### SUPPLEMENTARY TABLES

**Supplementary Table 1. Association of lifestyle activities and healthy diet score with the presence of non-robust status.**

|                        | N | Crude OR (95%CI) | p     | Adjusted OR* (95%CI) | p   |
|------------------------|----|------------------|-------|----------------------|-----|
| **Social activities in midlife** |    |                  |       |                      |     |
| Never                  | 323| 1                |       |                      |     |
| Irregular              | 464| 0.73 (0.54-0.97) | 0.034 | 0.78 (0.57-1.05)     | 0.112|
| Daily                  | 103| 0.64 (0.41-1.00) | 0.053 | 0.59 (0.36-0.94)     | 0.028|
| **Social activities in late-life** |    |                  |       |                      |     |
| Never                  | 183| 1                |       |                      |     |
| Irregular              | 597| 0.48 (0.34-0.69) | <0.001| 0.44 (0.30-0.64)     | <0.001|
| Daily                  | 114| 0.33 (0.20-0.55) | <0.001| 0.26 (0.15-0.43)     | <0.001|
| **Intellectual activities in midlife** |    |                  |       |                      |     |
| Never                  | 350| 1                |       |                      |     |
| Irregular              | 225| 0.65 (0.46-0.91) | 0.013 | 0.59 (0.41-0.85)     | 0.005|
| Daily                  | 310| 0.57 (0.42-0.78) | 0.001 | 0.61 (0.43-0.85)     | 0.004|
| **Intellectual activities in late-life** |    |                  |       |                      |     |
| Never                  | 305| 1                |       |                      |     |
| irregular              | 259| 0.57 (0.40-0.80) | 0.001 | 0.56 (0.39-0.80)     | 0.001|
| daily                  | 326| 0.48 (0.35-0.67) | <0.001| 0.53 (0.38-0.75)     | <0.001|
| **Work more than 9 hours in midlife** |    |                  |       |                      |     |
| Never                  | 350| 1                |       |                      |     |
| Irregular              | 257| 1.06 (0.76-1.46) | 0.721 | 1.03 (0.73-1.46)     | 0.835|
| Daily                  | 283| 1.18 (0.86-1.62) | 0.303 | 1.16 (0.83-1.63)     | 0.372|
| **Work more than 9 hours in late-life** |    |                  |       |                      |     |
| Never                  | 823| 1                |       |                      |     |
| irregular              | 45 | 0.90 (0.49-1.65) | 0.749 | 1.06 (0.55-2.02)     | 0.857|
| daily                  | 24 | 1.92 (0.79-4.69) | 0.149 | 2.37 (0.95-5.90)     | 0.063|
| **HDS in midlife per 1 point increase** |    |                  |       |                      |     |
| -                      | 0.93 (0.89-0.98) | 0.011 | 0.94 (0.90-0.99)     | 0.033|
| **HDS in late-life per 1 point increase** |    |                  |       |                      |     |
| -                      | 0.91 (0.86-0.95) | <0.001| 0.92 (0.87-0.97)     | 0.003|

OR was obtained using logistic analysis, depended variable was defined as robust and non-robust (i.e. prefrailty and frailty). N, number of participants; OR, odds ratio; CI, confidence interval; HDS, healthy diet score. * Adjusted for age, gender, education level, housing type, marital status, living condition, number of comorbidities (15), and SM-MMSE score.
Supplementary Table 2. Gender differences in participation in lifestyle activities and the HDS.

| Activity                                      | Male     | Female    | p*     |
|-----------------------------------------------|----------|-----------|--------|
| Social activities in midlife                  | 177(68.3)| 390(61.8) | 0.066  |
| Social activities in late-life                | 193(74.2)| 518(81.7) | 0.012  |
| Intellectual activities in midlife            | 160(62)  | 375(59.8) | 0.542  |
| Intellectual activities in late-life          | 170(65.6)| 415(65.8) | 0.97   |
| Work more than 9 hours in midlife             | 198(76.2)| 342(54.3) | <0.001 |
| Work more than 9 hours in late-life           | 22(8.5)  | 47(7.4)   | 0.603  |
| HDS in midlife                                | 14.6±3.2 | 14.8±2.7  | 0.351**|
| HDS in late-life                              | 14.9±3.0 | 15.0±2.6  | 0.375**|

Participation was defined more than once a month.
HDS, healthy diet score.
*P-value obtained using Chi-square test.
**P-value obtained using Kruskal Wallis Test.
### Supplementary Table 3. Summary of studies on the prevalence and risk factors of frailty in Singapore.

| Investigator | Participation (cohort) | Criteria of frailty (prevalence of frailty, prefrailty) | Factors associated with frailty | Specific chronic diseases associated with frailty | Factors not associated with frailty |
|--------------|------------------------|--------------------------------------------------------|--------------------------------|--------------------------------------------------|-----------------------------------|
| Liang Feng   | 1827 Chinese aged 55 and above (SLAS) | Fried criteria (2.5%, 32.4%) | age, education level, alcohol, smoking, comorbidity, cognitive impairment, depression, ADL, IADL | diabetes, hypertension, cardiovascular disease, coronary heart disease, heart failure, atrial fibrillation, stroke, cataracts/glaucoma, visual impairment, hearing impairment, asthma/COPD, osteoporosis, gastrointestinal problems, chronic kidney disease. | sex, living alone. |
| Tze Pin Ng   | 1685 participants aged 55 and above (SLAS) | Fried criteria (5.3%, 42.3%) | age, education, housing type, ethnicity, living alone, smoking, comorbidity, polypharmacy, cognitive impairment, depression, self-rated health, obesity, high nutritional risk, low albumin, anemia, total cholesterol, white cell count, ALD, IADL, hospital admission. | diabetes, atrial fibrillation, heart failure, cataract and eye disorders, kidney failure, COPD, hip fracture. | sex, drinking, thyroid disease, arthritis, cancer, orthostatic hypotension, lymphocyte counts. |
| Liang Feng   | 1575 Chinese aged 55 and above (SLAS) | Fried criteria (2%, 32%) | age, education, smoking, alcohol, comorbidity, cognitive impairment, depression, ADL-IADL, hospitalization in the past 1 yea, physical component scale. | | sex, hypertension, high cholesterol, heart attack, asthma, arthritis, APOE epsilon4. |
| Liang Feng   | 2375 Chinese aged 55 and above (SLAS) | Fried criteria (2.6%, 33.3%) | age, education, smoking, alcohol, comorbidity, cognitive impairment, depression, ADL-IADL disability, physical component score. | | | |
| Nigel Teo    | 2406 participants aged 55 and above (SLAS) | Fried criteria (3.4%, 45.1%) | self-defined social frailty (including 7 components: Living alone, no education, absence of a confidant, infrequent contact, infrequent social activities, financial difficulty, socioeconomic deprivation). | | sex, APOE epsilon4 carrier, hospitalization in the past year. |
| Kai Wei      | 5685 participants aged 55 and above (SLAS) | Fried criteria (4.5%, 45.7%) | age, ethnicity, sex, education, housing status, comorbidity, polypharmacy, cognitive impairment, | diabetes, hypertension, cardiac disease, stroke, anemia, chronic kidney disease, kidney failure, hearing loss, visual | |
| Study                      | Participants | Study Details                                                                 | Frail Status Criteria                                                                                     | Other Measured Factors                                                                                     |
|----------------------------|--------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Janhavi Ajit Vaingankar    | 2101         | Participants aged 60 years and above (Well-being of the Singapore Elderly study) | Fried criteria (5.7%, 45.1%)                                                                          | Depression, ADL/IADL, hospitalization, quality of life, malnutrition.                                        |
| Reshma Merchant             | 1051         | Participants aged 65 years and above (Singapore Population Health Studies cohort) | 5-item FRAIL scale (6.2%, 37%)                                                                       | Age, sex, ethnicity, comorbidity, polypharmacy, cognitive impairment, depression, Timed-Up and-Go (TUG) test, grip strength, ADL, IADL, subjective health. |
| Lixia Ge                   | 721          | Participants aged 60 and above (longitudinal Population Health Index survey)    | Clinical Frailty Scale (prevalence of fraility was 24.5%)                                              | Age, marital status, education, employment, money insufficiency, living alone, smoking, depression.           |

SLAS, Singapore Longitudinal Ageing Studies; COPD, chronic obstructive pulmonary disease; ADL, activities of daily living; IADL, instrumental activities of daily living.
Supplementary Table 4. Association between engagement of midlife long working hours and other lifestyle activities.

|                       | Midlife long working hour |                  |          |          |          |
|-----------------------|----------------------------|------------------|----------|----------|----------|
|                       | Non-engagement | Engagement | p        |          |          |
|                       | N (%)          | N (%)          |          |          |          |
| Midlife physical activity |               |                 |          |          |          |
| Non-engagement        | 120(34.3)      | 228(42.3)      | 0.017    |          |          |
| Engagement            | 230(65.7)      | 311(57.7)      |          |          |          |
| Late-life physical activity |            |                 |          |          |          |
| Non-engagement        | 49(14.0)       | 110(20.4)      | 0.015    |          |          |
| Engagement            | 301(86.0)      | 430(79.6)      |          |          |          |
| Midlife social activity |                |                   |          |          |          |
| Non-engagement        | 100(28.6)      | 222(41.4)      | <0.001   |          |          |
| Engagement            | 250(71.4)      | 314(58.6)      |          |          |          |
| Late-life social activity |              |                   |          |          |          |
| Non-engagement        | 55(15.7)       | 128(23.7)      | 0.004    |          |          |
| Engagement            | 295(84.3)      | 411(76.3)      |          |          |          |
| Midlife Intellectual activity |            |                   |          |          |          |
| Non-engagement        | 109(31.7)      | 241(44.9)      | <0.001   |          |          |
| Engagement            | 235(68.3)      | 296(55.1)      |          |          |          |
| Late-life intellectual activity |             |                   |          |          |          |
| Non-engagement        | 96(27.7)       | 208(38.6)      | 0.001    |          |          |
| Engagement            | 250(72.3)      | 331(61.4)      |          |          |          |
| Late-life long working hour |              |                   |          |          |          |
| Non-engagement        | 334(95.7)      | 485(90.0)      | 0.002    |          |          |
| Engagement            | 15(4.3)        | 54(10.0)       |          |          |          |
Supplementary Table 5. Operational definition of healthy diet score; the scoring rules for each of the six components.

| Dietary item                  | Frequency of consumption |
|-------------------------------|-------------------------|
|                              | Never or rarely | More than once per month but less than once per week | 1-3 times per week | 4-6 times per week | 1-2 times per day | >2 times per day |
| Green vegetables              | 0                      | 1                                      | 2                        | 3                        | 4                        | 5                        |
| Fruits                        | 0                      | 1                                      | 2                        | 3                        | 4                        | 5                        |
| Legumes                       | 0                      | 1                                      | 2                        | 3                        | 4                        | 5                        |
| Nuts                          | 0                      | 1                                      | 2                        | 3                        | 4                        | 5                        |
| Marine fish                   | 0                      | 1                                      | 2                        | 3                        | 4                        | 5                        |
| Meat and meat products        | 5                      | 4                                      | 3                        | 2                        | 1                        | 0                        |

Supplementary Table 6. Association of lifestyle activities and healthy diet score with prefrailty and frailty.

| Life style activities, yes vs no | prefrailty | frailty |
|----------------------------------|------------|---------|
| Adjusted OR* (95% CI)            | p          | Adjusted OR** (95% CI) | p |
| Adjusted OR* (95% CI)            | p          | Adjusted OR** (95% CI) | p |
| Adjusted OR* (95% CI)            | p          | Adjusted OR** (95% CI) | p |
| Adjusted OR* (95% CI)            | p          | Adjusted OR** (95% CI) | p |
| Adjusted OR* (95% CI)            | p          | Adjusted OR** (95% CI) | p |
| Adjusted OR* (95% CI)            | p          | Adjusted OR** (95% CI) | p |

OR, odds ratio; CI, confidence interval; HDS, healthy diet score.

*Adjusted for age, gender, education level, housing type, marital status, living condition, SM-MMSE score, and number of comorbidities.

**Adjusted for age, gender, education level, housing type, marital status, living condition, SM-MMSE score, and comorbidities (including 15 diseases, using binary indicators of each disease).
### Supplementary Table 7. Correlation matrix of variables.

|                   | Frailty | Education level | Housing type | Marital status | Living condition | Comorbidities | SM-MMSE score |
|-------------------|---------|-----------------|--------------|----------------|------------------|---------------|---------------|
| Frailty           | 1       |                 |              |                |                  |               |               |
| Education level   | -0.142  | 1               |              |                |                  |               |               |
| Housing type      | -0.134  | 0.135           | 1            |                |                  |               |               |
| Marital status    | -0.082  | 0.150           | 0.219        | 1              |                  |               |               |
| Living condition  | 0.037   | -0.120          | 0.098        | -0.513         | 1                |               |               |
| Comorbidities     | 0.083   | -0.057          | -0.042       | -0.043         | 0.000            | 1             |               |
| SM-MMSE score     | -0.083  | 0.482           | 0.078        | 0.099          | -0.129           | -0.169*       | 1             |

Comorbidities means the number of 15 specific comorbidities.
SM-MMSE means score of SM-MMSE.
Shown are spearman correlation coefficients unless stated otherwise.
* Pearson correlation coefficient.

### Supplementary Table 8. Comorbidity-stratified association of lifestyle activities and healthy-diet pattern score with the presence of non-robust status.

| Life style activities, yes vs no | No comorbidity | Comorbidity |
|----------------------------------|----------------|-------------|
|                                  | Adjusted OR*   | p           | Adjusted OR*   | p           |
|                                  | (95%CI)        |             | (95%CI)        |             |
| Social activities in midlife     | 1.16 (0.71-1.89) | 0.545       | 0.55 (0.38-0.81) | 0.002       |
| Social activities in late-life   | 0.38 (0.21-0.68) | 0.001       | 0.40 (0.24-0.66) | <0.001      |
| Intellectual activities in midlife | 0.83 (0.51-1.34) | 0.449       | 0.49 (0.34-0.72) | <0.001      |
| Intellectual activities in late-life | 0.50 (0.30-0.82) | 0.007       | 0.58 (0.40-0.85) | 0.006       |
| Work more than 9 hours in midlife | 0.97 (0.59-1.59) | 0.918       | 1.12 (0.77-1.62) | 0.532       |
| Work more than 9 hours in late-life | 1.03 (0.50-2.08) | 0.933       | 2.13 (0.88-5.13) | 0.092       |

OR was obtained using logistic analysis, depended variable was defined as robust and non-robust (i.e. prefrailty/frailty).
No comorbidity means the sum of comorbidity is less than 2.
Comorbidity means the sum of comorbidity is equal or more than 2.
* Adjusted for age, sex, education level, housing type, marry status, living condition, SM-MMSE score.