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Midlife in the United States (MIDUS 2): Biomarker Project, 2004-2009

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Sleep Data Documentation

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DOCUMENTATION

for

SLEEP DATA

in

MIDUS 2
BIOMARKER PROJECT
(P4)

University of Wisconsin ♦ Institute on Aging
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INTRODUCTION

This document provides an overview of sleep quality data collected in the MIDUS 2 Biomarker Project (P4). It provides comprehensive information regarding methods used to collect sleep data as well as additional information regarding administrative, constructed scales, and computed variables that are available. Information about the construction and usage of these variables is also provided.

Data users are also encouraged to review the Biomarker (P4) Readme Data File Notes. This document provides information about naming conventions, as well as administrative and filter variables included in the data file. It also includes information about how we handled missing values and other issues that arose over the course of the study. For example, there are instances when variables were added or sections of an instrument were expanded for data entry purposes to accommodate additional information provided by the respondent.

This document will be periodically revised and updated as more information is gathered, and researchers continue to work with the MIDUS 2 Biomarker data. If there are suggestions or comments, please contact Gayle Love (glove@wisc.edu) or Barry Radler (bradler@wisc.edu).

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OVERVIEW OF DATA FILE AND COLLECTION PROTOCOLS

OVERVIEW OF DATA FILE AND COLLECTION PROTOCOLS

The Biomarker Project (P4) includes multiple types of sleep data from the following sources:

- Pittsburgh Sleep Quality Inventory (PSQ)
- Daily Sleep Diary
- Actiwatch® Activity Monitor

As described in the "Biomarker Project (P4) Readme Data File Notes", the P4 variable naming convention organizes variables according to the method used for data collection. We have followed this convention with respect to the sleep data, thus analysts using PSQ, Actiwatch®, and Daily Sleep Diary data will need to pull variables from different sections of the data file as indicated below.

The PSQ is implemented at all 3 P4 sites. The Actiwatch® and daily sleep diary are administered only at the UW-Madison (Site 2) location to facilitate linkages with Neuroscience (Project 5) data that are also collected at the same location. The following provides general information and also indicates where additional details can be found.

Pittsburgh Sleep Quality Inventory (PSQ):
A copy of the PSQ appears in Section B. Variable names have been added to the instrument just below the question number or to the right of a "____" provided for participants to record responses. It is a self-administered questionnaire completed during the clinic visit, or just prior to the visit while the participant was still at home. It is also a standalone instrument thus the variable names begin with their own unique 3 character set "B4S".

This set of variables appears in the data file immediately after the items from the Self-Administered Questionnaire Booklet. Scale construction information appears in the "Documentation of Psychosocial Constructs & Composite Variables".

Daily Sleep Diary:
A copy of the Daily Sleep Diary follows the PSQ in Section B. Variable names are inserted just below the question number or to the right of an item. Participants completed the diary at home during the Actiwatch® data collection period (see Section C for more information). The Diary is a standalone instrument, thus, the variable names begin with their own unique 3 character set "B4A".

This set of variables appears in the data file immediately after the biomarker assay data from the blood, urine and saliva samples.

Actiwatch® Activity Monitor:
Details of the Actiwatch® data collection and processing protocol appear in Section C. Actiwatch® data are collected for 7 consecutive days beginning in the morning on the Tuesday after the day the respondent returns home following the GCRC visit. The data collection period ends at the time the respondent wakes up on the following Tuesday. For each respondent, we report data for 7 rest periods, which include 7 sleep periods, and 6 activity periods occurring between the first and last rest/sleep periods. The Actiwatch® variable names begin with "B4W" and include the following measures:

- Data collection period start and end date

- For each Rest, Sleep and Active period:
    - Start Date, Day, and Time
    - End Date, Day and Time
    - Total activity counts
    - Average Activity Counts/Minute
    - Maximum Activity Counts
    - % Invalid Activity Counts
    - % Invalid Sleep/Wake Time
    - Wake Time
    - % Wake Time
    - # Wake Bouts
    - Average Wake Bouts
    - Sleep Time
    - % Sleep Time
    - # Sleep Bouts
    - Average Sleep Bouts

- The above information is used to compute the following summary statistics (see Actiwatch® protocol for computation details) for each Sleep period:
    - Sleep Onset Latency (in minutes)
    - Time Dozing Before Rising (Snooze Time, in minutes)
    - Sleep Efficiency (%)
    - Wake after Sleep Onset (WASO, in minutes)

<u>Actigraphy Rest-Activity Rhythm</u>
MIDUS collaborators at the University of Wisconsin conducted an additional analysis of actigraphy data to generate additional indices summarizing rest-activity patterns beyond the extant sleep-wake statistics. These appear in the data after the Daily Sleep variables and before the Actiwatch data. Details about the protocol for generating these data and related background can be found in Section D below.

The data set also includes the administrative variables that can be used to identify cases with missing or imputed data. These variables are described in Section C.

Additional information about Filter variables may be found in the “Biomarker Project (P4) Readme Data File Notes”.

SECTION B

SURVEY INSTRUMENTS

Pittsburgh Sleep Quality Inventory (PSQ)

Daily Sleep Diary

Site # _____

ID#: _____

PITTSBURGH SLEEP QUALITY INVENTORY (PSQ)

Date Completed: ____[B4ZCOMPM, B4ZCOMPY]**_____**

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all of the questions.

1.) During the past month, when have you usually gone to bed at night?

USUAL BED TIME _[B4S1]_:_____ AM or PM **(Circle One)** [B4S1AMPM]

2.) During the past month, how long (in minutes) has it taken you to fall asleep at night?

NUMBER OF MINUTES ___[B4S2]_____

3.) During the past month, when have you usually gotten up in the morning?

USUAL GETTING UP TIME _[B4S3]_:_____ AM or PM **(Circle One)** [B4S3AMPM]

4.) During the past month, how many hours of actual sleep did you get at night (This may be different than the number of hours you spend in bed.)

HOURS OF SLEEP PER NIGHT _[B4S4]_._____

For each of the remaining questions, circle the one best response. Please answer all of the questions.

5.) During the past month, how would you rate your sleep quality overall?
[B4S5]

Very good Fairly good Fairly bad Very bad

6.) During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
[B4S6]

No problem at all Only a very slight problem Somewhat of a problem A very big problem

7.) During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?
[B4S7]

Not during the past month Less than once a week Once or twice a week Three or more times a week

8.) During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
[B4S8]

Not during the past month Less than once a week Once or twice a week Three or more times a week

9.) Do you have a bed partner or roommate?
[B4S9]

No bed partner or roommate	Partner/roommate in other room	Partner/roommate in room, but not same bed	Partner in same bed

10.) If you have a roommate or bed partner, ask him or her how often during the past month you have had…

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Loud snoring. [B4S10A]	1	2	3	4
b. Long pauses between breaths while asleep. [B4S10B]	1	2	3	4
c. Legs twitching or jerking while sleeping. [B4S10C]	1	2	3	4
d. Episodes of disorientation or confusion during sleep. [B4S10D]	1	2	3	4
e. Other restlessness while you sleep. [B4S10E]	1	2	3	4

Please describe: _____

11.) During the past month, how often have you had trouble sleeping because you…

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Could not get to sleep within 30 minutes. [B4S11A]	1	2	3	4
b. Woke up in the middle of the night or early in the morning. [B4S11B]	1	2	3	4
c. Had to get up to use the bathroom. [B4S11C]	1	2	3	4
d. Could not breathe comfortably. [B4S11D]	1	2	3	4
e. Coughed and snored. [B4S11E]	1	2	3	4
f. Felt too cold. [B4S11F]	1	2	3	4
g. Felt too hot. [B4S11G]	1	2	3	4
h. Had bad dreams. [B4S11H]	1	2	3	4
i. Had pain. [B4S11I]	1	2	3	4
j. Other reason(s). [B4S11J]	1	2	3	4

Please Describe: _____

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

TUESDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD11]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD12]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD13] [B4AD13S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD14]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD15]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD16]
   (e.g. allergy or cold medicine, pain relievers, etc.)
   If yes, record the medication name(s) and dose(s): _____[B4AD16M]_____

WEDNESDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD17]
   If yes, please record the medication name and dose: _____[B4AD17M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD18]__ a.m./p.m. [B4AD18A]

9. How long did it take you to get to sleep last night? _[B4AD19]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD110]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD111]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD112]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD113]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD114]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD115] [B4AD115A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD116] [B4AD116A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD117]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD118]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD119]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD120]

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

WEDNESDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD21]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD22]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD23] [B4AD23S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD24]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD25]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD26]
   (e.g. allergy or cold medicine, pain relievers, etc.)
If yes, record the medication name(s) and dose(s): _____[B4AD26M]_____

THURSDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD27]
If yes, please record the medication name and dose: _____[B4AD27M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD28]__ a.m./p.m. [B4AD28A]

9. How long did it take you to get to sleep last night? _[B4AD29]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD210]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD211]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD212]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD213]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD214]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD215] [B4AD215A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD216] [B4AD216A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD217]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD218]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD219]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD220]

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

THURSDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD31]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD32]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD33] [B4AD33S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD34]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD35]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD36]
   (e.g. allergy or cold medicine, pain relievers, etc.)
If yes, record the medication name(s) and dose(s): _____[B4AD36M]_____

FRIDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD37]
If yes, please record the medication name and dose: _____[B4AD37M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD38]__ a.m./p.m. [B4AD38A]

9. How long did it take you to get to sleep last night? _[B4AD39]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD310]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD311]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD312]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD313]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD314]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD315] [B4AD315A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD316] [B4AD316A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD317]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD318]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD319]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD320]

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

FRIDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD41]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD42]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD43] [B4AD43S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD44]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD45]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD46]
   (e.g. allergy or cold medicine, pain relievers, etc.)
If yes, record the medication name(s) and dose(s): _____[B4AD46M]_____

SATURDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD47]
If yes, please record the medication name and dose: _____[B4AD47M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD48]__ a.m./p.m. [B4AD48A]

9. How long did it take you to get to sleep last night? _[B4AD49]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD410]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD411]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD412]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD413]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD414]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD415] [B4AD415A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD416] [B4AD416A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD417]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD418]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD419]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD420]

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

SATURDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD51]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD52]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD53] [B4AD53S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD54]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD55]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD56]
   (e.g. allergy or cold medicine, pain relievers, etc.)
If yes, record the medication name(s) and dose(s): _____[B4AD56M]_____

SUNDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD57]
If yes, please record the medication name and dose: _____[B4AD57M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD58]__ a.m./p.m. [B4AD58A]

9. How long did it take you to get to sleep last night? _[B4AD59]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD510]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD511]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD512]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD513]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD514]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD515] [B4AD115A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD516] [B4AD116A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD517]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD518]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD519]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD520]

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

SUNDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD61]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD62]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD63] [B4AD63S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD64]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD65]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD66]
   (e.g. allergy or cold medicine, pain relievers, etc.)
If yes, record the medication name(s) and dose(s): _____[B4AD66M]_____

MONDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD67]
If yes, please record the medication name and dose: _____[B4AD67M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD68]__ a.m./p.m. [B4AD68A]

9. How long did it take you to get to sleep last night? _[B4AD69]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD610]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD611]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD612]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD613]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD614]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD615] [B4AD615A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD616] [B4AD616A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD617]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD618]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD619]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD620]

MIDUS BIOMARKER PROJECT: DAILY SLEEP DIARY

ID# _____

MONDAY DATE:

BEFORE BED: (Please complete the following before going to sleep).

1. How alert were you today? (circle a number): **most alert 1 2 3 4 5 not alert at all** [B4AD71]

2. How many minutes of moderate or vigorous exercise did you get today? _____ [B4AD72]

3. Did you nap today? **Yes No** If yes, specify length of time: _____ (minutes) [B4AD73] [B4AD73S]

4. How many caffeinated drinks did you have today? _____ #of drinks [B4AD74]
   (Note: 1 mug of coffee or cup of tea, 1 can pop = 1 drink)

5. How many alcoholic drinks did you have today? _____ #of drinks [B4AD75]
   (Note: 1 bottle beer or wine cooler, 1 glass of wine, 1 shot of liquor = 1 drink)

6. Did you take any medications today that you don't regularly take every day? **Yes No** [B4AD76]
   (e.g. allergy or cold medicine, pain relievers, etc.)
   If yes, record the medication name(s) and dose(s): _____[B4AD76M]_____

TUESDAY MORNING

UPON AWAKENING: (Please complete soon after waking up, waiting no more than 10 minutes).

7. Did you take any medication or supplement specifically to help you sleep? **Yes No** [B4AD77]
   If yes, please record the medication name and dose: _____[B4AD77M]_____

8. What time did you go to bed and begin trying to go to sleep? ___[B4AD78]__ a.m./p.m. [B4AD78A]

9. How long did it take you to get to sleep last night? _[B4AD79]_ (minutes)

10. How difficult was it to get to sleep last night? (circle a number) **very easy 1 2 3 4 5 very difficult** [B4AD710]
11. How many times did you wake last night (after falling asleep but before your final awakening)? ___ [B4AD711]
12. Did you wake up because of noises, lights, or some other activity? **Yes No** [B4AD712]
13. If you woke up during the night, did you have difficulty getting back to sleep? **Yes No** [B4AD713]
14. If you woke up during the night, during how many of these awakenings did you get out of bed? ___ [B4AD714]
15. What time did you wake up for the day and not return to sleep? _____:_____ a.m./p.m. [B4AD715] [B4AD715A]
16. What time did you get out of bed for the day? _____:_____ a.m./p.m. [B4AD716] [B4AD716A]

Please rate the following: (circle a number)

17. How deeply you slept last night: **very deeply 1 2 3 4 5 very lightly** [B14AD717]

18. How well-rested you feel this morning: **well rested 1 2 3 4 5 poorly rested** [B4AD718]

19. How alert you feel this morning: **very alert 1 2 3 4 5 not alert at all** [B4AD719]

20. Overall quality of your sleep last night: **very good 1 2 3 4 5 very poor** [B4AD720]

SECTION C

ACTIWATCH® DATA COLLECTION AND PROCESSING

ACTIWATCH® DATA COLLECTION AND PROCESSING

This section describes the protocol for collecting and processing activity data collected via the Actiwatch® system. These data were only collected from individuals who participated in the Biomarker (P4) project at the University of Wisconsin-Madison (Site2).

Overview

Biomarker subjects who completed a General Clinical Research Center (GCRC) visit at site 2 (UW) were invited to participate in a 7 day sleep study. The protocol required that participants wear the Mini Mitter Actiwatch®-64 activity monitor, continuously, for 7 consecutive days and also complete a paper and pencil Daily Sleep Diary over the same time period.

At the end of the GCRC visit, the participant received a postage paid envelope containing the daily sleep diary, a pre-programmed Actiwatch®, along with a cover letter and instructions for wearing the watch, completing the daily diary, and then returning the materials at the end of the collection period. Participants also received a reminder call the day before the sleep data collection period began. More specific details about collecting and processing the diary and watch data are provided separately below.

Daily Sleep Diary (self-report)

A. Data Collection: The Daily Sleep Diary is a 7 page self-administered questionnaire (see Section B above) that includes two sets of questions:
   a. Before Bed – the participant was asked to complete this section before going to sleep. The items assess:
      - Alertness through the day
      - Exercise
      - Napping
      - Consumption of caffeinated and alcoholic beverages
      - Use of medications that are not regularly taken every day.
   b. Upon Awakening – the participant was asked to complete this section soon after waking up, waiting no more than 10 minutes. The items assess:
      - Use of medications or supplements to help sleep
      - Time to bed
      - Time to fall asleep
      - Difficulty falling asleep
      - Wakefulness during the night (4 items)
      - Time awoke for the day and did not return to sleep
      - Time out of bed for the day
      - Overall quality of sleep (4 items)

   The date for each day of data collection was written on the form before it was given to the participant.

B. Data Processing:
   a. As a standalone instrument, the Daily Sleep Diary was reviewed by designated staff prior and then data entered using the SPSS Data Entry double entry blind verification system.

b. Data were then cleaned (i.e. checked for inconsistencies or other errors and corrected as needed) according to standardized procedures.
c. The times recorded at Questions 8 (What time did you go to bed and begin trying to go to sleep?) and 15 (What time did you wake up for the day and not return to sleep?) were extracted from the cleaned data file and used to mark Rest and Exclusion intervals in the Actiwatch® (see below).

Actiwatch®-64

A. Data Collection: The Actiwatch®-64 collects data via a built-in motion sensor that can be programmed to detect the number of movements in a specified time interval beginning at a specified date and time. Data collection proceeds as follows:
   a. Staff programmed each watch to:
      - Begin collecting data at 7:00 a.m. on the Tuesday after the day the respondent returns home following their GCRC visit.
      - Detect the number of movements per epoch (30 second intervals).

   See Appendix A & B (Section D) for more information about how sleep statistics were computed using activity counts per epoch as well as definitions of key terms.

   b. Participants were instructed to:
      - Put the Actiwatch® on when they wake up on the designated day
      - Begin completing the Daily Sleep Diary before going to bed on that day.

      They also received a reminder phone call the day before the data collection period began.
   c. The data collection period ended at the time the respondent woke up on the following Tuesday, one week later.

Data was downloaded from the Actiwatch® and stored in the Actiwatch® database for processing upon receipt in the project office.

Note: The Actiwatch® has an event marker button on the side that users can push to indicate when they go to bed and when they wake up for the day. The Actiware software (version 4) available when data collection began in July 2004 could not take advantage of that feature, but Actiware 5, released in September 2005 does. Beginning in the fall 2005, participants were instructed to push the event marker button right before going to sleep and at rising. Compliance with this instruction varies quite a bit from participant to participant.

B. Data Processing: In Actiware Software
   The Actiware 5 software is used to generate summary statistics about a respondent's sleep. To compute these statistics, the program requires that intervals demarking rest and exclusion periods be specified for each day in the study period.
   a. Marking Intervals: We defined these intervals using information from the Daily Sleep Diary as follows:
      - Rest Interval: Time spent in bed on a given day as reported by the respondent:
        - Start date & time – The date recorded at the top of the page for a given day in the collection period and the response to Question 8 for that day. (What time did you go to bed and begin trying to go to sleep?)

- End date & time – The date recorded at the top of the page for the next day along with Question 15 for the current day. (What time did you wake up for the day and not return to sleep?)

- Exclusion Periods: These are activity periods the program should exclude when generating summary statistics.
  - Front End Exclusion period - extends from the programmed start time (7:00 a.m. on the first day of the collection period) to beginning of the first rest period (Time to bed - Day 1, Q8).
  - Back End Exclusion period – extends from the end of the last rest period (Awake Time – Day 7 Q15) to the time that staff end the data collection period by transferring data to the Actiwatch® database. This period may be several days in length.

b. Data Cleaning: Sometimes respondents provided incomplete information (forgot to put the watch on, took it off too early etc), or had experiences during the data collection period (e.g. travel to a different time zone, worked an extra shift, etc.) which made it difficult to mark Rest and Exclusion periods. Problematic cases were flagged for review and intervals were marked, or deleted, as appropriate according to the following guidelines. These guidelines were also used to create the administrative filter variables described at the end of Section A above that allow users to identify cases with missing or imputed data:

Note: Across the following:
"time" = the time specified at Q8 and/or Q15 on a given day in the Daily Sleep Diary.
"event marker time" = the time flagged when the participant pushed the event marker button.

- If the responses to Q8 and/or Q15 are 'missing' for a given day:
  - Use the event marker times if they are available and appear to be reliable.
  - Impute the appropriate mean times as follows:
    i. If data is missing for a weekday, impute the mean using the other weekday values if valid data is available for at least 3 weekdays.
    ii. If data is missing for a weekend impute the mean using the other day of the weekend.
  - If event marker times aren't apparent and means cannot be calculated, consult question #2 in the Pittsburgh Sleep Questionnaire (PSQ) and insert the beginning of a missing rest period 'x' numbers of minutes (per PSQ Q2) before the last activity count preceding the sleep period. If the end of the rest period cannot be calculated, we designate the first epoch that has activity as the end of the rest period.

- If the time listed is reported as a range, use the midpoint of the range or the event marker time whichever is more accurate.

- If the time listed differs quite a bit from the watch data, do not adjust.

- Time zone and Daylight Savings Time adjustments:
    - The time zone specified should always be the time zone of residence (e.g. the time zone the respondent lives in). If the respondent travels out of this time zone during the watch period then:
        i. Times in the diary should correspond to the time zone of residence.
        ii. Rest intervals in the Actiwatch® file should be marked to correspond to the time zone of residence.
    - If the data collection period includes the Daylight Savings Time transition date, adjust the times as appropriate to match the approximate sleep period.

- If data collection doesn't start on a Tuesday,
    - The Daily Sleep Diary data will be adjusted so that order of the days is consistent with the rest of the data.

c. The above criteria were subsequently used to create the following filter variables which identify cases with missing or imputed values, as well as those affected by issues such as Time Zone changes or Daylight Savings Time adjustments.

- B4AWAVL – categorical variable indicating whether daily sleep diary and/or Actiwatch® data are available for a given case.
- B4AWIMPU – dichotomous Yes/No variable indicating whether there is missing data in the Daily Sleep Diary which required that rest intervals be marked by using imputed values.
- B4AWMARK – dichotomous Yes/No variable indicating whether there is a discrepancy between the daily sleep diary (self-reported) and Actiwatch® data that required rest intervals be marked by using imputed values.
- B4AWDAYS – indicates the number of days of sleep data available for a given respondent. All participants are expected to have 7 days of sleep data.
- B4AWPART – dichotomous Yes/No variable indicating whether there is there is partial watch data. A case is flagged as having partial data if the respondent did not wear the watch for the full 7 days of the collection period because they: 1) took it off for a few hours, 2) forgot to put it on until a day or two into the collection period, 3) or took it off a day or two early.
- B4AWIDIO – dichotomous Yes/No variable indicating whether or not the respondent had an idiosyncratic sleep pattern. Sometimes this is due to the respondents work schedule, but may be due to an illness (self or family member), or traveling.
- B4AWTMZN –dichotomous Yes/No variable indicating whether or not the respondent traveled and slept outside their usual time zone during the data collection period or if the watch data collection period include a Daylight Savings Time change.
- B4AWLAG – indicates the number of days between the date the GCRC visit was completed and the date the watch data collection began.

d. <u>Generating Summary Statistics:</u> The Actiware 5 software has the capacity to generate a variety of statistics about sleep and activity. Currently we generate the following:
    - Sleep Onset Latency (in minutes)

- Time Dozing Before Rising (Snooze Time, in minutes)
- Sleep Efficiency (%)
- Wake after Sleep Onset (WASO, in minutes)

Definitions of these terms and details about computation can be found in the Section D (Appendices) at the end of this document.

SECTION D

ACTIGRAPHY REST-ACTIVITY RHYTHM PROTOCOL

I. **Introduction**

The Biomarker (P4) Actigraphy rest-activity rhythm protocol is an additional analysis of actigraphy data described above. The data were collected at the University of Wisconsin and processed in the Department of Psychiatry and Center for Sleep Medicine and Research, University of Wisconsin by Drs. Meredith Rumble and Kate Hanley White.

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II. **Overview of Protocol**

A. Purpose.

The actigraphy rest-activity rhythm protocol was designed to further analyze actigraphy data collected in the Biomarker project so that additional indices could be provided that summarize rest-activity patterns more fully beyond typical sleep-wake statistics already available in the MIDUS database.

B. Background.

A host of biological processes (e.g., melatonin secretion, core body temperature, the sleep-wake cycle) occur within living organisms in circadian cycles over an approximate 24-hour period. Circadian rhythms are not only orchestrated endogenously by the central clock in the superchiasmatic nucleus (SCN) within the hypothalamus, but also are behaviorally based in that they are sensitive to external input such as light-dark exposure, which sends signals directly from the eyes to the SCN [1]. Maintenance of circadian rhythms (i.e., staying within sync of an approximately 24-hour day) through biological and behavioral processes is thought to be adaptive and related to more positive health outcome, whereas circadian dysregulation has been linked with poor health outcome [2].

Circadian rhythms have been studied a variety of ways. One external measure of circadian rhythms is through rest-activity patterns measured with wrist-worn actigraphy. This approach to circadian rhythm measurement has been applied in several populations, including those with cancer [3-4], dementia [5], and psychiatric disorders [6-8], as well as community- or population-based samples [9-12]. Several approaches have been used in analyzing rest-activity data, including traditional cosinor analysis [13], a 5-parameter extended cosine model [14], and a non-parametric approach [15]. Regardless of analysis approach, the indices from each of these approaches have been used as a more sophisticated objective measure of rest-activity patterns beyond raw activity counts.

Studies using these various approaches have revealed that more dysregulated/dampened rest-activity rhythms were associated with or predicted negative outcomes, including increased fatigue [3-4], depressive symptoms [3, 6-8, 11-12], obesity [3, 6-18, 11-12], risk of incident dementia and mild cognitive impairment [10], and mortality [9]. Furthermore, studies using these various approaches have demonstrated relationships of indices with cortisol rhythms [5]. Thus, creation of such indices for the MIDUS study allows for an opportunity to contribute further to our understanding of how actigraphic rest-activity patterns contribute to overall health and functioning in a population-based sample as little work has been done in this area.

C. Procedure.
Please see Section C (above) for information regarding the collection and initial preparation of actigraphy data. For the current analyses, raw activity counts in 30-second intervals were given to Drs. Rumble and White by the University of Wisconsin MIDUS team. Raw activity counts labelled as excluded by initial MIDUS data collection and processing were deleted. These counts then were converted into 1-minute intervals and were exported to SAS and analyzed using traditional cosinor analysis, simultaneously fitting 24-hour and 12-hour rhythms to the data [13]. Sine and cosine functions for both 24-hour and 12-hour periods were created as follows where time is the time (by minute) at which the measurement was taken:

SinTime24 = sin(2 * π * time/24) and CosTime24 = cos (2 * π * time/24)
SinTime12 = sin(2 * π * time/12) and CosTime12 = cos (2 * π * time/12)

Then a multiple regression model was run using SAS proc reg with mean activity count by minute throughout the 24-hour interval as the outcome and CosTime24, SinTime24, CosTime12, and SinTime12 as the predictors. This model and subsequent equations yield the following 4 indices of rest-activity rhythms:

MESOR: the intercept of the above model. The mesor provides the mean activity level, assuming the above model, with lower values indicating less activity.

AMPLITUDE: the square root of ($SinTime24^2$ + $CosTime24^2$). The amplitude reflects the height of the activity-rest rhythm or the difference between maximum and minimum activity with lower values indicating a more dampened rhythm.

ACROPHASE: Acrophase is the time of day the rhythm peaks. Later times indicate a more delayed or "night owl" sleep-wake pattern, and earlier times indicate a more advanced or "morning lark" sleep-wake pattern.

R-SQUARED: the R-squared value for the regression model. R-squared can be interpreted as goodness-of-fit with higher values indicating a more robust rhythm.

III. **Key Variables and Naming Conventions**

A. Key Variables.

The key variables from the actigraphy analyses are listed below.

B4WMESOR	Mesor, mean activity level
B4WAMP	Amplitude, height of rest-activity rhythm
B4WACRO	Acrophase, time of day that rest-activity rhythm peaks
B4WRSQ	R-squared, robustness of rest-activity rhythm

In addition to these variables, the number of entries for actigraphy data (B4WACTENT) is provided so that researchers can determine a cut-off for adherence to the actigraphy protocol. As a reference point, participants were asked to wear actigraphy for roughly a 6.5 day period and original data was collected in 30 second epochs. Thus, if actigraphy was worn in full, each participant would roughly have 18720 entries.

B. Variable Naming Conventions

SPSS Variable Labels and Value Labels are included in the data set. Standard MIDUS naming conventions (Naming and Coding Conventions for Variables_10-26-05.doc) were followed and variable names were limited to 8 characters. All variables start with "B4W", indicating MIDUS wave 2 (B), Project 4 (4), data collected from the Actiwatch (W), per MIDUS conventions.

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SECTION E

APPENDICES

Appendix A: Actiwatch® Computations

Appendix B: Actiwatch® Definitions

APPENDIX A: ACTIWATCH® COMPUTATIONS

The following information is taken from the Actiware® Software Version 5.0 manual.

Sleep/Wake Analysis:

Actiware scores all epochs as either sleep or wake. Whether a particular epoch is scored as wake or sleep is determined by comparing activity counts for the epoch in question and those immediately surrounding it to a threshold value (Wake Threshold Value) set by the researcher. If the number of counts exceeds that threshold, the epoch is scored as wake. If it falls below, or is equal to, the threshold, the epoch is scored as sleep.

Sleep = Total Activity Counts <= Wake Threshold Value
Wake = Total Activity Counts > Wake Threshold Value

MIDUS uses a 30 second sampling epoch.

Calculating Total Activity Counts:
Actiware calculates total activity counts based on the sampling epoch. For instance, assume a 1-minute sampling epoch and the following activity values on and surrounding the time 12:00.

Time	Corresponding Activity Data
11:58	100
11:59	42
12:00	20
12:01	13
12:02	67

The total activity value for the 12:00 epoch would be: 100 * (1/25) + 42 * (1/5) +20 + 13 * (1/5) + 67 * (1/25) = 37.68.

If this value is less than or equal to the wake threshold value (next paragraph), then the epoch would be scored as sleep.

The total number of activity counts calculated above is compared to the wake threshold value selected by the researcher. These thresholds are listed in the table below.

Wake Threshold Values

Wake Threshold Selection	Wake Threshold Value
Low	20
Medium*	40
High	80
Automatic	Computed automatically based on activity data
Custom	User-selectable value

*MIDUS Wake Threshold value used for all cases.

APPENDIX B: ACTIWATCH® DEFINITIONS

The following information is taken from the Actiware® Software Version 5.0 manual.

Start Time
The time at the start of the given Rest, Active, Sleep, Custom, or Daily Interval (the start of the first epoch in the given interval).

End Time
The time at the end of the given Rest, Active, Sleep, Custom, or Daily Interval (the end of the last epoch in the given interval).

Interval Duration
The time elapsed between the Start Time and the End Time of the given interval, in minutes.

Total Activity
The sum of all valid physical activity counts [see Total Invalid Time, below] for all epochs from the Start Time to the End Time of the given interval.

Average Activity Per Minute
The average of all valid physical activity counts for all epochs from the Start Time to the End Time of the given interval divided by the Epoch Length in minutes.

Average Activity Per Epoch
The average of all valid physical activity counts for all epochs from the Start Time to the End Time of the given interval.

Standard Deviation of Activity
The standard deviation of all valid physical activity counts for all epochs from the Start Time to the End Time of the given interval. (The standard deviation is computed with (n – 1) rather than (n) in the denominator of the variance.)

Maximum Activity
The largest of any valid physical activity count for all epochs from the Start Time to the End Time of the given interval.

Total Invalid Time (Activity)
(The total number of epochs between the Start Time and the End Time of the given interval in which the physical activity count was found to exceed the maximum possible value from a properly functioning Actiwatch® [i.e., invalid data due to rare hardware error, communication error, or data corruption] plus the total number of epochs with valid physical activity counts manually excluded from the data set by the practitioner using Actiware) software multiplied by the Epoch Length in minutes (so the Total Invalid Time is in minutes).

Percent Invalid (Activity)
a) The percentage of Total Invalid Time (Activity) [see above] to the Interval Duration [see above]. b) (Total Invalid Time (Activity) divided by Interval Duration) multiplied by 100.

Total Invalid Time (Sleep/Wake)
(The total number of epochs between the Start Time and the End Time of the given interval for

which the sleep/wake scoring algorithm did not have enough data to determine a SLEEP or WAKE score) multiplied by the Epoch Length in minutes (so the Total Invalid Time is in minutes). Note: The insufficient data condition can be caused by invalid or manually excluded physical activity data at the epoch, and/or immediately before the epoch, and/or immediately after the epoch – how much before and after being a function of the Epoch Length.

Percent Invalid (Sleep/Wake)
a) The percentage of Total Invalid Time (Sleep/Wake) [see above] to the Interval Duration [see above]. b) (Total Invalid Time (Sleep/Wake) divided by Interval Duration) multiplied by 100.

Sleep Onset Latency
a) The time elapsed between the Start Time of a given Rest Interval and the following Sleep Start Time, in minutes. b) The time required for the onset of sleep after first attempting to get to sleep (i.e., from the “lights out” time). Calculated using the analysis setting made on Tools > Options > Analysis.

Snooze Time
a) The time elapsed between Sleep End Time and the End Time of a given Rest Interval, in minutes. b) The time elapsed between the end of sleep and the time lights are switched on or the subject gets out of bed.

Sleep Efficiency
a) The percentage of Scored Total Sleep Time [see below] to (Interval Duration [see above] minus Total Invalid Time (Sleep/Wake)), for the given Rest Interval. b) (Scored Total Sleep Time divided by (Interval Duration minus Total Invalid Time (Sleep/Wake)) of the given Rest Interval) multiplied by 100.

Wake after Sleep Onset (WASO)
The total number of epochs between the Start Time and the End Time of the given Sleep Interval scored as WAKE by Actiware software (or manually set as WAKE by the practitioner using Actiware software) multiplied by the Epoch Length in minutes (so the Wake After Sleep Onset is in minutes). Note: Wake After Sleep Onset is identical to Scored Total Wake Time [see below] when the given interval is a Sleep Interval.

Scored Total Wake Time
(The total number of epochs between the Start Time and the End Time of the given interval scored as WAKE by Actiware software [or manually set as WAKE by the practitioner using Actiware software]) multiplied by the Epoch Length in minutes (so the Scored Total Wake Time is in minutes). Note: In order to be scoreable as SLEEP or WAKE, an epoch must have a valid physical activity count [see Total Invalid Time (Sleep/Wake), above], and in addition there must be a sufficient number of epochs before and after the epoch being scored that also have valid physical activity counts.

Percent Wake
a) The percentage of Scored Total Wake Time to (Interval Duration minus Total Invalid Time (Sleep/Wake)), for the given interval. b) (Scored Total Wake Time divided by (Interval Duration minus Total Invalid Time (Sleep/Wake)) multiplied by 100.

Number of Wake Bouts
The total number of continuous blocks, one or more epochs in duration, with each epoch of each block scored as WAKE, between the Start Time and the End Time of the given interval.

Average Duration of Wake Bouts
The Scored Total Wake Time [see above] divided by the Number of Wake Bouts [see above], for the given interval.

Scored Total Sleep Time
(The total number of epochs between the Start Time and the End Time of the given interval scored as SLEEP by Actiware software [or manually set as SLEEP by the practitioner using Actiware software]) multiplied by the Epoch Length in minutes (so the Scored Total Sleep Time is in minutes). Note: In order to be scoreable as SLEEP or WAKE, an epoch must have a valid physical activity count [see Total Invalid Time (Sleep/Wake), above], and in addition there must be a sufficient number of epochs before and after the epoch being scored that also have valid physical activity counts.

Percent Sleep
a) The percentage of Scored Total Sleep Time to (Interval Duration minus Total Invalid Time (Sleep/Wake)), for the given interval. b) (Scored Total Sleep Time divided by (Interval Duration minus Total Invalid Time (Sleep/Wake)) multiplied by 100.

Number of Sleep Bouts
The total number of continuous blocks, one or more epochs in duration, with each epoch of each block scored as SLEEP, between the Start Time and the End Time of the given interval.

Average Duration of Sleep Bouts
The Scored Total Sleep Time [see above] divided by the Number of Sleep Bouts [see above], for the given interval.