



BRFSS Statistical Brief: Arthritis Module



Behavioral Risk Factor Surveillance System

Arthritis Program, Healthy Aging Branch

**National Center for Chronic Disease Prevention and Health Promotion
Centers for Disease Control and Prevention**



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SECTION I: BACKGROUND

Introduction

The Behavioral Risk Factor Surveillance System (BRFSS) is the nation's premier system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services.¹ BRFSS collects data across all 50 states, the District of Columbia, and three U.S. territories. More than 400,000 adults are interviewed each year for BRFSS, making it the largest continuously conducted health survey system in the world.¹ This document provides guidance to BRFSS coordinators and researchers who would like to conduct analyses of arthritis-specific measures that have appeared in either the BRFSS Core Module or the optional Arthritis Module. The goal of this guidance is to facilitate consistent data analysis and reporting of results.

Arthritis Background

Arthritis is a general term for more than 100 conditions that affect the joints or tissues around the joint, including osteoarthritis, rheumatoid arthritis, gout, and fibromyalgia. More than 58 million US adults have arthritis² and 78 million are projected to have arthritis by 2040.³ In 2013, the total national arthritis-attributable medical care costs and earnings losses among adults with arthritis were \$303.5 billion.⁴ Arthritis poses a huge societal burden not only because of its high prevalence and large economic impact, but also because of the pain and limitations it causes in both physical and social functioning. Many adults with arthritis have moderate or severe joint pain and approximately 44% of adults with arthritis report limitations, which can include trouble doing daily activities.² The number of U.S. adults whose activities are limited due to arthritis has increased from 23.7 million during 2013–2015 to 25.7 million during 2016–2018.^{2,5}

Arthritis and its limitations can be managed effectively, and symptoms improved, through routine physical activity and participation in self-management education (SME) programs.⁶ Low-cost arthritis-appropriate evidence-based interventions (AAEBIs) have been shown to decrease arthritis pain and/or disability and improve quality of life.^{7,8} A multifaceted approach is needed which includes individual level prevention strategies that encourage maintaining a healthy weight and avoiding injuries; and community level strategies such as increasing the promotion of physical activity and AAEBIs, increasing the number of AAEBI offerings, and engaging healthcare providers (HCP) in recommending physical activity and AAEBIs as ways to manage arthritis.



Healthy People 2030

Healthy People is a national effort that sets goals and objectives to improve the health and well-being of people in the United States. Healthy People includes national objectives to improve the health of all Americans by encouraging collaborations across sectors, guiding people toward making informed health decisions, and measuring the impact of prevention activities. Four arthritis objectives are included in Healthy People 2030 which focus on decreasing the negative impacts of arthritis and increasing the use of effective, evidence-based interventions to decrease pain and improve function, physical activity, and quality of life for the millions of adults affected by this condition.

Data from the BRFSS can help monitor progress towards meeting the following Healthy People 2030 (HP2030) arthritis objectives:⁹

Objective A-01—Reduce the proportion of adults with arthritis who experience severe or moderate joint pain.

Objective A-02—Reduce the proportion of adults with arthritis whose arthritis limits their activities.

Objective A-03—Reduce the proportion of adults with arthritis whose arthritis limits their work.

Objective A-04—Increase the proportion of adults with arthritis who get counseling for physical activity.

Statistical Brief Overview

The Centers for Disease Control and Prevention (CDC) Arthritis Program uses surveys such as the BRFSS to define state burden of arthritis, monitor trends, and assess how arthritis affects quality of life for adults with arthritis. Various arthritis measures are collected through both the BRFSS Core Module and an optional Arthritis Module. The BRFSS Core Module is asked annually of all states, while states can elect whether to collect the data with the Arthritis Module during odd years. This statistical brief focuses on arthritis-specific questions that have appeared in either the BRFSS Core Module or the optional Arthritis Module. In addition, it addresses other arthritis-related measures that are of direct interest to the DP18-1803 "State Public Health Approaches to Addressing Arthritis" cooperative agreement. Users should be aware that the arthritis measures collected have varied from year-to-year and should reference the [BRFSS website](#) for additional clarity on what measures were collected each year.



SECTION II: ANALYTIC CODE

The following section includes a description and recoding instructions for the following arthritis-related variables:

Doctor-Diagnosed Arthritis

Healthcare Provider Recommend Physical Activity

Self-Management Education Participation

Arthritis-Attributable Activity Limitations (AAAL)

Arthritis-Attributable Work Limitations (AAWL)

Severe Joint Pain

Fair/Poor Self-Rated Health

Physical Inactivity

Walking for Exercise

The variable names used to create recoded variables are the CDC assigned variable names for each question. For most questions, "don't know/not sure" and "refused" responses are set to missing; however, there may be circumstances when "missing" responses may be appropriate to include in the denominator. Sample codes and examples can be found in Appendix A. The full text of the 2021 and 2023 Arthritis Module can be found in Appendices B and C, while older versions can be found on the [BRFSS website](#). Data users should be aware that arthritis variable name changes can occur in different years of the BRFSS survey and should refer to individual year codebooks in these instances.



Doctor-Diagnosed Arthritis

To determine the prevalence of respondents who have doctor-diagnosed arthritis, an arthritis screening question is included as part of the core BRFSS. The question asks all BRFSS respondents if a doctor, nurse, or other health care professional ever told them that they had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia. CDC recognizes using self-reported doctor-diagnosed arthritis as the case definition for estimating the prevalence of arthritis. Monitoring the burden of arthritis is important for estimating the state-specific need for interventions that reduce symptoms, improve physical function, and improve the quality of life for people with arthritis. These interventions include self-management education programs that have been shown to help participants better manage pain and improve psychological health and health behaviors, and physical activity programs that have been shown to reduce pain, improve physical function, mental health, and quality of life.

1. Has a doctor, nurse or other health care professional ever told you that you had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?

- 1—Yes
- 2—No
- 7—Don't know/Not sure
- 9—Refused

VARIABLE NAME: HAVARTH5
Recorded Variable Name: arthritis

The code below creates variables to classify respondents who say "yes" to the screening question and respondents who say "no" that a health care professional ever told the respondent that they have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia. All other respondents are coded as missing and are excluded from denominators.

Have Arthritis

Software	Analytic Code
SAS	if havarth5 in (7,9) then arthritis = . ; else arthritis = havarth5;
R	arthritis = ifelse(havarth5 %in% c(1,2), havarth5, NA)



Healthcare Provider (HCP) Recommend Physical Activity

Respondents with arthritis are asked if a doctor or other healthcare professional has ever suggested physical activity to help manage arthritis or joint symptoms. Regular physical activity is an effective, low-cost, drug-free strategy for managing arthritis that can alleviate pain, improve physical functioning, and prevent or delay arthritis-related disability.^{7,8} Evidence suggests that adults are more likely to attend an education program and engage in physical activity when recommended by a healthcare provider.¹⁰ Physician-patient encounters can be used as opportunities to counsel about the benefits of physical activity, including walking, and refer adults with arthritis to AAEBIs for physical activity and self-management education.¹¹ This measure will indicate the proportion of adults with arthritis who have ever had a healthcare professional suggest physical activity to manage their arthritis (HP2030 A-04). This question is asked only of respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1).

2. Has a doctor or other health professional ever suggested physical activity or exercise to help your arthritis or joint symptoms?

- 1—Yes
- 2—No
- 7—Don't know/Not sure
- 9—Refused

VARIABLE NAME: ARTHEXER
Recoded Variable Name: arth_hcppa

HCP Recommended Physical Activity

Software	Analytic Code
SAS	if arthexer in (7,9,) then arth_hcppa = . ; else arth_hcppa = arthexer;
R	arth_hcppa = ifelse (arthexer %in% c(1,2), arthexer, NA)



Self-Management Education (SME) Participation

Respondents with arthritis are asked if they have ever taken an educational course or class to learn about how to manage problems related to their arthritis or joint symptoms. Self-management education refers to programs that help people who have ongoing, chronic health conditions learn how to live life to the fullest. It is an interactive educational process that focuses on building skills such as goal setting, decision-making, problem-solving, and self-monitoring and is different from didactic arthritis education and information dissemination.¹² Self-management education interventions have been shown to improve confidence and skills to manage pain by 10%-20%.¹³ Self-management education can help improve physical function and quality of life among adults with arthritis; however in 2019, only 16.2% reported engaging in self-management education.¹¹ The CDC Arthritis Program recommends evidence-based programs that are proven to improve the quality of life of people with arthritis, including self-management education classes/courses. This measure will indicate the proportion of adults with arthritis who have ever taken a course or class to manage their symptoms. This question is asked only of respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1).

3. Have you ever taken an educational course or class to teach you how to manage problems related to your arthritis or joint symptoms?

- 1—Yes
- 2—No
- 7—Don't know/Not sure
- 9—Refused

VARIABLE NAME: ARTHEDU
Recoded Variable Name: arth_sme

Self-Management Education

Software	Analytic Code
SAS	if arthedu in (7,9,) then arth_sme = . ; else arth_sme = arthedu;
R	arth_sme = ifelse (arthedu %in% c(1,2), arthedu, NA)



Arthritis-Attributable Activity Limitations (AAAL)

Respondents with arthritis are asked to report if they are limited in their activities in any way because of arthritis or joint symptoms. During 2016–2018, an estimated 44% or 25.7 million adults who have arthritis have "arthritis-attributable activity limitations (AAAL).² Projections suggest that by 2040, 1 in 9 adults or 34.6 million adults with arthritis will have AAALs.³ Monitoring the prevalence of AAAL among adults with doctor-diagnosed arthritis is important for estimating the state-specific impact of arthritis, the need for interventions and targeting interventions to reduce the disabling effects of arthritis, and potentially capturing how well existing interventions are working. This measure will provide the proportion of adults with arthritis who are limited in any way because of arthritis (HP2030 A-02). This question is asked only of respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1).

4. Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?

- 1—Yes
- 2—No
- 7—Don't know/Not sure
- 9—Refused

VARIABLE: LMTJOIN3
Recoded Variable Name: arth_lmtd

Arthritis-Attributable Activity Limitations

Software	Analytic Code
SAS	if lmtjoin3 in (7,9,.) then arth_lmtd = .; else arth_lmtd = lmtjoin3;
R	arth_lmtd = ifelse (lmtjoin3 %in% c(1,2), lmtjoin3, NA)



Arthritis-Attributable Work Limitations (AAWL)

Respondents with arthritis are asked whether arthritis or joint symptoms affect if they work, type of work they are able to do, and the amount of work. Arthritis and other rheumatic conditions are a leading cause of work disability among US adults. An estimated 20.1 million working-age adults aged 18 to 64 years reported work disability.¹⁴ Back or spine problems and arthritis/rheumatism are consistently among the top conditions reported to cause work disability.^{14,15} Monitoring the prevalence of arthritis-attributable work limitations among adults with arthritis is important for estimating the state-specific impact of arthritis, the need for interventions and targeting interventions to reduce the disabling effects of arthritis, and potentially capturing how well existing interventions are working. This measure will indicate the proportion of adults with arthritis who experience arthritis-attributable work limitations (HP2030 A-03). This question is asked only of respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1).

5. Do arthritis or joint symptoms now affect whether you work, the type of work you do or the amount of work you do?

- 1—Yes
- 2—No
- 7—Don't know/Not Sure
- 9—Refused

VARIABLE: ARTHDIS2
Recorded Variable Name: arth_wrklmtd

Arthritis-Attributable Work Limitations

Software	Analytic Code
SAS	if arthdis2 in (7,9,.) then arth_wrklmtd = .; else arth_wrklmtd = arthdis2;
R	arth_wrklmtd = ifelse (arthdis2 %in% c(1,2), arthdis2, NA)

Severe Joint Pain

Respondents with arthritis are asked about their level of joint pain during the past 30 days on a scale of 1 to 10, with 0 equivalent to "no pain" and 10 equivalent to "as bad as can be." Severe joint pain was defined as a pain level ranging between 7 and 10. An estimated 15 million adults with arthritis report experiencing severe joint pain related to arthritis.¹⁶ From 2015 to 2019 the median state severe joint pain prevalence reported by adults with arthritis increased slightly, from 29.7% to 32.8%.¹⁷ Monitoring the prevalence of severe joint pain among adults with arthritis is important for estimating the state-specific impact of arthritis, the need for interventions and targeting inventions to reduce the disabling effects of arthritis, and potentially capturing how well existing interventions are working. This measure will indicate the proportion of adults with arthritis who experience severe joint pain (HP2030 A-01). This question is asked only of respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1).

6. Please think about the past 30 days, keeping in mind all of your joint pain or aching and whether or not you have taken medication. Question: On a scale of 0 to 10 where 0 is no pain or aching and 10 is pain or aching as bad as it can be, DURING THE PAST 30 DAYS, how bad was your joint pain ON AVERAGE?

- 0–10
- 77—Don't know/Not sure
- 99—Refused

VARIABLE: JOINPAI2
Recorded Variable Name: sjp, msjp

Severe Joint Pain

Software	Analytic Code
SAS	if joinpai2 in (7:10) then sjp = 1; * reports severe joint pain; else if joinpai2 in (0:6) then sjp = 2; * does not report severe joint pain; if joinpai2 in (4:10) then msjp = 1; * reports moderate or severe joint pain; else if joinpai2 in (0:3) then msjp = 2; * does not report moderate or severe joint pain;
R	sjp = ifelse(joinpai2 %in% c(7:10), 1, ifelse(joinpai2 %in% c(0:6),2, NA)) msjp = ifelse(joinpai2 %in% c(4:10), 1, ifelse(joinpai2 %in% c(0:3),2, NA))





Fair/Poor Self-Rated Health

Respondents are asked to rate their health as excellent, very good, good, fair, or poor. An analysis of combined 2003, 2005, and 2007 BRFSS data, of persons ages ≥ 18 years with arthritis, found that 27% reported fair/poor health as compared to 12% without arthritis.¹⁸ Monitoring health-related quality of life among adults with arthritis is important for estimating the state-specific impact of arthritis, the need for interventions and targeting interventions to reduce the disabling effects of arthritis, and potentially capturing how well existing interventions are working. This measure will indicate the proportion of adults with arthritis who report fair or poor self-rated health. This question is part of the Health Status Core and is asked of all BRFSS respondents. Cross tabulations are then assessed among respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1) and the fair/poor self-rated health variable.

7. Would you say that in general your health is?

- 1—Excellent
- 2—Very Good
- 3—Good
- 4—Fair
- 5—Poor
- 7—Don't know/Not sure
- 9—Refused

VARIABLE: GENHLTH
Recorded Variable Name: psh

Poor Self-Rated Health

Software	Analytic Code
SAS	if genhlth in (4:5) then psh = 1; * fair/poor self-rated health; if genhlth in (1:3) then psh = 2; * good, very good, or excellent self-rated health;
R	psh = ifelse(genhlth %in% c(4,5), 1, ifelse(genhlth %in% c(1:3), 2, NA))

Physical Inactivity

Respondents are asked if they participated in any physical activity or exercise during the past month. The Physical Activity Guidelines for Americans, 2nd edition (Guidelines) recommends that adults, including those with chronic conditions like arthritis, do at least 150 to 300 minutes a week of moderate-intensity or 75 to 150 minutes a week of vigorous-intensity physical activity, or an equivalent combination, along with ≥ 2 days a week of muscle-strengthening activities.¹⁹ Adults with arthritis who are more physically active experience less pain, improved physical function, and better quality of life relative to less active adults with arthritis.²⁰ From 2008 to 2015, the percentage of adults meeting the physical activity guidelines was persistently lower among adults with arthritis versus adults without arthritis.²¹ In 2019, the median state prevalence of adults with arthritis who reported physical inactivity was 29.6%.¹⁷ Monitoring physical inactivity among adults with arthritis is important for promoting engagement in physical activity which can decrease arthritis pain and disability and improve quality of life. This measure will indicate the proportion of adults with arthritis who are physically inactive. This question is a part of the Exercise (Physical Activity) Core and is asked of all BRFSS respondents. Cross tabulations are then assessed among respondents who were classified as having some form of arthritis in the screening question (i.e., havearth5=1) and the physical activity variable.

8. During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?

- 1—Yes
- 2—No
- 7—Don't know/Not sure
- 9—Refused

VARIABLES: EXERANY2
Recorded Variable Name: inactive

Physical Inactivity

Software	Analytic Code
SAS	if exerany2 in (7,9,.) then inactive = . ; else if exerany2 = 2 then inactive = 1; * reports being inactive; else if exerany2 = 1 then inactive = 2; * reports being active;
R	inactive = ifelse(exerany2 == 2, 1, ifelse(exerany2 == 1, 2, NA))



Walking for Exercise

Respondents are asked to indicate the type of physical activity they engaged in during the past month. Participating in joint-friendly physical activity can improve arthritis pain, function, mood, and quality of life. Joint-friendly physical activities are low-impact, which means they put less stress on the body, reducing the risk of injury. Examples of joint-friendly activities include walking, biking and swimming.²² Walking is an ideal activity for adults with arthritis because it can be inexpensive, safe, convenient, low-impact, and adaptable to individual fitness levels.²³ It helps people with arthritis lose weight or maintain the proper weight which in turns lessens stress on the joints and improves arthritis symptoms.²⁴ Monitoring walking among adults with arthritis is important for promoting engagement in physical activity which can decrease arthritis pain and disability and improve quality of life. This measure will indicate adults with arthritis who report walking among the top two types of physical activity in which they engaged during the past month. Note that these variables are unavailable in BRFSS 2021 but will be available in subsequent years.

9. What type of physical activity or exercise did you spend the most time doing during the past month?

10. What other type of physical activity gave you the next most exercise during the past month?

VARIABLES: EXTRACT11 EXTRACT21 _TOTINDA
Recorded Variable Name: walking

Walking

Software	Analytic Code
SAS	<pre>if (_totinda=1 and (extract11 in (77,99,) and extract21 in (77,99,))) or _totinda=9 then walking = ; else if extract11 = 64 or extract21 = 64 then walking = 1; * reports walking as top two activity; else walking = 2; * walking is not a top activity;</pre>
R	<pre>walking = ifelse(totinda ==2 & is.na(extract11) & is.na(extract21), 2, ifelse(extract11 %in% c(1:63,65:76,98) & (extract21 != 64 is.na(extract21)), 2, ifelse(is.na(extract11) & extract21 %in% c(1:63,65:76,98), 2, ifelse(extract11 == 64 extract21 == 64, 1, NA)))</pre>





SECTION III: LIMITATIONS

There are limitations that an analyst should be aware of when using BRFSS data. The BRFSS is a cross-sectional, self-report survey and as such is subject to recall bias and social desirability bias, which may influence which events respondents recall or report at the time of the interview. For arthritis-related variables, doctor-diagnosed arthritis is self-reported in the BRFSS and was not confirmed by a health-care provider or objective monitoring; however, such self-reports have been shown to be acceptable for surveillance purposes.²⁵

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APPENDIX A: EXAMPLES OF STATISTICAL ANALYSIS SOFTWARE (SAS) AND ROSS IHAKA AND ROBERT GENTLEMAN SOFTWARE® (R) TO ESTIMATE ARTHRITIS VARIABLES, BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM, 2021

The following section contains sample SAS and R code to aid in recoding and analyzing arthritis variables

SAS

```
** This SAS example code is meant to provide guidance and one possible approach to analyzing BRFSS data for arthritis outcome measures **
*****
*****
/** SAS code to create a dataset with recoded variables for analysis
    BRFSS 2021 as example dataset **/
*****
*****;
data brfss2021_rc;
set brfss2021;
* This array can be used to recode the 5 variables with the same recoding scheme *;
array orig {5} havarth5 arthexer arthedu lmtjoin3 arthdis2;
array recoded {5} arthritis arth_hcppa arth_sme arth_lmtd arth_wrklmtd;
do i = 1 to 5;
if orig {i} in (7,9,.) then recoded {i} = .;
else recoded {i} = orig {i};
end;
* severe joint pain;
if joinpai2 in (7:10) then sjp = 1; /* reports severe joint pain */
else if joinpai2 in (0:6) then sjp = 2; /* does not report severe joint pain */
* moderate or severe joint pain;
if joinpai2 in (4:10) then msjp = 1; /* reports moderate or severe joint pain */
else if joinpai2 in (0:3) then msjp = 2; /* does not report moderate or severe joint pain */
```

```
* fair or poor self-rated health;
if genhlth in (4:5) then psh = 1; /* fair or poor self-rated health */
if genhlth in (1:3) then psh = 2; /* good, very good, or excellent self-rated health */
* physical inactivity;
if exerany2 in (7,9,.) then inactive = .;
else if exerany2 = 2 then inactive = 1; /* reports being inactive */
else if exerany2 = 1 then inactive = 2; /* reports being active */
* walking (variables not available in BRFSS 2021);
* if (_totinda=1 and (extract11 in (77,99,.) and extract21 in (77,99,.) or _totinda=9 then walking=.;
* else if extract11 = 64 or extract21 = 64 then walking = 1; /* reports walking as top two activity */
* else walking = 2; /* walking is not a top activity */
* age group;
Agegroup = .;
if _ageg5yr in (1:5) then agegroup = 1; * 18-44;
if _ageg5yr in (6:9) then agegroup = 2; * 45-64;
if _ageg5yr in (10:13) then agegroup = 3; * 65+;
run;
/** Sort by survey design variables ;**/
proc sort data = brfss2021_rc;
by _ststr _psu;
run;
*****
*****
/** SAS Surveyfreq to generate arthritis prevalence
```

```

Arkansas as an example **/
*****
*****;
proc surveyfreq data = brfss2021_rc;
strata _ststr ;
cluster _psu;
weight _llcpwt;
where _state = 5;
tables arthritis / cl;
title "Arthritis prevalence - Arkansas 2021";
run;
*****
*****
/** SUDAAN procedure to generate arthritis prevalence
North Carolina as an example **/
*****
*****;
proc descript data = brfss2021_rc filetype=sas design=wr;
nest _ststr _psu / missunit;
weight _llcpwt;
subpopn _state = 37;
class arthritis;
var arthritis;
catlevel 1;
rtitle "Arthritis prevalence - North Carolina 2021";
print percent lowpct uppct /
      percentfmt = f4.1 lowpctfmt = f4.1 uppctfmt = f4.1;
run;
*****
*****
/** SUDAAN procedure to generate prevalence of health
care provider
recommending physical activity
New York as an example **/

```

```

*****
*****;
proc descript data = brfss2021_rc filetype=sas design=wr;
nest _ststr _psu / missunit;
weight _llcpwt;
subpopn arthritis = 1 and _state = 36 ;
class arth_hcppa;
var arth_hcppa;
catlevel 1;
rtitle "Recommended PA prevalence among adults with arthritis -
New York 2021";
print percent lowpct uppct /
      percentfmt = f4.1 lowpctfmt = f4.1 uppctfmt = f4.1;
run;
*****
*****
/** SUDAAN procedure to generate age-standardized prevalence
of arthritis
Oregon as an example **/
*****
*****;
proc descript data = brfss2021_rc filetype=sas design=wr;
nest _ststr _psu / missunit;
weight _llcpwt;
subpopn _state = 41;
class arthritis agegroup;
var arthritis;
catlevel 1;
stdvar agegroup;
stdwgt 0.530535 0.299194 0.170271; * 2000 projected population;
rtitle "Age-standardized arthritis prevalence - Oregon 2021";
print percent lowpct uppct /
      percentfmt = f4.1 lowpctfmt = f4.1 uppctfmt = f4.1;
run;

```

R

```
# This is example code that provides one approach to analyzing
BRFSS data
library(dplyr)
library(foreign)
library(survey)
# read in SAS transport file
brfss2021 <- read.xport("LLCP2021.xpt")
# remove beginning underscore for ease of use in R
colnames(brfss2021) <- gsub("X_", "", colnames(brfss2021))
# change column names to lower case
colnames(brfss2021) <- tolower(colnames(brfss2021))
# recodes
brfss2021_rc <- brfss2021 %>%
  select(arthdis2, lmtjoin3, joinpai2, havarth5, genhlth,
         arthedu, arthexer, exerany2, totinda,
         psu, ststr, llcpwt, state) %>%
  mutate(arthritis = ifelse(havarth5 %in% c(1,2), havarth5, NA),
         arth_lmt = ifelse (lmtjoin3 %in% c(1,2), lmtjoin3, NA),
         arth_wrklmt = ifelse (arthdis2 %in% c(1,2), arthdis2, NA),
         arth_hcpga = ifelse (arthexer %in% c(1,2), arthexer, NA),
         arth_sme = ifelse (arthedu %in% c(1,2), arthedu, NA),
         selfhealth = ifelse(genhlth %in% c(1,2), 1,
                              ifelse(genhlth == 3, 2,
                                      ifelse(genhlth %in% c(4,5), 3, NA))),
         psh = ifelse(genhlth %in% c(4,5), 1,
                      ifelse(genhlth %in% c(1:3), 2, NA)),
         sjp = ifelse(joinpai2 %in% c(7:10), 1,
                      ifelse(joinpai2 %in% c(0:6), 2, NA)),
         msjp = ifelse(joinpai2 %in% c(4:10), 1,
                       ifelse(joinpai2 %in% c(0:3), 2, NA)),
         inactive = ifelse(exerany2 == 2, 1,
                           ifelse(exerany2 == 1, 2, NA))
# create survey design object
brfss2021_ds <- svydesign(id = ~psu, strata = ~ststr, nest =
```

```
TRUE, weight = ~llcpwt, data = brfss2021_rc)
# specify option in case any strata contain a single psu
options(survey.lonely.psu="adjust")
## Prevalence of arthritis using Alabama as example
# subset data for Alabama
AL_arthritis_2021 <- subset(brfss2021_ds, state == 1)
# prevalence estimate
svymean(~factor(arthritis), AL_arthritis_2021, na.rm = TRUE)
# confidence interval (95%)
svycirop(~factor(arthritis==1), AL_arthritis_2021, na.rm =
TRUE)
# population estimate
svytotal(~factor(arthritis), AL_arthritis_2021, na.rm = TRUE)
## Prevalence of health care provider recommending physical
activity among adults with arthritis, ## Arkansas as example
AK_hcpga_2021 <- subset(brfss2021_ds, state == 5 & arthritis
==1)
svymean(~factor(arth_hcpga), AK_hcpga_2021, na.rm = TRUE)
svycirop(~factor(arth_hcpga==1), AK_hcpga_2021, na.rm = TRUE)
```

APPENDIX B: 2021 BRFSS ARTHRITIS MODULE

Core Section 8: Arthritis

Question Number	Question Text	Variable Names	Responses (DO NOT READ UNLESS OTHERWISE NOTED)	SKIP INFO/ CATI Note	Interviewer Note(s)
C08.01	Has a doctor, nurse or other health professional ever told you that you had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?	HVARTH5	1 Yes 2 No 7 Don't know / Not sure 9 Refused	Go to next section	
C08.02	Has a doctor or other health professional ever suggested physical activity or exercise to help your arthritis or joint symptoms?	ARTHEXER	1 Yes 2 No 7 Don't know / Not sure 9 Refused		If the respondent is unclear about whether this means increase or decrease in physical activity, this means increase.
C08.03	Have you ever taken an educational course or class to teach you how to manage problems related to your arthritis or joint symptoms?	ARTHEDU	1 Yes 2 No 7 Don't know / Not sure 9 Refused		
C08.04	Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?	LMTJOIN3	1 Yes 2 No 7 Don't know / Not sure 9 Refused		If a respondent question arises about medication, then the interviewer should reply: "Please answer the question based on your current experience, regardless of whether you are taking any medication or treatment"
C08.05	In the next question, we are referring to work for pay. Do arthritis or joint symptoms now affect whether you work, the type of work you do or the amount of work you do?	ARTHDIS2	1 Yes 2 No 7 Don't know / Not sure 9 Refused		If respondent gives an answer to each issue (whether works, type of work, or amount of work), then if any issue is "yes" mark the overall response as "yes." If a question arises about medications or treatment, then the interviewer should say: "Please answer the question based on your current experience, regardless of whether you are taking any medication or treatment."
C08.06	Please think about the past 30 days, keeping in mind all of your joint pain or aching and whether or not you have taken medication. During the past 30 days, how bad was your joint pain on average one a scale of 0 to 10 where 0 is no pain and 10 is pain or aching as bad as it can be?	JOINPA12	___ Enter number [00-10] 77 Don't know/ Not sure 99 Refused		

APPENDIX C: 2023 BRFSS ARTHRITIS MODULE (PROPOSED)

Module 3: Arthritis

Question Number	Question text	Variable names	Responses (DO NOT READ UNLESS OTHERWISE NOTED)	SKIP INFO/ CATI Note	Interviewer Note (s)
MARTH.01	Has a doctor or other health professional ever suggested physical activity or exercise to help your arthritis or joint symptoms?	ARTHEXER	1 Yes 2 No 7 Don't know / Not sure 9 Refused		If the respondent is unclear about whether this means increase or decrease in physical activity, this means increase.
MARTH.02	Have you ever taken an educational course or class to teach you how to manage problems related to your arthritis or joint symptoms?	ARTHEDU	1 Yes 2 No 7 Don't know / Not sure 9 Refused		
MARTH.03	Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?	LMTJOIN3	1 Yes 2 No 7 Don't know / Not sure 9 Refused		If a respondent question arises about medication, then the interviewer should reply: "Please answer the question based on your current experience, regardless of whether you are taking any medication or treatment"
MARTH.04	In the next question, we are referring to work for pay. Do arthritis or joint symptoms now affect whether you work, the type of work you do or the amount of work you do?	ARTHDIS2	1 Yes 2 No 7 Don't know / Not sure 9 Refused		If respondent gives an answer to each issue (whether works, type of work, or amount of work), then if any issue is "yes" mark the overall response as "yes." If a question arises about medications or treatment, then the interviewer should say: "Please answer the question based on your current experience, regardless of whether you are taking any medication or treatment."
MARTH.05	Please think about the past 30 days, keeping in mind all of your joint pain or aching and whether or not you have taken medication. During the past 30 days, how bad was your joint pain on average on a scale of 0 to 10 where 0 is no pain and 10 is pain or aching as bad as it can be?	JOINPAI2	____ Enter number [00-10] 77 Don't know/ Not sure 99 Refused		

