

Can there be a single best measure of reported physical activity?^{1,2}

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Physical activity researchers often face a frustrating question from colleagues. The conversation usually goes something like this: “I am conducting a study What is the best question or questionnaire to assess physical activity?” The equally frustrating, but honest and true, answer for the inquiring colleague is that most scientific reply: “It depends.” The choice of assessment tool depends on factors such as what aspect of physical activity the researcher wants to measure, characteristics of the target population such as age and sex, and whether the data will be used to describe groups or individuals.

In this issue of the Journal, the article by Corder et al (1) shows how measures of questionnaire validity can depend on these factors. The authors compared 4 questionnaires with 2 objective measures: 1) physical activity energy expenditure (PAEE), based on doubly labeled water (DLW), and 2) time in moderate- and vigorous-intensity physical activity (MVPA), based on accelerometer measures. Comparisons were made in 3 groups of young persons (ages 4–5, 12–13, and 16–17 y). Examinations of questionnaire effect between age groups and age group effect for one questionnaire were possible because of assignment of questionnaires across the age groups.

Briefly, the strength and statistical significance of correlation between questionnaire and objective measure varied by questionnaire, criterion (PAEE or MVPA), and age (1). Sex also may have been a factor, because the groups aged 12–13 y and 16–17 y had quite different proportions of boys and girls. Beyond correlations, direction and magnitude of error estimations also depended on questionnaire, age group, and the accelerometer threshold used to indicate moderate-intensity physical activity. One consistent finding was that all questionnaires underestimated PAEE, but the difference from DLW was not always significant. Corder et al (1) highlight an important observation from the error estimation that is often overlooked. Even instruments that had reasonable correlation with an objective measure and, on average, no significant bias showed such large error that the instrument would be useless for making individual-level estimates of PAEE or MVPA. Individual-level estimates are used to track participants in an intervention or to associate personal attributes or physiologic outcomes with physical activity level.

The work of Corder et al represents progress in our understanding of the characteristics of self-reported physical activity among young people. Sallis and Saelens (2) evaluated the state of reported physical activity instruments used in published

studies in the 1990s. They found that among 8 questionnaires that were solely self-report (no interview or proxy report) and compared with an objective measure, none was evaluated in more than one study, and only 3 were evaluated against more than one objective measure (eg, accelerometer and heart rate) within a study. Corder et al (1) have moved the physical activity assessment field forward by applying multiple criterion measures and by evaluating the same instrument in more than one population. Their findings are cautionary, however, because they show that validation in one group may not generalize to others. Furthermore, a questionnaire that correlates reasonably well with one criterion measure may not be correlated with another, even if related, measure.

The Corder et al (1) study also highlights that challenges remain with the objective so-called criterion methods. The authors state that the choice between 2 accelerometer thresholds did not materially affect their outcomes, but this observation was true only for level of correlation. In several cases, the mean bias switched direction. The need to apply energy expenditure values from the Compendium of Physical Activities (3), which was designed to be used for adults, was another methodologic challenge. The authors corrected for the age mismatch to some extent by using a more age-appropriate estimate of resting energy expenditure. A recent publication presents a Compendium of Energy Expenditures for Youth (4). However, only 35% of the values in the youth compendium are derived from data measured in young persons. Other values are extrapolated from the adult data. Energy expenditure studies in young persons are needed, particularly given the focus on youth obesity.

It is not uncommon for researchers to refer to a questionnaire that has been correlated with an objective measure as “validated.” However, Patterson (5) points out that establishing correlation with an objective measure is not really criterion-related evidence of validity. Rather, a single correlation provides one piece of evidence toward establishing the validity of measuring the construct of physical activity. She summarized the

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First published online January 28, 2009; doi: 10.3945/ajcn.2008.27461.

multistep process of developing an instrument to measure an underlying construct such as physical activity (5). Physical activity is a complex construct, encompassing different dimensions, such as PAEE or MVPA; different contexts such as occupation, transportation, exercise, and daily activities; and different types of activity, such as aerobic, muscle strengthening, and balance improvement.

Given the complexity of the construct and the variety of applications for measures of physical activity in surveillance, epidemiology, clinical, and intervention research, a single, comprehensive best measure of reported physical activity may not be achievable. It is clear that continued methodologic research is needed, and efforts such as the National Institutes of Health (NIH) program announcement, Improving Diet and Physical Activity Assessment (6, 7), and projects funded by the Exposure Biology Program of the NIH's recent Genes, Environment, and Health Initiative (8) seek to stimulate this type of research. Progress is being made with approaches that combine objective measures, such as accelerometers, geographic location sensors, and heart rate monitoring with self-report of context and purpose, sometimes reported in real time. As researchers await affordable technological advances to measure physical activity, 2 improvements can be made in the use of self-report instruments. The first is to remember that "It depends." The choice of assessment instrument depends on what aspect of physical activity the researcher wants to measure, characteristics of the target population, and whether the data will be used to describe groups or individuals. The second improvement would be to

refer to the measures based on self-report instruments as "reported physical activity" to help us keep in mind that what is reported may not precisely and accurately reflect the behavior being sought.

The author had no conflict of interest associated with this editorial.

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