

## MEASURING PHYSICAL ACTIVITY IN DEVELOPING COUNTRIES

Many developing countries, including Brazil, are currently undergoing a rapid epidemiological transition towards a Westernised lifestyle. This transition is usually characterised by urbanisation, rural to urban migration, changes in dietary habits substituting more traditional foods with high energy dense fast foods, and physical inactivity. These changes may contribute to a positive energy balance and an increase in the prevalence of overweight, obesity and associated co-morbidities such as cardio-vascular disease and type 2 diabetes. For example, the prevalence of type 2 diabetes is estimated to 5.2% in adults in Brazil in 2003 expected to affect 7 to 8% of the adult population in 2025. These figures are similar to the prevalence values observed in the US and in Canada and higher than in many European countries. This is already a major challenge for the health care systems in terms of costs for treatment (insulin and hypoglycaemic drugs), estimated to about 10,000 US\$ per patient and year. This highlights the need for preventive action including promotion of physical activity as one of the cornerstones to combat the increasing prevalence of overweight, obesity and related metabolic diseases in developing countries.

### **Why should we measure physical activity more precisely?**

Ecological data on car use and number of TV sets in the home may suggest that overall energy expenditure through physical activity has declined in both developed and developing countries. However, physical activity is a complex human behaviour no-

toriously difficult to measure precisely and time trend data on changes in population levels of physical activity are scarce or even absent in developing countries. This suggests the need for incorporating precise measures of physical activity in population based survey systems similar to the use of objective monitoring of activity by accelerometry in the National Health And Nutrition Examination Survey (NHANES) in the US<sup>1</sup>.

There are at least four additional reasons why it is important to increase the measurement precision of physical activity. Firstly, individual level data on accurately measured physical activity is needed to assess the detailed dose-response associations between subcomponents of physical activity with intermediate traits and hard clinical endpoints. Recent studies using objective measurements of physical activity suggest that the totality of activity is associated with intermediate metabolic traits such as glucose intolerance and insulin resistance independent of adiposity both in developed and developing countries<sup>2,3</sup>. Furthermore, total time spent sedentary measured by minute-by-minute heart rate monitoring has recently been suggested to predict insulin resistance independent of time spent at more vigorous intensity activity<sup>4</sup>. These associations required precise measurement of the exposure variable on an individual level and would not been detected by self-reported methods.

Secondly, most individuals are likely to accurately report their amount and intensity of regular exercise such as swimming, jogging or strengthening conditioning exercise in the gym. However, in developing

countries where regular exercise may be less common and where other domains of physical activity, such as occupational activity, domestic activity and transport related activity are more likely to contribute to the totality of physical activity, reporting bias may be even more pronounced compared with developed countries. This is because people from different cultures are likely to apprehend time differently and the intensity and duration of these activities are notoriously difficult to report with a high degree of accuracy, at least compared with more structured exercise.

Thirdly, despite attempts to develop universal self-report instruments for assessing cross-cultural differences in physical activity levels, such as the International Physical Activity Questionnaire and the Global Physical Activity Questionnaire, it is unlikely that these instruments will capture the variability of types and activity levels between populations. This is simply due to the diversity in mode of transport, occupation, sports and other cultural activities between and within countries.

Fourthly, understanding the determinants of physical activity is a prerequisite for effective preventive actions. The individual, organisational, environmental and societal determinants of physical activity are likely different between developed and developing countries. Research is emerging to understand the determinants of activity in developed societies, however little is known about the individual and collective determinants of physical activity in developing countries. Thus, studies examining determinants of

activity using objective methods for quantifying physical activity levels are warranted.

Finally, it seems immensely important to understand the effects of interventions aimed at increasing levels of physical activity in developing populations. From a public health point, two different approaches are available, either shifting the distribution of activity in the whole population or focusing on increasing activity in specific risk groups, for example those with impaired fasting glucose or glucose intolerance. Regardless of approach, accurate measurements of activity before, during and after the intervention are needed to evaluate the effects. It is unlikely that self-report methods are accurate to fulfil this.

#### **Is it possible to measure physical activity objectively in developing countries?**

The field of physical activity epidemiology is moving towards the use of objective monitoring also in relatively large scale (> 1,000 individuals) epidemiological studies. Available options include measurements of body movement by means of accelerometry, measurements of physiological responses to physical activity, for example heart rate or increased body temperature, or a combination of the above. Although these methods have their own limitations, they are substantially more accurate than self-reported physical activity by questionnaires. Further, comparison between studies is facilitated by the use of objective methods. Measurement of physical activity by accelerometry and combined heart rate and movement sensing

was recently successfully implemented in a sub-group of the 1993 Pelotas birth cohort<sup>5</sup>. The compliance was excellent with more than 90% of eligible participants providing valid objective data on physical activity (457 individuals wore the monitor for at least 10 hours per day). Several important strategies were put in place to achieve this. First, data were collected in the participant homes by trained field workers reducing the number of drop outs. Secondly, motorcyclists were used when delivering and collecting activity monitors facilitating a rapid turnover of monitors. Strikingly, no single activity monitor was lost during the data collection. Thirdly, all participants were contacted by telephone during the measurement period ensuring a high compliance with the protocol.

Taken together, the experiences from the Pelotas 1993 birth cohort and similar studies<sup>6</sup> suggest that it is feasible to implement and conduct high quality data collection of objectively measured physical activity also in developing countries.

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