

Is the COVID-19 lockdown nudging people to be more active: a big data analysis

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The COVID-19 pandemic has brought unparalleled destruction to global health, social and economic systems. To control the spread of COVID-19, most countries have enforced a societal-level lockdown. This mass disruption of civil life provides opportunities for observational 'natural experiments', mandating lifestyle changes overnight. Big data, such as Google Trends (GT), have been used to identify outbreaks¹ and monitor risk communication strategies,² public awareness³ and misinformation⁴ during COVID-19. The real-time nature of data, together with ubiquitous internet access and Google's dominance of online search traffic, has uniquely positioned GT as a useful tool for 'nowcasting' social trends and lifestyle changes.⁵

An area of life significantly impacted by COVID-19 lockdown is physical activity. Closure of gyms and restrictions on 'non-essential' travel may lead to declines in overall physical activity. Conversely, changing circumstances may interrupt 'automatic' behavioural patterns through 'habit discontinuity'⁶ leading to formation of new health habits, as demonstrated by previous research on residential relocation.⁷ Here, we used GT data to explore community interest in physical activity before and during COVID-19 outbreaks in Australia, the UK and the USA.

We extracted GT data of nation-level online queries for the topic 'exercise', which included all related search terms sharing the same concept, such as 'workouts' and 'fitness training' (online supplementary file). GT normalises search data within a defined time frame and geography on a scale of 0–100,

based on a topic's search proportion out of all searches, representing population-level interest in selected topics (Google Relative Search Rate (GRSR)). To contextualise the trend in exercise, we contrasted the GRSR of 'exercise' with 'television show' as a proxy for population-level interest in television viewing, a common sedentary activity expected to increase during the lockdown. A 12-month period was selected to account for the seasonal variation in both activities. To compare search trends before and after a national lockdown was implemented, we used segmented regression with autoregressive errors to model the interrupted time series for GRSR in 'exercise' in relation to 'television show' in the statistical programme R V.3.5.0.

In all three countries, community interest in exercise surged immediately following the lockdown, peaked within the first 2 weeks, then declined but remained at a higher level than before the lockdown (figure 1). A similar pattern was observed for more specific searches targeting the topic 'high-intensity interval training' and search terms on 'home-based exercise' (online supplementary file). In fact, population-level interest in exercise in April 2020 was at an all-time high since GT records began in January 2004. As

expected, community interest in television also increased since the COVID-19 lockdown. Despite 'television show' remained an overall more searched topic than 'exercise', the increase in 'exercise' was so large that it surpassed 'television show' for the first 2 weeks following the lockdown in Australia and the UK. In Australia, the UK and the USA, respectively, the mean (SD) GRSR for 'exercise' accounting for 'television show' was 47.1 (3.2), 36.6 (4.8) and 50.5 (5.2) before, and 77.3 (11.0), 78.9 (9.4) and 71.1 (4.1) after the lockdown, suggesting significant (all $p < 0.01$) proportionate increases in 'exercise' interest when accounting for the rise in 'television show'.

These data suggest that despite challenges to an active lifestyle, the COVID-19 lockdown may have led to increases in population-level interest in and engagement with physical activity. This increase is still salient when considering simultaneous rise in the common sedentary behaviour of television viewing. Potential explanations for the relative increase in exercise interest include compensation for reduced incidental activities, availability of discretionary time, increased health awareness and ubiquitous messages recommending exercise during COVID-19 from media, governments and health authorities (eg, WHO). In countries such as the UK and Australia, lockdown rules have explicitly allowed for exercises as 'essential' activities, which may nudge some to exercise outside. Our findings are supported by a recent survey conducted by Sport England, where 62% of adults considered that being active is more important now than pre-COVID-19, and more than half reported being encouraged to exercise by the Government's guidelines.⁸

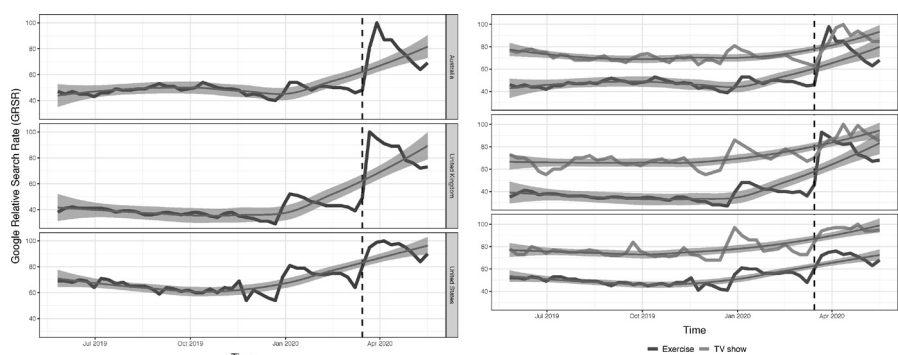


Figure 1 Google Relative Search Rates on the topic of 'exercise' alone (one the left) and 'exercise' in relation to 'television show' (one the right). Locally weighted scatterplot smoothing curve represents the estimated trend and 95% CI bandwidth of weekly Google Relative Search Rates during the 12-month-period of 26 May 2019–22 May 2020. The dashed vertical line represents the date when the lockdown policy started (the national lockdown started on 23 March 2020 in Australia and the UK; policies varied by state in the USA, with the earliest state-wise lockdown enforced in California on 19 March 2020).

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It is important to acknowledge that the observed surge in community interest in exercise may not translate into behavioural change as we do not have the information on who participated in physical activity following online searching; nonetheless, Google searches represent community-level intention, information seeking and preparation, important precursors of behavioural change. Furthermore, GT data could not distinguish whether searches emanated from habitually active individuals or from exercise novices. Therefore, the actual change in the population prevalence of physical activity is not yet known. Recent data from Garmin fitness trackers suggested that despite step-count decreases during COVID-19, exercise, particularly indoors, increased substantially.⁹ The Sport England Survey found that although 41% of the adult respondents reported doing less physical activity than prelockdown, 31% reported doing more.⁸

Big data offer potential for real-time 'infoepidemiology' and 'infoveillance',⁵ which are useful when behavioural and social trends emerge too quickly for conventional surveillance systems to capture. During the COVID-19 lockdown, some governments halted routine data collection (eg, New South Wales Population Health Surveys). Currently, many physical activity-related online surveys are being conducted; however, these surveys use selected samples and rely on recalls without baseline measures. Within this context, big data may be the most practical and least biased way to identify population-level trends. If our findings are corroborated

by additional behavioural data, such as those from fitness trackers⁹ or routine surveillance systems, public health efforts should capitalise on the increased awareness of and interest in physical activity to promote active lifestyles post-COVID-19.

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