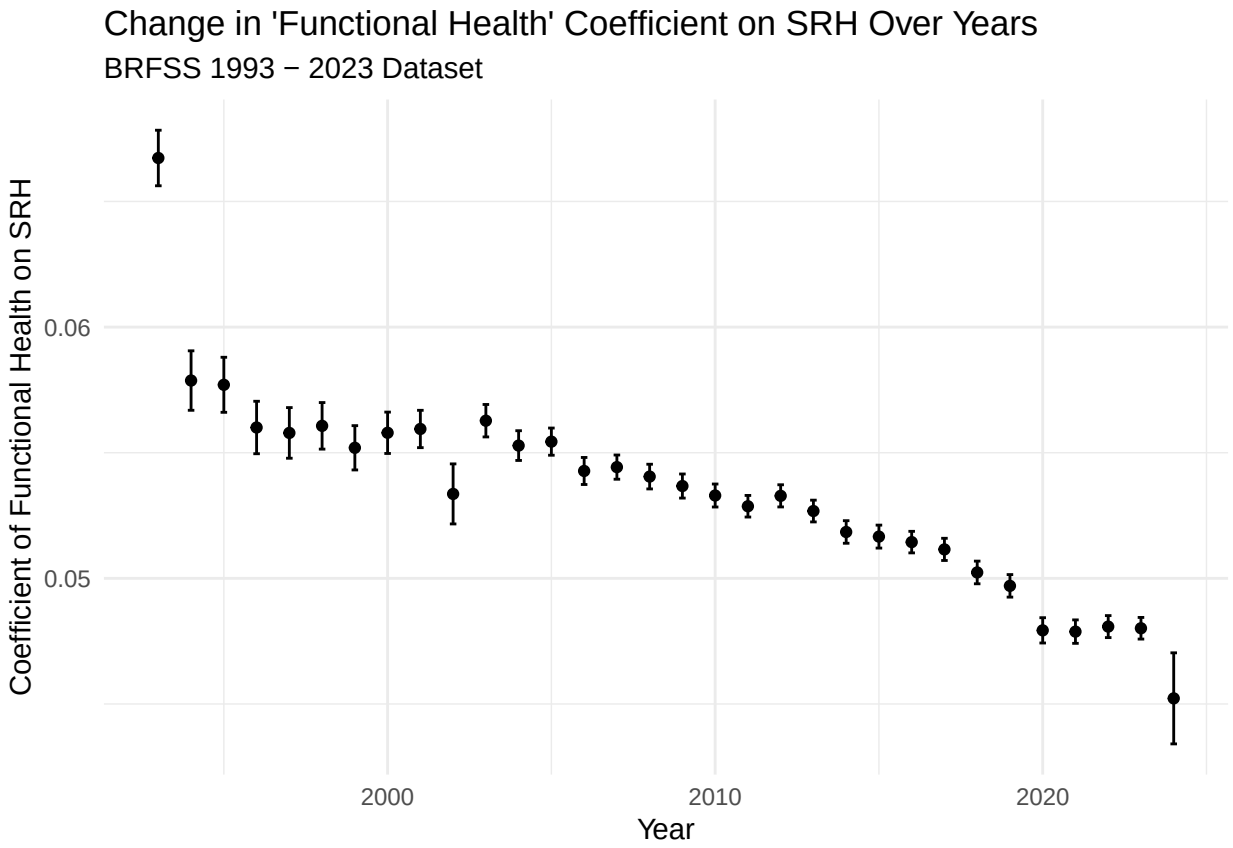
```
data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ physical_health_good_days, data = .), conf.int = TRUE)) %>%  # Add conf.int =
  filter(term == "physical_health_good_days") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Physical Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Physical Health on SRH"
  ) +
  theme_minimal()
```



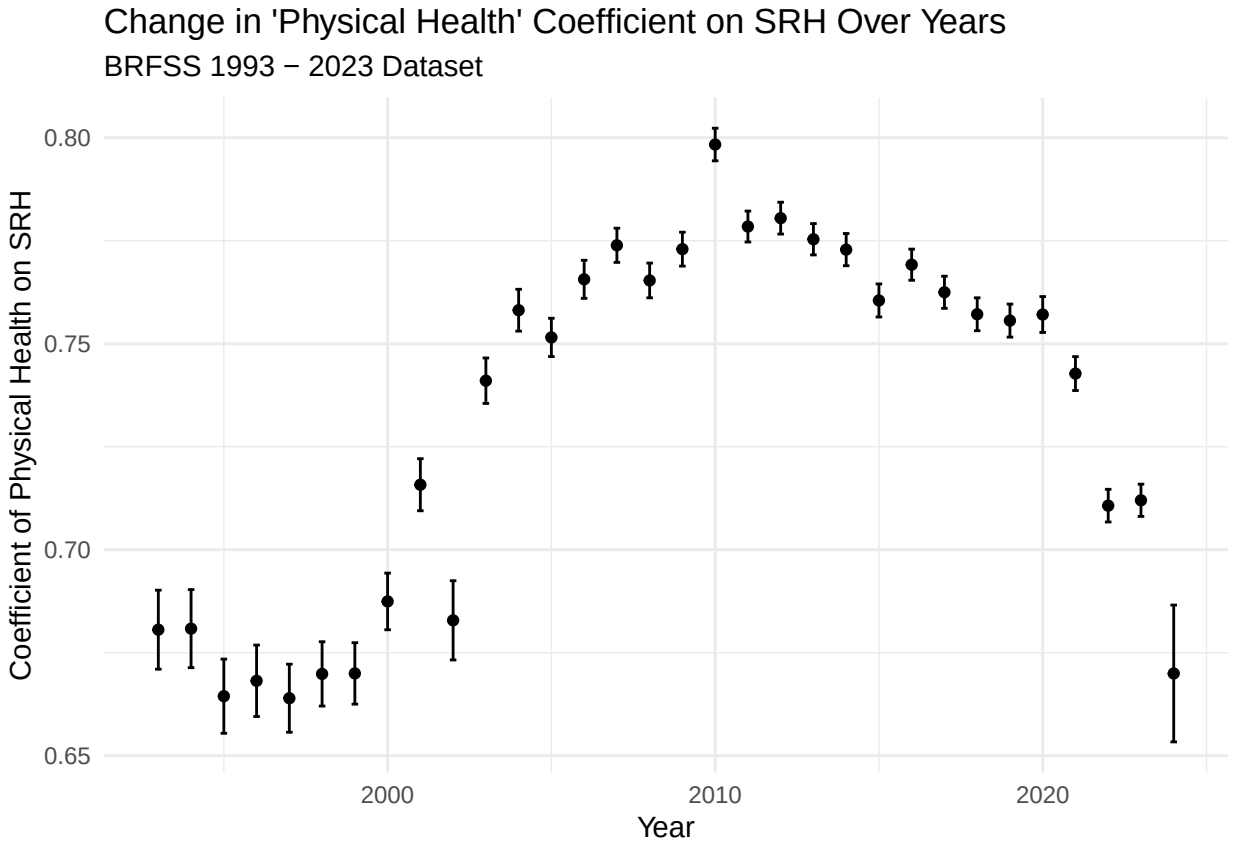

```
data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ mental_health_good_days, data = .), conf.int = TRUE)) %>%  # Add conf.int = T
  filter(term == "mental_health_good_days") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Mental Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Mental Health on SRH"
  ) +
  theme_minimal()
```



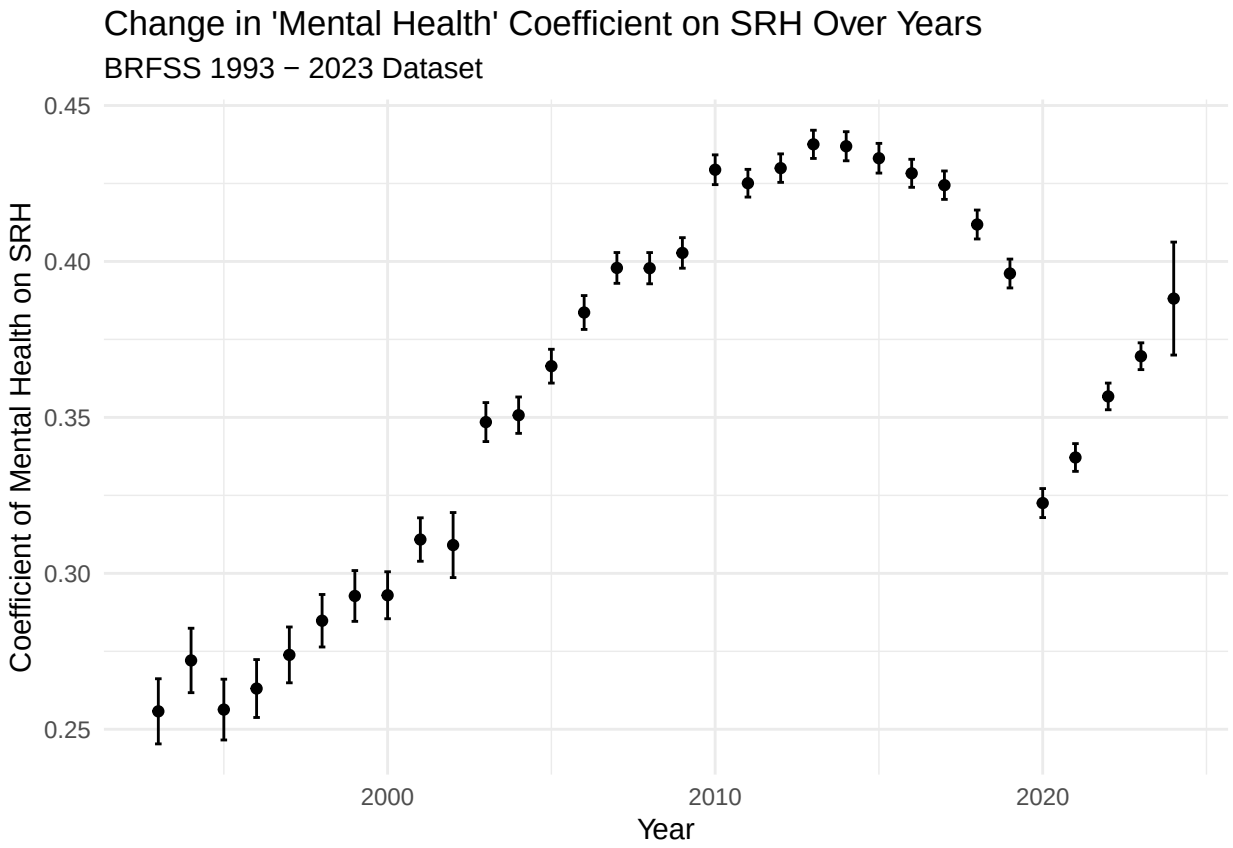

```
data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ usual_activities_health_good_days, data = .), conf.int = TRUE)) %>%  # Add co
  filter(term == "usual_activities_health_good_days") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Functional Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Functional Health on SRH"
  ) +
  theme_minimal()
```



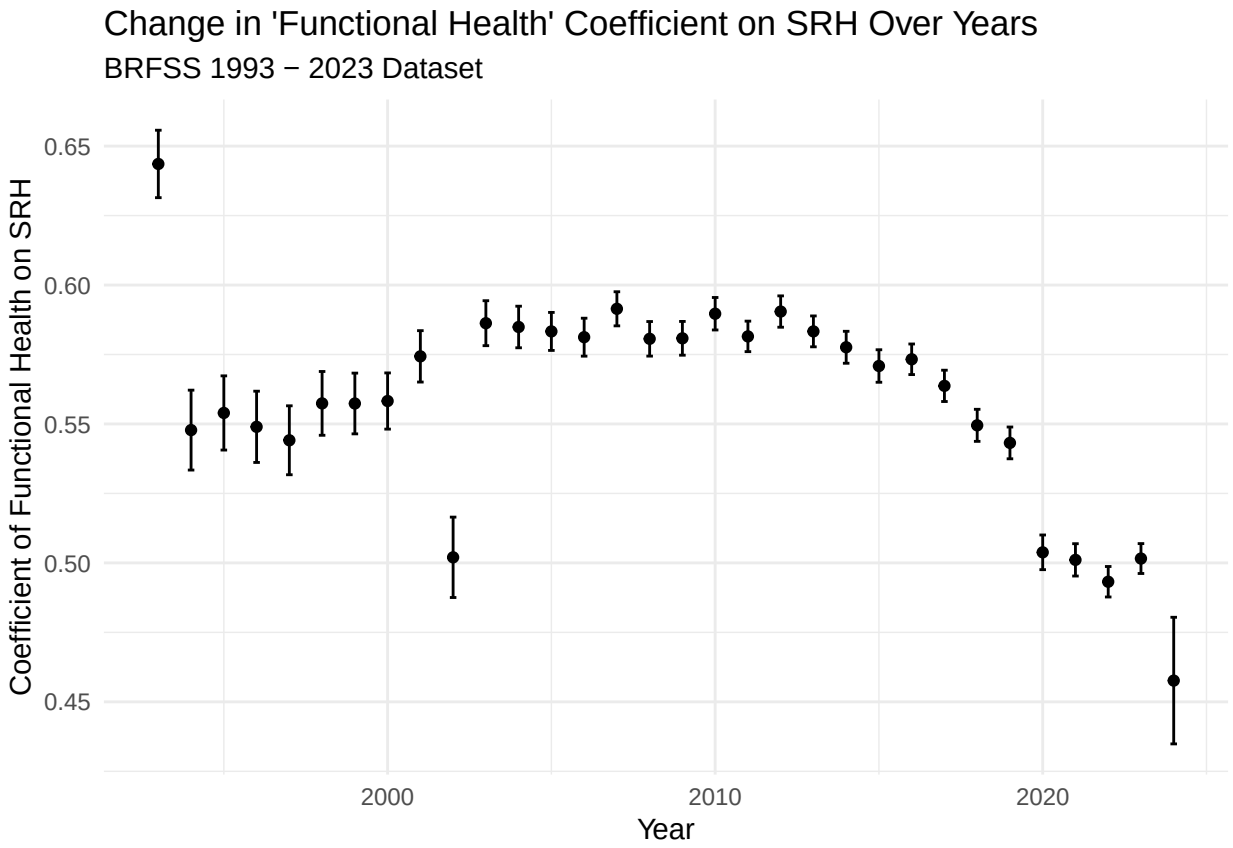

```
# Recoded

data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ physical_health, data = .), conf.int = TRUE)) %>%  # Add conf.int = TRUE for
  filter(term == "physical_health") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Physical Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Physical Health on SRH"
  ) +
  theme_minimal()
```




```
data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ mental_health, data = .), conf.int = TRUE)) %>%  # Add conf.int = TRUE for CI
  filter(term == "mental_health") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Mental Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Mental Health on SRH"
  ) +
  theme_minimal()
```




```
data_brfss %>%
  group_by(year) %>%
  do(broom::tidy(lm(srh ~ usual_activities_health, data = .), conf.int = TRUE)) %>%  # Add conf.int = T
  filter(term == "usual_activities_health") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef)) +
  geom_point() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Functional Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Functional Health on SRH"
  ) +
  theme_minimal()
```

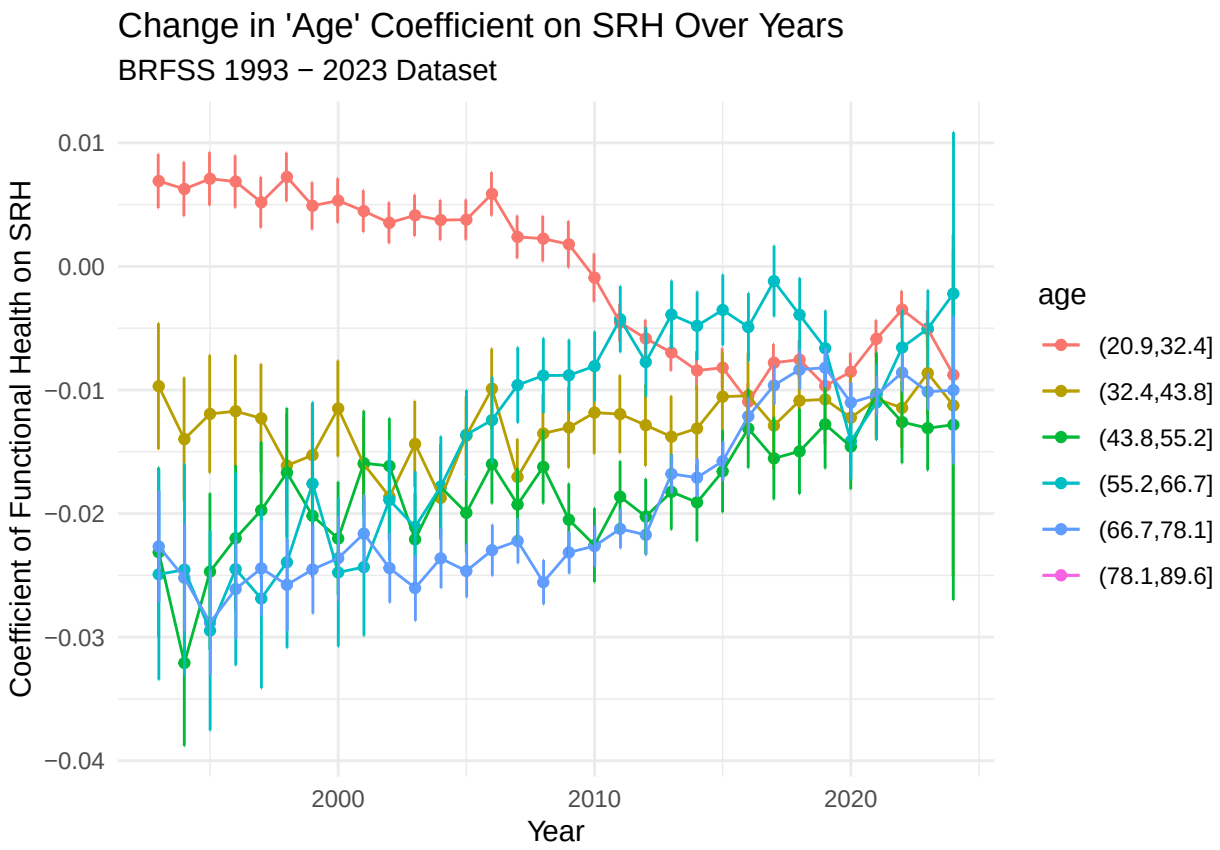



```
data_brfss %>%
  mutate(age = cut(age_5yr_num, breaks = 6)) %>%
  group_by(year, age) %>%
  do(broom::tidy(lm(srh ~ age_5yr_num, data = .), conf.int = TRUE)) %>%  # Add conf.int = TRUE for CIs
  filter(term == "age_5yr_num") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef, color = age)) +
  geom_point() +
  geom_line() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Age' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Functional Health on SRH"
  ) +
  scale_color_discrete() +
  theme_minimal()
```

```
## Adding missing grouping variables: `age`
```

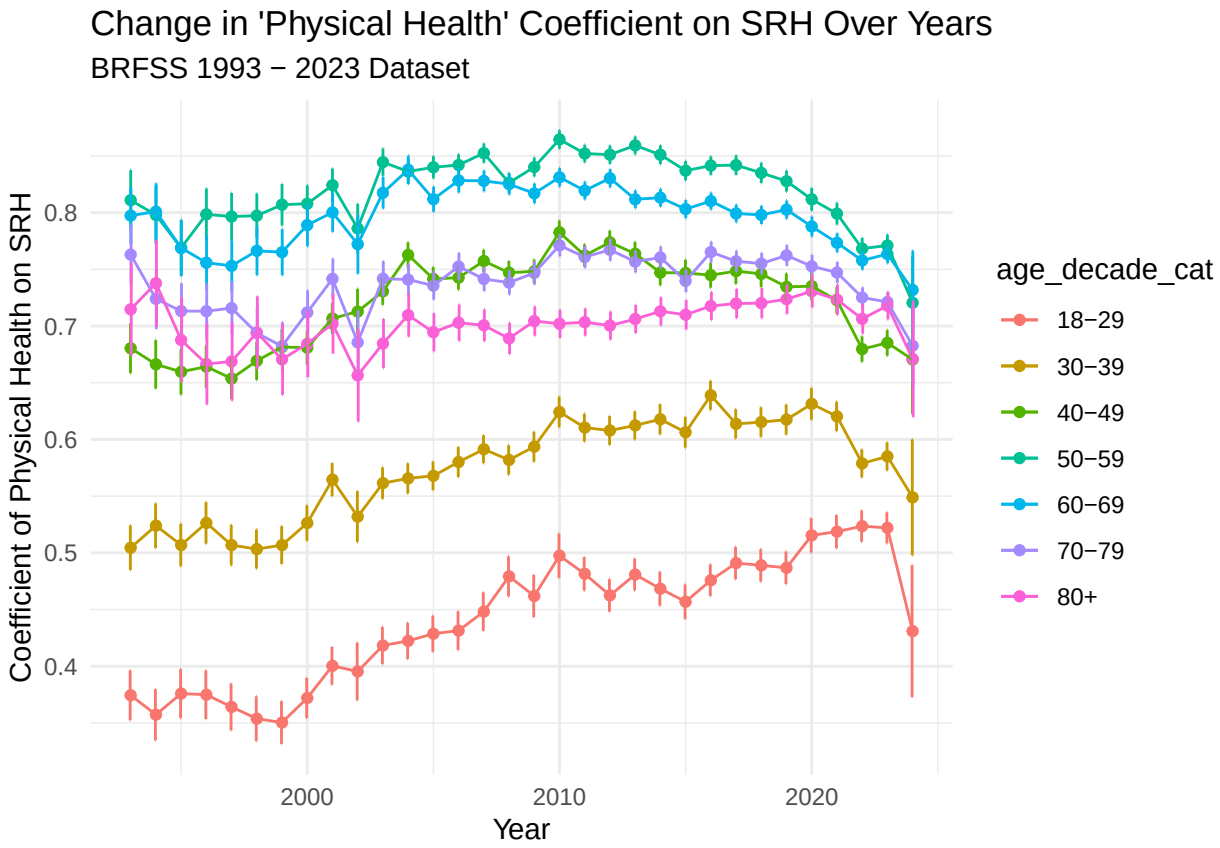
```
## Warning: Removed 32 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

```
## Warning: Removed 32 rows containing missing values or values outside the scale range
## (`geom_line()`).
```



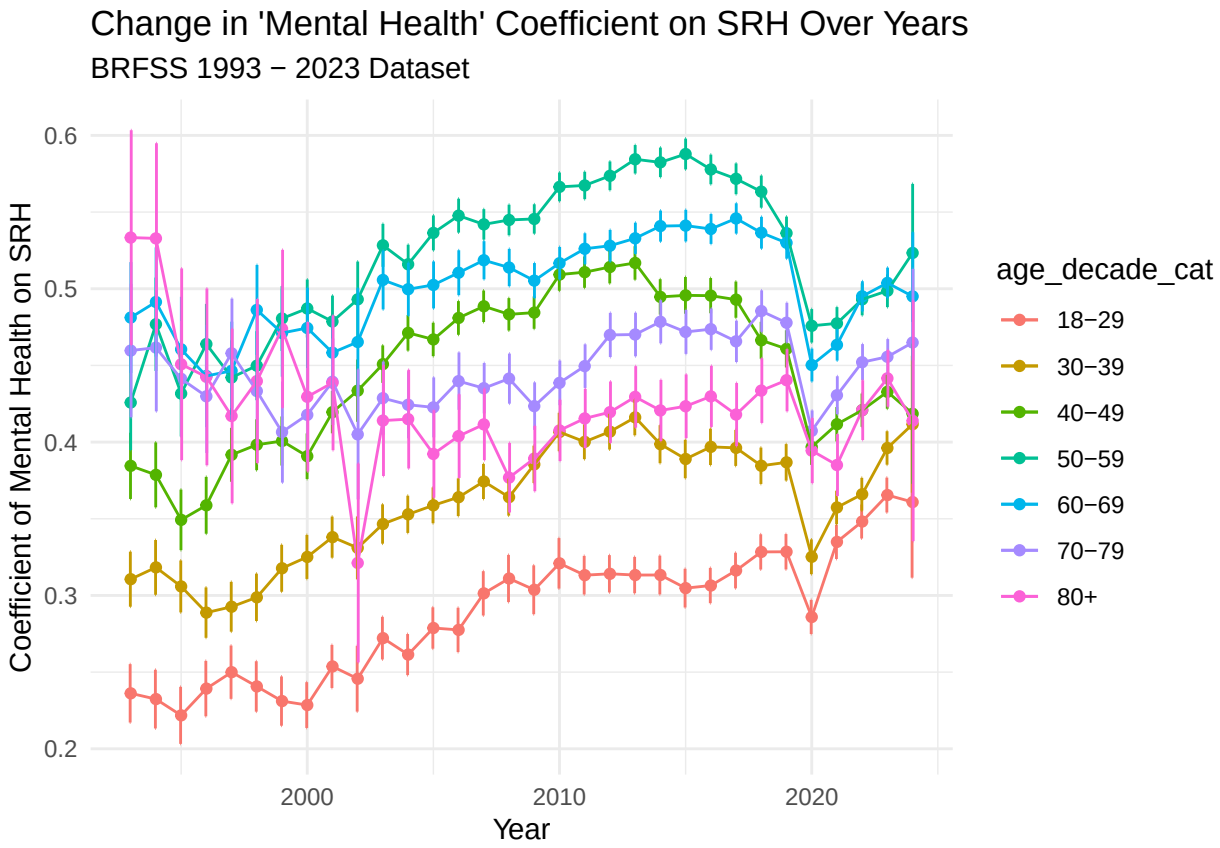

```
data_brfss %>%
  group_by(year, age_decade_cat) %>%
  do(broom::tidy(lm(srh ~ physical_health, data = .), conf.int = TRUE)) %>%  # Add conf.int = TRUE for
  filter(term == "physical_health") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef, color = age_decade_cat)) +
  geom_point() +
  geom_line() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Physical Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Physical Health on SRH"
  ) +
  scale_color_discrete() +
  theme_minimal()
```

```
## Adding missing grouping variables: `age_decade_cat`
```



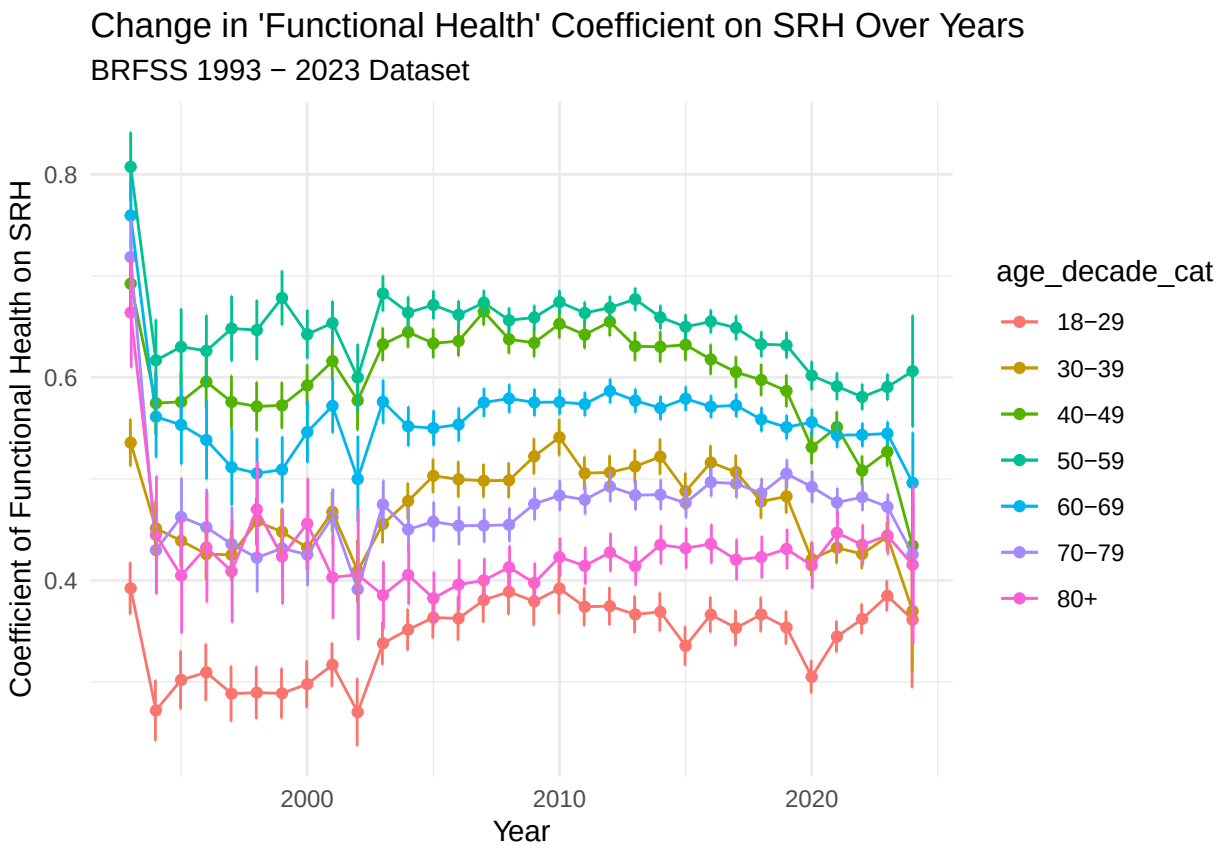

```
data_brfss %>%
  group_by(year, age_decade_cat) %>%
  do(broom::tidy(lm(srh ~ mental_health, data = .), conf.int = TRUE)) %>%  # Add conf.int = TRUE for CI
  filter(term == "mental_health") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef, color = age_decade_cat)) +
  geom_point() +
  geom_line() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Mental Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Mental Health on SRH"
  ) +
  scale_color_discrete() +
  theme_minimal()
```

```
## Adding missing grouping variables: `age_decade_cat`
```




```
data_brfss %>%
  group_by(year, age_decade_cat) %>%
  do(broom::tidy(lm(srh ~ usual_activities_health, data = .), conf.int = TRUE)) %>%  # Add conf.int = T
  filter(term == "usual_activities_health") %>%
  select(year, coef = estimate, conf.low, conf.high, se = std.error, t_statistic = statistic,  p_value =
ggplot(aes(x = year, y = coef, color = age_decade_cat)) +
  geom_point() +
  geom_line() +
  geom_errorbar(aes(ymin=conf.low, ymax=conf.high), width=.2,
                position=position_dodge(0.05)) +
  labs(
    title = "Change in 'Functional Health' Coefficient on SRH Over Years",
    subtitle = "BRFSS 1993 - 2023 Dataset",
    x = "Year",
    y = "Coefficient of Functional Health on SRH"
  ) +
  scale_color_discrete() +
  theme_minimal()
```

```
## Adding missing grouping variables: `age_decade_cat`
```



Regression

```
lm(srh ~ physical_health + mental_health + usual_activities_health,
   data = data_brfss)
```

```
##
## Call:
## lm(formula = srh ~ physical_health + mental_health + usual_activities_health,
##     data = data_brfss)
##
## Coefficients:
##             (Intercept)          physical_health            mental_health
##                  0.6193                   0.7180                   0.2274
## usual_activities_health
##                  0.2343
```

```
lm(srh ~ physical_health + mental_health + usual_activities_health +
     physical_health*mental_health + physical_health*usual_activities_health + mental_health*usual_acti
   data = data_brfss)
```

```
##
## Call:
## lm(formula = srh ~ physical_health + mental_health + usual_activities_health +
##     physical_health * mental_health + physical_health * usual_activities_health +
##     mental_health * usual_activities_health, data = data_brfss)
##
## Coefficients:
```

```
##                              (Intercept)
##                                  0.37866
##                           physical_health
##                                  0.69629
##                             mental_health
##                                  0.11835
##                   usual_activities_health
##                                  0.60007
##             physical_health:mental_health
##                                  0.15178
## physical_health:usual_activities_health
##                                 -0.11530
##   mental_health:usual_activities_health
##                                 -0.07981
```

```r
library(dplyr)          # For data manipulation
library(broom)          # For tidying model outputs
library(ggplot2)        # For plotting
library(purrr)          # For functional programming utilities
library(tidyr)          # For reshaping data
# If you haven't already installed these packages, install them with:
# install.packages(c("dplyr", "broom", "ggplot2", "purrr", "tidyr"))

# --- Data Preparation and Model Fitting ---

# Suppose your data frame is called data_brfss and has the columns:
#   - srh (the response variable)
#   - physical_health
#   - mental_health
#   - usual_activities_health
#   - year (the grouping variable)

# 1) Group data by 'year'
# 2) Fit a linear model srh ~ physical_health + mental_health + usual_activities_health within each yea
# 3) Use broom::tidy() to get coefficient estimates, standard errors, confidence intervals, etc.

model_results <- data_brfss %>%
    group_by(year) %>%
    do(
        broom::tidy(
            lm(srh ~ physical_health + mental_health + usual_activities_health,
               data = .),
            conf.int = TRUE
        )
    ) %>%
    ungroup() %>%
    # 4) Filter only the terms of interest
    filter(term %in% c("physical_health", "mental_health", "usual_activities_health"))

# Now 'model_results' has multiple rows per 'year':
#   - one for the intercept
#   - one for physical_health
#   - one for mental_health
#   - one for usual_activities_health
```

```r
# We keep only the three predictors.

# Inspect the resulting data frame:
head(model_results)
```

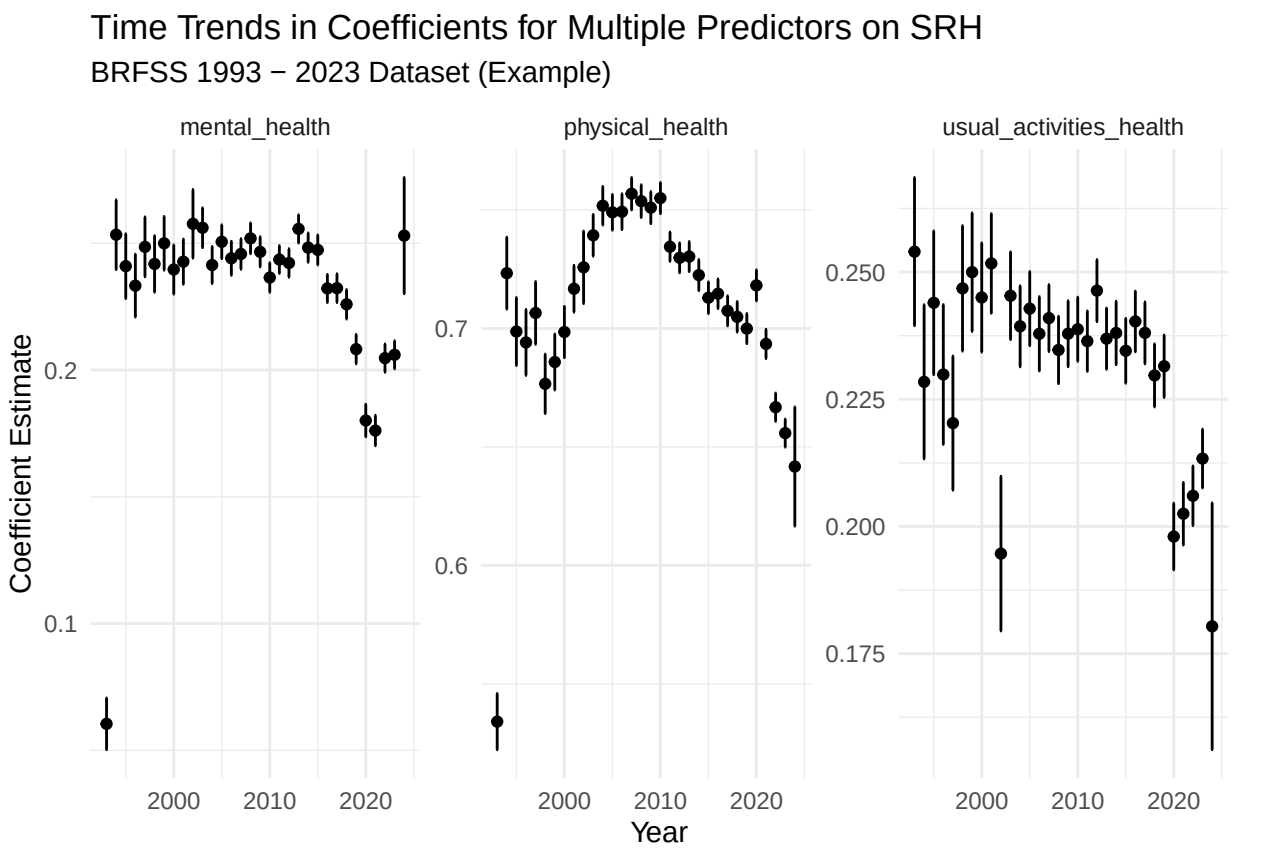
```
## # A tibble: 6 x 8
##    year term           estimate std.error statistic   p.value conf.low conf.high
##   <dbl> <chr>             <dbl>     <dbl>     <dbl>     <dbl>    <dbl>     <dbl>
## 1  1993 physical_heal~   0.534    0.00603      88.5 0           0.522     0.546
## 2  1993 mental_health    0.0605   0.00519      11.6 2.62e- 31   0.0503    0.0706
## 3  1993 usual_activit~   0.254    0.00742      34.2 2.50e-255   0.239     0.269
## 4  1994 physical_heal~   0.723    0.00773      93.6 0           0.708     0.738
## 5  1994 mental_health    0.253    0.00698      36.3 2.30e-284   0.240     0.267
## 6  1994 usual_activit~   0.228    0.00772      29.6 7.90e-191   0.213     0.244
```

```r
# --- Summarize or Explore the Results ---

# For convenience, let's rename some columns and keep relevant ones
model_results_clean <- model_results %>%
    select(
        year,
        term,
        estimate,
        conf.low,
        conf.high,
        std.error,
        statistic,
        p.value
    )

# This clean version can be used for tabular summary or plotting.
# Example tabular summary:
model_results_clean
```

```
## # A tibble: 96 x 8
##     year term           estimate conf.low conf.high std.error statistic   p.value
##    <dbl> <chr>             <dbl>    <dbl>     <dbl>     <dbl>     <dbl>     <dbl>
##  1  1993 physical_hea~   0.534    0.522     0.546    0.00603      88.5 0
##  2  1993 mental_health   0.0605   0.0503    0.0706   0.00519      11.6 2.62e- 31
##  3  1993 usual_activi~   0.254    0.239     0.269    0.00742      34.2 2.50e-255
##  4  1994 physical_hea~   0.723    0.708     0.738    0.00773      93.6 0
##  5  1994 mental_health   0.253    0.240     0.267    0.00698      36.3 2.30e-284
##  6  1994 usual_activi~   0.228    0.213     0.244    0.00772      29.6 7.90e-191
##  7  1995 physical_hea~   0.699    0.684     0.713    0.00730      95.7 0
##  8  1995 mental_health   0.241    0.228     0.254    0.00650      37.1 2.16e-297
##  9  1995 usual_activi~   0.244    0.230     0.258    0.00720      33.9 3.77e-249
## 10  1996 physical_hea~   0.694    0.680     0.708    0.00707      98.2 0
## # i 86 more rows
```

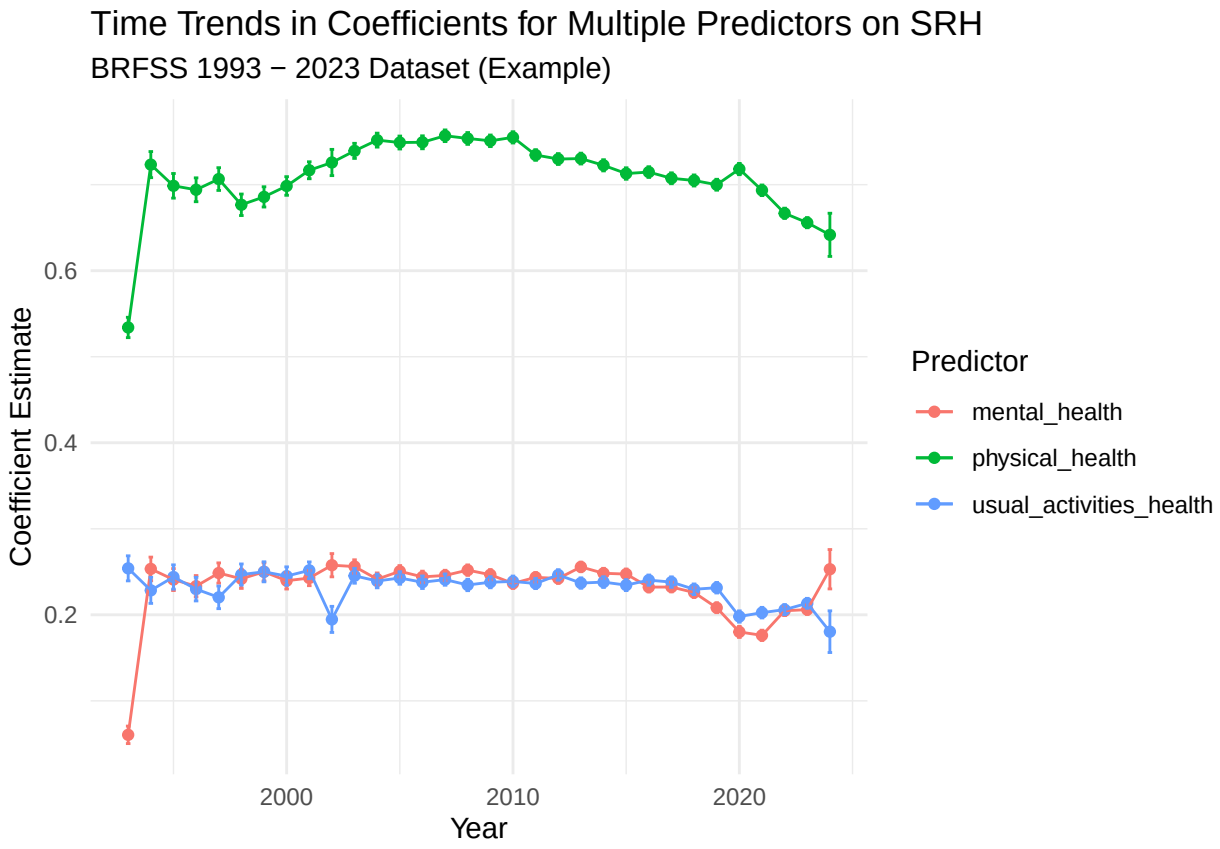
```r
# --- Plotting the Coefficients ---

# Approach A: Facet by predictor
# This will place each predictor's time-series coefficient plot in its own facet.
ggplot(model_results_clean,
       aes(x = year, y = estimate)) +
```

```
    geom_point() +
    geom_errorbar(aes(ymin = conf.low, ymax = conf.high),
                  width = 0.2) +
    facet_wrap(~ term, scales = "free_y") +
    labs(
        title = "Time Trends in Coefficients for Multiple Predictors on SRH",
        subtitle = "BRFSS 1993 - 2023 Dataset (Example)",
        x = "Year",
        y = "Coefficient Estimate"
    ) +
    theme_minimal()
```




```
# Approach B: Single Plot, Different Colors by Predictor
# This will overlay lines for the different predictors on the same plot.
# (May be less clear if the scales differ, but it can be a useful comparison.)
ggplot(model_results_clean,
       aes(x = year, y = estimate, color = term)) +
    geom_point() +
    geom_line() +
    geom_errorbar(aes(ymin = conf.low, ymax = conf.high),
                  width = 0.2) +
    labs(
        title = "Time Trends in Coefficients for Multiple Predictors on SRH",
        subtitle = "BRFSS 1993 - 2023 Dataset (Example)",
        x = "Year",
        y = "Coefficient Estimate",
        color = "Predictor"
```

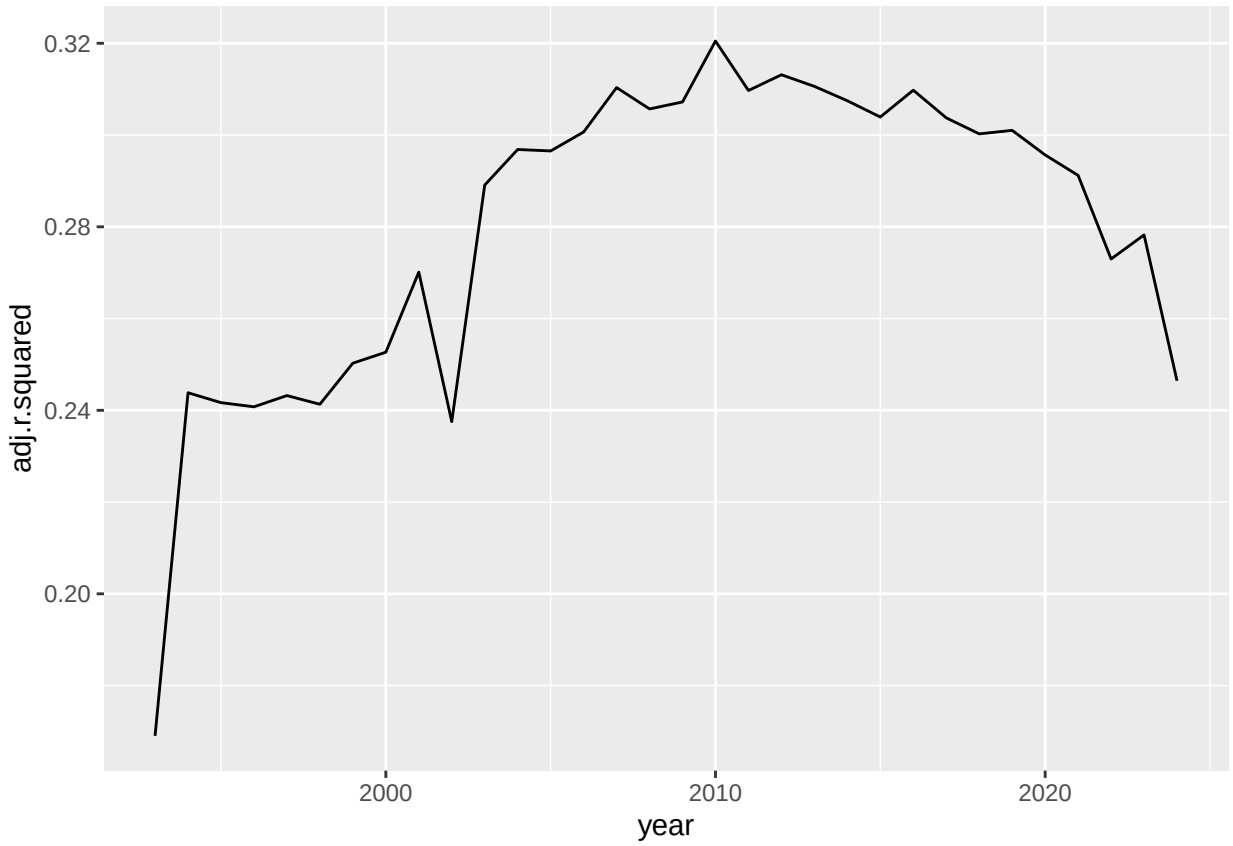
```
    ) +
    theme_minimal()
```



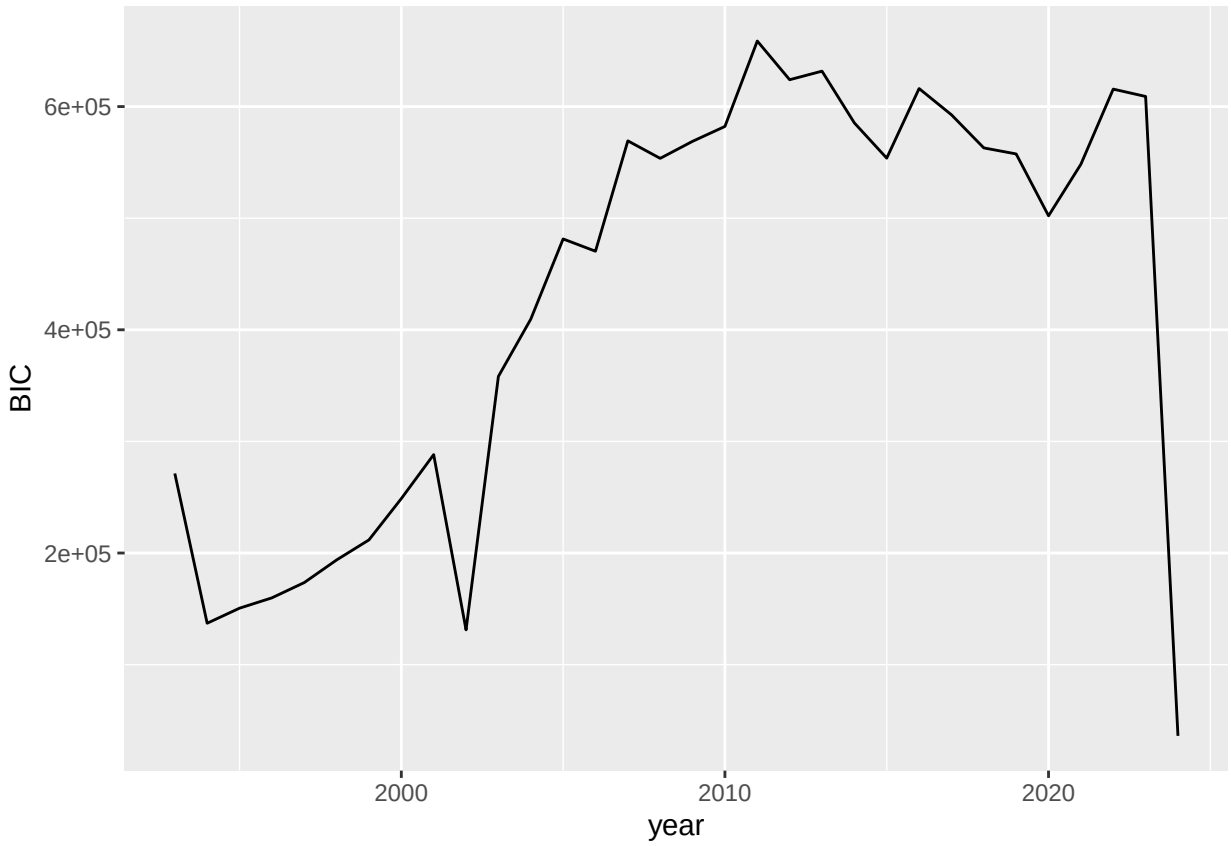

```
model_fit_stats <- data_brfss %>%
    group_by(year) %>%
    do(
        broom::glance(
            lm(srh ~ physical_health + mental_health + usual_activities_health, data = .)
        )
    ) %>%
    ungroup()

colnames(model_fit_stats)
```

```
##  [1] "year"          "r.squared"     "adj.r.squared" "sigma"
##  [5] "statistic"     "p.value"       "df"            "logLik"
##  [9] "AIC"           "BIC"           "deviance"      "df.residual"
## [13] "nobs"
```

```
model_fit_stats %>% ggplot(aes(x = year, y = adj.r.squared)) + geom_line()
```




```
model_fit_stats %>% ggplot(aes(x = year, y = BIC)) + geom_line()
```


6e+05
4e+05
2e+05
BIC
2000
2010
2020
year