

**Table S1** The 30 items used to construct the frailty index

| No. | Description of the items                                                          | Cut-off value                                       |
|-----|-----------------------------------------------------------------------------------|-----------------------------------------------------|
| 1   | Self-reported physician-diagnosed hypertension                                    | Yes = 1, No = 0                                     |
| 2   | Self-reported physician-diagnosed diabetes                                        | Yes = 1, No = 0                                     |
| 3   | Self-reported physician-diagnosed heart disease                                   | Yes = 1, No = 0                                     |
| 4   | Self-reported physician-diagnosed stroke                                          | Yes = 1, No = 0                                     |
| 5   | Self-reported physician-diagnosed cancer                                          | Yes = 1, No = 0                                     |
| 6   | Self-reported physician-diagnosed arthritis                                       | Yes = 1, No = 0                                     |
| 7   | Self-reported physician-diagnosed chronic lung disease                            | Yes = 1, No = 0                                     |
| 8   | Self-reported physician-diagnosed asthma                                          | Yes = 1, No = 0                                     |
| 9   | Self-reported physician-diagnosed any emotional, nervous, or psychiatric problems | Yes = 1, No = 0                                     |
| 10  | Self-reported physician-diagnosed memory-related disease                          | Yes = 1, No = 0                                     |
| 11  | Self-reported vision problems                                                     | Yes = 1, No = 0                                     |
| 12  | Self-reported hearing problems                                                    | Yes = 1, No = 0                                     |
| 13  | Self-reported general health status                                               | Poor or fair = 1, excellent, very good, or good = 0 |
| 14  | Difficulty with dressing                                                          | Yes = 1, No = 0                                     |
| 15  | Difficulty with bathing or showering                                              | Yes = 1, No = 0                                     |
| 16  | Difficulty with eating                                                            | Yes = 1, No = 0                                     |
| 17  | Difficulty with getting in and out of bed                                         | Yes = 1, No = 0                                     |
| 18  | Difficulty with using the toilet                                                  | Yes = 1, No = 0                                     |
| 19  | Difficulty with managing money                                                    | Yes = 1, No = 0                                     |
| 20  | Difficulty with taking medications                                                | Yes = 1, No = 0                                     |
| 21  | Difficulty with shopping for groceries                                            | Yes = 1, No = 0                                     |
| 22  | Difficulty with preparing meals                                                   | Yes = 1, No = 0                                     |
| 23  | Difficulty with doing housework                                                   | Yes = 1, No = 0                                     |
| 24  | Mobility: difficulty with walking 100 yards                                       | Yes = 1, No = 0                                     |
| 25  | Mobility: difficulty with getting up from a chair after sitting for long periods  | Yes = 1, No = 0                                     |
| 26  | Mobility: difficulty with climbing several flights of                             | Yes = 1, No = 0                                     |

| No. | Description of the items                                             | Cut-off value   |
|-----|----------------------------------------------------------------------|-----------------|
|     | stairs without resting                                               |                 |
| 27  | Mobility: difficulty with lifting or carrying weights over 10 pounds | Yes = 1, No = 0 |
| 28  | Mobility: difficulty with picking up a coin from the table           | Yes = 1, No = 0 |
| 29  | Mobility: difficulty with stooping, kneeling, or crouching           | Yes = 1, No = 0 |
| 30  | Mobility: difficulty with reaching arms above shoulder level         | Yes = 1, No = 0 |

**Note:** The table presents 30 health deficit items used to construct the frailty index (FI). Each item is dichotomized as 1 (deficit present) or 0 (deficit absent). The FI is calculated as the sum of the deficit scores divided by the total number of items (n=30), yielding a continuous score ranging from 0 to 1.

**Table S2** Questionnaire Items and Prevalence of Each ACE Indicator

| ACE indicators                 | Questionnaire Items                                                                                                                                                                                                  |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parental separation or divorce | Were your biological parents divorced (including long separation due to emotional problems) before you were 17 years? (yes <sup>a</sup> or no)                                                                       |
| Physical abuse                 | When you were growing up, did your female/male guardian ever hit you? (often <sup>a</sup> , sometimes <sup>a</sup> , rarely, or never)                                                                               |
| Domestic violence              | Have your father/mother ever beat up your mother/father? (often <sup>a</sup> , sometimes <sup>a</sup> , not very often, or never)                                                                                    |
| Emotional Neglect              | 1)How much love and affection did your female guardian give you while you were growing up? (often, sometimes, rarely <sup>a</sup> , or never <sup>a</sup> )                                                          |
|                                | 2)How much effort did your female guardian put into watching over you? (a lot, some, a little <sup>a</sup> , or not at all <sup>a</sup> )                                                                            |
| Household mental illness       | 1)Did your female/male guardian have abnormality of mind when you were young? (yes <sup>a</sup> or no)                                                                                                               |
|                                | 2)During the years you were growing up, had your female/male guardian often showed continued signs of sadness or depression? (during all <sup>a</sup> , most <sup>a</sup> , some, or only a little of the childhood) |
| Household substance abuse      | During the years you were growing up, did your female/male guardian ever have alcoholism or drug? (yes <sup>a</sup> or no)                                                                                           |
| Incarcerated household member  | During the years you were growing up, have your female/male guardian ever been arrested or sent to prison? (yes <sup>a</sup> or no)                                                                                  |
| Unsafe neighborhood            | Was it safe being out alone at night in the neighborhood where you lived as a child? (very safe, somewhat safe, not very safe <sup>a</sup> , or not safe at all <sup>a</sup> )                                       |
| Bullying                       | 1)When you were a child, how often were you picked on or bullied by kids in your neighborhood? (often <sup>a</sup> , sometimes <sup>a</sup> , not very often, or never)                                              |
|                                | 2)When you were a child, how often were you picked on or bullied by kids in your school? (often <sup>a</sup> , sometimes <sup>a</sup> , not very often, or never)                                                    |
| Parental death                 | Either of the parents was dead before participant was 17 years. (yes <sup>a</sup> or no)                                                                                                                             |
| Parental disability            | 1)Did your female/male guardian have a long time being sick on bed when you were young? (yes <sup>a</sup> or no)                                                                                                     |
|                                | 2)Did your female/male guardian have a serious deformity when you were young? (yes <sup>a</sup> or no)                                                                                                               |
| Sibling death                  | Any of the siblings was dead before participant was 17 years. (yes <sup>a</sup> or no)                                                                                                                               |

**Abbreviations:** ACE, Adverse Childhood Experiences. Options marked 'a' are coded as 1 (ACE present); all other responses are coded as 0 (ACE absent). For indicators derived from multiple sub questions (e.g., emotional neglect), a positive ACE status (coded as 1) was assigned if either subquestion is positive.

**Table S3** Baseline characteristics and attrition analysis of the study population

| Characteristic                           | Excluded<br>N = 16,684 | Included<br>N = 3,491 | SMD <sup>1</sup> | p-value <sup>1</sup> |
|------------------------------------------|------------------------|-----------------------|------------------|----------------------|
| <b>Age, years, Mean (SD)</b>             | 58 (10)                | 58 (8)                | 0.41             | 0.013                |
| <b>Gender, n (%)</b>                     |                        |                       |                  | <0.001               |
| Male                                     | 7,688 (46%)            | 1,883 (54%)           |                  |                      |
| Female                                   | 8,996 (54%)            | 1,608 (46%)           |                  |                      |
| <b>Marital status, n (%)</b>             |                        |                       |                  | <0.001               |
| Not married                              | 2,410 (22%)            | 231 (6.6%)            |                  |                      |
| Married                                  | 8,528 (78%)            | 3,260 (93%)           |                  |                      |
| <b>Residency, n (%)</b>                  |                        |                       |                  | <0.001               |
| Urban                                    | 4,078 (37%)            | 1,188 (34%)           |                  |                      |
| Rural                                    | 6,867 (63%)            | 2,303 (66%)           |                  |                      |
| <b>Education level, n (%)</b>            |                        |                       |                  | <0.001               |
| < Middle School                          | 12,227 (73%)           | 2,298 (66%)           |                  |                      |
| ≥ Middle School                          | 4,457 (27%)            | 1,193 (34%)           |                  |                      |
| <b>Body Mass Index, kg/m<sup>2</sup></b> | 24.3 (34.8)            | 23.5 (3.9)            | 0.78             | 0.046                |
| <b>Smoking status, n (%)</b>             |                        |                       |                  | <0.001               |
| Never smoked                             | 6,737 (62%)            | 1,994 (57%)           |                  |                      |
| Ever smoked                              | 4,129 (38%)            | 1,497 (43%)           |                  |                      |
| <b>Alcohol consumption, n (%)</b>        |                        |                       |                  | <0.001               |
| Never drank                              | 6,807 (62%)            | 1,959 (56%)           |                  |                      |
| Ever drank                               | 4,047 (37%)            | 1,530 (44%)           |                  |                      |
| <b>Depressive symptoms (CESD-10)</b>     | 9 (7)                  | 7 (6)                 | 1.3              | <0.001               |
| <b>Baseline Frailty Index</b>            | 0.13 (0.13)            | 0.08 (0.06)           | 0.05             | <0.001               |
| <b>Total ACE score</b>                   | 1.78 (1.39)            | 1.82 (1.45)           | 0.028            | <0.001               |

<sup>1</sup>Welch Two Sample t-test; Pearson's Chi-squared test

**Table S4** Multivariable logistic regression analysis of incident frailty

| Characteristic                       | Model 1 |            |         | Model 2 |            |         | Model 3 |            |         |
|--------------------------------------|---------|------------|---------|---------|------------|---------|---------|------------|---------|
|                                      | OR      | 95% CI     | p-value | OR      | 95% CI     | p-value | OR      | 95% CI     | p-value |
| ACE Total Score                      | 1.07    | 1.01, 1.13 | 0.027   | 1.06    | 0.99, 1.13 | 0.082   | 1.02    | 0.95, 1.08 | 0.6     |
| Age (years)                          |         |            |         | 1.06    | 1.04, 1.07 | <0.001  | 1.06    | 1.05, 1.07 | <0.001  |
| Gender (Female vs. Male)             |         |            |         | 2.05    | 1.58, 2.69 | <0.001  | 1.78    | 1.36, 2.35 | <0.001  |
| Education ( $\geq$ Middle School)    |         |            |         | 0.58    | 0.47, 0.73 | <0.001  | 0.60    | 0.47, 0.75 | <0.001  |
| Residency (Rural vs. Urban)          |         |            |         | 1.23    | 1.01, 1.50 | 0.037   | 1.18    | 0.97, 1.45 | 0.10    |
| Smoking status (Ever vs. Never)      |         |            |         | 1.36    | 1.06, 1.76 | 0.017   | 1.47    | 1.14, 1.92 | 0.004   |
| Drinking status (Ever vs. Never)     |         |            |         | 0.91    | 0.74, 1.13 | 0.4     | 0.90    | 0.73, 1.12 | 0.4     |
| Marital status (Married vs. Other)   |         |            |         | 0.67    | 0.49, 0.93 | 0.014   | 0.73    | 0.53, 1.01 | 0.053   |
| Body Mass Index (kg/m <sup>2</sup> ) |         |            |         |         |            |         | 1.07    | 1.05, 1.10 | <0.001  |
| Depression score (CESD-10)           |         |            |         |         |            |         | 1.08    | 1.07, 1.10 | <0.001  |

**Abbreviations:** OR, odds ratio; CI, confidence interval; ACE, adverse childhood experiences; BMI, body mass index; CES-D, Center for Epidemiologic Studies Depression Scale. Reference groups for categorical variables: Male (gender); Single/Divorced/Widowed (marital status); < Middle School (education level); Urban (residency); Never smoked (smoking); Never drank (drinking). Model 1: Unadjusted model. Model 2: Adjusted for socio-demographic factors (age, gender, education level, residency, and marital status) and health behaviors (smoking and drinking status). Model 3: Further adjusted for health-related covariates, including Body Mass Index (BMI) and depressive symptoms (CES-D score), based on Model 2. The ACE Total Score was treated as a continuous variable in the regression models.

**Table S5** Causal mediation analysis of the association between Unsafe neighborhood and Frailty Index via depressive symptoms

| Path                          | Estimate | 95% CI          | p-value |
|-------------------------------|----------|-----------------|---------|
| <b>ACME (Indirect Effect)</b> | 0.0038   | [0, 0.008]      | 0.056   |
| <b>ADE (Direct Effect)</b>    | 0.0131   | [-0.002, 0.029] | 0.112   |
| <b>Total Effect</b>           | 0.0169   | [0, 0.032]      | 0.024   |
| <b>Proportion Mediated</b>    | 0.2239   | [-0.025, 1.357] | 0.076   |

**Abbreviations:** ACME, average causal mediation effect; ADE, average direct effect; CI, confidence interval; Prop. Mediated, the Proportion mediated estimates the percentage of the total effect.

**Note:** Causal mediation analysis was performed using the non parametric bootstrapping with 1,000 simulations. ACME represents the indirect effect of neighborhood safety on the Frailty Index through depressive symptoms. ADE represents the direct effect not mediated by depressive symptoms.