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Impact of Road Traffic Gridlock, Related Stress and Office Sedentary Behaviour on Workforce Health and Well-being in sub-Saharan Africa

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ABSTRACT: The workforce in sub-Saharan Africa faces stressful conditions while commuting on the road and while at work. This could propel it towards developing unhealthy lifestyle and contribute to the growing burden of non-communicable disease in the sub-region. The objective of this review is to highlight the plausible health challenges to and impacts on the well-being of workers in sub-Saharan Africa who regularly have to commute between home and the workplace under stressful conditions imposed by traffic gridlock and the associated exposure to air pollution and noise. Effort is also devoted to describe, the health challenges of prolonged sitting both while in traffic gridlock and during office hours. Also approaches towards mitigating these challenges are discussed. A systematic literature review search was carried out using Google, Google Scholar and PubMed search engines for peer reviewed published literature relevant to the subject. The challenges to health and well-being of workers in sub-Saharan Africa posed by traffic gridlock and sedentary behaviour in the office setting with attendant risk of susceptibility to non-communicable diseases could be mitigated by improving transportation infrastructure and implementing exercise-based office wellness programmes. There is need for more evidence-based research on the subject.

Keywords: Traffic gridlock, Stress, Workforce, Sedentary behaviour, Sub-Saharan Africa

Introduction

Traffic congestion or gridlock is characterized by delayed movement of vehicles due to limited capacity of road infrastructure (Rahane and Saharkar, 2013). The workforce in sub-Saharan Africa (SSA) faces stressful conditions while commuting on the road and while at work that propel it towards developing unhealthy behaviour and lifestyle. These stressful conditions could contribute to the growing burden of non-communicable diseases in sub-region as they may be associated with the development of diabetes mellitus, hypertension, cardiovascular diseases, chronic respiratory diseases and cancers.

Stress may be defined as a perceived experience or feeling that the demands placed on people exceeds their ability to cope (Chemelo *et al.*, 2020). Excessive or prolonged stress may there exceed the individual's natural capacity to adapt to the stressor and permanently affect coping responses (Chemelo *et al.*, 2020).

This paper aims to assess the challenges to health and well-being of workers in sub-Saharan Africa who regularly have to commute between home and the workplace under stressful conditions imposed by traffic gridlock, and the associated routine exposure to air pollution and noise (Zhang and Batterman, 2013; Schwela and Haq, 2013; Wang *et al.*, 2022), as well as the health challenges of prolonged sitting while in traffic, and during office hours. Approaches towards mitigating these challenges are discussed. Prolonged sitting which

connotes sedentary behaviour has deleterious cardiovascular and metabolic effects. Recent evidence has shown deleterious relationship between sedentary behaviour and mortality outcomes (Dustan *et al.*, 2011).

Materials and methods

A systematic literature review search was carried out using Google, Google Scholar and PubMed search engines for relevant peer reviewed published literature related to the subject The search was done using different combinations of appropriate keywords (Table 1). Relevant publications were consequently identified and reviewed.

Table 1: Summary of literature review search strategy

Keywords	Search engine	Number of Articles	Publication Year(s)
Traffic gridlock, workforce, sedentary behaviour, SSA	Google Google Scholar	Three	2022, 2021, 2013
Traffic gridlock, workforce health and well-being	Google	Two	2019, 2018
Traffic gridlock in SSA	Google Google Scholar	Four	2021, 2019, 2013 2013
Impact of traffic gridlock on society, economy	Google	One	2018
Traffic gridlock and workforce sedentary behaviour, SSA	Google PubMed Google Scholar	Two One One	2021, 2013 2021 2022
Workforce sedentary behaviour, SSA	Google Scholar PubMed	Two One	2021, 2020 2015
Road traffic air pollution emission	Google Google Scholar	Two	2016, 2013
Road traffic emission, SSA	Google PubMed	One Three	2012 2022, 2020, 2019
Road traffic emission	Google	One	2020
Traffic gridlock, stress and bruxism	Google Google Scholar PubMed	Two One	2022, 2020 2022
Bruxism and Stress	Google	One	2020
Prolonged sitting, workforce	PubMed	One	2018
Seated immobility, work, thromboembolism	PubMed	One	2008
Prolonged sitting, workforce sedentary behaviour, SSA	Google	Two	2021, 2013
Prolonged sitting office worker	Google PubMed PubMed Central	One	2017
Studies on workplace wellness programme, SSA	Google	One	2017
Health effects, traffic air pollution	Google	One	2010
Health effects, transport elated air pollution	Google	One	2005
Traffic congestion, public health	Google	One	2010
Prolonged sitting, venous thromboembolism	Google PubMed Central	One	2010
Worksite Physical activity effect	PubMed	One	2003
Corporate exercise programme	PubMed	One	2020
Workplace physical activity	Biomed Central (BMC)	One	2020
Traffic congestion, effects, productivity, sub-Saharan Africa	Google	One	2013

Results and Discussion

Impact of road traffic gridlock: In sub-Saharan Africa (SSA), the combination of urbanization and growth of the middle-class has led to rapid increase in motor vehicle traffic on the roads resulting in daily traffic gridlock especially on week days in many urban cities across the region. Schwela and Haq (2013) noted that rapid growth in economic development and population as well as increase in motor vehicle transportation has contributed to the rise in urban air pollution in sub-Saharan Africa with the attendant harm to human health. Traffic congestion is aggravated by poor road infrastructure in many cities in sub-Saharan Africa. Etim (2016) described excessive vehicular traffic and congestion especially from a predominantly aging vehicular fleet that is prevalent in a major traffic route within Ibadan Metropolis in southwestern Nigeria. This excessive traffic congestion undermines economic productivity by shortening work hours, increasing transit costs and contributing to a range of environmental and health problems including exposure to air pollution (Etim, 2016). Peak values of carbon monoxide emissions due to private cars in Yopougon City, Abidjan in Côte d'Ivoire have also been linked to advancing age of the vehicle fleet (Doumbia *et al.*, 2021). Wang *et al.* (2022) in a recent study observed significant increase in Nitrogen Oxide (NO) and Nitrogen Dioxide (NO₂) levels (by 25-180%) in two high-density Accra residential neighborhoods in Ghana compared to levels of the same atmospheric pollutants from an earlier study carried out in 2006. The authors suggested that road traffic may be supplanting community biomass use such as wood and charcoal as the dominant source of air pollution in Accra, Ghana.

Traffic congestion can result in increase in motor vehicle emissions with associated degradation of ambient air quality (Zhang and Batterman, 2013; Krzyzanowski *et al.*, 2005; Etim, 2016). Recent studies have demonstrated excess morbidity and mortality among drivers, commuters and individuals living near major roadways (Zhang and Batterman, 2013). Furthermore, evidence indicates that transport-related air pollution contributes to an increased risk of death, particularly from cardiopulmonary causes, and increases the risk of non-allergic respiratory disease (Krzyzanowski *et al.*, 2005). Moreover, long-term exposure to combustion-related fine particulate air pollution has been linked to environmental risks for cardiopulmonary and lung cancer mortality (Pope *et al.*, 2002). In 2010, an expert committee summarized the available epidemiological literature on exposure to traffic-generated air pollution and adverse health effects and found strong evidence for a causative role for traffic-related air pollution on mortality particularly from cardiovascular events (Health Effects Institute, 2010).

While a number of published studies have examined the environmental, physical and economic impacts of road traffic congestion in certain countries in sub-Sahara Africa e.g. Mauritius in southern Africa (Vencataya *et al.*, 2018); Ghana in West Africa (Takyi *et al.*, 2013); Apapa area in Lagos, Nigeria (Iroham *et al.*, 2019), only little attention has been paid to the impact on health and well-being of people that commute on a daily basis through heavy traffic gridlock especially the workforce. A survey in Mauritius found that traffic congestion induces a high level of stress and frustration in commuters (Vencataya *et al.*, 2018).

Potential impact of traffic gridlock on oral health: Oral health may be adversely impacted by exposure to high levels of stress associated with traffic gridlock. Bruxism, a repetitive muscular activity of the jaw characterized by grinding or clenching the teeth without a functional purpose, and bracing or thrusting of the mandible is one oral health manifestation of stress (Ahlberg *et al.*, 2002). Ahlberg *et al.*, (2002) found that severe stress experience was the most significant factor associated with frequent bruxism among the multi-professional media personnel. One study involving dental students found a high prevalence of possible bruxism in association with stress and anxiety, especially for awake bruxism (Vlăduțu *et al.*, 2022). Furthermore, when compared to healthy individuals stressed individuals may show a higher risk for bruxism. Indeed, some studies suggest that patients with stress are very likely to present bruxism (Chemelo *et al.*, 2020).

Studies in Nigeria have noted that the repetitive grinding action of teeth that characterizes bruxism could lead to tooth surface loss (attrition) affecting the occlusal and incisal surfaces of teeth (Ojehanon *et al.*, 2010). In individuals with bruxism, dental attrition progresses more rapidly leading to a reduction in cuspal height as well as flattening of the occlusal inclined planes thereby leading to dentine being exposed with resultant dentine hypersensitivity (Cope and Cope, 2012). Apart from tooth sensitivity, the presence of possible bruxism has also been associated with grinding of teeth and signs of temporomandibular disorder such as pain in the masticatory muscles or neck muscles (Vlăduțu *et al.*, 2022). Other symptoms such as pain, malocclusion and reduced facial heights may occur and ultimately adversely impart quality of life as well as the social well-being of the individual (Ogunrinde *et al.*, 2020). Further studies are needed to define the relationship between traffic gridlock and bruxism.

Traffic congestion, with its associated and environmental pollution in Lagos, Nigeria has been noted to exert a significant adverse impact on workers' mental and physical health (Akorede, 2019).



Figure 1: Road traffic gridlock in Lagos metropolis, Nigeria. **Source:** Akorede. (CNN Marketplace Africa 2019)

Impact of prolonged sitting on public health: Prolonged sitting associated with traffic gridlock and the sedentary setting of office work has significant health implications (Ali *et al.*, 2021). Owen *et al.*, (2010) noted that time sitting in motor vehicles increases premature mortality risk. The combination of prolonged sitting on the road and in the office setting can predispose to cardiovascular risk factors such as obesity and the metabolic syndrome characterized by hypertension, type 2 diabetes mellitus and dyslipidemia (Dustan *et al.*, 2011). The unhealthy combination can also predispose to deep vein thrombosis especially in individuals at risk for the disease (Healy *et al.*, 2010; West *et al.*, 2008) and musculoskeletal disorders (Ali *et al.*, 2021; Daneshmandi *et al.*, 2017). Moreover, traffic gridlock compels people particularly workers in corporate organizations to deny themselves adequate night time sleep and rest in order to wake up early every morning so as to get to work on time. In addition, long hours in traffic and a work period that extends into the early evening promotes dependence on fast food for important meals such as breakfast and lunch during the week days in many cases. In effect, many workers in sub-Saharan Africa are inadvertently subjected to daily stress combined with poor quality nutrition (Skaal and Mathibedi, 2015), which could ultimately lead to ill health and chronic non-communicable diseases (NCDs). The rise of NCDs has been driven by primarily four major risk factors namely physical inactivity (sedentary behavior), unhealthy diets, tobacco use and harmful use of alcohol. Physical inactivity (sedentary behavior) is a major risk factor for NCDs in sub-Saharan Africa (Motuma *et al.*, 2021; Haileamlak, 2019), and is considered to account for about nine percent of all deaths globally (Haileamlak, 2019).

Office workforce sedentary behaviour: Sedentary behaviour involves sitting or reclining position while one is awake and is characterized by low energy expenditure (Straker *et al.*, 2016). It is an important risk factor for the development of non-communicable diseases and its burden has been noted to be increasing in sub-Saharan Africa (Motuma *et al.*, 2021). Although there is a dearth of studies on workforce sedentary behaviour in sub-Saharan Africa, a recent study by Motuma *et al.* (2021) found a relatively high prevalence of sedentary behaviour of about 20 per cent among Ethiopian adult workers. Factors that have exacerbated the burden of sedentary behaviour in low-income countries have been suggested as increasing access to modern technology, transportation as well as access to modern communication systems (Albawardi *et al.*, 2017). The office workforce is particularly susceptible to lack of physical activity (PA) and generally, workers spend about 70% of their working hours sitting (Todorovi *et al.*, 2020). There have been consistent independent associations observed between sitting time/sedentary behaviours and elevated all-cause mortality as well as cardiovascular disease mortality risk (Dustan *et al.*, 2011). Moreover, after adjustment for physical activity these associations persisted. Therefore, it is important to avoid prolonged, uninterrupted periods of sitting time in order to safeguard cardiovascular health (Dustan *et al.*, 2011).

The lack of physical activity in the office workplace where workers spend an average of eight (8) hours of the day is associated with many adverse health consequences in employees, including the increased risk of metabolic disorders, cardiovascular disease, weight gain, and type-2 diabetes (Motuma *et al.*, 2021). Moreover, musculoskeletal symptoms such as low back pain have been linked to sedentary lifestyles and prolonged time workers spent sitting at their offices (Todorovi *et al.*, 2020; Daneshmandi *et al.*, 2017; Motuma *et al.*, 2017; Mayer *et al.*, 2015).

Mitigating adverse impacts on health and well-being: Public health impacts of traffic congestion could be significant in magnitude particularly in urban areas, to be considered in the evaluations of the benefits of

policies directed towards mitigating traffic congestion (Levy *et al.*, 2010). Concerns about the health effects of motor-vehicle combustion emissions led to the introduction of regulations and innovative pollution-control approaches that have resulted in significant reduction of exhaust emissions, especially in developed countries (Health Effects Institute, 2010). Such reductions have been achieved through a comprehensive strategy that included determining emissions standards, use of cleaner fuels, and vehicle-inspection programmes (Health Effects Institute, 2010). Unfortunately, these concerns and innovative approaches towards vehicular pollution control are lacking in many developing countries such as those in sub-Saharan Africa. For instance, only eight countries in SSA namely Botswana, Ethiopia, Ghana, Madagascar, South Africa, Tanzania, Zambia and Zimbabwe have operational routine air quality monitoring systems, with South Africa having the most comprehensive air quality management system (Schwela and Haq, 2022).

In view of the adverse impact on health and well-being associated with stressful conditions on the road imposed by traffic gridlock and the sedentary nature of office work, there is the need to give workplace wellness programmes greater attention as a means of mitigating the development of cardiovascular diseases and ultimately improving employee health and lowering healthcare costs. Moreover, mitigating these risk factors to health and well-being by implementing workplace wellness programmes has been associated with reduction in cardiovascular risk profile, physical fitness and improved productivity at work (Torres *et al.*, 2020). Implementing health and wellness programmes in the workplace enables engagement of groups of individuals on a regular basis for the purpose of effecting a positive and sustainable change in lifestyle choices (Arena *et al.*, 2013). Furthermore, implementing employee health and fitness programme at the workplace has the added potential benefit of enhancing employee work performance and work output (Ganu *et al.*, 2017).

Again, workplace general physical activity (PA) programmes are effective in enhancing levels of physical activity of employees and promoting employee health (Todorovi *et al.*, 2020). In addition, they help to deal with muscular disorders, poor productivity, as well as improve health outcomes in the workforce (Todorovi *et al.*, 2020). A study found strong evidence of a beneficial effect of a worksite physical activity programme on physical fitness and musculoskeletal disorders (Proper *et al.*, 2003). Non-traditional physical activity programmes such as resistance and stretching exercises at the workplace have been suggested to be associated with improved health outcomes and brief period of such exercise intervention of just 15 minutes per day at least three (3) times per week for over eight (8) weeks has been associated with reduction of musculoskeletal pain and improved work performance (Todorovi *et al.*, 2020). Moreover, such non-traditional exercise interventions have no significant side effects and the risk of exercise-induced injuries is minimal (Todorovi *et al.*, 2020). Participating in non-traditional exercise can also prevent sedentary behavior at the workplace (Todorovi *et al.*, 2020).

A recent study investigated the effect of an on-site exercise-based wellness programme using a gym facility in a South African Corporation by assessing the impact of the programme on health risk factors, physiological parameters and corporate productivity (Torres *et al.*, 2020). The wellness programme involved a 12-week exercise programme based on the participant's cardiovascular risk stratification. The study showed positive effects on cardiovascular risk factors, biometric, muscle strength and improved cardio-respiratory fitness (CRF) of participating employees with associated reduction in employee productivity loss. It also demonstrated the need to encourage on-site workplace wellness programmes (Torres *et al.*, 2020).

While availability of resources might prove a limitation to a comprehensive wellness activity programmes such as use of gym facilities in many workplace settings in sub-Saharan Africa, easily applicable simple and inexpensive workplace physical activity programmes could include a deliberate effort to sit less and move about periodically at regular intervals while in the office. Brief ergonomic breaks of about 15 minutes accompanied with resistance and stretching exercises in the workplace could also be helpful in mitigating cardiovascular risks in corporate workers. Such ergonomic breaks would be more effective if implemented in the context of deliberate workplace or corporate organization policy. Moreover, a single bout of physical exercise has been shown to have three most consistent cognitive/behavioral effects in humans namely: improved executive functions, enhanced mood states, and decreased stress levels (Basso and Suzuki, 2017).

Straker *et al.*, (2016) proposed a range of initiatives to reduce occupational sitting exposure such as those focused on the design of safe work systems that target work tasks, work tools and the individual worker. However, multi-component interventions targeting multiple elements of work systems appear to have been most successful. The use of a standing desk at work rather than sitting at a desk for prolonged periods could be useful in mitigating the risk of cardiovascular disease. Daneshmandi *et al.*, (2017) noted that sit-standing workstations reduced the symptoms of musculoskeletal disorders resulting from prolonged sitting. Furthermore, the use of height-adjustable workstations resulted in office workers sitting less by 40-66 fewer minutes during a workday (Daneshmandi *et al.*, 2017). The muscle activity needed for standing and other movements appears to trigger processes that break down body fat and sugars thereby preventing accumulation of body fat, dyslipidemia and other attendant risks for cardiovascular morbidity and mortality. Again, there is evidence that breaking up sedentary time (independent of total sedentary time and moderate-to-vigorous intensity activity) is beneficially

associated with cardiovascular health and mitigation of cardiovascular risks (Dustan *et al.*, 2011; Owen *et al.*, 2010). This further supports the importance of avoiding prolonged, uninterrupted periods of sitting time.

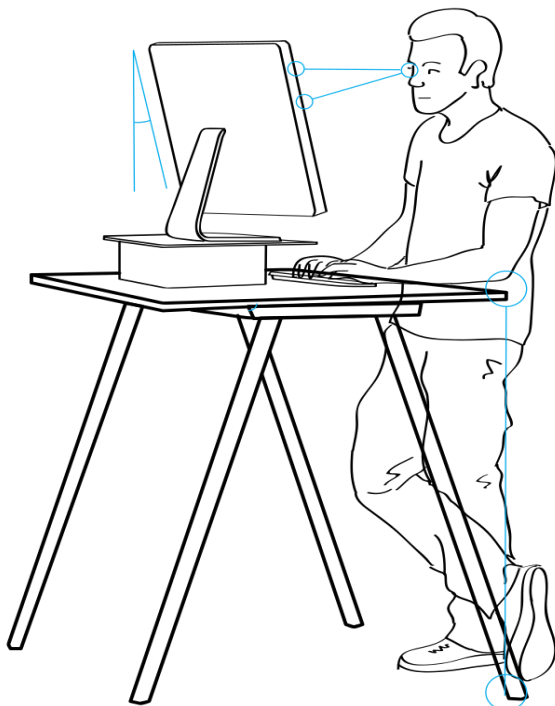


Figure 2: Illustration of office standing desk. **Source:** Wellable Google Images

Conclusion

The challenges to health and wellbeing of workers in sub-Saharan Africa posed by traffic gridlock and sedentary behaviour in the office setting with attendant risk of susceptibility to non-communicable diseases could be mitigated by improving road infrastructure, developing alternative means of transportation such as the railways and waterways, and by implementing exercise-based office wellness programmes. In view of the rapidly growing evidence base on health impacts and interventions, the widespread exposure of workers to prolonged occupational sitting, and the growing hazard of excessive occupational sitting, it is recommended that public health authorities and practitioners as well as other healthcare practitioners actively drive a public awareness campaign to address the growing hazards of occupational sitting.

Further research on the subject of this review is recommended given the preponderance of second-hand automobile vehicles plying the roads of cities in sub-Saharan Africa as well as a large population of sedentary workforce. Data from such studies could serve to provide impetus to policy makers towards providing better public transportation services and road infrastructure as well as motivating corporate organizations and public sector employers towards developing safe and effective workplace exercise and wellness programmes.

Further recommendations

1. It is recommended that government departments in sub-Saharan African countries in charge of transportation should ensure construction of good road networks and other necessary road infrastructure to facilitate smooth movement of motor vehicles
2. Policy-makers in these countries should enunciate appropriate regulatory policies on innovative pollution-control approaches that would result in significant reduction of motor vehicle exhaust emissions as obtained in developed countries
3. Communities such as government establishments and corporate organizations could establish brief ergonomic breaks as corporate policy to help in mitigating cardiovascular risks associated with office sedentary behaviour among the workforce.

4. Also, individual members of the workforce should make deliberate efforts to sit less and move about periodically at regular intervals during office work hours. A recent small cross-over study showed that taking a five-minute light walk after every half-hour of sitting was associated with significant improvement in cardiometabolic indices such as blood glucose and systolic blood pressure (Duran *et al.*, 2023).
5. It is also recommended that public health authorities and practitioners as well as other healthcare practitioners actively drive a public awareness campaign to address the growing hazards of occupational sitting.

Conflict of interest

The authors do not declare any conflict of interest

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