



A Data Users Guide to the BRFSS Physical Activity Questions

How to Assess the 2008 Physical Activity
Guidelines for Americans

National Center for Chronic Disease Prevention and Health Promotion
Division of Nutrition, Physical Activity, and Obesity





TABLE OF CONTENTS

SECTION I

Introduction	4
2008 Physical Activity Guidelines for Americans	4

SECTION II

Using the BRFSS to Assess the <i>2008 Physical Activity Guidelines for Americans</i>	6
Determining the frequency, duration, and intensity of aerobic physical activities	9

SECTION III

Classifying Respondents into Physical Activity Levels Based on the <i>2008 Guidelines</i>	12
Classifying Respondents into Physical Activity Levels—Examples	15
Selected Limitations to Using the Physical Activity Rotating Core Questions.....	21
Conclusion	23
References	24

APPENDIX

A. BRFSS 2011 Physical Activity Rotating Core	25
B. Directory of MET Values and Aerobic Activities for the BRFSS	28
C. Statistical Analysis Software (SAS) Code to Estimate the Prevalence of Adults Meeting 2008 Physical Activity Guidelines for Americans using BRFSS	30



Dear Behavioral Risk Factor Surveillance System Physical Activity Rotating Core Data User:

Before you begin using the 2011 Physical Activity Rotating Core, we would like to share information with you that we hope will increase your ability to effectively use the 2011 Physical Activity Rotating Core. Specifically, this document will provide:

1. Guidance on how to use the 2011 Physical Activity Rotating Core to assess the *2008 Physical Activity Guidelines for Americans*
2. Guidance on how to classify respondents into physical activity levels based on the *2008 Physical Activity Guidelines for Americans*
3. Statistical Analysis Software (SAS) code to analyze the 2011 Physical Activity Rotating Core to estimate the prevalence of adults meeting the *2008 Physical Activity Guidelines for Americans*

As your data needs with the Physical Activity Rotating Core change, we will be happy to help you evaluate those needs and offer you technical assistance to achieve your goals.

Please contact Carmen Harris (charris2@cdc.gov) or Kathy Watson (kwatson@cdc.gov) with any questions, comments, or concerns you have in using the 2011 Physical Activity Rotating Core. Again, thank you for choosing to use the Behavioral Risk Factor Surveillance System's Physical Activity Rotating Core.

Kind regards,

The Physical Activity and Health Branch
Division of Nutrition, Physical Activity, and Obesity
Centers for Disease Control and Prevention



SECTION I

Introduction

The BRFSS 2011 Physical Activity Rotating Core (PARC) can be used to assess the *2008 Physical Activity Guidelines for Americans (2008 Guidelines)*. These questions differ from the physical activity survey questions asked as part of the 2001–2009 PARC. As with any change, questions may arise about how to use the PARC. The purpose of this document is to provide answers to common questions associated with the PARC and to help data users increase their ability to effectively use the PARC. This document will address the following questions:

1. How can data users use the 2011 PARC to assess the *2008 Guidelines*?
2. What is the Statistical Analysis Software (SAS) code to analyze the PARC to estimate the prevalence of adults meeting the *2008 Guidelines*?

The document will answer these questions by first describing the *2008 Guidelines* and then providing step-by-step instructions on how to use the rotating core to assess the *2008 Guidelines*. The document will also provide three examples of classifying respondents into physical activity levels using the *2008 Guidelines*. The document concludes with 3 Appendices: (A) The 2011 Physical Activity Rotating Core Questions, (B) Directory of MET Values and Aerobic Activities for BRFSS, and (C) Statistical Analysis Software (SAS) Code to Estimate the Prevalence of Adults Meeting *2008 Physical Activity Guidelines for Americans* Using the BRFSS.

2008 Physical Activity Guidelines for Americans

The *2008 Guidelines* provide evidence-based guidance to help Americans improve their health through sufficient physical activity. The key guidelines for adults from the *2008 Guidelines* are shown in Table 1. Additional information about the *2008 Guidelines* is available at: www.health.gov/paguidelines.

Table 1. Key Guidelines for Adults from the *2008 Physical Activity Guidelines for Americans*

2008 Physical Activity Guidelines for Americans	
Physical activity component	Guideline
Inactivity	All adults should avoid inactivity
Aerobic activity	<p>For substantial health benefits, adults should do at least 150 minutes a week of moderate-intensity, or 75 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity</p> <p>For additional and more extensive health benefits, adults should increase their aerobic physical activity to 300 minutes a week of moderate-intensity, or 150 minutes a week of vigorous-intensity activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity</p> <p>Aerobic activity should be performed in episodes of at least 10 minutes</p>
Muscle-strengthening activity	Adults should also do muscle-strengthening activities that are of moderate or high intensity and involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits

U.S. Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*. Hyattsville, MD: U.S. Department of Health and Human Services;2008. www.health.gov/paguideines



SECTION II

Using the BRFSS to Assess the 2008 Physical Activity Guidelines for Americans

The Physical Activity Rotating Core (PARC) has been an integral part of the BRFSS since 1984. The PARC is administered as part of the BRFSS in odd calendar years. One main use of the PARC is to assess the proportion of the U.S. adult population meeting physical activity guidelines. To assess the current guidelines, the PARC contains 6 questions to assess aerobic activity and one question to assess muscle-strengthening activity in adults (Table 2).

In 2011, the PARC changed the questions to assess aerobic physical activity. The 2011 questions (administered in 2011 and subsequent odd years) are originally from the PARC administered in 1984–2000. A comparison of the PARC questions from 2001–2009 and those in 2011 is shown in Table 2. The change to the 2011 PARC improves the core for two reasons. First, the change removes the complex cognitive computations the respondent had to perform during the survey in previous years. Second, the 2011 PARC provides data users with an opportunity to identify activity patterns for specific behaviors such as walking, running, basketball, or bicycling by assessing the frequency and duration, and intensity of activity types.

Table 2. Comparison of the 2001–2009 and 2011 BRFSS Physical Activity Rotating Core (PARC) by Physical Activity Guideline Component

Physical Activity Rotating Core, BRFSS		
Physical Activity Guideline Component	2001–2009	2011
No leisure-time physical activity	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?	Question remained the same
Aerobic activity	<p>Lead in: We are interested in two types of physical activity - vigorous and moderate. Vigorous activities cause large increases in breathing or heart rate while moderate activities cause small increases in breathing or heart rate.</p> <p>Now, thinking about the moderate activities you do [fill in “when you are not working” if “employed” or self-employed”] in a usual week, do you do moderate activities for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate?</p> <p>How many days per week do you do these moderate activities for at least 10 minutes at a time?</p> <p>On days when you do moderate activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?</p>	<p>Skip Pattern: Aerobic questions only asked to respondents who said ‘yes’ to the no leisure-time physical activity question.</p> <p>What type of physical activity or exercise did you spend the most time doing during the past month?</p> <p>How many times per week or per month did you take part in this activity?</p> <p>And when you took part in this activity, for how many minutes or hours did you usually keep at it?</p>

Table continued on next page.

Physical Activity Rotating Core, BRFSS

Physical Activity Guideline Component	2001–2009	2011
Aerobic activity (continued)	<p>Now, thinking about the vigorous activities you do [fill in “when you are not working” if “employed” or “self-employed”] in a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?</p> <p>How many days per week do you do these vigorous activities for at least 10 minutes at a time?</p> <p>On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?</p>	<p>What other type of physical activity gave you the next most exercise during the past month?</p> <p>How many times per week or per month did you take part in this activity?</p> <p>And when you took part in this activity, for how many minutes or hours did you usually keep at it?</p>
Muscle-strengthening activity	Not Assessed	<p>During the past month, how many times per week or per month did you do physical activities or exercises to STRENGTHEN your muscles? Do NOT count aerobic activities like walking, running, or bicycling. Count activities using your own body weight like yoga, sit-ups or push-ups and those using weight machines, free weights, or elastic bands.</p>



Determining the frequency, duration, and intensity of aerobic physical activities

Data users who intend to use the 2011 PARC to classify respondents as meeting the *2008 Guidelines* will need to know the frequency (the number of times an exercise or activity is performed), duration (the length of time in which an exercise or activity is performed), and intensity (how much work is being performed or the magnitude of the effort required to perform an exercise or activity) of each reported physical activity. As part of the PARC, frequency is assessed by the question “How many times per week or per month did you take part in this activity?” Response options are collected in times per week or times per month. Duration is assessed by the question “And when you took part in this activity, for how many minutes or hours did you usually keep at it?” Response options are collected in hours and minutes (Appendix A).

To estimate the intensity of reported activities, data users will use the method from the 1984–2000 PARC.¹ This method estimates the relative intensity of each reported activity to determine if the activity is of moderate- or vigorous-intensity for each respondent. Relative intensity takes into account the respondent’s maximal oxygen uptake (or their exercise capacity) which is estimated based on their sex and age. The method follows three steps as described below. These steps are also described in the statistical programming code provided in Appendix C (Step 2, parts a, b, and c).



Step 1. Estimate the maximal oxygen uptake

Maximal oxygen uptake (VO_{2max}) is the body's capacity to transport and use oxygen during a maximal exertion involving dynamic contraction of large muscle groups, such as during walking, running, or cycling. The sex- and age-specific equations shown below are used to estimate the VO_{2max} of each respondent.² In these equations, VO_{2max} is expressed in metabolic equivalents (METs). One MET is the rate of energy expenditure while sitting at rest. It is taken by convention to be an oxygen uptake of 3.5 milliliters per kilogram of body weight per minute (approximately 3.5 ml/kg/min or 1 kilocalorie/kg/hour). Physical activities are frequently classified by their intensity using the MET as a reference.

Estimated VO_{2max} (expressed in METs) =

Men

$$\text{Estimated } VO_{2max} \text{ (METs)} = (60 - 0.55 * \text{age in years}) / 3.5$$

Women

$$\text{Estimated } VO_{2max} \text{ (METs)} = (48 - 0.37 * \text{age in years}) / 3.5.$$

Step 2. Determine the criterion MET values for moderate- and vigorous-intensity activities

The minimum intensity for vigorous activities is 60% of maximal oxygen uptake or VO_{2max} .³ Thus, the criterion MET value for vigorous activity is 60% of maximal oxygen uptake (expressed in METs). For example, if a respondent's maximal oxygen uptake is 10 METs (see Step 1), then to be classified as vigorous intensity, an activity must be $\geq (10 \text{ METs} \times 0.60)$ or ≥ 6 METs. Independent of maximal oxygen uptake, based on evidence-based recommendations, the criterion value for moderate-intensity activities is ≥ 3 METs.³ This method to determine intensity is consistent with previous administration (1984–2000) of these PARC questions.⁴



Step 3. Determine if the intensity for each reported activity is moderate or vigorous

Compare the respondent's criterion moderate- and vigorous-intensity MET values (from Step 2) to the MET value ascribed to each reported activity using the standard MET value listing in Appendix B (2011 Compendium of Physical Activities <http://sites.google.com/site/compendiumofphysicalactivities/>). Determine if the MET value from the list in Appendix B meets the moderate- or vigorous-intensity criterion MET value from Step 2. Classify each reported activity as moderate- or vigorous-intensity. Note that some activities may not be moderate- or vigorous-intensity aerobic activity because they are not considered aerobic activities (e.g., Pilates, tai chi, weight lifting, yoga) or they are light-intensity activities (i.e., activities with a MET value <3 METs).

Once the frequency, duration and intensity of each reported activity are known, data users will combine this information to estimate the time spent per week in moderate-intensity and vigorous-intensity physical activities for each respondent.



SECTION III

Classifying Respondents into Physical Activity Levels Based on the 2008 Guidelines

Based on the 2008 Guidelines, data users may classify respondents into any of the physical activity levels described below.

- Meets 2008 Aerobic Guidelines
1. Inactive
Respondent answers “no” to the no leisure-time physical activity question or respondent reports performing an aerobic physical activity bout for less than 10 minutes in duration or respondent reports performing a nonaerobic activity.
 2. Insufficiently Active
Respondent reports greater than 0 minutes and less than or equal to 149 minutes of aerobic activity per week.
 3. Active
Respondent reports at least 150 minutes per week of moderate-intensity activity, or at least 75 minutes per week of vigorous-intensity activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity (multiplied by 2) totaling at least 150 minutes per week.
 4. Highly Active
Respondent reports greater than 300 minutes per week of moderate-intensity activity, greater than 150 minutes per week of vigorous-intensity activity, or an equivalent combination of moderate- and vigorous-intensity activity (multiplied by 2) totaling more than 300 minutes per week.
 5. Meets Muscle-Strengthening Guideline
Respondent reports participation in muscle-strengthening activities at least 2 times per week.
 6. Meets Aerobic and Muscle-Strengthening Guidelines
Respondent reports participation in muscle-strengthening activities at least 2 times per week AND at least 150 minutes per week of moderate-intensity activity, or at least 75 minutes per week of vigorous-intensity activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity (multiplied by 2) totaling at least 150 minutes per week.



For an activity to count toward meeting the aerobic physical activity guidelines, the activity must satisfy the following two criteria: 1) it must be an aerobic activity and 2) it must be performed for at least 10 sustained minutes. Therefore, a general order of operations is used in the programming code (Appendix C) to classify respondents into activity levels. First, the activity is determined to be an aerobic activity (Appendix B). Second, the aerobic activity must be performed for duration of at least 10 minutes. From this information, the total minutes per week for each reported activity is calculated for each respondent. For respondents who report monthly minutes, total minutes per week are calculated using the average of the monthly minutes over 4 weeks.

The *2008 Guidelines* states that the duration of physical activity must be at least 10 minutes to be health enhancing.⁵ The Physical Activity Rotating Core allows respondents to report their total activity frequency for the month or the week. Regardless of how the respondent reports activity frequency (monthly or weekly), physical activity reported in durations of at least 10 minutes will be counted toward meeting the aerobic guideline. Conversely, regardless of the activity frequency, if the duration of an activity is reported as less than 10 minutes, the reported time will not count toward meeting the aerobic guideline.

For the very few respondents (< 0.3%) who report a small amount of total monthly activity minutes, the monthly minutes of activity will convert to less than 10 minutes of total minutes of activity per week. Because these respondents have performed activity that counts toward meeting the *2008 Guidelines*, these respondents are classified as insufficiently active. This classification may appear to be inconsistent with classifying some respondents as inactive; however, these respondents are not inactive because they have performed aerobic activity for at least 10 minutes in duration.



For example, respondent A reports less than 8 minutes of walking per week. Using the order of operations, respondent A meets the qualifying aerobic activity criteria but does not meet the second criteria for activity duration of at least 10 minutes. Therefore, respondent A is classified as inactive. Respondent B reports 12 minutes of walking twice a month. Using the order of operations, respondent B's walking is a qualifying aerobic activity and meets the 10 minute duration criteria. Thus, respondent B's 24 total monthly minutes of walking are converted into 6 minutes per week of walking. Because respondent B met the first two criteria in the order of operations, respondent B is classified as insufficiently active.

The *2008 Guidelines* also address the issue that some respondents report participating in moderate- and vigorous-intensity activities. To determine whether respondents are participating in enough activity to meet the aerobic guidelines through a combination of moderate- and vigorous-intensity activity, data users need a "rule of thumb" to equate moderate- to vigorous-intensity. The rule of thumb is 1 minute of vigorous-intensity activity counts the same as 2 minutes of moderate-intensity activity. Thus, a respondent receives "double credit" for vigorous-intensity activity.⁵

Classifying Respondents into Physical Activity Levels—Examples

The following examples provide guidance to data users to classify respondents into physical activity levels based on the *2008 Guidelines*. For a detailed explanation, please see the Statistical Analysis Software (SAS) code provided in Appendix C.

Example 1

A Respondent Classified as “Active”

Respondent A

Age = 65 years

Sex = male

During the past week, respondent A participated in walking 3 times a week for 30 minutes each time and tennis 1 time for 30 minutes. To classify respondent A as meeting the *2008 Guidelines*, use the following 4 steps.

Step 1. Determine the Frequency and Duration of Respondent A’s Activity

Determine if respondent A reported aerobic activity for at least 10 minute episodes. During the past week, respondent A reported a total of 30 minutes of walking 3 times and 30 minutes of tennis 1 time. Each activity is an aerobic activity and was performed in at least 10 minute episodes. Also, determine if respondent A reported any muscle-strengthening activity. Respondent A did not report any muscle-strengthening activity during the week.

Step 2. Estimate the Maximal Oxygen Uptake of Respondent A and Determine the Intensity for Each of Respondent A’s Reported Activities

Estimated maximal oxygen uptake (VO_{2max}) in METs = $(60 - 0.55 * 65) / 3.5 = 6.92$ METs.

Vigorous-intensity activity criterion = 60% of Respondent A’s VO_{2max} in (METs) = $(.60 * 6.92 \text{ METs}) = 4.2$ METs.

Using the 2011 Compendium of Physical Activities (see Appendix B), the MET value of walking is 3.5 METs and the MET value of tennis is 7.3 METs.

For Respondent A:

- Walking is a **moderate-intensity** activity because The Compendium MET value for walking is 3.5 METs.

Example 1 continued on next page.

Example 1 continued

A Respondent Classified as “Active”

Respondent A

Age = 65 years

Sex = male

During the past week, respondent A participated in walking 3 times a week for 30 minutes each time and tennis 1 time for 30 minutes. To classify respondent A as meeting the *2008 Guidelines*, use the following 4 steps.

For respondent A, walking will be categorized as a moderate-intensity activity because the walking MET level (3.5 METs) does not meet the criterion for vigorous-intensity activity (4.2 METs, see Step 2).

- Tennis is a **vigorous-intensity** activity because The Compendium MET value for tennis is 7.3 METs. For respondent A, tennis will be categorized as a vigorous-intensity activity because the tennis MET level (7.3 METs) meets the criterion for vigorous-intensity activity (4.2 METs, see Step 2).

Step 3. Determine Respondent A's total minutes of activity

Sum the total of respondent A's moderate-intensity activity (walking) with his vigorous-intensity activity (tennis) for the week. Vigorous-intensity activities receive “double credit” toward meeting the *2008 Guidelines*.

Therefore, 90 minutes of moderate-intensity walking + (30*2) minutes of vigorous-intensity tennis = 150 total minutes of aerobic activity. Thus, respondent A participated in a total of 150 minutes per week of at least moderate-intensity aerobic activity.

Step 4. Classify Respondent A into the Appropriate Physical Activity Level

Respondent A reported 150 minutes per week of at least moderate-intensity aerobic activity so he meets the aerobic guidelines and is classified as “Active.” He does not meet the muscle-strengthening guideline because he did not report any muscle-strengthening activities.

Example 2

A Respondent Classified as “Active” and “Meets Muscle-Strengthening Guidelines” and “Meets Aerobic and Muscle-Strengthening Guidelines”

Respondent B

Age = 25

Sex = female

During the past month, respondent B participated in ballet class 4 times for 60 minutes and bicycling 4 times for 60 minutes. She also reports participation in a weight-lifting class 3 times a week to strengthen her muscles. To classify respondent B as meeting the *2008 Guidelines*, use the following 4 steps.

Step 1. Determine the Frequency and Duration of Respondent B’s Activity

Determine if respondent B reported aerobic activity for at least 10 minute episodes. During the past month, respondent B reported at total of 240 minutes of ballet and a total of 240 minutes of bicycling. This is equivalent to reporting 60 minutes of ballet and bicycling each week. Each activity is an aerobic activity and was performed in at least 10 minute episodes. Also, determine if respondent B reported any muscle-strengthening activity. Respondent B reported participation in weight-lifting class, a muscle-strengthening activity, 3 times per week.

Step 2. Estimate the Maximal Oxygen Uptake of Respondent B and Determine the Intensity for Each of Respondent B’s Reported Activities

Estimated maximal oxygen uptake (VO_{2max}) in METs = $(48 - 0.37 * 25) / 3.5 = 11.07$ METs.

Vigorous-intensity activity criterion = 60% of Respondent B’s VO_{2max} in METs = $(.60 * 11.07$ METs) = **6.6 METs**.

Using the 2011 Compendium of Physical Activities (See Appendix B), the MET activity value of ballet is 7.8 METs and the MET activity value of bicycling is 6.8 METs.

For Respondent B:

- Ballet is a **vigorous-intensity** activity because The Compendium MET value for ballet is 7.8 METs. For respondent B, ballet will be categorized as a vigorous-intensity activity because the ballet MET level (7.8 METs) meets the criterion for vigorous-intensity activity (6.6 METs, see Step 2).

Example 2 continued on next page.

Example 2 continued

A Respondent Classified as “Active” and “Meets Muscle-Strengthening Guidelines” and “Meets Aerobic and Muscle-Strengthening Guidelines”

Respondent B

Age = 25

Sex = female

During the past month, respondent B participated in ballet class 4 times for 60 minutes and bicycling 4 times for 60 minutes. She also reports participation in a weight-lifting class 3 times a week to strengthen her muscles. To classify respondent B as meeting the *2008 Guidelines*, use the following 4 steps.

- Bicycling is a **vigorous-intensity** activity because The Compendium MET value for bicycling is 6.8 METs. For respondent B, bicycling will be categorized as a vigorous-intensity activity because the bicycling MET level (6.8 METs) meets the criterion for vigorous-intensity activity (6.6 METs, see Step 2).

Step 3. Determine Respondent B’s Total Minutes of Activity

Sum the total of respondent B’s vigorous-intensity activities (ballet and bicycling) for the week. 60 minutes of vigorous-intensity ballet + 60 minutes of vigorous-intensity bicycling = 120 minutes of total vigorous-intensity activity. Thus, respondent B participated in a total of 120 minutes per week of vigorous-intensity activity.

Step 4. Classify Respondent B into the Appropriate Physical Activity Level

Determine the activity levels in which respondent B is classified. Respondent B reported 120 minutes per week of vigorous-intensity activity (or using the “double credit” rule of thumb $120 \times 2 = 240$ minutes of moderate-intensity equivalent minutes) so she meets the aerobic guideline and is classified as “Active.” She also reported participating in a muscle-strengthening activity 3 times per week so respondent B also meets the muscle-strengthening guideline. Thus, respondent B is classified as “Active,” “Meeting Muscle-Strengthening Guideline,” and “Meets Aerobic and Muscle-Strengthening Guidelines.”

Example 3

A Respondent Classified as “Highly Active”

Respondent C

Age = 42

Sex = female

During the past week, respondent C walked for 65 minutes 5 times. She reports no muscle-strengthening activities. To classify respondent C as meeting the *2008 Guidelines*, use the following 4 steps.

Step 1. Determine the Frequency and Duration of Respondent C's Activity

Determine if respondent C reported aerobic activity for at least 10 minute episodes. During the past week, respondent C reported 65 minutes of walking 5 times. The activity is an aerobic activity and was performed in at least 10 minute episodes. Also, determine if respondent C reported any muscle-strengthening activity. Respondent C reported did not participate in any muscle-strengthening activities.

Step 2. Estimate the Maximal Oxygen Uptake of Respondent C and Determine the Intensity for Each of Respondent C's Reported Activities

Estimated maximal oxygen uptake (VO_{2max}) in METs = $(48 - 0.37 * 42) / 3.5 = 9.27$ METs.

Vigorous-intensity activity criterion = 60% of Respondent B's VO_{2max} in METs = $(.60 * 9.27 \text{ METs}) = 5.6$ METs.

Using the 2011 Compendium of Physical Activities (See Appendix B), the MET activity value of walking is 3.5 METs.

For Respondent C:

- Walking is a **moderate-intensity** activity because The Compendium MET value for walking is 3.5 METs. For respondent C, walking will be categorized as a moderate-intensity activity because the walking MET level (3.5 METs) does not meet the criterion for vigorous-intensity activity (5.6 METs, see Step 2).

Example 3 continued on next page.

Example 3 continued

A Respondent Classified as “Highly Active”

Respondent C

Age = 42

Sex = female

During the past week, respondent C walked for 65 minutes 5 times. She reports no muscle-strengthening activities. To classify respondent C as meeting the *2008 Guidelines*, use the following 4 steps.

Step 3. Determine Respondent C’s Total Minutes of Activity

Sum the total of respondent C’s moderate-intensity activity (walking) for the week—65 minutes of moderate-intensity walking*5 episodes = 325 minutes of total moderate-intensity activity. Thus, respondent C participated in a total of 325 minutes per week of moderate-intensity activity.

Step 4. Classify Respondent C into the Appropriate Physical Activity Level

Determine the activity levels in which respondent C is classified. Respondent C reported 325 minutes per week of moderate-intensity activity so she meets the aerobic guideline. **Please note that the guideline for “Highly Active” is greater than 300 minutes of aerobic and not greater than or equal to 300 minutes.** Thus, respondent C is classified as “Active” and “Highly Active.”



Selected Limitations to Using the Physical Activity Rotating Core Questions

There are limitations specific to the questions used to assess aerobic and muscle-strengthening activities. The validity of the current questions has not been formally evaluated. However, the reliability of the current questions to classify respondents as regularly active ranged from 0.57 (whites) to 0.77 (blacks).⁶ Thus, the current questions should provide a reliable estimate of aerobic physical activity behaviors. While the estimates are based on self-report data and subject to recall and social desirability biases, many studies have shown self-report physical activity data is associated with improved health outcomes and substantial health benefits.⁵

Additionally, the physical activity rotating core questions captures only two aerobic activities because of time and space constraints in survey administration. Thus, respondents are classified as meeting the aerobic guideline (Table 1), based on participation in their two most frequent aerobic activities. In reality, respondents may participate in more than two aerobic activities. For respondents participating in more than two aerobic activities, this information will not be counted toward meeting the aerobic guideline. This limitation, however, likely has little effect on physical activity prevalence. In a preliminary analysis from the 1999–2006 National Health and Nutrition Examination Survey where respondents reported all moderate- and vigorous-intensity physical activities, 96.7% (95% CI: 96.2, 97.2) of those who met the *2008 Guidelines* based on all reported activities also met the guidelines when reporting the top two activities.

There are also limitations to the question assessing the muscle-strengthening guideline (Table 1). To meet the *2008 Guidelines* on muscle-strengthening activities adults must do muscle-strengthening activities of moderate or higher intensity involving all major muscle groups on 2 or more days a week. The BRFSS muscle-strengthening question (Table 2) asks respondents the frequency of muscle-strengthening participation, but does not ask respondents about the intensity of the activities or the muscle groups strengthened. However, most muscle-strengthening activities



have MET values that are considered to be at least moderate intensity. For example, light or moderate weight lifting and heavy calisthenics both have a MET value ≥ 3 , and; therefore, are considered to be of moderate or greater intensity as specified in the *2008 Guidelines*. Thus, the impact of not asking about intensity is likely very small on muscle-strengthening prevalence estimates.

The lack of information on the muscle groups strengthened is of greater concern. A recent study found that while more than one-third of adults met the muscle-strengthening guideline using the 2 times per week frequency criterion, only 6% of adults met the muscle-strengthening guideline using the 2 times per week frequency criterion + activity involving all major muscle groups criterion.⁷ These findings suggest assessing only frequency could result in an overestimation of the prevalence of meeting the muscle-strengthening activity guideline.

It is not currently feasible to ask respondents the muscle groups strengthened because there is only space and time on the BRFSS for one muscle-strengthening activity question. While using one question to assess muscle-strengthening activities likely overestimates the prevalence of meeting the muscle-strengthening guideline, the provided valuable information to states on the frequency and intensity of muscle-strengthening behaviors.



Conclusion

This document provides guidance for those who use the 2011 PARC to assess the *2008 Physical Activity Guidelines for Americans*. After reading this document, data users know how to assess the frequency, duration, and intensity of respondents' physical activity and classify respondents into physical activity levels. By using the step-by-step approaches outlined, data users have the proper information needed to effectively analyze the BRFSS physical activity data. The three appendices provide relevant information on the 2011 PARC including A) The 2011 Physical Activity Rotating Core Questions, B) Directory of MET Values and Aerobic Activities for the BRFSS, and C) Statistical Analysis Software (SAS) Code to Estimate Prevalence of Adults Meeting *2008 Physical Activity Guidelines for Americans* Using the BRFSS.



References

1. Caspersen CJ, Powell KE. A computerized scoring system for the physical activity questions of the Behavioral Risk Factor Surveillance System. Communication received from author.
2. Jones NL *Clinical Exercise Testing, 3rd ed.* Toronto, Canada: W.B. Saunders Company; 1988.
3. U.S. Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, GA: U.S. Dept of Health and Human Services; 1996.
4. Centers for Disease Control and Prevention. Physical activity trends—United States, 1990–1998. *MMWR.* 2001;50:166–169.
5. U.S. Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans.* Hyattsville, MD: U.S. Dept of Health and Human Services; 2008. <http://health.gov/paguidelines/>
6. Shea S, Stein AD, Lantigua R, Basch CE, Reliability of the Behavioral Risk Factor Survey in a triethnic population. *Am J Epidemiol.* 1991;133:489–500.
7. Loustalot F, Carlson SA, Kruger J, Buchner DM, Fulton JE. Muscle-strengthening activities and participation among adults in the United States. *Res Q Exerc Sport.* 2013;84:30–38.

APPENDIX A BRFSS 2011 Physical Activity Rotating Core

The next few questions are about exercise, recreation, or physical activities other than your regular job duties.

INTERVIEWER INSTRUCTION: If respondent does not have a “regular job duty” or is retired, they may count the physical activity or exercise they spend the most time doing in a regular month.

1.1 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?
(171)

- | | | |
|---|---------------------|--------------|
| 1 | Yes | |
| 2 | No | [Go to Q1.8] |
| 7 | Don't know/Not sure | [Go to Q1.8] |
| 9 | Refused | [Go to Q1.8] |

1.2 What type of physical activity or exercise did you spend the most time doing during the past month?
(172-173)

- | | | |
|----|-----------------------|---------------------|
| -- | (Specify) | [See Coding List A] |
| 77 | Don't know / Not Sure | [Go to Q1.8] |
| 99 | Refused | [Go to Q1.8] |

INTERVIEWER INSTRUCTION: If the respondent's activity is not included in the Coding List A, choose the option listed as “Other.”

INTERVIEWER NOTE: Housework may be included as a physical activity or exercise spent and can be coded as “Other.”

1.3 How many times per week or per month did you take part in this activity during the past month?
(174-176)

- | | |
|-----|---------------------|
| 1__ | Times per week |
| 2__ | Times per month |
| 777 | Don't know/Not sure |
| 999 | Refused |

1.4 And when you took part in this activity, for how many minutes or hours did you usually keep at it?
(177-179)

- | | |
|------|---------------------|
| :_:_ | Hours and minutes |
| 777 | Don't know/Not sure |
| 999 | Refused |

1.5 What other type of physical activity gave you the next most exercise during the past month?
(180-181)

- | | | |
|----|---------------------|---------------------|
| -- | (Specify) | [See Coding List A] |
| 88 | No other activity | [Go to Q1.8] |
| 77 | Don't know/Not Sure | [Go to Q1.8] |
| 99 | Refused | [Go to Q1.8] |

INTERVIEWER INSTRUCTION: If the respondent's activity is not included in the Coding List A, choose the option listed as “Other.”

Continued on next page.

APPENDIX A BRFSS 2011 Physical Activity Rotating Core Continued

INTERVIEWER NOTE: Housework may be included as a physical activity or exercise spent and can be coded as “Other.”

1.6 How many times per week or per month did you take part in this activity during the past month?

(182-184)

- 1__ Times per week
- 2__ Times per month
- 777 Don't know/Not sure
- 999 Refused

1.7 And when you took part in this activity, for how many minutes or hours did you usually keep at it?

(185-187)

- _:__ Hours and minutes
- 777 Don't know/Not sure
- 999 Refused

1.8 During the past month, how many times per week or per month did you do physical activities or exercises to STRENGTHEN your muscles? Do NOT count aerobic activities like walking, running, or bicycling. Count activities using your own body weight like yoga, sit-ups, or push-ups and those using weight machines, free weights, or elastic bands.

(188-190)

- 1__ Times per week
- 2__ Times per month
- 888 Never
- 777 Don't know/Not sure
- 999 Refused

APPENDIX A BRFSS 2011 Physical Activity Rotating Core Continued

Coding List A

Code Description (Physical Activity, Questions 2 and 5 above)

0 1 Active gaming devices (Wii Fit, Dance Dance Revolution)	2 5 Hunting large game—deer, elk	4 9 Snow skiing
0 2 Aerobics video or class	2 6 Hunting small game—quail	5 0 Snowshoeing
0 3 Backpacking	2 7 Inline Skating	5 1 Soccer
0 4 Badminton	2 8 Jogging	5 2 Softball/baseball
0 5 Basketball	2 9 Lacrosse	5 3 Squash
0 6 Bicycling machine exercise	3 0 Mountain climbing	5 4 Stair climbing/Stairmaster
0 7 Bicycling	3 1 Mowing lawn	5 5 Stream fishing in waders
0 8 Boating (canoeing, rowing, kayaking, sailing for pleasure, camping)	3 2 Paddleball	5 6 Surfing
0 9 Bowling	3 3 Painting/papering house	5 7 Swimming
1 0 Boxing	3 4 Pilates	5 8 Swimming in laps
1 1 Calisthenics	3 5 Racquetball	5 9 Table tennis
1 2 Canoeing/rowing in competition	3 6 Raking lawn	6 0 Tai Chi
1 3 Carpentry	3 7 Running	6 1 Tennis
1 4 Dancing—ballet, ballroom, Latin, hip hop, etc.	3 8 Rock climbing	6 2 Touch football
1 5 Elliptical/EFX machine exercise	3 9 Rope skipping	6 3 Volleyball
1 6 Fishing from river bank or boat	4 0 Rowing machine exercise	6 4 Walking
1 7 Frisbee	4 1 Rugby	6 6 Waterskiing
1 8 Gardening (spading, weeding, digging, filling)	4 2 Scuba diving	6 7 Weight lifting
1 9 Golf (with motorized cart)	4 3 Skateboarding	6 8 Wrestling
2 0 Golf (without motorized cart)	4 4 Skating—ice or roller	6 9 Yoga
2 1 Handball	4 5 Sledding, tobogganing	7 0 Other_____
2 2 Hiking—cross-country	4 6 Snorkeling	9 9 Refused
2 3 Hockey	4 7 Snow blowing	
2 4 Horseback riding	4 8 Snow shoveling by hand	

APPENDIX B Directory of MET Values and Aerobic Activities for the BRFSS

This list provides MET activity values that should be used with the 2011 PARC. This list also provides information on what activities were considered aerobic with the 2011 PARC. Nonaerobic activity does not contribute to a person's time spent in moderate- or vigorous-intensity activity. In general, MET values were based on values from 2011 Compendium of Physical Activities using the general category description (e.g. aerobics, general) or moderate effort category description (e.g., calisthenics, moderate-effort).

Activity Description 2011	Year 2011	
	METs	Aerobic Activity
01 Active gaming devices (Wii Fit, Dance Revolution)	3.8	Yes
02 Aerobics video or class	7.3	Yes
03 Backpacking	7.0	Yes
04 Badminton	5.5	Yes
05 Basketball	6.5	Yes
06 Bicycling machine exercise	6.8	Yes
07 Bicycling	6.8	Yes
08 Boating (Canoeing, rowing, kayaking, sailing for pleasure)	5.8	Yes
09 Bowling	3.8	Yes
10 Boxing	12.8	Yes
11 Calisthenics	3.8	Yes
12 Canoeing/rowing in competition	12.5	Yes
13 Carpentry	3.0	Yes
14 Dancing-ballet, ballroom, Latin, hip hop, etc.	7.8	Yes
15 Elliptical/EFX machine exercise	5.0	Yes
16 Fishing from river bank or boat	3.5	Yes
17 Frisbee	3.0	Yes
18 Gardening (spading, weeding, digging, filling)	5.0	Yes
19 Golf (with motorized cart)	3.5	Yes
20 Golf (without motorized cart)	4.3	Yes
21 Handball	12.0	Yes
22 Hiking—cross-country	6.0	Yes
23 Hockey	8.0	Yes
24 Horseback riding	5.5	Yes
25 Hunting large game—deer, elk	6.0	Yes
26 Hunting small game—quail	5.0	Yes
27 Inline skating	9.8	Yes
28 Jogging	7.0	Yes
29 Lacrosse	8.0	Yes
30 Mountain climbing	8.0	Yes
31 Mowing lawn	5.5	Yes
32 Paddleball	6.0	Yes
33 Painting/papering house	3.3	Yes
34 Pilates	3.0	No
35 Racquetball	7.0	Yes
36 Raking lawn	3.8	Yes
37 Runninga	6.0	Yes
38 Rock climbing	8.0	Yes
39 Rope skipping	11.0	Yes
40 Rowing machine exercise	7.0	Yes
41 Rugby	6.3	Yes
42 Scuba diving	7.0	Yes
43 Skateboarding	5.0	Yes

Continued on next page.

APPENDIX B Directory of MET Values and Aerobic Activities for the BRFSS continued

Activity Description 2011	Year 2011	
	METs	Aerobic Activity
44 Skating—ice or roller	7.0	Yes
45 Sledding, tobogganing	7.0	Yes
46 Snorkeling	5.0	Yes
47 Snow blowing	2.5	Yes
48 Snow shoveling by hand	5.3	Yes
49 Snow skiing	7.0	Yes
50 Snowshoeing	5.3	Yes
51 Soccer	7.0	Yes
52 Softball/baseball	5.0	Yes
53 Squash	7.3	Yes
54 Stair climbing/Stairmaster	9.0	Yes
55 Stream fishing in waders	6.0	Yes
56 Surfing	3.0	Yes
57 Swimming	6.0	Yes
58 Swimming in laps	5.8	Yes
59 Table tennis	4.0	Yes
60 Tai Chi	4.0	No
61 Tennis	7.3	Yes
62 Touch football	8.0	Yes
63 Volleyball	3.0	Yes
64 Walking	3.5	Yes
66 Waterskiing	6.0	Yes
67 Weight lifting	3.5	No
68 Wrestling	6.0	Yes
69 Yoga	2.5	No
70 Other_____		Yes
99 Refused		

^aMETs for running currently reflect running at 4mph (13 minute mile)

APPENDIX C Statistical Analysis Software (SAS) Code to Estimate the Prevalence of Adults Meeting 2008 Physical Activity Guidelines for Americans using BRFSS

```

*****
*
*   COMMANDS TO CREATE INDICATORS FOR THE 2008 PHYSICAL ACTIVITY AND
*   MUSCLE STRENGTHENING GUIDELINES USING THE 2011 BRFSS DATA
*
*
*   FINAL VERSION BRFSS_PA2011.SAS
*   USING BSB APPROACH & VARIABLE NAMES
*   BY KATHY WATSON 01-19-2011   (THIS IS VERSION 16)
*
*
*   LIBNAME INPUT 'your file directory for the data goes here';
*****

LIBNAME INPUT "\\CDC.GOV\PRIVATE\L319\IYR4\BRFSS_CO_TEST";*REPLACE WITH THE FILE
*LOCATION OF YOUR DATA;

*ADD FORMAT VALUES FOR VARIABLES THAT ARE TO BE CREATED;

PROC FORMAT;
  VALUE _TOTINDAf
    1 = 'YES'
    2 = 'NO'
    9 = 'MISSING';

  VALUE _PACATf
    1 = 'HIGHLY ACTIVE'
    2 = 'ACTIVE'
    3 = 'INSUFFICIENTLY ACTIVE'
    4 = 'INACTIVE'
    9 = 'Missing';

  VALUE _PAINDEXf
    1 = 'MET AEROBIC PAG'
    2 = 'DID NOT MEET AEROBIC PAG'
    9 = 'MISSING';

  VALUE _PA150R1f
    1 = 'ACTIVE >=150 MODERATE MINUTES OR VIGOROUS EQUIVALENT'
    2 = '1-149 MODERATE MINUTES (OR VIGOROUS EQUIVALENT)'
    3 = '0 MINUTES'
    9 = 'MISSING';

  VALUE _PA300R1f
    1 = 'ACTIVE >300 MODERATE MINUTES OR VIGOROUS EQUIVALENT'
    2 = '1-300 MODERATE MINUTES (OR VIGOROUS EQUIVALENT)'
    3 = '0 MINUTES'
    9 = 'MISSING';

  VALUE _PA3002Lf
    1 = 'ACTIVE >300 MODERATE MINUTES OR VIGOROUS EQUIVALENT'
    2 = '0-300 MODERATE MINUTES (OR VIGOROUS EQUIVALENT)'
    9 = 'MISSING';

  VALUE _PASTRNGf
    1 = 'MET MS GUIDELINES'
    2 = 'DID NOT MEET GUIDELINES'
    9 = 'MISSING';

  VALUE _PARECF
    1 = 'MET BOTH GUIDELINES'
    2 = 'MET AEROBIC GUIDELINES ONLY'
    3 = 'MET MUSCLE STRENGTHENING GUIDELINES ONLY'

  4 = 'DID NOT MEET EITHER GUIDELINES'
  9 = 'MISSING';

  VALUE _PASTAERf
    1 = 'MET BOTH GUIDELINES'
    2 = 'DID NOT MEET BOTH GUIDELINES'
    9 = 'MISSING';

  4 = 'DID NOT MEET EITHER GUIDELINES'
  9 = 'MISSING';

  VALUE _TOTINDA
    *CREATE a variable for performed any leisure time physical activity _TOTINDA
    ADULTS THAT REPORT PA OR EXERCISE DURING THE PAST
    30 DAYS OTHER THAN THEIR JOBS (1=YES, HAD PA OR EXERCISE, 2=NO, NO PA OR
    EXERCISE IN LAST 30 DAYS, 9=DON'T KNOW/REFUSED/MISSING);
    *****
    IF EXERANY2 IN (1) THEN _TOTINDA=1;
    ELSE IF EXERANY2 IN (2) THEN _TOTINDA=2;
    ELSE IF EXERANY2 IN (.,7,9) THEN _TOTINDA=9;
    FORMAT _TOTINDA _TOTINDAf.;
    *****

  *NOW TO CREATE VARIABLES FOR CATEGORIZING PA
  *STEP1. ADD ACTIVITY MET VALUES
  *NOTE: PILATES (34), TAI CHI (60) WEIGHT LIFTING (67), & YOGA(69) ARE NOT
  AEROBIC ACTIVITIES THEREFORE THEY ARE ASSIGNED A METVALUE OF ZERO. ALSO FOR
  PERSON WHO DID NOT DO A SECOND ACTIVITY (EXTRACT02=88), THE METVALUE IS
  ASSIGNED A ZERO
  *****

  IF EXTRACT01 IN (34,60,67,69) THEN METVAL1_0;
  IF EXTRACT01 IN (47) THEN METVAL1_2.5;
  IF EXTRACT01 IN (13,17,56,63) THEN METVAL1_3;
  IF EXTRACT01 IN (33) THEN METVAL1_3.3;
  IF EXTRACT01 IN (16,19,64) THEN METVAL1_3.5;
  IF EXTRACT01 IN (1,9,11,36) THEN METVAL1_3.8;
  IF EXTRACT01 IN (59) THEN METVAL1_4;
  IF EXTRACT01 IN (20) THEN METVAL1_4.3;
  IF EXTRACT01 IN (70) THEN METVAL1_4.5;
  IF EXTRACT01 IN (15,18,26,43,46,52) THEN METVAL1_5;
  IF EXTRACT01 IN (48,50) THEN METVAL1_5.3;
  IF EXTRACT01 IN (4,24,31) THEN METVAL1_5.5;
  IF EXTRACT01 IN (8,58) THEN METVAL1_5.8;
  IF EXTRACT01 IN (22,25,32,37,55,57,66,68) THEN METVAL1_6;
  IF EXTRACT01 IN (41) THEN METVAL1_6.3;
  IF EXTRACT01 IN (5) THEN METVAL1_6.5;
  IF EXTRACT01 IN (6,7) THEN METVAL1_6.8;
  IF EXTRACT01 IN (3,28,35,40,42,44,45,49,51) THEN METVAL1_7;
  IF EXTRACT01 IN (2,53,61) THEN METVAL1_7.3;
  IF EXTRACT01 IN (14) THEN METVAL1_7.8;
  IF EXTRACT01 IN (23,29,30,38,62) THEN METVAL1_8;
  IF EXTRACT01 IN (54) THEN METVAL1_9;
  IF EXTRACT01 IN (27) THEN METVAL1_9.8;
  IF EXTRACT01 IN (39) THEN METVAL1_11;
  IF EXTRACT01 IN (21) THEN METVAL1_12;
  IF EXTRACT01 IN (12) THEN METVAL1_12.5;
  IF EXTRACT01 IN (10) THEN METVAL1_12.8;
  METVAL1_=(ROUND(METVAL1_*.01))*10;

  IF EXTRACT02 IN (34,60,67,69,88) THEN METVAL2_0;
  IF EXTRACT02 IN (47) THEN METVAL2_2.5;
  IF EXTRACT02 IN (13,17,56,63) THEN METVAL2_3;
  IF EXTRACT02 IN (33) THEN METVAL2_3.3;
  IF EXTRACT02 IN (16,19,64) THEN METVAL2_3.5;
  IF EXTRACT02 IN (1,9,11,36) THEN METVAL2_3.8;
  IF EXTRACT02 IN (59) THEN METVAL2_4;

```

APPENDIX C Statistical Analysis Software (SAS) Code to Estimate the Prevalence of Adults Meeting 2008 Physical Activity Guidelines for Americans using BRFSS continued

```

IF EXTRACT02 IN (20) THEN METVAL2 =4.3;
IF EXTRACT02 IN (70) THEN METVAL2 =4.5;
IF EXTRACT02 IN (15,18,26,43,46,52) THEN METVAL2_5=;
IF EXTRACT02 IN (48,50) THEN METVAL2 =5.3;
IF EXTRACT02 IN (4,24,31) THEN METVAL2 =5.5;
IF EXTRACT02 IN (8,58) THEN METVAL2 =5.8;
IF EXTRACT02 IN (22,25,32,37,55,57,66,68) THEN METVAL2 =6;
IF EXTRACT02 IN (41) THEN METVAL2 =6.3;
IF EXTRACT02 IN (5) THEN METVAL2 =6.5;
IF EXTRACT02 IN (6,7) THEN METVAL2 =6.8;
IF EXTRACT02 IN (3,28,35,40,42,44,45,49,51) THEN METVAL2 =7;
IF EXTRACT02 IN (2,53,61) THEN METVAL2 =7.3;
IF EXTRACT02 IN (14) THEN METVAL2 =7.8;
IF EXTRACT02 IN (23,29,30,38,62) THEN METVAL2 =8;
IF EXTRACT02 IN (54) THEN METVAL2 =9;
IF EXTRACT02 IN (27) THEN METVAL2 =9.8;
IF EXTRACT02 IN (39) THEN METVAL2 =11;
IF EXTRACT02 IN (21) THEN METVAL2 =12;
IF EXTRACT02 IN (12) THEN METVAL2 =12.5;
IF EXTRACT02 IN (10) THEN METVAL2 =12.8;
METVAL2_5=(ROUND(METVAL2_5,0.1))*10;

*****;
*STEP2. CREATE RELATIVE INTENSITY VARIABLE TO DETERMINE WHETHER THE ACTIVITY IS
* CONSIDERED MODERATE (=1), VIGOROUS (=2) OR < 3.0 METS/NOT AEROBIC/DID NOT DO
* SECOND ACTIVITY (=0) DEPENDING ON AGE-GENDER SPECIFIC MAXIMAL OXYGEN UPTAKE
*
*THIS IS DONE BY
*
* A. DETERMINING THE PERSON'S AGE-GENDER SPECIFIC MAXIMUM V02 THROUGH
* THE USE OF THE JONE'S EQUATION
*
* B. CALCULATE THE MAXIMAL OXYGEN UPTAKE AS 60% OF THE PERSON'S AGE-GENDER
* SPECIFIC MAXIMUM V02 AND CONVERT TO METS BY DIVIDING BY 3.5
* (WHERE 1 MET= 3.5 ML V02 PER KG,MIN)
*
* C. CREATE THE INDICATOR FOR THE INTENSITY OF THE 1ST & 2ND ACTIVITIES
*
* NOTE: MUST HAVE AGE & GENDER OR ELSE WE CANNOT DETERMINE
* THE INTENSITY LEVEL AND IT IS CONSIDERED MISSING;
*****;

*A.DETERMINING THE PERSON'S AGE-GENDER SPECIFIC MAXIMUM V02;
*FIRST INITIALIZE MV02 TO MISSING (999);

MAXVO2 =999;

IF (18<= AGE <=99 & (SEX=1 OR SEX=2))THEN DO;
  IF (SEX=1) THEN MAXVO2 =60-(.55*AGE); *MAXIMUM V02 FOR MALES;
  ELSE IF (SEX=2) THEN MAXVO2 =48-(.37*AGE);*MAXIMUM V02 FOR FEMALES;
END;
MAXVO2_5=(ROUND(MAXVO2_5,0.01)*100);

*B. CALCULATE EACH PERSON'S MAXIMAL OXYGEN UPTAKE;

IF (0 < MAXVO2_5/100< 55) THEN FC60_5=(.60*(MAXVO2_5/100))/3.5;
ELSE FC60 =999;
FC60_5=(ROUND(FC60_5,0.01))*100;

*C. CALCULATE THE RELATIVE INTENSITY OF EACH PERSON'S FIRST AND SECOND
*ACTIVITY: 2=VIGOROUS, 1=MODERATE, 0=LESS THAN MODERATE, NOT AEROBIC, OR
*NO SECOND ACTIVITY.
*FC60 IS THE PERSON'S AGE-GENDER SPECIFIC MET VALUE THRESHOLD FOR AN
*ACTIVITY TO BE CONSIDERED VIGOROUS;

IF FC60_5 < 99900 THEN DO;
  IF ((METVAL1_5/10) >= (FC60_5/100)) THEN ACTINT1_5=2; *Vigorous;
  ELSE IF ((METVAL1_5/10) >= 3.0) THEN ACTINT1_5=1; *Moderate;
  ELSE IF ((METVAL1_5/10) >= 0) THEN ACTINT1_5=0; *Light or not aerobic;
END;

IF FC60_5 < 99900 THEN DO;
  IF ((METVAL2_5/10) >= (FC60_5/100)) THEN ACTINT2_5=2; *Vigorous;
  ELSE IF ((METVAL2_5/10) >= 3.0) THEN ACTINT2_5=1; *Moderate;
  ELSE IF ((METVAL2_5/10) >= 0) THEN ACTINT2_5=0; *Light or not aerobic;
END;

*****STEP3-CREATE TOTAL MINUTES PER WEEK FOR EACH ACTIVITY
*****AND CREATE THE TIMES PER WEEK FOR MUSCLE STRENGTHENING
*****;
**TOTAL MINUTES PER WEEK IS DETERMINED BY THE MINUTES PER EPISODE
*(DURATION) MULTIPLIED BY THE FREQUENCY (IN WEEKS) THAT THE ACTIVITY
*WAS PERFORMED.

*EXERCISE HOURS/MINUTES-3 DIGITS WHERE 1ST DIGIT IS # HRS AND DIGITS 2-3 ARE MINUTES*;
*CALCULATE DURATION OF EACH EPISODE AND PUT IN TERMS OF MINUTES.*;
*USING INTEGER FUNCTION, I.E., 210=2 HOURS AND 10 MINUTES=130;
*
* INT(210/100)=INTEGER OF (2.1)=2
*SO DURAT=[INT(210/100)*60] + [210-INT(210/100)*100]
*          = [2 *60]   + [210 - 2*100] = 120 + 210-200=130;

IF EXERHMM1 NOTIN (777,999,.) THEN DO;
  PADUR1_5=INT(EXERHMM1/100)*60 + (EXERHMM1-INT(EXERHMM1/100)*100);
END;

IF EXERHMM2 NOTIN (777,999,.) THEN DO;
  PADUR2_5=INT(EXERHMM2/100)*60 + (EXERHMM2-INT(EXERHMM2/100)*100);
END;

*CREATE THE FREQUENCY VARIABLE WHERE 1ST DIGIT INDICATES WEEKLY (=1)
* OR MONTHLY (=2). DIGITS 2-3 REPRESENT THE FREQUENCY.
*PUT IN TERMS OF WEEKLY BY DIVIDING THE MONTHLY ESTIMATES BY THE NUMBER
*OF WEEKS IN A MONTH (30/7);

IF EXERANY2=1 AND EXEROFT1 NOTIN (777,999,.) THEN DO;
  IF (101 <= EXEROFT1 <= 199) THEN PAFREQ1_5=EXEROFT1-100;
  ELSE IF (201 <= EXEROFT1 <= 299) THEN PAFREQ1_5=(EXEROFT1-200)/(30/7);
END;
ELSE PAFREQ1_5 =.;
PAFREQ1_5=(ROUND(PAFREQ1_5,.001))*1000;

IF EXERANY2=1 AND EXEROFT2 NOTIN (777,999,.) THEN DO;
  IF (101 <= EXEROFT2 <= 199) THEN PAFREQ2_5=EXEROFT2-100;
  ELSE IF (201 <= EXEROFT2 <= 299) THEN PAFREQ2_5=(EXEROFT2-200)/(30/7);
END;
ELSE PAFREQ2_5 =.;
PAFREQ2_5=(ROUND(PAFREQ2_5,.001))*1000;

**CREATE VARIABLE FOR MINUTES PER WEEK FOR ACTIVITIES 1 AND 2
**TIME (EPISODE) MUST BE AT LEAST 10 MINUTES TO COUNT TOWARDS PA GUIDELINES;
**ALSO, IF THE ACTIVITY IS NOT MODERATE OR VIGOROUS THEN THE MINUTES DON'T COUNT;

IF PADUR1_5>=10 THEN _MINACT1=ROUND((PAFREQ1_5/1000)*PADUR1_5,1);
ELSE IF (PADUR1_5>=0 AND PADUR1_5<10) THEN _MINACT1=0;
IF (ACTINT1_5=0) THEN _MINACT1=0;
IF EXTRACT01 IN (34,60,67,69) THEN _MINACT1=0;

IF PADUR2_5>=10 THEN _MINACT2=ROUND((PAFREQ2_5/1000)*PADUR2_5,1);
ELSE IF (PADUR2_5>=0 AND PADUR2_5<10) THEN _MINACT2=0;
IF (ACTINT2_5=0) THEN _MINACT2=0;
IF EXTRACT02 IN (34,60,67,69,88) THEN _MINACT2=0;

*CREATE WEEKLY FREQUENCY OF STRENGTH TRAINING EXERCISE;

```

APPENDIX C Statistical Analysis Software (SAS) Code to Estimate the Prevalence of Adults Meeting 2008 Physical Activity Guidelines for Americans using BRFSS continued

```

IF STRENGTH IN ( 777,999,..) THEN STRFREQ_=. ;
ELSE IF (STRENGTH < 200) THEN STRFREQ_ =STRENGTH-100;
ELSE IF (200 < STRENGTH < 300) THEN STRFREQ_=(STRENGTH-200)/(30/7);
ELSE IF (STRENGTH = 888) THEN STRFREQ_ =0;
STRFREQ_=(ROUND(STRFREQ_ ,.001))*1000;

*CREATE AVARIABLE WHICH REPRESENTS WHETHER THERE IS MISSING DATA (MINUTES, FREQUENCY
OR ACTIVITY TYP/INTENITY*;

IF (NMISS(ACTINT1_ ,_MINACT1,ACTINT2_ ,_MINACT2))>0 AND EXERANY2=1) THEN PAMISS_ =1;
ELSE IF EXERANY2=1 OR EXERANY2=2 THEN PAMISS_ =0;
ELSE PAMISS_ =9;

*CREATE A VARIABLE REPRESENTING TOTAL MINUTES FOR EACH ACTIVITY--THE MINUTES ARE WEIGHTED
BASED ON INTENSITY MEANING THAT VIGOROUS ACTIVITY GETS DOUBLE CREDIT (2 X MINUTES);

IF ACTINT1_ =2 THEN DO;
    PAMIN1_ =ROUND(_MINACT1*2,1);
END;
ELSE IF ACTINT1_ =1 THEN DO;
    PAMIN1_ =ROUND(_MINACT1,1);
END;
IF ACTINT1_ =0 THEN PAMIN1_ =0;

IF ACTINT2_ =2 THEN DO;
    PAMIN2_ =ROUND(_MINACT2*2,1);
END;
ELSE IF ACTINT2_ =1 THEN DO;
    PAMIN2_ =ROUND(_MINACT2,1);
END;
IF ACTINT2_ =0 THEN PAMIN2_ =0;

*TOTAL MINUTES OF PA ACROSS BOTH ACTIVITIES;
*THIS IS IN TERMSOF MODERATE ACTIVITIES WHERE VIGOROUS
*IS WEIGHTED--THIS WOULD BE EQUIVALENT COMBINATION;
*EXAMPLE 90 MINUTES MODERATE + 30 MINUTES VIGOROUS IS
*PAMIN_ =150 MINUTES (90 + 2x30);

PAMIN_ =ROUND((SUM(PAMIN1_ ,PAMIN2_)),1);

*CREATE A VARIABLE FOR VIGOROUS MINUTES ONLY;

IF ACTINT1_ =2 THEN PAVIGM1_ =ROUND(_MINACT1,1);
ELSE IF ACTINT1_ IN (0,1) THEN PAVIGM1_ =0;

IF ACTINT2_ =2 THEN PAVIGM2_ =ROUND(_MINACT2,1);
ELSE IF ACTINT2_ IN (0,1) THEN PAVIGM2_ =0;

*TOTAL MINUTES OF VIGOROUS MINUTES ONLY;

PAVIGMN_ =ROUND((SUM(PAVIGM1_ ,PAVIGM2_)),1);

*****
*STEP 4. NOW WE HAVE THE VARIABLES NEEDED TO ASSESS THE PHYSICAL ACTIVITY
* GUIDELINES. THE NEW VARIABLES ARE AS FOLLOWS:
*****
*
*_TOTINDA--SOME LEISURE TIME PA (1=YES, 2=NO)--PREVIOUSLY CALCULATED
*
*_PACAT--AEROBIC PAG CATEGORIES-4 LEVELS 1= HIGHLY ACTIVE, 2=ACTIVE,
3=INSUFFICIENTLY ACTIVE, 4=INACTIVE
*
*_PAINDEX--AEROBIC PAG 2-LEVEL CATEGORIES 1= MET AEROBIC PAG, 2=DID NOT
MEET AEROBIC PAG, 9=MISSING
*
*
*_PA150R1 AEROBIC PAG CATEGORIES-3 LEVELS 1= ACTIVE >=150 MODERATE MINUTES
OR VIGOROUS EQUIVALENT, 2=1-149 MODERATE MINUTES (OR VIGOROUS EQUIVALENT),
3= 0 MINUTES, 9=Missing
*
*_PA300R1 AEROBIC PAG CATEGORIES-3 LEVELS 1= ACTIVE >300 MODERATE MINUTES
OR VIGOROUS EQUIVALENT, 2=1-300 MODERATE MINUTES (OR VIGOROUS EQUIVALENT),
3= 0 MINUTES
*
*_PA3002L AEROBIC PAG CATEGORIES-2 LEVELS 1= ACTIVE >300 MODERATE MINUTES
OR VIGOROUS EQUIVALENT, 2=0-300 MODERATE MINUTES (OR VIGOROUS EQUIVALENT),
9=MISSING
*
*_PASTRNG--MUSCLE STRENGTHENING GUIDELINES (1=MET MS GUIDELINES, 2= DID NOT
MEET GUIDELINES, 9=MISSING
*
*_PAREC--AEROBIC AND MUSCLE STRENGTHENING GUIDELINES (1= MET BOTH GUIDELINES,
2= MET AEROBIC GUIDELINES ONLY, 3= MET MUSCLE STRENGTHENING GUIDELINES ONLY,
4=2=DID NOT MEET EITHER GUIDELINES
*
*_PASTAER--AEROBIC AND MUSCLE STRENGTHENING GUIDELINES (1= MET BOTH GUIDELINES,
2=DID NOT MEET BOTH GUIDELINES
*
*****
*COMPUTE _PAG4L (AEROBIC PAG CATEGORIES-4 LEVELS) 1= HIGHLY ACTIVE, 2=ACTIVE,
* 3=INSUFFICIENTLY ACTIVE, 4=INACTIVE, 9=MISSING;

IF EXERANY2=2 THEN _PACAT=4;*No leisure time therefore inactive;
ELSE IF EXERANY2 IN (.,7,9) THEN _PACAT=9; *missing;
ELSE IF EXERANY2=1 THEN DO; *for those who reported doing some pa;
    IF PAMIN_ > 300 THEN _PACAT=1; *highly active;
    ELSE IF PAVIGMN_ > 150 THEN _PACAT=1; *highly active;
    ELSE IF 150 <= PAMIN_ <= 300 AND PAMISS_ =0 THEN _PACAT=2;*active;
    ELSE IF 1 <= PAMIN_ <=149 AND PAMISS_ =0 THEN _PACAT=3; *insufficiently active;
    ELSE IF PAMIN_ =0 AND PAMISS_ =0 THEN _PACAT=4; *inactive;
    ELSE _PACAT=9;
END;
FORMAT _PACAT _PACATf.;

*COMPUTE 2-LEVEL PAG CATEGORIES-2 LEVELS) 1= MET AEROBIC PAG, 2=DID NOT
MEET AEROBIC PAG, 9=MISSING;;

IF EXERANY2=2 THEN _PAINDEX=2; *Did not do leisure activity-thus did not meet pag;
ELSE IF EXERANY2 IN (.,7,9) THEN _PAINDEX=9; *missing;
ELSE IF EXERANY2=1 THEN DO; *For those who did leisure activity;
    IF PAMIN_ >= 150 THEN _PAINDEX=1; *Met PAG;
    ELSE IF 0 <= PAMIN_ < 150 AND PAMISS_ =0 THEN _PAINDEX=2;*Did not meet PAG;
    ELSE _PAINDEX=9; *Missing;
END;
FORMAT _PAINDEX _PAINDEXf.;

*COMPUTE _PA150R1 (AEROBIC PAG CATEGORIES-3 LEVELS) 1= ACTIVE >=150 MODERATE MINUTES
* OR VIGOROUS EQUIVALENT, 2=1-149 MODERATE MINUTES (OR VIGOROUS EQUIVALENT),
* 3= 0 MINUTES;

IF EXERANY2=2 THEN _PA150R1=3;*No leisure time-0 minutes of PA;
ELSE IF EXERANY2 IN (7,9,..) THEN _PA150R1=9; *Missing;
ELSE IF EXERANY2=1 THEN DO;*For those who reported leisure time;
    IF PAVIGMN_ >= 75 THEN _PA150R1=1; *150 min or equivalent (75x2);
    ELSE IF PAMIN_ >= 150 THEN _PA150R1=1; *150 minutes or equivalent;
    ELSE IF 0 < PAMIN_ < 150 AND PAMISS_ =0 THEN _PA150R1=2; *Some activity but< 150;
    ELSE IF PAMIN_ =0 AND PAMISS_ =0 THEN _PA150R1=3; *No minutes of PA;
    ELSE _PA150R1=9; *Missing;
END;
FORMAT _PA150R1 _PA150R1f.;

*COMPUTE _PA300R1 (AEROBIC PAG CATEGORIES-3 LEVELS) 1= ACTIVE >300 MODERATE MINUTES

```


APPENDIX C Statistical Analysis Software (SAS) Code to Estimate the Prevalence of Adults Meeting 2008 Physical Activity Guidelines for Americans using BRFSS continued

```

*      OR VIGOROUS EQUIVALENT, 2=1-300 MODERATE MINUTES (OR VIGOROUS EQUIVALENT),
*      3= 0 MINUTES;

IF EXERANY2=2 THEN _PA300R1=3;
ELSE IF EXERANY2 IN (9,7,.) THEN _PA300R1=9;
ELSE IF EXERANY2=1 THEN DO;
    IF PAMIN > 300 THEN _PA300R1=1;
    ELSE IF 0 < PAMIN <= 300 AND PAMISS =0 THEN _PA300R1=2;
    ELSE IF PAMIN =0 AND PAMISS =0 THEN _PA300R1=3;
    ELSE _PA300R1=9;
END;
FORMAT _PA300R1 _PA300R1f.;

*COMPUTE _PA300_2 (AEROBIC PAG CATEGORIES-2 LEVELS) 1= ACTIVE >300 MODERATE MINUTES
*      OR VIGOROUS EQUIVALENT, 2=0-300 MODERATE MINUTES (OR VIGOROUS EQUIVALENT);

IF _PA300R1=1 THEN _PA3002L=1;
ELSE IF _PA300R1 IN (2,3) THEN _PA3002L=2;
ELSE _PA3002L=9;
FORMAT _PA3002L _PA3002Lf.;

*****
* MUSCLE STRENGTHENING GUIDELINES
*****
*GUIDELINES STATE THEY MUST DO AT LEAST TWICE A WEEK;
*COMPUTE MS (MUSCLE STRENGTHENING GUIDELINES) 1=MET MS GUIDELINES,
* 2= DID NOT MEET GUIDELINES;

IF STRFREQ/1000 >=2 THEN _PASTRNG=1;
ELSE IF 0 <= STRFREQ/1000 < 2 THEN _PASTRNG=2;
ELSE _PASTRNG=9;
FORMAT _PASTRNG _PASTRNGf.;

*****
* COMBINATION OF AEROBIC AND MUSCLE STRENGTHENING GUIDELINES
*****

*COMPUTE MSPAG4 (AEROBIC AND MUSCLE STRENGTHENING GUIDELINES, 4-LEVELS)
*1= MET BOTH GUIDELINES,2= MET AEROBIC GUIDELINES ONLY, 3= MET MUSCLE STRENGTHENING
*GUIDELINES ONLY,4=DID NOT MEET EITHER GUIDELINES;

IF _PASTRNG=1 AND _PAINDEX=1 THEN _PAREC=1;
ELSE IF _PASTRNG=2 AND _PAINDEX=1 THEN _PAREC=2;
ELSE IF _PASTRNG=1 AND _PAINDEX=2 THEN _PAREC=3;
ELSE IF _PASTRNG=2 AND _PAINDEX=2 THEN _PAREC=4;
ELSE _PAREC=9;
FORMAT _PAREC _PARECf.;

*COMPUTE MSPAG2 (AEROBIC AND MUSCLE STRENGTHENING GUIDELINES), 1= MET BOTH
*GUIDELINES, 2=DID NOT MEET BOTH GUIDELINES;

IF _PAREC=1 THEN _PASTAER=1;
ELSE IF _PAREC IN (2,3,4) THEN _PASTAER=2;
ELSE _PASTAER=9;
FORMAT _PASTAER _PASTAERf.;

*NOW ADD VARIABLE LABELS FOR THE NEWLY CALCULATED VARIABLES;
LABEL _TOTINDA='ADULTS THAT REPORT DOING PHYSICAL ACTIVITY OR EXERCISE DURING
THE PAST 30 DAYS OTHER THAN THEIR REGULAR JOB'
METVAL1='ACTIVITY MET VALUE FOR FIRST ACTIVITY, (ONE IMPLIED DECIMAL PLACE) '
METVAL2='ACTIVITY MET VALUE FOR SECOND ACTIVITY, (ONE IMPLIED DECIMAL PLACE)'
MAXVO2 ='ESTIMATED AGE-GENDER SPECIFIC MAXIMUM OXYGEN CONSUMPTION, (2 IMPLIED DECIMAL
PLACES) '

FC60_  ='ESTIMATED MAXIMAL OXYGEN UPTAKE, (2 IMPLIED DECIMAL PLACES) '
ACTINT1='ESTIMATED ACTIVITY INTENSITY FOR FIRST ACTIVITY'
ACTINT2='ESTIMATED ACTIVITY INTENSITY FOR SECOND ACTIVITY'
PADUR1_='MINUTES OF FIRST ACTIVITY'
PADUR2_='MINUTES OF SECOND ACTIVITY'
PAFREQ1_='PHYSICAL ACTIVITY FREQUENCY PER WEEK FOR FIRST ACTIVITY'
PAFREQ2_='PHYSICAL ACTIVITY FREQUENCY PER WEEK FOR SECOND ACTIVITY'
_MINACT1_='MINUTES OF PHYSICAL ACTIVITY PER WEEK FOR FIRST ACTIVITY'
_MINACT2_='MINUTES OF PHYSICAL ACTIVITY PER WEEK FOR SECOND ACTIVITY'
STRFREQ_='STRENGTH ACTIVITY FREQUENCY PER WEEK'
PAMISS_  ='MISSING PHYSICAL ACTIVITY DATA'
FAMIN1_  ='MINUTES OF PHYSICAL ACTIVITY PER WEEK FOR FIRST ACTIVITY (VIGOROUS WEIGHTED X
2) '
FAMIN2_  ='MINUTES OF PHYSICAL ACTIVITY PER WEEK FOR SECOND ACTIVITY (VIGOROUS WEIGHTED X
2) '
FAMIN_   ='MINUTES OF TOTAL PHYSICAL ACTIVITY PER WEEK (VIGOROUS WEIGHTED X 2) '
PAVIGM1_='MINUTES OF VIGOROUS PHYSICAL ACTIVITY PER WEEK FOR FIRST ACTIVITY'
PAVIGM2_='MINUTES OF VIGOROUS PHYSICAL ACTIVITY PER WEEK FOR SECOND ACTIVITY'
PAVIGMN_='MINUTES OF TOTAL VIGOROUS PHYSICAL ACTIVITY PER WEEK'
_PACAT_  ='THE 4 PHYSICAL ACTIVITY CATEGORIES'
_PAINDEX='PHYSICAL ACTIVITY INDEX (MET OR DID NOT MEET PAG)'
_PA150R1='ADULTS THAT PARTICIPATED IN 150 MINUTES (OR VIGOROUS EQUIVALENT) OF PHYSICAL
ACTIVITY PER WEEK'
_PA300R1='ADULTS THAT PARTICIPATED IN 300 MINUTES (OR VIGOROUS EQUIVALENT) OF PHYSICAL
ACTIVITY PER WEEK'
_PA3002L='ADULTS THAT PARTICIPATED IN 300 MINUTES (OR VIGOROUS EQUIVALENT) OF PHYSICAL
ACTIVITY PER WEEK (2-LEVELS)'
_PASTRNG='MUSCLE STRENGTHENING RECOMMENDATION'
_PAREC_  ='AEROBIC AND STRENGTHENING GUIDELINE'
_PASTAER='AEROBIC AND STRENGTHENING (2-LEVEL)';

RUN;

```