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Link to publication record in Ulster University Research Portal

Published in:
Journal of Affective Disorders

Publication Status:
Published (in print/issue): 01/02/2022

DOI:
10.1016/j.jad.2021.10.114

Document Version
Author Accepted version

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Depression trajectories among older community dwelling adults: Results from the Irish Longitudinal Study on Ageing (TILDA).

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1. Abstract

Background: This study investigated the role of a large range psychological, attitudinal and health related variables as predictors of depression trajectories amongst older adults over a 4-year time period.

Methods: Data from three consecutive waves of the TILDA survey of older community dwelling adults aged 50+ in Ireland were combined for analysis. Depression symptom scores were assessed using the Center for Epidemiological Studies– Depression scale (CES-D). Changes in depression scores over the three time points were modelled as distinct trajectory classes using group-based trajectory modelling, whilst simultaneously controlling for demographic, attitudinal and health related predictors of these trajectory classes using multinomial regression.

Results:

Four distinct depression trajectories were identified as (1) a stable low symptom level group (79%), (2) a moderate but deteriorating symptoms group (7.6%), (3) a moderate but improving group (10.1%) and (4) a vulnerable group with consistently high symptoms (3.1%). Multinomial logistic regression indicated that limiting pain, mobility impairments, perceived stress and loneliness predicted membership of the moderate and higher depressive symptom classes. Retirement status and higher reported levels of worry were associated with a greater likelihood of membership of the moderate symptom classes only.

Limitations: Use of the CES-D is open to bias due to subjective nature of respondent reporting.
Conclusions: Results concur with previous studies on the development of depression among older people and highlight the key health related and psychological variables that may relate to interventions aimed at mitigating risks of developing depression among older adults.

2. Introduction

The course of depression among the older people, operationalised in the current study as those aged 50 years and over, may be qualitatively different compared to younger people (i.e., <50 years). Frazer’s (2005) systematic review of treatments for depression states that older people aged 60 years and over are more likely to present with different symptom profiles compared to younger adults with greater frequency of reporting somatic complaints such as sleeplessness, appetite loss, lack of energy, aches and pains, worry and irritability. In addition, the links between late life depression and cerebrovascular conditions and their associated risk factors (e.g., high blood pressure, type 2 diabetes, increased serum lipid levels, respiratory problems) has led some authors to use the term ‘vascular depression’ in connection with older people that is more linked to aspects of physical health and function (e.g., Taylor et al., 2013; Sneed et al., 2011; Sheline et al., 2010).

Studies show that the course of depression in older people is not homogeneous (Andresscu et al., 2008; Holmes et al., 2018; Kaup et al., 2016; Liang et al., 2011; McGiffin et al., 2019; Ryff et al., 1998; Tampubolon & Maharani., 2017; Xiang & Chen, 2019). Indeed, the evidence from representative general population samples of adults supports the idea of heterogeneity in depression trajectories among older persons. Studies differ in their interpretation and number of trajectory classes, but some common themes have emerged. For
example, using a modified Centre for Epidemiological Studies Depression scale CES-D (Radloff, 1977), Kuchibhatla et al. (2012) identified four latent depression trajectories which included a stable low symptomatic group (76.6%), an initially low symptomatic group but increasing to sub-syndromal levels (10%), a stable, high symptomatic group (5.4%) and a high symptomatic, improving cohort but reverting to high symptoms (8%). Using the growth mixture modelling techniques, McGiffin et al., (2019) also identified 4 trajectories of depressive symptoms using the modified CES-D among older adults following disability onset. These trajectory classes were labelled as ‘resilient’ (56.5%), ‘emerging depression’ (17.2%), ‘remitting depression’ (13.4%) and ‘chronic depression’ (12.9%). Using group-based trajectory modelling techniques, Xiang & Chen (2019) identified 4 trajectory classes of major depression based on responses to the shortened version of the Composite International Diagnostic Interview, which they labelled as ‘Nodepression’ (85.8%), ‘increasing’ (6.3%), ‘decreasing’ (%) and ‘persistently moderate/high’ (4.7%). Liang et al., (2011) also used group-based trajectory modelling on scores from the 8-item CES-D and included an additional item assessing energy levels among adults aged 50+ within the US Health and Retirement study (n=17196). The authors reported six trajectories of depression over 6 data collection time periods (11 years) which they labelled as ‘minimal’ (15.9%), ‘low’ (36.3%), ‘moderate/ stable’ (29.2%), ‘high symptom levels decreasing’ (6.6%), ‘moderate symptoms increasing’ (8.3%) and ‘persistently high’ (3.6%). In line with previous studies, it was expected 4-6 similar trajectory classes would exist in older Irish adults. The studies cited have all used generalised growth mixture modelling techniques using specialized software such as Mplus (Muthén & Muthén., 1998-2021). Growth mixture modelling combines conventional random effects modelling (Laird & Ware, 1982) with latent trajectory classes as in finite mixture modelling (Muthén and Shedden,
Predictors of depression

Negative perceptions of ageing among older people have been associated with a wide range of maladaptive outcomes including depression (Gum & Ayalon., 2018). Perceptions of ageing refer to one’s personal views of ageing (Levy, 2003), with many older adults perceiving ageing negatively, viewing it as being illustrative of poor or declining health and function (Warmoth et al., 2016). Freeman, Santini, Tyrovolas, Rummel-Kluge et al., (2016) employed a single global attitudinal score derived from the Brief Ageing Perceptions Questionnaire (B-APQ; Sexton et al., 2014) which showed that negative ageing perceptions predicted the onset and persistence of depression at baseline and after a two-year follow-up period. The B-APQ is a multidimensional measure which captures five key dimensions of ageing perceptions including Timeline Chronic (i.e., awareness of ageing as chronic process), Consequences Positive (i.e., perceived positive consequences of ageing), Consequences and Control negative (i.e., perceived negative impacts of ageing and ability to manage those negative aspects), Control Positive (i.e., ability to navigate the positive aspects of ageing) and Emotional Representations (i.e., affective impacts of ageing) (Sexton et al., 2014).

Musliner et al.’s (2016) review of the predictors of depression symptoms among older adults include poor self-reported health status (Kuchibhatla et al., 2012; Liang et al., 2011), the number of experienced chronic somatic diseases at baseline (Hsu, 2012; Kuo et al., 2011; Liang et al., 2011) and greater functional impairment (Andreescu et al., 2008; Byers et al., 2012; Hsu, 2012; Kuchibhatla et al., 2012). There is also evidence of links to higher depressive symptomology among those with specific health conditions such as Ishemic heart
disease (Montagnier et al., 2014), breast cancer, diabetes and obesity (Byers et al., 2012),
Hypertension (Moonan et al., 2015) and those with chronic pain experiences (Gerrits et al.,
2015). The evidence regarding cognitive function is mixed with some studies linking poor
cognitive function to higher depression trajectories (Andreeescu et al., 2008; Kuchibhatla et
al., 2012; Montagnier et al., 2014), whilst other studies have found no such association
(Byers et al., 2012; Kuo et al., 2011).

Finally, the association between loneliness and depression is well documented among older
adults (Cacioppo, Hughes, Waite, et al., 2006). A 5-year longitudinal study on older adults in
Chicago showed that loneliness predicted subsequent increases in depressive
symptomatology, however depressive symptoms at one time-point were not predictive of
loneliness at subsequent time-points depressive symptoms at one time-point did not predict
loneliness at a subsequent time-point (Cacioppo, Hawkley, & Thisted, 2010). Conversely, a
national longitudinal study among older adults in Sweden showed that increases in depressive
symptomatology predicted loneliness (Dahlberg, Andersson, et al., 2015). Using data from
The Irish Longitudinal Study on Ageing (TILDA), Santini, et al., (2016) found that loneliness
was a significant mediator in the association between social network related factors and
depression. Findings from the Longitudinal Aging Study Amsterdam, showed that both
loneliness and social network had an independent effect on the course of depression (Houtjes
et al., 2014).

Aims
The focus of this study to compare 2-6 class models in terms of model fit, meaningfulness
and class size using a representative sample of older Irish adults measured over a 4-year
period. This study attempted to replicate the five-factor structure of the shortened version of
the Ageing Perceptions questionnaire (B-APQ; Sexton et al., 2014) as first used by Freeman
et al. (2016) and to utilise the specific attitudinal dimensions derived from this model to predict trajectory class membership. Based on prior research (e.g., Kuchibhatla et al., 2012; Liang et al., 2011; McGiffin et al., 2019; Xiang & Cheng, 2019), we anticipated that at four distinct depression trajectories would be identified including a consistently low depression symptomology trajectory and a consistently high depression symptomology trajectory. We hypothesised that negative perceptions of ageing are associated with higher symptomatic depression trajectories whilst positive dimensions relate to lower initial symptomatic levels and healthier depression trajectories. Also, the study investigates whether various demographic (age, gender), health related and psychological variables can add to prediction of such trajectories. In particular, it was hypothesised that those with combined limitations from multiple health conditions, functional impairments or greater pain experiences at baseline would report higher depression symptomology and greater deterioration in depression over time. In a similar way, those reporting greater emotional loneliness, worry or anxiety at baseline were expected to exhibit similar change profiles.

3. Methodology

3.1. Study Design and Sample

Data was analysed from three consecutive waves of the TILDA survey, The Irish Longitudinal Study on Ageing, conducted by Trinity College Dublin. The TILDA is a nationally representative study of adults in Ireland aged 50 years and over. Participants were sampled using the RANSAM system, which is based on the Irish Geodirectory and ensures equal probability of selection for all households comprising of at least one person aged 50 years and older in Ireland (Donoghue et al., 2018; Whelan & Savva, 2013). Data from participants was collected using computer-aided personal interviews (CAPI), self-completed questionnaires (SCQ) as well as health assessments which occurred at each alternate wave.
Response rates remained relatively high throughout the waves with CAPI response rates reducing from 88% in Wave 2 to 85% in Wave 3 (Donoghue et al., 2018). At baseline, a total of 8178 CAPI interviews were conducted with 8073 valid responses on the CES-D. At wave 2, 6995 of the original sample and 170 new respondents completed interviews resulting in 7100 valid responses on the CES-D and this reduced to 6566 interviews at wave 3 with 6367 respondents providing valid CES-D data. Factors contributing to attrition rates between waves included withdrawal from survey, refusal to participate, relocation outside of Ireland, death of participant, among others (Donoghue et al., 2018). Complete details of the survey and its sampling procedures have been described elsewhere (Whelan & Savva., 2013, Kenny et al., 2010). The first wave was conducted between October 2009 and July 2011, the second wave was conducted between February 2012 and March 2013 whilst the third was undertaken between March 2014 and October 2015. The TILDA survey excluded those who resided in long-term care institutions or had a doctor’s diagnosis of dementia. Ethical approval for TILDA was obtained from the Faculty of Health Sciences Research Ethics Committee at Trinity College Dublin. Written informed consent was provided by all participants.

3.2. Measures

**Depression:** The 8-item Centre for Epidemiologic Studies Depression Scale (CES-D short form; Radloff, 1977) was utilised at all three waves. Scores on each item ranged from 0 (none or almost none of the time) to 3 (all or almost all of the time). Scores were summed to range from 0-24, with higher scores indicating higher symptom levels. The 8-item scale has shown to have almost identical alpha coefficients to the 20-item scale (Halloran et al., 2014). A score of $\geq 9$ on the 8-item scale has been used to define clinically significant depression symptoms (Briggs et al., 2018). The CES-D demonstrated high internal consistency at all three time points (Cronbach’s $\alpha >.90$).
**Ageing Perceptions:** These were assessed using the Brief Ageing Perceptions Questionnaire (B-APQ; Sexton et al., 2014). The scale consists of 17 items rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Items were scored in terms of the five dimensions of ageing perceptions proposed by Sexton et al., (2014); Timeline Chronic, Consequences and Control Negative, Emotional Representations, Consequences Positive and Control Positive. Cronbach’s α values for these sub-scales ranged from 0.75 to 0.84 and these values were replicated in the current study. The B-APQ has also been shown to be psychometrically sound measure in older Irish adults over the age of 50 years with good construct validity (Sexton et al., 2014).

**Anxiety:** Anxiety symptoms were assessed using the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A; Zigmond & Snaith., 1983). The scale consists of seven items rated on a 4-point scale ranging from 0 (not at all) to 3(hardly at all), with five items reverse scored. The scores of the seven items were summed to create a scale ranging from 0 to 21, with higher scores indicative of greater anxiety. The HADS-A has good sensitivity and specificity for assessing anxiety disorders among specific age groups of older adults (Spinhoven, et al., 1997) with good internal consistency (0.83) (Bjelland et al., 2002). Cronbach’s α was .65 in the baseline sample.

**Perceived Stress:** Perceived stress was assessed using the 4-item Perceived Stress Scale (PSS-4; Cohen et al., 1983). The PSS includes four questions based on the previous month answered on a 5-point Likert scale from 0 (Never) to 4 (Very Often). Scores ranged from 0-4 with a higher score indicative of greater perceived stress. The scale recorded a Cronbach’s alpha value of .68 using baseline data.

**Worry:** An 8-item abbreviated version of the Penn State Worry Questionnaire (PSWQ-A) was used. All items were scored on a 1-5 scale and item scores were totalled to compute an
overall worry score with higher scores indicating higher perceived levels of worry. Internal consistency was high in this scale (Cronbach’s $\alpha$ =.97).

**Loneliness:** Emotional loneliness was assessed using a modified version of the University of California-Los Angeles (UCLA) Loneliness scale (Russell, 1996) with five items: e.g. How often do you feel you lack companionship? Each question has three response options (hardly ever or never = 0, some of the time = 1, often = 2). Item responses were summed to produce an overall score ranging from 0 (not lonely) to 10 (extremely lonely) (Ward, et al., 2019) and Cronbach’s $\alpha$ at baseline was 67.

**Control Variables:** Control variables included sex, age, highest education qualification and employment status. Education was classified as primary (some primary/ not complete or primary/equivalent), secondary (intermediate/junior/group certificate or equivalent; leaving certificate/equivalent) and tertiary (diploma/certificate; primary degree; postgraduate/higher degree). Employment status was classified as employed (employed and self-employed), retired and unemployed (unemployed; permanently sick or disabled; looking after home or family or in education or training).

In the TILDA study, the number of chronic conditions one had were assessed by the question “has a doctor ever told you that you have any of the conditions on this card?”. Responses included 17 conditions such as hypertension and cancer. The total number of chronic medical conditions was categorized as 0 (none), 1, 2, 3 and 4 or more conditions. Difficulties with six types of activities of daily living (ADL); dressing, walking, bathing, eating, getting in or out of bed and using the toilet (Katz., 1963), were assessed. ADL disability in this study was defined as having difficulty with at least one ADL. Cognitive function was assessed utilizing the Montreal Cognitive Assessment (MOCA; Nasreddine et al., 2005). MOCA is a measure
of global cognitive function with scores ranging from 0-30. Higher scores are indicative of poorer cognitive functioning.

3.3. Statistical Analysis

All analyses were conducted using Mplus 8.2 (Muthén & Muthén, 2018). An initial confirmatory factor analysis using maximum likelihood estimation was performed to replicate the five-factor structure of the shortened version of the Ageing Perceptions questionnaire (B-APQ) as proposed by Sexton et al., (2014).

Group-based trajectory modelling (GBTM) utilising robust maximum likelihood estimation (MLR) was employed to identify specific trajectory classes over the 4-year time period. GBTM attempts to group individual growth trajectories into probabilistic groups, thus providing separate growth models for each latent class, each with its own starting (baseline) estimate of CES-D (based on summed continuous score) and each with its own rate of change (Jung & Wickrama, 2008). For the GBTM models, the number of classes was determined by means of the smallest Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), sample size adjusted BIC as well as analysing the Vuong-Lo-Mendell-Rubin likelihood ratio test. Entropy values greater than 0.8 were considered acceptable (Ram & Grimm, 2009).

Multinomial logistic regression analyses were simultaneously modelled within the GBTM analysis to assess the utility of ageing perceptions and various other demographic, psychological, health-related variables to the prediction of trajectory class membership. Sampling weights were generated with respect to age (in years), sex and educational attainment using the Quarterly National Household Survey 2010. These weights were applied to the GBTM and the multinomial logistic regression analyses.
4. Results

4.1. Confirmatory Factor Analysis of the B-APQ

A confirmatory factor analysis of the B-APQ items replicated the five-factor structure proposed by Sexton et al., (2014) and this model was used to estimate factor scores centred on zero for each subscale. This model was estimated using a baseline sample of 7143 participants and displayed excellent fit to the data, \( X^2 = 1412.21, \text{df} (109), p < 0.001, \) \( \text{RMSEA} = 0.04, \text{CFI} = 0.97, \text{TLI} = 0.96 \). Standardized parameter estimates ranged from .50 to .84, with correlations between factors ranging from -0.04 to 0.71 and Cronbach’s internal consistency coefficients in the range .75 to .84.
4.2. Group-based trajectory modelling (GBTM)

Separate group-based trajectory models specifying 2-6 classes were estimated, with fit indices for each model presented in Table 2. GBTMs were estimated whilst simultaneously including the covariates of interest as predictors of the trajectory classes. Due to missing data on exogenous covariates the sample size was reduced to 3947 participant trajectories.

The 2-class solution offered a low stable class (87.9%) with estimated mean symptom levels over the three time points ranging from 1.74 to 2.35 and a persistently high trajectory class (12.1%) with gradually improving mean symptom scores of 9.32 at baseline and 8.1 at time point 3.

The 3-class solution consisted of a stable low symptom group (81.2%) with estimated mean symptom levels ranging from 1.35 to 2.26, a stable moderate symptom level class (15.6%) with estimated means in the range 5.82 to 7.03 and a high symptom class (3.2%) which showed gradual improvement in mean symptom levels over time from 14.54 at baseline to 8.76 at time point 3.

The 4-class solution offered a stable low symptom group 1 (79.1%) with estimated means at each time point of 1.38, 1.55 and 1.91 and a stable high symptom group 4 (3.1%) with mean symptom levels improving from 13.6 at baseline to 12.41 and 10.86 at subsequent time points. In addition, a class emerged with moderate but deteriorating symptoms (group 2, 7.6%) with means ranging from 3.35 at baseline to 6.38 and 9.58 at subsequent time points.
The final group 3 (10.1%) with moderate and improving symptoms exhibited a baseline mean of 8.14 decreasing to 6.11 and 3.98 over subsequent time points. The 5-class solution also indicated a stable low symptom class (74.7%) with means ranging from 1.27, 1.46 and 1.81 over the three time periods and a persistently high symptom class (1.3%) showing modest improvements in means scores from 17.51 at baseline to 14.21 and 10.63 at subsequent time points. This solution also offered a second low symptom group 4 (8.6%) with deteriorating mean symptom scores over the time period of 2.60, 5.67 and 8.92 and two moderate symptom classes. The first was the stable moderate symptom class 2 (4.3%) whose mean scores ranged from 9.69 to 10.01 and the second a moderate symptom class 3 (11.1%) showed gradual improvement in mean symptom levels from 7.6 at baseline to 3.22 at time point 3.

The 6-class solution failed to replicate the best loglikelihood value despite increasing the number of random starts and iterations and did therefore did not yield a stable final solution. In addition, one of the emergent classes represented less than 1% of the cohort.

In terms of model fit, the 6-class solution provided the lowest AIC, BIC and adjusted BIC estimates but was not considered a stable solution.

Insert Table 1

On the basis of fit statistics, AIC, BIC values suggested the that a 6-class solution provided best fit to the data. This contrasted with the entropy values which suggested that the 2-class model provided best classification accuracy. The VLMR values showed that the 3 class model offered no improvement over the 2-class model (LMR adjusted $p = .207$), but that the 4-class model did offer improvement over the 3-class solution model (LMR adjusted $p = .046$)
and that increasing the number of classes to 5 or 6 did not improve model fit with adjusted LMR \( p \)-values = .225 and .725 respectively. The 4-class solution resulted in the lowest entropy value but entropy was nevertheless high and close to the other model values (.905) which was deemed as acceptable. For these reasons and after inspection of the classes for size and interpretability, the 4-class solution was judged to be the most appropriate and was therefore selected for further analysis.

Insert Table 2.
Insert Fig 1

4.3. Characteristics of trajectory classes and non-classified

Demographic characteristics of each trajectory class are presented in table 3. Chi-square tests of independence showed that sex, age group, employment and education status were all significantly associated with trajectory class membership \( (p < .001) \). Table 4 summarises each trajectory class in terms of the various health-related, psychological and B-APQ subscale factor scores.. Table 4 shows that for positive ageing perceptions (Consequences Positive and Control Positive), class 4 (stable low symptoms) recorded the highest factor scores compared to other classes. Conversely, scores for the negatively scored perceptions (Timeline, Consequences Negative, Emotional Representations) were lowest in class 4.
Table 3

Table 4
4.4 Multinomial logistic Regression

Demographic predictors

Table 5 shows that when compared to those in the low stable symptoms class, retired people were more likely than to be in both the moderate declining class 2 (Exp (B) =1.85, p=.026) and the moderate improving class 3 (Exp (B) =1.65, p=.026). Females were more likely to be in the moderate declining symptom class 2 than the low stable class 1 (Exp (B) =1.89, p=.002). Neither age nor education background was associated with trajectory class membership.

Health predictors

The number of health conditions and MOCA cognitive function scores did not predict class membership. Those reporting the experience of pain that limits their activities of daily living (ADL) and separate mobility impairment scores both uniquely predicted membership of higher depressive symptom classes. More specifically, higher mobility impairment score were linked to increased likelihood of membership to the moderate declining group (Exp (B)=1.41, p<.001), the moderate improving group (Exp (B)=1.30, p<.001) and the high stable group (Exp (B)=1.31, p=.022) when compared to the stable low symptom class. Mobility impairment scores did not separate either of the moderate symptom classes from the high stable class.

Those experiencing pain that limits their daily activities were also more likely to report being in the moderate declining class (Exp (B) = 1.88, p<.001), the moderate improving class (Exp (B) = 1.76, p=.007) and high stable group (Exp (B) = 3.84, p=.020) when compared to the low stable group. Pain also predicted greater likelihood of membership of the high stable
group over the moderate declining group \( (Exp (B) = 2.04, p=.002) \) and the moderate improving group \( (Exp (B) = 2.19, p<.001) \).

Psychological predictors

Also, increases in Perceived Stress Scale (PSS) scores increased the likelihood of belonging to the moderate declining class \( (Exp (B) = 1.14, p=.001) \), the moderate improving class \( (Exp (B) = 1.20, p<.001) \), and the high stable class \( (Exp (B) = 1.42, p<.001) \) when compared against the low stable class. In the same way, higher PSS scores were associated with reduced likelihood of being in both the moderate declining class \( (Exp (B) = 0.82, p<.001) \) and the moderate improving class \( (Exp (B) = .84, p<.001) \) compared to the high stable class. In the same way higher Worry scores were associated with a greater likelihood of membership of the moderate declining class \( (Exp (B) = 1.04, p=.027) \) and moderate improving class \( (Exp (B) = 1.03, p=.025) \) when compared to the stable low class but Worry was not linked to membership of the high stable class over any of the other three classes \( (p>.05) \).

Increases in UCLA loneliness scores showed a similar pattern of results with higher scores associated with greater probability of membership to the moderate declining class \( (Exp (B) = 1.14, p=.001) \), the moderate improving class \( (Exp (B) = 1.20, p<.001) \) and the high stable class \( (Exp (B) = 1.42, p<.001) \). Higher loneliness scores did not predict membership of the high stable class over the moderate declining class \( (p=.068) \) or moderate improving class \( (p=.308) \).

Finally, none of the five Ageing Perceptions subscales uniquely predicted membership \( (p > .10) \).
Table 5
5. Discussion

The primary objective of the current study was to identify depression trajectory classes in older Irish adults through examining changes in reported depression scores across three time points. Furthermore, we sought to identify demographic, health-related, attitudinal and psychological predictors of the various depression trajectories identified. Results demonstrated support for a model comprising four distinct trajectories of depression, namely class 1 which exhibited low and stable symptoms over time (79.1%), class 2 (7.6%) which demonstrated moderate but increasing symptom levels, class 3 (10.1%) with people expressing moderate but reducing symptoms and a consistently high symptom class 4 (3.1%) which improved a little over the time period.

Sample size and missing data Issues

A total of 8073 respondents provided valid CES-D scores at baseline and 5496 of these also provided CES-D responses on two subsequent time occasions. However, the GBTM employed a two-step analysis (classification and prediction) and therefore included all relevant covariates for the subsequent regression analysis. Listwise deletion was employed to deal with missingness on covariates which reduced the effective sample size to 3947. A total of 1549 respondents were therefore not classified using GBTM despite providing CES-D data on three occasions (due to missing data on covariates) and an additional 1624 respondents who did not provide full CES-D data over the three time points were also not included in the GBTM. These are important groups against which to compare against the various trajectory classes. Tables 3 and 4 show demographic, psychological and health-related variable scores of the trajectory classes alongside those who were not-classified classified due to missing responses on the CES-D or other covariates used to predict trajectory class membership.
Table 3 compares the demographic characteristics of each trajectory class with non-classified respondents. The baseline sample composition was as follows: 54% females, 40% aged 50-59 years, 29% educated at tertiary level and 27% were out of work due to unemployment, sickness or caring responsibilities. Higher proportions of females occurred in the moderate and high stable classes (63-68%) and there was a higher proportion of those aged 50-59 years in the high stable class. Those educated at tertiary level were more prevalent in the low stable class (38.3%) and the moderate improving class (36.5%). Comparing those in the trajectory classes with those who were not classified due to missing data reveals that the latter were more likely to be in the older age categories, have lower educational attainment, be retired or out of work and report experiences of pain that limited their daily activities at baseline. Table 4 shows that non-classified respondents reported higher scores on depression, perceived stress, worry and loneliness, lower scores on cognitive function and more negative perceptions of ageing than those in the combined trajectory classes.

Differences between trajectory classes

Although no ageing perception dimensions significantly differentiated the depression trajectory groups within the multivariate analysis, results demonstrated how those in the ‘high stable’ group reported the highest levels of negative ageing perceptions and the lowest levels of positive ageing perceptions compared to all other classes. In terms of demographic predictors, those in retirement were more likely to be in the ‘moderate declining’ and ‘moderate improving’ classes and females were more likely to be in the ‘moderate improving’ subgroup. Experiences of pain, mobility issues, perceived stress and emotional loneliness were identified as a shared risk factor for the higher depression symptom classes and individuals in both the ‘moderate declining’ and ‘moderate improving’ groups reported higher levels of worry.
Findings surrounding depression trajectories in older adults have been largely heterogenous to date with some studies identifying three (de la Torre-Luque et al., 2019; Kaup et al., 2016; Hybels et al., 2016), four (Kuchibhatla et al., 2015; Byers et al., 2012; Nyberg et al., 2019; Xiang & Cheng, 2019), five (e.g. Mirza et al., 2018) and six depression trajectories (e.g. Liang et al., 2011). The identification of four depression trajectories in the present study corresponds with previous findings from general-population research indicating three or four depression trajectory classes to be most common (see Musliner et al., 2016 for a review). The emergence of four qualitatively different depression trajectories in the present study highlights the presence of distinct subgroups with varying levels of depression symptomology in the older Irish general population keeping in mind that the majority of older Irish adults report minimal depressive symptomology.

Similar to Sexton et al. (2014), confirmatory factor analytic results confirmed the construct validity of the B-APQ. However, when the various ageing perception dimensions were investigated in the context of other demographic, health-related and psychological variables within the multivariate analysis, none of the ageing perception dimensions significantly predicted membership to any depression trajectory. This finding is surprising given that previous research has shown negative ageing perceptions to significantly predict the onset and maintenance of depression symptomology over time (Freeman et al., 2016). It is possible that when analysed in the presence of other potentially more dominant or prevailing issues in older age such as loneliness and vascular issues that ageing perceptions have little additive utility.

Consistent with some research indicating retirement to increase depression symptomology in some older adults (Mosca & Barrett, 2016; Segel-Karpas et al., 2018), results demonstrated that individuals in retirement were more likely to be in both the
‘moderate declining’ and ‘moderate improving’ class relative to the reference class. Different mechanisms have been proposed to explain the association between retirement and increased depression symptomology such as financial stress (Lue et al., 2010), threat of loss of resources (Topa & Valero, 2017), loss of subjective social status (Nyberg et al., 2019) and loss of work role and social networks (van Solinge & Henkens, 2008). Furthermore, the circumstances which led to retirement such as poor physical health, care-giving responsibilities and inability to find a job may also explain the influence of retirement on depression severity (Lee and Smith, 2009). Notably, retirement was not found to be a significant predictor of the ‘high stable’ class. Given that individuals in the high stable class reported higher severity in mobility difficulties, health conditions as well as many other psychological predictors, it is possible that retirement per se is not related to depression severity.

Results demonstrated that neither number of health conditions nor impaired cognitive functioning increased risk of membership to any of the depression trajectory classes compared to the low symptomatic group. However, experiences of pain which impacted daily functioning as well as mobility impairment were identified as significant predictors of membership of more severe depression trajectories. These findings concur with previous research on poor physical functioning (Bozo et al., 2010, Sjoberg et al., 2017). Given that these types of disabilities severely affect both sense of independence and the quality of life of older adults (Covinksky et al., 2010), it is not unexpected that these impairments would reduce opportunities to experience positive affect as a result. It is possible in the present study that it is not the number of health conditions which predict severity of depression symptomology but rather the degree to which these health conditions affect mobility and daily living. The finding that pain increased likelihood of membership to the more severe depression trajectories is consistent with research indicating old age, pain and depression to
be reciprocally related (Chou, 2007; Geerrlings et al., 2002). Overall, these findings highlight the role of pain and mobility impairments in both the onset and maintenance of depression in older adults.

Consistent with previous research demonstrating an association between perceived stress and depression symptomology (Chen et al., 2017; Ezzati et al., 2014; Kwag et al., 2011), all classes relative to the reference class experienced greater levels of perceived stress, and these effects were most prevailing for the ‘high stable’ class. Kwag et al. (2011) aptly suggested that higher stress levels in older adults may increase likelihood of becoming dissatisfied with oneself or one’s circumstances, thereby increasing depressive symptomology. Furthermore, Fiske et al. (2009) highlighted how older adults experiencing depression may behave in ways which create greater vulnerability to future stressful events. Other factors which may also explain the higher levels of perceived stress in older age include cognitive decline, multimorbidity and physical disability, which can occur in older age (Osmanovic-Thunström et al., 2015). Furthermore, consistent with previous research (Dar et al., 2017), both the ‘moderate declining’ and ‘moderate improving’ classes reported higher levels of worry when compared to the reference class although this effect did not transfer to the ‘high stable class’. These results highlight the role of perceived stress and worry in explaining depressive symptoms in older Irish adults.

Emotional loneliness is the subjective assessment of an individual’s satisfaction with the quality of their social relationships and while most often considered the psychological embodiment of social isolation (Steptoe, et al., 2013), can also be present among highly socially integrated individuals (McHugh, et al., 2017). Research has identified emotional loneliness to be associated with greater psychiatric burden (Hyland et al., 2019). The finding that the ‘high stable’ class reported higher levels of emotional loneliness is unsurprising.
given that previous research has demonstrated a strong association between emotional loneliness and depression, with these effects being greater for those with more severe depression (Peerenboom et al., 2015). Different explanations have been offered on the mechanisms which underpin the associations between emotional loneliness and depression such as lack of social support/social networks (Liu et al., 2016; Domènech et al., 2017).

Given the recognised maladaptive consequences of loneliness on health and mortality (Holwerda et al., 2016), the adaptive transition into retirement (Segel-Karpas et al., 2016), subjective life expectancy (Bodner & Bergman, 2016), psychiatric morbidity (Hyland et al., 2019) and poorer prognosis with late-life depression (Holvast et al., 2015), these findings highlight the integral role of emotional loneliness in increasing depression symptomology in older adults.

The large sample size and naturally representative nature of the data are notable strengths of the present study. Nonetheless, this study has several limitations. Firstly, many of the measures utilized including those used to assess ageing perceptions and depression symptomology were self-report based and may have been subject to participant response bias. The B-APQ was only administered at baseline and thus, it was not possible to examine the temporal stability of these attitudes. A significant number of participants were excluded due to missing data on covariates and results suggest that those not included in the classification may also be more at risk given their health and age profile summarised in tables 3 and 4. Neverthess, the results may nevertheless be representative of the older Irish population since the recommended weighting variables were applied in the GBTM analyses.

Conclusions, implications and limitations

In conclusion, the results of this study highlight role of demographic, attitudinal and health-related predictors of heterogeneity in depression trajectories among older Irish adults. These
findings may have potential implications for the assessment, treatment and prevention of depression in older adults through identifying the factors most relevant in driving depression symptomology and change in symptoms over time. Notably, the ‘high stable’, ‘moderate improving’ and ‘moderate declining’ were relatively small sub-populations but it should be acknowledged that those who were excluded from the trajectory classification analysis are likely to be in poor mental and physical health. In reality therefore, the finding here that these at-risk trajectory groups constitute approximately 20.8% of the older adult population is likely to be an underestimate. Nevertheless, being able to distinguish these smaller at-risk groups in research is useful to both public health researchers as well as health service providers and practitioners.

6. **Acknowledgements**

We thank The Irish Longitudinal Study of Ageing and also the Irish Social Sciences Data Archive- [www.ucd.ie/issda](http://www.ucd.ie/issda) for providing the data utilized to conduct this research study.

7. **Funding**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
8. References


Relationships with sociodemographic and health-related factors. *Journal of Affective Disorders, 246*, 329-337.


28. 


Table 1.
Estimated mean CES-D scores over three time points for separate trajectory classes based on 2-6 class estimated using Group-based trajectory modelling (N=3947).

<table>
<thead>
<tr>
<th>2-yearly time points</th>
<th>2-class Solution</th>
<th>3-class solution</th>
<th>4-class solution</th>
<th>5-class solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>Class 1</td>
<td>Class 2</td>
<td>Class 1</td>
<td>Class 2</td>
</tr>
<tr>
<td></td>
<td>87.9</td>
<td>12.1</td>
<td>81.2</td>
<td>79.1</td>
</tr>
<tr>
<td>1</td>
<td>1.74</td>
<td>9.32</td>
<td>1.35</td>
<td>1.38</td>
</tr>
<tr>
<td>2</td>
<td>1.92</td>
<td>8.74</td>
<td>1.72</td>
<td>1.55</td>
</tr>
<tr>
<td>3</td>
<td>2.35</td>
<td>8.10</td>
<td>2.26</td>
<td>1.91</td>
</tr>
</tbody>
</table>

Trajectory class labels:
- Low stable
- High stable
- Mod. deteriorating
- Mod. improving
- Low deteriorating
- Mod. Stable
- Mod. Improving

Table 2.
GBTM Fit indices for 2-6 class models estimated using GBTM (N=3947).

<table>
<thead>
<tr>
<th>Classes</th>
<th>AIC</th>
<th>BIC</th>
<th>Sample Size Adjusted BIC</th>
<th>VLMR $X^2$ (df=22)</th>
<th>LMR adjusted P</th>
<th>LMR adjusted p</th>
<th>Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>56870.92</td>
<td>57059.34</td>
<td>56964.02</td>
<td>2766.81</td>
<td>.0000</td>
<td>.0000</td>
<td>.923</td>
</tr>
<tr>
<td>3</td>
<td>56292.93</td>
<td>56619.53</td>
<td>56454.30</td>
<td>621.99</td>
<td>.2043</td>
<td>.2070</td>
<td>.912</td>
</tr>
<tr>
<td>4</td>
<td>55621.09</td>
<td>56085.86</td>
<td>55850.72</td>
<td>715.85</td>
<td>.0454</td>
<td>.0463</td>
<td>.905</td>
</tr>
<tr>
<td>5</td>
<td>55314.40</td>
<td>55917.35</td>
<td>55612.30</td>
<td>350.69</td>
<td>.2239</td>
<td>.2253</td>
<td>.908</td>
</tr>
<tr>
<td>6</td>
<td>55117.64</td>
<td>55858.77</td>
<td>55483.82</td>
<td>240.76</td>
<td>.7248</td>
<td>.7250</td>
<td>.901</td>
</tr>
</tbody>
</table>

Note: AIC=Aikie Information criteria  BIC= Bayesian Information Criteria, VLMR=Vuong-Lo-Mendell-Rubin Likelihood Ratio test
Figure 1a.
Growth trajectories based on CES-D (short form) scores over 3 (two-yearly) time points.
Table 3. Comparison of baseline demographic characteristics of respondents classified and not into depression trajectory classes.

<table>
<thead>
<tr>
<th></th>
<th>% of baseline Non-classified</th>
<th>% of All Trajectory classes</th>
<th>% of Class 1 Low Stable</th>
<th>% of Class 2 Mod. deteriorating</th>
<th>% of Class 3 Mod. improving</th>
<th>% of Class 4 High Stable</th>
<th>$X^2$ (df)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>44.5</td>
<td>46.1</td>
<td>49.4</td>
<td>35.5</td>
<td>32.0</td>
<td>36.9</td>
<td>62.81(3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Females</td>
<td>55.5</td>
<td>53.9</td>
<td>50.6</td>
<td>64.5</td>
<td>68.0</td>
<td>63.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age Group (Years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td>34.2***</td>
<td>44.9</td>
<td>44.5</td>
<td>39.5</td>
<td>49.8</td>
<td>52.5</td>
<td>9.76 (3)</td>
<td>.021</td>
</tr>
<tr>
<td>60-69</td>
<td>28.8***</td>
<td>35.0</td>
<td>35.7</td>
<td>32.8</td>
<td>32.5</td>
<td>31.1</td>
<td>3.25 (3)</td>
<td>.354</td>
</tr>
<tr>
<td>70-79</td>
<td>25.1***</td>
<td>16.8</td>
<td>16.7</td>
<td>21.7</td>
<td>14.5</td>
<td>13.9</td>
<td>7.05 (3)</td>
<td>.070</td>
</tr>
<tr>
<td>80+</td>
<td>11.9***</td>
<td>3.3</td>
<td>3.1</td>
<td>6.0</td>
<td>3.3</td>
<td>2.5</td>
<td>7.73 (3)</td>
<td>.052</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>37.8***</td>
<td>20.3</td>
<td>19.0</td>
<td>25.2</td>
<td>25.8</td>
<td>23.6</td>
<td>16.04 (3)</td>
<td>.001</td>
</tr>
<tr>
<td>Secondary</td>
<td>39.0**</td>
<td>42.3</td>
<td>42.7</td>
<td>41.2</td>
<td>37.8</td>
<td>48.8</td>
<td>5.88 (3)</td>
<td>.113</td>
</tr>
<tr>
<td>Tertiary</td>
<td>23.1***</td>
<td>37.4</td>
<td>38.3</td>
<td>33.6</td>
<td>36.5</td>
<td>27.6</td>
<td>8.11 (3)</td>
<td>.045</td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>40.7***</td>
<td>34.7</td>
<td>34.9</td>
<td>43.2</td>
<td>29.0</td>
<td>27.6</td>
<td>18.07 (3)</td>
<td>.001</td>
</tr>
<tr>
<td>Employed</td>
<td>30.1***</td>
<td>41.7</td>
<td>45.0</td>
<td>24.3</td>
<td>34.5</td>
<td>22.8</td>
<td>78.28 (3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Unemployed/sick/caring</td>
<td>29.3***</td>
<td>23.6</td>
<td>20.1</td>
<td>32.6</td>
<td>36.5</td>
<td>49.6</td>
<td>117.38 (3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Pain status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Often troubled by pain</td>
<td>35.6</td>
<td>34.9</td>
<td>29.3</td>
<td>53.3</td>
<td>53.3</td>
<td>73.2</td>
<td>226.50 (3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Limits usual daily activities</td>
<td>22.0***</td>
<td>18.8</td>
<td>13.4</td>
<td>36.9</td>
<td>34.8</td>
<td>57.7</td>
<td>312.09 (3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>valid N</strong></td>
<td>3173</td>
<td>3947</td>
<td>3123</td>
<td>301</td>
<td>400</td>
<td>123</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of sample in each class</td>
<td>100</td>
<td>79.1</td>
<td>7.6</td>
<td>10.1</td>
<td>3.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentages within the combined trajectory classes are compared to those not classified. * $p < .05$   ** $p < .01$   *** $p < .001$ (two-tailed).
Table 4

Mean scores (and standard deviations) at baseline on age, health difficulties, mobility, cognitive function, anxiety, stress, worry, loneliness, depression and levels of pain for trajectory classes and non-classified.

<table>
<thead>
<tr>
<th></th>
<th>Non-classified (missing on covariates)</th>
<th>Non-classified (missing CES-D data)</th>
<th>Trajectory Classes (combined)</th>
<th>Class 1 Low Stable</th>
<th>Class 2 Moderate Deteriorating</th>
<th>Class 3 Moderate Improving</th>
<th>Class 4 High Stable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at baseline (range 49-80)</td>
<td>62.62* (10.15)</td>
<td>65.36*** (10.02)</td>
<td>61.87 (8.29)</td>
<td>61.25 (8.24)</td>
<td>63.56 (8.82)</td>
<td>61.21 (8.11)</td>
<td>60.55 (7.99)</td>
</tr>
<tr>
<td>Health Conditions (range 0-4)</td>
<td>1.05 (1.09)</td>
<td>1.15 (1.17)</td>
<td>1.08 (1.08)</td>
<td>1.01 (1.04)</td>
<td>1.37 (1.16)</td>
<td>1.24 (1.19)</td>
<td>1.46 (1.33)</td>
</tr>
<tr>
<td>Mobility Difficulties (range 0-4)</td>
<td>.12 (.52)</td>
<td>.19*** (.69)</td>
<td>.10 (.44)</td>
<td>.06 (.32)</td>
<td>.20 (.57)</td>
<td>.21 (.64)</td>
<td>.60 (.10)</td>
</tr>
<tr>
<td>MOCA score (range 0-30)</td>
<td>24.52*** (3.71)</td>
<td>22.98*** (4.50)</td>
<td>25.40 (3.17)</td>
<td>25.50 (3.08)</td>
<td>24.92 (3.72)</td>
<td>25.16 (3.14)</td>
<td>24.59 (3.84)</td>
</tr>
<tr>
<td>Anxiety (range 0-21)</td>
<td>5.57 (3.64)</td>
<td>5.57 (3.84)</td>
<td>5.31 (3.57)</td>
<td>4.67 (3.13)</td>
<td>7.04 (3.71)</td>
<td>7.56 (3.82)</td>
<td>10.08 (4.63)</td>
</tr>
<tr>
<td>Perceived stress (range 0-16)</td>
<td>4.52*** (3.15)</td>
<td>4.81*** (3.17)</td>
<td>3.92 (3.05)</td>
<td>3.30 (2.69)</td>
<td>5.53 (3.17)</td>
<td>6.22 (2.92)</td>
<td>8.37 (3.17)</td>
</tr>
<tr>
<td>Worry (range 8-40)</td>
<td>16.20* (8.06)</td>
<td>16.16* (8.34)</td>
<td>15.52 (7.43)</td>
<td>14.19 (6.41)</td>
<td>19.44 (8.59)</td>
<td>20.19 (8.52)</td>
<td>24.75 (8.66)</td>
</tr>
<tr>
<td>Loneliness (range 0-10)</td>
<td>2.04*** (2.20)</td>
<td>2.28*** (2.38)</td>
<td>1.75 (2.06)</td>
<td>1.30 (1.66)</td>
<td>2.91 (2.19)</td>
<td>3.52 (2.38)</td>
<td>4.70 (2.82)</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------</td>
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<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1549</td>
<td>1624</td>
<td>3947</td>
<td>3123</td>
<td>301</td>
<td>400</td>
</tr>
<tr>
<td><strong>Depression</strong></td>
<td></td>
<td>.308</td>
<td>.325</td>
<td>.362</td>
<td>.390</td>
<td>1.12</td>
<td>1.16</td>
</tr>
<tr>
<td>(range 0-24)</td>
<td></td>
<td>(3.87)</td>
<td>(3.95)</td>
<td>(3.62)</td>
<td>(3.90)</td>
<td>(1.12)</td>
<td>(1.16)</td>
</tr>
<tr>
<td><strong>Pain level</strong></td>
<td></td>
<td>.71</td>
<td>.73</td>
<td>.66</td>
<td>.53</td>
<td>1.05</td>
<td>1.11</td>
</tr>
<tr>
<td>(range 0-3)</td>
<td></td>
<td>(1.07)</td>
<td>(1.06)</td>
<td>(0.99)</td>
<td>(0.90)</td>
<td>(1.12)</td>
<td>(1.16)</td>
</tr>
<tr>
<td><strong>Ageing perceptions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Timeline</strong></td>
<td></td>
<td>.04</td>
<td>.15</td>
<td>-.08</td>
<td>-.16</td>
<td>.14</td>
<td>.20</td>
</tr>
<tr>
<td>(range -1.37 – 2.29)</td>
<td></td>
<td>(.69)</td>
<td>(.73)</td>
<td>(0.63)</td>
<td>(0.60)</td>
<td>(0.65)</td>
<td>(0.65)</td>
</tr>
<tr>
<td><strong>Consequences (Positive)</strong></td>
<td></td>
<td>-.01</td>
<td>-.08</td>
<td>.04</td>
<td>.06</td>
<td>-.02</td>
<td>-.04</td>
</tr>
<tr>
<td>(range -2.47 – 1.06)</td>
<td></td>
<td>(.61)</td>
<td>(.61)</td>
<td>(.55)</td>
<td>(.54)</td>
<td>(.54)</td>
<td>(.56)</td>
</tr>
<tr>
<td><strong>Consequences (Negative)</strong></td>
<td></td>
<td>.05</td>
<td>.17</td>
<td>-.09</td>
<td>-.18</td>
<td>.21</td>
<td>.24</td>
</tr>
<tr>
<td>(range -1.71 – 2.36)</td>
<td></td>
<td>(.74)</td>
<td>(.77)</td>
<td>(.68)</td>
<td>(.65)</td>
<td>(.65)</td>
<td>(.68)</td>
</tr>
<tr>
<td><strong>Control (Positive)</strong></td>
<td></td>
<td>-.05</td>
<td>-.10</td>
<td>.06</td>
<td>.07</td>
<td>-.02</td>
<td>.05</td>
</tr>
<tr>
<td>(range -2.73 – 1.01)</td>
<td></td>
<td>(.63)</td>
<td>(.70)</td>
<td>(.59)</td>
<td>(.59)</td>
<td>(.61)</td>
<td>(.50)</td>
</tr>
<tr>
<td><strong>Emotional Representation</strong></td>
<td></td>
<td>.04</td>
<td>.10</td>
<td>-.06</td>
<td>-.16</td>
<td>.23</td>
<td>.31</td>
</tr>
<tr>
<td>(range -1.33 – 2.45)</td>
<td></td>
<td>(.68)</td>
<td>(.71)</td>
<td>(.64)</td>
<td>(.59)</td>
<td>(.66)</td>
<td>(.66)</td>
</tr>
</tbody>
</table>

Note: Mean scores within the non-classified groups are compared to the combined trajectory classes. * p < .05  ** p < .01  *** p < .001 (two-tailed).
Table 5: Multinomial logistic regression predicting CES-D depression symptom trajectory classes as a function of baseline characteristics.

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>Moderate Declining vs. Low Stable (reference)</th>
<th>Moderate Improving vs. Low Stable (reference)</th>
<th>High Stable vs. Low Stable (reference)</th>
<th>Moderate Declining vs. High Stable (reference)</th>
<th>Moderate Improving vs. High Stable (reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exp ($B$)</td>
<td>$p$</td>
<td>Exp ($B$)</td>
<td>$p$</td>
<td>Exp ($B$)</td>
</tr>
<tr>
<td>Age in years</td>
<td>1.004 (.014)</td>
<td>.771</td>
<td>0.992 (.012)</td>
<td>.513</td>
<td>0.999 (.021)</td>
</tr>
<tr>
<td>Female (reference male)</td>
<td>1.484 (.25)</td>
<td>.053</td>
<td>1.892 (.296)</td>
<td>.003</td>
<td>1.685 (.472)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>Reference</td>
<td>-</td>
<td>-</td>
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<td>.705</td>
<td>0.731 (.143)</td>
<td>.060</td>
<td>1.315 (.448)</td>
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<td>Tertiary</td>
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<td>.759</td>
<td>1.016 (.211)</td>
<td>.938</td>
<td>1.402 (.598)</td>
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<td>Employment status</td>
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<tr>
<td>Unemployed</td>
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<td>1.243 (.251)</td>
<td>.334</td>
<td>2.084 (.874)</td>
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<tr>
<td>Retired</td>
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<td>1.654 (.293)</td>
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<td>2.654 (.892)</td>
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<td>No. of health conditions</td>
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<td>.297</td>
<td>1.063 (.076)</td>
<td>.406</td>
<td>1.168 (.130)</td>
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<td>No. of mobility impairments</td>
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<td>.002</td>
<td>1.301 (.081)</td>
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<td>1.312 (.136)</td>
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<td>Pain limits activities</td>
<td>1.879 (.352)</td>
<td>.012</td>
<td>1.756 (.282)</td>
<td>.007</td>
<td>3.841 (1.221)</td>
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<td>Cognitive function</td>
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<td>1.031 (.027)</td>
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<td>1.015 (.043)</td>
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<td>Perceived Stress</td>
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<td>1.195 (.037)</td>
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<td>1.417 (.079)</td>
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<td>Timeline</td>
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<td>0.841 (.221)</td>
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<td>Consequences (negative)</td>
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<td>1.016 (.434)</td>
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<td>1.245 (.282)</td>
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<td>1.313 (.490)</td>
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Notes: Effective sample size was 3947 after listwise deletion of missing data on X variables. Reference category was the low stable group and high stable group. Figures in brackets are standard errors. ADL= Activities of daily living; HADS = Hospital Anxiety and Depression score (anxiety component only); UCLA = University College of California, Los Angeles Short Loneliness Scale.