Harvard School of Public Health
Prevention Research Center
on Nutrition and Physical Activity

Community Partners Meeting
Examples of Current Technology Used for Obesity Research

Physical Activity Measurement

Measure	Description	Strengths	Weaknesses	Costs (estimated as of October 2013)
All Activity Monitors	There are many different activity monitors on the market today. Based on studies comparing activity monitors to "gold standard" measures of energy expenditure, most activity monitors seem to accurately assess physical activity among youth ages 2-18 years.	• Provide a more accurate picture of activity levels compared with self-report • Minimal burden on participant • Minimal staff resources required to collect activity monitor data	• Unable to detect certain forms of activity, depending on wear location • Devices dependent on specific software are less accessible • Technology changes rapidly	• More features = higher cost • More software and support = higher cost
Accelerometer	Accelerometers track movement in up to three dimensions and record acceleration, or speed and direction of movement over time, in pre-determined intervals	• Capture patterns of activity (frequency, intensity, and duration of activity) • Can detect activity in small time-stamped windows • Provide flexibility in analyzing data different ways • Body size does not influence counts • Wireless setup and download possible	• Expensive • Data management & analysis require expertise & labor • Outputs device-specific units (i.e., intensity counts) that need to be calibrated with meaningful units for interpretation	• Actigraph wGT3X+: $249/monitor + $8/USB cable + $1,295/ ActiLife software license www.actigraphcorp.com • FitLinxx Pebble: $36/monitor + $9/USB link + $715/online software account www.fitlinxx.net
Pedometer	Pedometers track movement in one dimension (up and down) and record accumulated steps taken.	• Inexpensive • Useful for capturing volume of activity performed (i.e., steps) • Outputs well-understood units (i.e., steps) for easy interpretation • Models with open display screen may motivate behavior change	• Cannot assess frequency, intensity, or duration • Body size and movement speed influence step counts • Not all models have data storage capacity	• Omron HJ-322U: $45/monitor + Free online software omronhealthcare.com/home-products/fitness • Accusplit AE120XL: $25/monitor www.accusplit.com

HPRC Projects Using Technology in Physical Activity Measurement, and Additional References

Out of School Nutrition and Physical Activity Initiative (OSNAP): http://www.hsph.harvard.edu/prc/projects/osnap/

Active School Day: http://www.hsph.harvard.edu/prc/projects/active-school-day/

YMCA-Harvard Afterschool Food and Fitness Project: http://www.hsph.harvard.edu/prc/projects/ymca-harvard-after-school-food-and-fitness/

Long MW, Sobol AM, Cradock AL, Subramanian SV, Blendon RJ, Gortmaker SL. School-day and overall physical activity among youth. Am J Prev Med. 2013 Aug;45(2):150-7.

Gortmaker SL, Lee R, Cradock AL, Sobol AM, Duncan DT, Wang YC. Disparities in youth physical activity in the United States: 2003-2006. Med Sci Sports Exerc. 2012 May 44(5):888-93.

Bassett DR. Device-based monitoring in physical activity and public health research. Physiol Meas. 2012 Nov;33(11):1769-83.

De Vries SI, Van Hirtum HW, Bakker I, Hopman-Rock M, Hirasing RA, Van Mechelen W. Validity and reproducibility of motion sensors in youth: a systematic update. Med Sci Sports Exerc. 2009 Apr;41(4):818-27.

Harvard School of Public Health
Prevention Research Center
on Nutrition and Physical Activity

Community Partners Meeting
Examples of Current Technology Used for Obesity Research

Diet Measurement

Measure	Description	Strengths	Weaknesses	Costs (estimated as of October 2013)
All Photography	Photography is increasingly used as a diet measurement tool, in comparison with recall, record, or direct observation of eating occasions. The plate waste photography method has shown to accurately assess children's setting-specific dietary intake, and other methods need further investigation.	• Improves on accuracy of recall, which is poor among children • Potential to link directly to large databases of food and beverage information for off-site data analysis	• Battery life may be limited • Participant-initiated photography may lack completeness • Observer-initiated photography requires outside resources • Automated photography is expensive and not easily scalable	• No added device cost if using mobile phone • Labor cost of photograph processing & image assessment
Plate Waste Photography	Trained observers take photographs of meals before and after consumption and later assess (off-site) the proportion of each food and beverage item consumed.	• Useful for measuring intake in groups and specific settings outside the home • Minimal burden on participant • Inexpensive	• Not optimal for capturing total daily dietary intake	• For labor associated with assessing plate waste: $0.59/observation of one plate • Assumes observer uses pre-existing mobile phone to take photographs
Mobile Phone Food Record	Similar to traditional food records, individuals record each food and beverage consumed throughout the day, except written records are replaced with photographic records.	• Useful for measuring total daily dietary intake • Inexpensive • Accessible given the abundance of mobile phones	• Relies on participant to take photos, so greater chance for gaps in data • Privacy concerns if other people are in view • Participant may not be trained to capture appropriate view of food	• Depends on how automated vs. manual photograph processing is • Assumes participant uses pre-existing mobile phone to take photographs
Wearable Camera	Wearable cameras, which are clipped to clothing or worn on a lanyard around the neck, automatically take photographs at regular intervals throughout the day to capture a person's surroundings.	• Useful for measuring total daily dietary intake • Minimal burden on participant • Automated, no training required	• Expensive, may not be feasible for assessment among large groups • Privacy concerns if other people are in view	• Depends on how automated vs. manual photograph processing is • Narrative Clip: $279/ device getnarrative.com

HPRC Projects Using Technology in Diet Measurement, and Additional References

Out of School Nutrition and Physical Activity Initiative (OSNAP): http://www.hsph.harvard.edu/prc/projects/osnap/

Nutrition and Obesity Policy Research and Evaluation Network (NOPREN): http://www.hsph.harvard.edu/prc/projects/nopren/

Doherty AR, Hodges SE, King AC, Smeaton AF, Berry E, Moulin CJ, et al. Wearable cameras in health: the state of the art and future possibilities. Am J Prev Med. 2013 Mar;44(3):320-3.

Illner AK, Freisling H, Boeing H, Huybrechts I, Crispim SP, Slimani N. Review and evaluation of innovative technologies for measuring diet in nutritional epidemiology. Int J Epidemiol. 2012 Aug;41(4):1187-203.