The emerging public-health science of sedentary time: what is the relevance to low and middle income countries?

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With economic development and urbanization, the life settings and behavioural choices of people in low and middle income countries are changing and doing so in a plethora of ways that can be important determinants of their health outcomes. Reduced levels of physical activity, changes from traditional eating patterns to the consumption of manufactured foods and Westernised diets, with consequent weight gain – metabolically-toxic market failures within economic development – are associated with increased risk of type 2 diabetes, cardiovascular disease and breast and colon cancer; and, will result in unaffordable future health-care costs. In this context, too much sitting is emerging as a preventive-health concern.

SEDENTARY VERSUS PHYSICALLY-ACTIVE TIME

For health-related physical activity, we typically consider moderate-to-vigorous activity (MVPA) such as bicycling, swimming, walking, or running, which require an energy expenditure of 3 to 8 METs (METs are, broadly speaking, multiples of the basal metabolic rate – energy expenditure at rest). Light intensity activity activities are behaviours typically done while standing, requiring expenditure of no more than 2.9 METS. The other broad class of determinant of energy expenditure during waking hours involves sedentary behaviours (from the Latin sedere, ‘to sit’) – sitting during commuting, in the workplace and the domestic environment, and during leisure time. Sedentary behaviours are in the energy-expenditure range of 1.0 to 1.5 METs. The Sedentary Behaviour Research Network defines this as any behaviour during waking hours that is characterized by energy expenditure greater than or equal to 1.5 METs, while in a sitting or reclining posture; the term “inactive” should thus be used to describe those who are performing insufficient amounts of MVPA (i.e., not meeting specified physical activity guidelines).

TOO MUCH SITTING AS A NEW PUBLIC HEALTH CONCERN

Prolonged sitting is a health risk distinct from a lack of physical activity or exercise. Findings of the relevant large-scale epidemiological studies have been reviewed elsewhere. For example, in AusDiab (the Australian Diabetes, Obesity and Lifestyle Study – a large national survey on obesity, diabetes and risk factors among adults), high levels of TV viewing time were associated with having the metabolic syndrome and its components (abdominal obesity, in combination with indices of disordered glucose and lipid regulation), with abnormal glucose metabolism and with adverse levels of insulin and blood glucose; with continuous measures of metabolic syndrome components; and, with adverse retinal blood vessel indices associated with development of eye and broader systemic diseases.
participants who wore accelerometers – small electronic devices placed on the hip – for a week showed not only adverse associations of total sedentary time with risk biomarkers, but also a protective role for breaks in sedentary time. This influential 'breaks' finding has been confirmed using a large US population-based data set and in a laboratory experimental model. Mortality outcomes from AusDiab and their implications have also been examined. Six years following the AusDiab baseline assessment, those with higher levels of television viewing time had an increased risk of premature death from all causes and from cardiovascular disease. It was estimated that for every one hour of television viewing after 25 years of age, there is a 22 minute reduction in life expectancy – an effect that is comparable to the estimated impact of obesity on population health.

**ADULTS CAN SIT FOR PROLONGED PERIODS OF TIME**

Recent studies that have employed objective measures of all movement during every minute of waking hours (using accelerometers) have shown that typical adults in the USA and Australia, for example, on average only engage in around 20-30 min of moderate-to-vigorous physical activity, can have up to 10 hours of sedentary (sitting) time and spend the balance of their waking hours in light-intensity activity. Time spent sitting displaces time spent in higher-intensity physical activities – thereby contributing to a reduction in overall energy expenditure. For example, replacing two hours of sitting time with light-intensity activity (2 hours * (2.5 METs - 1.5 METs) = 2.0 MET-hours) would exceed the additional energy-expenditure associated with 30 min of walking that would displace either sitting-time (0.5 hours * (3.5 METs - 1.5 METs) = 1.0 MET-hours) or light intensity-time (0.5 hours * (3.5 METs - 2.5 METs) = 0.5 MET-hours). Thus, two additional hours of sitting each day, in simple energy-expenditure terms, would negate what is achieved by meeting the basic physical activity and health recommendation through walking.

**SEDENTARY TIME VARIES SIGNIFICANTLY BETWEEN COUNTRIES**

Bauman and colleagues have recently reported a study of sitting time in 20 countries. Countries in which adults reported the lowest amount of sitting included Portugal, Brazil, and Colombia (medians of 180 min/day), whereas respondents from Taiwan, Norway, Hong Kong, Saudi Arabia and Japan reported the highest sitting times (medians of 360 min/day). This two-fold variation between countries in what are already high volumes of total sitting time is likely attributable to multiple factors that vary between countries, which might include built-environment attributes; work, family and other social arrangements; cultural practices and preferences; and, other factors. There is some preliminary evidence that the relationships of built environment attributes with sedentary behaviour have consistencies and differences between countries.

**MULTI-COUNTRY INITIATIVES WILL BE CRUCIAL**

Multi-country research initiatives (including the International Physical Activity and the Environment Network project) are now building methods to examine a broad-range of environmental variations that may determine physically-active and
sedentary behaviours. With much of the research on environmental determinants of physical activity and sedentary behaviour having been conducted in the USA, Belgium and Australia, it has become clear that in order to understand how such determinants might operate and to inform the relevant environment and policy initiatives, data from a variety of international sources with broad social, environmental and culturally-related variations will be required.18,19 Important insights into the relevant environmental, economic, social and cultural variations and other factors influencing prolonged sitting time are likely to arise, particularly through findings from low and middle income countries where the population impacts of changes can be documented. These findings have important public-health implications.

REFERENCES