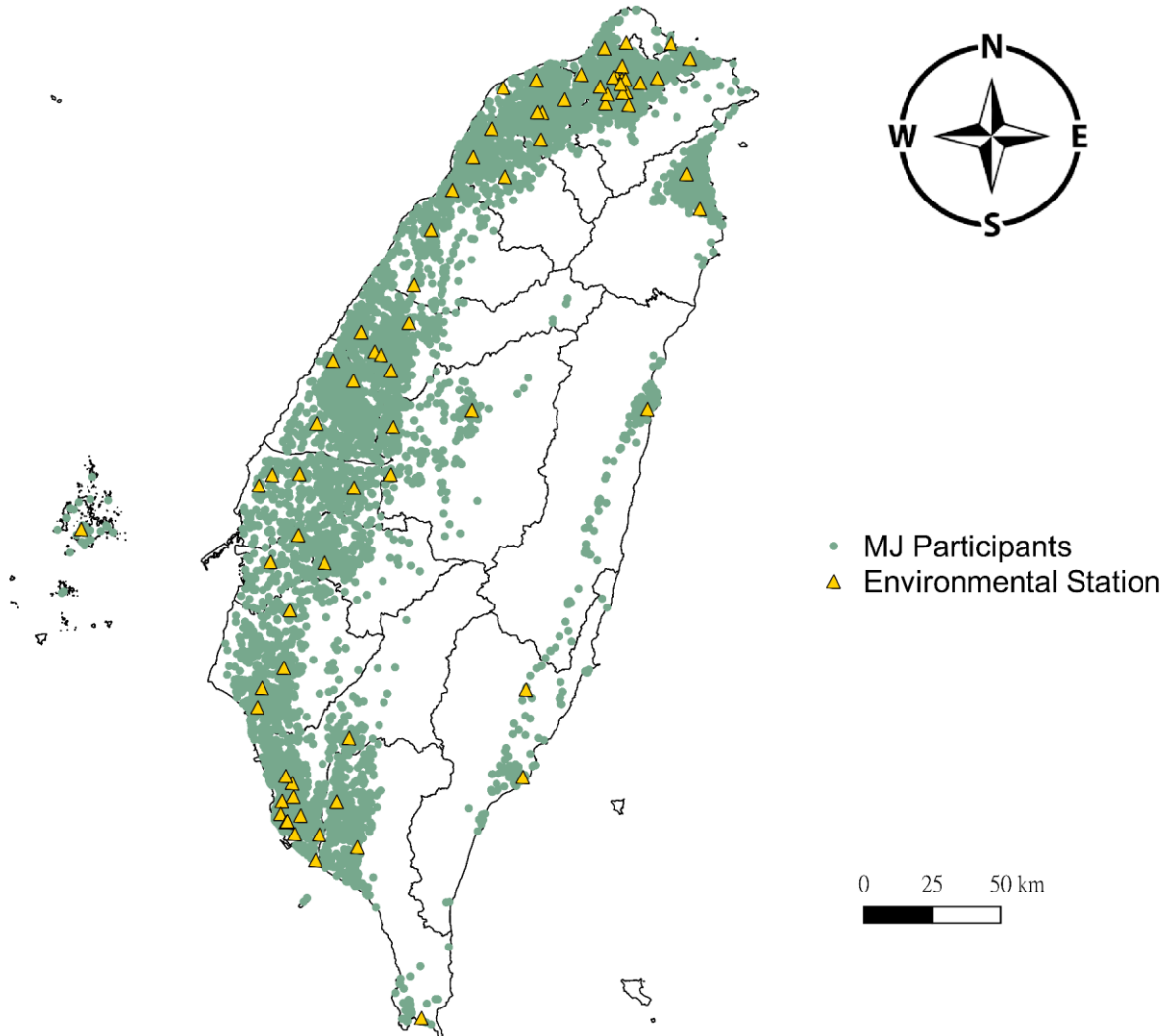
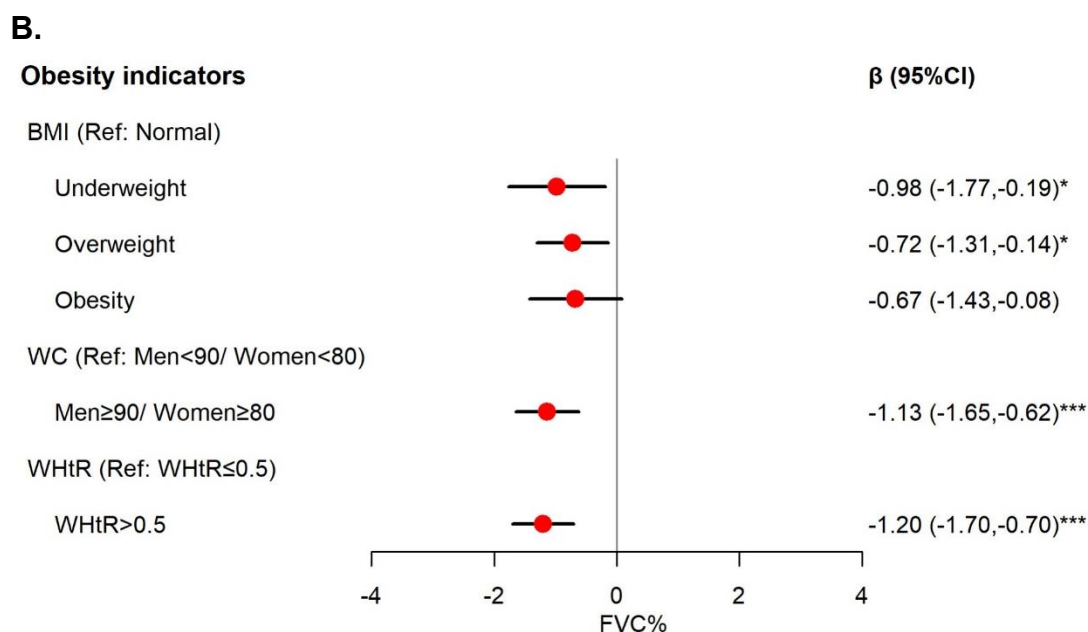
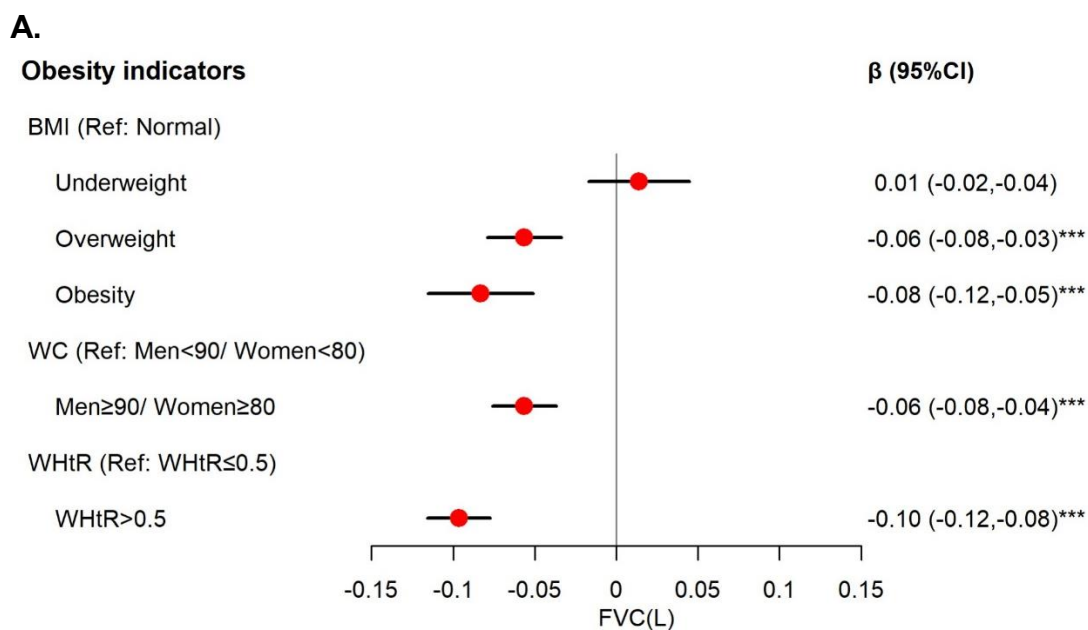


## Supplementary materials



**Figure S1. Distribution of the MJ participants for the years 2000-2015.**



**Figure S2. Effect of obesity indicators on FVC (excluding participants with FVC%<80) in asthmatic persons**

(A) The associations between obesity (defined by BMI, WC and WHtR) and FVC among asthma participants. Adjusted for season, gender, age group, education, and PSI. (B) The associations between obesity (defined by BMI, WC and WHtR) and FVC% among asthma participants.

Adjusted for season, gender, age group, education, PSI, and tobacco exposure.

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Table S1. Adjusted coefficient and odds ratios for pulmonary function in relation to BMI and other risk factors among participants in adult aged 20 and more, MJ.**

|                                    | Asthma               |         |                      |         |                    |         | Non-asthma           |         |                      |         |                    |         |
|------------------------------------|----------------------|---------|----------------------|---------|--------------------|---------|----------------------|---------|----------------------|---------|--------------------|---------|
|                                    | FVC<br>β (95% CI)    | p-value | FVC%<br>β (95% CI)   | p-value | RSP<br>OR (95% CI) | p-value | FVC<br>β (95% CI)    | p-value | FVC%<br>β (95% CI)   | p-value | RSP<br>OR (95% CI) | p-value |
| BMI (ref: normal)                  |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Underweight                        | -0.06 (-0.09, -0.03) | <0.001  | -3.31 (-4.18, -2.43) | <0.001  | 1.50 (1.32, 1.69)  | <0.001  | -0.04 (-0.05, -0.04) | <0.001  | -3.25 (-3.41, -3.08) | <0.001  | 1.56 (1.52, 1.60)  | <0.001  |
| Overweight                         | -0.05 (-0.07, -0.03) | <0.001  | -0.53 (-1.04, -0.02) | 0.041   | 1.08 (1.00, 1.15)  | 0.030   | -0.04 (-0.04, -0.03) | <0.001  | -0.24 (-0.34, -0.14) | <0.001  | 1.06 (1.05, 1.08)  | <0.001  |
| Obesity                            | -0.11 (-0.14, -0.08) | <0.001  | -1.91 (-2.64, -1.19) | <0.001  | 1.33 (1.21, 1.46)  | <0.001  | -0.08 (-0.09, -0.08) | <0.001  | -1.48 (-1.63, -1.33) | <0.001  | 1.27 (1.24, 1.29)  | <0.001  |
| Women                              | -1.01 (-1.03, -0.98) | <0.001  | 2.59 (1.92, 3.26)    | <0.001  | 0.76 (0.70, 0.83)  | <0.001  | -1.00 (-1.01, -1.00) | <0.001  | 3.18 (3.06, 3.3)     | <0.001  | 0.70 (0.68, 0.71)  | <0.001  |
| Age ≥60 years (ref: <60 years)     | -0.33 (-0.36, -0.30) | <0.001  | -2.42 (-3.31, -1.53) | <0.001  | 1.43 (1.30, 1.59)  | <0.001  | -0.22 (-0.23, -0.22) | <0.001  | 0.92 (0.75, 1.09)    | <0.001  | 1.01 (0.99, 1.04)  | 0.270   |
| Education (ref: primary and below) |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Junior/ senior high school         | 0.39 (0.34, 0.44)    | <0.001  | 6.98 (5.76, 8.20)    | <0.001  | 0.50 (0.43, 0.58)  | <0.001  | 0.34 (0.33, 0.35)    | <0.001  | 4.63 (4.42, 4.85)    | <0.001  | 0.61 (0.59, 0.62)  | <0.001  |
| College and above                  | 0.74 (0.69, 0.78)    | <0.001  | 12.1 (10.9, 13.3)    | <0.001  | 0.30 (0.26, 0.35)  | <0.001  | 0.59 (0.58, 0.60)    | <0.001  | 7.82 (7.62, 8.03)    | <0.001  | 0.42 (0.41, 0.43)  | <0.001  |
| <i>p-trend</i>                     | <0.001               |         | <0.001               |         | <0.001             |         | <0.001               |         | <0.001               |         | <0.001             |         |
| HTN (ref: non-HTN )                | -0.10 (-0.14, -0.06) | <0.001  | -                    | -       | -                  | -       | -0.08 (-0.09, -0.07) | <0.001  | -                    | -       | -                  | -       |
| AHTN (ref: not used AHTN )         | -0.03 (-0.06, <0.00) | 0.022   | -                    | -       | -                  | -       | -0.02 (-0.03, -0.01) | <0.001  | -                    | -       | -                  | -       |
| DM (ref: non-DM )                  | -0.05 (-0.10, <0.00) | 0.031   | -                    | -       | -                  | -       | -0.06 (-0.07, -0.05) | <0.001  | -                    | -       | -                  | -       |
| PM (ref: not used PM )             | 0.05 (>0.00, 0.10)   | 0.035   | 1.71 (0.23, 3.18)    | 0.024   | 0.75 (0.62, 0.92)  | 0.005   | 0.02(>0.00, 0.03)    | 0.003   | 1.07 (0.67, 1.47)    | <0.001  | 0.88 (0.83, 0.93)  | <0.001  |
| Season (ref: Spring )              |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Summer                             | -0.04 (-0.06, -0.03) | <0.001  | -1.52 (-1.96, -1.07) | <0.001  | 1.21 (1.13, 1.29)  | <0.001  | -0.05 (-0.05, -0.04) | <0.001  | -1.70 (-1.79, -1.61) | <0.001  | 1.22 (1.20, 1.24)  | <0.001  |
| Autumn                             | -0.05 (-0.07, -0.04) | <0.001  | -1.70 (-2.17, -1.23) | <0.001  | 1.21 (1.13, 1.29)  | <0.001  | -0.04 (-0.04, -0.04) | <0.001  | -1.54 (-1.63, -1.45) | <0.001  | 1.18 (1.17, 1.20)  | <0.001  |
| Winter                             | -0.04 (-0.05, -0.02) | <0.001  | -1.26 (-1.71, -0.81) | <0.001  | 1.16 (1.08, 1.25)  | <0.001  | -0.03 (-0.03, -0.03) | <0.001  | -1.13 (-1.22, -1.03) | <0.001  | 1.14 (1.13, 1.16)  | <0.001  |
| PSI(each 10 units)                 | -0.02 (-0.03, -0.02) | <0.001  | -0.92 (-1.06, -0.77) | <0.001  | 1.11 (1.09, 1.14)  | <0.001  | -0.02 (-0.02, -0.02) | <0.001  | -0.94 (-0.97, -0.91) | <0.001  | 1.11 (1.11, 1.12)  | <0.001  |
| PA (ref: light-intensity)          |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Moderate-intensity                 | -                    | -       | 0.24 (-0.13, 0.60)   | 0.2111  | 0.98 (0.93, 1.04)  | 0.517   | -                    | -       | 0.39 (0.32, 0.47)    | <0.001  | 0.95 (0.94, 0.96)  | <0.001  |
| Vigorous-intensity                 | -                    | -       | 1.08 (0.51, 1.65)    | <0.001  | 0.91 (0.84, 0.98)  | 0.017   | -                    | -       | 0.82 (0.71, 0.93)    | <0.001  | 0.90 (0.88, 0.91)  | <0.001  |
| <i>p-trend</i>                     | -                    |         | <0.001               |         | 0.030              |         | -                    |         | <0.001               |         | <0.001             |         |

HTN: Hypertension; AHTN: Antihypertensive agent, DM: Diabetes; PM: Psychiatric medication; PSI: pollutant standards index; PA: Physical activity

**Table S2. Adjusted coefficient and odds ratios for pulmonary function in relation to WC and other risk factors among participants in adult aged 20 and more, MJ.**

|                                    | Asthma               |         |                      |         |                    |         | Non-asthma           |         |                      |         |                    |         |
|------------------------------------|----------------------|---------|----------------------|---------|--------------------|---------|----------------------|---------|----------------------|---------|--------------------|---------|
|                                    | FVC<br>β (95% CI)    | p-value | FVC%<br>β (95% CI)   | p-value | RSP<br>OR (95% CI) | p-value | FVC<br>β (95% CI)    | p-value | FVC%<br>β (95% CI)   | p-value | RSP<br>OR (95% CI) | p-value |
| Obesity (ref: non-obesity)         | -0.07 (-0.09, -0.05) | <0.001  | -1.69 (-2.18, -1.19) | <0.001  | 1.25 (1.17, 1.34)  | <0.001  | -0.04 (-0.05, -0.04) | <0.001  | -1.25 (-1.35, -1.14) | <0.001  | 1.22 (1.20, 1.24)  | <0.001  |
| Women                              | -1.00 (-1.03, -1.00) | <0.001  | 2.45 (1.80, 3.11)    | <0.001  | 0.77 (0.71, 0.84)  | <0.001  | -1.00 (-1.00, -0.99) | <0.001  | 2.96 (2.85, 3.08)    | <0.001  | 0.71 (0.70, 0.73)  | <0.001  |
| Age ≥60 years (ref: <60 years)     | -0.33 (-0.36, -0.3)  | <0.001  | -2.28 (-3.17, -1.39) | <0.001  | 1.41 (1.27, 1.56)  | <0.001  | -0.22 (-0.23, -0.22) | <0.001  | 1.03 (0.86, 1.19)    | <0.001  | 0.99 (0.97, 1.02)  | 0.630   |
| Education (ref: primary and below) |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Junior/ senior high school         | 0.39 (0.34, 0.4)     | <0.001  | 6.82 (5.60, 8.04)    | <0.001  | 0.51 (0.44, 0.59)  | <0.001  | 0.34 (0.33, 0.35)    | <0.001  | 4.45 (4.24, 4.66)    | <0.001  | 0.62 (0.61, 0.64)  | <0.001  |
| College and above                  | 0.74 (0.69, 0.8)     | <0.001  | 11.9 (10.7, 13.0)    | <0.001  | 0.31 (0.27, 0.36)  | <0.001  | 0.59 (0.58, 0.60)    | <0.001  | 7.55 (7.35, 7.76)    | <0.001  | 0.44 (0.43, 0.45)  | <0.001  |
| <i>p-trend</i>                     | <0.001               |         | <0.001               |         | <0.001             |         | <0.001               |         | <0.001               |         | <0.001             |         |
| HTN (ref: non-HTN )                | -0.11 (-0.15, -0.07) | <0.001  | -                    | -       | -                  | -       | -0.08 (-0.09, -0.07) | <0.001  | -                    | -       | -                  | -       |
| AHTN (ref: not used AHTN )         | -0.03 (-0.06, <0.00) | 0.045   | -                    | -       | -                  | -       | -0.02 (-0.03, -0.01) | <0.001  | -                    | -       | -                  | -       |
| DM (ref: non-DM )                  | -0.03 (-0.07, <0.00) | 0.046   | -                    | -       | -                  | -       | -0.04 (-0.05, -0.03) | <0.001  | -                    | -       | -                  | -       |
| PM (ref: not used PM )             | 0.05 (>0.00, 0.1)    | 0.036   | 1.62 (0.15, 3.10)    | <0.001  | 0.76 (0.62, 0.93)  | 0.008   | 0.02 (0.01, 0.03)    | 0.003   | 1.07 (0.67, 1.47)    | <0.001  | 0.88 (0.83, 0.93)  | <0.001  |
| Season (ref: Spring )              |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Summer                             | -0.04 (-0.06, -0.03) | <0.001  | -1.52 (-1.97, -1.08) | <0.001  | 1.21 (1.13, 1.29)  | <0.001  | -0.05 (-0.05, -0.05) | <0.001  | -1.72 (-1.81, -1.63) | <0.001  | 1.22 (1.2, 1.24)   | <0.001  |
| Autumn                             | -0.05 (-0.07, -0.03) | <0.001  | -1.71 (-2.18, -1.24) | <0.001  | 1.21 (1.13, 1.29)  | <0.001  | -0.04 (-0.04, -0.04) | <0.001  | -1.56 (-1.65, -1.47) | <0.001  | 1.19 (1.17, 1.21)  | <0.001  |
| Winter                             | -0.04 (-0.05, -0.02) | <0.001  | -1.27 (-1.72, -0.81) | <0.001  | 1.16 (1.08, 1.25)  | <0.001  | -0.03 (-0.03, -0.03) | <0.001  | -1.13 (-1.23, -1.04) | <0.001  | 1.14 (1.13, 1.16)  | <0.001  |
| PSI(each 10 units)                 | -0.02 (-0.03, -0.02) | <0.001  | -0.92 (-1.06, -0.77) | <0.001  | 1.11 (1.09, 1.14)  | <0.001  | -0.02 (-0.02, -0.02) | <0.001  | -0.95 (-0.98, -0.92) | <0.001  | 1.12 (1.11, 1.12)  | <0.001  |
| PA (ref: light-intensity)          |                      |         |                      |         |                    |         |                      |         |                      |         |                    |         |
| Moderate-intensity                 | -                    | -       | 0.25 (-0.12, 0.62)   | 0.1851  | 0.98 (0.93, 1.04)  | 0.449   | -                    | -       | 0.42 (0.34, 0.5)     | <0.001  | 0.95 (0.94, 0.96)  | <0.001  |
| Vigorous-intensity                 | -                    | -       | 1.09 (0.52, 1.66)    | <0.001  | 0.91 (0.84, 0.98)  | 0.015   | -                    | -       | 0.84 (0.73, 0.95)    | <0.001  | 0.89 (0.88, 0.91)  | <0.001  |
| <i>p-trend</i>                     | -                    |         | <0.001               |         | 0.024              |         | -                    |         | <0.001               |         | <0.001             |         |

HTN: Hypertension; AHTN: Antihypertensive agent, DM: Diabetes; PM: Psychiatric medication; PSI: pollutant standards index; PA: Physical activity

**Table S3. Adjusted coefficient and odds ratios for pulmonary function in relation to WHtR and other risk factors among participants in adult aged 20 and more, MJ.**

|                                      | Asthma               |         |                      |         |                   |         | Non-asthma           |         |                      |         |                   |         |
|--------------------------------------|----------------------|---------|----------------------|---------|-------------------|---------|----------------------|---------|----------------------|---------|-------------------|---------|
|                                      | FVC                  |         | FVC%                 |         | RSP               |         | FVC                  |         | FVC%                 |         | RSP               |         |
|                                      | $\beta$ (95% CI)     | p-value | $\beta$ (95% CI)     | p-value | OR (95% CI)       | p-value | $\beta$ (95% CI)     | p-value | $\beta$ (95% CI)     | p-value | OR (95% CI)       | p-value |
| Obesity (ref: non-obesity)           | -0.11 (-0.13, -1.10) | <0.001  | -1.41 (-1.89, -0.93) | <0.001  | 1.20 (1.13, 1.29) | <0.001  | -0.09 (-0.10, -0.09) | <0.001  | -0.95 (-1.04, -0.86) | <0.001  | 1.17 (1.16, 1.19) | <0.001  |
| Women                                | -1.02 (-1.04, -0.99) | <0.001  | 2.27 (1.61, 2.93)    | <0.001  | 0.79 (0.73, 0.86) | <0.001  | -1.02 (-1.02, -1.01) | <0.001  | 2.84 (2.72, 2.96)    | <0.001  | 0.73 (0.72, 0.74) | <0.001  |
| Age $\geq$ 60 years (ref: <60 years) | -0.32 (-0.36, -0.29) | <0.001  | -2.23 (-3.12, -1.33) | <0.001  | 1.39 (1.26, 1.54) | <0.001  | -0.22 (-0.22, -0.21) | <0.001  | 1.06 (0.89, 1.22)    | <0.001  | 0.99 (0.97, 1.01) | 0.280   |
| Education (ref: primary and below)   |                      |         |                      |         |                   |         |                      |         |                      |         |                   |         |
| Junior/ senior high school           | 0.38 (0.33, 0.43)    | <0.001  | 6.79 (5.57, 8.01)    | <0.001  | 0.51 (0.44, 0.59) | <0.001  | 0.33 (0.32, 0.34)    | <0.001  | 4.43 (4.22, 4.64)    | <0.001  | 0.63 (0.61, 0.64) | <0.001  |
| College and above                    | 0.72 (0.67, 0.77)    | <0.001  | 11.8 (10.6, 13.0)    | <0.001  | 0.31 (0.27, 0.36) | <0.001  | 0.57 (0.57, 0.58)    | <0.001  | 7.50 (7.30, 7.71)    | <0.001  | 0.44 (0.43, 0.45) | <0.001  |
| <i>p-trend</i>                       | <0.001               |         | <0.001               |         | <0.001            |         | <0.001               |         | <0.001               |         | <0.001            |         |
| HTN (ref: non-HTN )                  | -0.10 (-0.14, -0.06) | <0.001  | -                    | -       | -                 | -       | -0.08 (-0.09, -0.07) | <0.001  | -                    | -       | -                 | -       |
| AHTN (ref: not used AHTN )           | -0.03 (-0.06, <0.00) | 0.031   | -                    | -       | -                 | -       | -0.02 (-0.02, -0.01) | <0.001  | -                    | -       | -                 | -       |
| DM (ref: non-DM )                    | -0.03 (-0.07, >0.00) | 0.087   | -                    | -       | -                 | -       | -0.04 (-0.05, -0.03) | <0.001  | -                    | -       | -                 | -       |
| PM (ref: not used PM )               | 0.05 (>0.00, 0.10)   | 0.033   | 1.62 (0.15, 3.10)    | 0.031   | 0.76 (0.62, 0.93) | 0.007   | 0.02 (0.01, 0.03)    | 0.002   | 1.07 (0.67, 1.47)    | <0.001  | 0.88 (0.83, 0.93) | <0.001  |
| Season (ref: Spring )                |                      |         |                      |         |                   |         |                      |         |                      |         |                   |         |
| Summer                               | -0.05 (-0.06, -0.03) | <0.001  | -1.53 (-1.98, -1.09) | <0.001  | 1.21 (1.13, 1.29) | <0.001  | -0.05 (-0.05, -0.05) | <0.001  | -1.71 (-1.80, -1.62) | <0.001  | 1.22 (1.20, 1.24) | <0.001  |
| Autumn                               | -0.05 (-0.07, -0.04) | <0.001  | -1.71 (-2.18, -1.24) | <0.001  | 1.21 (1.13, 1.29) | <0.001  | -0.04 (-0.04, -0.04) | <0.001  | -1.56 (-1.65, -1.47) | <0.001  | 1.19 (1.17, 1.20) | <0.001  |
| Winter                               | -0.04 (-0.05, -0.02) | <0.001  | -1.27 (-1.73, -0.82) | <0.001  | 1.16 (1.08, 1.25) | <0.001  | -0.03 (-0.03, -0.03) | <0.001  | -1.13 (-1.22, -1.04) | <0.001  | 1.14 (1.13, 1.16) | <0.001  |
| PSI(each 10 units)                   | -0.02 (-0.03, -0.02) | <0.001  | -0.92 (-1.07, -0.78) | <0.001  | 1.11 (1.09, 1.14) | <0.001  | -0.02 (-0.02, -0.02) | <0.001  | -0.95 (-0.98, -0.92) | <0.001  | 1.12 (1.11, 1.12) | <0.001  |
| PA (ref: light-intensity)            |                      |         |                      |         |                   |         |                      |         |                      |         |                   |         |
| Moderate-intensity                   | -                    | -       | 0.25 (-0.12, 0.62)   | 0.186   | 0.98 (0.93, 1.04) | 0.461   | -                    | -       | 0.42 (0.35, 0.50)    | <0.001  | 0.95 (0.94, 0.96) | <0.001  |
| Vigorous-intensity                   | -                    | -       | 1.09 (0.52, 1.67)    | <0.001  | 0.91 (0.84, 0.98) | 0.014   | -                    | -       | 0.85 (0.74, 0.96)    | <0.001  | 0.89 (0.88, 0.91) | <0.001  |
| <i>p-trend</i>                       | -                    |         | <0.001               |         | 0.024             |         | -                    |         | <0.001               |         | <0.001            |         |

HTN: Hypertension; AHTN: Antihypertensive agent, DM: Diabetes; PM: Psychiatric medication; PSI: pollutant standards index; PA: Physical activity

**Table S4. Effect of obesity indicators on FEV1, FEV1%, FEV1%<80%, FEV1/FVC, and annual change of FEV1 and FEV1/FVC**

|                         | FEV1 <sup>a</sup><br>β (95% CI) | FEV1% <sup>b</sup><br>β (95% CI) | FEV1%<80 <sup>c</sup><br>OR (95% CI) | FEV1/FVC <sup>d</sup><br>β (95% CI) | ΔFEV1/year <sup>e</sup><br>β (95% CI) | ΔFEV1%/year <sup>e</sup><br>β (95% CI) | ΔFEV1/FVC/year <sup>e</sup><br>β (95% CI) |
|-------------------------|---------------------------------|----------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|--|---|
| <b>Asthma</b>           |                                 |                                  |                                      |                                     |                                       |  |   |
| BMI (ref: normal)       |                                 |                                  |                                      |                                     |                                       |  |   |
| Underweight             | -0.03 (-0.06, -0.01)*           | -3.34 (-4.24, -2.44)***          | 1.33 (1.17, 1.51)***                 | 1.09 (0.63, 1.56)***                | 0.001 (-0.006, 0.008)                 | -0.015 (-0.266, 0.236)                 | 0.051 (-0.117, 0.218)                     |
| Overweight              | -0.05 (-0.07, -0.03)***         | -0.20 (-0.76, 0.37)              | 1.10 (1.03, 1.18)**                  | -0.22 (-0.50, 0.05)                 | -0.001 (-0.005, 0.003)                | -0.039 (-0.180, 0.101)                 | 0.080 (-0.001, 0.160)                     |
| Obesity                 | -0.09 (-0.12, -0.07)***         | -0.94 (-1.74, -0.13)*            | 1.25 (1.13, 1.37)***                 | 0.13 (-0.24, 0.49)                  | -0.001 (-0.006, 0.004)                | 0.001 (-0.170, 0.172)                  | 0.123 (0.029, 0.217)**                    |
| ΔBMI/year               | -0.026 (-0.042, -0.010)**       | -0.490 (-0.994, 0.014)           | -                                    | 0.044 (-0.162, 0.249)               | -0.033 (-0.046, -0.020)***            | -0.901 (-1.322, -0.479)***             | -0.065 (-0.303, 0.173)                    |
| WC (ref: non-obesity)   |                                 |                                  |                                      |                                     |                                       |  |   |
| Obesity                 | -0.06 (-0.08, -0.05)***         | -1.21 (-1.76, -0.66)***          | 1.22 (1.14, 1.31)***                 | -0.14 (-0.40, 0.12)                 | -0.005 (-0.009, <0.000)*              | -0.155 (-0.301, -0.008)*               | 0.067 (-0.015, 0.148)                     |
| ΔWC/year                | -0.006 (-0.010, -0.003)**       | -0.131 (-0.255, -0.007)*         | -                                    | 0.002 (-0.051, 0.055)               | -0.006 (-0.01, <0.000)***             | -0.168 (-0.281, -0.055)**              | -0.043 (-0.104, 0.019)                    |
| WHtR (ref: non-obesity) |                                 |                                  |                                      |                                     |                                       |  |   |
| Obesity                 | -0.10 (-0.12, -0.09)***         | -1.04 (-1.57, -0.51)***          | 1.21 (1.13, 1.29)***                 | -0.39 (-0.64, -0.14)**              | -0.003 (-0.006, 0.001)                | -0.053 (-0.184, 0.078)                 | 0.065 (-0.008, 0.139)                     |
| ΔWHtR/year <sup>§</sup> | -0.010 (-0.016, -0.004)**       | -0.166 (-0.370, 0.038)           | -                                    | 0.014 (-0.073, 0.101)               | -0.009 (-0.014, -0.004)***            | -0.235 (-0.423, -0.048)*               | -0.061 (-0.161, 0.039)                    |
| <b>Non-asthma</b>       |                                 |                                  |                                      |                                     |                                       |  |   |
| BMI (ref: normal)       |                                 |                                  |                                      |                                     |                                       |  |   |
| Underweight             | -0.02 (-0.03, -0.02)***         | -3.55 (-3.73, -3.37)***          | 1.52 (1.47, 1.57)***                 | 0.93 (0.85, 1.02)***                | -0.001 (-0.002, 0.001)                | -0.063 (-0.114, -0.012)*               | <0.000 (-0.026, 0.026)                    |
| Overweight              | -0.04 (-0.04, -0.03)***         | 0.06 (-0.06, 0.17)               | 1.09 (1.07, 1.11)***                 | -0.22 (-0.27, -0.17)***             | <0.000 (-0.001, >0.000)               | 0.016 (-0.015, 0.047)                  | 0.003 (-0.013, 0.018)                     |
| Obesity                 | -0.076 (-0.081, -0.070)***      | -0.95 (-1.11, -0.78)***          | 1.36 (1.32, 1.39)***                 | -0.10 (-0.17, -0.04)**              | -0.002 (-0.003, -0.001)***            | -0.024 (-0.065, 0.017)                 | 0.009 (-0.011, 0.028)                     |
| ΔBMI/year               | -0.018 (-0.021, -0.015)***      | -0.254 (-0.353, -0.154)***       | -                                    | -0.016 (-0.058, 0.027)              | -0.032 (-0.038, -0.025)***            | -0.999 (-1.408, -0.590)***             | -0.067 (-0.136, 0.002)                    |
| WC(ref: non-obesity)    |                                 |                                  |                                      |                                     |                                       |  |   |
| Obesity                 | -0.04 (-0.05, -0.04)***         | -0.81 (-0.93, -0.70)***          | 1.25 (1.22, 1.27)***                 | -0.15 (-0.20, -0.10)***             | -0.002 (-0.003, -0.001)***            | -0.045 (-0.080, -0.011)*               | 0.012 (-0.005, 0.029)                     |
| ΔWC/year                | -0.003 (-0.004, -0.002)***      | -0.029 (-0.052, -0.006)*         | -                                    | -0.007 (-0.017, 0.003)              | -0.006 (-0.008, -0.004)***            | -0.204 (-0.319, -0.089)***             | -0.015 (-0.033, 0.003)                    |
| WHtR(ref: non-obesity)  |                                 |                                  |                                      |                                     |                                       |  |   |
| Obesity                 | -0.08 (-0.08, -0.08)***         | -0.50 (-0.60, -0.40)***          | 1.20 (1.18, 1.22)***                 | -0.16 (-0.21, -0.12)***             | -0.002 (-0.003, -0.001)***            | -0.016 (-0.046, 0.015)                 | 0.019 (0.004, 0.033)*                     |
| ΔWHtR/year <sup>§</sup> | -0.005 (-0.006, -0.004)***      | <0.000 (-0.038, 0.038)           | -                                    | -0.002 (-0.018, 0.014)              | -0.009 (-0.012, -0.006)***            | -0.292 (-0.466, -0.118)**              | -0.019 (-0.047, 0.008)                    |

a. Adjusted for season, age group, sex, education, HTN, and PSI. (non-asthma: a+ AHTN and DM)

b. Adjusted for season, age group, sex, education, PSI, and physical activity (non-asthma: b+ HTN, AHTN, DM, and PM).

c. Adjusted for season, age group, sex, education, PM, PSI, and physical activity.

d. Adjusted for age group, sex, education, and PSI.

e. Adjusted for season, age group, sex, education, and PSI.

§ means per 1% increase

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

**Table S5. Sensitive analysis of Obesity and pulmonary function**

|                          | BMI (ref: normal)              |                               |                            | WC (ref: non-obesity)      | WHtR (ref: non-obesity)    |
|--------------------------|--------------------------------|-------------------------------|----------------------------|----------------------------|----------------------------|
|                          | Underweight<br>β / OR (95% CI) | Overweight<br>β / OR (95% CI) | Obesity<br>β / OR (95% CI) | Obesity<br>β / OR (95% CI) | Obesity<br>β / OR (95% CI) |
| <b>Asthma</b>            |                                |                               |                            |                            |                            |
| FVC (L) <sup>a</sup>     | -0.06 (-0.09, -0.02) ***       | -0.05 (-0.07, -0.04) ***      | -0.13 (-0.15, -0.10) ***   | -0.08 (-0.10, -0.06) ***   | -0.12 (-0.14, -0.10) ***   |
| FVC% <sup>b</sup> (%)    | -3.29 (-4.16, -2.41) ***       | -0.53 (-1.05, -0.02) *        | -1.91 (-2.64, -1.19) ***   | -1.68 (-2.18, -1.19) ***   | -1.41 (-1.89, -0.93) ***   |
| RSP <sup>b</sup>         | 1.49 (1.32, 1.69) ***          | 1.08 (1.01, 1.16) *           | 1.33 (1.21, 1.46) ***      | 1.25 (1.17, 1.34) ***      | 1.21 (1.13, 1.29) ***      |
| FEV1 (L) <sup>a</sup>    | -0.03 (-0.06, <0.00) *         | -0.05 (-0.07, -0.04) ***      | -0.10 (-0.13, -0.08) ***   | -0.07 (-0.09, -0.05) ***   | -0.11 (-0.12, -0.09) ***   |
| FEV1% (%) <sup>b</sup>   | -3.32 (-4.22, -2.41) ***       | -0.20 (-0.77, 0.36)           | -0.93 (-1.74, -0.13) ***   | -1.21 (-1.76, -0.66) ***   | 1.04 (-1.58, -0.51) ***    |
| FEV1% < 80% <sup>b</sup> | 1.33 (1.16, 1.52) ***          | 1.10 (1.03, 1.19) **          | 1.25 (1.13, 1.37) ***      | 1.22 (1.14, 1.31) ***      | 1.21 (1.13, 1.29) ***      |
| FEV1/FVC <sup>c</sup>    | 1.08 (0.61, 1.55) ***          | -0.22 (-0.50, 0.05)           | 0.13 (-0.24, 0.49)         | -0.14 (-0.40, 0.12)        | -0.39 (-0.64, -0.14) ***   |
| <b>Non-asthma</b>        |                                |                               |                            |                            |                            |
| FVC (L) <sup>a</sup>     | -0.04 (-0.05, -0.04) ***       | -0.04 (-0.05, -0.04) ***      | -0.09 (-0.10, -0.09) ***   | -0.05 (-0.05, -0.05) ***   | -0.10 (-0.10, -0.09) ***   |
| FVC% <sup>b</sup> (%)    | -3.25 (-3.41, -3.08) ***       | -0.24 (-0.34, -0.14) ***      | -1.48 (-1.63, -1.33) ***   | -1.25 (-1.35, -1.14) ***   | -0.95 (-1.04, -0.86) ***   |
| RSP <sup>b</sup>         | 1.56 (1.52, 1.60) ***          | 1.06 (1.05, 1.08) ***         | 1.27 (1.24, 1.29) ***      | 1.22 (1.20, 1.24) ***      | 1.17 (1.16, 1.19) ***      |
| FEV1 (L) <sup>a</sup>    | -0.02 (-0.03, -0.02) ***       | -0.04 (-0.04, -0.04) ***      | -0.08 (-0.09, -0.08) ***   | -0.05 (-0.05, -0.04) ***   | -0.08 (-0.09, -0.08) ***   |
| FEV1% (%) <sup>b</sup>   | -3.55 (-3.73, -3.37) ***       | 0.06 (-0.06, 0.17)            | -0.95 (-1.11, -0.78) ***   | -0.81 (-0.93, -0.70) ***   | -0.50 (-0.60, -0.40) ***   |
| FEV1% < 80% <sup>b</sup> | 1.52 (1.47, 1.57) ***          | 1.09 (1.07, 1.11) ***         | 1.36 (1.32, 1.39) ***      | 1.25 (1.22, 1.27) ***      | 1.20 (1.18, 1.22) ***      |
| FEV1/FVC <sup>c</sup>    | 0.93 (0.85, 1.01) ***          | -0.22 (-0.27, -0.17) ***      | -0.10 (-0.17, -0.04) **    | -0.15 (-0.20, -0.10) ***   | -0.16 (-0.21, -0.12) ***   |

a. Adjusted for season, age group, sex, education, and PSI.

b. Adjusted for season, age group, sex, education, PSI, and physical activity

c. Adjusted for age group, sex, education, and PSI.

\*<0.05, \*\*<0.01, \*\*\*<0.001



**Table S6. Effect of central obesity on lung function**

|                             | Non-central obesity     |        |                         |                         | Central obesity         |                         |                         |
|-----------------------------|-------------------------|--------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                             | Underweight             | Normal | Overweight              | Obesity                 | Normal                  | Overweight              | Obesity                 |
| <b>Asthma</b>               |                         |        |                         |                         |                         |                         |                         |
| β of FVC <sup>a</sup>       | -0.06 (-0.09,-0.03)***  | Ref    | -0.04 (-0.06,-0.02)***  | -0.07 (-0.11,-0.03)***  | -0.01 (-0.05,0.03)      | -0.09 (-0.11,-0.06)***  | -0.13 (-0.16,-0.10)***  |
| β of FVC% <sup>b</sup>      | -3.33 (-4.21,-2.46)***  | Ref    | -0.06 (-0.60,0.48)      | -0.32 (-1.40,0.76)      | 0.09 (-1.28,1.45)       | -1.69 (-2.44,-0.94)***  | -2.46 (-3.22,-1.71)***  |
| OR of RSP <sup>b</sup>      | 1.51 (1.33,1.70)***     | Ref    | 1.02 (0.94,1.10)        | 1.05 (0.89,1.23)        | 0.91 (0.74,1.12)        | 1.24 (1.12,1.37)***     | 1.42 (1.28,1.56)***     |
| β of FEV1 <sup>c</sup>      | -0.03 (-0.06, -0.01)*   | Ref    | -0.04 (-0.06, -0.02)*** | -0.06 (-0.10, -0.03)*** | -0.03 (-0.06, <0.00)*   | -0.08 (-0.11, -0.06)*** | -0.11 (-0.14, -0.08)*** |
| β of FEV1% <sup>d</sup>     | -3.37 (-4.28, -2.47)*** | Ref    | 0.19 (-0.40, 0.79)      | 0.21 (-0.95, 1.38)      | -0.15 (-1.53, 1.24)     | -1.27 (-2.10, -0.45)**  | -1.44 (-2.30, -0.59)*** |
| OR of FEV1%<80 <sup>e</sup> | 1.33 (1.17, 1.52)***    | Ref    | 1.04 (0.96, 1.13)       | 1.06 (0.91, 1.24)       | 1.03 (0.86, 1.24)       | 1.27 (1.14, 1.41)***    | 1.31 (1.19, 1.45)***    |
| β of FEV1/FVC <sup>f</sup>  | 1.07 (0.61, 1.54)***    | Ref    | -0.07 (-0.65, 0.51)     | -1.04 (-1.79, -0.29)**  | -0.35 (-0.76, 0.05).    | 0.13 (-0.25, 0.51)      | -0.07 (-0.65, 0.51)     |
| <b>Non-asthma</b>           |                         |        |                         |                         |                         |                         |                         |
| β of FVC <sup>a</sup>       | -0.04 (-0.05,-0.04)***  | Ref    | -0.03 (-0.04,-0.03)***  | -0.07 (-0.08,-0.06)***  | -0.03 (-0.04,-0.02)***  | -0.06 (-0.06,-0.05)***  | -0.09 (-0.10,-0.08)***  |
| β of FVC% <sup>b</sup>      | -3.27 (-3.43,-3.10)***  | Ref    | 0.00 (-0.10,0.11)       | -0.66 (-0.87,-0.44)***  | -0.86 (-1.16,-0.57)***  | -1.09 (-1.25,-0.94)***  | -1.84 (-1.99,-1.68)***  |
| OR of RSP <sup>b</sup>      | 1.56 (1.52,1.60)***     | Ref    | 1.02 (1.01,1.04)*       | 1.09 (1.05,1.13)***     | 1.13 (1.08,1.19)***     | 1.21 (1.19,1.24)***     | 1.34 (1.31,1.37)***     |
| β of FEV1 <sup>c</sup>      | -0.02 (-0.03, -0.02)*** | Ref    | -0.03 (-0.04, -0.03)*** | -0.06 (-0.07, -0.06)*** | -0.04 (-0.04, -0.03)*** | -0.06 (-0.06, -0.05)*** | -0.08 (-0.09, -0.08)*** |
| β of FEV1% <sup>d</sup>     | -3.59 (-3.77, -3.41)*** | Ref    | 0.23 (0.12, 0.35)***    | -0.38 (-0.62, -0.13)**  | -0.49 (-0.82, -0.16)**  | -0.60 (-0.77, -0.43)*** | -1.25 (-1.43, -1.07)*** |
| OR of FEV1%<80 <sup>e</sup> | 1.53 (1.48, 1.57)***    | Ref    | 1.05 (1.03, 1.07)***    | 1.20 (1.15, 1.25)***    | 1.13 (1.07, 1.19)***    | 1.23 (1.20, 1.27)***    | 1.42 (1.38, 1.45)***    |
| β of FEV1/FVC <sup>f</sup>  | 0.92 (0.84, 1.01)***    | Ref    | -0.20 (-0.26, -0.15)*** | -0.10 (-0.21, 0.01).    | -0.31 (-0.46, -0.15)*** | -0.30 (-0.37, -0.22)*** | -0.12 (-0.19, -0.05)**  |

Central obesity means WC ≥ 80 cm for women and ≥ 90 cm for men.

a. Adjusted for season, gender, age group, education, HTN, DM, AHTN, PM, and PSI.

b. Adjusted for season, gender, age group, education, PM, PSI, and physical activity.

c. Adjusted for season, gender, age group, education, HTN, AHTN and PSI.

d. Adjusted for season, gender, age group, education, PM and PSI.

e. Adjusted for season, gender, age group, education, PM, PSI and physical activity.

f. Adjusted for season, gender, age group, education and PSI.

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001