Am J of Geriatric Psychiatry 34:8 (2026) 1040–1053

Available online at www.sciencedirect.com

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journal homepage: www.ajgponline.org

Regular Research Article

Shifting Sense of Control: State, Trait, and Scar Effects of Late-life Depression in Trajectories of Mastery

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ARTICLE INFO

Article history:
Received February, 21 2026
Revised May, 3 2026
Accepted May, 4 2026

Keywords:
Mastery
depression
late-life depression
state, trait, and scar effects
sense of control
aging

ABSTRACT

Objective: *Depression may influence one's sense of control over life, i.e., mastery. However, course trajectories of mastery during a major depressive episode (MDE) in late-life are unknown. Our aim was to examine heterogeneity in the course of mastery, from 6 years before to 6 years after a MDE in late-life. We hypothesized that state, trait and scar effects may be identified.* ***Method:*** *Data were derived from the Longitudinal Aging Study Amsterdam (LASA), a prospective population-based study. A total of 246 respondents aged 55–84 with MDE and mastery scores (pre-, during and post-MDE) were included. Data were collected between 1992 and 2018. Piecewise Latent Class Growth Analysis (LCGA) was employed to identify distinct course trajectories of mastery. Multinomial regression analysis was conducted to examine the association between characteristics and mastery-trajectories.* ***Results:*** *Four distinct trajectories of mastery were identified. Two reflected stable levels of mastery over time (trait effect), one with high mastery (67.1% of the sample) and the other by low mastery (13.0%). A scar trajectory (11.8%) showed lasting decline in mastery after MDE. Finally, a temporary decline during MDE, with post episode recovery of mastery, was observed (8.1%), indicating a state-effect. Lower education level, chronic disease, lower levels of physical functioning, and higher depression severity were associated with unfavorable mastery-trajectories.* ***Conclusion:*** *Course trajectories of mastery around MDE are heterogeneous.*

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https://doi.org/10.1016/j.jagp.2026.05.002

Differentiating between these trajectories may enable clinicians to tailor care to individual recovery patterns, which should be validated in future treatment studies. (Am J Geriatr Psychiatry 2026; 34:1040−1053)

Highlights

- **What was the aim of this study?**
  This study investigates the heterogeneity in the course of mastery, before, during and after a depression in late-life.
- **How does mastery develop around a depressive episode adults?**
  Course trajectories of mastery in older adults, facing a major depressive episode, are heterogeneous.
- **Why is identifying mastery trajectories important?**
  Higher levels of education and better physical functioning are associated with a more resilient mastery course trajectory.
- **Why are the findings clinically relevant?**
  By identifying vulnerable subgroups, clinicians can better tailor interventions thereby help preventing future depressive episodes.

INTRODUCTION

Depression is the most prevalent psychiatric disorder in later life and carries a substantial disease burden. It also shows high rates of recurrence and chronicity[1,2] particularly in older persons.[1,3] Depression in older adults in the Netherlands is relatively common, with community-based studies reporting an overall point prevalence of approximately 14%−15%, including around 2% major depression and 10%−13% minor depression.[4] Epidemiological studies have mainly focused on physical and cognitive decline, as well as social circumstances such as loneliness and role changes, as important risk factors for late-life depression.[5] However, psychological concepts may also play an important role. A meta-analysis of 122 studies found that about half of adults with a depressive disorder also have a personality disorder.[6] Although less studied in later life,[7] personality traits and coping styles are psychological factors influencing depressive symptoms across the lifespan.[8] Sense of mastery has also been consistently linked to mental health, but warrants closer examination in late-life depression.

The concept of mastery was first described in 1978 by Pearlin and Schooler as the extent to which "one regards one's life-chances as being under one's own control in contrast to being fatalistically ruled",[9] based on Rotter's concept of locus of control.[10] Evidence indicates that mastery is associated with socioeconomic position, physical functioning, well-being and life satisfaction, key components of healthy aging, and that higher levels of mastery are linked to a more favorable course of late-life depression.[11−14]

However, mastery is not static and may decline with age, physical and functional deterioration, and adverse life events such as bereavement.[11,12,15] Depression is one such adverse experience: Assari et al.[16] found it predicted a significant decline in mastery over time among older, white adults. A depressive episode may therefore undermine one's sense of control over life, resulting in reduced levels of mastery afterwards.[16,17] Sense of mastery is also shaped by interrelated structural, social, and individual factors. Age-related processes, particularly physical health and disability, may undermine mastery through role loss, reduced social support, and limited opportunities for participation.[12]

We hypothesized that the sense of mastery follows different trajectories over time in older adults facing a major depressive episode (MDE). In previous studies, it was demonstrated that psychological concepts may be altered differently by an episode of major depression, with the impact of MDE on psychosocial functioning being classified as trait, state and scar effects.[18] This may also account for course trajectories of mastery. First, mastery may remain stable despite experiencing a

depressive episode. This type reflects a "*trait trajectory*," as the level of mastery does not seem to be sensitive to an MDE. Second, mastery may temporarily decline during an MDE but return to premorbid levels following remission, representing a "*state trajectory*." Third, mastery may remain reduced after remission, reflecting a "*scar trajectory*" and greater vulnerability to future depression.

To our knowledge, only two studies have examined changes in mastery before, during and after an MDE. These studies found evidence for a moderate trait and state effect, but no evidence of a scar effect.[19,20] Ormel et al.[19] studied a predominantly younger population (mean age of 40 years, ±SD 11.4 years; 64% female) with three measurements over 36 months. Oldehinkel et al.,[20] examined an older sample (mean age 67.2 years, ±SD 7.3 years; 61.5% female) with longer follow-up but a small sample size (n = 122, with 26 depressed persons). Both studies were general population based. While these studies examined average trait, state, and scar effects, they did not address heterogeneity in longitudinal patterns. The present study builds on this work by identifying distinct trajectories of mastery over time.

The primary aim of this study is to examine heterogeneity in the impact of an MDE episode on mastery during 12-year follow-up in a large population-based sample of people aged 55 years and older. We hypothesize to identify subgroups with a trait, state, and scar effect. Secondarily, we will explore which baseline characteristics are associated with the identified mastery trajectories.

METHOD

Design and Participants

We used data from the Longitudinal Aging Study Amsterdam (LASA), a prospective population-based cohort study in the Netherlands. LASA commenced in 1992/1993, focusing on the determinants and trajectories of physical, mental, cognitive, and social functioning in older adults aged 55−84 years at baseline. A total of 3,107 older adults were randomly selected from population registries of eleven municipalities in three different regions in the Netherlands, varying in urbanization and religious denomination (cooperation rate was 61%). Subsequently, new measurements were undertaken in the sample population every 3−4 years. Additional information about the design and data collection procedure is reported elsewhere.[21,22]

For this study, we selected respondents with MDE on at least one of the waves and available mastery scores at least one wave before, during, and after the MDE. Subsequently, all available measurements of mastery were longitudinally centered around the first wave with MDE. Hence, MDE served as T0 in the trajectory analysis; observations of mastery before T0 were labelled as T-1, T-2 and so on, and all observations of mastery after T0 as T+1, T+2 and so on. These centered observations were used as input for the trajectory analysis. If respondents had MDE during multiple waves, only the first MDE was used in the analysis. To minimize potential misclassification due to floor effects in scar trajectories among individuals with recurrent episodes, the sample was therefore restricted to first MDEs. However, post-hoc, we investigated the rate of recurrence of MDE during follow-up in the different trajectory groups.

MEASURES

Mastery

Mastery was measured using a five-item version of the (originally seven-item) Pearlin Mastery scale.[9] This five-item version includes only the negatively worded items, such as 'I have little control over the things that happen to me'. The response options range from 1 "strongly disagree" to 5 "strongly agree". The sum of the items presents the overall score, ranging from 5 to 25. After reverse scoring the items, a higher score indicates a higher sense of mastery. The mastery scale demonstrated good reliability in the current sample ($\alpha = 0.8$).

Depression

In LASA a depression algorithm was used to determine the likelihood of MDE being present between all measurement waves, based on a combination of four distinct indicators.

The first indicator was the presence of MDE according to diagnostic interviews. These were conducted only in participants scoring ≥16 on the Center

for Epidemiologic Studies Depression scale (CES-D) and/or ≥8 on the Hospital Anxiety and Depression Scale−Anxiety subscale (HADS-A; from 2008/09 onwards).[23] This was the Diagnostic Interview Schedule (DIS) during the largest part of the study, and the Composite International Diagnostic Interview (CIDI) from 2015/16 onwards. The second indicator was having a CES-D score ≥16. The third indicator was self-reported use of antidepressants (yes/no). Finally, the fourth indicator was information obtained from participants' general practitioners (GPs), including whether a depressive disorder was diagnosed (yes/no), the year of diagnosis, and whether a specialist was involved. All four depression indicators were available starting from the first wave.

We categorized each combination of these indicators into a likelihood of MDE being present at each measurement wave. For example, a positive diagnosis of MDE based on the DIS/CIDI and a positive diagnosis by the GP with additional involvement of a specialist, were regarded as a sufficient indication of "very likely" MDE. Other categories of "likely," "possible," "unlikely," "no," and "unsure" were constructed based on different combinations of indicators. For example, CES-D ≥ 16 and GP diagnosis without involvement of a specialist was regarded as "likely" MDE. The algorithm only covers MDE and not dysthymia. In the current analyses we selected participants with "likely" or "very likely" MDE. Further details of the algorithm are available in Appendix 3.

Covariates

Covariates included sex (male/female), age (in years), years of education, chronic somatic diseases, cognition, physical functioning, loneliness, and severity of depression. These covariates were chosen based on their association with MDE[5,24] and mastery,[12,25] and their availability in LASA. *Chronic somatic disease* was examined by a self-reported questionnaire, assessing chronic somatic diseases that occur in more than 5% of Dutch adults aged 55 years and older,[26] including chronic obstructive pulmonary disease, cardiac disease, peripheral arterial disease, diabetes mellitus, cerebrovascular accidents, rheumatoid arthritis or osteoarthritis and cancer. The number of diseases present was counted (0−8). *Cognition* was measured by the Mini-Mental State Examination (MMSE). A 20 items questionnaire.[27] Scores ranged from 0 to 30 and higher scores indicated better cognitive functioning. *Physical functioning* was measured using a self-reported questionnaire, which focuses on the extent that older adults can perform six everyday activities (Activities of Daily Living; ADL) each rated from 1 ("without difficulty") to 5 ("no longer possible"). Physical functioning was assessed by summing all items (range 6−30).[28] *Loneliness* was measured using the 11-item questionnaire developed by de Jong Gierveld et al.,[29] measuring social and emotional loneliness. The loneliness scale demonstrated good internal consistency with a Cronbach's alpha of 0.87. All covariates were measured in the wave before MDE onset.

All assessments were conducted in Dutch, and participants were required to have sufficient command of the Dutch language to complete the interviews and questionnaires. Depressive symptoms were assessed using the CES-D, validated in Dutch older adults,[30] loneliness with the De Jong Gierveld scale,[29] a validated Dutch instrument, and functional limitations using items derived from established disability indicators, including the OECD scale validated in the Netherlands.[31,32] Mastery (Pearlin Mastery Scale) and cognitive function (MMSE) were measured using widely applied instruments.

Statistical Analysis

To identify subgroups with similar course trajectories of mastery, we performed piecewise Latent Class Growth Analysis (LCGA).[33] Data on mastery was centered around the first wave, when participants fulfilled the criteria of MDE, according to the algorithm. The first observed wave served as the intercept of the trajectory, and two slope parameters were estimated: one based on all waves of mastery before depression and one starting at the wave of depression and spanning all subsequent waves. We used two steps to assess model fit. First, to find the best single-class representation of change we established a baseline latent growth model comparing linear, quadratic, and cubic single-class models. Second, we established the number of subgroups that best fitted the data by examining a series of models with an increasing number of classes (a "class" is a sub-group with a distinct type of trajectory). We assessed model fit using different criteria: lower Bayesian and adjusted Bayesian Information Criterion (BIC and aBIC[34]), higher

entropy and posterior class membership probabilities,[35] significance level of the adjusted Lo-Mendell-Rubin likelihood ratio test (aLMR-LRT) comparing the fit of the k-class model with the fit of the k-1 class model,[36,37] class size with a minimum 5% of the total sample, and interpretability and theoretical validity of emerging classes.[34] We included only participants with at least one observation of mastery before MDE and at least one observation from the wave of MDE onwards.

Next, we investigated how baseline (i.e., the wave prior to the onset of MDE) characteristics differed across LCGA-derived trajectory classes to identify individuals at risk of different mastery trajectories during the course of depression. First, descriptive analyses were performed, comparing the distribution of characteristics across course trajectories, using one-way chi-square tests, t-tests or ANOVA analyses (depending on the number of identified trajectories), or nonparametric tests depending on the nature of the variables. Next, multinomial logistic regression analyses were conducted to examine which characteristics assessed at the wave prior to the MDE episode were significantly associated with trajectory class membership, in fully adjusted models that controlled for sex, age, years of education, chronic somatic diseases, cognition, physical functioning, and loneliness. All four trajectory groups were included simultaneously in the model, and pairwise comparisons between groups were obtained by varying the reference category.

To estimate selection bias, regression analysis was conducted to examine the extent to which all covariates mentioned above were associated with the likelihood of being excluded from analyses.

Finally, post-hoc descriptive comparisons were conducted to examine the proportion of participants with persistent MDE across the identified mastery classes.

All analyses were performed in Mplus Version 8.5 and SPSS version 28. Missing data were handled using Full Information Maximum Likelihood (FIML) estimation in Mplus, which allows all available data to be used under the Missing At Random (MAR) assumption.

RESULTS

A total of 732 respondents were identified as likely or very likely to have an MDE on at least one measurement wave. Individuals with an MDE at their first wave (n = 331) were excluded due to the absence of a measurement of mastery prior to depression. Next, we excluded an additional n = 155 participants because of missing data at T0 or follow-up. The final study sample consisted of 246 respondents. Multivariable logistic regression analyses examining baseline differences between included and excluded participants showed that higher age (OR = 1.16, 95% CI: 1.11−1.21, p <0.001) and a greater number of chronic diseases (OR = 1.35, 95% CI: 1.05−1.74, p = 0.018) were associated with a higher likelihood of exclusion from the analytic sample. In contrast, higher depression severity was associated with a lower likelihood of exclusion (OR = 0.94, 95% CI: 0.90−0.98, p = 0.006).

TABLE 1. Descriptive Statistics of the Final Study Sample (n = 246)

		n = 246
Cohort (n, %)	1992/1993	169 (68.7%)
	2002/2003	67 (27.2%)
	2012/2013	10 (4.1%)
Sex (female) (M, ±SD)		167 (67.9%)
Age (M, ±SD)		67.9 (7.1; range, 55.2−87)
Physical functioning (M, ±SD)		27.6 (3.8; range, 12−30)
MMSE (M, ±SD)		27.7 (2.1; range, 19−30)
Years of education (M, ±SD)		9.4 (3.4; range, 5−18)
Loneliness(M, ±SD)		2.7 (3.1; range, 0−11)
Chronic somatic diseases (M, ±SD)		2.0 (1.4; range, 0−6)
Severity of depression (M, ±SD)		11.9 (9.2; range, 0−54)
Mean mastery (M, ±SD)	3 years before MDE	16.4 (3.8; range, 5−25)
	During MDE	15.8 (3.8; range, 5−25)
	3 years after MDE	15.9 (3.8; range, 5−25)

Notes: M: mean; SD: standard deviation; range; MMSE: Mini-Mental State Exam.

TABLE 2. Parameters of Fit of Latent Class Growth Analysis (LCGA), Linear Models

No. of Classes	Class Size (n, %)	BIC	aBIC	aLMR-LRT	p	Entropy	PMP
1	246 (100%)	5827	5792	-	-	-	-
2	226 (91.9%) 20 (8.1%)	5821	5773	27	0.01	0.83	0.68–0.98
3	23 (9.3%) 20 (8.1%) 203 (82.5%)	5815	5755	20	0.04	0.71	0.51–0.96
4	32 (13.0%) 29 (11.8%) 20 (8.1%) 165 (67.1%)	5816	5743	21	0.04	0.68	0.60–0.92
5	30 (12.2%) 33 (13.4%) 1 (0.4%) 162 (65.9%) 20 (8.1%)	5826	5741	11	0.019	0.73	0.60–0.92

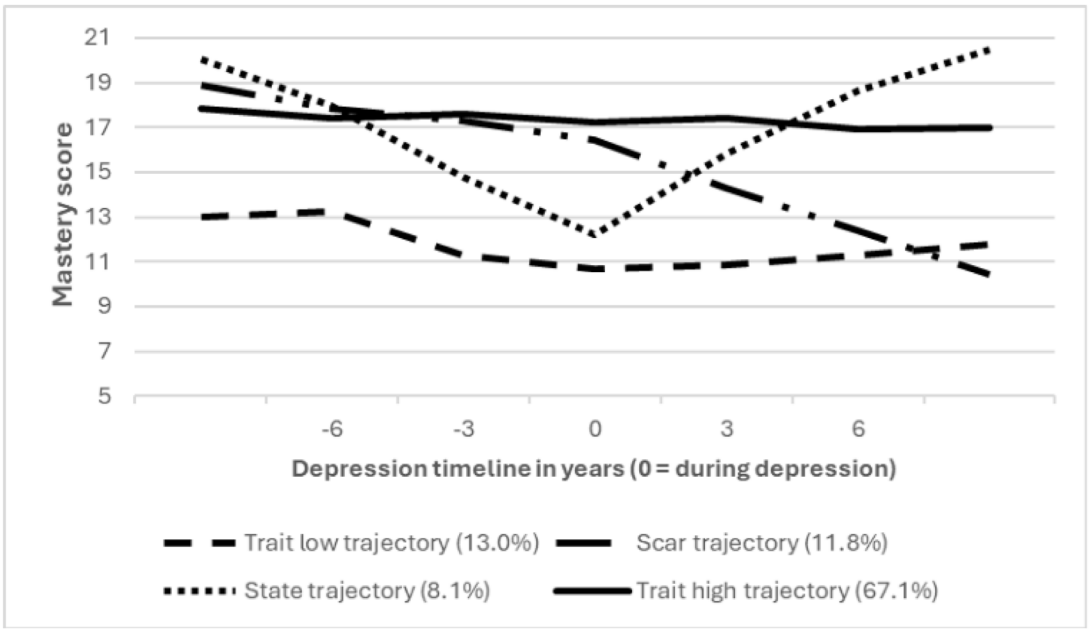
Notes: BIC: Bayesian information criteria; aBIC: adjusted Bayesian information criteria; aLMR-LRT: adjusted Lo-Mendell-Rubin likelihood ratio test; PMP: posterior class membership probabilities.

No significant differences were observed for physical functioning, loneliness, or MMSE scores. The descriptive statistics at baseline are presented in Table 1.

Latent Class Growth Analysis

Indices of fit for the LCGA models are presented in Table 2. When comparing the Bayesian and adjusted Bayesian information criteria (BIC and aBIC) values for the linear, quadratic and cubic model, it appeared that a model with linear slopes before and after depression fit the data best. This comparison was conducted within a single-class (baseline) model using the pooled sample, to determine the functional form independent of the number of classes (see appendix 4). Next, determining the number of classes,

FIGURE 1. Trajectories of mastery around depression, based on latent class growth analysis (observed means).



the aLMR-LRT was significant up to the five-class model. However, in the five-class model, class sizes were lower than 5%, hampering clinical relevance. Hence, we preferred the four-class model. The model had moderate entropy (0.68), indicating some uncertainty in classification.

As shown in Figure 1, four different course trajectories of mastery can be distinguished. Two trajectories represent a trait-pattern, with similar pre- and post-MDE mastery levels. One group showed a stable and high level of mastery, henceforth called "trait high trajectory" (67.1%), the other a relatively low also stable level of mastery, henceforth called "trait low trajectory" (13.0%). In both, mastery trajectories remained unaffected by the MDE across all time points, in both estimated and observed values.

A less common pattern (11.8%) involved intermediate mastery score before MDE but this score declined during the depressive episode and did not recover to premorbid levels afterwards. This corresponds to a "scar" trajectory, where there is a decrease in mastery scores after an episode of MDE.

The remaining trajectory (8.1%) showed high pre-MDE mastery, a decline during the episode, and recovery afterward, indicating a temporary impact on mastery, corresponding to a "state" trajectory.

Differentiation Among Identified Mastery Classes

Table 3 presents the descriptive statistics of the different trajectory groups, measured at the wave preceding an MDE. Significant differences between trajectory groups were observed for physical functioning, loneliness, depression severity, and mastery. For physical functioning and loneliness, the stable low trait trajectory group differed from the stable high trait trajectory group, whereas the scar and state trajectory groups did not differ from either. For depression severity, the stable low trait and state trajectory groups reported higher levels than the scar and stable high trait trajectory groups. For mastery, the stable low trait trajectory group had lower scores than all other groups. Overall, the stable high trait trajectory showed the most favorable profile, characterized by higher mastery, better physical functioning, and lower depression severity, whereas the stable low trait trajectory showed a less favorable profile with respect to psychosocial and clinical characteristics. The scar and state effect groups occupied intermediate positions. No significant differences were found for sex, age, years of education, MMSE scores, or the number of chronic somatic diseases.

Next, multinomial logistic regression analyses were conducted to examine predictors of mastery trajectories membership. The results are shown in Table 4.

All trajectory groups were included simultaneously in the model, first, compared to the most favorable course trajectory (i.e., "Trait high trajectory" is reference group), mastery was statistically significantly associated with "Trait low trajectory" membership (OR = 0.60; 95% CI: 0.50−0.73; p <0.001), indicating that persons with higher levels of mastery have a 40% reduced likelihood of being in the "Low trait trajectory." Next, both education level and

TABLE 3. Descriptive Statistics of the Subgroups at Wave Prior to MDE

	Trait Low Trajectory N = 32 (13.0%)	Scar Trajectory N = 29 (11.8%)	State Trajectory N = 20 (8.1%)	Trait High Trajectory N = 165 (67.1%)	Overall Statistics χ^2 (df)/ F (df) p-value
Sex (f)	78.1%	65.5%	60.0%	67.3%	2.2 (3) 0.5
Age[a]	69.5 (8.2)	68.7 (7.5)	66.4 (6.9)	67.7 (6.8)	1.0 (3) 0.4
Years of education[a]	8.8 (3.3)	9.0 (2.8)	8.3 (3)	9.7 (3.5)	1.5 (3) 0.2
Chronic somatic diseases[a]	2.5 (1.6)	2.2 (1.2)	1.7 (1.4)	1.9 (1.3)	2.3 (3) 0.1
MMSE[a]	27.1 (1.9)	27.8 (2.3)	27.1 (2.5)	28.0 (2)	2.5 (3) 0.1
Physical functioning[a]	25.4 (4.9)	27.7 (3.2)	25.9 (5.9)	28.3 (3.1)	**7.0 (3) <0.001**
Loneliness[a]	4.6 (3.5)	2.9 (3.3)	3.1 (3.4)	2.3 (2.8)	**5.1 (3) 0.002**
Severity depression[a]	18.4 (11.9)	10.3 (7.0)	17.6 (12.6)	10.3 (7.7)	**10.4 (3) <0.001**
Mastery[a]	11.2 (3.4)	16.5 (3.9)	15.7 (3.6)	17.5 (2.9)	**35.8(3) <0.001**
Number of time points[a]	5.5 (1.4)	6.1 (1.4)	5.9 (1.7)	5.9 (1.7)	0.8 (3) 0.5

Notes: MMSE: Mini Mental State Examination.
Boldface indicates statistical significance (p < .05).
[a] Mean (standard deviation); Number of time points: Number of available measurement waves per participant.Significant differences across classes (p <0.05), MD (Mean Difference): Group differences were tested using chi-square tests for categorical variables and ANOVA for continuous variables. Significant differences between trajectory groups were observed for physical functioning, loneliness, depression severity, and mastery (p <0.05, Bonferroni-corrected). In general, the stable low trait trajectory differed from the other trajectories, whereas the scar, state, and stable high trait trajectories showed fewer differences between each other.

TABLE 4. Multinomial, Fully Adjusted Logistic Regression Analyses, Examining Association Between Covariates and Outcome Defined as Course Trajectory (High Trait-trajectory is Reference Group)

Variables	Low Trait Trajectory OR (95% CI) p	Scar Trajectory OR (95% CI) p	State Trajectory OR (95% CI) p
Sex	0.83 (0.25−2.75) 0.76	1.39 (0.56−3.46) 0.48	3.22 (0.96−10.8) 0.06
Age	1.01 (0.94−1.08) 0.87	1.01 (0.95−1.07) 0.87	0.93 (0.86−1.01) 0.10
Years of education	0.92 (0.79−1.08) 0.31	0.93 (0.81−1.06) 0.29	**0.79 (0.64−0.98) 0.03**
Chronic diseases	1.13 (0.77−1.66) 0.53	1.24 (0.91−1.67) 0.18	0.69 (0.45−1.08) 0.10
MMSE	1.01 (0.78−1.29) 0.97	1.04 (0.84−1.30) 0.73	0.99 (0.79−1.25) 0.95
Physical functioning	0.92 (0.81−1.04) 0.19	0.96 (0.84−1.09) 0.54	**0.85 (0.74−0.98) 0.03**
Loneliness	1.07 (0.91−1.27) 0.31	1.08 (0.90−1.25) 0.32	0.98 (0.81−1.19) 0.83
Mastery	**0.60 (0.50−0.73) <0.001**	0.90 (0.78−1.05) 0.18	0.92 (0.76−1.11) 0.37
Depression severity	0.99 (0.93−1.05) 0.67	0.96 (0.90−1.03) 0.24	1.06 (0.99−1.13) 0.08

Notes: OR: odds ratio; CI: confidence interval; p: p-value.
Boldface indicates statistical significance ($p < .05$).

physical functioning were significantly associated with "State trajectory" membership (education: OR = 0.79; 95% CI: 0.64−0.98; p: 0.03 physical functioning: OR = 0.85; 95% CI: 0.74−0.98; p: 0.03). These findings indicate that, persons with higher levels of education had a 21% lower likelihood of belonging to the "State trajectory," and, likewise, persons with better physical functioning had a 15% lower likelihood of "State trajectory" membership ("Trait High trajectory" is reference). No statistically significant differences were observed for the "scar" trajectory compared to the "stable high trait" trajectory.

Next, three additional multinominal regression analyses were performed using each unfavorable trajectory as reference category (i.e., low trait-, scar- and state-trajectories). Here we report only the results that were statistically significant. First, "Trait low" was taken as refence category. These analyses demonstrated that higher levels of mastery were associated with "State trajectory" membership (OR = 1.52; 95% CI: 1.20−1.92; p <0.001) as well as with "Scar trajectory" membership (OR = 1.49; 95% CI: 1.21−1.84; p <0.001). Finally, we compared the "Scar" and "State" trajectories. Number of somatic diseases (OR = 1.78; 95% CI: 1.07−3.00; p <0.03) and severity of depression (OR = 0.91; 95% CI: 0.83−0.99; p <0.03) were significantly associated with "Scar trajectory" membership ("State trajectory" is reference), indicating that persons with higher number of somatic diseases were more at risk to have a persistent decline (scar) in levels of mastery after depression, whereas persons with higher depression levels were more likely to belong to a state trajectory.

Overall, course trajectories were largely determined by pre-MDE mastery levels, with only limited additional contributions from education, physical functioning, depression severity, and somatic illness.

Finally, we examined in post-hoc analyses whether unfavorable trajectories were partly explained by persistent depressive symptoms by assessing post-MDE depression prevalence at wave 3. Prevalence rates of MDE were highest in the scar trajectory (86.2%) compared with the high trait (72.8%), low trait (65.6%), and state trajectories (70%).

CONCLUSION

In line with our hypothesis, four distinct mastery trajectories emerged, reflecting differential effects of MDE in older adults: two trait-like (stable high versus low mastery course), one state-like trajectory (lower mastery during MDE), and one consistent with a scar effect (post-MDE decline). Most participants (67.1%) belonged to the high trait group, characterized stable mastery resilient to depressive episodes. This group showed better physical functioning and higher education, that may promote a stable sense of control and buffer destabilizing MDE effects. The remaining participants were distributed across the low trait (13.0%), state (8.1%), and scar (11.8%) trajectories. Pre-MDE mastery differed significantly between trajectory groups, but similar effect sizes for the state and scar trajectories suggest it did not distinguish between these groups.

Critically, while prior work has described trait and state effects,[19,20] our study extends this by empirically identifying corresponding mastery trajectories, including a novel scar trajectory (11.8%) not previously reported. Ormel et al.[19] studied younger adults,

while Oldehinkel et al.[20] examined a sample with a mean age of 57 years. Given our higher mean age (68 ± SD 7.1 years), differences may reflect the older population. Our study also differs in design and methods. Considering two-thirds of participants in our study maintained high mastery despite an MDE, our larger sample may have facilitated identification of smaller subgroups not detected in studies with smaller samples[20] or shorter follow-up despite larger samples.[19] Next, differences in findings may be attributed to differences in how mastery was measured. In these previous studies, mastery was conceptualized as one of several interrelated personality traits within a broader construct, including self-esteem, neuroticism, and self-efficacy. Whereas such aggregation may be useful for capturing general personality effects, it risks obscuring more nuanced, domain-specific effects of mastery.[38] By contrast, our study examines mastery as a distinct construct, allowing for a more precise assessment of its unique role.

Participants in the less favorable trajectories were similar in their baseline characteristics, suggesting limited differentiation in predictors of mastery decline following MDE.

Fewer years of education and poorer physical functioning were significantly associated with the state trajectory versus high trait trajectory. No examined characteristics significantly differentiated the scar trajectory from the other courses.

Finally, clinically, it might be important to identify individuals at risk for a scar effect, as their mastery may not recover, increasing vulnerability to future depressive episodes. Participants with higher depression severity and fewer chronic somatic diseases were more likely to follow a state trajectory rather than a scar trajectory. This is in line with findings that elevated depression severity at baseline predicts temporarily mastery decline (state effect),[16] while physical health problems demonstrate a persistent negative impact (scar effect).[12,39] The accumulation of chronic conditions and disability in late life gradually erodes mastery, which may explain the scar pathway. Hence, although both trajectories result in persistently low mastery, they differ in developmental pathways.

Ageing, chronic somatic diseases, and physical functioning predict a decline of mastery over time.[12,39] Age-related vulnerabilities may hinder restoration of mastery after depression. Hence in our older study population, mastery may be more susceptible to decline, increasing the likelihood of a scar effect, whereas this appears to be less prevalent in younger populations.[19,20]

Our study has several strengths. First, we had a sample size sufficient to support stable LCGA estimation. Participants were followed for twelve years, with mastery assessed during, as well as 6 years before and after MDE onset, enabling more precise examination of changes over time. Second, LASA's extensive data facilitated analysis of the putative association between pre-MDE characteristics, and subsequent mastery trajectories. This is clinically relevant for identifying vulnerable subgroups.

The most important methodological limitation was the 3−4-year intervals between measurements, during which substantial life changes may influence key outcomes. Although our well-defined depression algorithm (incorporating multiple indicators and longitudinal mastery data before and after depression) was a strength, it also introduced limitations. The stringent data requirements reduced the final sample size, potentially limiting generalizability of the findings and statistical power to detect differences in covariate distributions across trajectories.

Second, the high rate of persistent MDE across all groups, especially in the scar group (86.2%), may have biased our findings. This complicates distinguishing a true long-term scar effect from a prolonged state effect due to ongoing depressive symptoms. Persistent depression may also accelerate mastery decline, creating a reciprocal process in which depression and low mastery mutually exacerbate each other.[16] However, our data cannot disentangle these possibilities, and interpretation is limited by the lack of information on the duration of MDEs. Future research should use datasets with more frequent and detailed measurements of depression and mastery.

Generalizability could also be noted as a limitation, as our findings should be interpreted in light of the Dutch study context. Given the relatively individualistic nature of Dutch culture, these findings may be less generalizable to more collectivistic societies.[40] Mastery is a culturally sensitive construct, and both its levels and its association with health outcomes may vary across societal contexts, with personal control typically playing a more prominent role in individualistic settings than in more interdependent ones.[40,41] Additionally, measurement equivalence across cultural groups cannot be assumed.[42,43]

From a clinical perspective, these findings suggest that mastery trajectories following depressive episodes differ between individuals and may help identify those at risk for less favorable outcomes. Individuals in the low trait trajectory showed persistently low levels of mastery, indicating a reduced sense of control, whereas those in the state trajectory were characterized by lower educational attainment and poorer physical functioning, suggesting a more transient disruption. Importantly, lower mastery has been associated with a more chronic or recurrent course of depression in previous research, indicating that individuals with persistently low mastery may represent a particularly vulnerable group that warrants close monitoring.

These findings highlight the importance of monitoring mastery during and after depressive episodes. Individuals with persistently low mastery may benefit from interventions targeting perceived control and coping, while those with lower education and reduced physical functioning may require additional support during recovery. Routine assessment of mastery alongside depression severity may help tailor care to individual recovery trajectories. This dual focus on intervention and monitoring underscores the importance of addressing mastery as a relevant component of mental health care.

Future studies should examine the underlying mechanisms linking an MDE to specific trajectories, as well as develop interventions to improve or stabilise mastery and their impact on future health outcomes.

AUTHOR CONTRIBUTIONS

Delphine A. Ambe, Amarins T. Gaastra, Didi Rhebergen, Silvia S. Klokgieters, Almar A. L. Kok: contributed to the conception and design of the study. Delphine A. Ambe, Amarins T. Gaastra: analysed and interpreted the findings. Drafted the initial manuscript. Almar A. L. Kok, Silvia S. Klokgieters: contributed to study design, performed data analysis, and contributed substantially to interpretation of results. Didi Rhebergen, Silvia S. Klokgieters, Almar A. L. Kok, Radboud M. Marijnissen, Richard C. Oude Voshaar,: critically reviewed and revised the manuscript for intellectual rigor. Almar A. L. Kok, Didi Rhebergen, Silvia S. Klokgieters: provided methodological guidance, contributed to study design and data interpretation.

DATA SHARING STATEMENT

Given that this study utilized data from the Longitudinal Aging Study Amsterdam (LASA), which include sensitive participant information, respondents were informed that all raw data would be handled in strict compliance with LASA confidentiality agreements and would not be publicly disclosed.

DATA STATEMENT

The data has not been previously presented orally or by poster at a scientific meeting.

DISCLOSURES

The authors report no conflicts with any product mentioned or concept discussed in this article.

APPENDIX 1, TABLE S1: DESCRIPTIVE STATISTICS FOR THE EXCLUDED GROUP

		Excluded Group n = 151
Cohort[a]	1992/1993	129
	2002/2003	19
	2012/2013	3
Sex (female)		79 (50.1%)
Age[b]		75.5 (8.8)
Physical functioning[b]		24.1(6.1)
MMSE[b]		26.5 (3.1)
Years of education[b]		8.5 (3.3)
Loneliness[b]		3.1(2.9)
Chronic diseases[b]		2.4 (1.3)
Severity of depression[b]		10.4(7.4)
Mean mastery[b]	3 years before MDE	-
	During MDE	12.1(7.5)
	3 years after MDE	-

[a] Frequency.
[b] Mean (standard deviation).

APPENDIX 2 LASA DEPRESSION CLASSIFICATION INDICATORS

Indicator	Measurement Instrument	Comments
Clinically significant depressive symptoms	CES-D ≥ 16	Data from main interview and telephone with respondent.
Major depressive disorder diagnosis	DIS or CIDI	Only available if participant scored ≥16 on the CES-D.
General practitioner (GP) diagnosis	GP report	Diagnosis was determined with or without a medical specialist. Diagnosis was set at missing if year of diagnosis was not reported.
Use of antidepressant		

APPENDIX 3 LASA DEPRESSION ALGORITHM

Category					
Very Likely					
7	Missing	Yes	Missing	Yes any	Very likely
19	N/A (CES-D No)	Yes	No	Yes any	Very likely
31	No	Yes	Yes	Yes any	Very likely
35	Yes	any	any	any	Very likely
36	Missing	Missing	Missing	Yes spec	Very likely
37	Missing	No	Missing	Yes spec	Very likely
38	N/A (CES-D No)	Missing	No	Yes spec	Very likely
39	N/A (CES-D No)	No	No	Yesspec	Very likely
40	No	Missing	Yes	Yes spec	Very likely
41	No	No	Yes	Yes spec	Very likely
53	Missing	Missing	Yes	Yes any	Very likely
54	Missing	No	Yes	Yes any	Very likely
55	Missing	Yes	Yes	Yes any	Very likely
58	Missing	Yes	Yes	Possible[a]	Very likely
	N/A (CES-D No)	Missing	No	No	No
15	N/A (CES-D No)	No	No	No	No
5	Missing	Missing	Missing	Yes GP only Likely	
6	Missing	No	Missing	Yes GP only Likely	
10	Missing	Yes	Missing	Possible[a] Likely	
17	N/A (CES-D No)	Missing	No	Yes GP only Likely	
18	N/A (CES-D No)	No	No	Yes GP only Likely	
22	N/A	Yes	No	Possible[a] Likely	
29	No	Missing	Yes	Yes GP only Likely	
30	No	No	Yes	Yes GP only Likely	
34	No	Yes	any	Possible[a] Likely	
56	Missing	Missing	Yes	Possible[a] Likely	
Likely					
Possible					
13	N/A (CES-D No)	Yes	No	Missing	Possible
47	Missing	Missing	Yes	Missing	Possible
48	Missing	No	Yes	Missing	Possible
49	Missing	Yes	Yes	Missing	Possible
52	Missing	Yes	Yes	No	Possible
57	Missing	No	Yes	Possible[a]	Possible
Unlikely					
1	Missing	No	Missing	Missing	Unlikely
2	Missing	Missing	Missing	No	Unlikely
4	Missing	Yes	Missing	No	Unlikely
11	N/A (CES-D No)	Missing	No	Missing	Unlikely
12	N/A (CES-D No)	No	No	Missing	Unlikely

(*continued*)

23	No	Missing	Yes	Missing	Unlikely
25	No	Yes	Yes	Missing	Unlikely
50	Missing	Missing	Yes	No	Unlikely
51	Missing	No	Yes	No	Unlikely
No					
16	N/A (CES-D No)	Yes	No	No	No
24	No	No	Yes	Missing	No
26	No	Missing	Yes	No	No
27	No	No	Yes	No	No
28	No	Yes	any	No	No
32	No	Missing	any	Possible[a]	No
33	No	No	any	Possible[a]	No
3	Missing	No	Missing	No	No
Unsure					
0 missing yes		Missing	Missing		Unsure
8 Missing no		Missing	Possible[a]		Unsure
9 Missing no		Missing	Possible[a]		Unsure
20 N/A (CES-D NO) missing		No	Possible[a]		Unsure
21 N/A (CES-D NO) no		No	Possible[a]		Unsure

Categories 42−46 are redundant.
Msissing all indicators (-2).

[a] Yes, but year is missing.

Prevalence of at Least One Diagnosis of MDD According to the Algorithm

	N	%	Cohort 1	%	Cohort 2	%	Cohort 3	%
Total	5,110[**]	99,6	3,091	99,5	998	99,6	1,021	99,8
Likely/Very Likely	732	13,6	457	14,8	180	18	95	9,3
Very Likely	550	10,8	314	10,2	120	12	75	7,3

[**] The complete LASA baseline sample consists of N = 5,132 participants; N = 22 had insufficient data for the algorithm to be applied.

APPENDIX 4 COMPARISON OF LINEAR, QUADRATIC AND CUBIC SLOPES

Piecewise Model	Class Size	BIC	aBIC
Baseline model with a single class			
Linear	246	5827	5792
Quadratic—Pre	246	5831	5793
Quadratic—Post	246	5832	5794
Quadratic—Pre & Post	246	5837	5795
cubic—pre	246	5842	5798
cubic—post	246	5841	5796
cubic—pre & post	246	5846	5798

BIC: Bayesian Information Criterion; aBIC: sample size adjusted BIC.
Fit indices of LCGA of Mastery as outcome with linear quadratic and cubic slopes.

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