

Manchester Institute for Collaborative Research on Ageing (MICRA) - Seedcorn Funding 2019

For consideration in the joint award “Manchester China Institute/MICRA”

Project Title: Trajectory of allostatic load among older Chinese: A life-course approach to biological ageing

Background: China, the most populous country in the world, is ageing rapidly. The average life expectancy at birth in that country rose from 44 years in 1949 to 77 years in 2015.¹ In 2050, the population aged 80+ is projected to reach 90 million and represent the world’s largest elderly population. One major concern in relation to population ageing is the associated increase in the burden of non-communicable diseases. In 2013, almost half of the 202 million older people in China had at least one chronic disease.¹ From the biological point of view, the major feature of ageing is a progressive decline in bodily function, leading to an increasing susceptibility to disease and death. One of the early markers of bodily dysfunction is allostatic load, indicating “wear and tear” on the body and brain as a cumulative physiological response to stress.²

Our prior work using longitudinal data from the US and England found that older adults accumulate allostatic load as they age; the trajectories of allostatic load are related to gender, socio-economic factors and health behaviours.³ Based on our work in developed countries, the proposed project will contribute to the literature in several ways: Firstly, it will use a longitudinal, nationally representative study from China to understand the potential life-course targets for preventing adverse aging outcomes in a developing country. Secondly, it will include a wide range of measures from early life, midlife and later life in one study (Figure 1). Lower socio-economic status, especially in early life, has been consistently observed to be associated with lower cognitive function, lesser physical ability, and steeper inflammation trajectories.⁴⁻⁶ Yet little is known regarding the consequences of childhood socio-economic status on the trajectories of allostatic load in old age. Adopting the life-course perspective, the proposed research will examine how childhood conditions and allostatic load trajectories in later life are associated: childhood conditions affect allostatic load trajectories directly or indirectly through other life-course mediators (midlife socio-economic status and late-life health behaviour and health status). Figure 1 shows the risk factors of accelerated allostatic load trajectories in three schematic periods in the life course: early life, midlife, and late life. Examining the risk factors in three different life-course periods in one study will facilitate a fuller picture of risk factors of more severe biological ageing as it considers the total effect (direct effect and indirect effect) of childhood conditions on allostatic load trajectories in old age. These findings will provide valuable inputs for the future life-course model of risk factors for poorer health in old age.

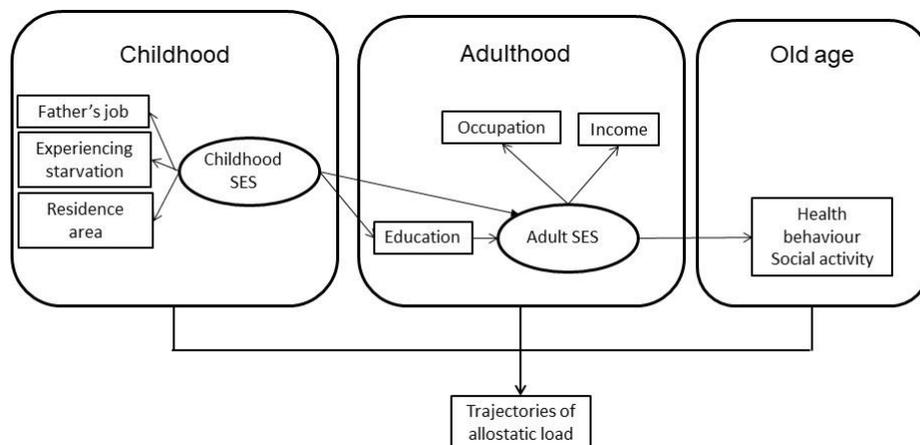


Figure 1 The pathways through which different lifetime exposures may relate to the trajectories of allostatic load

Aims and objectives: The overall aim of this study is to discern the pathways leading to accelerated allostatic load trajectories among older people in China. The aim will be operationalised by two interrelated objectives:

1. To identify the trajectories of allostatic load in later life and their determinants in China
2. To investigate the life-course (childhood and early adulthood) socio-economic determinants of the trajectories of allostatic load in old age.

Methodology: To achieve the research aims, this study will use longitudinal, nationally representative surveys in China: the China Health and Retirement Longitudinal Study (CHARLS) Waves 1-4 (2011-2015) and CHARLS Life History.⁷ CHARLS collected information on the social, economic, and health circumstances and biomarkers of more than 23,000 community residents in China aged 45+ and their spouses. The analyses will be performed in two sub-studies:

Sub-study 1: Defining the trajectories of allostatic load among older adults in China

To achieve the first research aim, we will use a linear mixed model to derive trajectories of allostatic load. We calculate allostatic load scores in two stages.³ Firstly, we standardise each of the marker scores available in

CHARLS (systolic and diastolic blood pressure, haemoglobin A1c, high-density lipoprotein/total cholesterol, waist circumference, BMI, triglycerides, cystatin C and C-reactive protein) to have a mean of zero and a standard deviation of one. Secondly, we take the average of those standardised scores, resulting in a summary allostatic load score that can be interpreted in terms of standard deviation units. Higher values indicate higher multisystem physiological dysregulation. In applying mixed or random coefficient models, we will include both random intercepts and random slopes of age. If there is no significant variation in the slopes, we will include only random intercepts in the analysis. When modelling, in addition to age and sex, we will include covariates indicating socio-economic position earlier in the life course: education and income. Because the number of repeated observations has declined due to attrition, we follow the extensive literature in using inverse proportion to attrition weighting.⁵ To account for potentially informative attrition in our analyses, we estimate weight by performing the attrition model which includes age, sex, education, smoking behaviour, and the presence of chronic diseases including hypertension, cardiovascular disease, and diabetes; stabilised weights will then be computed with base model including age, sex, and education.

Sub-study 2: Childhood conditions and trajectories of allostatic load in later life

Following prior studies, childhood socio-economic conditions and health are treated as latent constructs with potentially inaccurate indicators as they involve self-reports of childhood conditions.^{4,5} To achieve the second research aim, we will use three analytic phases of latent class modelling. In the first phase, we will derive latent constructs of childhood conditions based on several pieces of information on childhood conditions (father's job, ever having experienced starvation, and residence area) to indicate whether a respondent's childhood was poor. We will then assign respondents to the latent classes in the second phase. In the third phase, a latent class model with trajectories of allostatic load as a distal outcome will be explored. The two previously developed classes of childhood conditions will be maintained.

Expected outputs of the research: To achieve maximum, multidisciplinary academic exposure, we plan to submit articles to high-impact journals in medicine (PLOS Medicine) and medical sociology (Social Science and Medicine). The findings would also be disseminated via academic seminars and international conferences. For maximum exposure to non-academic partners in China, results from the proposed project would be disseminated to the broader public and community through the Manchester China Institute.

Summary budget for project costs:

Activities	Description	Cost
Software purchase	Latent Gold 5.1	£ 1,595
Software purchase	STATA 16	£ 771
Conference attendance	International Association of Gerontology and Geriatrics Asia/Oceania Regional Congress in Taiwan	£ 1,200
Open-access publication	PLOS Medicine/Social Science and Medicine	£ 2,350
Total		£ 5,916

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