

*Using Accelerometers in Active  
Living Research:  
Practical Issues in Collecting and  
Managing Data (Beginner Level)*

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# NIH Studies

Study	Aims	PI	Population	N	Mode of delivery	Actigraph model
NQLS 2001-2007	Walkability & PA	Jim Sallis	Adults, 20-65	2000	Mail	7164 and 71256
NQLS-S 2004-2009	Walkability & PA, Physical Functioning	Abby King	Seniors, 66+	900	Mail	7164 and 71256
NIK 2005-2010	Walkability/ Rec/Food Environment & BMI, PA, Diet	Brian Saelens	Children, 5-11	800	In-person & mail	GT1M
TEAN 2007-2011	Walkability, Rec/Food Env & PA, Diet	Jim Sallis	Teens, 12-16	850	Mail	7164, 71256, GT1M & GT3X
IPEN 2009-2013	Walkability & PA in numerous countries	Jim Sallis	Adults, 18-65	3000+	In-person & mail	7164, 71256, GT1M & GT3X

# Format of workshop

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## ■ Presentation

A. Pre-data Collection

B. Boosting Compliance

C. Data Screening & MeterPlus

D. Decisions about Cleaning, Compliance & Cutpoints

## ■ Breakout

Goals:

1. ask more in-depth questions

2. learn from others experience & approaches

3. try MeterPlus with your own files

# Learning Objectives

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## A. Pre-data Collection

1. How to plan and budget for data collection
2. Benefits of having a good tracking database

## B. Boosting Compliance

1. Tips for in-person & mail delivery & retrieval
2. Tips to increase compliance
3. Prompting protocols – how to get devices back

# Learning Objectives

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## C. Data Screening & MeterPlus

1. Why it's important to screen data
2. What 'valid' vs 'invalid' data look like
3. MeterPlus demonstration

## D. Decisions about Cleaning, Compliance & Cutpoints

1. What cleaning & compliance decisions need to be made
2. What cutpoints are out there and will this choice affect my outcomes

# Pre-data Collection

Carrie Geremia



7164



GT1M / GT3X

# Data Decisions

- 1. How long will you ask participants to wear the Actigraph?
- 2. When will you ask them to wear the Actigraph (e.g., waking time only, only when in town, all day and night)?
- 3. Will you ask participants to complete a log of when they put the unit on and take it off? Any other daily assignments?
- 4. Will you ask participants to re-wear the Actigraph if not enough good data are collected the first time?
- 5. What will be enough wearing time to be considered compliant and therefore not asked to do a re-wear?

# Data Decisions, cont.

- 6. How will you define a valid hour?
- 7. How will you define a valid day?
- 8. Will you have different valid wear time criteria for weekday vs. weekend?
- 9. What software will you use to screen and score your Actigraph data?
- 10. Will you collect any additional data streams (e.g., step counts)? How will you process it/use it?



# 11. What epoch will you use?

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- Activity in kids is intermittent so shorter epoch length will capture short bursts of activity and categorize them appropriately
- Longer epoch dilutes vigorous activity
- In use: 2, 5, 10, 15, 30, 60 seconds
- Enough memory in new models to use short epochs

# How much memory?

15 second epoch	Days of data collection with Activity-only	Days of data collection with Activity+Steps (or 2 selections in GT3X)	Days of data collection with Activity+Dual+Steps (or 3 selections in GT3X)	Days of data collection with 4 selections in GT3X
GT1M	85	42	28	NA
GT3X	358	179	119	89

- Battery runs out before memory.
- GT1M has about 14 days and GT3X has about 20 days (15 in tri-axial mode)

# Budgeting for Data Collection

Staff	Part time equipment manager (at least 20 hours/week), for 30-50 meters/week; additional recruitment/participant management staff
Actigraphs	$\# \text{ days of data collection} / [\text{return time} + \text{in-office time}] = X$ $X * [\text{loss rate}] = Y$ $X - Y = \text{the number of time the unit can go out in one year (Z)}$ Number of participants to measure / Z = desired inventory to meet your measurement goals

Example: Assuming a 1 year data collection period, 30-day average return time, 5 day in-office time, 4% loss rate with a target of 100 participants to measure, it would be determined that 10 Actigraphs are needed.

# Equipment

- Actigraphs
  - Label
  - Inventory



- Belts, clips
  - Where to purchase
  - Different sizes



- Calibrator
  - \*older models only\*



# Delivery

- Online USPS
- Priority Mail <http://www.usps.com/shipping/prioritymail.htm>
- Tracking
- Cost
- Materials



Click-N-Ship(R) Notification - Windows Internet Explorer provided by Yahoo!

https://webmail.foundation.sdsu.edu/Projects/Erin.Merz/Inbox/TEAN%20Mailing/Click-N-Ship(R)%20Notification-242.EML?Cmd=open

Reply Reply to all Forward [Icons] Help

From: USPS\_Shipping\_Services@usps.com [USPS\_Shipping\_Services@usps.com] Sent: Sat 2/7/2009 2:46 PM  
To: Erin Merz  
Cc:  
Subject: Click-N-Ship(R) Notification  
Attachments:

\*\*\*\* This is a post-only message. Please do not respond. \*\*\*\*

Dear TEAN STUDY,

This ship notification is being sent to you by the U.S. Postal Service at the request of PARTICIPANT X . If the "Shipped To" address information is not correct, please contact the Shipper.

A package with a Click-N-Ship label created on usps.com containing the following information is scheduled to be shipped on 02/10/2009.

<u>From:</u> PARTICIPANT X 555 MAIN STREET SAN DIEGO CA 92103-3138	<u>Shipped to:</u> TEAN STUDY ATTN: ERIN 3900 5TH AVE STE 300 SAN DIEGO CA 92103-3138
---	---

Type of Service: Delivery Confirmation™  
Label Number: 0103 8555 7495 4018 2249

To check on the delivery status of your package, please go to [Track and Confirm](#) at [www.usps.com](http://www.usps.com).

Done Unknown Zone (Mixed) 100%

# Tracking

- Access database
- Each wearing is a record
- Track by serial number and participant
- Queries
  - Length of time out
  - Problem units
  - Compliance
  - Outstanding units

# Access Database

## TEAN GPS and Meters

Participant ID#

City

Stage

Recruiter

GPS Round #

Meter Round #

GPS Serial #

Charger Serial #

Meter Serial #

Meter Model

Meter Battery Life

Last Day for Meter

# GPS Intervals

Last Day for GPS

Meter Log Dated?

### Outgoing

Date GPS Sent

Date Meter Sent

Date Meter Activated

Charts

GPS for repair

Meter for repair

### Incoming

Date GPS Received

Date Meter Received

Date GPS Downloaded

Date Meter Downloaded

Valid GPS Days

Valid Meter Days

## Data Problems

Meter Needs Repair

Bad GPS data

Bad Meter data

GPS Not Downloaded

Meter Not Downloaded

GPS Never Worn

Meter Never Worn

Memory Address Error

Repeat Data

ID of Repeat Data File

Notes about Repeat Data File

Scoring status repeat file

Other GPS Data Problems

Other Meter Data Problems

## Comments

Meter

GPS

## Meter Log

Meter Log

Past Midnight

### DAY 1

Day  Date

**Time on:**  **Time off:**

Meter  Meter

GPS  GPS   Home all day

Time removed

Reason removed

Valid hours  Reason for invalid day

GPS valid day  GPS turned on

Comments

### DAY 2

Day  Date

**Time on:**  **Time off:**

Meter  Meter

GPS  GPS   Home all day

Time removed

Reason removed

Valid hours  Reason for invalid day

GPS valid day  GPS turned on

Comments

### DAY 3

Day  Date

**Time on:**  **Time off:**

Meter  Meter

GPS  GPS   Home all day

Time removed

Reason removed

Valid hours  Reason for invalid day

GPS valid day  GPS turned on

Comments

Questions?



# Boosting Compliance

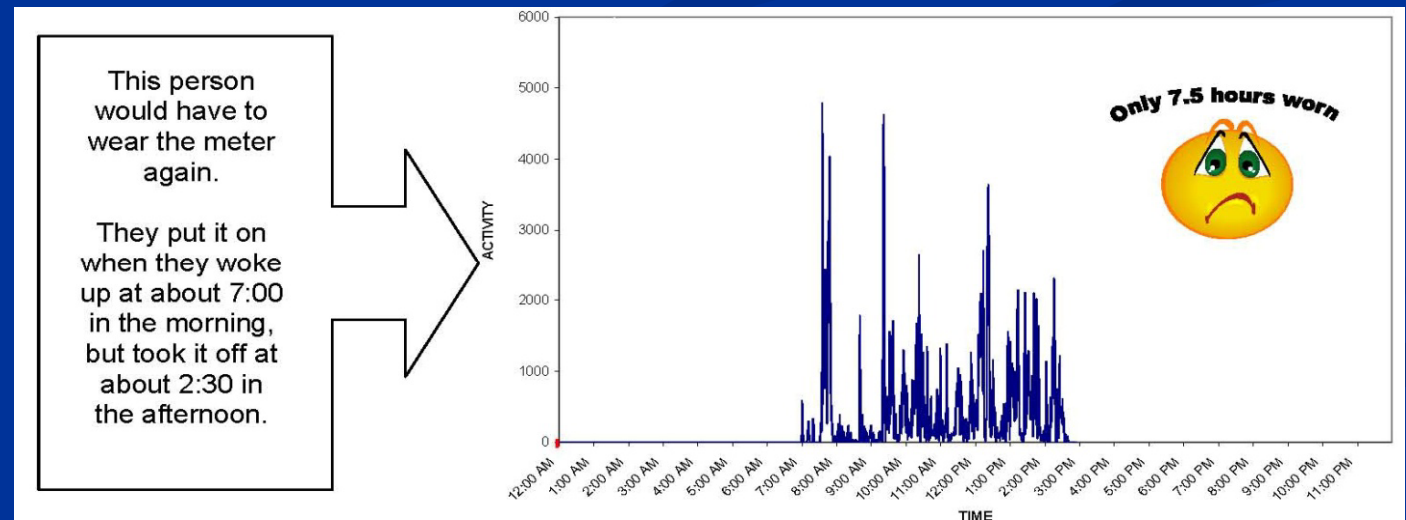
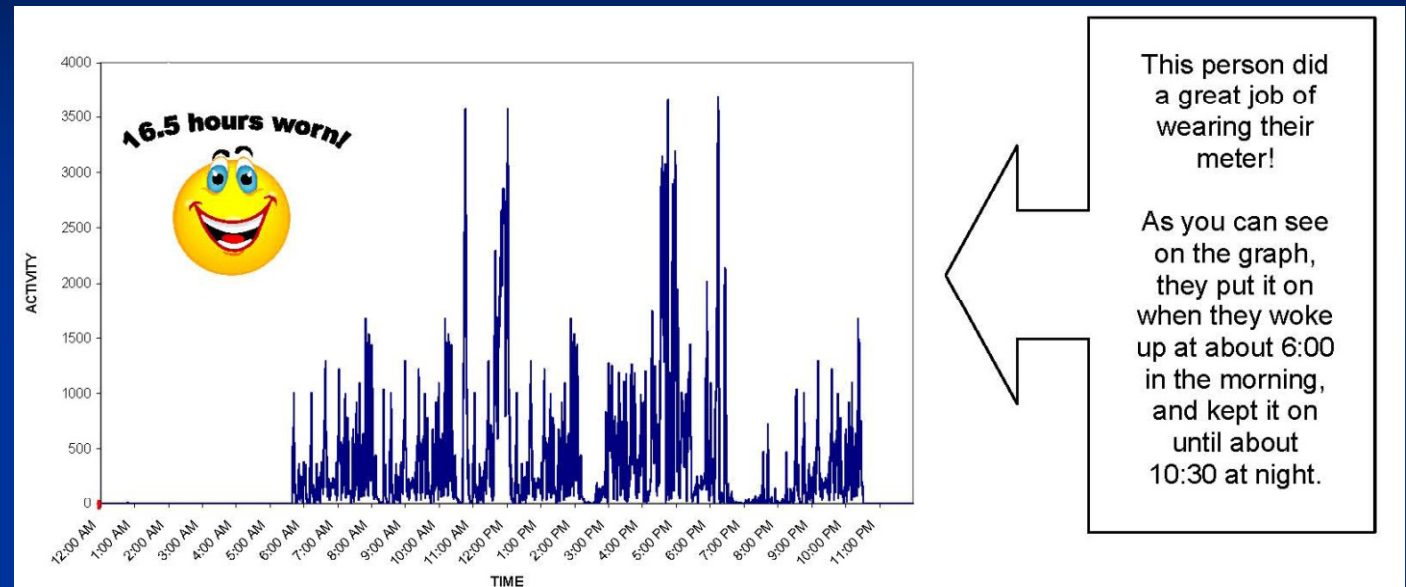


# Rates

Study	Valid Wearing Time Guidelines	Compliance	Return Time (median)	Equipment Loss Rate
Seniors	5 valid days, <45 minutes of consecutive “0” counts per hour	90%	20 days	0.7%
Adults	5 valid days, <30 minutes	88%	20 days	2.6%
Teens	5 valid days (1 weekend), <30 minutes	71%	23 days	1.8%
Children	6 valid days (1 weekend), <20 minutes	74%	19 days	1.6%

# Wearing Instructions

- Delivery one day early, preferably near the weekend
- Show how to wear
- Stress how long to wear (see charts)
- Will ask to re-wear



# Meter Instructions

- How to wear meter
- Increase valid wearing time expectations
- Providing an end date



## How to Wear the Activity Meter

This small activity meter records general movement and allows us to get a better idea of your overall activity level. We will **not** be able to tell what kind of specific activity is happening. At first, the belt may feel slightly awkward, but after a few hours, you will probably get used to it and not notice it as much. It is **extremely** important for our study that you wear the meter properly. If it is not worn properly, we may have to send it back for you to wear again. Please follow these instructions carefully:

- ✦ Wear the meter attached to the belt around your waist, just above your **right** hipbone. You can wear it either underneath or on top of your clothing.
- ✦ Wear the meter so that the star sticker is facing **up**.



- ✦ Wear the meter **snug** against your body. If you have to, you can adjust the belt by pulling the end of the strap to make it tighter. Or, to loosen the belt, push more of the strap through the loop. **Wear the belt tight enough so that the meter does not move when you are being active.**
- ✦ Please **put it on first thing in the morning** -- either just after you get out of bed or just after you shower or take a bath in the morning.
- ✦ **Do not submerge the meter in water** (swimming, bathing, etc.)
- ✦ Keep the activity meter on all day (unless swimming or in the water).
- ✦ At night, **take it off right before you go to bed**. You should be wearing the meter for **at least 12 hours each day**.
- ✦ Do not let anyone else wear it.
  
- ✦ **The meter has a very short battery life.**
- ✦ **The last full day that it will work is \_\_\_\_\_.** If you cannot begin wearing it by \_\_\_\_\_, please call **1-877-440-4832 as soon as possible!**

There is no "ON" or "OFF" switch that you need to worry about turning on or off every day. The activity meter runs on a battery and is programmed to run continuously without you needing to turn it on. Please do not try to open the activity meter.

# Log/Journal



## Meter and GPS Log

Wear the movement meter and GPS for seven (7) days in a row, including weekends. In the spaces below, write down the dates, days and times which you wear them. If you take the devices off for more than 30 minutes, such as for swimming, record when they were removed and for what reason. If you are unable to wear the meter for at least 12 hours one day, please wear it one extra day. Thank you!

Please start wearing your meter on or before \_\_\_\_\_.  
The last full day that your meter will work is \_\_\_\_\_!

### Day 1

(Circle Day) Mon Tues Wed Thurs Fri Sat Sun Date \_\_\_\_\_

<u>Time Meter Put On:</u>	am / pm	<u>Time Left Home with GPS:</u>	am / pm <i>or</i>
<u>Time Meter Taken Off:</u>	am / pm		<input type="checkbox"/> Home All Day
Time removed during the day (e.g. 10:30-11am): _____			
Why removed (e.g. swimming): _____			

### Day 2

(Circle Day) Mon Tues Wed Thurs Fri Sat Sun Date \_\_\_\_\_

<u>Time Meter Put On:</u>	am / pm	<u>Time Left Home with GPS:</u>	am / pm <i>or</i>
<u>Time Meter Taken Off:</u>	am / pm		<input type="checkbox"/> Home All Day
Time removed during the day (e.g. 10:30-11am): _____			
Why removed (e.g. swimming): _____			

### Day 3

(Circle Day) Mon Tues Wed Thurs Fri Sat Sun Date \_\_\_\_\_

<u>Time Meter Put On:</u>	am / pm	<u>Time Left Home with GPS:</u>	am / pm <i>or</i>
<u>Time Meter Taken Off:</u>	am / pm		<input type="checkbox"/> Home All Day
Time removed during the day (e.g. 10:30-11am): _____			
Why removed (e.g. swimming): _____			

### Day 4

(Circle Day) Mon Tues Wed Thurs Fri Sat Sun Date \_\_\_\_\_

<u>Time Meter Put On:</u>	am / pm	<u>Time Left Home with GPS:</u>	am / pm <i>or</i>
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# Prompting Material Return

## Phone calls

- First calls at the beginning of wearing: to remind of criteria, proper wearing
- Prompt calls weekly

## Emails/Text Messages

- Use in combination with phone calls, most effective with adults and teens

## Mailings

- Last resort: if phone calls are not successful, begin mailing return materials, reward letter or home visit

**DON'T GIVE UP!**

Action (MC=meter check-in call; MR=meter reminder call; PC=prompt call)	Length of time before next contact
Make your MC call the day you expect your participant to receive the meter.	Schedule next call for <b>3 days later.</b>
Make your MR call to check in again and make sure the participant started wearing the meter.	Schedule next call for <b>5 days later.</b>
Make your PC1 call (first prompt call).	Schedule your next call for <b>1 week later.</b>
Make your PC2 call.	Schedule your next call for <b>1 week later.</b> If local, offer a home pickup.
Make your PC3 call and send an email if possible.	Schedule your next call for <b>1 week later.</b>
Make your PC4 call and mail a return envelope (#1).	Schedule your next call for <b>1 week later.</b>
Make your PC5 call.	Schedule your next call for <b>1 week later.</b>
Make your PC6 call and send an email if possible.	Schedule your next call for <b>1 week later.</b>
Make your PC7 call.	Schedule your next call for <b>1 week later.</b>
Make your PC8 call and mail another return envelope (#2).	Schedule your next call for <b>2 weeks later.</b>
Make your PC9 call.	Schedule your next call for <b>2 weeks later.</b>
Make your PC10 call and send an email if possible.	Schedule your next call for <b>2 weeks later.</b>
Make your PC11 call.	Schedule your next call for <b>2 weeks later.</b>
Make your PC12 call and mail another return envelope.	Schedule your next call for <b>2 weeks later and continue calling until at least 6 months have passed.</b>
At this point, the meter has been out for at least 6 months and 3 envelopes have been sent. Consult a supervisor about the next steps.	Continue calling if you have had contact with participant and think continued attempts will help. A reward letter is an option but only if nothing else helps. The reward is usually comparable to the incentive they would have received for completing the study.

# Compliance Elements

- Charts/graphs
- Instruction sheets with dates
- Logs/Journals
- Calls/Emails/Texts/Mailings
- Letter to schools and coaches
- Stickers





Questions?

# MeterPlus & Data Screening

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Kelli Cain

# MeterPlus

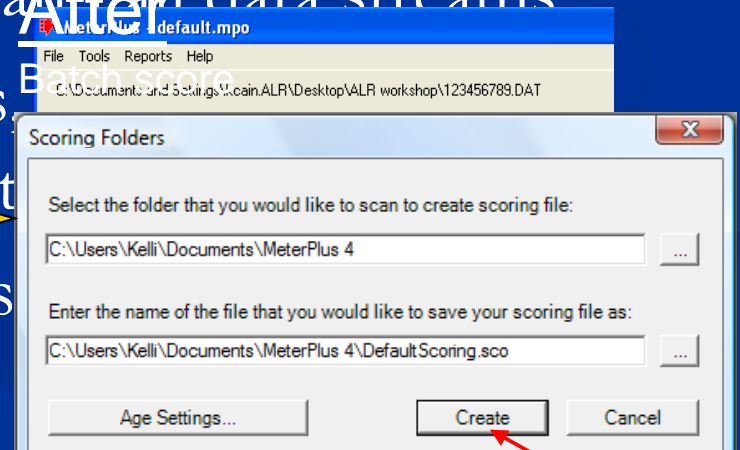
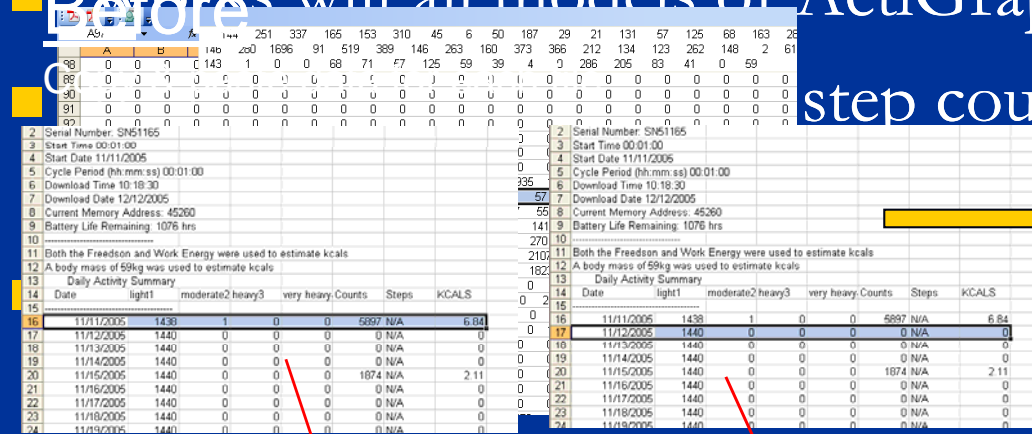
- Anyone can use it, no programming skills required
- Windows-based, with user-friendly interface for data screening

■ Before batch-process your files

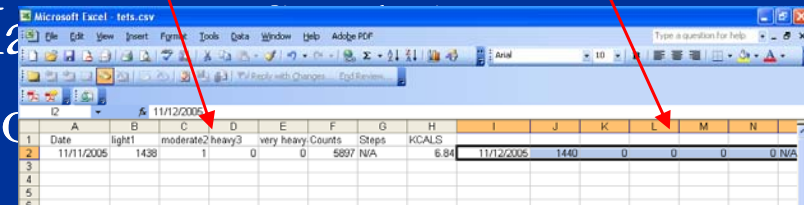
After

■ Visual screen for consecutive zeros

■ Automated screen for consecutive zeros



■ MeterPlus has many parameters for selecting days to score, bouts of activity, time filters, and more...



# Steps

## 1. Convert

Convert DAT files to CSV files with a one-click utility.

## 2. Screen

Screen data files individually for enough valid wear time. Useful when checking for compliance.

## 3. Clean

Eliminate non-wearing time and save days of data you really want to keep as MPD files.

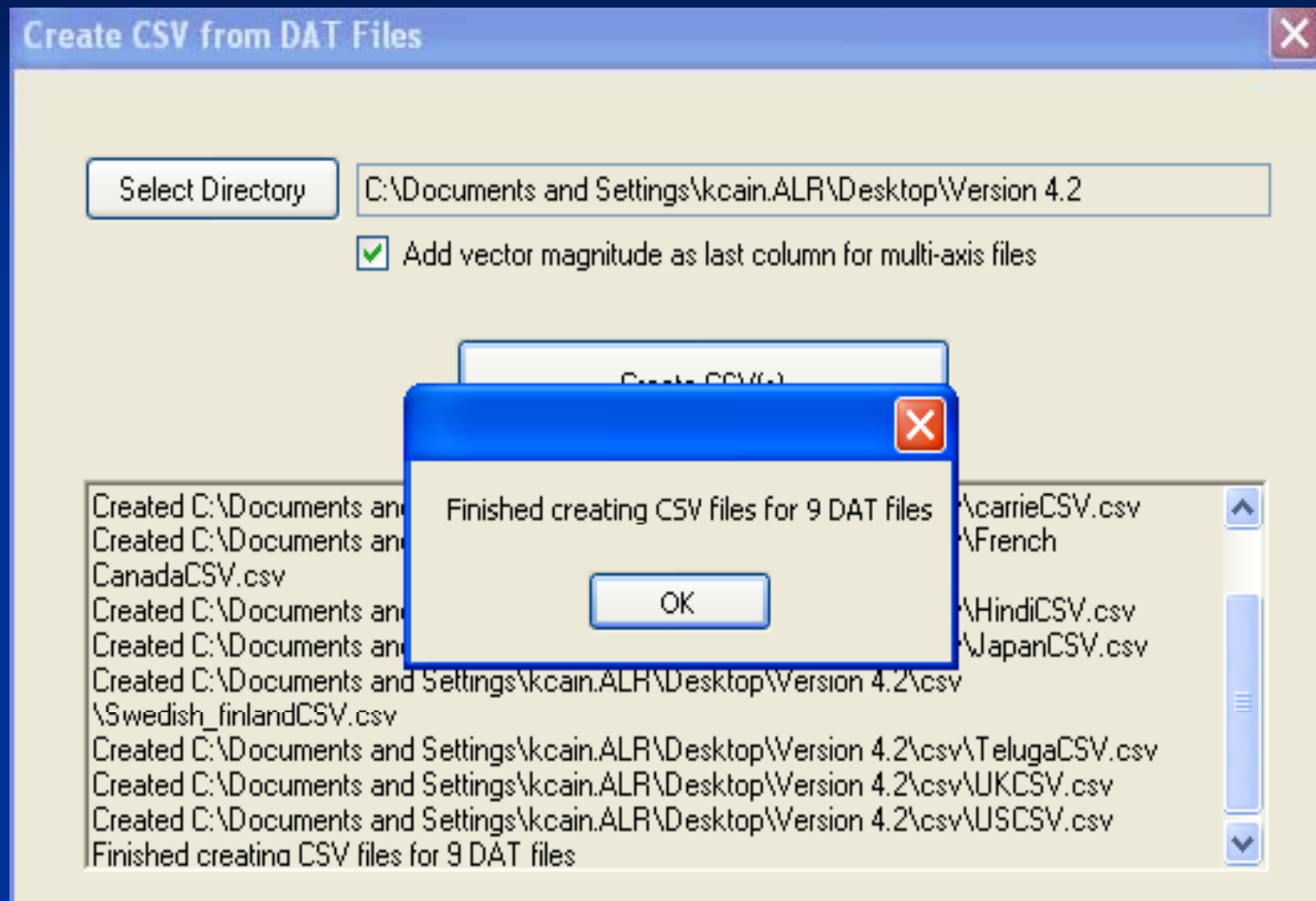
## 4. Score

Batch score your files and create one comma-delimited file containing variables for your entire sample.

## 5. Analyze

Import the comma-delimited file into statistical software and analyze.

# Step 1. Convert DAT to CSV



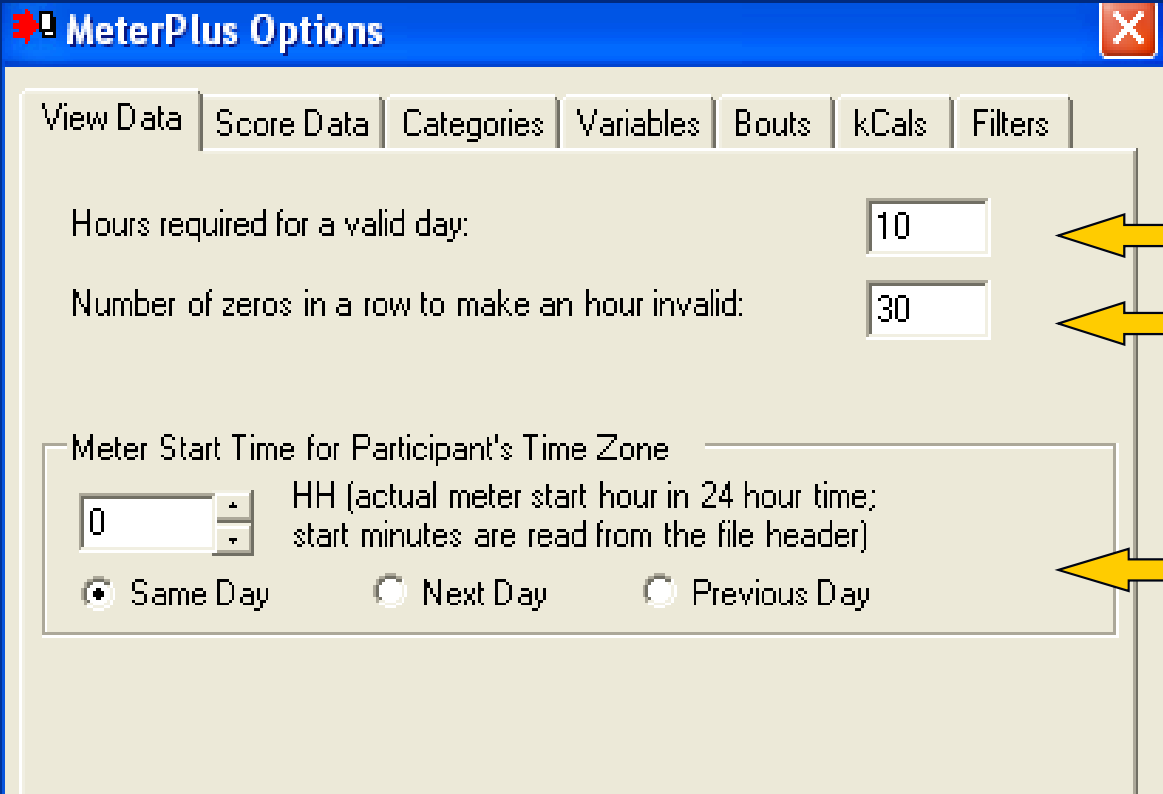
## 2. Screen

# Data screening

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- Screen data right away
  - Compliance with first wearing only 70-75% in children & teens. About 95% with additional wearing.
- Looking for valid wear time & malfunction
  - Decide if re-wear is needed
- MeterPlus makes this easy

# Screening data



The screenshot shows the 'MeterPlus Options' dialog box with the following settings and annotations:

- Hours required for a valid day:** 10 (Annotated as 'Valid hours')
- Number of zeros in a row to make an hour invalid:** 30 (Annotated as 'Non-wearing time')
- Meter Start Time for Participant's Time Zone:** 0 (Annotated as 'Time zone or start time adjustments')
  - HH (actual meter start hour in 24 hour time; start minutes are read from the file header)
  - Same Day
  - Next Day
  - Previous Day





# Examples of data

- Wear time
- Mail days that may look like wear time
- Malfunction/Invalid data
- Repeat data (older models)

# Wear time – typical pattern

Daily Info for Thursday, August 22, 2002

Number of Data Points each Hour: 60

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
198	164	344	148	311	108	207	76	14	86	25	68	127	260	95
20	37	77	211	12	24	0	10	0	4	11	0	0	0	0
6	4	0	5	0	0	8	8	2	0	0	0	0	0	0
87	2	0	195	315	0	11	15	20	19	13	71	49	4	6
5	0	253	1131	951	182	251	6	1480	831	90	11	0	162	269
83	0	280	76	86	194	138	28	150	426	12	513	173	246	39
202	15	195	132	223	382	196	45	101	782	1239	757	1213	3832	704
0	0	0	0	0	0	0	12	423	469	1133	488	392	197	816
894	1063	900	386	760	208	537	90	160	265	1079	558	1332	1090	862
469	873	1338	1963	2133	1079	684	1093	1347	2070	662	334	531	846	1231
768	159	385	1634	1898	2009	539	2076	2167	2225	310	321	3136	2675	616
525	772	639	132	149	125	33	49	99	98	490	638	261	126	34
544	1022	319	239	310	0	15	0	1	26	83	38	0	43	7
0	0	1	4	0	0	0	0	0	0	127	0	0	0	9
0	0	28	2	0	0	1	104	0	0	0	0	0	6	0
0	0	0	0	0	0	236	314	894	584	342	35	419	291	159

Change Valid Value     Valid     Invalid

OK    Cancel

# Mail days

MeterPlus - Kids\_3 METS-30 epoch.mpo

File Tools Reports Help

S:\CSA Data\Actigraph Training\B\_mail time\Mail\_60s.DAT

Date	Valid Hours	Valid Day?	Day Of Week	Parameter
8/15/2002	11	Yes	Thursday	Activity
8/16/2002	0	No	Friday	Activity
8/17/2002	0	No	Saturday	Activity
8/18/2002	12	Yes	Sunday	Activity
8/19/2002	17	Yes	Monday	Activity
8/20/2002	13	Yes	Tuesday	Activity
8/21/2002	15	Yes	Wednesday	Activity
8/22/2002	17	Yes	Thursday	Activity
8/23/2002	12	Yes	Friday	Activity
8/24/2002	2	No	Saturday	Activity
8/25/2002	10	Yes	Sunday	Activity
8/26/2002	6	No	Monday	Activity
8/27/2002	10	Yes	Tuesday	Activity
8/28/2002	5	No	Wednesday	Activity

Daily Info for Tuesday, August 27, 2002

Number of Data Points each Hour: 60

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	13	0	0	0	0	0	0	0	47	94	31	30	23	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	56	9	16	65	0	2	2	23	8	14	0	6	14	0	0	0
10	23	11	0	0	16	7	0	0	9	1	0	6	13	0	0	0	0
64	8	13	2	0	110	20	21	11	0	0	0	95	16	13	0	0	0
123	1	0	0	0	0	0	0	0	32	62	10	7	35	27	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	19	3	15	37	0	0	163	6	0	0	0

Change Valid Value   
 Valid   
 Invalid



### 3. Clean

# Cleaning data

The screenshot shows the 'MeterPlus Options' dialog box with the following settings and annotations:

- Hours required for a valid day:** 10 (Annotation: Define wearing time)
- Number of consecutive zeros to make an hour invalid:** 30
- Value to use for undefined field:** NULL
- Replace strings of zeros with the following value:** -999 (Annotation: Code non-wearing time)
- (Zeros will only be replaced if there is a string that meets the criteria set above to make an hour invalid.)*
- Output:** Totals for Valid Days Only (Annotation: Select level of output)
- Parameter:** ---Select--- (Annotation: Select the type of data that is batch scored)
- Directory to save:** C:\Documents and Settings\... (Annotation: Browse for location to save cleaned files (MPD))

Buttons at the bottom: Save, Save and Close, Exit.

Define wearing time

Code non-wearing time

Select level of output

Select the type of data that is batch scored

Browse for location to save cleaned files (MPD)

# Saving wear time

Select the days to be scored. Days without enough valid wearing time can be excluded from this process so they are not included in the final data set.

The screenshot shows the MeterPlus software interface. The main window displays a table with the following columns: Date, Valid Hours, Valid Day?, Day Of Week, and Parameter. The data is organized into three groups of rows, each corresponding to a different parameter: Activity, Steps, and 2nd Axis. The 'Valid Day?' column indicates whether the day is valid for scoring (No or Yes). The 'Day Of Week' column shows the day of the week for each date. The 'Parameter' column identifies the data source (Activity, Steps, or 2nd Axis).

Date	Valid Hours	Valid Day?	Day Of Week	Parameter
10/11/2008	2	No	Saturday	Activity
10/12/2008	1	No	Sunday	Activity
10/13/2008	2	No	Monday	Activity
10/14/2008	0	No	Tuesday	Activity
10/15/2008	1	No	Wednesday	Activity
10/16/2008	0	No	Thursday	Activity
10/17/2008	2	No	Friday	Activity
10/18/2008	0	No	Saturday	Activity
10/11/2008	4	No	Saturday	Steps
10/12/2008	5	No	Sunday	Steps
10/13/2008	3	No	Monday	Steps
10/14/2008	0	No	Tuesday	Steps
10/15/2008	2	No	Wednesday	Steps
10/16/2008	2	No	Thursday	Steps
10/17/2008	2	No	Friday	Steps
10/18/2008	0	No	Saturday	Steps
10/11/2008	0	No	Saturday	2nd Axis
10/12/2008	0	No	Sunday	2nd Axis
10/13/2008	2	No	Monday	2nd Axis
10/14/2008	0	No	Tuesday	2nd Axis
10/15/2008	0	No	Wednesday	2nd Axis
10/16/2008	0	No	Thursday	2nd Axis
10/17/2008	2	No	Friday	2nd Axis
10/18/2008	0	No	Saturday	2nd Axis

Three dialog boxes are shown on the right side of the screen, each reporting the successful saving of data for a specific parameter:

- 24 days were successfully saved to C:\Documents and Settings\kcaain.ALR\Desktop\Version 4.2\version 4203\GT1M MODE=5CSV\_Activity(1).mpd
- 24 days were successfully saved to C:\Documents and Settings\kcaain.ALR\Desktop\Version 4.2\version 4203\GT1M MODE=5CSV\_Steps(1).mpd
- 15 days were successfully saved to C:\Documents and Settings\kcaain.ALR\Desktop\Version 4.2\version 4203\Actitrainer MODE=3\_2nd Axis.mpd

The 'Save Selected Days' button is highlighted with a yellow arrow.

Variables: Date, Valid Hours, Valid Day, Day of Week & Parameter

- There are a few things to configure in MeterPlus before batch-scoring your files
  - Cut-points
  - Filename variables
  - Energy Expenditure
  - Bouts
  - Time Filters

# Programming cut-points

The screenshot shows the 'MeterPlus Options' dialog box with the 'Categories' tab selected. It displays a table of activity categories and their corresponding meter value ranges. The categories are: NIK (age 6 to 11), TEAN (age 12 to 16), Adult (age 18 to 64) with sub-categories (not\_wearing, sedentary, light, moderate, hard, very\_hard), and Senior (age 65 to 100). Buttons for 'Add Group', 'Add Category', 'Edit', and 'Delete' are visible at the bottom.

Group/Category Name	Min Value	Max Value
+ NIK (age 6 to 11)		
+ TEAN (age 12 to 16)		
- Adult (age 18 to 64)		
not_wearing	-999	-999
sedentary	0	100
light	101	1952
moderate	1953	5724
hard	5725	9498
very_hard	9499	100000
+ Senior (age 65 to 100)		

## Create Groups

The screenshot shows the 'Edit Category Form' dialog box. It has a 'Name' field containing 'Child', 'Age from' and 'to' spinners set to 9 and 10 respectively, and 'OK' and 'Cancel' buttons.

## Add/Edit Cut-points

The screenshot shows the 'CutPointForm' dialog box. It has a 'Name' field containing 'moderate', 'Meter values from' and 'to' spinners set to 1953 and 5724 respectively, and 'OK' and 'Cancel' buttons.

## Variables Created

- Total, Daily and Hourly: time spent in each activity category (not wearing, sedentary, light, moderate, vigorous). All days and/or Valid Days Only



# Filename variables

Parse data file name into variables

Begin parsing for variables after the last  character.

Map source data file name to:

Sample file name:

Variables:

Variable	Character Position
City	0-1
Neighborhood	1-3
Walkability	3-4
Group	4-5
ID	5-9

Enter sample file name

Designate character positions

Name your variables

# Settings for bouts (sustained levels of activity)

MeterPlus Options

View Data | Score Data | Categories | Filename | Bouts | kCals | Filters

Include Bouts in output

Bout length (minutes)

Lower limit (activity count)

Upper limit (activity count)

Tolerance (minutes)

Save Save and Close Exit

Minimum length

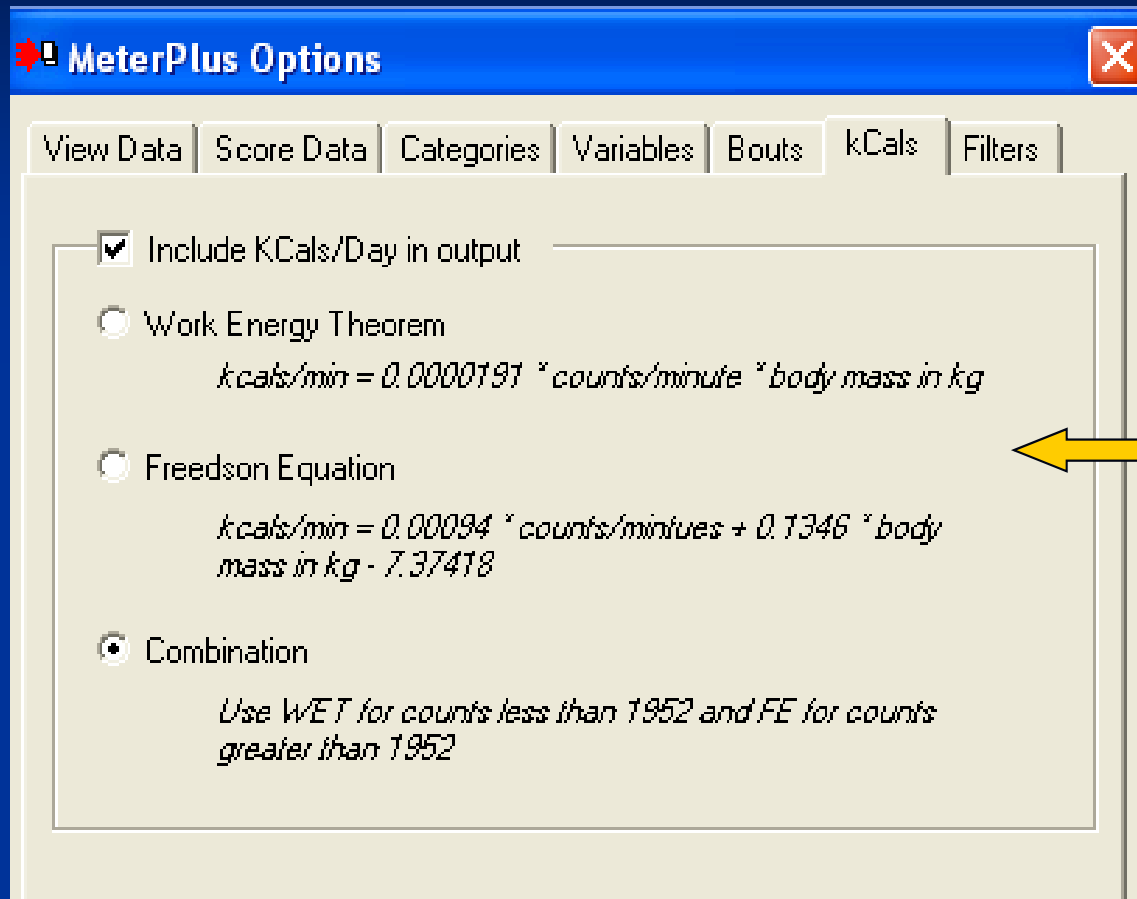
Intensity

Allowable interruption

## Variables Created

- Number, total length and average length of bouts
- Start and end times of each bout
- Total, Daily and Hourly

# Energy expenditure

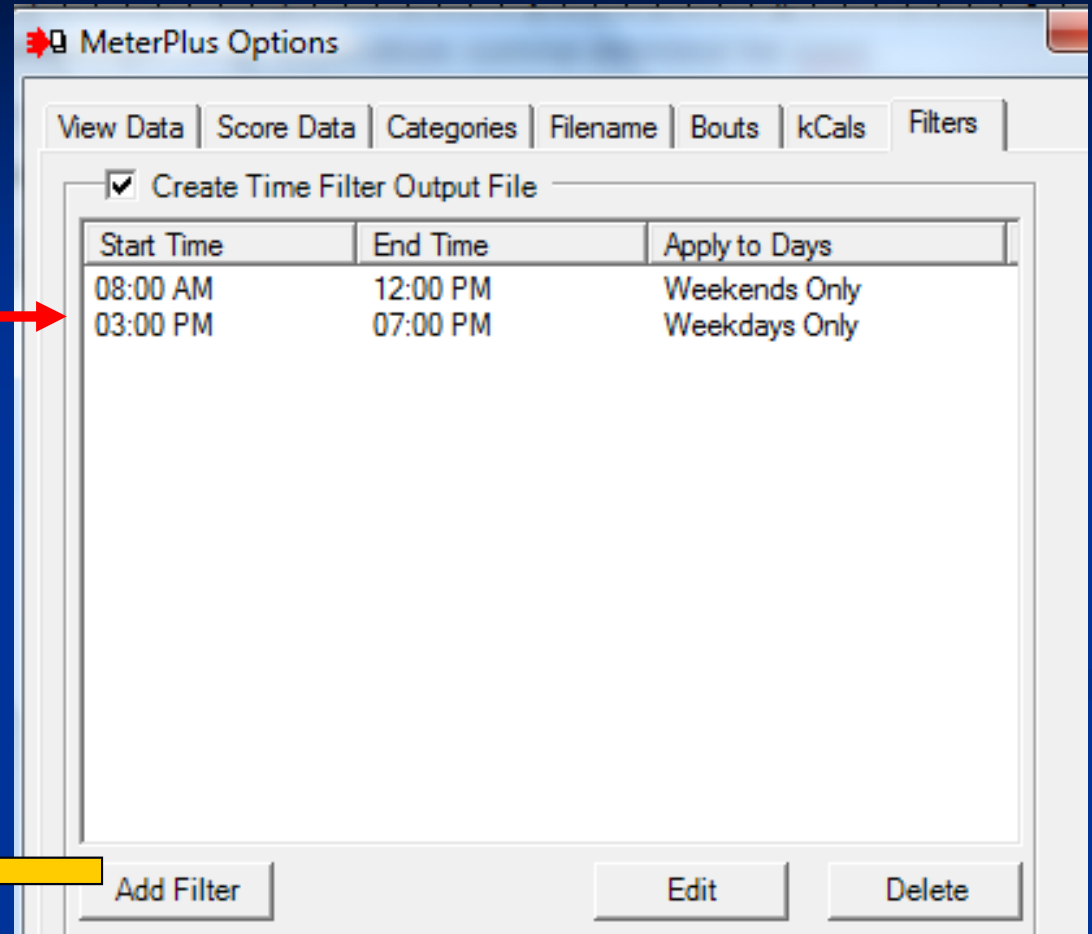
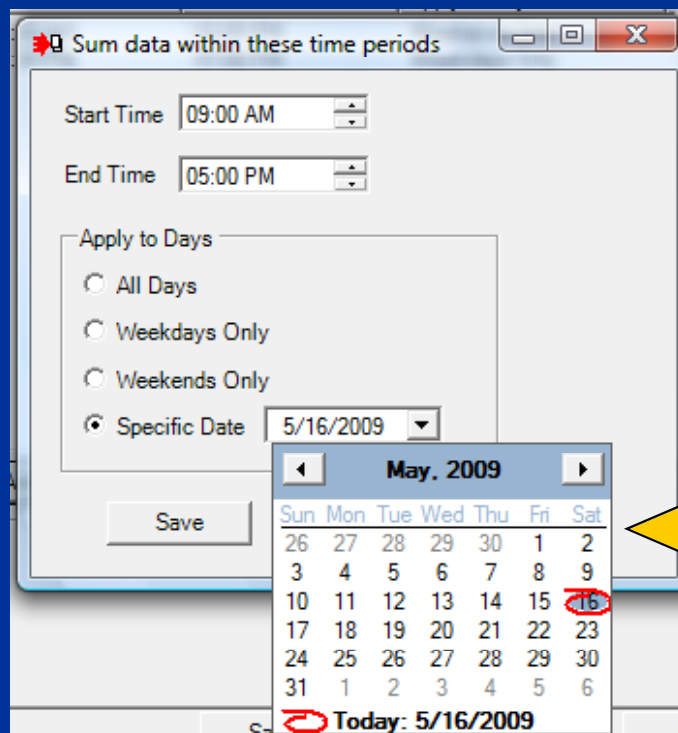


Choice of 3 algorithms

## Variables Created

- Total, mean and peak energy expenditure
- Energy expenditure in each activity category
- Total, Daily and Hourly

# Time filters



## Variables Created

- Date and day of week
- Start and end times of each filter
- Time spent in each activity category during each defined time period.

# Age and weight scoring

**Participant Age Data for Scoring**

Participant Age Data

Age file for participants:  ...  
*Leave blank if you don't have an age file.*

If a participant's age is unknown, use the following category group or specify an age:

Category Group:   
Adult (age 18 to 64)  
NIK (age 6 to 11)  
TEAM (age 12 to 16)  
Senior (age 65 to 100)

Participant Weight Data

You have specified to include Kcals in the output so you need to provide the participant's weight for scoring.

Weight file for participants:  ...  
*Leave blank if you don't have a weight file.*

If a participant's weight is unknown, use the following weight:

Weight:   (in Kg)

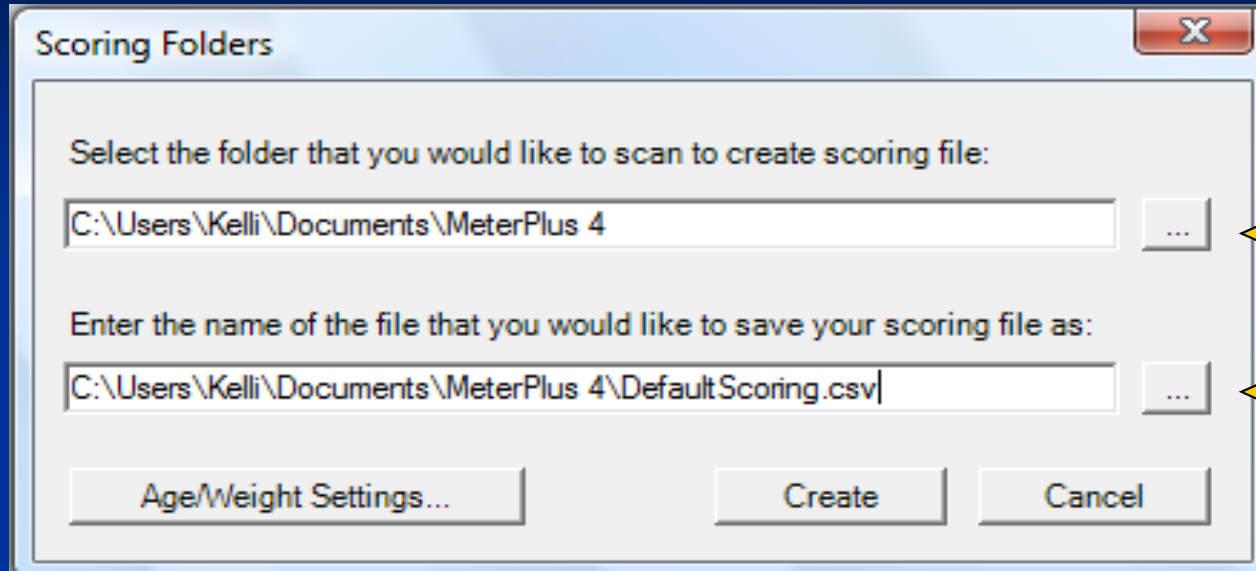
Use subject age to apply different cutpoints within the same batch

Select a group of cutpoints to use for your entire sample

Use subject body weight for energy expenditure calculations

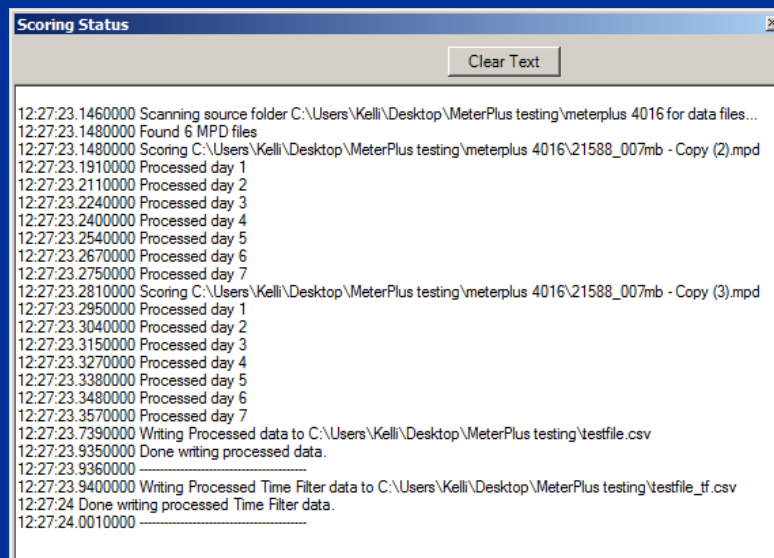
Select a weight to be used for your entire sample

# Batch scoring



Where to find individual files to process

Where to save processed CSV file for entire sample



One step  Create

## 5. Analyze

# Output

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File type	Description
CSV	Comma-delimited file containing the results of the batch scoring including activity counts, step counts, bouts and energy expenditure.
TF.CSV	Comma-delimited file containing the time-filtered activity variables only
SPS	SPSS syntax file that will import data into SPSS

# MeterPlus

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- Where to get more information  
[www.meterplussoftware.com](http://www.meterplussoftware.com)
- Demonstration at breakout session
- ALR grantee discount



Questions?

# Data Decisions

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- No consensus, big differences across studies
- Cut-points and METs
  - Differences in outcomes depending on cutpoints and MET value used to define MVPA threshold
  - “Brisk walk”=3 METs for adults and 4+ METs for children
- Data cleaning and compliance
  - What are some of the decisions to make?
  - What are people using?

# Calibration Studies

	MVPA cutpoint (60s equiv)	METs	Age	Validation/Criterion measure	Activity
Freedson, 1997	<u>10 yr:</u> 1017 <u>10 yr:</u> 1910	3 4	6-18	VO2 consumption	Treadmill [60s]
Pate, 2006	1680	20 mL/kg/min (equiv to brisk walk)	3-5	Cosmed	Walk, run, lifestyle [15s]
Ekelund , 2004	2000	3	9-10	Used previous research to establish	Treadmill
Evenson, 2008	2296	ROC curve analysis	5-8	Cosmed	Lifestyle and treadmill [15s]
Treuth, 2004	3000	4.6	13-14 girls	Cosmed & heart rate	Lifestyle [30s]
Puyau, 2002	3200	AEE: .05 kcal/kg/mn (hrt rate 130)	6-16	room respiration, microwave detector & heart rate	Lifestyle and treadmill [60s]
Sirard, 2005	<u>3 yr old:</u> 2460 <u>5 yr old:</u> 3564	ROC curve analysis	3-5	Observation	Walk, run, sit, play [15s]
Mattocks, 2007	3582	4	12	Cosmed	Lifestyle

# Differences in sedentary and MVPA in same sample ( $n=72$ ; 4-7 yr olds; $p<.01$ )

	MVPA cutpoint	Mean minutes MVPA/day	Sedentary cutpoint	Mean minutes sedentary/day
Puyau	3200	28	800	488
Treuth	3000	41	650	180
Freedson	630	266	NA	NA
Reilly	NA	NA	1100	501

*Reilly, Penpraze, Hislop, Davies, Grant & Paton (2008). Objective measurement of physical activity and sedentary behaviour: review with new data. Arch. Dis. Child, 93, 614-619.*

# Cleaning and compliance decisions

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- Reliable data processing staff
- Number of valid days & valid hours
- How many minutes of consecutive zero counts to define non-wearing

# Reliability between data cleaners

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- Ideally, same person would clean data for entire sample
- Detailed protocols with thorough training
- Inter-rater reliability

# Same data, different cleaning parameters

7 wearing days

10 minutes of zeros

MeterPlus - ALR(1).mpo

File Tools Reports Help

C:\Documents and Settings\kcaain.ALK\Desktop\Test data\Wearing Time test\Mail\_60s.DAT

Date	Valid Hours	Valid Day?	Day Of Week	Parameter
8/15/2002	2	No	Thursday	Activity
8/16/2002	0	No	Friday	Activity
8/17/2002	0	No	Saturday	Activity
8/18/2002	8	No	Sunday	Activity
8/19/2002	11	Yes	Monday	Activity
8/20/2002	12	Yes	Tuesday	Activity
8/21/2002	13	Yes	Wednesday	Activity
8/22/2002	14	Yes	Thursday	Activity
8/23/2002	11	Yes	Friday	Activity
8/24/2002	0	No	Saturday	Activity
8/25/2002	7	No	Sunday	Activity
8/26/2002	1	No	Monday	Activity
8/27/2002	4	No	Tuesday	Activity
8/28/2002	0	No	Wednesday	Activity

5 valid days

20 minutes of zeros

MeterPlus - default.mpo

File Tools Reports Help

S:\CSA Data\Actigraph Training\B\_mail time\Mail\_60s.DAT

Date	Valid Hours	Valid Day?	Day Of Week	Parameter
8/15/2002	5	No	Thursday	Activity
8/16/2002	0	No	Friday	Activity
8/17/2002	0	No	Saturday	Activity
8/18/2002	11	Yes	Sunday	Activity
8/19/2002	13	Yes	Monday	Activity
8/20/2002	13	Yes	Tuesday	Activity
8/21/2002	15	Yes	Wednesday	Activity
8/22/2002	16	Yes	Thursday	Activity
8/23/2002	11	Yes	Friday	Activity
8/24/2002	2	No	Saturday	Activity
8/25/2002	8	No	Sunday	Activity
8/26/2002	5	No	Monday	Activity
8/27/2002	5	No	Tuesday	Activity
8/28/2002	1	No	Wednesday	Activity

6 valid days

30 minutes of zeros

MeterPlus - default.mpo

File Tools Reports Help

S:\CSA Data\Actigraph Training\B\_mail time\Mail\_60s.DAT

Date	Valid Hours	Valid Day?	Day Of Week	Parameter
8/15/2002	11	Yes	Thursday	Activity
8/16/2002	0	No	Friday	Activity
8/17/2002	0	No	Saturday	Activity
8/18/2002	12	Yes	Sunday	Activity
8/19/2002	17	Yes	Monday	Activity
8/20/2002	13	Yes	Tuesday	Activity
8/21/2002	15	Yes	Wednesday	Activity
8/22/2002	17	Yes	Thursday	Activity
8/23/2002	12	Yes	Friday	Activity
8/24/2002	2	No	Saturday	Activity
8/25/2002	10	Yes	Sunday	Activity
8/26/2002	6	No	Monday	Activity
8/27/2002	10	Yes	Tuesday	Activity
8/28/2002	5	No	Wednesday	Activity

9 valid days

60 minutes of zeros

MeterPlus - default.mpo

File Tools Reports Help

S:\CSA Data\Actigraph Training\B\_mail time\Mail\_60s.DAT

Date	Valid Hours	Valid Day?	Day Of Week	Parameter
8/15/2002	16	Yes	Thursday	Activity
8/16/2002	0	No	Friday	Activity
8/17/2002	0	No	Saturday	Activity
8/18/2002	13	Yes	Sunday	Activity
8/19/2002	20	Yes	Monday	Activity
8/20/2002	14	Yes	Tuesday	Activity
8/21/2002	17	Yes	Wednesday	Activity
8/22/2002	17	Yes	Thursday	Activity
8/23/2002	14	Yes	Friday	Activity
8/24/2002	4	No	Saturday	Activity
8/25/2002	12	Yes	Sunday	Activity
8/26/2002	9	No	Monday	Activity
8/27/2002	17	Yes	Tuesday	Activity
8/28/2002	15	Yes	Wednesday	Activity

10 valid days

# Differences in sedentary & non-wear time

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Zeros	Valid Days	Minutes of “Not wearing” time in same 7 wearing days	Minutes of “Sedentary” time in same 7 wearing day
10	5	4680	2861
20	6	4505	3036
30	9	4396	3145
60	10	4278	3263

- No differences in MVPA
- Difference between 2861 (10 zeros) & 3263 (60 zeros) = 402 min
- Almost one hour per day difference on average



# Protocols – select studies

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	Minimum wearing days	Minimum valid hours	# consecutive minutes of zero counts for non-wear time	Cutpoints	METs
NHANES, US	4	10	60+ (with allowance of a few low counts)	Freedson	4
TAAG, US	1	80% standard day is non-missing	20+	Treuth	4.6
EYHS, 4 European	3	10	10+	Freedson	3
ALSPAC, UK	3	10	10+	Mattocks	4
Kolle 2009, Norway	2	8	10+	Ekelund	3

# What about activities that are missed by accelerometer?

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- Under-estimates certain activities (biking, swimming, etc.)
- Use diary or log to identify time, duration and type of activity
- Get MET value for activity from Compendium of Physical Activities
- Using a regression equation, get corresponding count value
- Insert or replace values with new count value
- Labor intensive and didn't make a difference in one of our studies

*Esliger, D.W., Copeland, J.L., Barnes, J.D. & Tremblay, M.S. (2005). Standardizing and optimizing the use of accelerometer data for free-living physical activity monitoring. Journal of Physical Activity and Health, 3, 366-383.*

# Summary

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- MeterPlus can help manage and score your data but each investigator has many decisions to make
- Need more research to reach consensus...any takers?

# The end...

- Questions, Comments?
- Come try out MeterPlus and discuss other topics
- References and other materials to take
- Roundtable in the morning