Table S1. Full list of characteristics of the study participants

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | None  (n=2,313) | Moderate famine  (n=9,123) | Severe  Famine  (n=1,569) | *P* |
| Outcome  Depression, % | 22.7 | 28.5 | 37.8 | <0.0001 |
| Exposure  Developmental stages (age when famine occurred), % | | | | <0.0001 |
| Fetal (born or conceived in famine) | 15.4 | 11.8 | 7.3 |  |
| Infant (0-1 year) | 3.3 | 3.6 | 2.1 |  |
| Toddler (1-2 years) | 10.2 | 9.1 | 6.4 |  |
| Preschool (3-5 years) | 9.9 | 10.5 | 11.1 |  |
| mid-childhood (6-11 years) | 18.4 | 29.3 | 31.3 |  |
| Young Teen (12-14 years) | 8.6 | 9.9 | 11.3 |  |
| Teenagers (15-17 years) | 6.4 | 7.5 | 10.6 |  |
| Adult (18- years) | 27.7 | 18.5 | 19.8 |  |
| Demographics  Male, % | 43.1 | 49.9 | 47.0 | <0.0001 |
| Age, years, mean (SD) | 62.1 (9.4) | 61.5 (8.1) | 62.8 (8.0) | <0.0001 |
| Living in rural area, % | 74.3 | 81.0 | 86.0 | <0.0001 |
| Currently married, % | 85.9 | 88.4 | 85.7 | 0.0002 |
| Education, % |  |  |  | <0.0001 |
| Illiterate | 27.2 | 27.2 | 37.1 |  |
| <elementary school | 17.5 | 18.2 | 22.8 |  |
| Elementary school | 19.5 | 23.0 | 19.2 |  |
| Middle school | 21.8 | 20.6 | 14.0 |  |
| High school or above | 14.0 | 11.2 | 6.8 |  |
| Self-reported family income, % |  |  |  | 0.0002 |
| Average and above | 59.8 | 55.3 | 52.4 |  |
| Relatively poor | 28.5 | 32.0 | 34.3 |  |
| Poor | 11.7 | 12.7 | 13.3 |  |
| Individual income sources, % |  |  |  | <0.0001 |
| Wage and bonus | 18.0 | 16.4 | 11.5 |  |
| Others | 23.2 | 21.0 | 22.1 |  |
| None | 58.8 | 62.6 | 66.4 |  |
| Currently employed, % | 65.6 | 70.8 | 73.3 | <0.0001 |
| Health Behaviors |  |  |  |  |
| Drinking status, % |  |  |  | <0.0001 |
| Never | 77.2 | 72.3 | 72.2 |  |
| Former | 5.3 | 6.2 | 8.0 |  |
| Occasional drinker | 3.6 | 4.2 | 4.7 |  |
| Regular drinker | 13.9 | 17.2 | 15.2 |  |
| Smoking status, % |  |  |  | <0.0001 |
| Never | 66.3 | 60.0 | 62.0 |  |
| Former | 7.3 | 8.7 | 8.4 |  |
| Current smoker | 26.4 | 31.3 | 29.6 |  |
| BMI, kg/m2, mean (SD) | 23.3 (3.9) | 23.4 (4.0) | 23.2 (4.1) | 0.006 |
| SBP, mm Hg, mean (SD) | 132.2 (21.9) | 131.9 (21.6) | 130.6 (21.8) | 0.21 |
| DBP, mm Hg, mean (SD) | 75.4 (12.1) | 76.0 (12.1) | 74.8 (12.1) | 0.003 |
| Self-reported chronic conditions, % | | |  |  |
| Lung disease | 10.2 | 10.1 | 13.4 | 0.0004 |
| Hypertension | 25.5 | 24.5 | 24.6 | 0.65 |
| Dyslipidemia | 8.4 | 9.8 | 8.7 | 0.06 |
| Liver disease | 4.1 | 3.9 | 4.8 | 0.21 |
| Heart disease | 11.2 | 12.3 | 12.5 | 0.36 |
| Stroke | 2.0 | 2.1 | 2.2 | 0.93 |
| Kidney disease | 4.9 | 6.8 | 7.0 | 0.003 |
| Digestive disease | 19.6 | 22.8 | 28.2 | <0.0001 |
| Asthma | 3.3 | 3.7 | 4.6 | 0.08 |
| Arthritis | 29.2 | 34.2 | 43.7 | <0.0001 |
| Diabetes | 5.8 | 5.8 | 5.8 | 0.99 |
| Cancer | 1.0 | 0.9 | 0.9 | 0.94 |

*Note*. Severe Famine = ‘One or more member of the family died from starvation between 1959 and 1961’. Major depression = CESD10 >= 12; BMI=body mass index in kg/m2; DBP=diastolic blood pressure, mmHg; SBP=systolic blood pressure mmHg; SD=standard deviation.

Table S2. Percent exposed to severe famine by age and gender groups among participants of the Chinese Health and Aging Retirement Longitudinal Study (CHARLS, 2014)

|  |  |  |  |
| --- | --- | --- | --- |
| Age groups | Total, % (CI)  (n=12,910) | Male, % (CI)  (n=6,235) | Female, % (CI)  (n=6,664) |
| 45-50 | 9.3 (7.9 - 10.7) | 9.5 (7.7 - 11.4) | 9.1 (7.3 - 11.0) |
| 50-55 | 8.1 (4.0 - 12.1) | 6.2 (4.6 - 7.8) | 9.7 (2.5 - 16.9) |
| 55-60 | 12.7 (11.2 - 14.3) | 12.5 (10.4 - 14.5) | 12.9 (11.0 - 14.9) |
| 60-65 | 11.7 (10.3 - 13.0) | 11.2 (9.4 - 13.0) | 12.1 (10.3 - 14.0) |
| 65-70 | 16.6 (12.0 - 21.2) | 19.0 (16.5 - 21.5) | 14.1 (11.5 - 16.7) |
| 70-75 | 11.3 (9.2 - 13.5) | 7.7 (5.6 - 9.7) | 15.3 (11.7 - 18.8) |
| 75-80 | 12.6 (9.4 - 15.7) | 13.1 (10.2 - 16.0) | 12.1 (7.6 - 16.7) |
| 80- | 13.0 (9.5 - 16.6) | 12.1 (7.9 - 16.4) | 13.7 (10.4 - 17.0) |

*Note*. Severe Famine = ‘One or more members of the family died from starvation between 1959 and 1961’. CI = 95% confidence interval.

Table S3. Associations of exposure to the Chinese Great Famine at different fetal stages with risk of major depression in late adulthood among participants of the CHARLS study.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Severity of  famine experience | Age, sex, education and  living area adjusted model | |  | Fully adjusted model\* | |
| OR (95% CI) | *P* |  | OR (95% CI) | *P* |
| *Exposed at least the entire first 3 months of pregnancy (n=1,005)* | | | | |  |
| None | 1.00 (reference) | 0.002 |  | 1.00 (reference) | 0.02 |
| Moderate | 1.42 (0.96 - 2.11) |  |  | 1.14 (0.70 - 1.84) |  |
| Severe | 2.76 (1.56 - 4.89) |  |  | 2.48 (1.23 - 5.01) |  |
| *Exposed during the entire pregnancy (n=644)* | | |  |  |  |
| None | 1.00 (reference) | 0.006 |  | 1.00 (reference) | 0.01 |
| Moderate | 1.43 (0.88 - 2.33) |  |  | 1.50 (0.79 – 2.86) |  |
| Severe | 3.21 (1.56 - 6.62) |  |  | 4.00 (1.57 - 10.20) |  |
| *Conceived in the last 3 months of famine (n=172)* | | |  |  |  |
| None | 1.00 (reference) | 0.02 |  | 1.00 (reference) | 0.02 |
| Moderate | 1.46 (0.52 - 4.13) |  |  | 0.36 (0.08 – 1.60) |  |
| Severe | 5.87 (1.58 – 21.77) |  |  | 3.42 (0.54 – 21.60) |  |

*Note.* OR=odds ratio, CI=confidence interval. Severity of famine definitions: Moderate = ‘Experienced starvation in 1959-1961, but had no family member dying from starvation’. Severe = ‘One or more family members died from starvation between 1959 and 1961’.

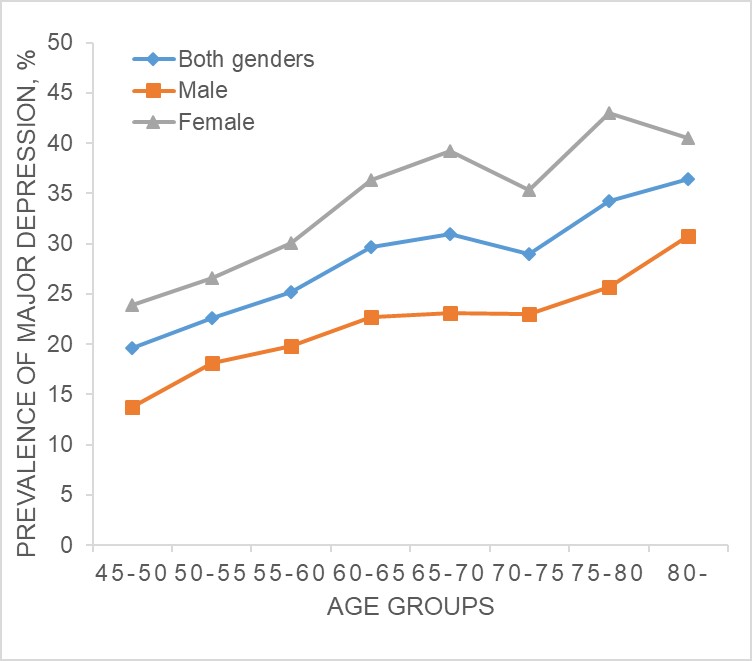
\*Fully adjusted model controlled for age, sex, education, childhood living area, current living area, marital status, self-perceived family income level, individual income sources, employment status, smoking, drinking, body mass index, diastolic blood pressure, and self-reported conditions, including lung disease, chronic kidney disease, digestive diseases, and arthritis.

Table S4. Odds ratios (95% confidence intervals) for all variables in the fully adjusted logistic regression models among the overall participants and in each birth cohort.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Overall | Fetal | Infant | Toddler | Preschool | Mid-  Childhood | Young  teenage | Teenager | Young  adulthood |
| Famine exposure,  per level increase | **1.28 (1.16 - 1.41)** | **1.41 (1.03 - 1.94)** | 1.21 (0.65 - 2.27) | 1.01 (0.69 - 1.48) | 1.09 (0.81 - 1.48) | **1.27 (1.05 - 1.54)** | **1.43 (1.05 - 1.93)** | 1.15 (0.82 - 1.61) | **1.49 (1.20 - 1.85)** |
| Age, per year increase | 1.00 (1.00 - 1.01) | 1.10 (0.95 - 1.26) |  | 1.07 (0.73 - 1.56) | 1.13 (0.81 - 1.57) | 1.02 (0.96 - 1.08) | 1.09 (0.90 - 1.32) | 1.00 (0.80 - 1.25) | 1.01 (0.98 - 1.04) |
| Gender (Female vs. Male) | 1.69 (1.44 - 1.98) | 1.77 (1.03 - 3.05) | 1.27 (0.43 - 3.71) | 1.80 (0.93 - 3.49) | 1.04 (0.60 - 1.79) | 1.69 (1.25 - 2.29) | 2.15 (1.32 - 3.48) | 1.73 (0.96 - 3.13) | 2.16 (1.52 - 3.08) |
| Education |  |  |  |  |  |  |  |  |  |
| Illiterate | reference | reference | reference | reference | reference | reference | reference | reference | reference |
| <elementary school | 1.10 (0.95 - 1.27) | 1.04 (0.59 - 1.82) | 1.79 (0.69 - 4.65) | 1.37 (0.81 - 2.33) | 1.27 (0.82 - 1.97) | 1.05 (0.81 - 1.36) | 0.89 (0.57 - 1.37) | 0.83 (0.48 - 1.44) | 1.14 (0.80 - 1.61) |
| Elementary school | 0.86 (0.74 - 1.00) | 0.60 (0.35 - 1.01) | 0.56 (0.20 - 1.60) | 0.96 (0.50 - 1.84) | 0.98 (0.59 - 1.62) | 0.74 (0.56 - 0.98) | 0.82 (0.54 - 1.25) | 0.86 (0.52 - 1.40) | 1.21 (0.85 - 1.73) |
| Middle school | 0.85 (0.71 - 1.02) | 0.94 (0.58 - 1.53) | 1.04 (0.40 - 2.69) | 0.96 (0.53 - 1.75) | 0.78 (0.46 - 1.33) | 0.81 (0.56 - 1.15) | 0.49 (0.26 - 0.92) | 0.66 (0.34 - 1.28) | 0.99 (0.56 - 1.75) |
| High school or above | 0.55 (0.42 - 0.71) | 0.58 (0.32 - 1.02) | 0.81 (0.25 - 2.61) | 0.73 (0.35 - 1.51) | 0.26 (0.10 - 0.67) | 0.54 (0.29 - 1.00) | 0.22 (0.05 - 1.00) | 0.62 (0.23 - 1.70) | 0.65 (0.31 - 1.38) |
| Current living areas  (rural vs. urban) | 1.48 (1.22 - 1.79) | 1.44 (0.80 - 2.60) | 1.97 (0.54 - 7.21) | 0.78 (0.40 - 1.53) | 2.07 (1.16 - 3.73) | 1.47 (1.03 - 2.10) | 1.44 (0.78 - 2.66) | 1.63 (0.81 - 3.29) | 1.64 (1.07 - 2.51) |
| Childhood living areas  (rural vs. urban) | 1.19 (0.91 - 1.57) | 1.58 (0.63 - 3.96) | 0.90 (0.16 - 5.15) | 2.53 (0.82 - 7.74) | 0.85 (0.35 - 2.04) | 1.32 (0.80 - 2.19) | 1.66 (0.61 - 4.51) | 0.79 (0.30 - 2.06) | 0.90 (0.48 - 1.66) |
| Marital status  (married vs. not married) | 0.62 (0.53 - 0.72) | 0.33 (0.18 - 0.63) | 0.22 (0.06 - 0.84) | 0.28 (0.12 - 0.65) | 0.45 (0.26 - 0.78) | 0.50 (0.36 - 0.70) | 0.54 (0.35 - 0.84) | 0.92 (0.58 - 1.48) | 0.88 (0.66 - 1.15) |
| Self-reported family income | |  |  |  |  |  |  |  |  |
| Average and above | 0.27 (0.23 - 0.31) | 0.21 (0.13 - 0.34) | 0.38 (0.16 - 0.93) | 0.14 (0.08 - 0.25) | 0.34 (0.21 - 0.55) | 0.23 (0.17 - 0.31) | 0.36 (0.22 - 0.57) | 0.26 (0.15 - 0.45) | 0.30 (0.21 - 0.43) |
| Relatively poor | 0.49 (0.42 - 0.57) | 0.40 (0.24 - 0.66) | 0.60 (0.23 - 1.56) | 0.35 (0.20 - 0.61) | 0.67 (0.41 - 1.10) | 0.48 (0.36 - 0.65) | 0.55 (0.34 - 0.91) | 0.40 (0.22 - 0.73) | 0.45 (0.31 - 0.66) |
| Poor | reference | reference | reference | reference | reference | reference | reference | reference | reference |
| Individual income sources | |  |  |  |  |  |  |  |  |
| Wage and bonus | 0.62 (0.51 - 0.76) | 0.60 (0.39 - 0.95) | 0.45 (0.17 - 1.21) | 0.65 (0.37 - 1.14) | 0.49 (0.28 - 0.85) | 0.74 (0.51 - 1.06) | 0.64 (0.29 - 1.42) | 0.40 (0.13 - 1.24) | 0.69 (0.33 - 1.41) |
| Others | 0.81 (0.71 - 0.93) | 0.83 (0.35 - 1.98) | 0.39 (0.10 - 1.53) | 0.92 (0.40 - 2.12) | 0.95 (0.51 - 1.77) | 0.85 (0.65 - 1.11) | 0.89 (0.63 - 1.27) | 0.67 (0.45 - 1.00) | 0.81 (0.62 - 1.06) |
| None | reference | reference | reference | reference | reference | reference | reference | reference | reference |
| Employment status  (Y vs. N) | 0.91 (0.80 - 1.04) | 0.98 (0.61 - 1.57) | 0.52 (0.21 - 1.34) | 1.31 (0.74 - 2.33) | 0.58 (0.37 - 0.91) | 0.82 (0.63 - 1.06) | 0.96 (0.65 - 1.41) | 1.13 (0.73 - 1.74) | 1.02 (0.78 - 1.35) |
| Smoking status |  |  |  |  |  |  |  |  |  |
| Never | reference | reference | reference | reference | reference | reference | reference | reference | reference |
| Former | 0.99 (0.80 - 1.24) | 0.61 (0.24 - 1.54) | 1.64 (0.30 - 9.17) | 0.84 (0.27 - 2.62) | 0.86 (0.41 - 1.81) | 0.98 (0.65 - 1.47) | 1.45 (0.76 - 2.75) | 1.01 (0.45 - 2.27) | 1.04 (0.68 - 1.58) |
| Current smoker | 1.06 (0.91 - 1.25) | 0.98 (0.58 - 1.66) | 1.09 (0.42 - 2.82) | 1.55 (0.82 - 2.91) | 0.96 (0.56 - 1.63) | 1.02 (0.76 - 1.37) | 1.01 (0.63 - 1.61) | 1.14 (0.65 - 2.02) | 1.04 (0.73 - 1.46) |
| Drinking status |  |  |  |  |  |  |  |  |  |
| Never | reference | reference | reference | reference | reference | reference | reference | reference | reference |
| Former | 1.38 (1.12 - 1.70) | 1.52 (0.60 - 3.81) | 8.20 (1.91 - 35.10) | 0.81 (0.30 - 2.16) | 1.25 (0.59 - 2.65) | 1.70 (1.13 - 2.53) | 1.22 (0.67 - 2.22) | 0.96 (0.50 - 1.83) | 1.35 (0.87 - 2.09) |
| Occasional drinker | 1.35 (1.04 - 1.76) | 1.37 (0.70 - 2.68) | 0.89 (0.15 - 5.43) | 0.67 (0.27 - 1.70) | 1.13 (0.51 - 2.49) | 1.47 (0.87 - 2.48) | 0.72 (0.28 - 1.85) | 3.00 (1.20 - 7.49) | 1.99 (1.01 - 3.91) |
| Regular drinker | 0.80 (0.67 - 0.95) | 0.92 (0.52 - 1.62) | 1.59 (0.67 - 3.79) | 0.60 (0.32 - 1.11) | 0.56 (0.32 - 0.97) | 0.66 (0.47 - 0.91) | 0.79 (0.48 - 1.32) | 1.00 (0.55 - 1.80) | 1.10 (0.72 - 1.67) |
| BMI, per unit increase | 0.97 (0.96 - 0.99) | 1.00 (0.95 - 1.04) | 0.99 (0.89 - 1.10) | 0.99 (0.94 - 1.04) | 0.95 (0.91 - 1.00) | 0.97 (0.94 - 0.99) | 0.95 (0.90 - 0.99) | 1.01 (0.96 - 1.06) | 0.97 (0.94 - 1.00) |
| DBP, per unit increase | 1.00 (0.99 - 1.00) | 1.00 (0.98 - 1.01) | 0.99 (0.97 - 1.02) | 0.98 (0.97 - 1.00) | 0.99 (0.98 - 1.01) | 0.99 (0.99 - 1.00) | 1.00 (0.98 - 1.01) | 1.02 (1.00 - 1.03) | 1.00 (0.99 - 1.01) |
| Chronic lung disease  (Y vs. N) | 1.48 (1.26 - 1.74) | 0.76 (0.41 - 1.40) | 1.78 (0.64 - 4.93) | 1.51 (0.71 - 3.24) | 1.28 (0.73 - 2.24) | 1.75 (1.30 - 2.37) | 1.50 (0.95 - 2.39) | 1.64 (0.97 - 2.76) | 1.43 (1.03 - 2.00) |
| Chronic kidney disease  (Y vs. N) | 1.47 (1.20 - 1.79) | 1.38 (0.74 - 2.57) | 1.15 (0.38 - 3.48) | 1.42 (0.64 - 3.15) | 1.34 (0.75 - 2.38) | 1.56 (1.06 - 2.29) | 1.38 (0.79 - 2.41) | 1.60 (0.77 - 3.35) | 1.52 (0.90 - 2.59) |
| Digestive disease  (Y vs. N) | 1.58 (1.41 - 1.78) | 1.78 (1.24 - 2.56) | 1.12 (0.53 - 2.34) | 1.94 (1.28 - 2.95) | 1.38 (0.93 - 2.03) | 1.86 (1.50 - 2.31) | 1.42 (0.98 - 2.05) | 1.21 (0.79 - 1.85) | 1.56 (1.16 - 2.10) |
| Arthritis (Y vs. N) | 1.83 (1.65 - 2.04) | 2.12 (1.51 - 2.96) | 1.75 (0.91 - 3.36) | 1.29 (0.86 - 1.94) | 1.70 (1.21 - 2.40) | 1.91 (1.56 - 2.33) | 1.68 (1.21 - 2.34) | 2.48 (1.70 - 3.62) | 1.78 (1.38 - 2.30) |

*Note.* Famine was treated as a continuous variable in order to show linear trends. All models modeled on depressive symptoms.

**Figure S1**. Prevalence of major depression defined as the Center for Epidemiologic Studies Depression Scale (CESD) short form score ≥12 by 5-year age groups for both male and female participants in the 2011 survey of the China Health and Retirement Longitudinal Study (CHARLS).



**Figure S2.** Prevalence of depressive symptoms by famine severities overall and for each birth cohort 