

Supplementary Online Content

Laukkanen T, Khan H, Zaccardi F, Laukkanen JA. Association between sauna bathing and fatal cardiovascular and all-cause mortality events.. *JAMA Internal Medicine*. Published online February 23, 2015. doi:10.1001/jamainternmed.2014.8187.

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Characteristics of Study Population and Numbers of Outcomes According to the Frequency of Sauna Bathing

| Characteristics | Frequency of sauna bathing times/week | | | p value |
|------------------------------------|---------------------------------------|-------------|-------------|---------|
| | 1(n=601) | 2-3(n=1513) | 4-7 (n=201) | |
| Sauna (mean (SD)) | | | | |
| Temperature, °C | 80.5 | 78.4 (9.1) | 77.2 (8.9) | <0.001 |
| Duration, minutes/session | 14.0 | 14.4 (7.3) | 13.7 (8.1) | 0.378 |
| | | | | |
| Demographics (mean (SD) or | | | | |
| Age, years | 53.5 | 53.3 (5.0) | 51.5 (5.7) | <0.001 |
| Body mass index, kg/m ² | 26.9 | 26.7 (3.4) | 27.7 (4.2) | <0.001 |
| Systolic blood pressure, | 135 (18) | 133 (16) | 135 (17) | 0.097 |
| Diastolic blood pressure, | 88 (11) | 88 (10) | 90 (11) | 0.089 |
| Resting heart rate, | 64 (11) | 62 (11) | 62 (11) | 0.001 |
| Alcohol consumption, | 83.1 | 66.5 | 94.8 | 0.001 |
| Smokers, % | 35.9 | 30.1 | 20.0 | <0.001 |
| Smoking, pack years* | 10.0 | 7.7 (15.9) | 5.3 (15.3) | 0.001 |
| Cardiorespiratory fitness, | 29.1 | 30.8 (7.9) | 31.9 (8.6) | 0.001 |
| Previous myocardial | 9.0 | 7.0 | 6.0 | 0.273 |
| Type 2 diabetes, % | 6.6 | 5.0 | 2.0 | 0.034 |
| Hypertension, % | 35.0 | 29.0 | 28.1 | 0.017 |
| Serum LDL cholesterol, | 4.02 | 4.06 | 3.93 | 0.227 |
| Serum HDL cholesterol, | 1.28 | 1.30 | 1.33 | 0.104 |
| Fasting blood glucose, | 4.9 (1.4) | 4.7 (1.2) | 4.7 (0.94) | 0.039 |
| | | | | |
| Numbers of outcomes | | | | |
| Sudden cardiac death (190) | 61 (10.1) | 119 (7.8) | 10 (5.0) | <0.001 |
| Fatal coronary heart | 89 (14.9) | 175 (11.5) | 17 (8.5) | <0.001 |
| Fatal cardiovascular | 134 | 249 (16.4) | 24 (12.0) | <0.001 |
| All-cause mortality (929) | 295 | 572 (37.8) | 62 (30.8) | <0.001 |

* Pack-years denotes the lifelong exposure to smoking which was estimated as the product of years smoked and the number of tobacco products smoked daily at the time of examination.

† Cardiorespiratory fitness was defined as the highest value for or the plateau of oxygen uptake during exercise testing SD = standard deviation, min = minutes

eTable 2. Hazard Ratios of Sudden Cardiac Death, Fatal Coronary Heart Disease, Fatal Cardiovascular Disease, and All-Cause Mortality According to the Frequency of Sauna Bathing

| <i>First five years of follow-up excluded</i> | | | | | | | | |
|--|---------------------|---------|-----------------------------|---------|---------------------|---------|---------------------|---------|
| | Sudden Car | | Fatal Coronary Heart | | Fatal Cardi | | All-C | |
| <i>Freque ncy of</i> | Ha z | P value | Ha z | P value | Haz a | P value | Haz a | P value |
| <i>1 times/week</i> | 1.00 (referenc | | 1.00 (referenc | | 1.00 (referen | | 1.00 (referen | |
| <i>2-3 times/week</i> | 0.79 (0.56- | 0.174 | 0.76 (0.58- | 0.049 | 0.72 (0.58- | 0.003 | 0.76 (0.65- | <0.001 |
| <i>4-7 times/week</i> | 0.45 (0.22- | 0.029 | 0.61 (0.36- | 0.061 | 0.56 (0.36- | 0.008 | 0.66 (0.49- | 0.004 |
| | P for trend = 0.024 | | P for trend = 0.020 | | P for trend = 0.001 | | P for trend <0.001 | |
| <i>Follow-up time up to 10 years from baseline</i> | | | | | | | | |
| | Sudden Car | | Fatal Coronary Heart | | Fatal Cardi | | All-C | |
| <i>Freque ncy of</i> | Ha z | P value | Ha z | P value | Haz a | P value | Haz a | P value |
| <i>1 times/week</i> | 1.00 (referenc | | 1.00 (referenc | | 1.00 (referen | | 1.00 (referen | |
| <i>2-3 times/week</i> | 0.59 (0.36- | 0.034 | 0.68 (0.44- | 0.074 | 0.71 (0.48- | 0.078 | 0.75 (0.57- | 0.042 |
| <i>4-7 times/week</i> | 0.15 (0.03- | 0.011 | 0.15 (0.04- | 0.011 | 0.25 (0.09- | 0.011 | 0.46 (0.24- | 0.014 |
| | P for trend = 0.002 | | P for trend = 0.003 | | P for trend = 0.004 | | P for trend = 0.004 | |

*A death was determined sudden cardiac death (SCD) when it occurred either within 1 hour after the onset of an abrupt change in symptoms or within 24 hours after onset of symptoms when autopsy data did not reveal a non-cardiac cause of sudden death. Sudden cardiac deaths that were occurred out-of-hospital conditions were also defined.

† Adjusted for age, body mass index, systolic blood pressure, serum low-density lipoprotein cholesterol, smoking, alcohol consumption, previous myocardial infarction, type 2 diabetes, cardiorespiratory fitness, resting heart rate, physical activity and socio-economic status.

eTable 3. Hazard Ratios of Sudden Cardiac Death, Fatal Coronary Heart Disease, Fatal Cardiovascular Disease, and All-Cause Mortality According to the Duration of Sauna Bathing

| <i>First five years of follow-up excluded</i> | | | | | | | | |
|--|------------------|---------|-------------------|---------|-------------------|---------|---------------------|---------|
| | Sudden Ca | | Fatal Coro | | Fatal Card | | All-caus | |
| Dur atio | Haz a | P value | Ha z | P value | Ha z | P value | Hazard Ratio | P value |
| <11 minutes/session | 1.00 (reference) | | 1.00 (reference) | | 1.00 (reference) | | 1.00 (reference) | |
| 11-19 minutes/session (722) | 0.87 (0.61- | 0.425 | 0.87 (0.66- | 0.323 | 0.91 (0.72- | 0.761 | 0.91 (0.77-1.06) | 0.223 |
| >19 minutes/session | 0.46 (0.28- | 0.001 | 0.63 (0.45- | 0.008 | 1.78 (0.60- | 0.061 | 1.04 (0.88-1.23) | 0.669 |
| | P for trend = | | P for trend = | | P for trend = | | P for trend = 0.886 | |
| <i>Follow-up time up to first 10 years from baseline</i> | | | | | | | | |
| | Sudden C | | Fatal Coro | | Fatal Card | | All-caus | |
| Dur atio | Haz a | P value | Ha z | P value | Ha z | P value | Hazard Ratio | P value |
| <11 minutes/session | 1.00 (reference) | | 1.00 (reference) | | 1.00 (reference) | | 1.00 (reference) | |
| 11-19 minutes/session | 1.13 (0.67- | 0.641 | 1.03 (0.65- | 0.898 | 0.90 (0.59- | 0.630 | 0.82 (0.61-1.12) | 0.213 |
| >19 minutes/session (528) | 0.56 (0.28- | 0.113 | 0.52 (0.27- | 0.044 | 0.56 (0.33- | 0.036 | 0.78 (0.56-1.10) | 0.152 |
| | P for trend = | | P for trend = | | P for trend = | | P for trend = 0.112 | |

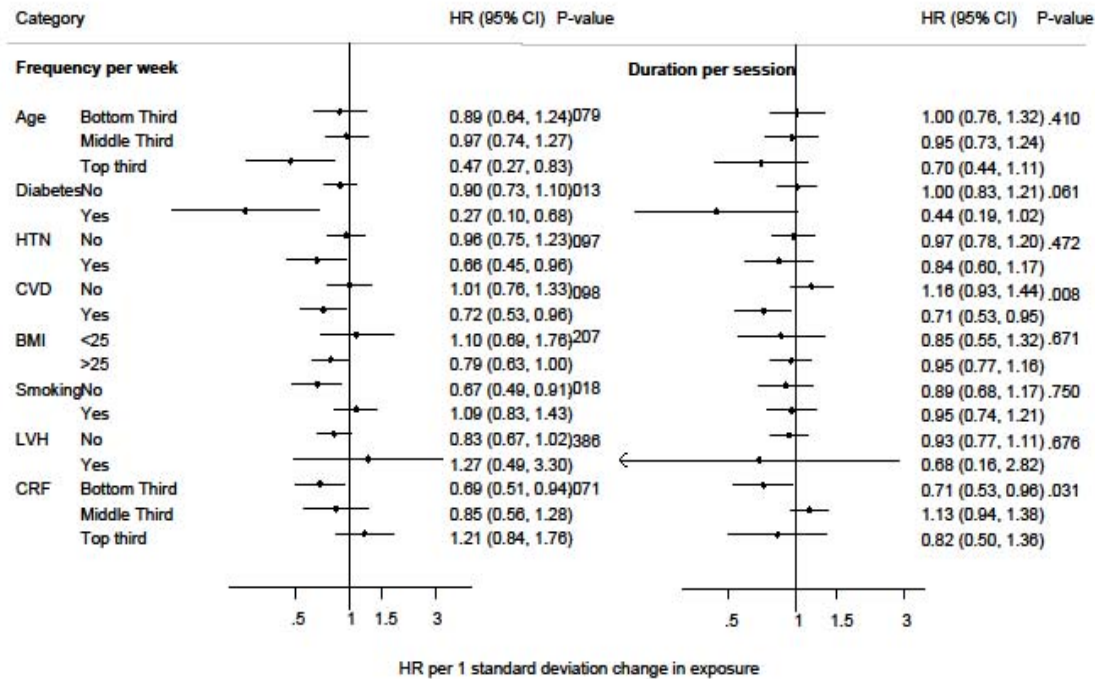
*A death was determined sudden cardiac death (SCD) when it occurred either within 1 hour after the onset of an abrupt change in symptoms or within 24 hours after onset of symptoms when autopsy data did not reveal a non-cardiac cause of sudden death. Sudden cardiac deaths that were occurred out-of-hospital conditions were also defined.

† Adjusted for age, body mass index, systolic blood pressure, serum low-density lipoprotein cholesterol, smoking, alcohol consumption, previous myocardial infarction, type 2 diabetes, cardiorespiratory fitness, resting heart rate, physical activity and socio-economic status.

eFigure 1. Subgroup Analysis in Clinically Relevant Groups of Subjects

Supplementary Figure 1: Subgroup analysis in clinically relevant groups of subjects

Outcome: Sudden Cardiac Death

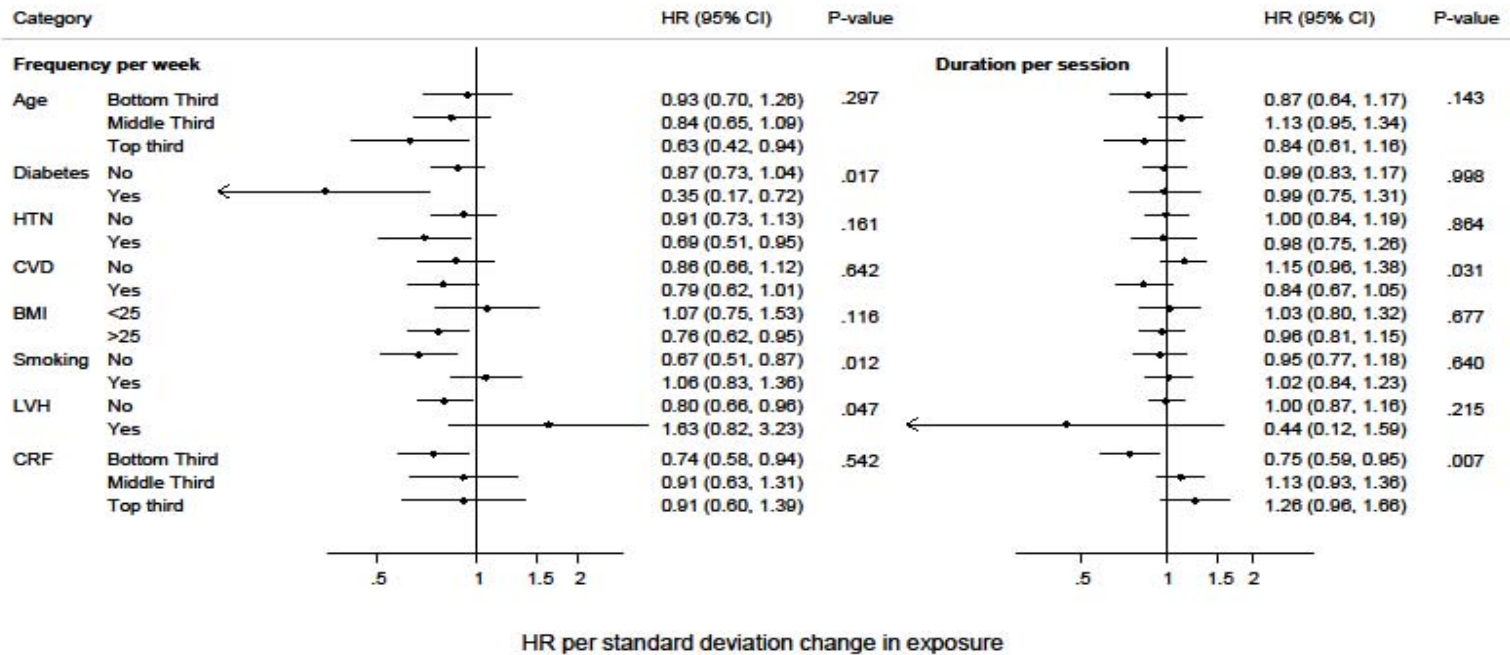


HTN= hypertension, CVD=cardiovascular disease, BMI = body mass index (kg/m²), LVH= left ventricular hypertrophy, CRF=cardiorespiratory fitness

eFigure 2. Subgroup Analysis in Clinically Relevant Groups of Subjects

Supplementary Figure 2: Subgroup analysis in clinically relevant groups of subjects

Outcome: Coronary Heart Disease Death

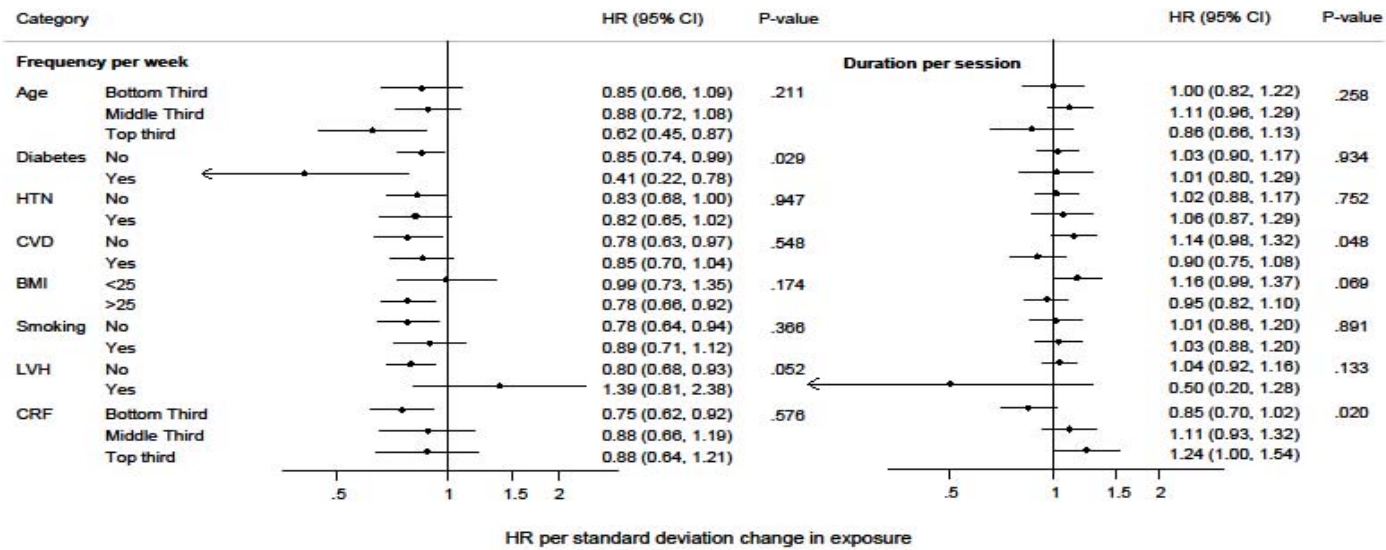


HTN= hypertension, CVD=cardiovascular disease, BMI = body mass index (kg/m²), LVH= left ventricular hypertrophy, CRF=cardiorespiratory fitness

eFigure 3. Subgroup Analysis in Clinically Relevant Groups of Subjects

Supplementary Figure 3: Subgroup analysis in clinically relevant groups of subjects

Outcome: Cardiovascular Disease Death



HTN= hypertension, CVD=cardiovascular disease, BMI = body mass index (kg/m²), LVH= left ventricular hypertrophy, CRF=cardiorespiratory fitness