Appendix

Does leisure time physical activity protect against low back pain? Systematic review and meta-analysis of 36 prospective cohort studies

R Shiri, 1 K Falah-Hassani 2

1 Finnish Institute of Occupational Health, Helsinki, Finland
2 Western University, London, Canada
**Supplementary Table S1:** PubMed search strategy made in July, 2016

<table>
<thead>
<tr>
<th>Search</th>
<th>Query</th>
<th>No of items found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final</td>
<td>#1 AND #2</td>
<td>8,135</td>
</tr>
</tbody>
</table>
### Table S2: Quality assessment

<table>
<thead>
<tr>
<th>Type of bias</th>
<th>Criteria definition</th>
<th>Classification (potential for bias)</th>
</tr>
</thead>
</table>
| Selection bias    | Sampling method of the study population, representativeness (response rate, difference between responders and non-responders, investigate and control of variables in case of difference between responders and non-responders) | **Low:** Target population defined as representative of the general population or subgroup of the general population (specific age group, women, men, specific geographic area, and specific occupational group) and response rate is 80% or more.  
**Moderate:** Target population defined as somewhat representative of the general population, a restricted subgroup of the general population, response rate 60%-79%.  
**High:** Target population defined as “self-referred”/volunteers, response rate less than 60%. |
| Performance bias  | Valid and reliable assessment of exposure  
Assessors blinded for outcome status | **Low:** Physical activity assessed using physical activity index or Metabolic Equivalent Task (MET), or frequency of participation in sports and other leisure-time physical exercise assessed.  
**Moderate:** Participation in some types of sports assessed. Other activities not considered.  
**High:** A “yes” or “no” question used. Frequency and duration of physical activity not assessed. |
| Confounding       | Matching two groups  
Stratification  
Statistical analysis | **Low:** Controlled for most potential confounding factors including age and sex.  
**Moderate:** Controlled for few potential confounding factors, including both age and sex.  
**High:** Not controlled for both age and sex, or controlled for less than two confounding factors. |
| Attrition bias    | Withdrawals and drop-out rates  
Size of missing data | **Low:** Follow up participation rate of 80% or higher or missing data on less than 20%.  
**Moderate:** Follow up participation rate of 60%-79%, or missing data on 20%-40%.  
**High:** Follow up participation rate of less than 60%, or missing data on more than 40%. |
Table S3: Studies included in the meta-analysis

<table>
<thead>
<tr>
<th>First author and year of publication</th>
<th>Country</th>
<th>Follow-up time</th>
<th>Study population</th>
<th>Low back pain at baseline</th>
<th>Age range at baseline</th>
<th>Sex</th>
<th>Sample size (in analysis)</th>
<th>Physical activity</th>
<th>Low back pain at follow-up</th>
<th>Quality assessment: Risk of bias</th>
<th>Results</th>
<th>Adjustment for other covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hübscher 2015</td>
<td>Denmark</td>
<td>2 years</td>
<td>A representative sample of twins, Longitudinal Study of Aging Danish Twins (LSADT)</td>
<td>Without back pain during the month before baseline interview</td>
<td>70 or older</td>
<td>Both, 55% were females</td>
<td>2333 for light and 2073 for strenuous activity</td>
<td>Current engagement in light leisure time physical activity (e.g., light gardening, easy gymnastics, short (less than 0.5 hours) walks, or bike rides (yes/no)) and in strenuous leisure time physical activity (e.g., heavy gardening, long (more than half an hour) walks or bike rides, sports, or dancing)</td>
<td>Low back pain in the past month</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Lunde 2015</td>
<td>Norway</td>
<td>6.5 years</td>
<td>Students of 13 technical schools</td>
<td>With or without low back pain</td>
<td>Mean age 17.5 ± 1.2</td>
<td>Both, 64% were women</td>
<td>420 (153 men and 267 women)</td>
<td>Frequency of leisure time physical activity leading to increased heart rate or shortness of breath (9 repeated measures). It</td>
<td>Low back pain in the past month (9 repeated measures)</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Age</td>
<td>Sex</td>
<td>Back Pain</td>
<td>Sample Size</td>
<td>Activity</td>
<td>Time</td>
<td>Classification</td>
<td>First Episode of Low Back Pain</td>
<td>OR</td>
<td>CI</td>
<td>Age, Sex, Race, Education, Income, Active Duty Status, Smoking, Body Mass Index, Time in Army, Previous Injury, Depression, Anxiety, Fear of Pain Questionnaire, and Exercise and Education Groups</td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td>-----</td>
<td>-------</td>
<td>-----------</td>
<td>-------------</td>
<td>-----------</td>
<td>------</td>
<td>----------------</td>
<td>------------------------------</td>
<td>------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>George 2012 ³</td>
<td>USA</td>
<td>2 years</td>
<td>Soldiers Without back pain</td>
<td>18-35, mean age 22.3 ± 4.5</td>
<td>1230</td>
<td>Exercising routinely prior to military service vs. not routinely</td>
<td>High, Moderate, Low</td>
<td>First episode of low back pain in the past month during the follow-up</td>
<td>Low</td>
<td>OR 1.074 (CI 0.834-1.382)</td>
<td>Estimated RR 1.04 (CI 0.90-1.19)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Age</th>
<th>Sex</th>
<th>Back Pain</th>
<th>Sample Size</th>
<th>Activity</th>
<th>Time</th>
<th>Classification</th>
<th>First Episode of Low Back Pain</th>
<th>OR</th>
<th>CI</th>
<th>Age, sex, race, education, income, active duty status, smoking, body mass index, time in army, previous injury, depression, anxiety, fear of pain questionnaire, and exercise and education groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wedderkop 2009 ⁴</td>
<td>Denmark</td>
<td>3 years</td>
<td>Schoolchildren Without back pain</td>
<td>8-10</td>
<td>265</td>
<td>Physical activity was assessed using accelerometer, and classified into average physical activity (counts per minute) and minutes per day spent on high physical activity (each grouped into low, moderate, or high)</td>
<td>Low, Moderate, High</td>
<td>Low back pain in the past month</td>
<td>Low</td>
<td>OR 2.5 (CI 1.0-6.2) for counts per minute and 4.6 (CI 1.9-11.2) for high physical activity, comparing the lowest tertile with the highest tertile. Estimated OR 0.40 (CI 0.16-0.996) for average physical activity and 0.22 (CI 0.09-0.53) for high physical activity, comparing the highest tertile with the lowest tertile. Estimated RR 0.44 (CI 0.18-0.997) for average physical activity (counts per minute) and 0.25 (CI 0.10-0.57) for high physical activity, comparing the lowest tertile with the highest tertile.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Age</th>
<th>Setting</th>
<th>Gender</th>
<th>Number of Participants</th>
<th>Physical Activity</th>
<th>Pain Intensity</th>
<th>Pain Duration</th>
<th>OR (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jones 2003</td>
<td>UK</td>
<td>1 year</td>
<td>Schoolchildren</td>
<td>Both</td>
<td>903</td>
<td>Low back pain lasted for one day or longer in the past month</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Harreby 1997</td>
<td>Denmark</td>
<td>25 years</td>
<td>Schoolchildren</td>
<td>Both</td>
<td>474</td>
<td>Number of hours of leisure time physical activity per week (e.g., sports or gardening)</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Hussain 2016</td>
<td>Australia</td>
<td>12 years</td>
<td>General population</td>
<td>Both</td>
<td>4974</td>
<td>Hours spent in walking, or other moderate or vigorous activities. Inactive vs. active defined as physical activity &lt;2.5 h/week vs. ≥2.5 h/week</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
</tbody>
</table>
OR for low back pain 1.08 (CI 0.89-1.31) for men, 0.91 (CI 0.76-1.07) for women and 0.98 (CI 0.86-1.12) for both sexes combined for inactive vs. active.

OR for low back pain 0.93 (CI 0.76-1.13) for men, 1.10 (CI 0.92-1.31) for women and 1.02 (CI 0.89-1.17) for both sexes combined for active vs. inactive.

RR for low back pain 0.99 (CI 0.94-1.03) for men, 1.02 (CI 0.98-1.05) for women and 1.01 (CI 0.98-1.04) for both sexes combined for active vs. inactive.

Estimated HR 0.85 (CI 0.59-1.23) for active vs. inactive
Students from two public and one private schools reported low back pain during the past 6 months. 47% were females. First 6 months and 357 for the second 6 months in different sports activities over the past 6 months. 91% were active at least in one extracurricular activity at least once a week during the past six months.

Participants with LBP (n = 48) and 5.4% of those without LBP (n = 329) were highly active. At 12 months 9.3% of participants with LBP (n = 32) and 6.1% of those without LBP (n = 357) were highly active.

Estimated RR 2.28 (CI 0.95-5.47) for the first 6 months and 1.52 (0.48-4.81) for the second 6 months.

Estimated RR 1.97 (CI 0.62-6.18) for high level of activity vs. moderate or low level of activity for 1-year follow-up.

### Low back pain in the past 12 months

**Brady 2016**
- **Australia**
- **15 years**
- A random sample national health insurance population (Medicare)
- With or without back pain
- Mean age 49.5 ± 1.5
- Women 11,478
- Participation in vigorous physical activity such as vigorous aerobics, competitive sport, or vigorous cycling or running
- Having sometimes or often back pain in the past 12 months
- Moderate
- Moderate
- Low
- Moderate
- Adjusted OR 0.91 (CI 0.87-0.95).
- Estimated RR 0.955 (CI 0.93-0.98)

**Kapellusch 2014**
- **USA**
- **Median 1.2 and mean 1.4 ± 1.0 years**
- Occupational population from 30 diverse production facilities
- Without low back pain for at least 3 months, sciatica and low back surgeries
- Both, 33% were females
- Frequency of leisure time physical activity; none, 1-3 times, and 4 times or more per week
- Self-reported use of over-the-counter or prescription medication for low back pain during the follow-up
- High
- Low
- Moderate
- Low
- HR 1.56 (CI 0.95-2.57) for moderate, 1.42 (CI 0.86-2.35) for high and 1.49 (CI 0.97-2.28) for moderate or high activity vs. inactivity.
- HR 1.41 (CI 0.87-2.28) for moderate, 1.37 (CI 0.83-2.26) for high and 1.39 (CI 0.92-2.10) for moderate or inactivity.
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Duration</th>
<th>Population / Occupation</th>
<th>Method</th>
<th>Activity Measure</th>
<th>Cut-off</th>
<th>Activity Level</th>
<th>Follow-up</th>
<th>Outcome Description</th>
<th>Odds Ratio (95% CI) for Active vs. Inactive</th>
<th>Additional Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shiri 2013</td>
<td>Finland</td>
<td>6 years</td>
<td>General population</td>
<td>MET</td>
<td>Consisting of frequency, intensity and duration of leisure time physical activity. Average leisure-time physical activity during baseline and follow-up period</td>
<td>Low back pain (with or without radiation) longer than 7 days in the past 12 months</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>RR 1.05 (CI 0.77-1.43) for moderate, 1.05 (CI 0.77-1.44) for high and 1.05 (0.80-1.38) for moderate/high compared with low activity in men. RR 1.01 (CI 0.74-1.38) for moderate, 1.19 (CI 0.90-1.58) for high and 1.11 (0.86-1.43) for moderate/high compared with low activity in women. RR 1.00 (CI 0.80-1.24) for moderate, 1.11 (CI 0.90-1.36) for high and 1.05 (0.87-1.27) for moderate/high compared with low activity in men and women combined</td>
<td>Age, sex, educational status, occupational status, and smoking</td>
</tr>
<tr>
<td>Thiese 2011</td>
<td>USA</td>
<td>Mean 1.4 years</td>
<td>Occupational population</td>
<td>Physical activity measured by accelerometer. Tertile distribution was used to define low, moderate, and high activity</td>
<td>New onset of low back pain during the follow-up period</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>HR 1.29 (0.48-3.47) for moderately active vs. inactive. HR 2.65 (CI 0.80-8.79) for highly active vs. inactive. HR 1.61 (CI 0.65-3.96) for active vs. inactive</td>
<td>Age, BMI, sex, smoking, back compressive force, feeling depressed, and seeing a health care provider for low back pain</td>
<td></td>
</tr>
<tr>
<td>Bovenzi 2010</td>
<td>Italy</td>
<td>1 year</td>
<td>Professional drivers of several industries</td>
<td>Frequency of leisure time physical activity per week</td>
<td>Low back pain for one day or longer in the past 12 months</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>OR 1.01 (CI 0.57-1.78) for at least one time per week vs. never/almost never. Estimated RR 1.01 (CI 0.68-1.37)</td>
<td>Age, body mass index, smoking, physical work load factors, and psychosocial or psychosomatic factors</td>
<td></td>
</tr>
<tr>
<td>Miranda 2008</td>
<td>Finland</td>
<td>1 year</td>
<td>Workers of forest industry</td>
<td>Without back pain</td>
<td>2237</td>
<td>Exercise (e.g., bicycling or swimming) for at least 20 minutes per session: None, once a week, and 2 times or more per week</td>
<td>Low back pain longer than 7 days in the past 12 months</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
<td>--------</td>
<td>----------------------------</td>
<td>-------------------</td>
<td>------</td>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>----------</td>
<td>----------</td>
<td>-----</td>
<td>----------</td>
</tr>
<tr>
<td>Estimated unadjusted RR 0.66 (CI 0.41-1.05) for once a week vs. inactive, 0.78 (CI 0.54-1.13) for 2 times or more vs. inactive and 0.75 (CI 0.52-1.08) for active vs. inactive in subjects younger than 40 years.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated unadjusted RR 1.35 (CI 0.86-2.11) for once a week vs. inactive, 1.16 (CI 0.79-1.72) for 2 times or more vs. inactive and 1.21 (CI 0.82-1.77) for active vs. inactive in subjects 40-49 years.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated unadjusted RR 1.08 (CI 0.68-1.71) for once a week vs. inactive, 0.82 (CI 0.54-1.22) for 2 times or more vs. inactive and 0.88 (CI 0.59-1.29) for active vs. inactive in subjects 50 years or older.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated unadjusted RR 0.995 (CI 0.76-1.30) for once a week vs. inactive, 0.90 (CI 0.72-1.13) for 2 times or more vs. inactive and 0.92 (CI 0.74-1.14) for active vs. inactive in all subjects.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated adjusted RR 0.8 (CI 0.52-1.24) for moderate, 1.0 (CI 0.68-1.47) for high and 0.91 (CI 0.68-1.21) for active vs. inactive in subjects younger than 40 years.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated adjusted RR 1.22 (CI 0.81-1.85) for moderate, 1.11 (CI 0.70-1.76) for high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Age, sex, smoking, body mass index, heavy lifting, awkward postures, and whole body vibration.
and 1.17 (CI 0.86-1.59) for active vs. inactive in subjects 40-49 years.

Estimated adjusted RR 0.79 (CI 0.50-1.23) for moderate, 0.71 (CI 0.46-1.09) for high and 0.75 (CI 0.54-1.02) for active vs. inactive in subjects 50 years or older.

Estimated adjusted RR 0.93 (CI 0.72-1.19) for moderate, 0.92 (CI 0.72-1.18) for high and 0.93 (CI 0.78-1.11) for active vs. inactive in all subjects

**Strøyer 2008**

Denmark 2.5 years

Healthcare workers at institutions for physically and mentally disabled persons

Without clinically significant low back pain

11% younger than 36 years, 28% 36-45, 41% 46-55, and 20% older than 55 years

Both, 83% were women

Leisure time physical activity more than 4 hours per week vs. 4 hours per week or less, using modified Saltin & Grimby questionnaire

Low back pain in the past 12 months

High

High

Moderate

Moderate

OR 1.08 (CI 0.35-3.32) for high vs. low or moderate activity

Age and sex

**Andersen 2007**

Denmark 2 years

Occupational population

Without musculoskeletal pain

18-67

Both

1492

Low or moderate activity (4 hours or less per week), and high activity (light activity 4 hours or more per week, or strenuous physical activity for 2 hours or

Low back pain in the past 12 months

Moderate

High

Moderate

Low

HR 1.0 (0.7-1.3) for high vs. low or moderate activity

Age, sex, occupational group, and intervention group
Hartvigsen 2007 15 Denmark 2 years A representati ve sample of twins. Longitudina l Study of Aging Danish Twins (LSADT) Without back pain during the month before baseline interview 70 or older Both, 52% were females 1387 (671 men and 716 women) Current engagement in light leisure time physical activity (e.g., light gardening, easy gymnastics, short (less than 0.5 hours) walks, or bike rides (yes/no)) and in strenuous leisure time physical activity (e.g., heavy gardening, long (more than half an hour) walks or bike rides, sports, or dancing) Low back pain for at least one day in the past 12 months Moderate Moderate High Low

OR 0.69 (CI 0.34-1.39) for men, 1.26 (CI 0.65-2.47) for women and 0.59 (CI 0.59-1.54) for both sexes combined for light activity.

OR 0.60 (CI 0.36-1.00) for men, 0.59 (CI 0.37-0.95) for women and 0.59 (CI 0.42-0.83) for both sexes combined for strenuous activity.

Estimated OR 0.630 (CI 0.416-0.952) for men, 0.760 (CI 0.517-1.116) for women and 0.692 (CI 0.524-0.914) for both sexes for active vs. inactive.

Estimated RR for men, 0.72 (CI 0.37-1.32) for light, 0.63 (CI 0.39-1.00) for strenuous and 0.66 (CI 0.45-0.96) for active vs. inactive.

Estimated RR for women, 1.21 (CI 0.69-2.00) for light, 0.63 (CI 0.41-0.96) for strenuous and 0.79 (CI 0.56-1.10) for active vs. inactive.

Estimated RR for both sexes, 0.96 (CI 0.63-1.43) for light, 0.63 (CI 0.46-0.85) for strenuous and 0.72 (CI 0.56-0.93) for active vs. inactive.

In the co-twin control analysis, OR 0.21 (CI 0.12-0.37) for strenuous activity.
<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Country</th>
<th>Duration</th>
<th>Setting</th>
<th>Population</th>
<th>Without low back pain in the past month</th>
<th>Mean age</th>
<th>Both, % females</th>
<th>Sport activity index, tertile distribution</th>
<th>Low back pain for at least one day in the past 12 months</th>
<th>High</th>
<th>Low</th>
<th>High</th>
<th>Low</th>
<th>Unadjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob 2006</td>
<td>Israel</td>
<td>1 year</td>
<td>Population-based</td>
<td>22-70, mean age 45.5</td>
<td>Both, 54.5% were females</td>
<td>211</td>
<td>Sport activity index, tertile distribution</td>
<td>Low back pain for at least one day in the past 12 months</td>
<td>1.33 (CI 0.41-2.51) for moderate vs. low and 0.57 (CI 0.13-2.05) for high vs. low.</td>
<td>Estimated OR 1.03 (CI 0.48-2.20) for active vs. inactive.</td>
<td>Estimated RR 1.25 (CI 0.46-1.97) for moderate, 0.62 (CI 0.15-1.72) for high and 1.02 (CI 0.53-1.80) for moderate or high activity.</td>
<td>Estimated RR 0.87 (CI 0.59-1.33) for moderate and 0.61 (CI 0.28-1.33) for high activity in women.</td>
<td>Estimated RR 0.88 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>1.38 (CI 0.88-2.17) for moderate, 1.28 (CI 0.65-2.50) for high, and 1.36 (CI 0.88-2.11) for moderate or high activity.</td>
</tr>
<tr>
<td>Leino-Arjas 2006</td>
<td>Finland</td>
<td>28 years</td>
<td>Metal industry employees</td>
<td>18–64</td>
<td>Both, 35% were females</td>
<td>544 (353 men and 191 women)</td>
<td>Number of hours multiply by intensity of different activities (sports, exercise, housework and commuting to work)</td>
<td>Often or frequent local low back pain in the past 12 months</td>
<td>0.67 (CI 0.37-1.22) for moderate and 0.78 (CI 0.45-1.35) for high activity in men and 0.87 (CI 0.40-1.86) for moderate and 0.61 (CI 0.28-1.33) for high activity in women.</td>
<td>Estimated RR 0.786 (CI 0.515-1.111) for moderate and 0.865 (CI 0.597-1.168) for high activity in men and 0.930 (CI 0.571-1.301) for moderate and 0.758 (CI 0.438-1.142) for high activity in women.</td>
<td>Estimated RR 0.83 (CI 0.64-1.07) in men and 0.85 (CI 0.62-1.17) in women for moderate/high activity.</td>
<td>Estimated RR 0.85 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>0.85 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>0.85 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
</tr>
<tr>
<td>Yip 2004</td>
<td>Hong Kong</td>
<td>1 year</td>
<td>A convenience sample of nurses from</td>
<td>1 year</td>
<td>Without low back pain</td>
<td>Mean age 31.1</td>
<td>Both, 85% were women</td>
<td>144</td>
<td>1) Low activity (no sports or other)</td>
<td>Low back pain in the past 12 months</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Country</th>
<th>Duration</th>
<th>Setting</th>
<th>Population</th>
<th>Without low back pain in the past month</th>
<th>Mean age</th>
<th>Both, % females</th>
<th>Sport activity index, tertile distribution</th>
<th>Low back pain for at least one day in the past 12 months</th>
<th>High</th>
<th>Low</th>
<th>High</th>
<th>Low</th>
<th>Unadjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob 2006</td>
<td>Israel</td>
<td>1 year</td>
<td>Population-based</td>
<td>22-70, mean age 45.5</td>
<td>Both, 54.5% were females</td>
<td>211</td>
<td>Sport activity index, tertile distribution</td>
<td>Low back pain for at least one day in the past 12 months</td>
<td>1.33 (CI 0.41-2.51) for moderate vs. low and 0.57 (CI 0.13-2.05) for high vs. low.</td>
<td>Estimated OR 1.03 (CI 0.48-2.20) for active vs. inactive.</td>
<td>Estimated RR 1.25 (CI 0.46-1.97) for moderate, 0.62 (CI 0.15-1.72) for high and 1.02 (CI 0.53-1.80) for moderate or high activity.</td>
<td>Estimated RR 0.87 (CI 0.59-1.33) for moderate and 0.61 (CI 0.28-1.33) for high activity in women.</td>
<td>Estimated RR 0.88 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>1.38 (CI 0.88-2.17) for moderate, 1.28 (CI 0.65-2.50) for high, and 1.36 (CI 0.88-2.11) for moderate or high activity.</td>
</tr>
<tr>
<td>Leino-Arjas 2006</td>
<td>Finland</td>
<td>28 years</td>
<td>Metal industry employees</td>
<td>18–64</td>
<td>Both, 35% were females</td>
<td>544 (353 men and 191 women)</td>
<td>Number of hours multiply by intensity of different activities (sports, exercise, housework and commuting to work)</td>
<td>Often or frequent local low back pain in the past 12 months</td>
<td>0.67 (CI 0.37-1.22) for moderate and 0.78 (CI 0.45-1.35) for high activity in men and 0.87 (CI 0.40-1.86) for moderate and 0.61 (CI 0.28-1.33) for high activity in women.</td>
<td>Estimated RR 0.786 (CI 0.515-1.111) for moderate and 0.865 (CI 0.597-1.168) for high activity in men and 0.930 (CI 0.571-1.301) for moderate and 0.758 (CI 0.438-1.142) for high activity in women.</td>
<td>Estimated RR 0.83 (CI 0.64-1.07) in men and 0.85 (CI 0.62-1.17) in women for moderate/high activity.</td>
<td>Estimated RR 0.85 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>0.85 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>0.85 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
</tr>
<tr>
<td>Yip 2004</td>
<td>Hong Kong</td>
<td>1 year</td>
<td>A convenience sample of nurses from</td>
<td>1 year</td>
<td>Without low back pain</td>
<td>Mean age 31.1</td>
<td>Both, 85% were women</td>
<td>144</td>
<td>1) Low activity (no sports or other)</td>
<td>Low back pain in the past 12 months</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Country</th>
<th>Duration</th>
<th>Setting</th>
<th>Population</th>
<th>Without low back pain in the past month</th>
<th>Mean age</th>
<th>Both, % females</th>
<th>Sport activity index, tertile distribution</th>
<th>Low back pain for at least one day in the past 12 months</th>
<th>High</th>
<th>Low</th>
<th>High</th>
<th>Low</th>
<th>Unadjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob 2006</td>
<td>Israel</td>
<td>1 year</td>
<td>Population-based</td>
<td>22-70, mean age 45.5</td>
<td>Both, 54.5% were females</td>
<td>211</td>
<td>Sport activity index, tertile distribution</td>
<td>Low back pain for at least one day in the past 12 months</td>
<td>1.33 (CI 0.41-2.51) for moderate vs. low and 0.57 (CI 0.13-2.05) for high vs. low.</td>
<td>Estimated OR 1.03 (CI 0.48-2.20) for active vs. inactive.</td>
<td>Estimated RR 1.25 (CI 0.46-1.97) for moderate, 0.62 (CI 0.15-1.72) for high and 1.02 (CI 0.53-1.80) for moderate or high activity.</td>
<td>Estimated RR 0.87 (CI 0.59-1.33) for moderate and 0.61 (CI 0.28-1.33) for high activity in women.</td>
<td>Estimated RR 0.88 (CI 0.64-1.13) for moderate, 0.83 (CI 0.63-1.09) for high and 0.84 (CI 0.69-1.02) for moderate/high activity in men and in men combined</td>
<td>1.38 (CI 0.88-2.17) for moderate, 1.28 (CI 0.65-2.50) for high, and 1.36 (CI 0.88-2.11) for moderate or high activity.</td>
</tr>
<tr>
<td>6 district hospitals</td>
<td>n</td>
<td>physical activities that caused sweating or breathlessness</td>
<td>high compared with low activity during leisure-time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---</td>
<td>----------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) district hospitals</td>
<td>2) physical activity (3 or more times/week at least for 20 minutes causing some sweating or breathlessness (e.g., walking, gardening or practicing Tai Chi); and 3) high activity (3 or more times/week at least for 20 minutes, of jogging/running, hiking, biking or swimming, causing moderate to high sweating or breathlessness, or 5 or more times/week at least for 30 minutes, of any physical activity causing some sweating or breathlessness)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Time Period</td>
<td>Cohort</td>
<td>Exclusions</td>
<td>Sample Size</td>
<td>Low Back Pain Lasted for More than One Day</td>
<td>OR</td>
<td>CI</td>
<td>Unadjusted for Age, Sex, and Low Back Pain at Baseline. The Results Did Not Differ in Working/Non-Working, or Educational Level Subgroups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>------------</td>
<td>-------------</td>
<td>------------------------------------------</td>
<td>----</td>
<td>----</td>
<td>------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picavet 2003</td>
<td>Netherlands</td>
<td>1 to 4 yrs.</td>
<td>Population based</td>
<td>With or without low back pain</td>
<td>Both</td>
<td>3759</td>
<td>Lack of moderate leisure-time activity defined as less than 0.5 hour per day or per week spent on activities of at least 4 METs (e.g., gardening, cycling, or sports)</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>OR 1.11 (CI 0.94-1.32) for &lt;0.5 hour per week and 1.04 (CI 0.90-1.21) for &lt;0.5 hour activity per day. Estimated OR 0.90 (CI 0.76-1.07) for 0.5 hour or more vs. &lt;0.5 hour per week and 0.96 (CI 0.83-1.12) for 0.5 hour or more vs. &lt;0.5 hour per day. Estimated RR 0.94 (CI 0.84-1.04) for 0.5 hour or more vs. &lt;0.5 hour per week and 0.98 (CI 0.89-1.07) for 0.5 hour or more vs. &lt;0.5 hour per day.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power 2001</td>
<td>UK</td>
<td>10 years</td>
<td>The 1958 British birth cohort</td>
<td>Excluded from analysis: those with back pain at 23 years, those with back pain at 23 years who recovered, persistent back pain at 23 and 33 years, and those with incident back pain between 23 and 32 years</td>
<td>Both, 51% were women</td>
<td>4906</td>
<td>Inactivity at age 23 years defined as watching more than 5 episodes of television and no sports activity per week</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>OR 1.04 (CI 0.87-1.25) for inactive vs. active. Estimated OR 0.962 (CI 0.802-1.153) for active vs. inactive Estimated RR 0.966 (CI 0.818-1.136) for active vs. inactive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Croft 1999**

UK 1 year Two registered general practice populations Without low back pain in the previous month 18-75 Both, 56% were women 1649 (722 men and 927 women) Participation in a regular sport activity (yes/no), walking > 30 minutes vs. < 30 minutes each day Consultation due to back pain in the past 12 months identified via computer recording system, or self-reported low back pain in the past 12 months without consultation High Moderate Moderate High RR 1.0 (CI 0.8-1.3) in men and 1.34 (CI 1.1-1.7) in women for sport activity. RR 1.0 (CI 0.8-1.3) in men and 1.1 (CI 0.9-1.4) in women for walking. RR 1.176 (CI 1.00-1.383) for sport activity and 1.054 (CI 0.895-1.241) for walking in both sexes. RR 1.0 (CI 0.8-1.3) in men, 1.22 (CI 0.94-1.57) in women and 1.11 (CI 0.92-1.35) in both sexes for sport activity or walking

**Eriksen 1999**

Norway 4 years Population-based Without back pain 20-62 Both, 47% were women 523 Number of leisure time physical activity sessions (for at least 20 minutes to the level of sweating or breathlessness) per week Low back pain in the past 12 months Low Moderate Low Moderate Estimated unadjusted RR 0.86 (CI 0.66-1.11) for 1-2 sessions vs. none, 0.74 (CI 0.52-1.04) for 3 or more sessions vs. none, and 0.82 (CI 0.65-1.03) for one or more vs. none. Adjusted OR 1.55 (CI 1.03-2.33) for inactive vs. active (1 session or more/week). Estimated OR for active vs. inactive 0.645 (CI 0.43-0.97). Estimated RR for active vs. inactive 0.75 (CI 0.56-0.98). Age, sex, marital status, smoking, heavy physical work, emotional symptoms, musculoskeletal pain other than low back pain, and monotonous movements in the job

**Harreby 1997**

Denmark 25 years Schoolchildren With or without low back pain 14 at baseline and 38 at follow-up Both, 54% were females 474 Number of hours of leisure time physical activity per week (e.g., sports or gardening) Low back pain in the past 12 months Low Low High Moderate Estimated RR 0.75 (CI 0.59-0.94) for leisure time physical activity for at least 3 hours/week vs. no activity

Age and sex.
Estimate for regular sport in women was controlled for age, General Health Questionnaire score, self-rated health, weight, and do-it-yourself activities
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Duration</th>
<th>Setting</th>
<th>Gender</th>
<th>Participants</th>
<th>Exercise History</th>
<th>Pain History</th>
<th>Relative Risk</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burdorf 1996</td>
<td>Netherlands</td>
<td>1 year</td>
<td>Novice golfers</td>
<td>Men</td>
<td>22-60</td>
<td>Participation in other sports (tennis, squash, jogging, field hockey, soccer, judo)</td>
<td>Low back pain in the past 12 months</td>
<td>Moderate High Moderate Low</td>
<td>RR 1.88 (CI 0.89-3.92) for active athletes compared with men who played golf only. Participation in other sports, frequency of playing golf, and number of golf lessons were not associated with first-time back pain in men without a history of back pain at baseline (quantitative results not reported)</td>
</tr>
<tr>
<td>Jacobs 2006</td>
<td>Israel</td>
<td>7 years</td>
<td>An elderly population</td>
<td>Both</td>
<td>70</td>
<td>Active vs. inactive. Active defined as going for a walk ≥ 4 times a week or performing sports ≥ 2 times a week</td>
<td>Back pain on a frequent basis at age 77</td>
<td>Moderate Moderate High Moderate</td>
<td>15% of subjects without back pain and 25% of those with back pain were inactive. Prevalence of back pain was 55% in 220 active subjects and 70% in 57 inactive subjects. Estimated RR 0.784 (CI 0.637-0.964) for active vs. inactive</td>
</tr>
<tr>
<td>Mikkelsson 2006</td>
<td>Finland</td>
<td>25 years</td>
<td>Schoolchildren</td>
<td>Both</td>
<td>12-17</td>
<td>Frequency of childhood physical activity outside school hours for at least 30 minutes per session</td>
<td>Having ever low back pain longer than one day for at least 10 times</td>
<td>Moderate Moderate Low Moderate</td>
<td>OR 0.62 (CI 0.39-0.98) for males and 0.80 (CI 0.48-1.32) for females for active (at least 2 times per week) vs. inactive (less than 2 times). Estimated RR 0.70 (CI 0.47-0.99) for males, 0.83 (CI 0.53-1.25) for females and 0.75 (CI 0.57-1.00) for both sexes combined</td>
</tr>
<tr>
<td>Sihawong 2006</td>
<td>Thailand</td>
<td>1 year</td>
<td>Full-time</td>
<td>Both</td>
<td>15-55</td>
<td>Frequency of Chronic low</td>
<td>High Moderate Low Low</td>
<td>Adjusted OR 0.82 (CI 0.27-1.38) for age and previous back pain more than once</td>
<td></td>
</tr>
</tbody>
</table>

**Frequent low back pain**

**Chronic low back pain**
<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Duration</th>
<th>Study Details</th>
<th>Population</th>
<th>Age</th>
<th>Sex</th>
<th>Exercise Level</th>
<th>Physical Activity</th>
<th>Outcome Description</th>
<th>Adjusted Effect</th>
<th>Confidence Interval</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>France</td>
<td>5 years</td>
<td>Occupation</td>
<td>All</td>
<td>37-52</td>
<td>Both, 36% were women</td>
<td>Participation in sports activities (yes/no)</td>
<td>Chronic low back pain (low back pain lasted at least 6 months (duration of current episode or intermittent symptoms over the last 6 months)</td>
<td>Low Moderate Moderate Low</td>
<td>HR 0.88 (CI 0.77-1.01) for men, and 0.99 (CI 0.82-1.19) for women.</td>
<td>Unadjusted age, sex, smoking, occupation</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>USA</td>
<td>9 years</td>
<td>Community</td>
<td>All</td>
<td>70 or older</td>
<td>Both, 65% were women</td>
<td>Low activity (score &lt;64 for men and &lt;52 for women) vs. moderate or high physical activity</td>
<td>One episode of back pain restricting activity lasting 2 months (persistent), or 2 episodes of any duration (recurrent) in the past 18 months</td>
<td>Moderate Low High Low</td>
<td>HR of persistent or recurrent back pain 1.44 (CI not reported, P value 0.001) for low activity.</td>
<td>Unadjusted age, sex, smoking, occupation</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Norway</td>
<td>11 years</td>
<td>Population</td>
<td>All</td>
<td>20 or older</td>
<td>Both, 52% were women</td>
<td>Number of hours of leisure time physical activity (e.g., walking, skating or swimming)</td>
<td>Chronic low back pain (low back pain lasted 3 consecutive months or longer during the past 12)</td>
<td>Low Low Moderate Low</td>
<td>RR 0.91 (CI 0.80-1.03) for &lt;1 hour, 0.88 (CI 0.77-1.00) for 1-1.9 hours, and 0.75 (CI 0.64-0.88) for 2 hours or more in men.</td>
<td>Unadjusted age, sex, smoking, occupation</td>
<td></td>
</tr>
</tbody>
</table>
Estimated RR 0.86 (CI 0.79-0.94) for 1-1.9 hours, and 0.84 (CI 0.75-0.93) for 2 hours or more in men and women combined.

Estimated RR for one hour or more vs. inactive 0.83 (CI 0.75-0.91) for men and 0.87 (CI 0.79-0.96) for women and 0.85 (CI 0.79-0.91) for men and women combined.
physical activity (e.g., heavy gardening, long (more than half an hour) walks or bike rides, sports, or dancing).

Estimated RR for men, 0.67 (CI 0.28-1.59) for light, 0.47 (CI 0.23-0.94) for strenuous and 0.54 (CI 0.31-0.92) for active vs. inactive.

Estimated RR for women, 1.04 (CI 0.46-2.22) for light, 0.59 (CI 0.32-1.09) for strenuous and 0.73 (CI 0.44-1.17) for active vs. inactive.

Estimated RR for both sexes, 0.86 (CI 0.48-1.54) for light, 0.53 (CI 0.34-0.84) for strenuous and 0.63 (CI 0.44-0.91) for active vs. inactive.

In the co-twin control analysis, OR 0.08 (CI 0.03-0.18) for strenuous activity.

---

Picavet 2003  
Netherlands  
1 to 4 yrs.  
Population based  
20–59 Both  
3759

Lack of moderate leisure-time activity defined as less than 0.5 hour per day or per week spent on activities of at least 4 METs (e.g., gardening, cycling, or sports).

Chronic low back pain (> 3 months)

High Moderate Moderate High

OR 0.91 (CI 0.72-1.15) for <0.5 hour per week and 0.99 (CI 0.80-1.21) for <0.5 hour activity per day.

Estimated OR 1.10 (CI 0.87-1.39) for 0.5 hour or more vs. <0.5 hour per week and 1.01 (CI 0.82-1.24) for 0.5 hour or more vs. <0.5 hour per day.

Estimated RR 1.09 (CI 0.88-1.32) for 0.5 hour or more vs. <0.5 hour per week and 1.01 (CI 0.84-1.20) for 0.5 hour or more vs. <0.5 hour per day.

Adjusted for age, sex, and low back pain at baseline. The results did not differ in working/non-working, or educational level subgroups.
**Hospitalization due to low back pain**

Rivinoja 2011

<table>
<thead>
<tr>
<th>Finland</th>
<th>28 years</th>
<th>Adolescents</th>
<th>With or without back pain</th>
<th>Both</th>
<th>9016 (4535 males and 4481 females)</th>
<th>Frequency of participation in sports, participation in different types of sports, and membership in a sport club outside of school hours</th>
<th>Hospitalization for conservative care for low back pain or sciatica</th>
<th>Low</th>
<th>Moderate</th>
<th>Low</th>
<th>Moderate</th>
</tr>
</thead>
</table>

Mattila 2008

| Finland | Mean 11.1 years. Range 0 to 23 years | Adolescents | With or without back pain | Both | 57,408 (26688 males and 30719 females) | Frequency of participation in sports clubs and other physical activity | Hospitalization due to low back pain | Moderate | Moderate | Moderate | Low |

| Sex, smoking, overweight, participation in sports, participation in sports with risk of injury, and membership in a sport club | Sex and age |
1.50 (CI 0.70-3.20) for 4 times or more/week, and 1.58 (CI 1.15-2.17) for 1 time or more/week compared with never in females.

For participation in other physical exercise, HR was 0.70 (0.50-1.20) for 1-3 times/week, 0.80 (CI 0.50-1.40) for 4 times or more/week, and 0.74 (CI 0.53-1.04) for 1 time or more/week compared with never in males and females combined.

For participation in sports clubs or other physical exercise, HR was 1.12 (CI 0.86-1.45) for 1-3 times/week, 0.99 (CI 0.65-1.51) for 4 times or more/week, and 1.09 (CI 0.87-1.36) for 1 time or more/week compared with never in males and females combined.

### Sick leave due to low back pain

<table>
<thead>
<tr>
<th>Hemingway 1999</th>
<th>UK</th>
<th>Mean 4 years</th>
<th>Non-industrial civil servants working in the London offices of 20 departments</th>
<th>With or without back pain</th>
<th>35-55</th>
<th>Both, 33% were females</th>
<th>4886 (3506 men and 1380 women)</th>
<th>Vigorous leisure time activity (e.g., running or digging): one hour or more vigorous activity. Moderate activity (e.g., scrubbing or polishing car): less than one hour</th>
<th>Sickness absence due to back pain during the follow-up</th>
<th>Moderate</th>
<th>Moderate</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 7 days or less sickness absence, RR 0.96 (CI 0.8-1.2) for moderate and 0.85 (CI 0.6-1.2) for low vs. high activity in men. For longer than 7 days, RR 0.75 (CI 0.5-1.2) for moderate and 1.17 (CI 0.6-2.2) for low vs. high activity in men. For 7 days or less sickness absence, RR 1.61 (CI 1.0-2.6) for moderate and 1.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, BMI, employment grade and baseline back pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
vigorous activity and one hour or more moderately energetic activity

For longer than 7 days, RR 0.68 (CI 0.3-1.4) for moderate and 1.01 (CI 0.5-2.2) for low vs. high activity in women.

For 7 days or less sickness absence, estimated RR 1.13 (CI 0.92-1.38) for moderate and 1.18 (CI 0.83-1.66) for high activity compared with low activity in men.

For longer than 7 days, estimated RR 0.64 (CI 0.41-0.99) for moderate and 0.85 (CI 0.45-1.64) for high activity compared with low activity in men.

For 7 days or less sickness absence, estimated RR 0.91 (CI 0.57-1.48) for moderate and 0.57 (CI 0.35-0.92) for high activity compared with low activity in women.

For longer than 7 days, estimated RR 0.67 (CI 0.31-1.45) for moderate and 0.99 (CI 0.47-2.08) for high activity compared with low activity in women.

For one day or longer sickness absence, estimated RR 1.02 (CI 0.75-1.40) for moderate and 1.10 (CI 0.66-1.83) for high, and 1.04 (CI 0.80-1.36) for moderate or high activity compared with low activity in men.

For one day or longer sickness absence, estimated
<table>
<thead>
<tr>
<th>Müller 1999</th>
<th>Denmark</th>
<th>15 years</th>
<th>Three age cohorts of one municipalit y</th>
<th>Without low back pain</th>
<th>Both, 53% were femal es</th>
<th>220</th>
<th>Time spent on sports activities</th>
<th>Self-reported sickness absence due to low back pain during the previous 7 years, or in the past 12 months before follow-up</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Moderate or high activity compared with low activity in both sexes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RR 0.84 (CI 0.43-1.64) for moderate and 0.67 (CI 0.34-1.32) for high, and 0.75 (CI 0.47-1.21) for moderate or high activity compared with low activity in women.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For one day or longer sickness absence, estimated RR 0.99 (CI 0.74-1.31) for moderate and 0.92 (CI 0.61-1.38) for high, and 0.96 (CI 0.76-1.21) for moderate or high activity compared with low activity in both sexes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OR 0.68 (CI 0.17-2.61) for physical activity &lt; 3h vs. 3 hours or more for sick leave in the past 12 months in 201 subjects.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OR 0.52 (CI 0.22-1.20) for physical activity &lt; 3h vs. 3 hours or more for sick leave in the past 7 years in 220 subjects.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Estimated OR 1.47 (CI 0.37-5.76) for physical activity 3 hours or more vs. less than 3 hours for sick leave in the past 12 months.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Estimated OR 1.92 (CI 0.82-4.49) for physical activity 3 hours or more vs. less than 3 hours for sick leave in the past 7 years.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Estimated RR 1.42 (CI 0.39-4.32) for physical activity 3 hours or more vs. less than 3 hours for sick leave in the past 12 months.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Estimated RR 1.68 (CI 0.84-2.89) for physical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
activity 3 hours or more vs. less than 3 hours for sick leave in the past 7 years

* Low means low risk of bias and high means high of bias
12,434 citations found by electronic searches

11,873 excluded on first pass based on abstracts

561 relevant studies identified and screened

509 studies on patient population, or cross sectional or case control design, or on sciatica or disc degeneration excluded

52 studies on association between leisure-time physical activity and low back pain

16 studies excluded
5 on back pain or disorder combined with neck pain or disorder\textsuperscript{38-42} 7 with insufficient data to estimate a risk ratio\textsuperscript{43-49} 1 that assessed both physical activity and low back pain at follow-up\textsuperscript{50} 1 that combined leisure time physical activity with physical activity at work\textsuperscript{51} 1 on muscle-strengthening exercises only\textsuperscript{52} 1 conducted in pregnant women\textsuperscript{53}

36 studies (37 reports) on relationship between leisure-time physical activity and low back pain included in the meta-analysis

**Figure S1:** Flow chart of the search strategy and selection of studies
Figure S2: A funnel plot of 20 studies on low back pain in the past 1-12 months for active vs. inactive. Dark orange line indicates the fitted regression line ($P$ for Egger test = 0.78)
Figure S3: A filled funnel plot showing 12 observed studies (solid black circles) on low back pain in the past 1-12 months for moderate vs. low physical activity and three studies imputed (solid maroon triangles) by the trim and fill method.
Figure S4: A funnel plot of nine studies on frequent or chronic low back pain for active vs. inactive. Dark orange line indicates the fitted regression line ($P$ for Egger test = 0.38)
Figure S5: A filled funnel plot showing nine observed studies (solid black circles) on frequent or chronic low back pain for active vs. inactive and three studies imputed (solid maroon triangles) by the trim and fill method.
References


Bovenzi M. A longitudinal study of low back pain and daily vibration exposure in professional drivers. *Ind Health* 2010;48:584-95.


