

Obesity is Indirectly Associated with Sudden Cardiac Arrest through Various Risk Factors

Supplementary Table S1. Baseline characteristics of patients with and without SCA.

| | SCA | | p-value |
|---|-------------------|----------------|---------|
| | No 4,040,071 | Yes 16,352 | |
| Male | 2,221,898 (55.0%) | 11,633 (71.1%) | < 0.001 |
| Age (years) | 47.0 ± 14.1 | 62.0 ± 13.2 | < 0.001 |
| Hypertension | 1,082,382 (26.8%) | 9,331 (57.1%) | < 0.001 |
| Diabetes mellitus | 349,134 (8.6%) | 4,264 (26.1%) | < 0.001 |
| Dyslipidemia | 732,983 (18.1%) | 4,610 (28.2%) | < 0.001 |
| Chronic kidney disease | 275,854 (6.8%) | 2,740 (16.8%) | < 0.001 |
| Body mass index (kg/m²) | 23.7 ± 3.2 | 23.8 ± 3.4 | 0.138 |
| Waist circumference (cm) | 80.2 ± 9.5 | 83.5 ± 8.9 | < 0.001 |
| Smoking | | | < 0.001 |
| Never-smoker | 2,399,679 (59.4%) | 7,916 (48.4%) | |
| Ex-smoker | 581,485 (14.4%) | 3,128 (19.1%) | |
| Current-smoker | 1,058,907 (26.2%) | 5,308 (32.5%) | |
| Alcohol consumption | | | < 0.001 |
| Non-drinker | 2,077,053 (51.4%) | 9,534 (58.3%) | |
| Mild-drinker | 1,641,427 (40.6%) | 5,263 (32.2%) | |
| Heavy-drinker | 321,591 (8.0%) | 1,555 (9.5%) | |
| Regular exercise | 733,609 (18.2%) | 3,148 (19.3%) | < 0.001 |

| | | | |
|---|-----------------|---------------|---------|
| Income (lowest 20%) | 704,587 (17.4%) | 3,075 (18.8%) | < 0.001 |
| Glucose (mg/dL) | 97.2 ± 23.8 | 110.0 ± 41.5 | < 0.001 |
| Systolic blood pressure (mmHg) | 122.4 ± 15.0 | 129.3 ± 17.2 | < 0.001 |
| Diastolic blood pressure (mmHg) | 76.3 ± 10.0 | 78.9 ± 11.0 | < 0.001 |
| Cholesterol (mg/dL) | 195.3 ± 41.1 | 195.1 ± 44.3 | 0.549 |
| High-density lipoprotein (mg/dL) | 56.5 ± 32.9 | 53.6 ± 30.9 | < 0.001 |
| Low-density lipoprotein (mg/dL) | 121.2 ± 214.2 | 115.0 ± 97.8 | < 0.001 |
| eGFR (mL/min/1.73m²) | 87.6 ± 44.9 | 80.4 ± 34.7 | < 0.001 |

eGFR: estimated glomerular filtration rate; SCA: sudden cardiac arrest.

Supplementary Table S2. Impact of BMI and waist circumference on SCA according to metabolic syndrome

| | n | SCA | Follow-up duration (person-years) | Incidence | Hazard ratio with 95% confidence interval | | | | | |
|---|-----------|-------|--------------------------------------|-----------|---|--------------------|--------------------|--------------------|--------------------|--------------------|
| | | | | | Univariate | Multivariate 1 | Multivariate 2 | Multivariate 3 | Multivariate 4 | Multivariate 5 |
| Participants who have all three diagnosis of hypertension, diabetes mellitus, and dyslipidemia | | | | | | | | | | |
| BMI | | | | | | | | | | |
| BMI < 18.5 | 427 | 16 | 2,819 | 5.68 | 2.02 (1.22 – 3.34) | 1.78 (1.08 – 2.95) | 1.75 (1.06 – 2.90) | 1.75 (1.06 – 2.90) | 1.79 (1.08 – 2.97) | 1.79 (1.08 – 2.95) |
| 18.5 ≤ BMI < 23 | 13,324 | 291 | 102,147 | 2.85 | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) |
| 23 ≤ BMI < 25 | 18,455 | 282 | 146,315 | 1.93 | 0.68 (0.57 – 0.80) | 0.70 (0.60 – 0.83) | 0.71 (0.61 – 0.84) | 0.71 (0.61 – 0.84) | 0.71 (0.60 – 0.83) | 0.70 (0.60 – 0.83) |
| 25 ≤ BMI < 30 | 36,720 | 458 | 295,317 | 1.55 | 0.54 (0.47 – 0.63) | 0.64 (0.55 – 0.74) | 0.65 (0.56 – 0.75) | 0.65 (0.56 – 0.75) | 0.64 (0.55 – 0.74) | 0.62 (0.53 – 0.72) |
| 30 ≤ BMI | 7,662 | 99 | 62,141 | 1.59 | 0.56 (0.44 – 0.70) | 0.88 (0.69 – 1.10) | 0.89 (0.71 – 1.12) | 0.89 (0.71 – 1.12) | 0.87 (0.69 – 1.10) | 0.84 (0.66 – 1.06) |
| Waist circumference (male / female; cm) | | | | | | | | | | |
| < 80 / 75 | 6,448 | 129 | 50,122 | 2.57 | 1.63 (1.32 – 2.02) | 1.66 (1.35 – 2.06) | 1.64 (1.32 – 2.03) | 1.64 (1.32 – 2.03) | 1.66 (1.34 – 2.06) | 1.69 (1.37 – 2.09) |
| – 85 / 80 | 12,903 | 206 | 102,052 | 2.02 | 1.27 (1.06 – 1.53) | 1.27 (1.06 – 1.53) | 1.27 (1.06 – 1.53) | 1.27 (1.06 – 1.53) | 1.28 (1.07 – 1.55) | 1.30 (1.08 – 1.56) |
| – 90 / 85 | 19,395 | 246 | 155,024 | 1.59 | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) |
| – 95 / 90 | 17,877 | 254 | 142,385 | 1.78 | 1.13 (0.94 – 1.34) | 1.12 (0.94 – 1.33) | 1.11 (0.93 – 1.32) | 1.11 (0.93 – 1.32) | 1.11 (0.93 – 1.33) | 1.10 (0.93 – 1.32) |
| – 100 / 95 | 11,308 | 164 | 90,481 | 1.81 | 1.14 (0.94 – 1.39) | 1.19 (0.98 – 1.45) | 1.19 (0.97 – 1.45) | 1.19 (0.97 – 1.45) | 1.17 (0.96 – 1.42) | 1.15 (0.94 – 1.40) |
| ≥ 100 / 95 | 8,657 | 147 | 68,674 | 2.14 | 1.35 (1.10 – 1.66) | 1.49 (1.21 – 1.83) | 1.47 (1.20 – 1.80) | 1.47 (1.20 – 1.80) | 1.44 (1.18 – 1.77) | 1.41 (1.15 – 1.74) |
| Counterpart (who have diagnosis none, one, or two of hypertension, diabetes mellitus, and dyslipidemia) | | | | | | | | | | |
| BMI | | | | | | | | | | |
| BMI < 18.5 | 148,033 | 814 | 1,194,167 | 0.68 | 1.54 (1.43 – 1.66) | 1.73 (1.61 – 1.87) | 1.64 (1.52 – 1.76) | 1.78 (1.65 – 1.92) | 1.79 (1.66 – 1.93) | 1.79 (1.66 – 1.93) |
| 18.5 ≤ BMI < 23 | 1,566,329 | 5,725 | 12,864,605 | 0.45 | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) |
| 23 ≤ BMI < 25 | 982,939 | 3,642 | 8,102,935 | 0.45 | 1.01 (0.97 – 1.05) | 0.84 (0.81 – 0.87) | 0.87 (0.83 – 0.90) | 0.81 (0.77 – 0.84) | 0.81 (0.77 – 0.84) | 0.78 (0.75 – 0.82) |
| 25 ≤ BMI < 30 | 1,145,678 | 4,457 | 9,447,808 | 0.47 | 1.06 (1.02 – 1.10) | 0.88 (0.85 – 0.92) | 0.92 (0.89 – 0.96) | 0.81 (0.78 – 0.84) | 0.80 (0.77 – 0.84) | 0.75 (0.72 – 0.78) |
| 30 ≤ BMI | 136856 | 568 | 1,127,123 | 0.50 | 1.13 (1.04 – 1.23) | 1.31 (1.20 – 1.43) | 1.34 (1.23 – 1.46) | 1.07 (0.98 – 1.17) | 1.06 (0.97 – 1.16) | 0.94 (0.87 – 1.03) |
| Waist circumference (male / female; cm) | | | | | | | | | | |
| < 80 / 75 | 1,484,444 | 4,157 | 12,233,853 | 0.34 | 0.64 (0.61 – 0.67) | 1.11 (1.07 – 1.17) | 1.08 (1.03 – 1.13) | 1.3 (1.24 – 1.36) | 1.22 (1.16 – 1.27) | 1.16 (1.11 – 1.22) |
| – 85 / 80 | 952,713 | 3,459 | 7,843,613 | 0.44 | 0.83 (0.79 – 0.87) | 0.97 (0.93 – 1.02) | 0.96 (0.92 – 1.01) | 1.03 (0.99 – 1.08) | 1.01 (0.96 – 1.06) | 0.99 (0.94 – 1.04) |
| – 90 / 85 | 784,313 | 3,444 | 6,448,451 | 0.53 | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) | 1 (reference) |
| – 95 / 90 | 453,306 | 2,266 | 3,717,557 | 0.61 | 1.14 (1.08 – 1.20) | 1.02 (0.97 – 1.08) | 1.02 (0.96 – 1.08) | 0.96 (0.91 – 1.01) | 0.98 (0.93 – 1.03) | 0.99 (0.94 – 1.05) |

| | | | | | | | | | | |
|------------|---------|-------|-----------|------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| – 100 / 95 | 198,384 | 1,146 | 1,623,538 | 0.71 | 1.32 (1.24 – 1.41) | 1.15 (1.08 – 1.23) | 1.15 (1.08 – 1.23) | 1.02 (0.95 – 1.09) | 1.06 (0.99 – 1.13) | 1.09 (1.02 – 1.16) |
| ≥ 100 / 95 | 106,675 | 734 | 869,627 | 0.84 | 1.58 (1.46 – 1.71) | 1.48 (1.36 – 1.60) | 1.46 (1.35 – 1.58) | 1.2 (1.11 – 1.30) | 1.27 (1.17 – 1.38) | 1.31 (1.21 – 1.42) |

Incidence is per 1,000 person-years follow-up.

BMI: body-mass-index; SCA: sudden cardiac arrest; γ -GTP: gamma-glutamyltransferase.

Multivariate model 1: adjusted for age and sex.

Multivariate model 2: adjusted for model 1 plus smoking, alcohol, regular exercise, and income.

Multivariate model 3: adjusted for model 2 plus hypertension, diabetes mellitus, dyslipidemia.

Multivariate model 4: adjusted for model 2 plus hypertension, diabetes mellitus, dyslipidemia, and chronic kidney disease.

Multivariate model 5: adjusted for model 4 plus γ -GTP.