Physical activity and mental health: commentary on Suetani et al. 2016: common mental disorders and recent physical activity status: findings from a National Community Survey

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Physical activity and physical health

The first epidemiological research to explore the effects of physical activity (PA) on physical health was conducted over 60 years ago by the pioneer of PA epidemiology, Professor Jeremiah Morris. His early work suggested that regular PA reduced the incidence of coronary heart disease by around 30% [1]. Since then, an overwhelming body of evidence has consistently confirmed the physical health benefits of regular PA, particularly in relation to cardiovascular and metabolic health, across the lifespan [2]. Indeed, physical inactivity is considered the fourth leading risk factor for mortality worldwide, accounting for an estimated 9% of global premature deaths [2].

National (and international) public health guidelines generally recommend the following levels of PA to achieve physical health benefits [2]:

- Adults: at least 150 min of moderate-vigorous physical activity (MVPA), or 75 min of vigorous PA (VPA), per week, in bouts of at least 10 min
- Children and adolescents (5–17 year olds): at least 60 min of MVPA per day, with VPA incorporated at least 3 times per week

Moreover, in recent years, research has demonstrated meaningful physical health benefits at levels of PA considerably lower (in duration and intensity) than recommended levels [2].

Physical activity and mental health

However, despite over 60 years of PA epidemiology, our understanding of the associations between PA and mental health is still very limited; the evidence to date is mixed, and hampered by methodological weaknesses [3–6]. There is some evidence from recent systematic reviews that PA can be effective in reducing depressive symptoms, and positive symptoms of schizophrenia, in adults with mental illness [5], but associations between PA and other mental health problems, and whether PA can prevent mental health problems in the general population, are unclear [5, 6]. Hypothesised mechanisms for associations between PA and mental health include biological (e.g., physiological stress responses and inflammation), psychosocial (e.g., social support), and psychological (e.g., self-esteem) effects [3], but few studies have explored underlying mechanisms in detail [3].

Suetani et al. 2017

In this issue of SPPE, Suetani et al. [7] examine associations between recent PA and history of common mental disorders (CMDs) and delusional-like experiences (DLEs) in a large, population-based sample of adults in Australia. Their findings suggest no relationship between history of CMD/DLEs and recent PA. However, as acknowledged by the authors, numerous methodological limitations preclude

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any conclusions at this stage. Arguably the most notable methodological weaknesses—typical of most studies of PA and mental health [3–6]—are the reliance on self-report (and dichotomised) PA data, and the cross-sectional study design, as discussed below.

Physical activity measurement

Physical activity is defined as ‘any bodily movement produced by skeletal muscles that requires energy expenditure’. For most of us, it is embedded in everyday life: doing household chores, climbing stairs, gardening, getting to school or work, playing sports, walking the dog, dancing, playing with the kids, running for the bus. PA is, therefore, inherently difficult to measure, due to its varied and often unstructured nature.

Self-report PA measures, such as that used by Suetani et al. [7], are widely employed in large epidemiological studies because they are quick, easy and inexpensive to administer, and thus permit data collection in large study populations over short periods of time [8]. They can also provide important information on type and context of PA (e.g., team sports vs. individual sports, occupational vs. recreational activity, etc.), which is likely of particular importance in mental health research given the various potential mechanisms involved [3]. However, self-report measures of PA are prone to bias (e.g., recall, social desirability), have relatively low test–retest reliability, are unable to accurately capture information on duration, intensity and frequency of PA [8], and might, therefore, conceal or exaggerate true associations. Measuring duration, frequency and intensity of PA is important because it allows us to develop, relate findings to, and make inferences about, national and international PA guidelines. So, although dichotomised self-report PA data—e.g., achieving vs. not achieving recommended levels—as used by Suetani et al. [7], are relatively easy to collect in large studies, they provide limited information. Measuring the full continuum of PA quantity and intensity, even below recommended levels, is important in understanding associations with mental health [2]. Indeed, the null association reported by Suetani et al. is inconsistent with recent findings from the US National Health and Nutrition Examination Survey (NHANES) in which PA was measured objectively in over 2800 adults in the general population [9]. In NHANES, a strong association between higher levels of MVPA and reduced odds of depression was observed: OR = 0.55 (95% CI 0.34–0.89), 0.49 (95% CI 0.26–0.93), 0.37 (95% CI 0.20–0.70) in the three most active quartiles, respectively, compared with the least active quartile [9]. Nonetheless, the direction of the associations is unclear from these cross-sectional findings.

Compared with self-report measures, objective PA measures are more expensive and resource-intensive (e.g., extra researchers/time needed to set-up, distribute and collect devices, and to download and process data), so have traditionally not been used in large studies. But recent technological advances and dedicated research have made objective measures much more accessible for epidemiological research. The most widely used and readily available objective measures of PA are pedometers (i.e., step-counters), heart rate (HR) monitors, accelerometers (i.e., motion sensors), and devices that combine two or more of these methods [8]. Each has strengths and limitations. Combined devices, such as the Actiheart, which combines both HR monitoring and accelerometry, are hypothesised to provide the most accurate estimates of PA (compared with pedometers, HR monitors and accelerometers alone), but are considerably more expensive, and the evidence for superiority over other devices is somewhat inconsistent [8]. Pedometers and HR monitors are generally less expensive and produce simpler output compared with other objective methods [8], but pedometers are only able to measure step-based activity, and HR monitors are unable to distinguish small elevations in HR due to physical exertion versus emotional stimuli [8]. For many PA researchers, accelerometers currently provide the optimal method for measuring free-living, habitual PA. They are small, lightweight, non-invasive, often waterproof, and provide standardised, objective data on frequency, duration and intensity of PA. They are also able to quantify time spent in sedentary activities, an increasing area of interest in health research [2]. Nonetheless, there are important limitations to consider, including: difficulties distinguishing non-wear time from periods of inactivity; limited ability to detect changes in PA intensity due to gradient or load; and lack of consensus regarding which intensity-thresholds, monitoring duration, and epoch length should be used [8].

Given the practical and scientific considerations outlined above, and, importantly, the likely complex and multifaceted associations between PA and mental health [3–6], a combination of both self-report and objective measures of PA, concurrently, may provide the most robust PA data in mental health research.

Temporality

As most available evidence in this field is cross-sectional, and largely based on adults, the temporality of associations between PA and mental health is yet to be confirmed. Does PA influence future mental health? Does mental health influence future PA? Or is the relationship bidirectional? Such knowledge is crucial for the development of effective

interventions and preventive strategies—for both mental health and cardiovascular and metabolic health.

Adolescence is a critical developmental period during which many health behaviours and cardiovascular risk factors, including PA, are established. In the general population, PA declines during adolescence, and tracks strongly from adolescence into adulthood, i.e., inactive adolescents are very likely to become inactive adults. Adolescence is also a critical time in the development of mental health and wellbeing [10]. It is estimated that about 50% of mental health problems begin by the age of 14 years, and 75% by the age of 24 years [10]. Thus, to understand the temporality of associations between PA and mental health, and to establish whether PA plays a role in preventing mental health problems, we need to examine the prospective relationships between PA and mental health starting in childhood and adolescence, i.e., before the onset of disorder.

The vast majority of research on PA and adolescent mental health has been described as low quality, and relates primarily to depression, or depressive symptoms [3, 4]. These studies have produced inconsistent findings, with reports of null, positive, and inverse associations between PA and depressive symptoms [3, 4]. Few have considered the reverse association (i.e., Does depressed mood in late childhood/early adolescence predict declines in PA during adolescence/early adulthood?), and we know very little about associations between PA and other aspects of adolescent mental health (e.g., conduct disorder, psychotic-like experiences, self-harm, etc.) [3, 4].

Significance

Adults with mental health problems experience markedly higher risk of cardiovascular mortality, cardiovascular diseases, and metabolic dysfunction, compared with the general population. PA is one of the most important modifiable risk factors for cardiovascular and metabolic disease [1, 2]. Understanding the longitudinal relationships between PA, mental health, and physical health is, therefore, crucial, and could help to inform preventive strategies to reduce physical-mental comorbidity. A comprehensive, rigorous study of the prospective associations between PA,

mental health and physical health, from late childhood/early adolescence into adulthood, is an important next step in this field.

Compliance with ethical standards

Conflict of interest The author declares that they have no conflict of interest.

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