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1 **From one pandemic to another: emerging lessons from COVID-19 for tackling physical**
2 **inactivity in cities**

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21 **Abstract**

22 Physical inactivity is a global pandemic. The COVID-19 crisis has altered global patterns of physical
23 activity in ways that were unimaginable before the outbreak. Enforced restrictions on mobility and the
24 mass closure of indoor fitness centres has highlighted the limitations of many urban areas for enabling
25 physical activity and reinforced inequalities in physical activity opportunities across cities. However,
26 unprecedented reductions in mobility and increases in localised physical activity provide unique insight
27 on opportunities for urban health promotion. COVID-19 responses can therefore, encourage new
28 perspectives in urban planning and inspire novel future strategies to design more sustainable, healthier
29 and equitable cities.

30

31 Key words: Physical activity; Neighbourhood inequality; Urban planning

32 Physical inactivity is one of the leading risk factors for global morbidity and mortality and has been
33 described as a world-wide health pandemic with extensive economic, environmental, and social
34 consequences (Kohl et al., 2012). Regular physical activity offers a variety of benefits for mental and
35 physical health and contributes to the prevention of communicable diseases, such as viral and bacterial
36 infections, and noncommunicable diseases (NCDs), such as diabetes and coronary heart disease. The
37 World Health Organisation (WHO) has a target of reducing global physical inactivity by 10 % by 2025;
38 however, this target will likely be missed as rates of inactivity continue to rise in many high-income
39 countries (Guthold et al., 2018).

40 The outbreak of Coronavirus Disease-19 (COVID-19) and the public health measures put in place to
41 curb its transmission have rapidly and radically altered global patterns of physical activity. Restrictions
42 on mobility and the mass closure of indoor fitness centres have localised opportunities for physical
43 activity, by only permitting outdoor exercise in the immediate neighbourhood. Despite these
44 restrictions, physical activity can play a key role in mitigating the health challenges presented by
45 COVID-19 and the physical and mental health side effects of the control measures designed to decrease
46 the spread of the virus (Mattioli et al., 2020). Physical inactivity and COVID-19 are, therefore,
47 inextricably linked and urban policy-makers should address these public health challenges
48 synergistically in order to generate a positive legacy from the COVID-19 crisis. This commentary seeks
49 to establish emerging opportunities, insights and research questions related to the impact of COVID-19
50 on physical activity patterns and inequalities in opportunities for physical activity in cities.

51 It is well established that significant life events can prompt major changes to physical activity patterns
52 (Engberg et al., 2012) and the COVID-19 crisis will likely have multi-directional effects on physical
53 activity levels in cities. For some, behaviours of recreational physical activity, such as organised sport
54 or the use of indoor fitness centres have been disrupted. Loss of employment and shifts towards home-
55 working mean reductions in physical activity from active travel for some, whilst for others home-
56 working may provide a chance to increase active lifestyle choices. Additionally, government promotion
57 of daily exercise to avoid the unintended health consequences of COVID-19 mitigation measures may
58 encourage more active behaviours. Substantial variations in lifestyle are changing individual

59 capabilities and opportunities for physical activity in cities and understanding these changes and their
60 lasting effect gives rise to a number of important policy-relevant research questions. Indeed, the
61 emerging research questions and public health challenges are three-fold: (i) how can healthy activity
62 habits and practices that have been disrupted by COVID-19 be re-established (ii) where this is not
63 possible, can alternative opportunities be identified and facilitated to minimise physical inactivity; and
64 (iii) what can be done to support the continuation of positive changes to physical activity that have been
65 developed as a result of COVID-19 interventions?

66 As COVID-19 induces multi-directional effects on global physical activity patterns, existing
67 inequalities in physical activity opportunities are being reinforced and new inequalities are emerging.
68 Participation in physical activity is often greater in neighbourhoods with lower reported crime, more
69 green, blue and open space and better walkability, although these characteristics vary significantly
70 among neighbourhoods (Wolch, Byrne and Newell, 2014). Restrictions on mobility reinforce
71 differences in neighbourhood characteristics and inequalities in the ability of neighbourhoods to support
72 physical activity are, therefore, more apparent than ever. These reinforced inequalities mean that
73 experiences of restricted mobility or ‘lockdown’ will differ substantially among urban populations.
74 There could be considerable benefit to public health throughout and beyond the COVID-19 pandemic
75 if national and local governments recognise these differences and identify opportunities to reduce area-
76 level inequalities e.g. by permitting access to semi-private green space or implementing temporary
77 pedestrianisation. Such interventions can be particularly beneficial in neighbourhoods with an absence
78 of characteristics that support physical activity, such as those with insufficient green or open space
79 provision and poor walkability and active travel infrastructure.

80 The potential for COVID-19 mitigation to reinforce inequalities in physical activity opportunities
81 extends beyond the built environment and may occur through the economic and social systems of cities.
82 As such, effective short and long-term mitigation strategies must be viewed through the lens of gender,
83 age and deprivation to avoid increasing disparities in physical activity opportunities that are often
84 present in high income countries (Althoff et al., 2017). For example, the widespread closure of schools
85 and shifts towards digital schooling eliminates an important resource for adolescent physical activity.

86 Whilst, in some cultures, there are issues related to the cultural acceptance of women exercising in
87 public spaces and these issues may be exacerbated by the closure of indoor or gender-specific fitness
88 centres. Collectively, these concerns highlight a critical research question: what are the short and long-
89 term inequalities for physical activity opportunities emerging from COVID-19 responses and what
90 adaptive and mitigate measures can be introduced to limit their effect?

91 Whilst COVID-19 generates many challenges for physical inactivity, the pandemic offers the possibility
92 to think, design and plan more radically to improve opportunities for physical activity in cities and
93 reduce inequalities in physical activity opportunities across neighbourhoods. Mobility restrictions as a
94 consequence of COVID-19 have caused substantial reductions in traffic flow and improvements in air
95 quality in cities making many urban areas more suitable for physical activity than before the outbreak.
96 Moreover, cities across the world are implementing temporary or “pop up” cycle infrastructure and
97 pedestrianisation to alleviate motorised transport dominance, thus increasing public space and enabling
98 safer exercise and active travel. Responses to COVID-19 have therefore, shown that reorganising public
99 space in cities to promote physical activity and reducing barriers to physical activity, such as motorised
100 transport presence, is both possible and effective. Future research should seek to understand the
101 feasibility of sustaining (or partly sustaining) these strategies in post COVID-19 policy trajectories to
102 ensure positive effects for physical activity. Identifying and prioritising locations where temporary
103 reorganisations of space are most effective in terms of increases in physical activity participation and
104 most valuable in overcoming insufficient opportunities for physical activity and neighbourhood
105 inequalities represent key research avenues for investigation. Research that seeks to quantify the effects
106 of reorganising public space on physical activity patterns and barriers to physical activity among
107 different demographic groups that is based on empirical data rather than anecdotal evidence will be
108 particularly valuable to inform future city planning and policy decisions. Personal Global Positioning
109 Systems (GPSs) such as mobile fitness tracking applications and fitness wearables offer a valuable data
110 source to quantify physical activity patterns in these temporary spaces and underpin future policy.

111 Opportunities for innovative physical activity planning and remediating neighbourhood inequalities can
112 also gain inspiration from the ‘home-workout’ movement which has been catalysed by global

113 recommendations of household confinement. This new exercise trend, supported by international
114 governments, sports stars and celebrities, has seen everyday household spaces in cities across the world
115 reimagined, as furniture becomes temporary fitness equipment and living spaces become
116 multifunctional. Home-workouts challenge conceptions of ‘normal’ behaviour in everyday spaces and
117 exploring the transferability of this process for city infrastructure and outdoor public spaces may offer
118 potential to overcome the limitations of many urban environments for facilitating physical activity.
119 Children and other subgroups of society, including skateboarders and those who partake in free-
120 running/parkour often use the public realm and urban space in ways not foreseen or imagined by urban
121 designers. However, urban governance often deters such behaviour by ‘designing-out’ processes or by
122 legislating against it due to associations with nuisance or crime. Indeed, unlike privately owned
123 household spaces, without effective management multifunctional public spaces can cause conflict
124 among different users groups (Ioja et al., 2014). However, the adoption of inclusive urban planning and
125 management approaches (Fig.1), rather than preventative design strategies, can encourage a more
126 collaborative approach between multiple stakeholders and users groups to create multifunctional urban
127 infrastructure and (re)design public space to encourage and enable physical activity. As cities densify,
128 the benefits of multifunctional infrastructure and public space is becoming increasingly apparent,
129 particularly in neighbourhoods with limited resources. Harnessing insights from the growing home-
130 work out movement by collaborating with key individuals and organisations that facilitate and design
131 home-work outs and developing case studies of innovative exercise routines and novel uses of everyday
132 space highlights an opportunity to radically re-think the public realm as a resource for physical activity
133 and a novel area of future research.

134 The COVID-19 crisis has changed physical activity patterns in cities in ways that were unimaginable
135 before the outbreak and inequalities in physical activity opportunities among neighbourhoods have been
136 reinforced, whilst new inequalities are emerging. We, therefore, have a truly unique opportunity to
137 critically review our urban environments and their ability to support and enable physical activity. Thus,
138 addressing physical inactivity and COVID-19 synergistically offers scope to generate a positive legacy
139 from the crisis. Clearly, a new wave of public health thinking based upon preventing ill-health is

140 required to remediate COVID-19 and to ensure cities are more resilient to future infectious disease
141 outbreaks. However as concepts such a ‘social distancing’ become embedded in the global public health
142 lexicon, we must not lose sight of other public health challenges including physical inactivity and
143 neighbourhood inequality and ensure that cities are not just places of ill-health prevention, but places
144 of health promotion. For some, as post COVID-19 normalities begin to emerge and restrictions on travel
145 are reduced, opportunities for physical activity beyond their own neighbourhood will resume. For more
146 vulnerable members of society with limited mobility, such as children, the elderly and those without
147 the physical or economic means to travel, the neighbourhood remains crucial for physical activity. As
148 normality returns, our collective experience of the geographies of some of the most vulnerable in society
149 should be used as a valuable reminder that to create more sustainable, healthier and equitable cities, we
150 must enable physical activity for all.

151

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156 **Fig. 1: Riverside Museum, Glasgow, Scotland.** A co-design process involving local authorities and
 157 skateboarders enabled the creation of a multifunctional shared urban space. Subtle design features make
 158 the area almost unrecognisable as a designated skating location thus catering to the needs of
 159 skateboarders, who sought “street like” features and members of the public and museum visitors by
 160 providing an open space that is suitable for play, socialising and physical activity.

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