**Supplementary Figure 1.** ROC Curves and Based on Logistic Regression Models for Assessing Steatosis Severity, and Fibrosis Stage

(A) ROC Curve: Discriminating Mild-to-Severe Steatosis (Score ≥ 1)

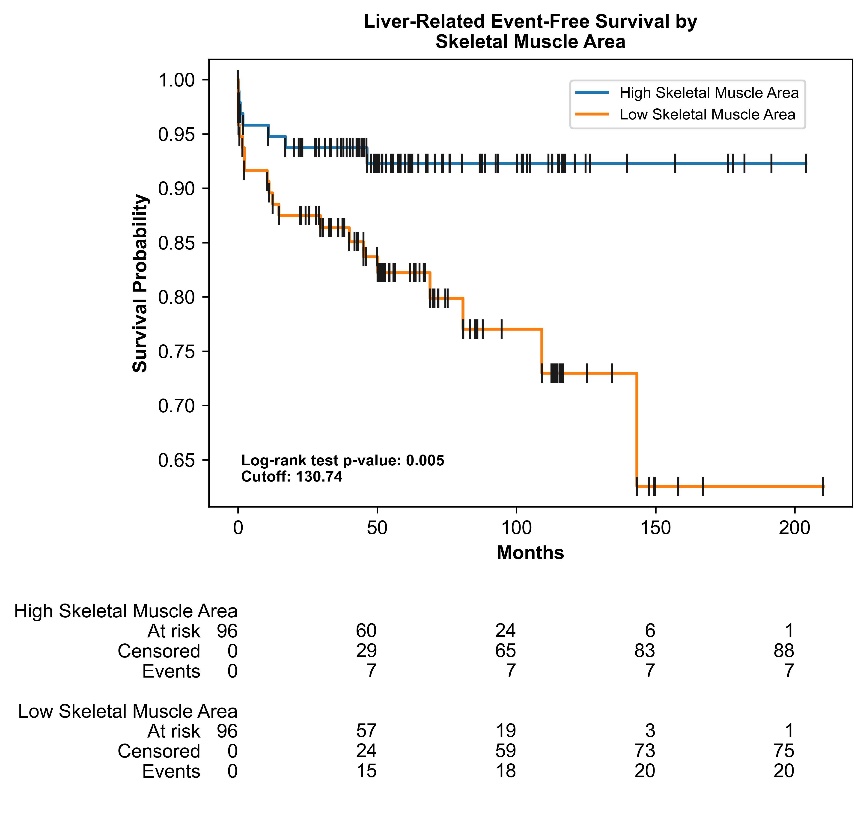
(B) ROC Curve: Predicting Significant Fibrosis (Stage ≥ 2)

텍스트, 스크린샷, 라인, 도표이(가) 표시된 사진

AI가 생성한 콘텐츠는 부정확할 수 있습니다.텍스트, 스크린샷, 라인, 도표이(가) 표시된 사진

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**Supplementary Figure 2.** Kaplan–Meier Curve for Liver-Related Event-Free Survival Stratified by Skeletal Muscle

Area

**Supplementary Table 1.** Baseline Characteristics of Patients by Steatosis Severity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total Patients (n=192)** | **Moderate-to-Severe Steatosis Patients a (n=68)** | **None-to-Mild Steatosis Patients b (n=124)** | ***P*** |
| **Age, yrs** | 49.5 (38.8-62.0) | 45.0 (34.5-54.0) | 52.5 (40.0-63.2) | 0.004 |
| **Weight, kg** | 72.0 (64.0-82.0) | 74.6 (66.3-91.5) | 71.0 (63.0-78.0) | 0.007 |
| **Height, cm** | 165.0 (157.9-173.0) | 168.5 (160.0-175.0) | 164.0 (157.0-170.1) | 0.006 |
| **Waist to Height Ratio** | 5.5 (5.2-6.0) | 5.7 (5.3-6.4) | 5.4 (5.1-5.8) | 0.003 |
| **BMI, kg/m2** | 910.9 (841.1-983.8) | 946.6 (880.1-1059.9) | 895.9 (826.1-950.8) | 0.000 |
| **VFI, cm3/m2** | 26.8 (24.2-29.8) | 27.4 (24.9-31.5) | 26.4 (23.8-29.1) | 0.038 |
| **SFI, cm3/m2** | 381.8 (250.8-543.0) | 489.7 (362.6-639.8) | 335.9 (228.7-486.5) | 0.000 |
| **TFI, cm3/m2** | 541.0 (409.7-777.5) | 587.4 (458.5-935.2) | 511.2 (365.6-702.5) | 0.018 |
| **SMI, cm3/m2** | 943.5 (689.2-1325.2) | 1123.9 (827.7-1511.3) | 845.5 (671.8-1219.4) | 0.000 |
| **VFV, cm3** | 365.8 (298.7-442.9) | 405.4 (338.7-470.0) | 347.3 (282.0-416.7) | 0.001 |
| **SFV, cm3** | 1031.1 (682.0-1433.4) | 1362.4 (985.4-1798.2) | 891.5 (620.9-1288.7) | 0.000 |
| **Spleen Volume, cm3** | 1498.3 (1096.9-2010.0) | 1648.1 (1286.2-2725.6) | 1371.1 (1006.8-1814.6) | 0.003 |
| **VFA (Area), cm2** | 195.8 (143.5-295.0) | 194.0 (147.4-297.6) | 197.8 (142.4-283.9) | 0.940 |
| **SFA (Area), cm2** | 147.9 (107.5-189.1) | 180.8 (140.8-237.5) | 128.3 (99.4-173.5) | 0.000 |
| **SMA (Area), cm2** | 184.0 (143.5-261.8) | 209.8 (162.1-297.7) | 177.0 (141.4-243.5) | 0.021 |
| **VFA (Attenuation), HU** | 130.7 (107.1-158.7) | 142.7 (115.2-177.6) | 123.5 (105.7-151.1) | 0.003 |
| **SFA (Attenuation), HU** | -97.0 (-103.8--90.0) | -101.3 (-105.8--95.2) | -95.3 (-102.0--87.8) | 0.000 |
| **SMA (Attenuation), HU** | -102.5 (-109.2--95.9) | -104.4 (-109.5--97.5) | -101.2 (-109.2--92.5) | 0.061 |
| **Liver-to-Spleen Volume** | 35.9 (29.1-41.9) | 37.7 (32.7-42.3) | 34.6 (27.7-41.9) | 0.133 |
| **Spleen Volume, cm3** | 7.6 (5.4-10.2) | 8.7 (6.8-12.8) | 7.1 (4.1-9.1) | 0.000 |
| **Liver-to-Spleen Attenuation** | 0.9 (0.7-1.1) | 0.6 (0.5-0.8) | 1.0 (0.9-1.1) | 0.000 |
| **Liver Attenuation, HU** | 46.3 (36.4-56.4) | 29.7 (23.7-44.7) | 50.9 (43.9-58.7) | 0.000 |
| **Spleen Attenuation, HU** | 46.8 (43.2-52.2) | 47.6 (44.2-50.5) | 46.5 (42.6-52.6) | 0.651 |
| **Liver (PDFF), %** | 11.2 (5.6-16.8) | 20.9 (12.0-24.4) | 8.7 (3.9-12.6) | 0.000 |
| **LSM, kPa** | 7.6 (5.2-12.2) | 9.1 (7.0-12.2) | 7.0 (4.8-11.9) | 0.007 |
| **CAP, dB/m** | 288.0 (253.2-327.0) | 321.5 (290.5-341.2) | 271.5 (235.8-304.5) | 0.000 |
| **AST, IU/L** | 47.0 (30.0-83.2) | 63.0 (35.8-101.0) | 43.5 (28.0-70.2) | 0.004 |
| **ALT, IU/L** | 57.5 (29.5-99.5) | 64.0 (38.8-132.2) | 53.0 (25.8-88.2) | 0.031 |
| **T.bil, mg/dL** | 0.7 (0.5-1.1) | 0.7 (0.5-1.0) | 0.8 (0.6-1.1) | 0.396 |
| **PLT, x 103/mm3** | 227.5 (176.8-287.2) | 262.5 (201.8-323.2) | 212.0 (173.2-266.0) | 0.001 |
| **PT INR** | 1.0 (0.9-1.1) | 1.0 (0.9-1.0) | 1.0 (0.9-1.1) | 0.047 |
| **Albumin, g/dL** | 4.4 (3.8-4.7) | 4.7 (4.3-4.8) | 4.2 (3.5-4.6) | 0.000 |
| **Glucose, mg/dL** | 106.0 (95.0-133.2) | 110.0 (98.0-140.0) | 105.0 (94.0-126.2) | 0.065 |
| **HbA1c, %** | 4.4 (4.4-6.0) | 4.5 (4.4-6.7) | 4.4 (4.4-5.4) | 0.001 |
| **eGFR, mL/min** | 98.4 (84.9-122.5) | 101.4 (88.5-118.7) | 95.7 (82.6-123.5) | 0.347 |
| **T.chol, mg/dL** | 169.0 (133.8-202.0) | 186.0 (143.5-220.8) | 164.5 (126.8-192.0) | 0.001 |
| **HDL, mg/dL** | 38.0 (9.0-47.0) | 38.5 (9.0-47.2) | 38.0 (9.0-46.2) | 0.471 |
| **LDL, mg/dL** | 24.0 (24.0-78.0) | 24.0 (24.0-63.0) | 24.0 (24.0-92.5) | 0.298 |
| **TG, mg/dL** | 113.5 (37.0-165.2) | 133.5 (37.0-184.8) | 109.0 (37.0-143.0) | 0.079 |
| **SBP, mmHg** | 126.0 (116.0-134.0) | 129.0 (121.8-138.2) | 123.0 (114.0-133.0) | 0.002 |
| **DBP, mmHg** | 79.0 (71.8-87.0) | 82.5 (76.5-90.2) | 77.0 (70.0-84.2) | 0.004 |
| **FIB-4** | 1.3 (0.7-3.0) | 1.0 (0.7-2.7) | 1.5 (0.8-3.7) | 0.205 |
| **Sex** |  |  |  | 0.018 |
| Male | 84 (43.8) | 38 (55.9) | 46 (37.1) |  |
| Female | 108 (56.2) | 30 (44.1) | 78 (62.9) |  |
| **MASLD Type c** |  |  |  | 0.000 |
| None | 21 (10.9) | 0 (0.0) | 21 (16.9) |  |
| MASLD | 89 (46.3) | 29 (42.7) | 60 (48.4) |  |
| MASH | 60 (31.2) | 35 (51.5) | 25 (20.2) |  |
| Cirrhosis | 22 (11.5) | 4 (5.9) | 18 (14.5) |  |
| **Fibrosis Stage d** |  |  |  | 0.000 |
| 0 | 58 (30.2) | 7 (10.3) | 51 (41.1) |  |
| 1 | 64 (33.3) | 36 (52.9) | 28 (22.6) |  |
| 2 | 22 (11.5) | 13 (19.1) | 9 (7.3) |  |
| 3 | 26 (13.5) | 8 (11.8) | 18 (14.5) |  |
| 4 | 22 (11.5) | 4 (5.9) | 18 (14.5) |  |
| **Smoking** |  |  |  | 0.200 |
| Yes | 32 (16.7) | 15 (22.1) | 17 (13.7) |  |
| No | 160 (83.3) | 53 (77.9) | 107 (86.3) |  |
| **Liver-Related Event e** |  |  |  | 0.371 |
| Yes | 27 (14.1) | 7 (10.3) | 20 (16.1) |  |
| No | 165 (85.9) | 61 (89.7) | 104 (83.9) |  |
| **Diabetes/Prediabetes Status** |  |  |  | 0.051 |
| Diabetes | 43 (22.4) | 21 (30.9) | 22 (17.7) |  |
| Prediabetes | 10 (5.2) | 5 (7.4) | 5 (4.0) |  |
| No | 139 (72.4) | 42 (61.8) | 97 (78.2) |  |
| **Hypertension Status** |  |  |  | 0.458 |
| Yes | 49 (25.5) | 20 (29.4) | 29 (23.4) |  |
| No | 143 (74.5) | 48 (70.6) | 95 (76.6) |  |
| **Dyslipidemia Status** |  |  |  | 0.862 |
| Yes | 48 (25.0) | 16 (23.5) | 32 (25.8) |  |
| No | 144 (75.0) | 52 (76.5) | 92 (74.2) |  |
| **Ischemic Heart Disease Status** |  |  |  | 0.977 |
| Yes | 10 (5.2) | 3 (4.4) | 7 (5.6) |  |
| No | 182 (94.8) | 65 (95.6) | 117 (94.4) |  |
| **Cerebrovascular Disease Status** |  |  |  | 0.615 |
| Yes | 8 (4.2) | 4 (5.9) | 4 (3.2) |  |
| No | 184 (95.8) | 64 (94.1) | 120 (96.8) |  |
| **Nephropathy Status** |  |  |  | 0.977 |
| Yes | 10 (5.2) | 3 (4.4) | 7 (5.6) |  |
| No | 182 (94.8) | 65 (95.6) | 117 (94.4) |  |

a Moderate-to-severe fibrosis was defined as a histologic fibrosis stage of 2 or 3

b None-to-mild fibrosis was defined as a histologic steatosis score of 0 or 1

c MASLD includes both MASLD and probable MASH, while MASH refers to definitive steatohepatitis

d Fibrosis stage was graded from 0 to 4 based on liver biopsy: 0, no fibrosis; 1, perisinusoidal or periportal fibrosis; 2, perisinusoidal and portal/p eriportal fibrosis; 3, bridging fibrosis; and 4, cirrhosis

**e** Liver-Related Event was defined as the first occurrence of any of the following: ascites, variceal bleeding, hepatic encephalopathy, hepatorenal syndrome (HRS), or liver transplantation (LT), confirmed via clinical documentation or imaging.

**Supplementary Table 2.** Crude and Adjusted Odds Ratios for the Association Between Predictors and Moderate-to-Severe Steatosis

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure group** | **Events** | **Total** | **Event rate a** | **Crude model** | | **Adjusted model (Backward Stepwise Selection)** | |
| **OR (95% CI)** | ***P*-value** | **OR (95% CI)** | ***P*-value** |
| **Liver-to-Spleen Attenuation** |  |  |  |  | 0.0087 |  | 0.0000 |
| High Liver-to-Spleen Attenuation (Above Median) | 98 | 114 | 86.0 | 0.22 (0.07-0.68) |  | 0.16 (0.07-0.35) |  |
| Low Liver-to-Spleen Attenuation (Below Median) | 111 | 115 | 96.5 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Liver Volume** |  |  |  |  | 0.0087 |  | 0.0085 |
| High Liver Volume  (Above Median) | 98 | 114 | 86.0 | 0.22 (0.07-0.68) |  | 2.84 (1.31-6.17) |  |
| Low Liver Volume  (Below Median) | 111 | 115 | 96.5 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Total Fat Index** |  |  |  |  | 0.0037 |  | 0.0076 |
| High TFI (Above Median) | 111 | 114 | 97.4 | 6.42 (1.83-22.56) |  | 3.01 (1.34-6.76) |  |
| Low TFI (Below Median) | 98 | 115 | 85.2 | 1.00 (reference) |  | 1.00 (reference) |  |
| **PT INR** |  |  |  |  | 0.0058 |  | 0.0197 |
| High PT INR (Above Median) | 99 | 101 | 98.0 | 8.10 (1.83-35.79) |  | 0.40 (0.19-0.87) |  |
| Low PT INR (Below Median) | 110 | 128 | 85.9 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Sex** |  |  |  |  | 0.0078 |  | 0.0057 |
| Male | 109 | 114 | 95.6 | 3.27 (1.15-9.32) |  | 3.20 (1.40-7.29) |  |
| Female | 110 | 115 | 87.0 | 1.00 (reference) |  | 1.00 (reference) |  |

a Shown as percentages (%), calculated as (events / total) × 100

**Supplementary Table 3.** Crude and Adjusted Odds Ratios for the Association Between Predictors and Mild-to-Severe Steatosis Discrimination

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure group** | **Events** | **Total** | **Event rate a** | **Crude model** | | **Adjusted model (Backward Stepwise Selection)** | |
| **OR (95% CI)** | ***P*-value** | **OR (95% CI)** | ***P*-value** |
| **Liver-to-Spleen Attenuation** |  |  |  |  | 0.0007 |  | 0.0013 |
| High Liver-to-Spleen Attenuation (Above Median) | 75 | 96 | 78.1 | 0.08 (0.02-0.33) |  | 0.08 (0.02-0.38) |  |
| Low Liver-to-Spleen Attenuation (Below Median) | 94 | 96 | 97.9 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Waist-to-Height Ratio** |  |  |  |  | 0.0247 |  | 0.0028 |
| High WHR  (Above Median) | 92 | 96 | 95.8 | 5.68 (1.85-17.39) |  | 6.16 (1.87-20.27) |  |
| Low WHR (Below Median) | 77 | 96 | 80.2 | 1.00 (reference) |  | 1.00 (reference) |  |
| **PT INR** |  |  |  |  | 0.0066 |  | 0.0052 |
| High PT INR (Above Median) | 78 | 96 | 81.2 | 0.24 (0.08-0.67) |  | 0.20 (0.07-0.62) |  |
| Low PT INR (Below Median) | 91 | 96 | 94.8 | 1.00 (reference) |  | 1.00 (reference) |  |

a Shown as percentages (%), calculated as (events / total) × 100

**Supplementary Table 4.** Crude and Adjusted Odds Ratios for the Association Between Predictors and Advanced Fibrosis Prediction

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure group** | **Events** | **Total** | **Event rate a** | **Crude model** | | **Adjusted model (Backward Stepwise Selection)** | |
| **OR (95% CI)** | ***P*-value** | **OR (95% CI)** | ***P*-value** |
| **Skeletal Muscle Volume** |  |  |  |  | 0.0000 |  | 0.0000 |
| High SMV (Above Median) | 9 | 96 | 9.4 | 0.15 (0.07-0.34) |  | 0.13 (0.05-0.31) |  |
| Low SMV (Below Median) | 39 | 96 | 40.6 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Waist-to-Height Ratio** |  |  |  |  | 0.0211 |  | 0.0404 |
| High WHR (Above Median) | 31 | 96 | 32.3 | 2.22 (1.13-4.36) |  | 2.34 (1.04-5.44) |  |
| Low WHR (Below Median) | 17 | 96 | 17.7 | 1.00 (reference) |  | 1.00 (reference) |  |
| **AST** |  |  |  |  | 0.0009 |  | 0.0002 |
| High AST (Above Median) | 34 | 95 | 35.8 | 3.30 (1.63-6.69) |  | 6.44 (2.45-16.93) |  |
| Low AST (Below Median) | 14 | 97 | 14.4 | 1.00 (reference) |  | 1.00 (reference) |  |
| **ALT** |  |  |  |  | 0.0474 |  | 0.0091 |
| High ALT (Above Median) | 18 | 96 | 18.8 | 0.51 (0.26-0.99) |  | 0.29 (0.11-0.73) |  |
| Low ALT (Below Median) | 30 | 96 | 31.2 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Diabetes** |  |  |  |  | 0.0132 |  | 0.0299 |
| Yes | 20 | 53 | 37.7 | 2.40 (1.20-4.80) |  | 2.56 (1.10-5.98) |  |
| No | 28 | 7139 | 20.1 | 1.00 (reference) |  | 1.00 (reference) |  |

a Shown as percentages (%), calculated as (events / total) × 100

**Supplementary Table 5.** Crude and Adjusted Odds Ratios for the Association Between Predictors and Significant Fibrosis Prediction

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure group** | **Events** | **Total** | **Event rate a** | **Crude model** | | **Adjusted model (Backward Stepwise Selection)** | |
| **OR (95% CI)** | ***P*-value** | **OR (95% CI)** | ***P*-value** |
| **Skeletal Muscle Volume** |  |  |  |  | 0.0000 |  | 0.0016 |
| High SMV (Above Median) | 20 | 96 | 20.8 | 0.24 (0.13-0.46) |  | 0.29 (0.13-0.62) |  |
| Low SMV (Below Median) | 50 | 96 | 52.1 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Waist-to-Height Ratio** |  |  |  |  | 0.0172 |  | 0.0142 |
| High WHR (Above Median) | 43 | 96 | 44.8 | 2.07 (1.14-3.78) |  | 2.54 (1.21-5.34) |  |
| Low WHR (Below Median) | 27 | 96 | 28.1 | 1.00 (reference) |  | 1.00 (reference) |  |
| **AST** |  |  |  |  | 0.0003 |  | 0.0018 |
| High AST (Above Median) | 47 | 95 | 49.5 | 3.15 (1.70-5.84) |  | 3.18 (1.54-6.59) |  |
| Low AST (Below Median) | 23 | 97 | 23.7 | 1.00 (reference) |  | 1.00 (reference) |  |
| **PLT** |  |  |  |  | 0.0011 |  | 0.0492 |
| High PLT (Above Median) | 24 | 96 | 25.0 | 0.36 (0.20-0.67) |  | 0.47 (0.22-0.99) |  |
| Low PLT (Below Median) | 46 | 96 | 47.8 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Age** |  |  |  |  | 0.0000 |  | 0.0099 |
| High Age (Above Median) | 50 | 96 | 52.1 | 4.13 (2.19-7.79) |  | 2.63 (1.26-5.49) |  |
| Low Age (Below Median) | 20 | 96 | 20.8 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Diabetes** |  |  |  |  | 0.0014 |  | 0.0024 |
| Yes | 29 | 53 | 54.7 | 2.89 (1.50-5.54) |  | 3.39 (1.54-7.46) |  |
| No | 41 | 139 | 29.5 | 1.00 (reference) |  | 1.00 (reference) |  |

a Shown as percentages (%), calculated as (events / total) × 100

**Supplementary Table 6.** Crude and Adjusted Hazard Ratios for the Association Between Predictors and the Risk of Liver-Related Events

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure group** | **Events** | **Person**  **-years** | **Incidence rate a** | **Crude model** | | **Adjusted model (Backward Stepwise Selection)** | |
| **HR (95% CI)** | ***P*-value** | **HR (95% CI)** | ***P*-value** |
| **Skeletal Muscle Area** |  |  |  |  | 0.0132 |  | 0.0137 |
| High SMA (Above Median) | 7 | 559.06 | 125.21 | 0.34 (0.14-0.80) |  | 0.33 (0.14-0.80) |  |
| Low SMA (Below Median) | 20 | 504.49 | 396.44 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Viscerl Fat Attenuation** |  |  |  |  | 0.0247 |  | 0.0185 |
| High VFA (Above Median) | 20 | 561.05 | 356.47 | 2.81 (1.19-6.67) |  | 2.87 (1.19-6.91) |  |
| Low VFA (Below Median) | 7 | 502.50 | 139.30 | 1.00 (reference) |  | 1.00 (reference) |  |
| **Spleen Attenuation** |  |  |  |  | 0.0469 |  | 0.0249 |
| High Spleen Attenuation  (Above Median) | 8 | 513.37 | 155.83 | 0.43 (0.19-0.99) |  | 0.38 (0.17-0.89) |  |
| Low Spleen Attenuation (Below Median) | 19 | 550.18 | 345.34 | 1.00 (reference) |  | 1.00 (reference) |  |
| **PT INR** |  |  |  |  | 0.0147 |  | 0.0090 |
| High PT INR (Above Median) | 19 | 463.47 | 409.95 | 2.81 (1.23-6.44) |  | 3.04 (1.32-6.99) |  |
| Low PT INR (Below Median) | 8 | 600.08 | 133.31 | 1.00 (reference) |  | 1.00 (reference) |  |

a Per 10,000 person-years