# Health-Chair Reform

## Your Chair: Comfortable but Deadly

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In the 1 h before work, a person can use more than 50 labor devices. At work, between logging-on to logging-off, a person can remain nearly continuously in their chair. At the end of the work-day, if the home is the castle, the chair is its throne. From their throne, a person can order food, purchase a car, find a new life-partner, and play war; all this—and more—without ever getting up. With creativity, a person can eat, work, reproduce, play, shop, and sleep without taking a step.

The articles in this issue of *Diabetes* by Højbjerre et al. (1), Katzmarzyk (2), and Franks (3), plus a growing body of evidence suggest that chair-living is lethal. Of concern is that for most people in the developed world, chair-living is the norm.

The consequences of modern chair-dependency are substantial. The data summarized by Katzmarzyk suggest that chair-dependency is linked to cardiovascular disease, metabolic sequelae, excess weight, and shorter life span. Other authorities stress deleterious psychological and psychosocial effects as well (4,5).

The consequences of chair-dependency, however, extend beyond human health. Chair-living has been associated with the increased sales of automobiles, machines of convenience (e.g., dishwashers), and the ubiquitous prevalence of computers and televisions at work and at home (6). These factors, in turn, have had deleterious impact on fuel use, global warming, and the depletion of human resources. Corn crops are used to fuel cars rather than feed people (7). Neighborhoods are designed without walkways (8). Motorized walking belts are commonplace and escalators are everywhere (9). Modernity has imposed a Chair Sentence; work, home, and play are the shackles.

In an evolutionary context, Katzmarzyk and Franks suggest that the human evolved over several million years to be bipedal and ambulatory. This time frame is consistent with the genetic and epigenetic design of the human physique and organ systems. Neuro-behaviorists would argue that the human brain and behavior evolved in concert (10). The human evolved to competitively flourish while upright with respect to providing food (agriculture and hunting), shelter (home building), and tool design (e.g., flint knives) (11). The human evolved to feed, shelter, and invent while ambulatory. The human, simply put, was not designed to sit all day.

That said, if logic suggests a biological evolutionary role for ambulation, it is difficult to dismiss a biological function for sitting (12). Here, it is reasonable to argue that energy conservancy is at play. Hunting and threshing may be highly exothermic but resting, while seated, is almost as energy efficient as lying down. While sitting, though, a person can be vigilant of their surroundings. Detailed analysis of agricultural work demonstrates periodicity of exothermic and restful tasks (13). Sitting is not bad for you in moderation, but in excess it is addictive and harmful.

The Chair Sentence is likely to have been imposed over three temporal phases (14). The first phase was the Neolithic transition, 10,000 years ago, from hunter-gather to agriculturalist. The second phase was the last two centuries, which saw the effects of the Industrial Revolution. The third phase covered the last 30 years, which have been impacted by technological advances, particularly with respect to electronic engineering and computer sciences. In the developed world, with urbanization and the geographic centralization of work, economic productivity per person has increased along with enhanced food, shelter, and infant security. This societal change occurred faster than physical and maybe psychological adaptation could. But once enticed to the chair, we were stuck. Work and home alike: we do it sitting.

Chair-living is not without potential solutions. Katzmarzyk suggests that the exercisers of the last 60 years have identified one solution: moderate and high-intensity exercise. The more of it, the better; it promotes health for those that do it. The problem is, however, that people, especially those prone to be inactive with obesity, do not exercise regularly. Moreover, human and animal data suggest that repeated frequent bouts of low-intensity meandering-style activity may be more health-beneficial than occasional bouts at the gym and that a primary risk of ill health is sitting time per se (15). A pharmacological solution is a possibility as well; for example, there could be population-wide deployment of medications to mitigate the ill effects of day-long sitting. Current embodiments of the metabolic polypill are close to this (16). From early school onwards, the biological adaptation needed to accommodate to chair-living could be met using life-long medication. Most efficiently, such medications could be infused into the water such as occurs with fluoride supplementation. A third arena for consideration in combating the Chair Sentence might be, based on Franks' review, epigenetic modification of the obesity-prone fetus.

In conclusion, the physical, mental, societal, and environmental sequelae of the modern Chair Sentence have broad-based implications. There are solutions to chair-associated ill health that range from population-wide gym

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**See accompanying articles, pp. 2717, 2732, and 2790.**

attendance, pharmacological administration, or genetic manipulation. Alternatively, people could get up.

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