Commentary: Measuring physical activity in Sub-Saharan Africa

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Many have speculated that the rising incidence of non-communicable diseases in developing countries is, in part, attributable to changes to population physical activity patterns. However, the evidence supporting such assertions is relatively weak, largely because physical activity is a difficult behaviour to characterize in epidemiological studies. The increasing interest in attempting to assess it better has led to a proliferation of reports of the development and evaluation of physical activity questionnaires. Almost all of these questionnaires have been developed for use in developed countries and their transfer to different cultural settings may not be appropriate. The report by Sobngwi et al. in this issue of the International Journal of Epidemiology, in which a questionnaire was designed specifically for use in Sub-Saharan Africa, is therefore to be welcomed as an effort to develop an instrument for measuring this important exposure in a part of the world where changes in population energy expenditure could be having far reaching effects on disease patterns.

Like many other groups, Sobngwi et al. find that their questionnaire has high retest reliability. Reliability is rarely a problem with physical activity questionnaires and the main issues usually concern validity. The difficulty in these studies is the selection of the measurement method that is to be used as the comparison or gold standard. Physical activity is a multi-dimensional exposure. If the interest in a particular study were in assessing energy expenditure, for example, then ideally the comparison instrument should independently and accurately assess this particular sub-dimension. Selecting a comparison instrument which assesses a different but related dimension, such as aerobic fitness, may give rise to spurious validity and may eventually make it difficult to interpret the results of studies that use that questionnaire. Previous validation studies have also run into problems when they have used subjective physical activity diaries to validate questionnaires. They may have claimed to have demonstrated validity when in reality they have shown correlated error. Unfortunately the best method for measuring energy expenditure in free-living individuals, the doubly labelled water technique, is extremely expensive and has only been used in few studies even in the developed world. The next best thing then is a method which is objective and which has itself been compared to the optimal methods. Sobngwi et al. elected to employ heart rate monitoring and movement sensing as the comparison methods, a decision which makes the field work much harder but which has the potential for producing more robust results.

It has long been known that heart rate and energy expenditure are positively related and many groups have investigated different approaches to using heart rate as a measure of physical activity. Heart rate monitoring is most accurate when an individual calibration is made of the relationship between heart rate and energy expenditure at rest and increasing workloads. This method has a high correlation (>0.9) with doubly labelled water or whole body calorimetry. However, the individual calibration that is required is time consuming, taking at least one hour per person and the equipment necessary to undertake the respiratory gas analysis during exercise is not available in all centres. It may be possible to predict the individual parameters needed to convert heart rate to energy expenditure, an advance that would open up heart rate monitoring to less specialized groups. Other advances in heart rate monitoring are likely to include its combination with simultaneous movement sensing which should improve precision. This method has considerable potential not only as a validation instrument for evaluating questionnaires, but also as an epidemiological tool in its own right. Even though Sobngwi et al. were unable to undertake the individual calibration necessary to use heart rate monitoring to its fullest extent, the results using heart rate alone plus movement sensing are encouraging.

The questionnaire that they devised asks about the frequency and duration of specific activities that have been undertaken. In order to convert these different activities into a common currency, it is customary to multiply the participation time for these activities by their intensity. These are usually taken from published compendia which list the energy cost of activities relative to the energy cost of resting. The resulting MET (metabolic equivalent) scores vary, for example, from 2.0 for playing a musical instrument such as the flute, through 4.0 for walking briskly on the level at 3.5 miles an hour, to 12.0 for playing squash. The source data for these scores is often small studies in selected individuals and it is uncertain whether they are generalizable to all individuals who undertake that activity within a given population. Not all people who play squash, for example, expend the same amount of energy; intensity being a function of the competitive level at which the game is played, age and enthusiasm. It is also unclear whether these MET scores can be transferred to other populations. Is the energy cost of ‘light farming’ in Sub-Saharan Africa the same as that in the US? Although refinements can be made to the compendia, including greater specificity about types of activity, the problems of attributing an average energy cost to all individuals, irrespective of their particular circumstances, is a major limitation of using questionnaires to measure and compare physical activity between cultural groups. Efforts to derive internationally standardized questionnaires such as the International Physical Activity...
Questionnaire (IPAQ) initiative are important, but require equivalent validation and reliability studies in all countries which intend to use the instrument. The difficulties of achieving the goal of an internationally accepted questionnaire may eventually make it necessary to employ objective and quantitative methods such as heart rate monitoring with individual calibration in studies which seek to compare energy expenditure between different cultural groups.

References