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Opinion

# The burden of prolonged sedentary behavior imposed by uberization

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A B S T R A C T

Mobility applications are rapidly growing in cities worldwide due to their convenience and low cost. Mobility applications drivers experience vast flexibility in work hours, often work longer than in fixed-hours jobs, and can constantly transport passengers in their vehicles for up to 12 h; after this, they must go offline for eight consecutive hours before driving again. Nonetheless, drivers have found an easy way around this limitation by switching to other apps and continuing driving. This burden of prolonged work can increase sedentary behavior among mobility applications drivers. Sedentary behavior is any waking activity in which the individual expends 1.5 metabolic equivalents (METs) or less while sitting or reclining. This behavior can increase the risk of detrimental effects on health. In this opinion article, we aim to discuss the possible effects of the burden of prolonged work on the sedentary behavior of mobility applications drivers and propose possible strategies to face this concerning situation.

## Mobility apps and "uberization"

Mobility applications (apps) are rapidly growing in cities worldwide due to their convenience and low cost. For example, in April 2016, Uber (the leading transport company by application) operated in more than 60 countries and 400 cities worldwide.[1] Mobility apps model is based on the supply and demand of passenger transport. With increased demand, the cost of a journey increases, which in turn encourages more drivers to become available.[1] Furthermore, mobility app drivers experience vast flexibility in work hours and often work longer than in fixed-hours jobs.[2]

Although those apps provide flexibility and freedom to their drivers, they also have significant downsides. Some studies showed that the drivers work longer than their fixed-hour job counterparts, which can result in negative health outcomes such as obesity, type II diabetes, metabolic syndrome, sleep disturbances,[3] and hypertension.[4–7] Currently, "uberization'' indicates the transition to the on-demand business model through an informal work app created and managed by a technology company that connects service providers directly to customers at low cost and high efficiency. This term is derived from the company name Uber Technologies.[8,9] In this type of work, there are no benefits or labor rights, as these workers are not employees but collaborators of the company.[10] Therefore, commercial drivers can transport passengers in their vehicles for up to 12 h. After this, they must go offline for eight consecutive hours before driving again.[11] But drivers have found an easy way around this limitation by switching to other apps and continuing to drive,[12] probably in an attempt to increase income. The drivers working hours can reach around 19 h a day.[13] This burden of prolonged work among drivers can increase their sedentary behavior, defined as any waking activity in which the individual expends 1.5 metabolic equivalents (METs) or less while in a seating or reclining position.[14] For example: watching TV, playing video games, in the work environment, at home, or in leisure time.[15,16]

Considering that there are 844 000 taxies or for-hire drivers, only in the United States of America,[17] along with 4–5 million Mobility applications drivers worldwide,[18] professional drivers are a target population for public and work policies to enhance health habits (e.g., physical activity level and lower sedentary behavior) and to reduce total financial

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**Abbreviation list**

| | |
|---|---|
| Apps | Applications |
| CVD | Cardiovascular Disease |
| HDL | High-Density Lipoprotein |
| LPA | Light Physical Activity |
| METs | Metabolic Equivalents |
| MVPA | Moderate-to-Vigorous Physical Activity |
| SB | Sedentary Behavior |
| SHIFT | Safety and Health Involvement For Truckers |

costs of the sedentarism burden. In this article, we discuss the possible effects of the burden of prolonged work on the sedentary behavior of mobility applications drivers and propose possible strategies to face this concerning situation.

## Sedentary behavior and health outcomes

Sedentary behavior (SB) has been related to major non-communicable diseases, such as obesity,[4] type II diabetes,[5] metabolic syndrome,[6] hypertension, and other cardiac diseases.[7] In a systematic review of studies conducted from 1996 to 2011, Thorp et al.[19]found evidence of the connection between self-reported SB with body mass gain and cardiometabolic risks. Kolu et al.[20] examined the financial costs of low physical activity and high SB (more than 50% of waking hours) using three Finnish population studies. The authors found that, in 2017, costs attributable to high SB were around €1.5 billion, considering direct (i.e., patient care and medications) and indirect costs (i.e., sickness-related absences, disability pensions, and all-cause mortality that causes losses of income taxes). These results demonstrate the economic burden of SB. This problem adds to the burden of physical inactivity, which is considered a pandemic, given the major association with chronic diseases and premature deaths.[21]

Pinto Pereira et al.,[6] in a British cohort study including 7 660 people with 44–45 years of follow-up, found an association between television watching and sitting at work with worsening cardiometabolic markers. Odds for a metabolic syndrome were 33% higher in men who spent three or more hours sitting at work than those who spent less than 1 h. In a recent state-of-the-art review, Lavie et al.[22] highlighted the deleterious effects of SB in cardiovascular diseases (CVD), associating SB with a decrease in HDL (high-density lipoprotein) levels, higher oxidative stress, higher all-cause and CVD mortality. Carbone et al.[23] described that human physiology needs movement, coming from our ancestors who were hunters, and despite today we do not need to move to hunt for our food, human organism continues to have a genetic component that necessitates constant movement. Other studies found an association between occupational sitting time and colon cancer,[24] being overweight,[25] higher mortality,[26] and risk of musculoskeletal conditions.[27] Moreover, Baker et al.[28] showed that 2 h of sitting increased discomfort and worsened perceived mental state compared to baseline. The authors also found that after 2 h of sitting, the number of errors in a problem-solving test increased.

Mobility app drivers usually accumulate many hours of sitting time during work[29] and, therefore, are considered a high-risk metabolic profile population,[30] presenting a high number of sedentary hours, an increased risk of being physically inactive,[31] and unhealthy habits.[32] Brodie et al.[33] studied 58 bus drivers and showed that they presented poor health behaviors and high sitting times, which can contribute to overweight and obesity, besides major chronic disease risks. In another study, Gilson et al.[34] found that truck drivers have lower cardiorespiratory fitness than the general population, presenting a lower physical activity practice. Many driving hours during the day ($>$ 8 h) are also associated with a high prevalence of low back pain,[35] which can lead to poor sleep quality,[36] and quality of life.[37]

Along with that, the incidence of myocardial infarction,[38] risk factors for metabolic syndrome,[39] and obesity[40] are higher in professional drivers than in non-drivers. Van Vreden et al.[41] conducted an online-based cross-sectional study among 1 390 truck drivers who answered a general health questionnaire. The authors found that 79.5% of the truck drivers were obese or overweight, 44% reported chronic pain, and half of the questioned drivers reported severe or moderate psychological distress. Specifically, taxi or for-hire drivers might have poor nutritional habits, lower physical activity levels, and high-risk cardiometabolic profiles.[42] Drivers are also more likely to report musculoskeletal pain, sleep disorders, fatigue, and worse physical activity habits than the general population.[43] Therefore, it is reasonable to assume that mobility app drivers are also affected by these deleterious health consequences. An excellent example of how sedentary life can breed deleterious effects was seen during the COVID-19 lockdown, where individuals stayed at home, which induced less movement and physical activity, and this fact led to negative consequences in well-being.[44]

Besides the health consequences, some conditions, such as obesity, sleep disorders, and fatigue, could be related to accidents,[45] generating a substantial economic burden. Concerning the economic impact, overweight and obese transportation drivers have higher annual healthcare costs than not overweight and obesity drivers.[46]

To face this situation entailed by SB, a considerable number of researchers have been focusing on the benefits of reducing SB and its temporal substitution with light or moderate-to-vigorous physical activity.[47–49]

Additionally, physical inactivity and SB have influenced the mortality rate of the world population, gaining increasing prominence, especially in epidemiological studies.[50–54] Also, physical inactivity has contributed to the increase in the population's mortality rates[55] and may still be potentiated by excessive exposure to SB.[54] However, this association is not yet clarified in the literature since there are divergences between studies. The authors observed that physical activity could reduce the deleterious effects of SB on mortality risk.[56,57]

## The importance of taking breaks in sedentary behavior

As shown previously, SB is a major health problem leading to higher risks of non-communicable diseases. However, substituting sedentary time for physical activity has proven to improve health. Galmes-Panades[58] explored temporal substitution modeling to assess the possible association of time substitution of light (LPA) or moderate-to-vigorous physical activity (MVPA). To this end, the authors recruited 2 189 participants. The authors found that the reallocating of 30 min per day of sedentary time for LPA and MVPA was associated with lower body mass index, waist circumference, total fat, and higher body mass and HDL cholesterol. Similarly, Gonze et al.[47] studied the effects of a 10-min isotemporal substitution model. They found that substituting SB with 10 min of MVPA can reduce body mass, body mass index, and fat body mass. Ekelund et al.[48] analyzed 16 studies with self-declared daily sitting, television viewing, and physical activity. The total sample was 1 005 791 individuals with two to-18-year follow-ups. The authors found that increased sitting time ($>$ 8 h/day) combined with lower levels of physical activity ($\leq$ 5 min/day) was positively associated with all-cause mortality. Among the highly physically active, there was no association between the amount of sitting time and mortality. These results suggest that practicing 60–75 min of moderate physical activity daily can eliminate the increased mortality risk of prolonged sitting time. The mortality risk was 59% higher among those who did less than 5 min of physical activity per day and more than 8 h of sitting. This study showed that physical activity could reduce or even eliminate the deleterious effects of sitting time on mortality rates.

Additionally, Pulsford et al.[49] investigated the effects of uninterrupted sitting, sitting interrupted with 2-min standing bouts every 20 min, and sitting interrupted with 2-min LPA bouts every 20 min on glucose response. The authors showed that the two-minute LPA bouts improved glucose uptake and reduced insulin demand, offering better glycemic control when interrupting SB. Similarly, other studies suggested that breaking up prolonged sitting can benefit cognitive function,[59,60] lower back pain, and discomfort,[61] but there is a lack of high-quality evidence.

There is evidence of workplace-based interventions' effects on reducing sitting time, such as sit-stand desks, cycling workstations, office sit balls, and face-to-face meetings.[62,63] However, the evidence is limited, lacks quality studies,[64] and the interventions do not fit drivers who do not work in offices and have flexible working hours.

Specifically, the safety and health involvement for truckers (SHIFT) intervention created by Clemes et al.[65] targeted physical activity, diet, and the sitting time of truck drivers. This intervention consisted of group-based structured education sessions to discuss feasible behavior changes for better health, including strategies to increase physical activity and reduce sitting time during work and non-working time (when not driving). But, as shown in Pritchard et al.,[66] the results of the studies with the SHIFT protocol or other interventions to enhance healthy behaviors among truck drivers lack high-quality evidence. However, the benefits of LPA and MVPA for health status are indisputable. Therefore, mobility app companies could implement strategies to promote higher physical activity levels among drivers.

## Practical suggestions

The ideal would be for drivers to reduce their daily working hours and join a regular physical activity program. For the general population, it is recommended to engage in 150–300 min of moderate physical activity or 75–150 min of vigorous physical activity per week.[67] However, this is unfeasible for most drivers. A novel strategy to improve health emerged called "exercise snacks".[68] It's a way of breaking up sedentary time with more frequent bouts of activity throughout the day, diluting physical activity time daily, and decreasing sedentary time. Jenkins et al.[69] showed that "exercise snacks" with three bouts of stair climbing ascending 3-flight stairs separated by 1–4 h of recovery effectively increased peak oxygen uptake. Other studies have shown the potential benefit of "exercise snacks" of 15–30 s per hour[70] or 20 s every 1–4 h.[71]

Considering this, we suggest the drivers stop every 2–4 h work-hours to perform exercises such as stair climbing, squats, jumping jacks, pushups, fast walking, or abdominal crunches for at least 5 min in high intensity with short breaks. This action can reduce SB and improve the health of mobility app drivers and it does not take much work time. Another suggestion is the use of commercial wearable devices that have been shown to increase physical activity levels and decrease sedentary time.[72] These devices can be programmed to remind the user to take a break from sitting.[73] Indeed, reallocating sedentary time for standing, light stepping, or moderate-to-vigorous stepping is beneficial for cardiovascular risk and body composition.[74,75] Some practical suggestion for professional drivers to replace sedentary time with physical activity time is to stop the car every 60 min, between rides, get out of the car, stand up, and do light stepping or walking for around 2–5 min, as well as do stretching exercises. Also, include resistance and aerobic training in the daily routine for additional benefits.

Finally, government authorities must be aware of SB impairments and create public policies in order to minimize health problems related to the SB of the drivers.

## Conclusions

The current situation of the world economic crisis has increased the demand for jobs that somehow allow, officially or not, the citizen to work many hours in a day, consequently, increasing the number of weekly hours of sedentary activities. Although this type of work may be interesting for some individuals as it generates financial gain in a time of crisis, the maintenance of this activity for long periods can generate important health problems to be tackled. The work routine and the burden of prolonged SB can be harmful to the general health of mobility app drivers. To face this situation, we suggest that the companies behind these mobile applications encourage their drivers to take short breaks between voyages to decrease their sedentary behavior and encourage drivers to adopt a routine of regular physical activity.

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## Authors' contributions

V.N.O., T.G.C. and C.A.B.L.: study concept; V.N.O. and T.G.C.: article preparation; M.S.A., R. B. V., R.L.V., D. A. T. S., K.W., B.K. and C.A.B.L.: critical revision of the article. All authors read and approved the final article.

## Conflict of interest

Beat Knechtle is an editorial board member for Sports Medicine and Health Science and was not involved in the editorial review or the decision to publish this article. All authors declare that there are no competing interests.

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