Using the right questionnaire is a crucial step in understanding the connections between physical activity and health

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Physical activity can protect against coronary heart diseases and cancers with the greatest benefits occurring among subjects who are moderately active compared to sedentary people. This is probably a result of the current western lifestyle: because most people do not perform sports nor other high intensity activities, most of the potential protection is attributable to the energy expended in moderate intensity activities. Therefore, measuring total energy expenditure and its proportion expended in moderate and high intensity activities may be crucial for understanding the relationship of physical activity to disease and to provide a basis for planning public health intervention. This issue has been recognised since the 1996 Surgeon General's report and has been taken into account by the New York Cancer Project (NYCP) to develop its own questionnaire.

Even though assessment of physical activity is possible through a variety of methods, questionnaires are most suitable for large epidemiologic studies as they require no technical equipment, are less expensive and do not interfere with the subjects' usual activity. Since the pioneering work of Paffenberger et al. (1978), many questionnaires have been proposed to quantify physical activity. They usually aim at ranking individuals in broad categories ranging from sedentary to very active and focus on typical activities that differentiate subgroups rather than reflect total energy expenditure. As a result, they correlate well with heavy intensity activities and treadmill performance but not with low and moderate intensity activities or total energy expenditure.

The design of the NYCP questionnaire was inspired by the one previously used in Geneva, Switzerland (Bernstein et al. 1998). The key criteria in designing these two questionnaires were:First, to increase the accuracy and the precision of the measures, physical activities that were listed in the questionnaire had to be specific to the target population, that is, those actually performed, by the respondents. Second, all moderate intensity activities had to be measured as they may play a major role in mostly sedentary populations. While heavy intensity leisure activities, such as soccer, aerobics, or running, are usually performed on a regular basis and are associated with a well-known nomenclature, light and moderate intensity activities tend to vary more and their nomenclature is less standard (e.g., household chores, handy work, or office work). They must be specifically mentioned in order to be recalled by the subjects. Third, occupational activities and occupational transportation-related activities had to be included in the questionnaire in order not to miss important energy expenditures in some specific groups of the population as, for instance, construction workers, who were found in a Swiss survey to expend most of their energy into occupation activities (Bernstein et al. 1998). Finally, measuring all performed physical activities is essential if the total energy expenditure is the supposed disease protective factor.

The aim of the NYCP work was to develop a physical activity questionnaire, to measure total and activity-specific energy expenditure in subgroups of a multi-ethnic/racial cohort, with special attention to light and moderate intensity activities including household, occupations and occupational transportation-related, and recreational activities. The methodology was very similar to that used in the previous Swiss study and was based on the similarity between physical activity and diet from the perspective of behavioural assessment: quantification of energy intake or expenditure when obtained from questionnaires requires the transformation of numerous items (food or activities) into energy equivalents. Food frequency questionnaires are usually developed by identifying food items which are major sources of energy from population-based 24-hour recalls. This was applied in both the Swiss and the NYCP questionnaires with

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the major sources of energy expenditure being identified by using 24-hour recalls of physical activity.
This approach identified activities which otherwise may have been overlooked as important contributors to energy output. Light and moderate intensity activities were selected when performed by many subjects and for a long duration, such as office work, being seated quietly at home reading or watching television, or food preparation. Moderate activities involving household work and occupations were also selected, as well as the most frequently performed high intensity activities, in order to obtain 95% of the population sex-, site-, and age-specific energy expenditure. When this first list of major contributors to the energy expenditure was established, additional activities were also included if they contributed to 10% or more of an individual's energy expenditure.
The similarity of the results in terms of type and number of activities that were incorporated into the Swiss and the NYCP questionnaires at each step of the selection is striking. For instance, in both studies about 70 activities were necessary to account for 95% of the total energy expenditure of the population. Also, results in both populations show that about one quarter of the respondents did not perform any moderate to high intensity activities (expending at least four times the basal metabolism rate) and three fifths of the respondents did not perform any high intensity activities such as sports (at least six times the basal metabolism rate) (Bernstein et al. 2001). Those few selected activities which were different in each of these studies clearly show that the method allows capture of specific population activities.
As an example, New Yorkers use alternative (non-personal automobile) means of transportation more than other individuals in the US or in Switzerland. Capturing transportation-related physical activity is more complex in this population and required special attention with specific questions identified and selected by the development method; therefore the new questionnaire was specifically designed to measure this specific NYC physical activity.
Overall, the data-based approach applied for the development of the NYCP questionnaire was a crucial step in selecting an comprehensive list of physical activities. The same methodology, based on representative population samples, may be used in other surveys to design improved physical activity questionnaires. The NYCP questionnaire permits the evaluation of total energy expenditure and of the energy expended by performing specific activities, including those of low and moderate intensity. This approach will allow for in-depth investigations of the relation between physical activity and subsequent cancer incidence and may help to identify new means for cancer prevention.

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