Too Much Sitting: Health Risks of Sedentary Behaviour and Opportunities for Change

Introduction

Large volumes of daily sedentary time—i.e., too much sitting—are an integral element of how humans have adapted to our modern-day physical and social environments. In contemporary societies, we sit not only to pursue most of our serious purposes in life, but also to enjoy the majority of our diversions and recreations. Most obviously, we sit in cars to get to and from our places of work; we sit to do much of our work, particularly when using communication technology that has become integral to so many contemporary occupations; and at home, we sit in front of our television sets and when we use other screen-based entertainment and communication devices. Put simply, most of us are likely to move from chair to chair throughout our daily lives.

We know that regular exercise has numerous health benefits across the adult age range; and we place a high social value on sporting prowess and sport participation. However, a high proportion of adults in the United States and other developed countries do not participate in sport and many do very little walking as they go about their lives. Further, less than half of all adults meet the minimum levels of physical activity recommended for health: accumulating 150 minutes of at least moderate-intensity activity each week or at least 75 minutes per week of vigorous-intensity activity.1,2

Evidence from several large-scale epidemiologic observational studies, together with recent findings from controlled laboratory experiments, are beginning to identify the distinct metabolic and other health-related impacts of excessive sitting time. These relationships are apparent even after accounting for the deleterious consequences that flow from lack of physical activity during leisure time.
For children, research findings have already led to recommendations on avoiding too much screen-based sedentary time. For adults, there is now a rapidly emerging body of evidence on sedentary behaviour and health that is receiving widespread scientific and media attention.

This new evidence does not contradict or downplay the importance of regular participation in moderate-to-vigorous physical activity, which remains the centrepiece of public health and clinical recommendations. Rather, what we are learning about too much sitting—sedentary behaviour—and health, particularly through technological innovations in measurement, is further expanding our understanding of the crucial importance of physical activity for health promotion and disease prevention.

Guidelines for health professionals and advice to the general public are now beginning to address the importance for health of reducing sitting time. However, further evidence is required to inform specific guidelines. For instance:

- Is there a total volume of overall daily sitting time that has the most adverse health consequences?
- How often should we interrupt our sitting?
- Does breaking up prolonged sitting through simply standing provide health benefits?
- Should breaks from sitting include particular types of physical activity for optimal benefits?

Answers to these questions should soon emerge from the applications of advanced measurement methods; from further observational studies; from controlled laboratory studies providing insights into the relevant physiological mechanisms and dose-response relationships; and—importantly—from real-world intervention trials on the feasibility and benefits of sedentary behaviour changes.

**Sedentary Behaviour: A New Term for the Physical Activity and Health Equation**

Sedentary behaviours are defined by both their posture (sitting or reclining), and their low energy expenditure of 1.0 to 1.5 METs (where one MET represents the average resting energy expenditure of a young, healthy adult—i.e., 3.5 ml/kg/min). Importantly, sleep is not considered a sedentary behaviour, due to its physiological restorative functions—only those behaviours occurring during waking hours are considered as being sedentary. In contrast, moderate-to-vigorous physical activity such as brisk walking or running involves an energy expenditure of at least three METs. The physical activity and health field has focused most of its attention on moderate-to-vigorous activities, sometimes characterizing those with no participation at this level as “sedentary.” However, the incorporation of a specific sedentary behaviour focus within physical activity recommendations suggests that the term “sedentary” no longer be used to characterise those who do not engage in the recommended amounts of moderate-to-vigorous activity.

The significance for health of too much sitting is now being acknowledged within the sports medicine and public health constituencies as a concern that is additional to the deleterious health consequences of insufficient physical activity.

For example, the 2011 *Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise* position stand of the American College of Sports Medicine acknowledges that “in addition to exercising regularly, there are health benefits in concurrently reducing total time spent in sedentary pursuits and also by interspersing frequent, short bouts of standing and physical activity between periods of sedentary activity, even in physically active adults.”

From the United Kingdom—the 2011 *Start Active, Stay Active* document proposes guidelines on the volume, duration, frequency, and type of physical activity across the life course needed to achieve broad-based health benefits. Further to the well-accepted advice relating to moderate and vigorous physical activity, the *Start Active, Stay Active* document makes the case for the importance of reducing sedentary behaviour, albeit with the quite general message to “minimise the amount of time spent being sedentary (sitting) for extended periods”—that is intended to be applied across the various age groups from the early years to older adults.

Notably, such recommendations are at this point rather broad, endorsing the importance of reducing sitting time. They do not, however, identify what might be an unsafe or detrimental amount of overall daily sitting time, nor do they specify how frequently sitting time should be broken up nor the type and intensity of activity that would be desirable in doing so.

With sedentary behaviour emerging as an element of the physical activity, public health, and clinical agendas, it is helpful to reflect on what the evidence now tells us and, importantly, what we need to know in the future in order to address too much sitting as a novel target for improving health.
Sitting is ubiquitous in contemporary societies

The increasing use of activity monitors to measure free-living physical activity patterns in large-scale surveillance and epidemiological studies provides a compelling picture of active and sedentary time in populations. In studies using accelerometers (a type of small, unobtrusive, wearable activity monitor typically used in such studies) that capture every minute of activity, it is repeatedly observed that time spent in moderate-to-vigorous intensity physical activity—the intensity at which most public health efforts have been targeting—constitutes only a fraction of daily waking hours. The bulk of time is balanced between light-intensity activities (defined as 1.5 to 2.9 METs and including activities such as gentle walking, incidental movement, and standing: typically 5–6 hours per day), and sedentary time (typically 8–10 hours per day).

To put these volumes of sedentary and physically active time in perspective, consider the activities listed in the table with their MET values, ranging from sedentary to highly vigorous. For the majority of adults in the U.S. and comparable populations, activities of 3.5 METs or more have low—and many have extremely low—frequencies and volumes of participation.

A basic energy-expenditure perspective on sedentary behaviours—putting aside for the moment important nuances of what might be the relevant underlying physiological mechanisms leading to adverse health outcomes—illustrates why “too much sitting” might be of major public health importance. Displacement of two hours per day of light-intensity activity (2.5 METs) by sitting (conservatively, 1.5 METs) could reduce physical activity energy expenditure by about two MET-hours/day, or approximately the level of energy expenditure associated with level walking for 30 minutes (0.5 hours * 3.5 METs = 1.75 MET-hours).

Table 1. Physical Activities of Adults and Their Associated MET Values

<table>
<thead>
<tr>
<th>Activity</th>
<th>MET value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleeping</td>
<td>0.95</td>
</tr>
<tr>
<td>Lying quietly and watching television</td>
<td>1.0</td>
</tr>
<tr>
<td>Sitting quietly and watching television</td>
<td>1.3</td>
</tr>
<tr>
<td>Sitting tasks, light effort (e.g., office work, chemistry lab work, computer work)</td>
<td>1.5</td>
</tr>
<tr>
<td>Standing, talking in person, on the phone or computer</td>
<td>1.8</td>
</tr>
<tr>
<td>Active workstation, treadmill desk, walking</td>
<td>2.3</td>
</tr>
<tr>
<td>Standing tasks, light effort (e.g., bartending, store clerk, attending, filing, duplicating, librarian, etc.)</td>
<td>3.0</td>
</tr>
<tr>
<td>Cleaning, sweeping carpet or floors, general</td>
<td>3.3</td>
</tr>
<tr>
<td>Walking, 3.5 mph, level, brisk, firm surface</td>
<td>4.3</td>
</tr>
<tr>
<td>Mowing lawn, power mower, light or moderate effort</td>
<td>4.5</td>
</tr>
<tr>
<td>Golf, general</td>
<td>4.8</td>
</tr>
<tr>
<td>Shovelling snow by hand, moderate effort</td>
<td>5.3</td>
</tr>
<tr>
<td>Bicycling, 10–11.9 mph, leisure, slow, light effort</td>
<td>6.8</td>
</tr>
<tr>
<td>Running, 5 mph (12 min/mile)</td>
<td>8.3</td>
</tr>
<tr>
<td>Rope skipping, general</td>
<td>11.0</td>
</tr>
</tbody>
</table>

(One MET represents the average resting energy expenditure of a young, healthy adult—i.e., 3.5 ml/kg/min.)

Furthermore, there is also the potential for high sedentary time and being physically active to co-exist (the Active Couch Potato phenomenon). An example would be an office worker who jogs or bikes to and from work, but who then sits all day at a desk and spends several hours watching TV in the evening.

Using actual data on the distribution of time spent physically active and sedentary as determined by a monitoring device in the large, U.S. population-based National Health and Nutrition Examination Survey (NHANES) study, Figure 1 illustrates conceptually the potential importance of sedentary time as a distinct public health problem. While moderate-to-vigorous physical activity is a powerful biological stimulus with established functional and clinical health benefits, levels of participation in the adult population are low, whereas the volume of time spent sedentary is excessively high.

![Figure 1. Daily Time Allocations of Sedentary People](image)

This figure illustrates how the most sedentary individuals in the population allocate their time throughout the day. The data represent U.S. adults who are in the top quartile of sedentary time (using a <100 counts-per-minute cut-point); associated levels of light-intensity activity (100 to 1,951 cut-point); and moderate-to-vigorous intensity activity (1,952+ cut-point). Data are derived from accelerometer measurements in a large population-based sample—the U.S. National Health and Nutrition Examination Survey.

Too much sitting and adverse health outcomes

**Observational Study Evidence**

There is now substantial evidence (from cross-sectional and prospective observational studies) that higher levels of sedentary time are adversely associated with several adverse functional and clinical health outcomes in the general adult population. These include the presence of risk factors for chronic disease such as large waist circumferences; unhealthy levels of blood glucose, insulin, and blood fat; lower measures of physical functioning; and increased risk for mortality from all-causes, cardiovascular disease, and some cancers. Importantly, these detrimental relationships generally remain after accounting for self-reported time spent in moderate-to-vigorous leisure-time physical activity.

Detrimental associations of too much sitting are observed even in those meeting physical activity recommendations. For example, data from over 240,000 adults in the NIH-AARP Diet and Health Study showed that, even among those reporting high levels of
MVPA (>7 hours/week), watching television for seven or more hours per day was associated with a 50% greater risk of all-cause mortality and double the risk of cardiovascular mortality compared to those who watch <1 hour/day of television. Described as the “active couch potatoes,” findings from this active subgroup of adults—traditionally considered at low risk for poor health outcomes—underscore the need to educate clinicians and the public about the adverse consequences of too much sitting.

The detailed findings of these large-scale epidemiological studies have been reviewed elsewhere, but findings from our program of work in Australia are illustrative of the range of health outcomes that have been adversely linked to greater time spent in sedentary behaviours. In AusDiab (the Australian Diabetes, Obesity, and Lifestyle Study—a large national survey on obesity, diabetes, and risk factors among adults), high levels of television 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 certain eye diseases.

Further, among participants in the AusDiab study during the six years following the baseline assessment, we observed that higher levels of television 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 certain eye diseases.

A sub-study of AusDiab participants who wore accelerometers for a week showed detrimental associations with blood sugars, blood fats, and body composition when sedentary time across the whole day was measured. In contrast, light-intensity activity and frequent breaks from sedentary time appeared to be protective against several of the metabolic risk factors that were identified in the television viewing time studies. These findings were followed by work with data from the U.S. National Health and Nutrition Examination Survey (NHANES, 2003–2006), which showed that adults in the lowest quartile of breaks in sedentary time had, on average, a waist circumference 4.1 cm higher compared to those in the highest quartile of breaks (99.2 cm vs. 95.1 cm)—regardless of their total sedentary time.

Observational study evidence is particularly needed on the role of sedentary time in the health and functional capacities of older adults and among those with movement disabilities. There is evidence that among older adults, there are clear adverse cardio-metabolic correlates of sedentary time. Furthermore, there is a strong case—but as yet limited evidence—that there will be significant potential health benefits from addressing sedentary time among those with movement disabilities.

These observational study findings on the apparent metabolic and clinical benefits of breaking up prolonged sedentary time (and conversely, the detrimental health impact of prolonged, unbroken sedentary time) have important potential implications for public health and preventive medicine strategies to control the population burden of morbidity and mortality from several prominent chronic diseases. However, whether those relationships are likely to be causal in nature cannot be determined by observational study methodologies. This evidence has provided the impetus for experimental models to examine whether deliberate introduction of breaks in sedentary time would show beneficial metabolic changes.

**Experimental Evidence**

In a small number of recent experimental studies, some acute impacts of sitting time have been identified.

The metabolic effects of one day of predominantly sitting (16.9 hours sitting; 0.2 hours standing; 0.1 hours stepping) were compared to a day of minimal sitting (5.8 hours sitting; 9.8 hours standing; 2.2 hours stepping ≤5 km/hr) in 14 fit and healthy young men and women. The high sitting condition led to significant deleterious alterations in whole-body insulin sensitivity compared to the minimal sitting condition. The findings of this study suggest that for young healthy adults, maintaining daily low-intensity activities like standing and regular short bouts of ambulation may be important activity-related behaviours for minimising the likely harmful metabolic effects of high volumes of sitting throughout the day.

Our recent observational-study findings showing beneficial health associations with breaking up sedentary time has informed the development and implementation of an experimental study with 19 middle-aged (45–65 years), overweight (mean BMI 31.2, SD 4.1 kg.m⁻²) adults in the Baker IDI Heart and Diabetes Institute laboratories. In a cross-over design, we examined the effects of uninterrupted sitting on plasma glucose and serum insulin, compared with sitting interrupted by short, 2-minute bouts of activity (light to moderate intensity treadmill walking). Study participants (who had normal glycemia at baseline) completed three different trial conditions over a 7-hour period:

(i) uninterrupted sitting;

(ii) sitting interrupted by light-intensity treadmill walking (3.2 km/hr on level surface, equivalent to approximately 2.5 METs) for 2 minutes every 20 minutes during the last 5 hours; and
(iii) sitting interrupted by moderate-intensity treadmill walking (5.8–6.4 km/hr on level surface, equivalent to approximately 3.3 METs) for 2 minutes every 20 minutes during the last 5 hours.

For all three conditions, participants’ postprandial glucose and insulin levels were assessed over the 5 hours after they had consumed a standardised test drink (200 mL with 75 grams of carbohydrate and 50 grams of fat). Compared to uninterrupted sitting, blood glucose was reduced after both activity-break conditions (light-intensity walking: 24% reduction; moderate intensity walking: 30% reduction). Similarly, insulin was reduced by 23% after both the light and moderate intensity activity-break condition compared to uninterrupted sitting. Notably, there were no statistically significant differences between the two activity conditions, suggesting that brief interruptions to sitting can lead to significant reductions in glucose and insulin—irrespective of activity intensity. These favourable attenuations in glucose and insulin levels in the activity-break conditions suggests the likely importance of briefly breaking up sitting time with activity of at least light intensity.33

Understanding the biological mechanisms underlying the associations observed between sitting and adverse health outcomes is a research priority. Findings from animal studies have suggested that minimised local muscle contractile activity leads to both the suppression of skeletal muscle lipoprotein lipase (LPA) activity (which is necessary for the uptake of the constituents of triglyceride-rich lipoproteins by skeletal muscle and the production of key substrates for the maturation of HDL particles).15,16,34 Further understanding of how these mechanisms operate—and the other biological systems through which sitting may lead to adverse health outcomes—are fertile areas for future research.

The experimental science of sedentary behaviour needs also to progress to “real-world” intervention studies conducted in settings targeting the feasibility, acceptability, and efficacy of reducing and breaking up occupational, transit, and domestic sedentary time. Project STAND (Sedentary Time And Diabetes)35 is one such example—a randomised controlled trial which aims to reduce sedentary behaviour in younger (18–40 years) overweight and obese adults. The results of the study, expected in upcoming years, will help to inform future public health initiatives addressing the problem of excessive sitting in these rapidly expanding high risk populations.

**Future Sedentary Behaviour Initiatives: Translating Knowledge into Practice**

We have summarized above compelling emerging evidence that suggests a need to further develop the scientific understanding of the health consequences of sedentary behaviour, as well as targeted strategies to reduce sedentary time and to promote increased physical activity levels as part of current public health and clinical medicine guidelines. In particular, we need standardized measurement methods and quantitative definitions of sedentary behaviour time in order to systematically understand dose-response relationships with functional, metabolic, and clinical health outcomes, in the general adult population as well as in population subgroups that may be particularly susceptible to the effects of excessive sedentary time (e.g., older adults, postmenopausal women, those in lower socioeconomic groups, those with existing functional limitations), and the complex mechanisms through which prolonged sitting time exerts deleterious influences on the relevant body systems.

The translation of this new evolving knowledge into relevant clinical and public health initiatives requires a comprehensive strategic perspective on sedentary behaviour research and its applications. As we have discussed elsewhere, the behavioural epidemiology framework can provide such a perspective.28,29 In the practical context of translating concepts and evidence from sedentary behaviour research, Figure 2 identifies the relevant elements and their interrelationships. While there is a logical sequence of building evidence in these apparently sequential phases, they should not be thought of as fixed and sequential steps. For example, measurement development studies will do much to inform epidemiological research identifying the health impacts of sedentary behaviour; and, as policy and programmatic initiatives develop, research in all of the earlier phases will tend to be responsive to the new context that is thus provided.36,37
Within this perspective, one of the most dynamic and scientifically exciting elements of the sedentary behaviour and health research agenda involves the ongoing refinement of the relevant behavioural targets. Research on sedentary behaviour will be significantly enhanced over the next several years through advances in measurement and the use of new and more precise indices of sedentary time in epidemiological and health behaviour studies. Underpinning this research is the continued development and refinement of device-based and self-report measurement tools appropriate for particular research questions. These measures, together with further improvements in self-report methodologies, will be a strong basis for future national and state-level population-surveillance studies, providing invaluable information on the prevalence and variations in sedentary behaviours in different social, occupational, and health-status groups.

The resultant evidence will lead to the identification of what are the most relevant aspects of sedentary behaviour to try to change in future intervention trials. These might include: overall sedentary time; sedentary time spent in particular contexts or for particular purposes; bouts of sedentary time of specified durations; or interruptions to sedentary time that are of different activity intensities.

Understanding the Contextual Determinants of Adults’ Sedentary Behaviours

Mapping the importance for health outcomes of sedentary behaviour and identifying what individual-level and environmental-level characteristics need to change, plus high-quality information on population prevalence, trends, and variations in sedentary behaviour and its determinants are fundamental to developing practical strategies to reduce sedentary time. In addition, the behavioural epidemiology framework (Figure 2) points to the further evidence—understanding the determinants of sedentary behaviour in different contexts and developing and testing the relevant interventions—that will be required to inform practical initiatives and public health policy.

For the generic class of behaviour described as “sedentary,” there are particular sedentary behaviours in different settings: television viewing and other screen time in domestic environments; jobs that require high volumes of sitting in occupational environments (which increasingly are screen-based); and excessive sitting time in transportation, particularly using automobiles for commuting to and from work. Time spent sitting in these behaviour settings will have distinct determinants shaped by the attributes of the settings in which they occur and the social frame around such settings, each of which need to be considered when developing effective targeted intervention strategies to reduce overall sitting time.
Compare a person who lives in a suburban residential development to a person living in an older, mixed-use neighborhood near a city centre. Their day-to-day behaviour patterns can be very different. For example, the resident of the suburbs is more likely to spend long periods of time sitting in a car (to get to and from work, for family excursions, and for errands), whereas the inner-urban resident typically has many more options to choose from, including walking or bicycling to get to and from places. Where there are fewer local amenities within walking distance, it may be more likely that residents will spend more time indoors and more time watching television.

Within a comprehensive ecological perspective on the determinants of sedentary behaviours, under certain circumstances there are not only key roles for individual motivations and preferences, but also the family and broader social circumstances. Furthermore, the normative climate of neighborhood and social networks, the public and private resources available, and potentially many other factors will also be important elements which influence sedentary behaviours.

This perspective builds on the case from physical activity research—that it is not feasible to identify determinants of the generic class of behaviour encompassing exercising or being physically active. Rather, the focus should be on particular physical activity behaviours in particular contexts: for example, walking for recreation or exercise in local community green spaces; or walking for transport in relation to local street networks and destinations. This guiding principle will serve well in sedentary behaviour research and in the practical applications of its findings.

What Might Interventions to Reduce Adults’ Sedentary Behaviour Look Like in Real-World Practice?

Interventions to reduce sedentary time are likely to be different from those aimed at increasing physical activity. For employed adults, the workplace is a highly relevant context on which to focus, particularly given that work days are associated with less standing and more sitting than are leisure days; and occupational sedentary time has been linked to an increased risk of type 2 diabetes and premature mortality. However, little is known as yet about the effectiveness of workplace interventions for reducing sedentary time.

Two recent studies provide promising preliminary evidence on the feasibility of changing adults’ non-work sedentary time. TView, an intervention trial conducted in the United States, focused on reducing TV viewing time through a three-week program using an electronic TV lock-out system with 36 overweight and obese adults. There was a 61% reduction in TV viewing time among participants in the intervention group, who also reduced their measured total sedentary time by 3.8% compared to those in the control group. Stand Up For Your Health, an intervention trial conducted in Australia, took a whole-of-day approach to reduce and interrupt sedentary time, targeting TV time as well as other sedentary behaviours such as time sitting and reading or talking on the telephone. The intervention was conducted over two weeks with older adults, using a face-to-face goal-setting consultation and one tailored mailing; it resulted in reduction in accelerometer-derived measures of sedentary time of 3.2%. Both TView and Stand Up For Your Health were brief interventions that successfully reduced sedentary time. Their encouraging findings provide useful information to inform the development of future initiatives aiming to reduce adults’ sedentary time.

Although at this stage there is only modest evidence from these intervention trials, the broader body of available research findings does suggest some practical approaches to reducing sedentary time. Consistent with an ecological perspective on the determinants of sedentary behaviours, interventions would focus on particular settings: for example, sitting in the domestic environment or the workplace. The primary goals of such interventions would be to reduce total sedentary time and also to increase the number of breaks in sedentary time.

Key messages for interventions, consistent with the epidemiological evidence that we have described above, might be to limit discretionary sitting time (for example, when watching TV or using a computer) to no more than two or three hours each day and to stand up and move at least every 30 minutes. Reductions in...
sedentary time are most likely to be achieved primarily through
the substitution of light-intensity activities, such as standing and
gentle walking.57

Broad-reach approaches and environmental and policy initiatives
are soon likely to become part of the sedentary behaviour and
health agenda. It may be that the future mass media health-
promotion campaigns will routinely and explicitly include
messages about reducing sitting time in the home, workplace, and
other environments.

In the workplace, there is already active marketing of innovative
technologies (such as height-adjustable desks) that will act to
reduce sitting time.58 This is likely to increase as evidence
accumulates on the health benefits of reducing sitting time.
Potentially, community entertainment venues could provide some
non-sitting alternatives. As the evidence on the health impacts of
sitting time and a better understanding of its behavioural
dimensions accumulates, and subsequently, such innovations are
more broadly implemented, systematic evaluations of these
“natural experiments” could be highly informative, especially
through assessing whether changes in sedentary time actually
do result.53,56

There are also potential clinical implications of the newly
emerging evidence on sedentary behaviour and health.31 For
clinical settings and for broader healthcare practice, it may be a
feasible option to advise patients on reducing their sitting time
and increasing their routine light-intensity activities as a basis for
increasing other aspects of physical activity. This new perspective
is something that should be viewed not as an alternative to the
well-recognised benefits of participation in health-enhancing
moderate- to vigorous-intensity physical activity, but as a way of
providing further beneficial options within the overall physical
activity and health agenda.

Summary

Working with sedentary behaviour as a new term within the
physical activity and health equation requires a cautious and
thoughtful approach to relevant evidence and integrating it into
practice. Reducing and breaking up the sitting time that
characterises the lives of so many people is likely to be beneficial
and is unlikely to do harm, if approached with the appropriate
professional and clinical prudence.

New evidence linking excessive sitting time with significant
compromises to cardiometabolic health indicates that even in
physically active adults, concurrent reductions in the amount of
time spent sitting is likely to confer health benefits. At present, no
definitive recommendations can be made on how long adults
should sit for or how often they should break up their sitting time.
More experimental evidence is needed to clarify underlying
biological mechanisms and dose-response relationships, so as to
inform specific guidelines and advice that can be given to patients
and the general population.

To encapsulate the practical implications of the findings that we
have described above and perspectives that we suggest are likely
to be helpful at this stage, a simple message of “Stand Up, Sit Less,
Move More, More Often” would seem to be appropriate and
helpful.59 We would further suggest that advice can be given with
reasonable confidence, in order to encourage adults to create
opportunities to limit their sitting time while at home, at work,
and during transportation and to break up sitting time through
frequent transitions from sitting to standing and ambulating
throughout the day.

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