Weekend Warrior vs. Regularly Active: A Comparison of Physical Activity Frequency in Decreasing Mortality

Susan Ulaner

Recommended Citation
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Abstract

Background: Physical activity has long been known to be an integral part of a healthy lifestyle. It has been shown to reduce risk of early mortality and play a vital role in increasing health span. Although physical activity is one of the most consistent and effective lifestyle choices that can positively impact health, physical inactivity has become the fourth leading risk factor for mortality worldwide. Reasons for inactivity vary, but among the more common barriers, lack of time is one of the most prevalent and modifiable reason for not meeting physical activity guidelines. To manage time commitments, some individuals choose to compress their physical activity into 1 or 2 sessions per week. Those who practice this condensed form of physical activity pattern have been termed “weekend warriors.” Since weekend warriors do not meet the WHO recommended frequency, this raises the question, can being a weekend warrior decrease mortality as effectively as the regularly active?

Methods: A comprehensive search of medical literature was completed using MEDLINE-Ovid, Web of Science, and CINAHL with key words weekend warrior, exercise and mortality. Relevant studies that met inclusion criteria were assessed for quality with the GRADE Working Group guidelines.

Results: Two articles met the inclusion criteria, both of which were prospective cohort studies. The two studies examined similar primary outcomes, one study expanding on the research of the other. The results were fairly consistent between the two studies. One study found that when adjusted for health risk factors, weekend warriors had a 59% decrease in mortality vs. 42% decrease in those regularly active. The other study found despite obesity and major health risk factors, decrease in mortality of weekend warriors was only slightly inferior to those who were regularly active, 30% vs. 35%, respectively.

Conclusion: The two studies provide evidence that physical activity, regardless of it being less than recommended guidelines, or when it meets recommended guidelines in shorter bouts of frequency, can decrease mortality and offer considerable health benefit— even in the obese and those with major risk factors. However, due to the very low quality of both studies, further research is required to validate the results and to determine whether being a true long term weekend warrior is a beneficial physical activity regimen that can offer long term health outcomes.

Keywords: weekend warrior, exercise, mortality

Degree Type
Capstone Project

Degree Name
Master of Science in Physician Assistant Studies

Keywords
weekend warrior, exercise, mortality
Weekend Warrior vs. Regularly Active: A Comparison of Physical Activity Frequency in Decreasing Mortality

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A Clinical Graduate Project Submitted to the Faculty of the
School of Physician Assistant Studies
Pacific University
Hillsboro, OR
For the Masters of Science Degree, August 2018
Faculty Advisor: Professor Saje Davis-Risen
Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
BIOGRAPHY

Susan Ulaner is a native of California where she majored in Psychology with an emphasis in Biology at University of California, Davis. After completion of her undergraduate degree, she advanced to receive her Doctor of Chiropractic and practiced for 5 years before entering Pacific University for a Master of Science, Physician Assistant Studies. In her leisure time, she loves to travel and spend time with her family.
ABSTRACT

**Background:** Physical activity has long been known to be an integral part of a healthy lifestyle. It has been shown to reduce risk of early mortality and play a vital role in increasing health span. Although physical activity is one of the most consistent and effective lifestyle choices that can positively impact health, physical inactivity has become the fourth leading risk factor for mortality worldwide. Reasons for inactivity vary, but among the more common barriers, lack of time is one of the most prevalent and modifiable reason for not meeting physical activity guidelines. To manage time commitments, some individuals choose to compress their physical activity into 1 or 2 sessions per week. Those who practice this condensed form of physical activity pattern have been termed “weekend warriors.” Since weekend warriors do not meet the WHO recommended frequency, this raises the question, can being a weekend warrior decrease mortality as effectively as the regularly active?

**Methods:** A comprehensive search of medical literature was completed using MEDLINE-Ovid, Web of Science, and CINAHL with key words *weekend warrior*, *exercise* and *mortality*. Relevant studies that met inclusion criteria were assessed for quality with the GRADE Working Group guidelines.

**Results:** Two articles met the inclusion criteria, both of which were prospective cohort studies. The two studies examined similar primary outcomes, one study expanding on the research of the other. The results were fairly consistent between the two studies. One study found that when adjusted for health risk factors, weekend warriors had a 59% decrease in mortality vs. 42% decrease in those regularly active. The other study found despite obesity and major health risk factors, decrease in mortality of weekend warriors was only slightly inferior to those who were regularly active, 30% vs. 35%, respectively.

**Conclusion:** The two studies provide evidence that physical activity, regardless of it being less than recommended guidelines, or when it meets recommended guidelines in shorter bouts of frequency, can decrease mortality and offer considerable health benefit—even in the obese and those with major risk factors. However, due to the very low quality of both studies, further research is required to validate the results and to determine whether being a true long term weekend warrior is a beneficial physical activity regimen that can offer long term health outcomes.

**Keywords:** weekend warrior, exercise, mortality
ACKNOWLEDGMENTS

To my parents and sister: Thank you for supporting me through my endless endeavor towards expanding my knowledge and loving me through it all.

To my husband: Thank you for giving me the strength to achieve my dreams and the sacrifices made to support me unconditionally. I could not have done it without your love and support. It will all be worth it.
**TABLE OF CONTENT**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biography</td>
<td>2</td>
</tr>
<tr>
<td>Abstract</td>
<td>3</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>4</td>
</tr>
<tr>
<td>Table of Content</td>
<td>5</td>
</tr>
<tr>
<td>List of Tables</td>
<td>6</td>
</tr>
<tr>
<td>List of Abbreviations</td>
<td>6</td>
</tr>
<tr>
<td>Background</td>
<td>7</td>
</tr>
<tr>
<td>Methods</td>
<td>9</td>
</tr>
<tr>
<td>Results</td>
<td>9</td>
</tr>
<tr>
<td>Discussion</td>
<td>13</td>
</tr>
<tr>
<td>Conclusion</td>
<td>16</td>
</tr>
<tr>
<td>References</td>
<td>18</td>
</tr>
<tr>
<td>Tables</td>
<td>19-21</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1:  GRADE: Quality Assessment of Reviewed Studies
Table 2:  Summary of Findings

LIST OF ABBREVIATIONS

BMI     Body Mass Index
CI      Confidence Interval
CVD     Cardiovascular Disease
HR      Hazards Ratio
KCAL    Kilogram Calories
RR      Risk Ratio
WHO     World Health Organization
Weekend Warrior vs. Regularly Active: Comparison of Physical Activity Frequency in Decreasing Mortality

BACKGROUND

Physical activity has long been known to be an integral part of a healthy lifestyle. It has been shown to reduce risk of early mortality and increase health span through weight control, increased cardiovascular health, physical endurance and strength, reduced risk of diabetes and cancer, and improved mood and mental health.\(^1\) In order to achieve these benefits, the World Health Organization (WHO) recommends adults between the ages of 18 and 64 years a minimum of 150 minutes of moderate intensity physical activity, 75 minutes of vigorous intensity physical activity, or a combination of both throughout the week.\(^2\) The intensity of physical activity is easily measured by the “talk test.” Talking is possible when engaging in moderate intensity physical activity, whereas saying more than a few words without pausing for a breath is not possible during vigorous intensity physical activity.\(^1\)

Physical activity comes in various forms, yet is often mistaken as exercise. Exercise, to most, holds a negative connotation of having to be physically fit and athletic; however, that misnomer is untrue. Physical activity is any body movement that increases energy expenditure. This can vary from brisk walking, hiking, swimming, bicycling, dancing, and even gardening, to purposeful exercise such as sports and weight training. For instance, walking briskly or playing tennis meets moderate intensity physical activity while aerobic dancing or heavy gardening with continuous digging or hoeing constitutes as vigorous intensity physical activity.\(^1\)
While physical activity is one of the most consistent and effective lifestyle choices that can positively impact health, physical inactivity has become the fourth leading risk factor for mortality worldwide,\textsuperscript{2} costing global health care systems $53.8 billion dollars.\textsuperscript{3} In the United States, 51\% of adults do not meet recommendations for physical activity.\textsuperscript{1} Not meeting recommended guidelines is multifactorial and can vary from personal, psychological and behavioral barriers, to demographic or environmental barriers such as lack of accessibility, differing social groups, cultural beliefs, or busy lifestyles. Among the common barriers, the lack of time is one of the most prevalent yet modifiable reason for not meeting physical activity guidelines.\textsuperscript{4}

The prevalence of inactivity is not a surprise given the time commitment required to achieve positive health outcomes. Many individuals find having to engage in physical activity throughout the week to be a daunting task, but with the ever-growing awareness of its health benefits, new forms of modified physical activity have become popular. Among the various types, a condensed form of physical activity pattern termed “weekend warriors” has been widely exercised. These individuals opt to compress their physical activity into 150 minutes of moderate intensity, or 75 minutes of vigorous intensity into 1 or 2 sessions per week.

Yet, questions remain regarding the optimal combination of frequency, duration, and intensity of activity on health outcomes. WHO specified the recommended quantity of physical activity spread throughout the week, but does not clarify whether optimal outcomes are achieved with 7 days, 5 days, 3, or even 2 days of physical activity.
Since weekend warriors’ condensed physical activity regimen fails to meet WHO recommendations, this brings us to question whether equal health benefits can be achieved by being a weekend warrior or more specifically, can weekend warriors decrease mortality as effectively as individuals who are regularly active?

METHODS

A comprehensive search of medical literature was completed using MEDLINE-Ovid, Web of Science, and CINAHL with key words weekend warrior, exercise and mortality. Search results range from duplicate studies to integrated reviews of research. Studies were required to be in written English language, done on human subjects, and include participants who fit weekend warrior physical activity patterns and regularly active physical activity patterns. Studies that met inclusion criteria were assessed for quality with the Grading of Recommendations Assessment, Development, and Evaluation Working Group guidelines (GRADE).

RESULTS

The initial literature research resulted in 25 articles. After removing duplicate studies, 17 articles were screened for relevance and inclusion criteria. Two prospective cohort studies met the inclusion criteria.\(^5,6\) See Table 1.

Lee et al

Lee et al\(^5\) is one of the first prospective cohort studies to track patterns of physical activity in weekend warriors to determine whether 1 or 2 sessions of physical activity a week can generate health benefits.
As part of the Harvard Alumni Health study, participants (mean age, 66) were chosen based on their responses to mailed questionnaires on health habits and health status since 1962. There were 12,805 men who were chosen from this pool for analysis in 1988; 8,421 men were included in the study after screening for exclusion criteria of cardiovascular disease, cancer or diabetes (n= 3,942), and those with missing physical activity information (n= 442).

Health habits such as frequency and duration of daily walking, stair climbing, sports and recreational activities in the past week were collected from the participants through health questionnaires in 1988 and 1993. Energy expenditure was estimated and participants were categorized into 4 categories: 17% sedentary (<500 kcal/wk), 13% insufficiently active (500-999 kcal/wk or 75-150 min/wk of brisk walking), 7% weekend warrior (>1000 kcal/week from sports/recreation or 150 min of brisk walking 1-2 times/wk), and 62% regularly active (>1000 kcal/wk). Participants were followed from 1988 through 1997 for mortality outcomes, confirmed by death certificates. Follow-up rates were greater than 99% at the time of completion.

After adjusting for smoking, alcohol consumption, red meat intake, vegetable intake, vitamin supplementation, and early parental mortality, relative risk of mortality was estimated with the proportional hazards regression. Data was further subcategorized into 2 groups and evaluated. The groups were low risk men who had no risk factors of smoking, BMI > 25 kg/m², history of hypertension, and hypercholesterolemia, and high risk men who had a least 1 risk factor.
Lee et al\textsuperscript{5} found that after adjusting for the aforementioned variables, mortality rates for weekend warriors had a relative risk of 0.85 (95% CI, 0.65, 1.11) compared to sedentary men. Surprisingly, the insufficiently active had a relative risk of 0.75 (95% CI, 0.62, 0.91) while the regularly active had a relative risk of 0.64 (95% CI, 0.55, 0.73). Furthermore, when divided into subgroups of low risk vs. high risk men, mortality rates of low risk weekend warriors (RR, 0.41; 95% CI, 0.21, 0.81) was lower than sedentary men and comparable to regularly active men (RR, 0.58; 95% CI, 0.46, 0.74). Similarly, the study found a lower risk of mortality in the insufficiently active (RR, 0.56; 95% CI: 0.40, 0.79). The same correlation was not found in high-risk men.\textsuperscript{5} See Table 2.

The authors note several limitations; however, specifically the lack of generalizability of the findings due to homogeneity of participants. All the participants of this study were older, retired men of higher socioeconomic status who may not have been true weekend warriors, and/or lived healthier lifestyles. Relatively speaking, there were also few weekend warriors in the study, which “limits the statistical power of analyses.” Lastly, because of the observational nature of the study, there may have been confounding factors not taken into account despite the attempt to control for them.\textsuperscript{5}

O’Donovan et al

O’Donovan et al\textsuperscript{6} expanded on Lee et al research in a larger prospective cohort study that included men and women, and looked at different physical activity patterns on mortality due to all causes, cardiovascular disease (CVD), and cancer.

The prospective cohort study was conducted using Health Survey for England (HSE) and Scottish Health Survey (SHS), both household-based surveillance studies that
represent the target population based on geographic area. Surveys were collected between 1994 and 2008; included were participants 40 years or older. There were 63,591 participants with a median age of 59 who were interviewed by trained interviewers about physical activity in the 4 weeks prior to the interview. The questions were specific to frequency, duration, and perceived intensity of physical activity, pace of walking, and participation in sports and exercises. These data were categorized into moderate or vigorous intensity by the Compendium of Physical Activities. Confounding variants such as age, sex, smoking habit, long standing illness, occupation, ethnicity, BMI, blood pressure, blood glucose, and cholesterol levels were taken by skilled nurses and adjusted for. Mortality rates were attained in late 2009 and early 2011, confirmed by death certificates. Data sets were analyzed in 2016 using cox proportional hazards regression models.6

At baseline, 62.8% were inactive (no moderate or vigorous intensity activities), 22.4% were insufficiently active (<150 min/wk moderate or <75 min/wk vigorous intensity activities), 3.7% were weekend warriors (>150 min moderate or >75 min vigorous intensity activities in 1 or 2 sessions) and 11.1% were regularly active (>150 min/wk moderate or >75 min/wk vigorous intensity activities).6

Of the participants, 8,802 died from all causes, 2,526 died from cancer, and 2,780 died from CVD. After adjusting for age, sex, smoking, occupation and long-standing illness, the weekend warriors’ hazard ratio for all cause mortality was 0.70 (95% CI, 0.60, 0.82) compared to the inactive. The insufficiently active was 0.69 (95% CI, 0.65, 0.74) and regularly active was 0.65 (95% CI, 0.58, 0.73). Further adjustments revealed that 1 or
2 sessions per week of moderate or vigorous physical activity was sufficient to reduce all cause, CVD, and cancer mortality in the obese and those with major risk factors such as smoking, high cholesterol, and hypertension. See Table 2.

There are several limitations noted by the authors regarding this study, however. One such limitation is lack of diversity in the sample given that over 90% of the study subjects were white and a higher proportion of weekend warriors were men. Furthermore, the weekend warrior consisted of only 3.7% of the study. The validity of the study is also limited, as physical activity levels were only established at baseline without accounting for change over time, or considering that the amount and perceived intensity of physical activity was self-reported.

DISCUSSION

Extensive research has shown that physical activity is one of the most consistent and effective approaches towards decreasing mortality, yet most individuals do not comply with a regular exercise regime. The reasons for noncompliance are multifactorial and complicated, but with the ever-growing demands of busy lifestyles, time constraints are most commonly to blame. Taking this into consideration, if frequency, duration, and intensity of physical activity are adjusted to a more achievable level, would more individuals strap on their tennis shoes and move?

Lee et al. found that weekend warriors had a 15% decrease in mortality when compared to the sedentary. When adjusted for health risk factors, weekend warriors had a 59% decrease in mortality vs. sedentary subjects, and were superior to the 42% in the regularly active. O’ Donovan et al. found that despite obesity and major health risk
factors, decrease in mortality of weekend warriors was only slightly inferior to those who were regularly active, 30% vs. 35%, respectively.

The two studies\textsuperscript{5,6} concluded that compressing the recommended amount of physical activity into 1 or 2 sessions per week can postpone mortality, even in the obese and those with high risk factors such as smoking, high cholesterol, and hypertension. These results were also seen in those who did not meet recommended guidelines, such as the insufficiently active who engage in shorter quantity and frequency of physical activity.

Although these findings may be encouraging to individuals who feel discouraged to exercise due to time constraints, it is important to note that both studies\textsuperscript{5,6} have limitations of significance, including self-reported physical activity levels, lack of variability between study participants, small sample size, and confounding factors such as diet, genetics, and lifestyle not taken into account.

Statistical significance and applicability of the results need to be carefully evaluated considering the weekend warriors in both studies\textsuperscript{5,6} consisted of a small cohort with similar characteristics, specifically older, retired wealthy men in Lee et al\textsuperscript{5} and 90% white participants with a greater proportion of the weekend warriors being men in O’Donovan et al.\textsuperscript{6} Furthermore, in this study, physical activity was self-reported and assessed only at baseline without accounting for potential change over time, which could invariably lead to inaccurate data.

Even though both studies\textsuperscript{5,6} adjusted for age, chronic diseases, health risk factors and demographic variables that may interfere with physical activity, other confounding
factors that could affect physical activity and mortality such as musculoskeletal injury, diet, genetics, cardiovascular fitness, perceived effort, intensity of physical activity, stress, and differing lifestyles are difficult to account for. Due to these limitations, it is uncertain whether the results are applicable across all age groups, ethnicities, socioeconomic statuses, and fitness levels, and whether there is a direct causal relationship between weekend warriors and mortality.

In spite of the fact that the quality of the reviewed studies\textsuperscript{5,6} are very low, it is safe to conclude that any physical activity is better than none. These studies have certainly demonstrated an association between weekend warriors, and even the insufficiently active, with decreased mortality. This association reinforces the L-shaped dose response relationship between mortality and physical activity; increasing physical activity decreases mortality and vice versa.\textsuperscript{5,6,8} Thus, providers would do well to educate patients on all types of physical activity and offer a creative variety of option to help with compliance.

Moreover, despite the scarcity and quality of research on this particular subject, there are numerous studies demonstrating the benefits of physical activity such that medical providers should encourage individuals to engage in physical activity by manipulating frequency, duration, and intensity to improve compliance and ensure safety. Furthermore, providers can help eliminate the negative connotations associated with physical activity by educating on the varied forms of activity ranging from walking, bicycling, dancing, swimming, skiing, roller skating, ice skating, gardening, or playing Just Dance, to name a few. Assisting patients in choosing an enjoyable type of physical
activity can drastically improve compliance such that anyone can gain the health benefits of physical activity.

Being that weekend warriors is a new concept and a popular way to fit physical activity into busy lifestyles, these studies may be a stepping-stone for further research. Future research should include long-term large observational studies with diverse populations, more frequent standardized documentation of physical activity, and control for confounding variables to assess whether being a true long term weekend warrior can extend life and have universally positive health outcomes. Furthermore, it would be beneficial to extend this research to encompass the relationship between frequency, duration, and intensity of physical activity and its affect on health, rather than focusing strictly on duration.

CONCLUSION

Physical activity is a modifiable risk factor that can solve numerous health problems and reduce the cost of healthcare visits across the nation. “Everyone can gain the health benefits of physical activity - age, ethnicity, shape or size do not matter.”

These two studies provide evidence that physical activity, regardless of whether it is less than recommended guidelines, or meets recommended guidelines in shorter bouts of frequency, can decrease mortality and offer considerable health benefits. These results are similar to the regularly active with benefits also seen in the obese and those with major risk factors such as smoking, high cholesterol, and hypertension. This is encouraging to the individuals who can not or chose not to fit physical activity into a busy lifestyle by offering an achievable alternative to engage in physical activity 1 or 2
sessions a week. An important caveat, however, is that of the minimal research regarding this subject, limitations exist and further research is required to validate the findings.
REFERENCES


### TABLE 1 GRADE: Quality Assessment of Reviewed Articles

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Design</th>
<th>Downgrade Criteria</th>
<th>Upgraded Criteria</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Limitations</td>
<td>Inconsistency</td>
<td>Indirectness</td>
</tr>
<tr>
<td>Lee et al⁵</td>
<td>Prospective Cohort Study</td>
<td>Very Serious⁶a,b</td>
<td>Not Serious</td>
<td>Not Serious</td>
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<tr>
<td>O’Donovan et al⁶</td>
<td>Prospective Cohort Study</td>
<td>Very Serious⁶a,b,c</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
</tbody>
</table>

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⁶a Lack of variability in sample groups - Lee et al sample consisted of older, retired men of higher socioeconomic status; O’Donovan et al sample consisted of 90% white population and a higher proportion of men in weekend warriors

⁶b Small sample size among study groups - Lee et al had 7% weekend warriors; O’Donovan et al had 3.7% weekend warriors

⁶c Study variable only assessed at baseline - physical activity status may have changed over time
### TABLE 2 Summary of Findings

<table>
<thead>
<tr>
<th>Study</th>
<th>Physical Activity Pattern Defined</th>
<th>Sedentary/Inactive</th>
<th>Insufficiently Active</th>
<th>Weekend Warrior</th>
<th>Regularly Active</th>
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</thead>
<tbody>
<tr>
<td>Lee et al</td>
<td>Physical Activity Pattern Defined</td>
<td>&lt;500 kcal/wk</td>
<td>500-999 kcal/wk or 75-150 min/wk of brisk walking</td>
<td>&gt;1000 kcal from sports/recreation or 150 min of brisk walking 1-2 times/wk</td>
<td>&gt;1000 kcal/wk</td>
</tr>
<tr>
<td>Energy Expenditure, kcal/week</td>
<td>Lee et al</td>
<td>210</td>
<td>742</td>
<td>2,360</td>
<td>2,766</td>
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<tr>
<td>Relative Risk of Mortality (95% CI)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Lee et al</td>
<td>1 [reference]</td>
<td>0.75 (0.62, 0.91)</td>
<td>0.85 (0.65, 1.11)</td>
<td>0.64 (0.55, 0.73)</td>
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<td>Relative Risk of Mortality (95% CI) in Low Risk Men&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Lee et al</td>
<td>1 [reference]</td>
<td>0.56 (0.40, 0.79)</td>
<td>0.41 (0.21, 0.81)</td>
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<td>Physical Activity Pattern Defined</td>
<td>O’Donovan et al&lt;sup&gt;c&lt;/sup&gt;</td>
<td>no moderate or vigorous intensity activities</td>
<td>&lt;150 min/wk moderate or &lt;75 min/wk vigorous intensity activities</td>
<td>&gt;150 min moderate or &gt;75 min vigorous intensity activities in 1 or 2 sessions</td>
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<td>Leisure Time Physical Activity</td>
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<td>0</td>
<td>mean 2 sessions/wk; 60 min total/wk; 25 min vigorous/wk</td>
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<td>mean 7 sessions/wk; 449 min total/wk; 125 min vigorous/wk</td>
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<tr>
<td>Cox Proportional Hazards Regression (95% CI) of All Cause Mortality&lt;sup&gt;c&lt;/sup&gt;</td>
<td>O’Donovan et al&lt;sup&gt;c&lt;/sup&gt;</td>
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<td><strong>High Cholesterol</strong></td>
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<tr>
<td><strong>Hypertension</strong></td>
<td>1 [reference]</td>
<td>0.68 (0.51, 0.76)</td>
<td>0.75 (0.58, 0.95)</td>
<td>0.56 (0.46, 0.69)</td>
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</table>

a Adjusted for age, cigarette smoking, alcohol consumption, red meat intake, vegetable intake, vitamin/mineral supplements, early parental mortality
b Low risk men who had no risk factors of smoking, BMI > 25 kg/m², history of hypertension, and hypercholesterolemia
c Adjusted for age, sex, smoking, occupation, and long standing illness
d Adjusted for age, sex, occupation, and long standing illness; obesity was defined as BMI > 30 kg/m², high cholesterol was defined as > 5 mml/L total cholesterol concentration, hypertension was defined as systolic blood pressure > 140 mmHg and or diastolic pressure > 90 mmHg