

# **Objective Measures of Physical Activity:** *Considerations for Data Management, Processing, and Public Release*

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## Definition of Physical Activity and Associated Constructs

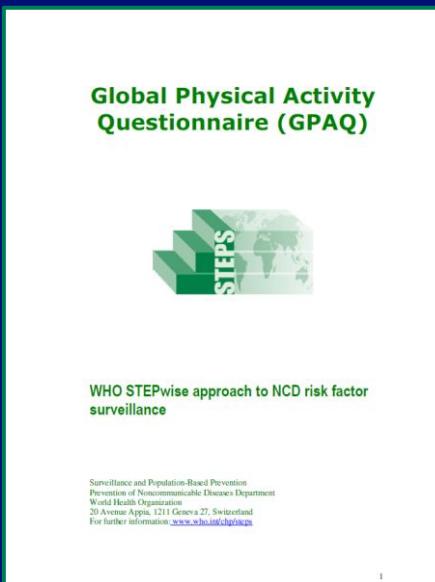
- **Physical Activity (PA): Any bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above a basal level.**
- **PA experts measure activity in Metabolic Equivalents (METs)**
- **Categorized by Intensity:**
  - Light (1.6 to 3 METs)
  - Moderate (3 to <6 METs)
  - Vigorous (6+ METs)

### REFERENCE:

US Department of Health and Human Services (USDHHS). Physical Activity Guidelines Advisory Committee Report, 2008.

# Assessment of Physical Activity Questionnaires

- **Questionnaires**
  - Most widely used
  - Inexpensive
  - Validity issues and potential for misclassification



Physical Activity		
Questions	Response	Code
<b>Activity at work</b>		
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously? <i>[INSERT EXAMPLES] (USE SHOWCARD)</i>	Yes 1 No 2 If No, go to P 4
2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days <input type="text"/>
3	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes <input type="text"/> : <input type="text"/> hrs mins
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously? <i>[INSERT EXAMPLES] (USE SHOWCARD)</i>	Yes 1 No 2 If No, go to P 7
5	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days <input type="text"/>
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes <input type="text"/> : <input type="text"/> hrs mins

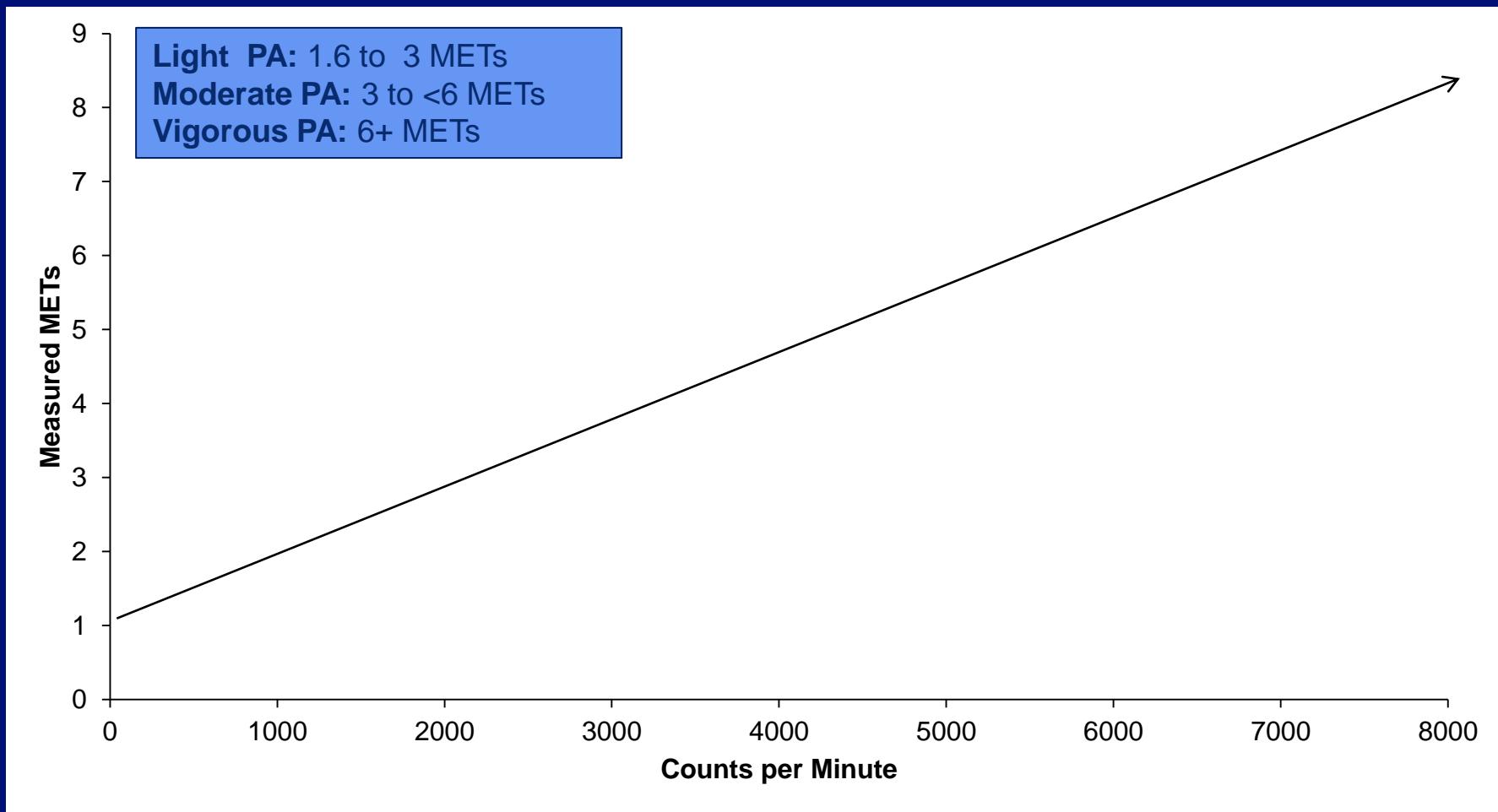
# Assessment of Physical Activity

## *Accelerometers*

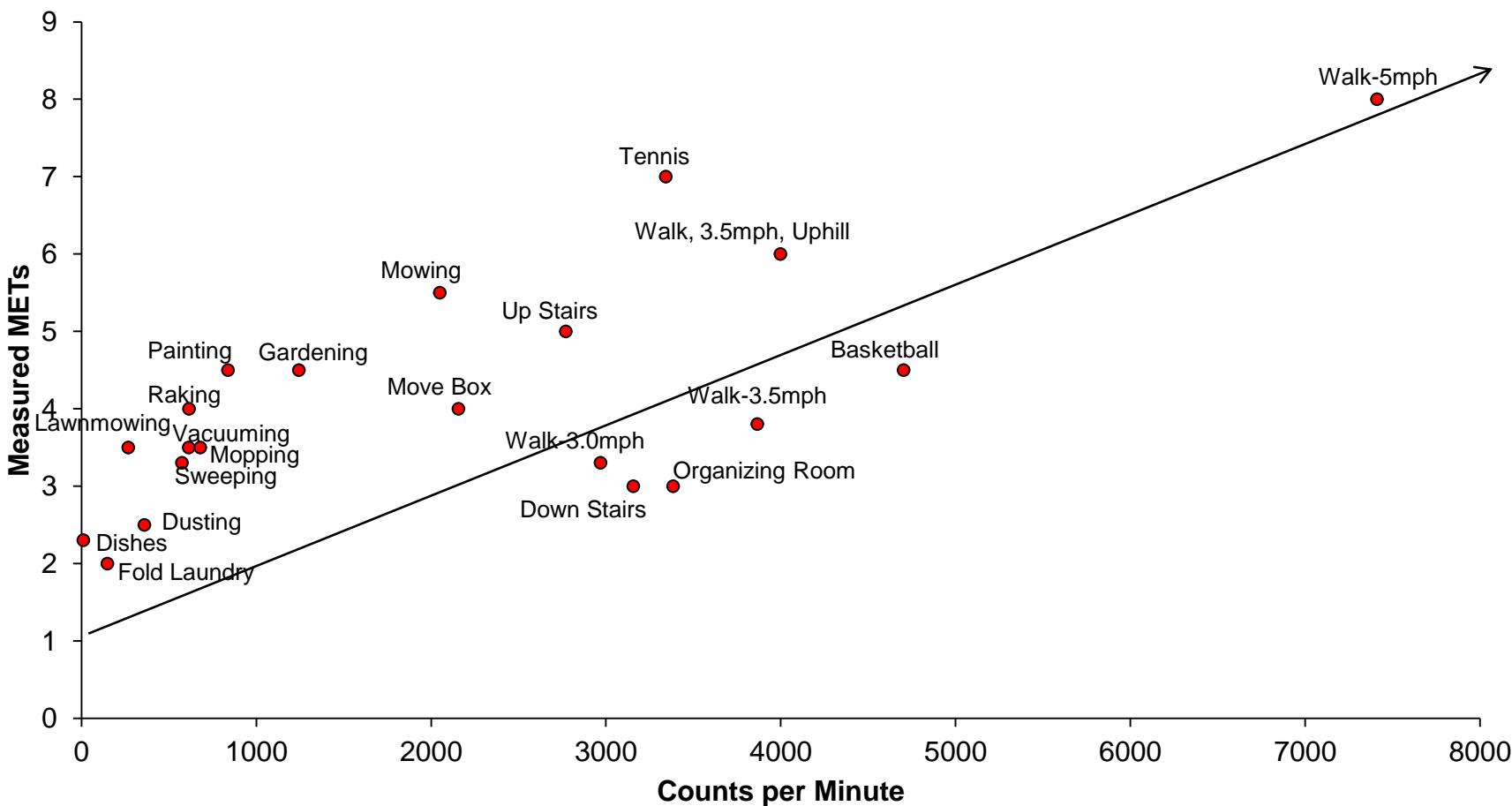
- **Quantify acceleration resulting from movement** (*plus gravity and noise*).
- **Processing techniques used to separate gravity and noise from PA-associated motion.**
- **Data outputs provide an estimate of acceleration due to PA-associated motion**
  - Raw data
  - Activity counts



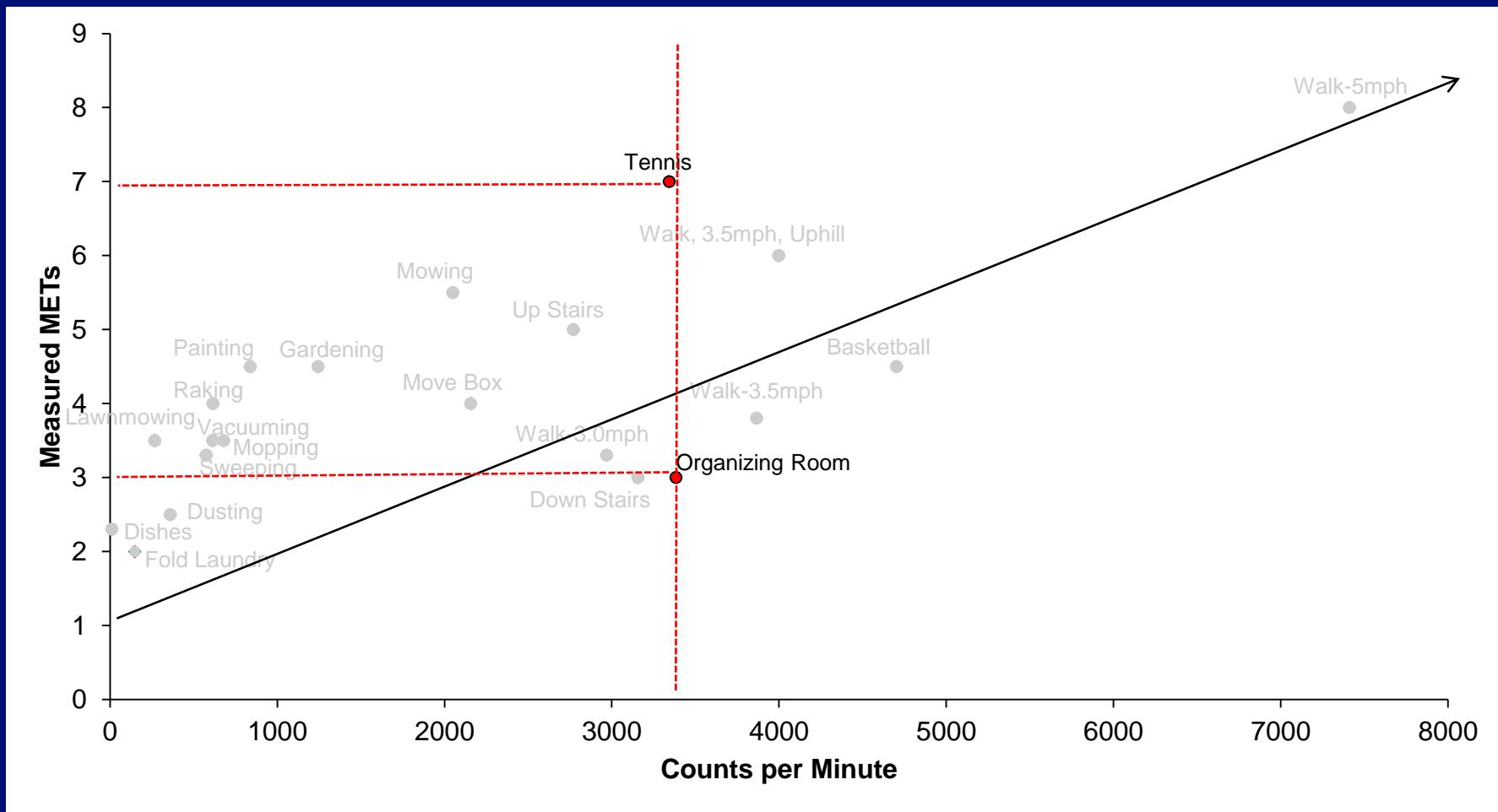
# Accelerometer Counts are NOT Linearly Associated with METs



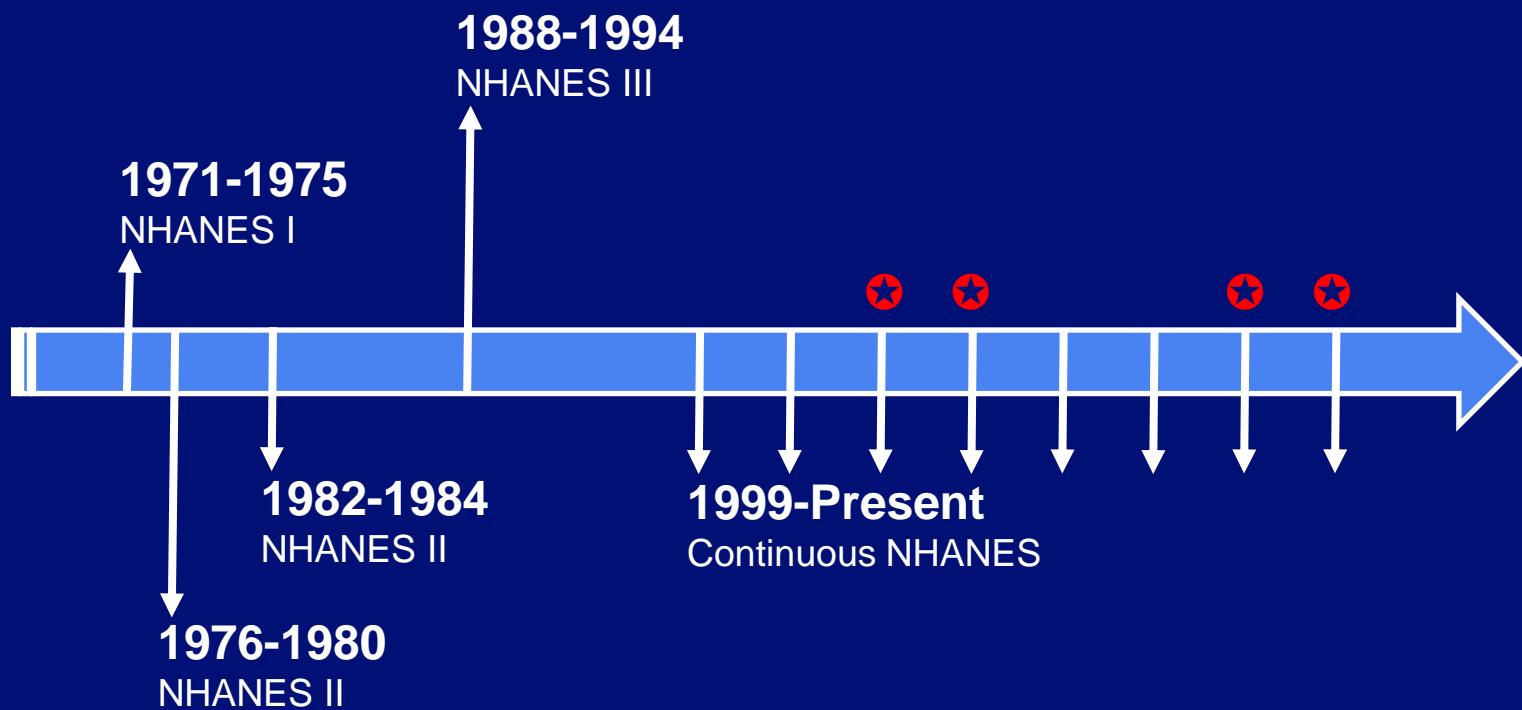
# Accelerometer Counts are NOT Linearly Associated with METs



# Accelerometer Counts are NOT Linearly Associated with METs



# Assessment of Physical Activity in NHANES



# **Assessment of Physical Activity using Accelerometers**

## ***Special Considerations***

- **Procedural Considerations**
- **Data Management Considerations**
- **Data Release Considerations**

# Procedural Considerations

- **Cost**
- **Wear location and protocol decisions**
  - NHANES 2003-2004 and 2005-2006:
    - Hip
    - Not waterproof – remove when bathing or swimming
    - Take off at night
  - NHANES 2011-2012 and 2013-2014
    - Wrist/Non-dominant arm
    - Water proof
- **Settings**
  - Sampling rate
  - Raw data vs counts

# Data Management Considerations

- **Data processing**
  - Proprietary algorithms to produce counts
  - Disagreement on the interpretation or raw data
- **Computational resources**
  - 20,736,000 data points/day/person
  - ~150 million data points/person
  - ~ 7 TB of data in NHANES

## Data Release Challenges

- **Hosting extensive data**
- **Data release product**
- **Protecting confidentiality**

## Best Practices: The NHANES Experience

- **24 hour wear protocol and wrist location improve compliance dramatically**
- **Raw Output Data**
  - Proprietary data processing tools not validated
- **Commercially available accelerometers are not recommended for research at this point**

## **Lessons Learned: The NHANES Experience**

- **A combination of a temperature and a heart rate sensor improves non-wear detection**
- **In-house content expertise facilitates timely and efficient data management**
- **Implications involved in being on the cutting-edge**

**Thank you!**