Device-measured physical activity and sedentary behaviour in relation to mental wellbeing: An analysis of the 1970 British Cohort Study.

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Abstract

Although physical activity and sedentary behaviour have established associations with mental illness, the extent to which they impact on mental wellbeing is not well understood. We examined associations between moderate to vigorous physical activity (MVPA), sitting time (ST) and mental wellbeing in 4,526 participants from the 1970 British Cohort Study (UK) in the age 46 survey (2016-18). MVPA and ST were measured using a thigh mounted accelerometer device (activPAL 3 micro) worn continuously for 7 days and participants completed the 14-item Warwick-Edinburg Mental Wellbeing Scale (WEMWBS) to assess mental wellbeing. In linear regression models MVPA (per hr) was associated with an additional 0.57 points on the WEMWBS (95% CI 0.03-1.12) regardless of gender, wear time, education, socioeconomic status, smoking, body mass index, disability and psychological distress. ST was not associated with WEMWBS in the adjusted models (B=-0.11, -0.23, 0.02). In MVPA stratified analyses, ST showed a linear trend with WEMWS in participants with low levels of MVPA but not in medium and high MVPA categories. In this large, nationally representative cohort, device-measured MVPA showed an association with higher mental wellbeing whilst ST was only associated with reduced mental wellbeing in participants with low levels of MVPA. Our main limitation was the cross-sectional design which precludes any inference of direction of association or causality. Nevertheless, interventions to promote MVPA may be an effective public health policy to promote mental wellbeing. Further investigation of the effect different sitting behaviours has on mental wellbeing is warranted.
Introduction

Mental wellbeing is a state of positive psychological health that allows individuals and communities to function well\(^1\). It can be conceptualised through two approaches: a hedonic perspective relating to subjective experiences of happiness and perceived life satisfaction and a eudaimonic perspective focusing on maximising human potential and functioning\(^2\). The World Health Organisation (WHO) recognises that positive mental wellbeing ‘work productively and fruitfully and make a contribution to their community’\(^3\) whilst wellbeing is also associated with reduced mortality in healthy and chronic disease populations\(^4\).

Physical activity and sedentary behaviour (defined as a sitting or reclining posture with low energy expenditure) are important determinants of physical and psychological health. Physical activity is linked to prevention and treatment of mental illness\(^5,6\) and moderate-to-vigorous physical activity (MVPA) is most beneficial\(^7\). However, the link between MVPA and mental wellbeing is not well established: device-measured MVPA has been associated with mental wellbeing in over 65s\(^8\) but not in adults\(^9\) or adolescents\(^10\). Sedentary behaviour is associated with mental illness\(^11\) but evidence for an association with mental wellbeing is also mixed: self-reported screen time correlates with wellbeing\(^12,13,14\) but device-measured sitting time (ST) has not shown an association\(^15\).

Current evidence is limited by small sample sizes and reliance on self-reported behaviour, which has known biases\(^16\). Wearable accelerometer devices have been used but have limitations. Some use a count-based threshold to classify sedentary behaviour\(^17\) which can misclassify low intensity non-sedentary behaviours such as standing and sleep\(^18,19,20\), whilst there are concerns over the accuracy of sitting estimates from wrist and hip worn monitors\(^20\). These limitations can be addressed using methods that directly estimate body posture, such as thigh mounted accelerometry\(^19\).

This study investigated whether device-measured MVPA and ST are associated with mental wellbeing and aimed to overcome preceding limitations by using data from a large national cohort study where MVPA and ST were assessed using thigh-mounted accelerometry.
Methods

i) Participants

The 1970 British Cohort Study consists of 17,196 people who were born in the UK during a single week in 1970 and followed up regularly throughout childhood and adulthood\(^{21, 22}\). This analysis utilises data from the age 46 survey (2016-2018): which involved interviews and biomedical assessments\(^{23}\). Participants provided informed consent and ethical approval was obtained from NRES Committee South East Coast - Brighton & Sussex (Ref 15/LO/1446).

ii) Measures of Physical Activity and Sedentary Behaviour

MVPA and ST were measured using a thigh-mounted accelerometer device (activPAL3 micro; PAL Technologies Ltd., Glasgow, UK\(^{24}\)) using a previously described wear protocol\(^{25}\). The device was fitted on the upper thigh and participants were advised to wear it continuously for 7 days including during sleep, bathing, and all physical activity. The activPAL uses thigh inclination and acceleration to estimate body posture (calculating 1-hour periods as sitting/lying, standing and walking), transition between postures, stepping and stepping speed (cadence). From this ST (hr/d) was calculated. The thigh mounted activPAL has been validated in measuring ST compared to direct observation\(^{26}\) and has been shown to be more precise and sensitive to changes in sitting time than hip worn monitors\(^{15}\). MVPA (hr/d) was derived using a step cadence threshold of ≥100\(^{27}\). Valid waking wear time was calculated using a previously validated algorithm which distinguishes sleep and prolonged non-wear\(^{28}\). Data on common types of MVPA and ST was obtained using self-reported questionnaires.

iii) Measures of Mental Wellbeing

Wellbeing was assessed using the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS), a 14-item scale focussing on positive hedonic and eudaimonic aspects of mental health (Supplementary Table 1)\(^{29}\). The scale provides a score from 14-70, with higher scores reflecting greater wellbeing. The WEMWBS has good content and criterion validity, internal consistency and test-retest reliability\(^{25}\) and has been validated in adults, adolescents, ethnic minorities and secondary mental health service users across the UK and Europe\(^{30}\).

iii) Covariates

Potential confounders were chosen from known correlates of MVPA/ST that may influence mental wellbeing including gender, health status and behaviours, education and socioeconomic status\(^{31}\). The covariates used included: occupation (National Statistics Socio-economic classification (NS-SEC):
professional/managerial; technical; manual; unemployed; not classifiable not stated), **highest educational qualification obtained** (non-degree educated; degree educated), **smoking status** (never smoked; ex-smoker; current smoker), **disability** (European Statistics of Income and Living Condition (EU-SILC) classification: none; some extent; severely hampered)\(^{32}\), **body mass index** (BMI \( \text{kg/m}^2 \)) and **Malaise Inventory Score** (a 9-item questionnaire assessing symptoms of psychological stress/depression/anxiety, Supplementary Table 2). The Malaise Inventory assesses important covariates that are distinct to mental wellbeing\(^{33, 34}\) and has shown robust psychometric properties\(^{35}\).

**iv) Statistical Analyses**

Associations between MVPA, ST (continuous data) and WEMWBS were examined using general linear regression models. We adjusted initially for gender and waking wear time (Model 1), additionally for highest educational qualification obtained, occupation, smoking, BMI and disability (Model 2) and additionally for Malaise Inventory (Model 3). Associations between self-reported activities and wellbeing were examined using linear models using similar covariates to Model 3. In order to examine joint associations, MVPA and ST were each categorised into three equal tertiles: MVPA (<0.6hr/d, 0.6-1hr/d, >1hr/d) and ST (<8hr/d, 8-10hr/d, >10hr/d). These were combined to produce nine groups (i.e. low MVPA / high ST; low MVPA / medium ST etc...). Linear models were used to examine differences in WEMBS between groups adjusting initially for gender and subsequently for all covariates.
Results

After excluding missing covariate and outcome data the final analysis comprised 4,526 participants: 2163 men and 2364 women (Figure 1). Participants declining to wear the device (11.8%) were more likely to be male, smokers, report poorer health, and be obese. Descriptive characteristics for the included sample are shown in Table 1. The mean WEMWBS score overall was 50.26 ± 8.35 and did not differ with gender. Mean MVPA and ST were 50.99 ± 25.42 mins/d and 9.25 ± 1.96 hr/d respectively. Gender, smoking, disability and malaise score were associated with WEMWBS scores (Supplementary Table 3).

In gender and wear time adjusted analyses (Model 1) MVPA showed a significant association with mental wellbeing (Table 2), with an extra hour per day of MVPA adding 2.15 additional points on the WEMWBS (95% CI 1.53-2.78, p<0.01). After further adjusting for educational status, social occupational position, smoking, BMI and disability (Model 2) MVPA remained associated with higher WEMWBS scores with an extra hour per day adding 0.92 points (95% CI 0.29-1.54, p<0.01). In Model 3, where malaise score was also adjusted for, MVPA remained associated with higher mental wellbeing: an extra hour per day providing 0.57 additional points on the WEMWBS (95% CI 0.03-1.12, p=0.04). ST was not associated with lower mental wellbeing in any of the models (Table 2). In analyses utilising context specific data, wellbeing was negatively associated with self-reported TV viewing and positively with walking for pleasure (Supplementary Table 4).

When analysing joint associations between sitting and MVPA, we observed a linear trend for sitting and WEMBS only in the lowest tertile of MVPA (p<0.001) when adjusted for covariates. We observed no consistent pattern in the medium and high MVPA categories (Figure 2).
Discussion

Device-measured MVPA was associated with higher mental wellbeing and this association was not nullified following adjustments for gender, wear time, educational status, social occupational position, smoking, BMI, disability and psychological distress. To our knowledge this is the first large scale cohort study showing an association between device-measured MVPA and mental wellbeing. A 1-unit increase in WEMBS is clinically relevant, correlating with reductions in suicidal thoughts and depressive or anxiety symptoms. Our demonstrated benefits of an additional hour of MVPA per day therefore may have relevance for population health. However, controlled trials are needed to establish causality and a meaningful effect size, which would fully elucidate any public health implications.

Physical activity and sitting are not mutually exclusive; time in one activity likely displaces another. Greater ST was associated with lower wellbeing only in participants recording lower MVPA levels. At higher levels, the association of sitting with wellbeing was markedly attenuated. Participants with highest levels of MVPA displayed the greatest wellbeing scores regardless of ST. Our findings may explain why pre-existing evidence linking ST with mental wellbeing has been mixed and mirror physical health outcomes including all-cause mortality and cardiovascular events where associations with ST are dependent on MVPA. The lack of independent association between ST and wellbeing may reflect differing types of sedentary activities. Consistent with our findings, mentally-passive activities (e.g. TV-viewing) are associated with lower wellbeing, whilst mentally-active activities (e.g. reading a book) are not, and can even be protective. Interventions focussing on reducing ST alone may not be effective in enhancing mental wellbeing without targeting negative sitting behaviours and promoting reallocation of that time to physically or mentally-active behaviours.

The association of MVPA and ST with wellbeing likely arises from cognitive, biological and social mechanisms. MVPA can be associated with higher cognition and reduction in stress levels, which are interrelated with mental wellbeing. Among biological mechanisms, both MVPA and lower ST are associated with reduced inflammation, and MVPA with cortisol release, both of which are associated with higher wellbeing. Neuroplasticity mediated by brain-derived neurotrophic factor (BDNF) and structural changes in hippocampal volume may also drive part of the association between MVPA, ST and higher wellbeing. In addition, MVPA as part of group activities is associated with higher social connectedness and social support, increasing mental wellbeing.

Our study has several significant limitations. Data are cross-sectional which does not allow for any causality inference. People with poor self-rated wellbeing may be more sedentary therefore the
direction of association is unclear. Interventional studies are therefore needed. As with all cohorts there were losses during follow-up and health-related and socioeconomic factors that were used as covariates are associated with dropout. Social support was not assessed but is known to be associated with both physical activity\textsuperscript{51} and mental wellbeing\textsuperscript{52}. Objectively measured physical activity may also imprecisely capture certain activities such as swimming and cycling, although the prevalence of these were low in our cohort. Finally, the lack of age variation of participants limits generalisability to other demographic groups such as children, adolescents or the elderly.

Nevertheless, our study has a number of strengths. This is a large-scale analysis from a nationally representative birth cohort. Physical activity and sitting were device-measured using thigh-based accelerometers and validated protocols were used to calculate ST and MVPA. Finally, we used a well-established measure of mental wellbeing and obtained mean scores consistent with UK population norms\textsuperscript{53}.

Our findings may have important policy implications. Promoting MVPA to WHO recommended levels\textsuperscript{54} may be an effective public health strategy to improve mental-wellbeing and should be a key focus of mental health policy. Reducing ST may not be as effective in promoting mental wellbeing but should be encouraged, especially in populations with low levels of MVPA. However, it is likely that not all sitting is the same and investigation of the difference between mentally-active and passive sitting is needed in order to establish targets for policy intervention.
Acknowledgements

Funding sources

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Author contributions

MH had full access to the data and takes responsibility for the integrity and accuracy of the results. NS and MH performed the analyses and drafted the paper. All authors contributed to the concept and design of the study and critical revision of the manuscript.
Table 1: Demographic and covariate information for study participants

<table>
<thead>
<tr>
<th></th>
<th>Total Sample (n = 4527)</th>
<th>Male (n = 2163)</th>
<th>Female (n = 2364)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean / n</td>
<td>SD / %</td>
<td>Mean / n</td>
</tr>
<tr>
<td>WEMWBS Score</td>
<td>50.56</td>
<td>8.35</td>
<td>50.22</td>
</tr>
<tr>
<td>MVPA (min/d)</td>
<td>50.99</td>
<td>25.42</td>
<td>50.34</td>
</tr>
<tr>
<td>ST (hr/d)</td>
<td>9.25</td>
<td>1.96</td>
<td>9.51</td>
</tr>
<tr>
<td><strong>COVARIATES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device Wear Time (hr/d)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15.82</td>
<td>1.25</td>
<td>15.98</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-degree educated</td>
<td>3318</td>
<td>73.3</td>
<td>1571</td>
</tr>
<tr>
<td>Degree educated</td>
<td>1209</td>
<td>26.7</td>
<td>592</td>
</tr>
<tr>
<td>Social Occupational Position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional / Managerial</td>
<td>1934</td>
<td>42.7</td>
<td>907</td>
</tr>
<tr>
<td>Technical</td>
<td>1254</td>
<td>27.7</td>
<td>627</td>
</tr>
<tr>
<td>Manual</td>
<td>580</td>
<td>12.8</td>
<td>265</td>
</tr>
<tr>
<td>Unemployed</td>
<td>92</td>
<td>2.0</td>
<td>45</td>
</tr>
<tr>
<td>Smoking</td>
<td>Not classifiable or not stated</td>
<td>667</td>
<td>14.7</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>Never smoked</td>
<td>2279</td>
<td>50.3</td>
</tr>
<tr>
<td></td>
<td>Ex-smoker</td>
<td>1455</td>
<td>32.1</td>
</tr>
<tr>
<td></td>
<td>Current smoker</td>
<td>793</td>
<td>17.5</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td></td>
<td>28.20</td>
<td>5.36</td>
</tr>
<tr>
<td>Disability</td>
<td>No long-standing health condition</td>
<td>3854</td>
<td>85.1</td>
</tr>
<tr>
<td></td>
<td>To some extent</td>
<td>455</td>
<td>10.1</td>
</tr>
<tr>
<td></td>
<td>Severely hampered</td>
<td>218</td>
<td>4.8</td>
</tr>
<tr>
<td>Malaise Inventory</td>
<td>Low malaise (0-3)</td>
<td>3759</td>
<td>83.0</td>
</tr>
<tr>
<td></td>
<td>High malaise (4+)</td>
<td>768</td>
<td>17.0</td>
</tr>
</tbody>
</table>

WEMWBS, Warwick-Edinburgh Mental Wellbeing Scale. MVPA, moderate to vigorous physical activity. ST, total daily sitting time (or sitting time). BMI, body mass index. Malaise Inventory – a 9-item questionnaire that assess for symptoms of psychological stress, anxiety and depression (see supplementary table 2).
**Table 2: Association of moderate to vigorous physical activity and sitting time with mental wellbeing**

<table>
<thead>
<tr>
<th></th>
<th>Mean difference in WEMWBS Score</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td></td>
</tr>
<tr>
<td>MVPA</td>
<td>B</td>
<td>2.15</td>
<td>0.92</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>95% CI</td>
<td>1.53 - 2.78</td>
<td>0.29 - 1.54</td>
<td>0.03 - 1.12</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>ST</td>
<td>B</td>
<td>-0.14</td>
<td>-0.08</td>
<td>-0.11</td>
</tr>
<tr>
<td></td>
<td>95% CI</td>
<td>-0.28 - 0.01</td>
<td>-0.22 - 0.06</td>
<td>-0.23 - 0.02</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.06</td>
<td>0.27</td>
<td>0.09</td>
</tr>
</tbody>
</table>

WEMWBS, Warwick-Edinburgh Mental Wellbeing Scale. MVPA, moderate to vigorous physical activity (hr/d). ST, sitting time (hr/d). CI, confidence interval.

Declined to wear activPAL, n = 877

Unusable data, n = 1,670
Nurse unable to initiate, n=102
Lost in post, n=591
Unable to download, n=272
Data available for less than one valid day, n=149
Unable to compute physical activity based on cadence, n=556

Incomplete co-variate / WEMWB data, n = 366

WEMWBS, Warwick-Edinburgh Mental Well-being Scale.
Figure 2: Adjusted combined association of physical activity and sitting time on wellbeing.

Data are presented as marginal mean WEMWBS scores with 95% confidence intervals minimally adjusted (for gender only) or fully adjusted (for gender, education, social occupational position smoking, disability, BMI, malaise). MVPA and sitting categories reflect tertiles. WEMWBS, Warwick-Edinburgh Mental Wellbeing Scale.
**Supplementary Table 1: The Warwick Edinburgh Mental Wellbeing Scale**

<table>
<thead>
<tr>
<th>Questions</th>
<th>None of the time</th>
<th>Rarely</th>
<th>Some of the time</th>
<th>Often</th>
<th>All of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I’ve been feeling optimistic about the future</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling useful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling relaxed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling interested in other people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve had energy to spare</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been dealing with problems well</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been thinking clearly</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling good about myself</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling close to other people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling confident</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been able to make up my own mind about things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling loved</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been interested in new things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I’ve been feeling cheerful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Scores for the 14 individual questions are summed to provide an overall score from 14-70 with greater scores reflecting higher levels of wellbeing.
**Supplementary Table 2: The Malaise Inventory used in the British Cohort Study Age 46 survey**

<table>
<thead>
<tr>
<th>Questions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you feel tired most of the time?</td>
<td></td>
</tr>
<tr>
<td>2. Do you often feel miserable or depressed?</td>
<td></td>
</tr>
<tr>
<td>3. Do you often get worried about things?</td>
<td></td>
</tr>
<tr>
<td>4. Do you often get in a violent rage?</td>
<td></td>
</tr>
<tr>
<td>5. Do you often suddenly become scared for no good</td>
<td></td>
</tr>
<tr>
<td>6. Are you easily upset or irritated?</td>
<td></td>
</tr>
<tr>
<td>7. Are you constantly keyed up and jittery?</td>
<td></td>
</tr>
<tr>
<td>8. Does every little thing get on your nerves and wear you down?</td>
<td></td>
</tr>
<tr>
<td>9. Does your heart often race like mad?</td>
<td></td>
</tr>
</tbody>
</table>

*Questions were asked in a yes/no format. A score of 0 was awarded for every 'no' response and a score of 1 awarded for every 'yes' response. ‘Low malaise was defined as an overall score of 0-3, ‘high malaise’ was defined as an overall score > 3.*
**Supplementary Table 3**: Mean differences in Warwick-Edinburgh Mental Wellbeing Scale with covariates

<table>
<thead>
<tr>
<th></th>
<th>Mean difference in WEMWBS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Gender</td>
<td>1.18</td>
</tr>
<tr>
<td>Highest academic qualification</td>
<td>-0.02</td>
</tr>
<tr>
<td>Social occupational class</td>
<td>0.01</td>
</tr>
<tr>
<td>Smoking</td>
<td>-0.57</td>
</tr>
<tr>
<td>BMI</td>
<td>-0.03</td>
</tr>
<tr>
<td>Disability</td>
<td>-2.10</td>
</tr>
<tr>
<td>Malaise score</td>
<td>-10.50</td>
</tr>
</tbody>
</table>

WEMWBS, Warwick-Edinburgh Mental Wellbeing Scale. BMI, body mass index. CI, confidence interval.
**Supplementary Table 4:** Wellbeing in relation to common types of activity recorded via self-reported questionnaire

<table>
<thead>
<tr>
<th>TV VIEWING</th>
<th>Wellbeing score - B (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 hr/d</td>
<td>Ref</td>
</tr>
<tr>
<td>1-2 hr/d</td>
<td>0.24 (-0.22, 0.69)</td>
</tr>
<tr>
<td>&gt;2-4 hr/d</td>
<td>-0.54 (-1.0, -0.04)</td>
</tr>
<tr>
<td>≥4hr/d</td>
<td>-0.69 (-1.21, -0.16)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WALKING FOR PLEASURE</th>
<th>Wellbeing score B (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Ref</td>
</tr>
<tr>
<td>1-2/month</td>
<td>0.14 (-0.29, 0.56)</td>
</tr>
<tr>
<td>1-3/week</td>
<td>0.77 (0.35, 1.19)</td>
</tr>
<tr>
<td>4 or more per week</td>
<td>0.60 (0.15, 1.04)</td>
</tr>
</tbody>
</table>

* B coefficient adjusted for sex, smoking, education, disability, self-rated health, malaise score, BMI
References


50 Isabelle Doré, Jennifer L. O’Loughlin, Mireille E. Schnitzer, Geetanjali D. Datta, Louise Fournier, The longitudinal association between the context of physical activity and mental health in early adulthood, Mental Health and Physical Activity. 2018;14:121-130.


