**‘Staying on Track’ with Exercise for Mental Health:
The Dangers of Implying Adverse Causal Relations from Cross-Sectional Findings**

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In *The Lancet Psychiatry*, Chekroud et al.1 recently presented a large cross-sectional examination of physical activity and mental health. Despite imprecision around the terms for ‘mental health’ and ‘exercise’ in the study, and lack of any follow-up data, the findings overall match the existing body of longitudinal research showing that regular physical activity is associated with better mental health.2

Although the article has received extensive media coverage, much of this has unfortunately focused on the cross-sectional observation that individuals reporting the highest levels of exercise also report poorer mental health. Troublingly, this has been interpreted as ‘high levels of exercise’ (i.e. >6 hours per-week, or ~52 minutes per-day) having adverse effects on mental health. This cannot be asserted from the data, for multiple reasons:

First, the cross-sectional nature introduces high chance of reverse causation. People who experience frequent stress/depression may engage in daily exercise to counter this; especially since exercise is a publicly accepted self-management strategy for mental illness.3 By analogy, engaging in highly frequent psychotherapy, or taking higher doses of antidepressant medication, could also be cross-sectionally associated with poor mental health - but this should not be misinterpreted as worsening mental health.

Second, self-report measures are notoriously poor at capturing actual physical activity, even in the general population. Furthermore, recent population-scale data from the U.K. Biobank has demonstrated that individuals with severe mental illness overestimate their physical activity in comparison to the general population.4 Therefore, Chekroud et al.’s1 observation of individuals with poorest mental health reporting the highest physical activity will be partly attributable to the known over-reporting of physical activity in this population.

Finally, the implied adverse effects from this cross-sectional analysis are unsupported by experimental data; as there is no compelling evidence of negative psychological effects from high doses of exercise in randomized trials. Indeed, in contrast with these cross-sectional indications, 90-minute bouts of vigorous exercise has actually been shown to produce positive neurobiological responses;5 activating the endocannabinoid system and upregulating BDNF, the two neurochemical factors attributable for the antidepressant benefits of exercise.5

Thus, it is at least premature, and at worst harmful and dangerous, for conventional or social media to disseminate information that a daily hour of exercise may impede mental well-being. The obvious casual limitations of Chekroud et al.’s1 findings must be seriously considered, alongside our comments above, to prevent researchers, clinicians and/or the public from prematurely concluding that daily exercise reduces mental health.

**Conflict of interest**

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**References**

1. Chekroud SR, Gueorguieva R, Zheutlin AB, et al. Association between physical exercise and mental health in 1· 2 million individuals in the USA between 2011 and 2015: a cross-sectional study. *The Lancet Psychiatry* 2018.

2. Schuch FB, Vancampfort D, Firth J, et al. Physical activity and incident depression: a meta-analysis of prospective cohort studies. *Am J Psychiatry* 2018: appi. ajp. 2018.17111194.

3. Jorm AF, Korten AE, Jacomb PA, et al. Helpfulness of interventions for mental disorders: beliefs of health professionals compared with the general public. *The British Journal of Psychiatry* 1997; **171**(3): 233-7.

4. Firth J, Stubbs B, Vancampfort D, et al. The Validity and Value of Self-reported Physical Activity and Accelerometry in People With Schizophrenia: A Population-Scale Study of the UK Biobank. *Schizophr Bull* 2017.

5. Heyman E, Gamelin F-X, Goekint M, et al. Intense exercise increases circulating endocannabinoid and BDNF levels in humans—possible implications for reward and depression. *Psychoneuroendocrinology* 2012; **37**(6): 844-51.