



Leisure time physical activity and future psychological distress: A thirteen year longitudinal population-based study

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ABSTRACT

A number of cross-sectional studies have suggested that physical activity (PA) is negatively associated with psychological distress in adulthood. A paucity of regionally representative and longitudinal studies has considered this relationship. This study investigated the association between leisure time light and moderate-vigorous PA (MVPA) and psychological distress over 13 years in a regionally representative sample. A total of 4754 men (mean age: 47.2 years) and 5571 women from (mean age: 46.9 years) the Tromsø Study were followed for 13 years. Light PA and MVPA was captured at baseline and psychological distress was captured using the Hopkins Symptom Check List-10 scale. Ordinary least square and Poisson regression models were used, adjusting for multiple confounders to investigate the relationship between light PA/MVPA and psychological distress. In the fully-adjusted model, accounting sociodemographics, history of parental psychopathology, socioeconomic status, marital status, smoking, social support and risk factors, we found evidence that both light PA (β 0.11, 95% CI: 0.03, 0.19; $p < 0.01$) and MVPA (β 0.19, 95% CI: 0.12, 0.26; $p < 0.001$) conferred protection against psychological distress at follow-up. Among men, a lower MVPA was associated with 14% (RR = 1.14, 95% CI: 1.01, 1.28) increased risk of clinically significant psychological distress; while among women, the risk was 15% (RR = 1.15, 95% CI: 1.06, 1.26; $p < 0.001$). In this regionally representative cohort, our study suggests that both higher levels of light PA and MVPA confer protection against future psychological distress. However, a key limitation of this study is that psychological distress at baseline was not controlled-for.

1. Introduction

Leisure time physical activity (PA) has a wide range of physical and mental health benefits (Penedo and Dahn, 2005; Sheikh et al., 2014a,b). Conversely, physical inactivity is the fourth leading cause of preventable mortality in the world, mainly due to the increased cardiovascular risks associated with it (Kohl et al., 2012). Among people with established mental illness, physical exercise, i.e. a structured form of physical exertion, is acknowledged as an essential aspect in the multi-disciplinary treatment of depression (Schuch et al., 2016a,b,c), anxiety (Stubbs et al., 2017a,b), and psychosis (J. Firth, Cotter, Elliott, French and Yung, 2015; Joseph Firth et al., 2017; Pajonk et al., 2010; Vancampfort et al., 2017). In the past decade, from a public health perspective there has been an increased interest in the beneficial effects

of PA on mental health (Lubans et al., 2011). Nowadays it is well-established that PA has a protective effect for future depression (Harvey et al., 2017), and cognitive decline (Stubbs et al., 2017a,b). It is associated with less suicidal ideation (D. Vancampfort et al., 2018) while acute bouts reduce feelings of state anxiety (Ensari et al., 2015). Psychological well-being, is however a much broader concept than the absence of mental illness and refers to a positive state of well-being where individuals realize their potential, experience positive emotions, and are able to maintain interpersonal relationships, work productively, contribute to their community and cope with psychological distress (Gong et al., 2016; Naci and Ioannidis, 2015; Sheikh et al., 2014a,b, 2016a, 2016b, 2017a,b,c). Other evidence suggests that individuals with higher symptoms of psychological distress are denied the same job opportunities as their peers, thereby restricting them to jobs with lower

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income (Dworsky and Courtney, 2007; Rizvi et al., 2015).

Psychological distress is a term that encapsulates unpleasant feelings and negative emotions that affect day-to-day functioning and affects a sizable share of the population in both high-income and low-to-middle-income countries (Gong et al., 2016; Perales et al., 2014; Sheikh, 2018a, 2018b). Perhaps unsurprisingly psychological distress has been associated with the risk of developing more severe mental health conditions and physical health issues including premature mortality, particularly due to cardiovascular and metabolic disease (Gong et al., 2016; Hamer et al., 2012; Lazzarino et al., 2013; Perales et al., 2014; Russ et al., 2012; Sheikh et al., 2016a). In addition, the considerable financial and human costs of psychological distress, has led to a pressing need to identify potentially modifiable risk factors which may be important for the development of efficient public health policies (Ding et al., 2016; Ekelund et al., 2016; Gong et al., 2016; Perales et al., 2014; Sheikh, 2017b, 2017c, 2018a, 2018b; Sheikh et al., 2016a). A nation-wide survey showed that over 10.2% of the population in Norway reported to have experienced psychological distress within the last two weeks (FHI, 2015), while a regionally representative survey of Tromsø region in Norway showed that over 9.3% of the adult population had clinically significant psychological distress (Sheikh et al., 2016a).

One key risk factor that has been associated with higher psychological distress in multiple cross-sectional studies is physical inactivity (Hamer et al., 2017; Hamer et al., 2009). A recent large nationally representative cross-sectional study in Scotland demonstrated a clear dose response benefit between lower PA levels and reduced psychological distress (Hamer et al., 2017). Another cross-sectional study among 4337 adults in Singapore demonstrated that higher levels of PA also appear to confer protection against psychological distress (Sloan et al., 2013). Whilst these studies have provided a useful insight into the relationship between PA and psychological distress, the cross-sectional nature precludes any inferences on the directionality of the observed relationships. However, there is a paucity of regionally representative and longitudinal studies that has investigated this relationship. Nonetheless, one four-year study in Australia including 17,080 people demonstrated that higher levels of moderate-vigorous PA (MVPA) was associated with a reduced incidence of psychological distress (Perales et al., 2014). Whilst helpful, the relatively short follow-up time period and lack of focus on leisure time light PA, which can also have benefits for health (Fuzeki et al., 2017), calls for future research.

Given the aforementioned, we set out to explore the relationship between leisure time light PA and MVPA levels and subsequent psychological distress levels using data from the regionally representative Tromsø Study over a 13 year period. The specific research questions were: (1) are those with lower levels of leisure time light PA or MVPA more likely to experience a higher psychological distress?, and; (2) do these associations differ significantly by gender?

2. Material and methods

2.1. Study population

The Tromsø Study is a representative, prospective cohort study of the adult population residing in the municipality of Tromsø, Norway (Jacobsen et al., 2012). Between 1974 and 2007–2008, six waves of the Tromsø Study were conducted (referred to as Tromsø I–VI) (Jacobsen et al., 2012). The present study has a two-wave design. To be eligible for the present analyses, participants had to have attended both Tromsø IV (1994–95) and Tromsø VI (2007–08) (N = 10,325). The study sample included respondents aged 25–74 years at Tromsø IV, and 38–87 years at Tromsø VI (Sheikh, 2017a; Sheikh et al., 2016b).

2.2. Study variables

2.2.1. Leisure time light physical activity and moderate to vigorous physical activity (Tromsø IV)

Leisure time PA was measured with two identical questions on light PA (not sweating or out of breath) and MVPA (sweating/out of breath) on a four-point Likert scale: “How has your weekly average physical activity in leisure time been during this last year?” The response alternatives were: ‘none’, ‘less than 1’, ‘1–2’, and ‘3 or more’ hours/week. The scores were inverted, so that a higher score represents lower leisure time PA. Cronbach alpha for the two items was 0.36 (inter-item covariance: 0.23). Light PA and MVPA exist on a continuum; therefore, we also constructed a composite PA as sum of scores from two indicators (light and MVPA). All associations with composite PA are presented in appendix (Online Supplementary Material).

2.2.2. Psychological distress (Tromsø VI)

Psychological distress was measured by the Hopkins symptom checklist (HSCL-10) scale, which is widely used in epidemiological studies (Sheikh, 2017b, 2018a; Sheikh et al., 2016b). Respondents rated each of the 10 items in the HSCL-10 on a four-point scale ranging from *not at all* (1) to *extremely* (4). We found an acceptable degree of internal consistency for the four-point scale in this sample (Cronbach's alpha 0.86, mean inter-item correlation: 0.41, McDonald's omega coefficient for composite reliability: 0.87) (Sheikh et al., 2016b). A composite variable was constructed as the sum of the 10 items (Sheikh et al., 2016b). An HSCL-10 score of 18.5 has been proposed as the cut-off for predicting clinically significant cases of psychological distress (Strand et al., 2003). Therefore, in addition to the continuous HSCL-10, we also constructed a binary variable by classifying respondents with scores below 18.5 as reference group (HSCL-10 = 0), and those with scores ≥ 18.5 as clinically significant cases of psychological distress (HSCL-10 = 1).

2.2.3. Confounding variables

Data on confounding variables were taken from the Tromsø IV questionnaire. The confounding variables age, gender, history of parental psychopathology, childhood socioeconomic status, marital status, daily smoking, social support, and education, were chosen based on *a priori* knowledge of PA correlates in the general population (Bauman et al., 2012) and of the association between PA and psychological distress (Hamer et al., 2009, 2017; Sheikh, 2017b, 2017c, 2018a, 2018b; Sheikh et al., 2016a).

Valid information on age and gender was obtained from Statistics Norway by using the unique personal identification number of each participant. Mother's/father's history of psychopathology was measured as: “Does your mother/father have/has your mother/father ever had psychiatric disorders?” (yes, no). The test-retest reliability of mother's history of psychopathology and father's history of psychopathology in Tromsø Study were Kappa: 0.57 (95% CI: 0.52–0.62) and Kappa: 0.61 (95% CI: 0.53–0.69), respectively (Sheikh, 2017a). Subjective childhood socioeconomic status was measured by the question, “How was your family's financial situation during childhood?” on a 4-point scale (1 = very good, 2 = good, 3 = difficult, 4 = very difficult). The reliability of childhood socioeconomic status was good [Kappa: 0.61, 95% confidence interval (CI) 0.59, 0.63] in Tromsø Study (Sheikh, 2017c). Daily smoking was measured by the question, “Do you smoke cigarettes daily?” (yes/no). The test-retest reliability of this variable was good (Kappa: 0.67, 95% CI: 0.63–0.71) in Tromsø Study (Sheikh, 2017c). Social support was measured with two questions on number of friends and perceived social isolation as “How many good friends do you have whom you can talk confidentially with and who give you help when you need it?” and “Do you feel that you have enough good friends?” (yes, no). Those who reported ‘no’ to the second question were categorized as socially isolated. Cronbach's alpha for the two items on social support was 0.32 (inter-item covariance: 0.19). Education level was

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