

Heterogeneous Trajectories of Depressive Symptoms in the Aging Process: A Sequence Analysis within Nine-Year Follow-Ups of Chinese Cohorts

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Extended Abstract

Depression is prevalent among populations entering their mid- to later life (Hu et al., 2022; Zenebe et al., 2021), but is aging necessarily associated with the onset of depressive disorders for an individual? There have been long-established studies documenting variations in the association between age and depression across populations. The risk of depression may increase (Lei et al., 2014; Li et al., 2016; Stordal et al., 2003) or decrease (Fan et al., 2021) with age; it is also observed to emerge non-linearly over the life course, with a relative peak possibly arising in midlife and latest life (Best et al., 2021; Snowden, 2001; Xu et al., 2024). Current knowledge on the progression of depression in the aging process is insufficient.

Depression results from complex interactions between the individual and the environment (Alexopoulos, 2005; Blazer & Hybels, 2005), and the progression of depression unfolds dynamically across the life course. Ill physical conditions and other stressful life events and adversity arising as people age, such as labor market status transitions and bereavement, may provoke and fuel depressive symptoms (Blazer & Hybels, 2005; Fan et al., 2021; Kendler et al., 1999; Lei et al., 2014; Li et al., 2016; Li et al., 2021; Stordal et al., 2003; Zenebe et al., 2021). On the other hand, people from different sociodemographic backgrounds typically experience heterogeneous life trajectories in their aging process, and socioeconomic advantages may protect individuals against the onset and persistence of depressive disorders in their aging process (Blazer & Hybels, 2005; Fan et al., 2021; Lei et al., 2014; Li et al., 2016; Lorant et al., 2003). As such, individuals possibly maintain stable mental health or go through a rise, decline, or fluctuation in depressive symptoms subject to their aging experiences and conditions, and the trajectories of depressive symptoms of individuals across their aging span are heterogeneous.

This present study, therefore, seeks to investigate heterogeneity in the trajectories of depressive symptoms among individuals entering older courses of life using a longitudinal sample of Chinese cohorts. Since each individual may have distinct experiences, the study employs sequence analysis to identify and cluster dissimilar trajectories. Sociodemographic factors associated with the cluster of trajectories were examined through multinomial regression.

Data and Methods

The study uses data from the 2011-2020 China Health and Retirement Longitudinal Study (CHARLS) focusing on the profile of middle-aged and older people sampled in the Chinese mainland (Zhao et al., 2014). The study includes a cohort of participants aged 50-69 years at baseline (born between 1941 and 1961) and participated in subsequent four waves of follow-ups in 2013, 2015, 2018, and 2020 with the depressive symptom scale repeatedly

measured five times. Participants who answered “don’t know” or refused to answer more than two out of the ten items of the depression scale in any survey wave are excluded from the analysis. The analytic sample includes 5170 participants, whose depressive symptoms were repeatedly assessed five times between 2011 and 2020. Of these participants, 50.3% are women, and the mean age at baseline is 58.4 years.

Depressive symptoms are measured by the short form of the Centre for Epidemiologic Studies Depression Scale (CES-D), which consists of 10 descriptive statements of moods and somatic symptoms and has been established as a valid screening tool (Andresen et al., 1994). Each item is assessed on a four-point scale in terms of the frequency of the symptom during the last week before the interview, ranging from “rarely or none of the time (less than 1 day)” to “most or all of the time (5-7 days)”. The CES-D score is obtained as the sum of scores for 10 items, ranging from 0 to 30, with a higher score indicating a greater degree of depressive symptoms. Three depressive states are defined using the cut-off points of 12 and 18. A score of 12, the 75th percentile of the score in the analytic sample, is identified as a valid threshold for diagnosing depression among older Chinese (Cheng & Chan, 2005), and a score of 18 represents the 90th percentile. Scores below 12 are therefore classified as “no symptoms”, scores between 12 and 17 as “depression”, and scores of 18 and above as “major depression”. The sequence of categorical depressive states at five survey waves defines the trajectory of depressive symptoms.

The study employs sequence analysis to capture the heterogeneous trajectory of depressive symptoms across individuals entering older courses of life over the nine-year span. The optimal matching (OM) algorithm is applied to quantify the pairwise distances defining the cost of transforming one to another by insertion/deletion (*indels*) and substitution. The cost regime is based on the transition rates that compute transition probability between pairs of states. A cluster analysis is then conducted using Wald’s hierarchical clustering method to classify dissimilar trajectories. The analysis is carried out through the R package TraMineR (Gabadinho et al., 2011).

A series of sociodemographic variables are selected to examine factors associated with belonging to a trajectory class. These factors include basic demographics (gender, baseline age, and birth cohort), time-varying demographic characteristics (marital status, parent-child relations, employment status, and physical health status), and socioeconomic conditions (the education level, parental education, urban/rural locality, and the geographical region). Any time-varying characteristics are categorized based on changes in the status at five sequential waves. Multinomial logistic regression is fitted to identify significant factors related to the progression of depression in the aging process.

Main Findings

Of the analytic sample, 41.8% of individuals have a mentally healthy trajectory with no depressive symptoms over the study period. However, pronounced heterogeneity in the trajectory of depressive symptoms exists among individuals who reported the symptoms at any waves during the study period. The depressive states may emerge, persist, become aggravated, or be mitigated for an individual over the nine-year span. Eight typical clusters of

trajectories are identified based on the cluster analysis (see Figure): sustained absence of symptoms (Type 1, 41.8%), occasional emergence of symptoms (Type 2, 22.4%), increasing symptoms (Type 3, 4.6%), increasing major depression (Type 4, 3.7%), sustained depression (Type 5, 5.3%), sustained major depression (Type 6, 4.0%), decreasing major depression (Type 7, 6.8%), decreasing symptoms (Type 8, 11.4%).

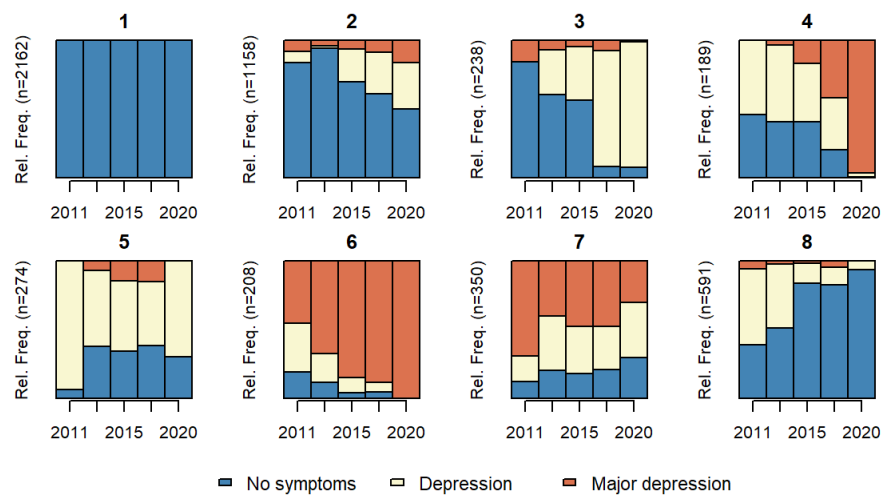


Figure. State distribution in eight trajectories of depressive symptoms

Estimations from multinomial logistic regression show the significant roles of socioeconomic conditions and age-related life events in determining the trajectory of depressive symptoms. On the one hand, socioeconomic advantages, such as higher levels of education and parental education and better-developed regional environments, are beneficial to reduce the risk of depression, and therefore, to reduce the likelihood of developing a trajectory where any symptoms presence with aging. On the other hand, there is little association between baseline age *per se* and the type of trajectory; however, age-related events, such as the loss of a spouse, weakening intergenerational ties and reduced labor and social participation, as well as worsening physical health, were closely related to the emergence and persistence of depression in the aging process.

Concluding Remarks

With the acceleration of population aging on a global scale, the burden of depression and associated mental health disorders in older populations may become heavier. However, given heterogeneity in the development of symptoms across populations, this study suggests that aging is not necessarily linked to depression among individuals entering their older ages, but maintaining and promoting mental health call for policy actions aimed at improving socioeconomic conditions, encouraging socioeconomic participation, and promoting physical health among the aging populations. Heterogeneity analysis may be a research focus to better understand the dynamics of mental health and to promote healthy aging in an aging society.

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