NATIONAL HEALTH AND AGING TRENDS STUDY (NHATS)

ACCELEROMETRY USER GUIDE

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Overview

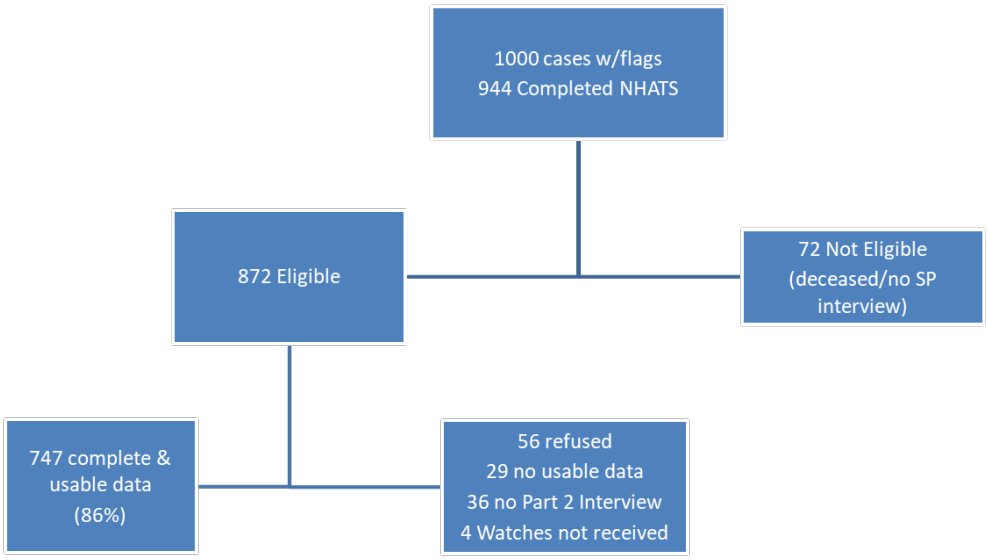
This document describes the collection of physical activity data collected using wrist accelerometry in Round 11 (2021) of the National Health and Aging Trends Study (NHATS). Data were collected using the Actigraph CentrePoint Insight Watch ("Activity Watch"), a research grade accelerometer that is triaxial and water-resistant. The Activity Watch continuously measures acceleration to estimate intensity, duration, and frequency of physical activity. Sample persons were fitted with the Activity Watch during their in-home interview and asked to continue wear the device at all times for the 7 days following their interview. This raw accelerometry data is processed to obtain estimates of active and non-active time in NHATS participants. This user guide provides details on the methodology, collection, data files, variables, and documentation to facilitate analysis of the data.

Accelerometry Pilot Study

To identify operational issues and evaluate data quality for the proposed accelerometry protocol, NHATS incorporated a pilot study into Round 9 (N=45 sample persons). The pilot study found that respondents were highly likely to participate, with compliance rates exceeding 90%. Data were high-quality, with low rates of non-wear, demonstrating that objective physical activity monitoring could be successfully incorporated into NHATS. Based on the pilot study results, the sample was expanded to 1,000 sample persons in 2021. These participants will be followed longitudinally in 2022 and 2023 (Rounds 12 and 13).

Eligibility & Response Rates

1,000 NHATS participants who were eligible for a sample person (SP) interview in Round 11 were flagged to wear the accelerometer. The accelerometry sample was selected proportional to the Round 9 analytic weight. Of the 1000 sample persons selected, 944 completed NHATS in Round 11 and 872 were eligible to wear the Watch. Of those eligible 747 (86%) returned an Activity Watch with usable data.



Wear Methodology

Sample persons were asked to wear the Activity Watch 24 hours/day on their non-dominant wrist for the seven days following the interview day (8 days total). Participants were instructed to wear the Activity Watch at all times, removing only for swimming or bathing lasting longer than 30 minutes. The Activity Watch records movement using an accelerometer sensory in units of gravity (g) at a sampling rate of 64 Hz. After the collection period, sample persons returned the Activity Watch to Westat offices using postage-paid padded mailers.

Interviewer Training & Evaluation

A standardized interviewer training was developed consisting of: (1) a home-study component and (2) hands-on training component.

The home study component was completed prior to the hands-on training. The home study consisted of multiple exercises including a review of the procedure manual describing the protocol in detail and a series of videos and exercises to aid in understanding how to initialize the Activity Watch.

Interviewers then completed an additional hands-on training that focused on setting up the activity in CAPI, initializing the Activity Watch, and describing the wear protocol to sample persons. Interviewers practiced assigning, un-assigning, and reassigning the Activity Watch.

Follow-up during the field period included data monitoring and data quality checks and targeted re-training as needed.

Data Collection Protocol

Equipment. Each interviewer was provided with a laptop with computer-assisted personal interview (CAPI) instrument software and a login ID for the Actigraph CentrePoint cloud-based software. Interviewers were instructed to fully charge the Activity Watch and assign it to the sample person using the CentrePoint software before the home visit to avoid difficulties with internet access in the sample person's home and to save time during the interview. Sample persons were asked to wear the Activity Watch for seven days after the interview day (8 days total), 24 hours per day. If the sample person agreed to wear the Activity Watch, they were fitted with the device and provided instructions on the date and time to remove the Activity Watch and place it in the mail for return.

The Westat home office tracked the return and receipt of the Activity Watches using USPS tracking numbers. All sample persons were mailed a postcard reminding them to return the Activity Watch, which was timed to arrive at the sample person's home within a day or so of when the Activity Watch was due to be mailed. If the Westat office did not receive the Activity Watch within 10 days of when it was expected, the data collectors were asked to follow-up with the sample person, reminding them to mail back the Activity Watch.

Data Processing

Upon receipt of the Activity Watch by the Westat office, data were uploaded to the CentrePoint cloud. The data were downloaded and processed using minute level epochs by the Johns Hopkins Accelerometry Resource to generate summary and detailed files. Data were processed using the R ARCTOOLS package. Manuals and examples for using ARCTOOLS are publicly available: https://www.rdocumentation.org/packages/arctools/versions/1.1.4. Data were processed for wear time compliance. Nonwear time was estimated using a 90 consecutive minutes threshold.[1] A valid day was defined as >90% wear, or 1296 minutes per day.[2,3]

Variable Names and Missing Data Conventions

Variable names. Variable names for accelerometry follow a standard convention. Variables start with "ag" (for Actigraph), followed by NHATS round number (e.g. 11). This "stem" is followed by a name that reflects the specific activity variable.

Derived variable names. Variables that are created for users ("derived" variables) use the same naming convention as other variable names, but a "d" is included after the round number.

Missing Data. Accelerometry files use the NHATS conventions of assigning -9 to missing.

Obtaining Accelerometry Data

The summary and detailed accelerometry files are designated as public for purposes of data release. The Instruments and Crosswalk are available at www.nhats.org. To obtain the data files and codebook, go to: https://nhats.org/researcher/nhats. Raw individual data files are available upon request. Please contact: nhatsdata@westat.com. For details on the development of Round 11 accelerometry weights, please see Jiao et al. (2022)[4].

Appendix A. Accelerometry Summary Variables

Variable Name	VARIABLE LABEL	Values	Interpretation
ag11dnumdays	R11 D NUMBER OF DAYS DEVICE WORN	6-8 days	Number of days the participant wore the device
ag11dnumdaysval	R11 D NUM DAYS DEVICE WORN MORE THAN 21.6 HRS	1-8 days	Number of valid days the participant wore the device (wear time >90% of the day)
ag11dnummin	R11 D NUM MINUTES DEV WORN ON VALID DAYS	1308-1440 min	Number of minutes the device was worn on valid days
ag11dtac	R11 D TOTAL ACTIVITY COUNTS	20,183-4,300,000 counts	Vector magnitude of total activity counts across the three axes
ag11dltac	R11 D LOG OF TOTAL ACTIVITY COUNTS	9.5-16.0 log counts	Logarithmic value of vector magnitude of total activity counts across the three axes
ag11dastp	R11 D ACTIVE TO SEDENTARY TRANSITION PROB	9.0-79.5%	Probability of transitioning from an active state to a sedentary state. A measure of activity fragmentation.[5]
ag11dsatp	R11 D SEDENTARY TO ACTIVE TRANSITION PROB	0.05-18.5%	Probability of transitioning from a sedentary state to an active state. A measure of sedentary behavior fragmentation.[6]
ag11dminact	R11 D SUM MINUTES ACTIVE PER DAY	0-745 min	Number of minutes per day spent above a threshold of 1853 counts per minute.[7]
ag11dminnon	R11 D NUM MINUTES NONACTIVE PER DAY	695-1440 min	Number of minutes per day spent below a threshold of 1853 counts per minute.[7]
ag11dactnum	R11 D NUM ACTIVE BOUTS PER DAY	0-145 bouts	Number of active bouts, where a bout is defined as an uninterrupted sequence of $\geq$1 active minutes (minutes with >1853 activity counts)
ag11dnonnum	R11 D NUM NONACTIVE BOUTS PER DAY	1-145 bouts	Number of nonactive bouts per day, where a bout is defined as an uninterrupted sequence of $\geq$1 nonactive minutes (minutes with $\leq$1853 activity counts)
ag11dactlen	R11 D MEAN LENGTH ACTIVE BOUTS	0-10.5 min	Average length of each active bout
ag11dnonlen	R11 D MEAN LENGTH NONACTIVE BOUTS	5.0-1440 min	Average length of each nonactive bout
ag11dmax10	R11 D MAX ACTIVITY COUNTS IN 10 CONSEC MIN	357-20,131	Maximum activity counts per minute accumulated in 10 consecutive minutes
ag11dmax30	R11 D MAX ACTIVITY COUNTS IN 30 CONSEC MIN	145-16,085	Maximum activity counts per minute accumulated in 30 consecutive minutes

ag11dmax60	R11 D MAX ACTIVITY COUNTS IN 60 CONSEC MIN	84-12,270	Maximum activity counts per minute accumulated in 60 consecutive minutes

All summary metrics are reported as the average across all valid days.
Note that this is a 24-hour wear protocol that does not differentiate sleep from wake.

Appendix B. Accelerometry Detailed Variables

Variable Name	**VARIABLE LABEL**	**Values**	**Interpretation**
ag11dday	R11 D DAY DEVICE WORN	1-8	Day number the participant wore the device
ag11dwday	R11 D WEEK DAY DEVICE WORN	1 (Sunday)-7 (Saturday)	Day of the week the participant wore the device
ag11dvalid	R11 D DEV WORN MORE THAN 21.6 HOURS	1-2	Denotes whether the device was worn >21.6 hours: 1 “YES” and 2 “NO”
ag11dmeanmin1	R11 D MEAN ACTIVITY COUNT MIN 1	0-9640	Mean activity counts at 12:00AM
ag11dmeanmin2	R11 D MEAN ACTIVITY COUNT MIN 2	0-16,230	Mean activity counts at 12:01AM
…			
ag11dmeanmin1440	R11 D MEAN ACTIVITY COUNT MIN 1440	0-9,395	Mean activity counts at 11:59PM

References

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