BMJ Open Sport & Exercise Medicine

Physical inactivity and health inequality during coronavirus: a novel opportunity or total lockdown?

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To cite: Shur NF, Johns D, Kluzek S, *et al*. Physical inactivity and health inequality during coronavirus: a novel opportunity or total lockdown? *BMJ Open Sport & Exercise Medicine* 2020;**0**:e000903. doi:10.1136/bmjsem-2020-000903

Accepted 24 October 2020

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ABSTRACT

Government-restricted movement during the coronavirus pandemic in various countries around the world has led to rapid and fundamental changes in our health behaviour. As well as being at a higher risk of contracting and being hospitalised with COVID-19, the elderly, those with chronic disease and lower socioeconomic groups are also disproportionately affected by restriction of movement, further widening the physical activity health inequality. In this viewpoint we discuss the physiological sequelae of physical inactivity, and the additional burden of ageing and inflammation. We provide recommendations for public health promotion and interventions to try to mitigate the detrimental effects of physical inactivity and rebalance the health inequality.

Key Points

- Large swathes of the population are likely to have been significantly more sedentary during the COVID-19 pandemic.
- Government enforced lockdowns and COVID-19 infection itself disproportionately affects the elderly, the comorbid and lower socioeconomic groups who may not have access to outdoor space.
- Action going forward should have targeted strategies to rebalance the health inequalities resulting from the pandemic.

INTRODUCTION

The new global pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has profoundly altered our everyday lives. People face the virus from uneven starting points. Existing health inequalities in non-communicable diseases such as hypertension and diabetes increase the severity of COVID-19 infection and likelihood of death. The wider societal measures introduced to control the spread of the virus and save lives now, are exacting a heavier social and economic price on those already experiencing hardship.

Societal lockdown's have varied worldwide, significantly impacting physical activity behaviour. Whilst some countries (eg, United Kingdom (UK), Australia) have not restricted people's ability to exercise outside daily, others (eg, Spain, Italy) restricted this for several weeks. Despite a likely increase in sedentary behaviour for some, other studies suggest lockdown may have led to increases in population-level interest in and engagement with physical activity.[1] A disproportionate increase in loneliness during lockdown can increase the risk of poor health behaviour, especially in groups living in areas of multiple deprivations. However, medical and government initiatives have largely focussed on health protection and managing COVID-19 related disease with little emphasis on health promotion.

The boundaries placed on physical activity have been felt disproportionately by the elderly; comorbid; those with caring responsibilities; those without access to outdoor space; and simply those less literate in exercise, thus widening further, inequalities in physical activity. Understanding the musculoskeletal and metabolic sequelae of physical activity and how they disproportionately affect certain groups, is an important element in designing population approaches that respond to the needs of different cohorts. As we tentatively enter the next stage, recovery and rehabilitation, are we able to mitigate some of these disparities?

Physiological sequelae of physical inactivity

Physical inactivity has a rapid and profound negative effect on musculoskeletal and metabolic health. Bed rest models, used to mimic the extreme unloading on the body experienced by astronauts, show a loss of quadriceps muscle volume of 18% after 90 days,[2] with greater decrements in muscle power. There is a rapid reduction in peripheral insulin sensitivity, largely at the muscle level.[3] More pragmatic-reduced step count models (under 1500 steps per day) in healthy volunteers demonstrate a 17% reduction in peripheral insulin sensitivity and a 7% reduction in VO_2 max[4] and these changes are amplified when participants are also overfed.[5] These changes

are more marked in the elderly due to the loss of muscle mass and quality with age, which is associated with a loss of functional independence. The mechanism is due to the relative 'anabolic resistance' to dietary protein and exercise in muscles of older individuals.[6] Previously independent elderly people may emerge from lockdown dependent due to functional strength loss. Muscle volume loss and insulin resistance are also accelerated where inflammation is present, such as secondary to sepsis or in pro-inflammatory chronic disease states. Intensive care patients with multiorgan failure lose 15% rectus femoris cross-sectional area by day 7, and face a prolonged recovery.[7] Worldwide, higher diagnosis rates, hospitalisations and death rates from COVID-19 are more common with increasing age as well as those living in deprived areas. In several countries, including the UK, USA and South Africa, those in Black, Asian and Minority Ethnic (BAME) groups were more likely to be infected and have worse mortality rates, thought to be secondary to structural and cultural disparities. Inequality in physical activity behaviour, as well as rates of and morbidity from infection are prevalent therefore.

Physical inactivity and mental health

The effect of physical isolation on our mental health also cannot be overlooked. Loneliness is particularly affecting those living alone and without children, and is strongly associated with depression, generalised anxiety and poor health behaviour.[8] Higher exercise levels in older adults during the COVID19 pandemic has been associated with more positive psychological well-being.[9] Controlled experiments have found that regular physical activity protects mental health in those undergoing 8 months of prolonged social isolation.[10] In the UK, data from Sport England indicate 65% of adults were using activity to manage their mental health during a time of increased stressors including fear of contagion, job insecurity, and a lack of normal social support.[11] The most vulnerable are probably likely to be those on the lowest income, and they will be disproportionately impacted by physical inactivity. The shift to increased home working for many people further reduces the social contact of the normal work environment.

Recommendations for action

Strategies to diminish these changes can be at an individual, a community, or a national public policy level. Public health campaigns should outline simple, affordable advice for engaging in physical activity. Targeted physical activity campaigns may be required for older age groups or vulnerable groups of society. A recent international white paper supports regular low/medium intensity high volume exercise and a 15–25% reduction in caloric intake to prevent physiological decline following sedentarism.[12] As group exercise opportunities become more limited, and outdoor exercise becomes less attractive approaching winter months, there may be a natural shift to online resources. With greater home working, employers should be proactive in incentivising physical activity. Businesses could be innovative by organising group exercise classes or challenges which reinforce the lost sense of connection and community. Regular breaks and short bursts of efficient physical activity at home should be promoted including resistance exercise requiring minimal equipment, such as bodyweight exercises. A need for simple and safe ways to stay physically active in a limited space has been highlighted as a priority among older adults living at home during the pandemic.[13] For those without access to the internet, there is a potential role for telephone volunteer services to support those isolated, especially in communities where these are less likely to be established by communities themselves. However, solely relying on interventions that focus on individual change may be limited due to disparity in accessibility and capability.[14]

As we re-open society, can we do so in a way to influence the environment in which we live? Health inequalities are due to a complex interplay of environmental and social factors which impact a local area.[15] Strategies should be place-based approaches and build physical activity and health into local and national government decisions. Active travel via government subsidised vouchers to those of lower socioeconomic status, has previously shown to be successful in early years nutrition.[16] As health services re-open, physical activity could be incorporated into new models of care. Post-COVID 'recovery' clinics using a multidisciplinary approach are currently sporadic or non-existent, but important as it is estimated that 10% of people experience prolonged illness after COVID-19.[17] Studies to evaluate intervention strategies for long-COVID are urgently required to prevent long term morbidity. Those with persistent or progressive symptoms need integrated physician-led care models with a strong musculoskeletal and prevention focus. Grant programmes to evaluate the effectiveness of new models are needed. Health promotion is as important as health protection in reducing morbidity and mortality and demands immediate prioritisation. Linking medicine and public health with evidence-based community physical activity programmes is a priority.

The United Nations and International Olympic Committee, recognising the physical and mental health benefits of physical activity, has advocated the incorporation of sport into international COVID-19 recovery plans.[18] Sporting organisations should also identify ways to engage with vulnerable groups who normally participate in sporting programmes in low-income communities who are currently unable due to restriction to movement. Outreach activities to promote physical activity and widen resources in specific disadvantaged cohorts is successful in previously targeted interventions.[19] Engagement in sport has many mental health benefits and promotes social cohesion at a time when social interaction is minimised. Finally, consideration of prioritising vaccination to those most at risk may become increasingly important as the months to come.

CONCLUSION

The current changes in our physical activity behaviour disproportionately impact certain groups of society. This may lead to a second wave of health inequality driven by disparities in access and availability to be physically active during a period of restricted movement. COVID-19 has likely further influenced how these different factors interact, multiply and reinforce each other. Acting on only one part of this complex system is likely to only ever provide a partial and incomplete response. Not only is a holistic, collaborative and integrated public health approach required to reduce the negative impact of high amounts of sedentary behaviour in the population during the current pandemic, but specific strategies using a place-based approach targeting at risk and disadvantaged groups from national to grass roots level need to be considered if we are ever to reduce the further widening of physical activity health inequality.

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Contributors NP was responsible for the initial idea. NFS wrote the initial manuscript. SK, DJ and NP revised the manuscript. All authors reviewed and approved the final version of the manuscript; and agreed to be accountable for all aspects of the work. All persons designated as authors qualify for authorship, and all those who are eligible for authorship are listed.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

1 Ding D, Del Pozo Cruz B, Green MA, *et al.* Is the COVID-19 lockdown nudging people to be more active: a big data analysis. *Br J Sports Med* 2020.
2 Alkner BA, Tesch PA. Knee extensor and plantar flexor muscle size and function following 90 days of bed rest with or without resistance exercise. *Eur J Appl Physiol* 2004;93:294–305.
3 Mikines KJ, Dela F, Galbo H. Seven days of bed rest decrease insulin action on glucose uptake in leg and whole body. *J Appl Physiol (1985)* 1991;70:1245–54.
4 Krogh-Madsen R, Thyfault JP, Broholm C, *et al.* A 2-wk reduction of ambulatory activity attenuates peripheral insulin sensitivity. *J Appl Physiol (1985)* 2010;108:1034–40.
5 Knudsen SH, Hansen LS, Pedersen M, *et al.* Changes in insulin sensitivity precede changes in body composition during 14 days of step reduction combined with overfeeding in healthy young men. *J Appl Physiol (1985)* 2012;113:7–15.
6 Cuthbertson D, Smith K, Babraj J, *et al.* Anabolic signaling deficits underlie amino acid resistance of wasting, aging muscle. *Faseb J* United States 2005:422–4.
7 Puthucheary ZA, Rawal J, PcPhail M, *et al.* Acute skeletal muscle wasting in critical illness. *JAMA* 2013;310:1591–600.
8 Beutel ME, Klein EM, Brahler E, *et al.* Loneliness in the general population: prevalence, determinants and relations to mental health. *BMC Psychiatry* 2017;17:97.
9 Whitehead BR, Torossian E. Older adults' experience of the COVID-19 pandemic: a mixed-methods analysis of stresses and joys. *Gerontologist*.
10 Abeln V, MacDonald-Nethercott E, Piacentini M, *et al.* Exercise in isolation: a countermeasure for electrocortical, mental and cognitive impairments. *PLoS One* 2015;10:e0126356.
11 Office of National Statistics. Analysis of death registrations not involving coronavirus (COVID-19), England and Wales: 28 December 2019 to 1 May 2020.
12 Narici M, De Vito G, Franchi M, *et al.* Impact of sedentarism due to the COVID-19 home confinement on neuromuscular, cardiovascular and metabolic health: physiological and pathophysiological implications and recommendations for physical and nutritional countermeasures. *Eur J Sport Sci* 2020:1–22.
13 Goethals L, Barth N, Guyot J, *et al.* Impact of home quarantine on physical activity among older adults living at home during the COVID-19 pandemic: qualitative interview study. *JMIR Aging* 2020;3:e19007.
14 Michie S, van Stralen MM, West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implement Sci* 2011;6:42.
15 Place - based approaches for reducing health inequalities: Main report. Public Health England, 2019.
16 McFadden A, Green JM, Williams V, *et al.* Can food vouchers improve nutrition and reduce health inequalities in low-income mothers and young children: a multi-method evaluation of the experiences of beneficiaries and practitioners of the healthy start programme in England. *BMC Public Health* 2014;14:148.
17 Greenhalgh T, Knight M, A'Court C, *et al.* Management of post-acute covid-19 in primary care. *BMJ* 2020;370.
18 The impact of COVID-19 on sport, physical activity and well-being and its effects on social development. *UN/DESA Policy Brief #73*. United Nationals Department of Economic and Social Affairs, 2020.
19 Craike M, Wiesner G, HIllant TA, *et al.* Interventions to improve physical activity among socioeconomically disadvantaged groups: an umbrella review. *Int J Behav Nutr Phys Act* 2018;15:43.