Table e-1. The autoregressive cross-lagged model between BMI (per SD), waist circumference (per SD), and habitual snoring (n=25,037)

<table>
<thead>
<tr>
<th>Characteristics at baseline</th>
<th>Outcomes at 2\textsuperscript{nd} resurvey</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β (95% CI)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>Waist circumference</td>
</tr>
<tr>
<td>BMI (per SD)</td>
<td>3.105 (3.064, 3.145)</td>
<td>3.264 (3.119, 3.410)</td>
</tr>
<tr>
<td>Waist circumference (per SD)</td>
<td>-0.011 (-0.053, 0.031)</td>
<td>5.158 (5.010, 5.306)</td>
</tr>
<tr>
<td>habitual snoring (yes vs no)</td>
<td>-0.023 (-0.075, 0.028)</td>
<td>0.018 (-0.166, 0.201)</td>
</tr>
</tbody>
</table>

BMI: body mass index; SD: standard deviation; OR: odds ratio; CI: confidence interval

*The model was adjusted for the same variables as in the model of Figure 1.
<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Cases/person years</th>
<th>HR (95% CI)</th>
<th>P values for interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>4,226/1,452,151</td>
<td>1.12 (1.05,1.19)</td>
<td>0.685</td>
</tr>
<tr>
<td>≥60</td>
<td>2,083/671,148</td>
<td>1.11 (1.01,1.22)</td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>3,522/1,113,299</td>
<td>1.07 (1.00,1.15)</td>
<td>0.376</td>
</tr>
<tr>
<td>Urban</td>
<td>2,789/806,000</td>
<td>1.18 (1.09,1.27)</td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2,080/614,924</td>
<td>1.07 (0.98,1.18)</td>
<td>0.100</td>
</tr>
<tr>
<td>Yes</td>
<td>4,231/1,304,375</td>
<td>1.15 (1.08,1.23)</td>
<td></td>
</tr>
<tr>
<td>Current weekly drinker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>4,181/1,268,524</td>
<td>1.08 (1.01,1.15)</td>
<td>0.062</td>
</tr>
<tr>
<td>Yes</td>
<td>2,130/650,775</td>
<td>1.20 (1.10,1.32)</td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>2,223/593,604</td>
<td>1.07 (0.98,1.17)</td>
<td>0.116</td>
</tr>
<tr>
<td>Medium</td>
<td>1,921/578,751</td>
<td>1.18 (1.07,1.30)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>2,167/746,943</td>
<td>1.12 (1.02,1.22)</td>
<td></td>
</tr>
<tr>
<td>Prevalent hypertension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2,887/1,246,461</td>
<td>1.12 (1.04,1.22)</td>
<td>0.287</td>
</tr>
<tr>
<td>Yes</td>
<td>3,424/672,838</td>
<td>1.12 (1.04,1.20)</td>
<td></td>
</tr>
<tr>
<td>Regular fruit consumer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>4,174/1,477,745</td>
<td>1.13 (1.06,1.20)</td>
<td>0.391</td>
</tr>
<tr>
<td>Yes</td>
<td>1,597/441,554</td>
<td>1.10 (0.99,1.22)</td>
<td></td>
</tr>
<tr>
<td>Regular meat consumer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2,579/927,016</td>
<td>1.15 (1.06,1.25)</td>
<td>0.697</td>
</tr>
<tr>
<td>Yes</td>
<td>3,736/902,283</td>
<td>1.10 (1.03,1.20)</td>
<td></td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>6,951/2,272,646</td>
<td>1.15 (1.05,1.22)</td>
<td>0.393</td>
</tr>
<tr>
<td>≥60</td>
<td>3,177/549,627</td>
<td>1.11 (1.03,1.20)</td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>6,033/1,601,438</td>
<td>1.12 (1.05,1.19)</td>
<td>0.472</td>
</tr>
<tr>
<td>Urban</td>
<td>4,165/1,228,846</td>
<td>1.16 (1.09,1.25)</td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9,939/2,748,579</td>
<td>1.14 (1.09,1.19)</td>
<td>0.558</td>
</tr>
<tr>
<td>Yes</td>
<td>475/73,705</td>
<td>1.11 (1.01,1.36)</td>
<td></td>
</tr>
<tr>
<td>Current weekly drinker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9,958/2,762,173</td>
<td>1.13 (1.08,1.19)</td>
<td>0.196</td>
</tr>
<tr>
<td>Yes</td>
<td>210/50,111</td>
<td>1.38 (1.02,1.87)</td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>3,877/943,295</td>
<td>1.13 (1.05,1.21)</td>
<td>0.529</td>
</tr>
<tr>
<td>Medium</td>
<td>3,564/1,016,029</td>
<td>1.16 (1.08,1.25)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>2,727/862,069</td>
<td>1.13 (1.03,1.23)</td>
<td></td>
</tr>
<tr>
<td>Prevalent hypertension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>4,631/846,561</td>
<td>1.12 (1.04,1.21)</td>
<td>0.362</td>
</tr>
<tr>
<td>Yes</td>
<td>5,477/875,227</td>
<td>1.15 (1.08,1.22)</td>
<td></td>
</tr>
<tr>
<td>Regular fruit consumer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7,144/1,917,774</td>
<td>1.13 (1.07,1.19)</td>
<td>0.589</td>
</tr>
<tr>
<td>Yes</td>
<td>3,024/904,310</td>
<td>1.16 (1.07,1.26)</td>
<td></td>
</tr>
<tr>
<td>Regular meat consumer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5,626/1,570,987</td>
<td>1.13 (1.07,1.21)</td>
<td>0.870</td>
</tr>
<tr>
<td>Yes</td>
<td>4,245/1,242,296</td>
<td>1.14 (1.07,1.22)</td>
<td></td>
</tr>
</tbody>
</table>

Figure e-1. Subgroup analyses of the association between habitual snoring and type 2 diabetes according to selected baseline characteristics.

HR: hazard ratio; CI: confidence interval.

* Total incident diabetes cases for participants with habitual snoring and non-snoring.

The Cox proportional hazard models were stratified by age groups and ten study regions, and adjusted for the same factors as in model 5 of Table 2 except the subgrouping variables.
Table e-2. Sensitivity analyses of the association between habitual snoring and type 2 diabetes

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
<th>P values for interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-snoring</td>
<td>Habitual snoring</td>
<td>Non-snoring</td>
</tr>
<tr>
<td>Sensitivity analysis by additionally adjusted for body fat percentage</td>
<td>3,700</td>
<td>2,611</td>
<td>7,271</td>
</tr>
<tr>
<td>Cases</td>
<td>1,376,688</td>
<td>542,611</td>
<td>2,357,347</td>
</tr>
<tr>
<td>Person years</td>
<td>26.9</td>
<td>48.1</td>
<td>30.8</td>
</tr>
<tr>
<td>Incidence rate (per 10,000 person years)</td>
<td>1.00</td>
<td>1.12 (1.06,1.18)</td>
<td>1.00</td>
</tr>
<tr>
<td>HR (95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity analysis by excluding cases occurring during the first 2 years of follow-up</td>
<td>3,364</td>
<td>2,400</td>
<td>6,585</td>
</tr>
<tr>
<td>Cases</td>
<td>1,376,300</td>
<td>542,355</td>
<td>2,356,541</td>
</tr>
<tr>
<td>Person years</td>
<td>24.4</td>
<td>44.3</td>
<td>27.9</td>
</tr>
<tr>
<td>Incidence rate (per 10,000 person years)</td>
<td>1.00</td>
<td>1.13 (1.07,1.19)</td>
<td>1.00</td>
</tr>
<tr>
<td>HR (95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity analysis by excluding participants who were never married, divorced or widowed</td>
<td>3,443</td>
<td>2,470</td>
<td>6,367</td>
</tr>
<tr>
<td>Cases</td>
<td>1,274,767</td>
<td>516,230</td>
<td>2,125,447</td>
</tr>
<tr>
<td>Person years</td>
<td>27.0</td>
<td>47.8</td>
<td>30.0</td>
</tr>
<tr>
<td>Incidence rate (per 10,000 person years)</td>
<td>1.00</td>
<td>1.11 (1.05,1.17)</td>
<td>1.00</td>
</tr>
<tr>
<td>HR (95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HR: hazard ratio; CI: confidence interval.

The Cox proportional hazard models were stratified by age groups and study regions, as appropriate, and were adjusted for the same factors as in model 5 of Table 2.
Table e-3. The association between habitual snoring and type 2 diabetes in 23,858 adults* participating in the second resurvey

<table>
<thead>
<tr>
<th></th>
<th>Non-snoring</th>
<th>Habitual snoring</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases†</td>
<td>1,076</td>
<td>557</td>
<td>1,633</td>
</tr>
<tr>
<td>Person years</td>
<td>147,528</td>
<td>41,046</td>
<td>188,574</td>
</tr>
<tr>
<td>Incidence rate (per 10,000 person years)</td>
<td>72.9</td>
<td>135.7</td>
<td>86.6</td>
</tr>
<tr>
<td>HR (95% CI)</td>
<td>1.00</td>
<td>1.17 (1.05,1.31)</td>
<td>---</td>
</tr>
</tbody>
</table>

HR: hazard ratio; CI: confidence interval.

The Cox proportional hazard model was stratified by gender, age groups, and study regions, and was adjusted for the same factors as in model 5 of Table 2. To maximize the statistical power, we did not assess the snoring-diabetes association in men and women separately.

* Participants without self-reported or screen-detected diabetes at baseline.
† Including cases self-reported or screen-detected at the 2nd resurvey, and those identified during the follow-up. Screened-detected diabetes was defined as a random glucose level $\geq 11.1$ mmol/L or a fasting glucose level $\geq 7.0$ mmol/L, but without self-reported diabetes.
<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never snoring</td>
<td>Sometimes snoring</td>
<td>Habitual snoring</td>
<td>Never snoring</td>
</tr>
<tr>
<td><strong>Cases</strong></td>
<td>2,148</td>
<td>1,552</td>
<td>2,611</td>
<td>4,729</td>
</tr>
<tr>
<td><strong>Person years</strong></td>
<td>860,669</td>
<td>516,019</td>
<td>542,611</td>
<td>1,727,068</td>
</tr>
<tr>
<td><strong>Incidence rate (per 10,000 person years)</strong></td>
<td>25.0</td>
<td>30.1</td>
<td>48.1</td>
<td>27.4</td>
</tr>
<tr>
<td><strong>HR (95% CI)</strong></td>
<td>1.00</td>
<td>0.94 (0.88,1.00)</td>
<td>1.09 (1.03,1.16)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

HR: hazard ratio; CI: confidence interval.

The Cox proportional hazard models were stratified by age groups and ten study regions, and adjusted for the same factors as in model 5 of Table 2.
Table e-5. Adjusted hazard ratios of type 2 diabetes for participants with different combinations of snoring status and adiposity measures

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-snoring</td>
<td>Habitual snoring</td>
</tr>
<tr>
<td><strong>BMI subgroups</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight/normal</td>
<td>1.00</td>
<td>1.12 (1.02, 1.24)</td>
</tr>
<tr>
<td>Overweight</td>
<td>1.47 (1.35, 1.60)</td>
<td>1.64 (1.49, 1.79)</td>
</tr>
<tr>
<td>General obesity</td>
<td>1.80 (1.57, 2.05)</td>
<td>2.06 (1.81, 2.34)</td>
</tr>
<tr>
<td><strong>Waist circumference subgroups</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>1.00</td>
<td>1.12 (1.03, 1.22)</td>
</tr>
<tr>
<td>Pre-central obesity</td>
<td>1.41 (1.28, 1.55)</td>
<td>1.69 (1.52, 1.88)</td>
</tr>
<tr>
<td>Central obesity</td>
<td>1.80 (1.63, 1.98)</td>
<td>1.96 (1.77, 2.18)</td>
</tr>
</tbody>
</table>

BMI: body mass index

The Cox proportional hazard models were stratified by age groups and ten study regions, and adjusted for the same factors as in model 5 of Table 2, except baseline BMI and waist circumference. Baseline BMI was adjusted for in joint analyses of waist circumference and snoring while baseline waist circumference was adjusted for in joint analyses of BMI and snoring.
Members of the China Kadoorie Biobank collaborative group
International Steering Committee: Junshi Chen, Zhengming Chen (PI), Robert Clarke, Rory Collins, Yu Guo, Liming Li (PI), Jun Lv, Richard Peto, Robin Walters.
Lingli Chen, Yidan Zhang, Dongxia Pan, Qijun Gu. Hunan Provincial CDC: Yuelong Huang, Biyun Chen, Li Yin, Huilin Liu, Zhongxi Fu, Qiaohua Xu. Liuyang CDC: Xin Xu, Hao Zhang, Huajun Long, Xianzhi Li, Libo Zhang, Zhe Qiu.