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Trajectories in mental health and socio-spatial conditions in a time of economic recovery and austerity: a longitudinal study in England 2011-17.

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Trajectories in mental health and socio-spatial conditions in a time of economic recovery and austerity: a longitudinal study in England 2011-17.

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Abstract

This paper examines trends in mental health among adults in England during the period of economic recovery and austerity following the 2008 'great recession'. We report analysis of data on 17,212 individuals living in England, from the longitudinal *Understanding Society Survey* (USS). We examined how individual's self-reported mental health over time (2011 -2017), related to their changing socio-geographical status.

Self-reported mental health is reported in the USS using version 2 of the SF12 Mental Component Summary. Trends in this score (across 5 observations per subject) were categorised into *Mental Health Trajectory Groups* (MHTGs) using Group Based Trajectory Modelling. We used maximum-likelihood multinomial logit models to estimate for individuals the relative likelihood of belonging to different Mental Health Trajectory categories as compared with a 'base' category, for whom mental health was good and stable throughout the period. We focus on likelihood of belonging to a group showing 'declining' mental health. Predictor variables included individuals' attributes and area conditions in their places of residence (including Office of National Statistics indicators of local employment deprivation and data on average income loss within districts due to welfare benefit reforms, published by the Centre of Regional Economic and Social Research at Sheffield Hallam University, UK).

Our results emphasise the multiple socio-geographical 'determinants' likely to be operating on individual mental health. Declining mental health was associated both with conditions at the start of the study period and with social and socio-geographical mobility by the end of the study period. Risks of declining mental health were significantly greater for more deprived individuals and also (controlling for individual attributes) among those living in English neighbourhoods that were already economically disadvantaged at the beginning of the 'great recession' and located in districts where average incomes were most severely impacted by the effects of governmental austerity programmes on welfare benefits.

Keywords

mental-health

England

austerity

deprivation

geography

mobility

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Introduction

This paper contributes to a growing body of research focussing on how health relates to changes over the life course of people and of the places where they live (e.g.: Pearce, 2018; van Lenthe and Mackenbach, 2004; Tunstall et al, 2014; Lund and Cois, 2018). We report below on a study in England of social and economic risk factors associated with change in individuals' mental health, during the period 2011-2017; a time of economic stress and austerity in public welfare expenditure following the 'great recession' that began in 2008.

We analysed data on 17,212 individuals living in England, drawn from the Understanding Society Survey (USS) (ISER, 2019a) (a national, longitudinal cohort study) and linked to indicators of conditions in the areas where they lived. Using data on self-reported mental health, we identified 5 groups of individuals with different mental health 'trajectories', recorded across five USS survey waves. We focussed especially on two of these groups; one reporting continuously stable, good mental health and another reporting initially good mental health which then deteriorated over time.

Drawing on the literature summarised below, we identified socio-economic risk factors which might theoretically be expected to show associations with these mental health trajectories. These included conditions in the places where sample members were living and individuals' own demographic, social and economic attributes. We focussed especially on how unemployment and impacts of welfare benefit reforms in places of residence were associated with mental health. We also included in the

models indicators of social and geographical mobility. We tested these as predictors of the mental health trajectories identified in our study sample.

We report findings that contribute particularly to the important debates concerning the mental health impacts of ~~recession~~ gradual economic recovery and austerity following recession, and the psychological outcomes associated with ‘upward’ and ‘downward’ social and geographical mobility of individuals.

Background: the theoretically complex relationships between socio-geographical status, socio-spatial mobility and mental health

Our study design was informed by published research, summarised below, which demonstrates links between mental health of individuals, and the socio-economic attributes of the places where they live, as well as their personal socio-economic status. Some of this research includes studies of how *changes* in mental health relate to socio-geographical mobility of individuals and to change in wider determinants of mental health in the areas where they live.

Conditions in places as factors associated with mental health

A large body of research in health geography, reviewed in a series of geographical texts (Jones and Moon, 1987; Philo, 2005; Parr, 2008; Curtis 2010) has focussed on people’s mental health and how it is associated with the *places* where they live. The literature referenced below shows that at a particular point in time, we may expect an individual’s mental health to relate to various aspects of their local neighbourhood and the wider geographical area where they live.

Most studies in these geographical texts indicate that risk of mental illness is worse in more socio-economically disadvantaged neighbourhoods than in more advantaged

1 areas. More recent studies, relating to local variation in mental illness and mental
2 health care in England, in the period since 2010, also report positive associations
3 between risk of mental illness, rates of mental health care use and area deprivation
4 (White et al, 2014; Remes et al, 2019, Keown et al, 2016). Anselmi et al. (2020) have
5 suggested that small area indicators based on receipt of welfare benefits by people
6 who are unemployed would be relevant for measuring geographical variation in need
7 for care.
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10 Within countries, differences are also observed in population health at the broader
11 regional level, which may partly reflect variations in regional economic development,
12 employment opportunities and impacts of policy interventions at this scale. In the
13 English context, these are sometimes referred to in terms of the 'north/south divide',
14 since populations in northern regions of England are more disadvantaged on a number
15 of health indicators than populations in the south of the country (Wilkinson et al., 2008;
16 Baker 2019). In addition, socio-economic systems at the national scale may affect
17 mental health. The relationship between personal socio-economic position and
18 physical and mental health is known to be variable internationally, depending on the
19 welfare provisions made at the level of the state (Copeland et al, 2015) and the degree
20 of socio-economic inequality at national scale (Wilkinson and Pickett, 2009).
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23 Research also suggests that population mental health varies according to other area
24 attributes, which may be distinct from socio-economic conditions. Notably some
25 research points to differences between more urban versus more rural localities (Levin
26 and Leyland, 2005; Paykel et al., 2000; Harriss and Hawton, 2011; Fontanella et al.,
27 2015). Some population health indicators (such as suicide rates) suggest worse
28 mental health in extremely isolated rural places in the UK, as well as more urban areas
29 (Allan et al. 2017; Levin and Leyland, 2005). However, in general, rural settings may
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1 be more beneficial than urban environments for mental health and sense of wellbeing
2 (Weich et al. 2006), partly because the highest levels of socio-economic disadvantage
3 are concentrated in urban areas (Paykel et al., 2000).
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7 **Change over the lifecourse of places**

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10 Research on population mental health inequalities viewed across time is also
11 increasingly focussing on how *changes* in socio-economic determinants operating at
12 the area level relate to health outcomes over time (Pearce, 2018; Pearce et al., 2018).
13 This takes a lifecourse perspective on *places* as well as *people*.
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21 Of particular relevance for this study is literature suggesting that mental health may be
22 strongly impacted by changing socio-geographical factors during ‘critical periods’ in
23 wider society, such as a downturn in economic conditions affecting whole communities
24 as well as the economic fortunes of individuals. Research in Scotland (Curtis, [Pearce](#)
25 et al, 2019) has shown that rates of deterioration in labour market conditions at district
26 level during the ‘great recession’ [and subsequent period of economic austerity](#) varied
27 geographically in ways that were statistically associated with worsening individual
28 mental health, after allowing for a range of other risk factors. In England, economic
29 impacts of the recession were also geographically variable [and research suggests that](#)
30 [deteriorating self-reported health \(not specific to mental health\) in the period 2001-11](#)
31 [was associated with changing labour market conditions 2007-11 \(Curtis, Norman et](#)
32 [al, 2019\).](#)
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51 At regional level, the worst [economic](#) effects [of recession](#) were felt in northern regions
52 where employment relies heavily on more traditional industries and public services
53 (Martin et al, 2016). These include the West Midlands region, which saw the most
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1 rapid growth in unemployment (House of Commons, 2010; Bailey and Berkeley,
2 2014).
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5 Also, subsequent to the 'great recession', reduced government spending on
6 programmes that support socio-economically disadvantaged groups have particularly
7 affected more deprived areas and are theoretically likely to exacerbate socio-
8 geographical health inequalities (Barr et al., 2015; Bambra et al., 2019). Beatty and
9 Fothergill (2016) have published data showing how the impact of these reforms on
10 incomes varied across Local Authority Districts in England.
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20 **Social and gGeographical mobility and mental health** 21 22 23

24 The associations between area level health determinants and changes in mental
25 health are likely to operate in complex ways, partly because individuals may be mobile
26 across space. Residential mobility from an area with lower risk to a place where the
27 environment is more detrimental for mental health might give rise to a new case of
28 mental illness. This pattern of migration also may be associated with other difficult life
29 events for the individual, causing them to develop mental illness (Tunstall et al., 2015).
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39 It is also important to consider that changes in mental health may give rise to
40 residential mobility, due to processes of health selective migration and drift (Norman,
41 2018). Those already suffering from deteriorating mental health may be at greater risk
42 of 'downward' residential mobility to more deprived areas (Maheswaran et al., 2018).
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49 For example, Wilding et al (2018) used longitudinal population survey data from the
50 *British Household Panel Survey* and its sequel, the *Understanding Society Survey* to
51 analyse residential migration between survey waves and how this was predicted by
52 various individual variables, including mental health. They concluded that those who
53 were residentially mobile, but would have preferred not to move, were more likely to
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1 have poor mental health. Also, among those with poor mental health, the probability
2 of moving between survey waves was greater if they had been living in areas where
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4 people in good mental health were more residentially stable between survey waves.
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6 This supported the idea of 'health selective' migration, especially when migration may
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8 not be a positive choice for the individuals involved.
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12 Other international research focuses on change in individual mental health over time
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14 as the outcome variable. This also demonstrates that health selective migration may
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16 help to explain associations between individual mental health and area level conditions
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18 (Dauncey et al., 1993; Moorin et al., 2006; Tunstall et al. 2014; Tunstall et al. 2015;
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20 van Lenthe and Mackenbach, 2004; Dartington-Pollock et al, 2018; Lund and Cois,
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22 2018).
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31 **Individual attributes as socio-economic determinants of mental health**

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34 We also considered the following literature showing how mental health may be
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36 associated with *individual risk factors* and *personal social mobility*. In addition to
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38 information about places, geographical studies of mental health variations in adult
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40 populations need to consider this wider literature on mental health differences
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42 associated with *individual* attributes. These include gender, age, ethnicity, marital
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44 status, housing tenure and socio-economic position (as measured by occupational
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46 class, income, and employment status). It is well established in the literature on
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48 inequalities in mental health that, at any particular point during a person's lifecourse,
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50 contemporaneous differences in socio-economic position are likely to be associated
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52 with differences in mental health. For example, Patel et al (2010) reported from an
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54 international review clear evidence that gender, household composition and
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disadvantage in terms of socio-economic position, and income are determinants of mental health. Daghler et al. (2015) report gender differences in mental health of the population of the USA during and after the great recession, finding that women were more likely than men to suffer anxiety in the post-recession period. An empirical study in England (Anselmi et al, 2020) reports that age group, living alone, and ethnic group were among the factors predicting medical treatment for mental illnesses. Public Health England (2018) also reports on inequalities in mental health between ethnic groups in the English population. A recent review showed that housing tenure and housing quality are also important for mental health (Singh et al.,2019).

Individual social mobility and mental health

Many studies (especially in sociology and economics), have interpreted social mobility in terms of changes in individual, occupationally-defined, social class position and/or income (Goldthorpe et al., 1987). Research suggests that 'downward' mobility is likely to be related to worse mental health. In a study based on the British city of Newcastle, Tiffin et al. (2005) found that amongst men (but not women), risk of reporting a mental illness was associated with downward social mobility. Similar findings are reported in a study in Belgium (Daenekindt, 2017). While the *actual experience* of downward socio-economic mobility is likely to be linked to worsening health, it may also be the case that the *prospect* of downward mobility (e.g. the threat of redundancy or reduction in income) may cause stresses that are detrimental to mental health, even before such changes become a reality (Curtis, [Pearce](#) et al. 2019; Benach et al., 2014; De Moortel et al, 2017; Dirlam and Zheng, 2017).

It is also interesting to consider whether 'upward' mobility in terms of social class is beneficial for outcomes such as mental health. Some research suggests that this

1 may be the case for some upwardly mobile individuals, but not for others. Some
2 individuals who are upwardly socially mobile, especially from initially very
3 disadvantaged levels, may find the process stressful as they confront barriers ('class
4 ceilings') to social integration in their new social settings, and this may create
5 stresses, at home, or in the workplace, which may be harmful to mental health
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7 (Friedman, 2014; Savage et al., 2015; Friedman et al., 2015; Friedman and Laurison,
8 2019). This may explain results from a Swedish cohort study of individuals born in
9 the decade between 1949 and 1959 (Tikkaja et al., 2013) showing that although
10 there was a significant association between upward social mobility and reduced risk
11 of psychiatric disorder, this relationship was weaker for men starting in the most
12 disadvantaged groups.
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27 Other research suggests that individual upward socio-economic mobility can be
28 promoted by residence in (generally more affluent) 'escalator regions' (Fielding, 1992)
29 where individuals have the best opportunities of promotion up the socio-economic
30 ladder. This might be expected to be beneficial for other outcomes such as mental
31 health. However, a rich strand of work is emerging (Miles and Leguina, 2018; Toft,
32 2017), suggesting that migration to escalator regions may, in some cases, be
33 coincident with other events in the lifecourse, undermining any psychological benefits
34 of such socio-geographic mobility (e.g. family/relationship break-up, or problems of
35 access to housing).
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50 **Aims of our research**

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53 Given these complex potential links between changing socio-geographical conditions
54 and mental health, there is considerable scope to extend research on geographies of
55 mental health using a temporal, as well as socio-spatial perspective. In this paper we
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1 focus on the situation in England during the period 2011-2017, which was one of
2 economic 'recovery' from the great recession, when employment rates had not
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4 regained pre-recession levels and the UK government introduced a suite of austerity
5 measures intended to reduce public spending.
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10 Using longitudinal data from a large sample of the English population (extracted from
11 the USS), we compared individuals with declining mental health with those in
12 continuously good health, during the period of 'recovery and austerity' in England
13 following the 'great recession'. Our research addressed the following specific research
14 question:
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- 22 - *Was the risk of declining mental health greater for people living in areas that*
23 *were most deprived in terms of unemployment and also most impacted by*
24 *austerity policies (after controlling for other individual and area risk factors*
25 *indicated in the literature)?*
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35 Given the debates reviewed above concerning health selective mobility and drift, a
36 broader, secondary question of interest in our analyses was this:
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- 40 - *Did aspects of geographical and social mobility of individuals during the study*
41 *period relate to differences in their mental health trajectories?*
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46 **Methods**

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49 Our study analysed data on a subset of individuals in the USS (ISER, 2019a), a large,
50 long-established longitudinal annual panel survey of UK households. We studied
51 17,212 individuals aged over 16 at the start of the study period (2011) and living in
52 England, with full data on the variables of interest, collected between 2011 and 2017,
53 in survey waves 3 to 7 - see ISER (2019b) for details of the timing of the different
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survey waves. We note below, under ‘limitations’ of the study, proportions of the full USS sample excluded from our analysis due to attrition and missing variables across the survey waves studied. –As discussed below, the analytical sample is not exactly representative of the whole English population, but they do include residents from all regions of the country and from across the range of socio-economic conditions prevailing in more local areas.

We used information on individual’s self-reported mental health and other personal and family attributes, collected in successive survey waves over the period 2011 - 2017. These were linked with geographical information about the economic conditions prevailing in the places where they lived over the period studied.

The outcome variable: trends in mental health

Information on self-reported mental health has been collected at each wave of the USS and scored, using version 2 of the SF12 Mental Component Summary (MCS) functioning score (Ware et al 2001; ISER, 2020). The self-completed responses to survey questions were converted to a ‘normalised’ score ranging from 0 (low functioning; very poor mental health) to 100 (high functioning; very good mental health) (ISER, 2020).

Across the individuals studied, trends in this score between waves 3 and 7 of the survey (5 observations for each subject) were categorised into *Mental Health Trajectory Groups* (MHTGs) using Group Based Trajectory Modelling (GBTM) software designed for use in Stata programming (Jones and Nagin, 2013, Nagin et al, 2018; Franklyn et al., 2013). GBTM is a finite mixture modelling technique using trajectory groups to represent latent trajectories across subjects in longitudinal studies.

We selected the GBTM model specification used for our analysis based on the Bayesian Information Criterion (BIC) which was compared between trajectory models with varying numbers of categories. (The BIC is here defined as the maximum likelihood value minus half the parameter total, multiplied by the logarithm of the sample size, so that higher BIC values indicate better model fit.) We found that a model with six groups has a higher (less negative) BIC than for a smaller number of groups. The choice of GBTM model specification aims also at parsimony and interpretability, considering the extent to which the classification distinguished clearly differing trends in reported mental health. Based on these criteria, the results reported here are derived from a GBTM model which classifies trends in mental health into the six categories shown in Figure 1, which also contains group membership shares (posterior classification probabilities times 100).

In this paper we focus particularly on individuals in two of these mental health trajectory groups (MHTGs):

- MHTG 6 – those who reported *consistently high* levels of mental health functioning across all waves, treated as the reference group and accounting for about 47% the entire sample; and
- MHTG 3 – those who initially reported relatively good mental health, but from wave 4 onward reported *declining mental health* across the waves – just under 8% of the sample.

The outcome variable in our analysis is the risk of being in MHTG 3 compared with MHTG 6.

The other four MHTGs shown in Figure 1 comprised those with mental health that was either: consistently improving (MHTG 4); continuously poor (MHTG 1); or stable at

intermediate levels (MHTGs 2 and 5). These are less clearly relevant to the research question of interest here regarding the risk of *worsening mental health* in the *wake period* of *'economic recovery' following* the 'great recession'. However, we make brief reference below to the results of models comparing MHTGs 1,2,4 and 5 with group 6.

Predictor variables

The predictor variables in our analyses included indicators categorising the person's geographical area of residence and their individual or family status. (Table A [Electronic Appendix] lists the categorisation and derivation of these variables).

Geographical variables in the models categorise socio-geographic aspects of the place of residence for each individual at wave 4. These variables were selected in light of our review of the literature (summarised above) and also based on preparatory analyses which tested the significance of their associations with the MHTG outcomes of interest. The indicators were chosen to capture the socio-economic impact of local unemployment levels at the start of the recession and the impacts of district level austerity measures during the *subsequent* recovery period, while controlling for local urban-rural differences and broad regional variations that might not be fully captured at the more local scale.

The geographical predictors are indicators for areas defined at various geographical scales. Lower-Level Super Output Areas (LSOAs), which, in England as a whole, total 32,844 small areas, ranging from 1,000-3,000 in total population size, are used to organize and publish data from the population census and other sources. They are taken here to indicate 'neighbourhood' conditions. We also included information relating to Local Authority District (LAD) areas in England, which are larger geographical units corresponding to administrative areas of local government at which

1 service provision is organized and welfare benefit reforms are implemented. Our
2 sample relates to 317 LADs in total, with resident populations in 2011 ranging from
3 approximately 35,000 to 1,000,000. At a broader geographical scale, information on
4 Government Region of residence was also used since some political and economic
5 processes operate at a larger scale and some published literature has used these
6 units to study geographical inequalities. We identified the person's place of residence
7 within one of 9 Government Regions across England.
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18 At the scale of the LSOA where each sample member was resident at USS wave 4,
19 we used as an indicator of area socio-economic deprivation the Employment domain
20 of the Index of Multiple Deprivation 2010 (Ministry of Housing Communities and
21 Local Government, 2011). The Employment Domain is based on data on receipt of
22 welfare benefits for unemployed residents in 2008 ~~around~~ coincident with the start of
23 the economic recession (published on behalf of the Office of National Statistics by
24 NOMIS (NOMIS ONS, 2011). This indicator was selected to capture the level of
25 disadvantage in the labour market at the onset of the 'great recession'. The
26 individual's LSOA of residence at USS wave 4 was categorised according to national
27 quintile ranking of the Employment Domain score. Most disadvantaged areas were
28 ranked 5 and least disadvantaged ranked 1. Our ranking is based on disadvantage
29 scores published by ONS, although readers may wish to note that some rankings
30 published by ONS use the reverse order, with most disadvantaged areas ranked 1.
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50 We classified the LAD of residence for sample members in quintiles using an indicator
51 developed by Beatty and Fothergill (2016), which classifies LADs by average income
52 loss per person of working age due to government 'Welfare Reforms' up to 2015. This
53 is relevant to our research because it captures statistically the 'population level'
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economic impacts of welfare reform. However, we note that it probably does not capture all the wider social manifestations of austerity impacts.

Since differences in population mental health between urban and rural areas have been reported in the literature (as explained in the background section above), area of residence at the scale of LSOAs was also categorised according to the 2011 rural-urban classification (ONS, 2019). In our preliminary analysis, these were summarised to distinguish between: conurbations, urban areas in cities and towns, settlements in and around smaller 'rural towns' and rural villages and dispersed settlements. We found that living in or near smaller towns in rural areas, compared with all other areas, showed the clearest association with the outcome, so our final model used a binary indicator of residence in this type of area vs other types of area.

In addition to differences at the scale of LSOA and LAD, we found that risks of the mental health outcome of interest varied regionally, especially between individuals living in the West Midlands (which includes the city of Birmingham, one of the major conurbations in England and its surrounding area) and other regions. Research conducted at the University of Warwick (Institute for Employment Research, 2009) shows that this region was particularly badly affected by the recession. This relationship was independent of the other geographical and individual variables tested [in our analysis](#), so we have used an indicator which distinguishes between the West Midlands and other regions.

For each geographical variable, we also generated an additional indicator showing whether the person had moved to a location in a different category during the period between wave 4 (data collected at a date between 2012 and 2014) and wave 7 (2015-17). We compared those who, at both waves, were living in areas classed in the same

category with ‘movers’ migrating to an area in a different category. For ‘movers’, we distinguished between those undergoing ‘upward’ residential mobility (to an area where conditions were theoretically likely to be more beneficial for mental health) and those with ‘downward’ mobility (to areas where conditions might be more detrimental).

Individual and family attributes considered in the analysis were the variables listed below. These were selected as likely to be relevant, based on our review of the background literature above, and showed significant associations with the mental health outcomes considered here. (The categories are summarised in Table 1 and details of the variable definitions are shown in [\[Table A: supplementary material\]](#) ~~[electronic appendix]~~:

- sex;
- age group (in 10 year categories);
- self-identified ethnic group (in broad categories);
- whether the person lived with a partner;
- occupational social class;
- income in the month prior to interview;
- employment status;
- housing tenure at wave 4, distinguishing between outright home owners and those who were renting or paying mortgages on their homes
- being in receipt of welfare benefits at wave 4 (other than child benefits and state pensions, which are rather ‘universal’ benefits for parents or older people and are not related to socio-economic disadvantage).

To capture socio-economic mobility, we also included in the models information on *changes* in socio-economic position between survey wave 4 and wave 7 (See Table

1 A). These relate to change in the individual's social class, income, employment,
2 tenure, and receipt of welfare benefits. For each of these attributes, we compare those
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4 for whom there was no change with others experiencing changes that might
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6 theoretically be likely to alter the risks of declining mental health. We distinguished
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8 between changes suggesting 'deteriorating' social conditions, likely to increase the
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10 risk of being in MHTG 3, and 'improving' socio-economic conditions that might
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12 theoretically be expected to reduce the risk of membership of MHTG 3. [Table A also](#)
13
14 [includes information on the percentage of the analytical sample in the different variable](#)
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16 [categories. \(To protect the confidentiality of respondents, avoiding any risks of](#)
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18 [disclosure, these data are summarised as whole percentage figures and some details](#)
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20 [relating to small percentages are withheld.\)](#)
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27 Method of analysis

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30 Our analysis used the 'mlogit' command in Stata to fit maximum-likelihood multinomial
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32 logit models, estimating for individuals the relative likelihood of belonging to one of the
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34 Mental Health Trajectory Groups (MHTG) 1 – 5 shown in Figure 1, as compared with
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36 MHTG 6, the 'base' category.
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41 Our preliminary analyses showed that area-level indicators based on employment
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43 deprivation and average income loss per person of working age due to government
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45 'Welfare Reforms ' both showed significant positive associations with relative risk of
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47 the mental health outcome (MHTG 3) when included separately in the analytical
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49 model. However, these indicators are intercorrelated and did not show an
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51 independently significant association with the mental health outcome of interest when
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53 both were included.
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We therefore generated a composite indicator of 'area economic disadvantage' for the study sample by summing the quintile ranks of area of residence on 'employment deprivation' and 'average loss of income due to welfare reforms', and producing a composite economic disadvantage score ranging from 2-10. This was summarized into two categories: those scoring 2-5 (lower disadvantage; 44% of the total) and those scoring 6-10 (greater disadvantage; 56%). These categories were chosen because, as shown in Figures 2 and 3, they distinguish between those in areas more affected by both employment deprivation at the start of the time of post-recession recession/recovery and austerity impact during the period studied (predominantly ranking in quintiles 3 to 5 on both of the components), and other areas which were less disadvantaged on both components (mainly ranking in quintiles 1-2).

Below we report on our findings that show how the likelihood of being in MHTG 3, compared with MHTG 6, varied in relation to individual and area predictor variables. Results are reported as adjusted odds ratio (AOR) coefficients and 95% confidence intervals. Statistical significance was defined as 'P' values lower than 0.05 (shown in bold text in Table 1).

Results

The results in Table 1 (part 1) show how the probability of membership of MHTG 3 vs. MHTG 6 relates to attributes of area of residence at waves 4 and 7 (controlling for relationships with personal characteristics, discussed below). Those living at wave 4 in localities with a higher economic disadvantage score (indicating greater disadvantage) had significantly higher relative risk of being in MHTG 3 vs MHTG 6 than those in areas with a lower economic disadvantage score.

Also, living in a small town within a rural region at wave 4 was negatively associated with risk of being in MHTG 3 vs. MHTG 6. Those living in the West Midlands, as compared with other parts of England, were more likely to be in MHTG 3, relative to MHTG 6.

Considering residential mobility, those who, between wave 4 and 7, moved to an area of higher employment deprivation, measured on the IMD2010, and those moving to an area where loss of income due to welfare reforms was greater were significantly more likely to be in MHTG 3 than MHTG 6, compared with 'non-movers'. Also, those moving to an area where average loss of income due to welfare reforms was lower were comparatively less likely to be in MHTG 3. Movements between areas in different categories in terms of rurality or Government Region were not significant predictors of the MHTG 3 outcome.

The general impression from these results is that those in MHTG 3, with declining mental health, were particularly likely to be living in disadvantaged areas at the beginning of the period and/or to have been downwardly mobile to more deprived areas subsequently. The associations with area economic disadvantage are independent of other geographical and individual variables in the model.

Table 1 (part 2) shows that most individual variables included in the model were also associated with statistically significant differences in the probability of having declining mental health (MHTG 3) compared with constantly good mental health (MHTG 6).

Individual attributes raising the probability of *declining mental health* (MHTG 3) were:

- being female (compared with males);
- being in younger age groups (under 30 years) at wave 4 (as compared with those aged 30-39 years);

- not living with a partner at both wave 4 and 7, as compared with those who lived with a partner at both survey waves);
- being in receipt of welfare benefits (other than child benefits or state pensions) at wave 4 (compared with not receiving benefits in these categories);

People were less likely to be in MHTG 3, compared with MHTG 6, if they had the following attributes:

- being among older age groups, over 50 years at wave 4 (compared with those aged 30-39 years);
- (with borderline significance) being in social class 3 (small employers and own account workers) or Class 5 (semi-routine and routine workers) at wave 4 (compared with class 1 managerial and professional);
- being outright owners of their homes at wave 4 (compared with other tenures);
- having higher income at wave 4.

There were also significant associations with some indicators of *change* in individual socio-economic status. The relative probability of being in MHTG 3 vs MHTG 6 was positively associated with:

- living with a partner at wave 4 but not wave 7, (compared with those who lived with a partner at both survey waves);
- becoming unemployed between waves 4 and 7 (compared with being employed at both waves);
- moving onto welfare benefits between wave 4 and 7;
- (less significantly) being upwardly mobile between social class groups.

The probability of being in MHTG3 was also negatively associated with moving off welfare benefits from wave 4 to 7.

Supplementary Table B [Electronic Appendix] reports the complete results from the model, showing the results for other parts of the model which predict probability of being in MHTG 1, 2, 4 or 5, as compared with MHTG 6). This shows, for example, that people in MHTG 2 (a group with relatively low, slightly declining mental health throughout the period studied) were also more likely to have been living in an area of higher economic disadvantage. However, membership of MHTG 2 was not significantly associated with mobility between areas in different categories of employment deprivation and loss of income due to welfare benefits. MHTG 4 represents those whose mental health improved from a relatively low level in wave 4 to a higher level. These may include individuals in recovery from a period of mental illness. Compared with MHTG 6, those in MHTG 4 are more likely to be women, in 'Asian' ethnic groups, not in a long-term partnership, who were on lower incomes and receiving welfare benefits at some point during the study period. They were less likely to be in the older age groups, identifying in 'Black' ethnic groups or outright homeowners. The indicators describing place of residence were not significantly associated with membership of MHTG 4. Table B shows that individual variables relating to ethnic group and change in income from wave 4 to 7 were not significantly associated with membership of MHTG 3 but were significantly associated with membership of other MHTGs, so they were retained in the model.

Limitations

We acknowledge some limitations to these analyses, some of which might be interesting to address in future research.

The analysis is not intended to be exactly representative of the English population. We have not applied any weightings in respect of under- or over-representation of some groups in the original sample. (We note that some authors (e.g. Solon et al, 2015) raise doubts over whether such weighting is appropriate in studies such as this one). Although the USS data includes some methods for weighting to make the total survey sample more representative of Britain as a whole, these do not apply to the English sub-sample we have used. [To provide an approximate indication of how our study sample compares with the population of England as a whole, we include in \[Table C supplementary material\] some summary information on how attributes of the sample recorded at wave 4 compare with similar indicators for the population of England as a whole, recorded in the 2011 census. This suggests, for example, that in the analytical sample, as compared with the census population, there may be some 'over-representation' of women, those in older age groups, and people living with a partner. Those in social classes III, IV and V may be somewhat 'under-represented' relative to the census population.](#)

[Some of these disparities may be due to exclusion from](#) our analytical sample of individuals in the USS missing data on relevant variables. Some individuals also left the relevant USS cohorts during the study period, which might be due to failure of follow up, migration to a location outside England, or death during the study period (which may include mental health related mortality such as suicide). [Such omissions are indicated, for example, by the observation that our analytical sample includes 17,212 of the 36,221 individuals who responded, at least partially, to the USS in wave 4, at the start of the period studied. Also, the technical report on USS wave 4 published by the USS managers indicates that of households included in the wave 4](#)

sample, 82% responded fully or partially, and 84% of eligible adults in these households completed an individual interview (Jessop & Oskala 2014, p28).

More generally, in terms of methodological limitations, we note that cautions regarding latent growth models may be considered. A latent growth model may not be appropriate to all growth processes – such as when homogeneous pattern of change, albeit with variation around the central trend, is expected (Connell and Frye, 2006). Moreover, drawing causal inferences from latent growth models may need to be circumspect (Von Stumm and Plomin, 2015). From a technical viewpoint, the classification of individuals to particular latent trajectories are subject to uncertainty. On the other hand, confidence in inferences from the model in the present application is strengthened by the large sample size and by the interpretability of the findings against wider research evidence.

There may also be scope for further analysis to explore interaction effects between the predictor variables, which might further illuminate the complex ways that different area and individual variables may operate in their association with mental health.

Discussion

Our results suggest a complex pattern of risk factors associated with individuals' mental health trajectories during a period of slow economic recovery immediately following the 'great recession', at a time when a range of austerity measures were taking effect in the UK. Several different attributes of places as well as individuals show independent associations with decline in mental health in this large sample from England

Of particular interest in this paper is association with our composite indicator of area economic disadvantage (combining neighbourhood level employment deprivation at

the start of the recession and District level impact of subsequent welfare reforms), This suggests that relative risks of having declining mental health (MHTG 3 compared with MHTG6) were higher in areas where employment deprivation was greater, and governmental austerity measures on welfare benefits also impacted most severely on the District population. This result is evident after a number of individual risk factors are controlled for, including individuals' employment status and receipt of welfare support such as unemployment benefits. Thus, the association with the composite indicator of area economic disadvantage is apparently reflecting a 'contextual' mental health risk factor, which is, to a significant degree, independent of personal characteristics.

The finding that there was also higher risk of declining mental health for those in the West Midlands region seems likely to reflect the especially severe economic impacts of the 2008 onset of recession in this region (reviewed above). This seems to reinforce the conclusion that the impacts of economic recession and related austerity policy implementations aimed at fiscal recovery (affecting local neighbourhoods and wider districts) were significant for individual mental health.

Our models also allow for urban-rural and regional differences in risk and show that these attributes of areas may also relate to declining mental health. Those in small towns in rural settings have a lower relative risk of declining mental health. This result seems broadly consistent with other research on rural/urban differences in self-reported mental health outcomes reviewed above.

We also found that those who were 'downwardly mobile' between survey waves 4 and 7, moving to more economically disadvantaged areas, where unemployment deprivation had been greater at the start of the 'great recession' in 2008, or to areas

1 where average loss of income due to welfare reforms was relatively high, were more
2 likely to experience declining mental health during this period. A corollary of this
3 observation is that those who moved to areas where average incomes were *less*
4 severely impacted by welfare benefit reforms had a lower risk of being in MHTG 3
5 relative to MHTG 6, so this aspect of 'upward' socio-geographic mobility may have
6 been protective for mental health.
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15 The results also indicate significant associations between individual attributes and
16 declining mental health. We have noted that, independently of other variables in the
17 model, individuals on lower incomes and those who, between survey waves 4 and 7,
18 became unemployed or moved onto welfare benefits had a greater risk of declining
19 mental health (MHTG 3), while those who moved off welfare benefits were less likely
20 to be in MHTG 3 relative to MHTG 6. This finding supports other research,
21 summarised above, reporting links between mental health and change in personal
22 employment status, income and welfare dependency.
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35 For the most part, the associations between mental health trajectories and other
36 individual risk factors are to be expected, based on other literature. Exceptions include
37 our findings for social class groups, suggesting that those who, at wave 4 were in
38 Social Class 1 (professional and managerial social classes, generally considered to
39 be most advantaged in terms of health) did *not* show any advantage in terms of risk of
40 declining mental health (MHTG 3). At a weak ($p \leq 0.10$) level of statistical significance,
41 those in Classes 3 and 5 were *less* likely to have declining health than those in Class
42 1. Also, risk was *greater* for those who were upwardly mobile in terms of social class
43 between survey waves 4 and 7. This could be interpreted as part of the socially
44 'dislocating' or isolating impact of social mobility identified in sociological research.
45 Class origins early in life may be associated with different attitudes towards social
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mobility (Manstead, 2018). The Bourdieusian idea of ‘cultural capital’ (Bourdieu, 1985) suggests that confidence and knowledge regarding expected patterns of behaviour within one’s social group are important social assets. Those who have always lived in more privileged communities will have acquired these assets through early life experiences, such as education in more elite institutions, from which those who are upwardly mobile may have been excluded (SMC, 2019). The socially uneven potential to benefit from upward mobility in class position between and within generations is therefore recognised as being a key driver and indicator of inequalities between individuals and groups, which in turn, is likely to have mental health implications.

It is also possible that measures of social status based on occupational group may be less relevant as indicators of risk for mental health than indicators such as income, which, in our results, shows a strong negative association with the risk of being in MHTG 3 *versus* MHTG 6. It may be that the relationships between class and mental illness risks reported in some other studies do not control fully for income variation, and that class disparities can be largely explained by differences in income between social class categories. Our findings also lead us to speculate that (despite better prospects in terms of income) moving to a higher professional status causes stressful challenges, especially during an economic recession, which may damage mental health.

Conclusions

We conclude that individuals were significantly more likely to suffer declining mental health if they were living in neighbourhoods with high levels of employment deprivation at the start of the 2008 recession, and where impacts of subsequent welfare benefit reforms at the scale of Local Authority Districts were greatest. This association is

1 independent of the individual risk factors for mental health in our models. It is also
2 independent of urban rural disparities or broader regional variations. The introduction
3 of welfare reforms during the [economic](#) recovery period, affecting [a range of](#) benefits
4 that are especially important for disadvantaged communities, seems to have
5 compounded the mental health impacts of unemployment in local labour markets.
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11 Trends in mental health show significant associations both with conditions at the start
12 of the study period and with subsequent social and socio-geographical mobility by the
13 end of the period. Health selective socio-geographical mobility and effects of 'drift'
14 probably explain some, but not all, of the mental health inequalities observed. Thus,
15 our study also underlines the importance of considering mobility as a factor associated
16 with varying risk of declining mental health. However, individuals' socio-geographical
17 'starting point' [in the early stages of post-recession recovery](#) is significantly associated
18 with subsequent changes in their mental health. Our findings are consistent with the
19 idea that area disadvantage may have a causal effect in triggering decline in mental
20 health.
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37 Our findings regarding the complex nature of risk factors for declining mental health in
38 our study seem consistent with arguments that risk factors for individual mental health
39 outcomes are 'multi-scalar' and 'relational' (Macintyre et al, 2002; Cummins et al,
40 2007; Dahlgren and Whitehead, 1991), involving area processes linked to inequality,
41 mobility, health selective migration and drift, operating at local, district and regional
42 scales, in combination with individual attributes. These are very important during
43 critical periods such as economic recessions and, given continuing instability in global
44 economies, these topics would be interesting to examine further in future international
45 research.
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1 From an international perspective, this research also emphasises that studies of
2 mental health during the 'recovery and austerity' period, following on from the 'great
3 recession' of 2008-2009 should consider the locally variable impacts of government
4 welfare programmes, as well as impacts of changes in labour markets. Our findings
5 invite further international comparative research on mental health variation in relation
6 to changing individual and community conditions over time, as recommended, for
7 example, by Pearce (2018).
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Introduction

This paper contributes to a growing body of research focussing on how health relates to changes over the life course of people and of the places where they live (e.g.: Pearce, 2018; van Lenthe and Mackenbach, 2004; Tunstall et al, 2014; Lund and Cois, 2018). We report below on a study in England of social and economic risk factors associated with change in individuals' mental health, during the period 2011-2017; a time of economic stress and austerity in public welfare expenditure following the 'great recession' that began in 2008.

We analysed data on 17,212 individuals living in England, drawn from the Understanding Society Survey (USS) (ISER, 2019a) (a national, longitudinal cohort study) and linked to indicators of conditions in the areas where they lived. Using data on self-reported mental health, we identified 5 groups of individuals with different mental health 'trajectories', recorded across five USS survey waves. We focussed especially on two of these groups; one reporting continuously stable, good mental health and another reporting initially good mental health which then deteriorated over time.

Drawing on the literature summarised below, we identified socio-economic risk factors which might theoretically be expected to show associations with these mental health trajectories. These included conditions in the places where sample members were living and individuals' own demographic, social and economic attributes. We focussed especially on how unemployment and impacts of welfare benefit reforms in places of residence were associated with mental health. We also included in the

models indicators of social and geographical mobility. We tested these as predictors of the mental health trajectories identified in our study sample.

We report findings that contribute particularly to the important debates concerning the mental health impacts of gradual economic recovery and austerity following recession, and the psychological outcomes associated with ‘upward’ and ‘downward’ social and geographical mobility of individuals.

Background: the theoretically complex relationships between socio-geographical status, socio-spatial mobility and mental health

Our study design was informed by published research, summarised below, which demonstrates links between mental health of individuals, and the socio-economic attributes of the places where they live, as well as their personal socio-economic status. Some of this research includes studies of how *changes* in mental health relate to socio-geographical mobility of individuals and to change in wider determinants of mental health in the areas where they live.

Conditions in places as factors associated with mental health

A large body of research in health geography, reviewed in a series of geographical texts (Jones and Moon, 1987; Philo, 2005; Parr, 2008; Curtis 2010) has focussed on people’s mental health and how it is associated with the *places* where they live. The literature referenced below shows that at a particular point in time, we may expect an individual’s mental health to relate to various aspects of their local neighbourhood and the wider geographical area where they live.

Most studies in these geographical texts indicate that risk of mental illness is worse in more socio-economically disadvantaged neighbourhoods than in more advantaged

1 areas. More recent studies, relating to local variation in mental illness and mental
2 health care in England, in the period since 2010, also report positive associations
3 between risk of mental illness, rates of mental health care use and area deprivation
4 (White et al, 2014; Remes et al, 2019, Keown et al, 2016). Anselmi et al. (2020) have
5 suggested that small area indicators based on receipt of welfare benefits by people
6 who are unemployed would be relevant for measuring geographical variation in need
7 for care.
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10 Within countries, differences are also observed in population health at the broader
11 regional level, which may partly reflect variations in regional economic development,
12 employment opportunities and impacts of policy interventions at this scale. In the
13 English context, these are sometimes referred to in terms of the 'north/south divide',
14 since populations in northern regions of England are more disadvantaged on a number
15 of health indicators than populations in the south of the country (Wilkinson et al., 2008;
16 Baker 2019). In addition, socio-economic systems at the national scale may affect
17 mental health. The relationship between personal socio-economic position and
18 physical and mental health is known to be variable internationally, depending on the
19 welfare provisions made at the level of the state (Copeland et al, 2015) and the degree
20 of socio-economic inequality at national scale (Wilkinson and Pickett, 2009).
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23 Research also suggests that population mental health varies according to other area
24 attributes, which may be distinct from socio-economic conditions. Notably some
25 research points to differences between more urban versus more rural localities (Levin
26 and Leyland, 2005; Paykel et al., 2000; Harriss and Hawton, 2011; Fontanella et al.,
27 2015). Some population health indicators (such as suicide rates) suggest worse
28 mental health in extremely isolated rural places in the UK, as well as more urban areas
29 (Allan et al. 2017; Levin and Leyland, 2005). However, in general, rural settings may
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1 be more beneficial than urban environments for mental health and sense of wellbeing
2 (Weich et al. 2006), partly because the highest levels of socio-economic disadvantage
3 are concentrated in urban areas (Paykel et al., 2000).
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7 **Change over the lifecourse of places**

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10 Research on population mental health inequalities viewed across time is also
11 increasingly focussing on how *changes* in socio-economic determinants operating at
12 the area level relate to health outcomes over time (Pearce, 2018; Pearce et al., 2018).
13 This takes a lifecourse perspective on *places* as well as *people*.
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21 Of particular relevance for this study is literature suggesting that mental health may be
22 strongly impacted by changing socio-geographical factors during ‘critical periods’ in
23 wider society, such as a downturn in economic conditions affecting whole communities
24 as well as the economic fortunes of individuals. Research in Scotland (Curtis, Pearce
25 et al, 2019) has shown that rates of deterioration in labour market conditions at district
26 level during the ‘great recession’ and subsequent period of economic austerity varied
27 geographically in ways that were statistically associated with worsening individual
28 mental health, after allowing for a range of other risk factors. In England, economic
29 impacts of the recession were also geographically variable and research suggests that
30 deteriorating self-reported health (not specific to mental health) in the period 2001-11
31 was associated with changing labour market conditions 2007-11 (Curtis, Norman et
32 al, 2019).
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51 At regional level, the worst economic effects of recession were felt in northern regions
52 where employment relies heavily on more traditional industries and public services
53 (Martin et al, 2016). These include the West Midlands region, which saw the most
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rapid growth in unemployment (House of Commons, 2010; Bailey and Berkeley, 2014).

Also, subsequent to the 'great recession', reduced government spending on programmes that support socio-economically disadvantaged groups have particularly affected more deprived areas and are theoretically likely to exacerbate socio-geographical health inequalities (Barr et al., 2015; Bambra et al., 2019). Beatty and Fothergill (2016) have published data showing how the impact of these reforms on incomes varied across Local Authority Districts in England.

Geographical mobility and mental health

The associations between area level health determinants and changes in mental health are likely to operate in complex ways, partly because individuals may be mobile across space. Residential mobility from an area with lower risk to a place where the environment is more detrimental for mental health might give rise to a new case of mental illness. This pattern of migration also may be associated with other difficult life events for the individual, causing them to develop mental illness (Tunstall et al., 2015).

It is also important to consider that changes in mental health may give rise to residential mobility, due to processes of health selective migration and drift (Norman, 2018). Those already suffering from deteriorating mental health may be at greater risk of 'downward' residential mobility to more deprived areas (Maheswaran et al., 2018).

For example, Wilding et al (2018) used longitudinal population survey data from the *British Household Panel Survey* and its sequel, the *Understanding Society Survey* to analyse residential migration between survey waves and how this was predicted by various individual variables, including mental health. They concluded that those who were residentially mobile, but would have preferred not to move, were more likely to

1 have poor mental health. Also, among those with poor mental health, the probability
2 of moving between survey waves was greater if they had been living in areas where
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4 people in good mental health were more residentially stable between survey waves.
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6 This supported the idea of 'health selective' migration, especially when migration may
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8 not be a positive choice for the individuals involved.
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12 Other international research focuses on change in individual mental health over time
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14 as the outcome variable. This also demonstrates that health selective migration may
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16 help to explain associations between individual mental health and area level conditions
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18 (Dauncey et al., 1993; Moorin et al., 2006; Tunstall et al. 2014; Tunstall et al. 2015;
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20 van Lenthe and Mackenbach, 2004; Dartington-Pollock et al, 2018; Lund and Cois,
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22 2018).
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31 **Individual attributes as socio-economic determinants of mental health**

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34 We also considered the following literature showing how mental health may be
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36 associated with *individual risk factors* and *personal social mobility*. In addition to
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38 information about places, geographical studies of mental health variations in adult
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40 populations need to consider this wider literature on mental health differences
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42 associated with *individual* attributes. These include gender, age, ethnicity, marital
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44 status, housing tenure and socio-economic position (as measured by occupational
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46 class, income, and employment status). It is well established in the literature on
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48 inequalities in mental health that, at any particular point during a person's lifecourse,
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50 contemporaneous differences in socio-economic position are likely to be associated
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52 with differences in mental health. For example, Patel et al (2010) reported from an
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54 international review clear evidence that gender, household composition and
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disadvantage in terms of socio-economic position, and income are determinants of mental health. Daghler et al. (2015) report gender differences in mental health of the population of the USA during and after the great recession, finding that women were more likely than men to suffer anxiety in the post-recession period. An empirical study in England (Anselmi et al, 2020) reports that age group, living alone, and ethnic group were among the factors predicting medical treatment for mental illnesses. Public Health England (2018) also reports on inequalities in mental health between ethnic groups in the English population. A recent review showed that housing tenure and housing quality are also important for mental health (Singh et al.,2019).

Individual social mobility and mental health

Many studies (especially in sociology and economics), have interpreted social mobility in terms of changes in individual, occupationally-defined, social class position and/or income (Goldthorpe et al., 1987). Research suggests that 'downward' mobility is likely to be related to worse mental health. In a study based on the British city of Newcastle, Tiffin et al. (2005) found that amongst men (but not women), risk of reporting a mental illness was associated with downward social mobility. Similar findings are reported in a study in Belgium (Daenekindt, 2017). While the *actual experience* of downward socio-economic mobility is likely to be linked to worsening health, it may also be the case that the *prospect* of downward mobility (e.g. the threat of redundancy or reduction in income) may cause stresses that are detrimental to mental health, even before such changes become a reality (Curtis, Pearce et al. 2019; Benach et al., 2014; De Moortel et al, 2017; Dirlam and Zheng, 2017).

It is also interesting to consider whether 'upward' mobility in terms of social class is beneficial for outcomes such as mental health. Some research suggests that this

1 may be the case for some upwardly mobile individuals, but not for others. Some
2 individuals who are upwardly socially mobile, especially from initially very
3 disadvantaged levels, may find the process stressful as they confront barriers ('class
4 ceilings') to social integration in their new social settings, and this may create
5 stresses, at home, or in the workplace, which may be harmful to mental health
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7 (Friedman, 2014; Savage et al., 2015; Friedman et al., 2015; Friedman and Laurison,
8 2019). This may explain results from a Swedish cohort study of individuals born in
9 the decade between 1949 and 1959 (Tikkaja et al., 2013) showing that although
10 there was a significant association between upward social mobility and reduced risk
11 of psychiatric disorder, this relationship was weaker for men starting in the most
12 disadvantaged groups.
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27 Other research suggests that individual upward socio-economic mobility can be
28 promoted by residence in (generally more affluent) 'escalator regions' (Fielding, 1992)
29 where individuals have the best opportunities of promotion up the socio-economic
30 ladder. This might be expected to be beneficial for other outcomes such as mental
31 health. However, a rich strand of work is emerging (Miles and Leguina, 2018; Toft,
32 2017), suggesting that migration to escalator regions may, in some cases, be
33 coincident with other events in the lifecourse, undermining any psychological benefits
34 of such socio-geographic mobility (e.g. family/relationship break-up, or problems of
35 access to housing).
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50 **Aims of our research**

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53 Given these complex potential links between changing socio-geographical conditions
54 and mental health, there is considerable scope to extend research on geographies of
55 mental health using a temporal, as well as socio-spatial perspective. In this paper we
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1 focus on the situation in England during the period 2011-2017, which was one of
2 economic 'recovery' from the great recession, when employment rates had not
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4 regained pre-recession levels and the UK government introduced a suite of austerity
5 measures intended to reduce public spending.
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10 Using longitudinal data from a large sample of the English population (extracted from
11 the USS), we compared individuals with declining mental health with those in
12 continuously good health, during the period of 'recovery and austerity' in England
13 following the 'great recession'. Our research addressed the following specific research
14 question:
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23 - *Was the risk of declining mental health greater for people living in areas that*
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25 *were most deprived in terms of unemployment and also most impacted by*
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27 *austerity policies (after controlling for other individual and area risk factors*
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29 *indicated in the literature)?*
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35 Given the debates reviewed above concerning health selective mobility and drift, a
36 broader, secondary question of interest in our analyses was this:
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- 40 - *Did aspects of geographical and social mobility of individuals during the study*
41
42 *period relate to differences in their mental health trajectories?*
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46 **Methods**

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48 Our study analysed data on a subset of individuals in the USS (ISER, 2019a), a large,
49 long-established longitudinal annual panel survey of UK households. We studied
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51 17,212 individuals aged over 16 at the start of the study period (2011) and living in
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53 England, with full data on the variables of interest, collected between 2011 and 2017,
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55 in survey waves 3 to 7 - see ISER (2019b) for details of the timing of the different
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1 survey waves. We note below, under ‘limitations’ of the study, proportions of the full
2 USS sample excluded from our analysis due to attrition and missing variables across
3 the survey waves studied. As discussed below, the analytical sample is not exactly
4 representative of the whole English population, but they do include residents from all
5 regions of the country and from across the range of socio-economic conditions
6 prevailing in more local areas.
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8 We used information on individual’s self-reported mental health and other personal
9 and family attributes, collected in successive survey waves over the period 2011 -
10 2017. These were linked with geographical information about the economic conditions
11 prevailing in the places where they lived over the period studied.
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13 **The outcome variable: trends in mental health**

14 Information on self-reported mental health has been collected at each wave of the
15 USS and scored, using version 2 of the SF12 Mental Component Summary (MCS)
16 functioning score (Ware et al 2001; ISER, 2020). The self-completed responses to
17 survey questions were converted to a ‘normalised’ score ranging from 0 (low
18 functioning; very poor mental health) to 100 (high functioning; very good mental health)
19 (ISER, 2020).
20

21 Across the individuals studied, trends in this score between waves 3 and 7 of the
22 survey (5 observations for each subject) were categorised into *Mental Health*
23 *Trajectory Groups* (MHTGs) using Group Based Trajectory Modelling (GBTM)
24 software designed for use in Stata programming (Jones and Nagin, 2013, Nagin et al,
25 2018; Franklyn et al., 2013). GBTM is a finite mixture modelling technique using
26 trajectory groups to represent latent trajectories across subjects in longitudinal studies.
27

We selected the GBTM model specification used for our analysis based on the Bayesian Information Criterion (BIC) which was compared between trajectory models with varying numbers of categories. (The BIC is here defined as the maximum likelihood value minus half the parameter total, multiplied by the logarithm of the sample size, so that higher BIC values indicate better model fit.) We found that a model with six groups has a higher (less negative) BIC than for a smaller number of groups. The choice of GBTM model specification aims also at parsimony and interpretability, considering the extent to which the classification distinguished clearly differing trends in reported mental health. Based on these criteria, the results reported here are derived from a GBTM model which classifies trends in mental health into the six categories shown in Figure 1, which also contains group membership shares (posterior classification probabilities times 100).

In this paper we focus particularly on individuals in two of these mental health trajectory groups (MHTGs):

- MHTG 6 – those who reported *consistently high* levels of mental health functioning across all waves, treated as the reference group and accounting for about 47% the entire sample; and
- MHTG 3 – those who initially reported relatively good mental health, but from wave 4 onward reported *declining mental health* across the waves – just under 8% of the sample.

The outcome variable in our analysis is the risk of being in MHTG 3 compared with MHTG 6.

The other four MHTGs shown in Figure 1 comprised those with mental health that was either: consistently improving (MHTG 4); continuously poor (MHTG 1); or stable at

intermediate levels (MHTGs 2 and 5). These are less clearly relevant to the research question of interest here regarding the risk of *worsening mental health* in the period of ‘economic recovery’ following the ‘great recession’. However, we make brief reference below to the results of models comparing MHTGs 1,2,4 and 5 with group 6.

Predictor variables

The predictor variables in our analyses included indicators categorising the person’s geographical area of residence and their individual or family status. (Table A [Electronic Appendix] lists the categorisation and derivation of these variables).

Geographical variables in the models categorise socio-geographic aspects of the place of residence for each individual at wave 4. These variables were selected in light of our review of the literature (summarised above) and also based on preparatory analyses which tested the significance of their associations with the MHTG outcomes of interest. The indicators were chosen to capture the socio-economic impact of local unemployment levels at the start of the recession and the impacts of district level austerity measures during the subsequent recovery period, while controlling for local urban-rural differences and broad regional variations that might not be fully captured at the more local scale.

The geographical predictors are indicators for areas defined at various geographical scales. Lower-Level Super Output Areas (LSOAs), which, in England as a whole, total 32,844 small areas, ranging from 1,000-3,000 in total population size, are used to organize and publish data from the population census and other sources. They are taken here to indicate ‘neighbourhood’ conditions. We also included information relating to Local Authority District (LAD) areas in England, which are larger geographical units corresponding to administrative areas of local government at which

1 service provision is organized and welfare benefit reforms are implemented. Our
2 sample relates to 317 LADs in total, with resident populations in 2011 ranging from
3 approximately 35,000 to 1,000,000. At a broader geographical scale, information on
4 Government Region of residence was also used since some political and economic
5 processes operate at a larger scale and some published literature has used these
6 units to study geographical inequalities. We identified the person's place of residence
7 within one of 9 Government Regions across England.
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17 At the scale of the LSOA where each sample member was resident at USS wave 4,
18 we used as an indicator of area socio-economic deprivation the Employment domain
19 of the Index of Multiple Deprivation 2010 (Ministry of Housing Communities and
20 Local Government, 2011). The Employment Domain is based on data on receipt of
21 welfare benefits for unemployed residents in 2008 coincident with the start of the
22 economic recession (published on behalf of the Office of National Statistics by
23 NOMIS (NOMIS ONS, 2011). This indicator was selected to capture the level of
24 disadvantage in the labour market at the onset of the 'great recession'. The
25 individual's LSOA of residence at USS wave 4 was categorised according to national
26 quintile ranking of the Employment Domain score. Most disadvantaged areas were
27 ranked 5 and least disadvantaged ranked 1. Our ranking is based on disadvantage
28 scores published by ONS, although readers may wish to note that some rankings
29 published by ONS use the reverse order, with most disadvantaged areas ranked 1.
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50 We classified the LAD of residence for sample members in quintiles using an indicator
51 developed by Beatty and Fothergill (2016), which classifies LADs by average income
52 loss per person of working age due to government 'Welfare Reforms' up to 2015. This
53 is relevant to our research because it captures statistically the 'population level'
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1 *economic* impacts of welfare reform. However, we note that it probably does not
2 capture all the wider social manifestations of austerity impacts.
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5 Since differences in population mental health between urban and rural areas have
6 been reported in the literature (as explained in the background section above), area
7 of residence at the scale of LSOAs was also categorised according to the 2011 rural-
8 urban classification (ONS, 2019). In our preliminary analysis, these were summarised
9 to distinguish between: conurbations, urban areas in cities and towns, settlements in
10 and around smaller 'rural towns' and rural villages and dispersed settlements. We
11 found that living in or near smaller towns in rural areas, compared with all other areas,
12 showed the clearest association with the outcome, so our final model used a binary
13 indicator of residence in this type of area vs other types of area.
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28 In addition to differences at the scale of LSOA and LAD, we found that risks of the
29 mental health outcome of interest varied regionally, especially between individuals
30 living in the West Midlands (which includes the city of Birmingham, one of the major
31 conurbations in England and its surrounding area) and other regions. Research
32 conducted at the University of Warwick (Institute for Employment Research, 2009)
33 shows that this region was particularly badly affected by the recession. This
34 relationship was independent of the other geographical and individual variables tested
35 in our analysis, so we have used an indicator which distinguishes between the West
36 Midlands and other regions.
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50 For each geographical variable, we also generated an additional indicator showing
51 whether the person had moved to a location in a different category during the period
52 between wave 4 (data collected at a date between 2012 and 2014) and wave 7 (2015-
53 17). We compared those who, at both waves, were living in areas classed in the same
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category with ‘movers’ migrating to an area in a different category. For ‘movers’, we distinguished between those undergoing ‘upward’ residential mobility (to an area where conditions were theoretically likely to be more beneficial for mental health) and those with ‘downward’ mobility (to areas where conditions might be more detrimental).

Individual and family attributes considered in the analysis were the variables listed below. These were selected as likely to be relevant, based on our review of the background literature above, and showed significant associations with the mental health outcomes considered here. (The categories are summarised in Table 1 and details of the variable definitions are shown in [Table A: supplementary material]):

- sex;
- age group (in 10 year categories);
- self-identified ethnic group (in broad categories);
- whether the person lived with a partner;
- occupational social class;
- income in the month prior to interview;
- employment status;
- housing tenure at wave 4, distinguishing between outright home owners and those who were renting or paying mortgages on their homes
- being in receipt of welfare benefits at wave 4 (other than child benefits and state pensions, which are rather ‘universal’ benefits for parents or older people and are not related to socio-economic disadvantage).

To capture socio-economic mobility, we also included in the models information on *changes* in socio-economic position between survey wave 4 and wave 7 (See Table A). These relate to change in the individual’s social class, income, employment,

tenure, and receipt of welfare benefits. For each of these attributes, we compare those for whom there was no change with others experiencing changes that might theoretically be likely to alter the risks of declining mental health. We distinguished between changes suggesting ‘deteriorating’ social conditions, likely to increase the risk of being in MHTG 3, and ‘improving’ socio-economic conditions that might theoretically be expected to reduce the risk of membership of MHTG 3. Table A also includes information on the percentage of the analytical sample in the different variable categories. (To protect the confidentiality of respondents, avoiding any risks of disclosure, these data are summarised as whole percentage figures and some details relating to small percentages are withheld.)

Method of analysis

Our analysis used the ‘mlogit’ command in Stata to fit maximum-likelihood multinomial logit models, estimating for individuals the relative likelihood of belonging to one of the Mental Health Trajectory Groups (MHTG) 1 – 5 shown in Figure 1, as compared with MHTG 6, the ‘base’ category.

Our preliminary analyses showed that area-level indicators based on employment deprivation and average income loss per person of working age due to government ‘Welfare Reforms ‘ both showed significant positive associations with relative risk of the mental health outcome (MHTG 3) when included separately in the analytical model. However, these indicators are intercorrelated and did not show an independently significant association with the mental health outcome of interest when both were included.

We therefore generated a composite indicator of ‘area economic disadvantage’ for the study sample by summing the quintile ranks of area of residence on ‘employment

deprivation' and 'average loss of income due to welfare reforms', and producing a composite economic disadvantage score ranging from 2-10. This was summarized into two categories: those scoring 2-5 (lower disadvantage; 44% of the total) and those scoring 6-10 (greater disadvantage; 56%). These categories were chosen because, as shown in Figures 2 and 3, they distinguish between those in areas more affected by both employment deprivation at the start of the time of post-recession recovery and austerity impact during the period studied (predominantly ranking in quintiles 3 to 5 on both of the components), and other areas which were less disadvantaged on both components (mainly ranking in quintiles 1-2).

Below we report on our findings that show how the likelihood of being in MHTG 3, compared with MHTG 6, varied in relation to individual and area predictor variables. Results are reported as adjusted odds ratio (AOR) coefficients and 95% confidence intervals. Statistical significance was defined as 'P' values lower than 0.05 (shown in bold text in Table 1).

Results

The results in Table 1 (part 1) show how the probability of membership of MHTG 3 vs. MHTG 6 relates to attributes of area of residence at waves 4 and 7 (controlling for relationships with personal characteristics, discussed below). Those living at wave 4 in localities with a higher economic disadvantage score (indicating greater disadvantage) had significantly higher relative risk of being in MHTG 3 vs MHTG 6 than those in areas with a lower economic disadvantage score.

Also, living in a small town within a rural region at wave 4 was negatively associated with risk of being in MHTG 3 vs. MHTG 6. Those living in the West Midlands, as

1 compared with other parts of England, were more likely to be in MHTG 3, relative to
2 MHTG 6.
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5 Considering residential mobility, those who, between wave 4 and 7, moved to an area
6 of higher employment deprivation, measured on the IMD2010, and those moving to
7 an area where loss of income due to welfare reforms was greater were significantly
8 more likely to be in MHTG 3 than MHTG 6, compared with 'non-movers'. Also, those
9 moving to an area where average loss of income due to welfare reforms was lower
10 were comparatively less likely to be in MHTG 3. Movements between areas in different
11 categories in terms of rurality or Government Region were not significant predictors of
12 the MHTG 3 outcome.
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25 The general impression from these results is that those in MHTG 3, with declining
26 mental health, were particularly likely to be living in disadvantaged areas at the
27 beginning of the period and/or to have been downwardly mobile to more deprived
28 areas subsequently. The associations with area economic disadvantage are
29 independent of other geographical and individual variables in the model.
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38 Table 1 (part 2) shows that most individual variables included in the model were also
39 associated with statistically significant differences in the probability of having declining
40 mental health (MHTG 3) compared with constantly good mental health (MHTG 6).
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46 Individual attributes raising the probability of *declining mental health* (MHTG 3) were:
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- 49 - being female (compared with males);
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- 52 - being in younger age groups (under 30 years) at wave 4 (as compared with
53 those aged 30-39 years);
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- not living with a partner at both wave 4 and 7, as compared with those who lived with a partner at both survey waves);
- being in receipt of welfare benefits (other than child benefits or state pensions) at wave 4 (compared with not receiving benefits in these categories);

People were less likely to be in MHTG 3, compared with MHTG 6, if they had the following attributes:

- being among older age groups, over 50 years at wave 4 (compared with those aged 30-39 years);
- (with borderline significance) being in social class 3 (small employers and own account workers) or Class 5 (semi-routine and routine workers) at wave 4 (compared with class 1 managerial and professional);
- being outright owners of their homes at wave 4 (compared with other tenures);
- having higher income at wave 4.

There were also significant associations with some indicators of *change* in individual socio-economic status. The relative probability of being in MHTG 3 vs MHTG 6 was positively associated with:

- living with a partner at wave 4 but not wave 7, (compared with those who lived with a partner at both survey waves);
- becoming unemployed between waves 4 and 7 (compared with being employed at both waves);
- moving onto welfare benefits between wave 4 and 7;
- (less significantly) being upwardly mobile between social class groups.

1 The probability of being in MHTG3 was also negatively associated with moving off
2 welfare benefits from wave 4 to 7.
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5 Supplementary Table B [Electronic Appendix] reports the complete results from the
6 model, showing the results for other parts of the model which predict probability of
7 being in MHTG 1, 2, 4 or 5, as compared with MHTG 6). This shows, for example, that
8 people in MHTG 2 (a group with relatively low, slightly declining mental health
9 throughout the period studied) were also more likely to have been living in an area of
10 higher economic disadvantage. However, membership of MHTG 2 was not
11 significantly associated with mobility between areas in different categories of
12 employment deprivation and loss of income due to welfare benefits. MHTG 4
13 represents those whose mental health improved from a relatively low level in wave 4
14 to a higher level. These may include individuals in recovery from a period of mental
15 illness. Compared with MHTG 6, those in MHTG 4 are more likely to be women, in
16 'Asian' ethnic groups, not in a long-term partnership, who were on lower incomes and
17 receiving welfare benefits at some point during the study period. They were less likely
18 to be in the older age groups, identifying in 'Black' ethnic groups or outright
19 homeowners. The indicators describing place of residence were not significantly
20 associated with membership of MHTG 4. Table B shows that individual variables
21 relating to ethnic group and change in income from wave 4 to 7 were not significantly
22 associated with membership of MHTG 3 but were significantly associated with
23 membership of other MHTGs, so they were retained in the model.
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51 **Limitations**

52 We acknowledge some limitations to these analyses, some of which might be
53 interesting to address in future research.
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3 The analysis is not intended to be exactly representative of the English population.
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5 We have not applied any weightings in respect of under- or over-representation of
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7 some groups in the original sample. (We note that some authors (e.g. Solon et al,
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9 2015) raise doubts over whether such weighting is appropriate in studies such as
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11 this one). Although the USS data includes some methods for weighting to make the
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13 total survey sample more representative of Britain as a whole, these do not apply to
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15 the English sub-sample we have used. To provide an approximate indication of how
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17 our study sample compares with the population of England as a whole, we include in
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19 [Table C supplementary material] some summary information on how attributes of
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21 the sample recorded at wave 4 compare with similar indicators for the population of
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23 England as a whole, recorded in the 2011 census. This suggests, for example, that
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25 in the analytical sample, as compared with the census population, there may be
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27 some 'over-representation' of women, those in older age groups, and people living
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29 with a partner. Those in social classes III, IV and V may be somewhat 'under-
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31 represented' relative to the census population.
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40 Some of these disparities may be due to exclusion from our analytical sample of
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42 individuals in the USS missing data on relevant variables. Some individuals also left
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44 the relevant USS cohorts during the study period, which might be due to failure of
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46 follow up, migration to a location outside England, or death during the study period
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48 (which may include mental health related mortality such as suicide). Such omissions
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50 are indicated, for example, by the observation that our analytical sample includes
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52 17,212 of the 36,221 individuals who responded, at least partially, to the USS in
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54 wave 4, at the start of the period studied. Also, the technical report on USS wave 4
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56 published by the USS managers indicates that of households included in the wave 4
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sample, 82% responded fully or partially, and 84% of eligible adults in these households completed an individual interview (Jessop & Oskala 2014, p28).

More generally, in terms of methodological limitations, we note that cautions regarding latent growth models may be considered. A latent growth model may not be appropriate to all growth processes – such as when homogeneous pattern of change, albeit with variation around the central trend, is expected (Connell and Frye, 2006). Moreover, drawing causal inferences from latent growth models may need to be circumspect (Von Stumm and Plomin, 2015). From a technical viewpoint, the classification of individuals to particular latent trajectories are subject to uncertainty. On the other hand, confidence in inferences from the model in the present application is strengthened by the large sample size and by the interpretability of the findings against wider research evidence.

There may also be scope for further analysis to explore interaction effects between the predictor variables, which might further illuminate the complex ways that different area and individual variables may operate in their association with mental health.

Discussion

Our results suggest a complex pattern of risk factors associated with individuals' mental health trajectories during a period of slow economic recovery immediately following the 'great recession', at a time when a range of austerity measures were taking effect in the UK. Several different attributes of places as well as individuals show independent associations with decline in mental health in this large sample from England

Of particular interest in this paper is association with our composite indicator of area economic disadvantage (combining neighbourhood level employment deprivation at

1 the start of the recession and District level impact of subsequent welfare reforms), This
2 suggests that relative risks of having declining mental health (MHTG 3 compared with
3 MHTG6) were higher in areas where employment deprivation was greater, and
4 governmental austerity measures on welfare benefits also impacted most severely on
5 the District population. This result is evident after a number of individual risk factors
6 are controlled for, including individuals' employment status and receipt of welfare
7 support such as unemployment benefits. Thus, the association with the composite
8 indicator of area economic disadvantage is apparently reflecting a 'contextual' mental
9 health risk factor, which is, to a significant degree, independent of personal
10 characteristics.
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25 The finding that there was also higher risk of declining mental health for those in the
26 West Midlands region seems likely to reflect the especially severe economic impacts
27 of the 2008 onset of recession in this region (reviewed above). This seems to reinforce
28 the conclusion that the impacts of economic recession and related austerity policy
29 implementations aimed at fiscal recovery (affecting local neighbourhoods and wider
30 districts) were significant for individual mental health.
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40 Our models also allow for urban-rural and regional differences in risk and show that
41 these attributes of areas may also relate to declining mental health. Those in small
42 towns in rural settings have a lower relative risk of declining mental health. This result
43 seems broadly consistent with other research on rural/urban differences in self-
44 reported mental health outcomes reviewed above.
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53 We also found that those who were 'downwardly mobile' between survey waves 4 and
54 7, moving to more economically disadvantaged areas, where unemployment
55 deprivation had been greater at the start of the 'great recession' in 2008, or to areas
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1 where average loss of income due to welfare reforms was relatively high, were more
2 likely to experience declining mental health during this period. A corollary of this
3 observation is that those who moved to areas where average incomes were *less*
4 severely impacted by welfare benefit reforms had a lower risk of being in MHTG 3
5 relative to MHTG 6, so this aspect of 'upward' socio-geographic mobility may have
6 been protective for mental health.
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15 The results also indicate significant associations between individual attributes and
16 declining mental health. We have noted that, independently of other variables in the
17 model, individuals on lower incomes and those who, between survey waves 4 and 7,
18 became unemployed or moved onto welfare benefits had a greater risk of declining
19 mental health (MHTG 3), while those who moved off welfare benefits were less likely
20 to be in MHTG 3 relative to MHTG 6. This finding supports other research,
21 summarised above, reporting links between mental health and change in personal
22 employment status, income and welfare dependency.
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35 For the most part, the associations between mental health trajectories and other
36 individual risk factors are to be expected, based on other literature. Exceptions include
37 our findings for social class groups, suggesting that those who, at wave 4 were in
38 Social Class 1 (professional and managerial social classes, generally considered to
39 be most advantaged in terms of health) did *not* show any advantage in terms of risk of
40 declining mental health (MHTG 3). At a weak ($p \leq 0.10$) level of statistical significance,
41 those in Classes 3 and 5 were *less* likely to have declining health than those in Class
42 1. Also, risk was *greater* for those who were upwardly mobile in terms of social class
43 between survey waves 4 and 7. This could be interpreted as part of the socially
44 'dislocating' or isolating impact of social mobility identified in sociological research.
45 Class origins early in life may be associated with different attitudes towards social
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mobility (Manstead, 2018). The Bourdieusian idea of ‘cultural capital’ (Bourdieu, 1985) suggests that confidence and knowledge regarding expected patterns of behaviour within one’s social group are important social assets. Those who have always lived in more privileged communities will have acquired these assets through early life experiences, such as education in more elite institutions, from which those who are upwardly mobile may have been excluded (SMC, 2019). The socially uneven potential to benefit from upward mobility in class position between and within generations is therefore recognised as being a key driver and indicator of inequalities between individuals and groups, which in turn, is likely to have mental health implications.

It is also possible that measures of social status based on occupational group may be less relevant as indicators of risk for mental health than indicators such as income, which, in our results, shows a strong negative association with the risk of being in MHTG 3 *versus* MHTG 6. It may be that the relationships between class and mental illness risks reported in some other studies do not control fully for income variation, and that class disparities can be largely explained by differences in income between social class categories. Our findings also lead us to speculate that (despite better prospects in terms of income) moving to a higher professional status causes stressful challenges, especially during an economic recession, which may damage mental health.

Conclusions

We conclude that individuals were significantly more likely to suffer declining mental health if they were living in neighbourhoods with high levels of employment deprivation at the start of the 2008 recession, and where impacts of subsequent welfare benefit reforms at the scale of Local Authority Districts were greatest. This association is

1 independent of the individual risk factors for mental health in our models. It is also
2 independent of urban rural disparities or broader regional variations. The introduction
3 of welfare reforms during the economic recovery period, affecting a range of benefits
4 that are especially important for disadvantaged communities, seems to have
5 compounded the mental health impacts of unemployment in local labour markets.
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11 Trends in mental health show significant associations both with conditions at the start
12 of the study period and with subsequent social and socio-geographical mobility by the
13 end of the period. Health selective socio-geographical mobility and effects of 'drift'
14 probably explain some, but not all, of the mental health inequalities observed. Thus,
15 our study also underlines the importance of considering mobility as a factor associated
16 with varying risk of declining mental health. However, individuals' socio-geographical
17 'starting point' in the early stages of post-recession recovery is significantly associated
18 with subsequent changes in their mental health. Our findings are consistent with the
19 idea that area disadvantage may have a causal effect in triggering decline in mental
20 health.
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37 Our findings regarding the complex nature of risk factors for declining mental health in
38 our study seem consistent with arguments that risk factors for individual mental health
39 outcomes are 'multi-scalar' and 'relational' (Macintyre et al, 2002; Cummins et al,
40 2007; Dahlgren and Whitehead, 1991), involving area processes linked to inequality,
41 mobility, health selective migration and drift, operating at local, district and regional
42 scales, in combination with individual attributes. These are very important during
43 critical periods such as economic recessions and, given continuing instability in global
44 economies, these topics would be interesting to examine further in future international
45 research.
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1 From an international perspective, this research also emphasises that studies of
2 mental health during the 'recovery and austerity' period, following on from the 'great
3 recession' of 2008-2009 should consider the locally variable impacts of government
4 welfare programmes, as well as impacts of changes in labour markets. Our findings
5 invite further international comparative research on mental health variation in relation
6 to changing individual and community conditions over time, as recommended, for
7 example, by Pearce (2018).
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Figure 1
Graph showing SF12 Mental Health Score trends for USS members during waves 3 to 7, in 6 trajectory groups

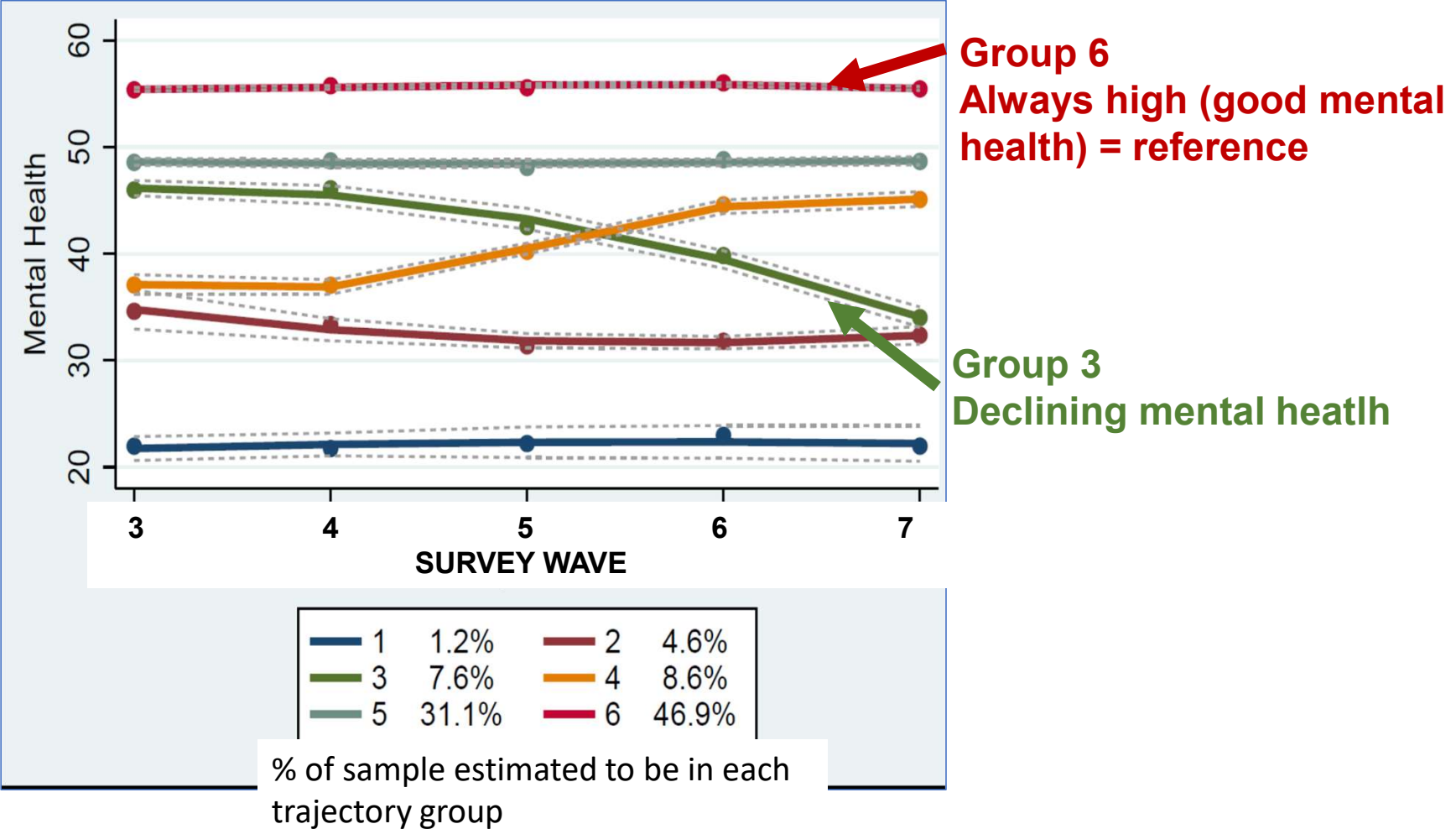
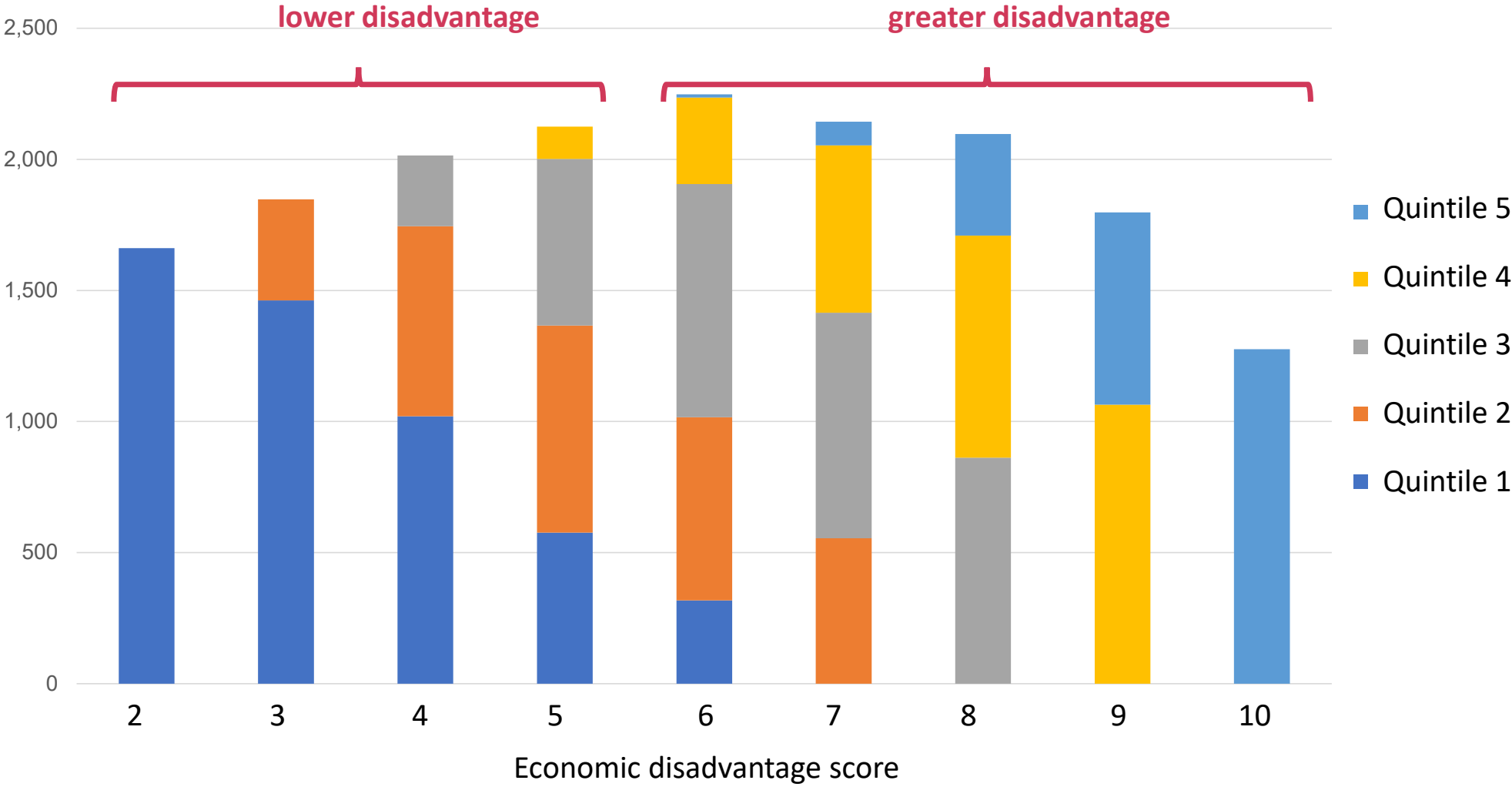


Figure 2 Distribution of sample by economic disadvantage score for place of residence and quintile group of LSOA of residence on IMD2010 employment domain



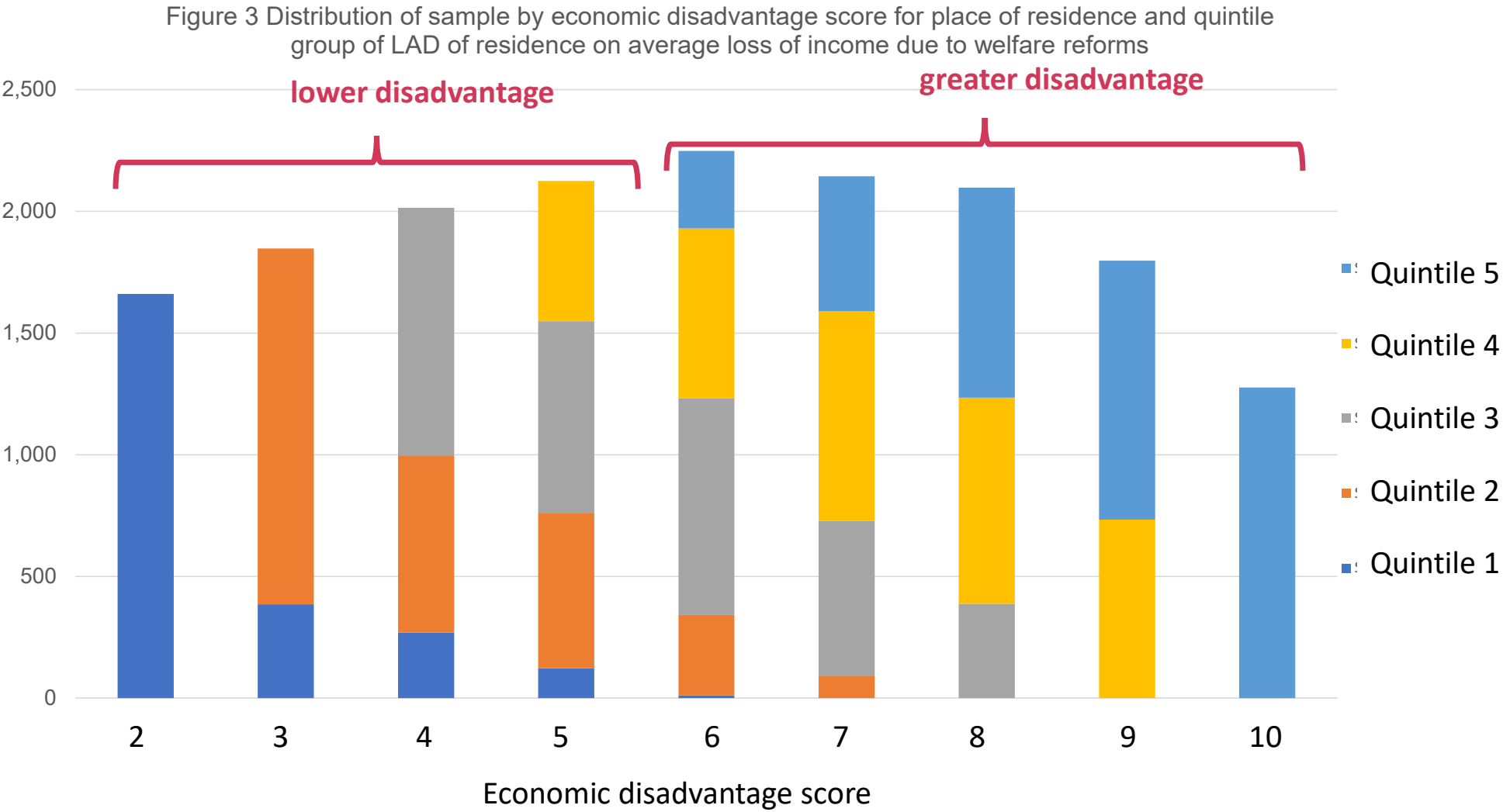


Table 1 Model of individual and area variables predicting membership of mental health trajectory group 3 compared with group 6 *

(P>|z| marked in bold text for significant associations)

* part of a multinomial logistic regression model (full model shown in Supplementary Table B)

Predictors (reference category):	categories of predictors	Coeff	Std. error	z	P> z	95% confidence interval	
Part 1: Area variables							
Rural Urban classification of place of residence at wave 4 (not in small towns and rural fringe)	town in rural area	-0.261	0.116	-2.250	0.024	-0.488	-0.034
Moved to area in different urban/rural category wave 4 to 7 (no change)	moved into less urbanised/more rural area	-0.111	0.214	-0.520	0.604	-0.530	0.308
	moved into more urbanised/less rural area	0.239	0.214	1.110	0.265	-0.181	0.658
Government Region of residence at wave 4 (region other than West Midlands)	West Midlands	0.354	0.100	3.540	<0.001	0.158	0.549
moved in or out of W. Midlands (no change wave 4 to 7)	moved into W. Midlands	0.081	0.554	0.150	0.884	-1.004	1.166
	moved out of W. Midlands	0.207	0.532	0.390	0.698	-0.836	1.249
area economic disadvantage category** wave 4 (1= lower disadvantage)	2 = greater disadvantage	0.172	0.070	2.450	0.014	0.035	0.309
residential mobility wave 4 to 7 between LSOA quintiles ranked by employment domain (no change)	moved to less deprived quintile	0.159	0.150	1.060	0.289	-0.135	0.452
	moved to more deprived quintile	0.300	0.146	2.050	0.040	0.013	0.587
residential mobility wave 4 to 7 between LAD quintiles ranked by loss of income due to welfare reforms (no change)	moved to less disadvantaged quintile	-0.595	0.263	-2.260	0.024	-1.111	-0.079
	moved to more disadvantaged quintile	0.341	0.159	2.140	0.032	0.029	0.652
Part 2 Individual variables							
Sex (male)	female	0.551	0.068	8.070	<0.001	0.417	0.685
Age group at wave 4 in 10 year groups (30-49 years)	under 20	0.621	0.193	3.220	0.001	0.243	0.999
	20-29	0.235	0.117	2.000	0.045	0.005	0.465
	40-49	-0.178	0.101	-1.770	0.077	-0.375	0.019
	50-59	-0.391	0.110	-3.550	<0.001	-0.607	-0.175
	60-69	-1.100	0.248	-4.430	<0.001	-1.587	-0.613
	70 +	-1.335	0.283	-4.720	<0.001	-1.889	-0.780
Partnership status wave 4 to 7 (living with a partner at wave 4 and 7)	not living living with a partner wave 4 or 7	0.233	0.081	2.870	0.004	0.074	0.392
	not with partner wave 4, with partner wave 7	-0.004	0.175	-0.030	0.980	-0.347	0.338
	lived with partner wave 4, not at wave 7	1.218	0.158	7.700	<0.001	0.908	1.528
Occupational Social class in wave 4 (Class I: Management & Professional)	Class II :Intermediate	-0.165	0.128	-1.290	0.198	-0.416	0.086
	Class III: small employers and own account	-0.306	0.157	-1.950	0.052	-0.615	0.002
	Class IV: lower supervisory & technical	-0.239	0.173	-1.380	0.167	-0.578	0.100
	Class V (semi-routine & routine)	-0.218	0.112	-1.950	0.052	-0.437	0.001
	Unclassified: Inapplicable	-0.119	0.184	-0.650	0.518	-0.480	0.242
change in social class wave 4 to 7 (no change)	upwardly mobile	0.265	0.143	1.840	0.065	-0.017	0.546
	downwardly mobile	-0.018	0.182	-0.100	0.920	-0.374	0.338
	inapplicable	0.058	0.194	0.300	0.767	-0.324	0.439
Income in £K wave 4	[continuous variable]	-0.053	0.016	-3.400	0.001	-0.084	-0.023
change in income £K wave 4 to 7	[continous variable]	-0.014	0.015	-0.920	0.356	-0.043	0.016
Employment status waves 4 and 7 (employed at waves 4 and 7)	not in paid employment at waves 4 or 7 and aged < 60 years 2011	0.179	0.205	0.870	0.384	-0.224	0.581
	became unemployed between wave 4 and 7 and aged <60 2011	0.597	0.208	2.860	0.004	0.188	1.005
	not employed wave 4 employed wave 7	-0.107	0.200	-0.530	0.593	-0.499	0.285
	aged 60 years + in wave 4 and not employed in wave 4 and/or wave 7	0.044	0.292	0.150	0.881	-0.529	0.616

ethnic group recorded wave 4 ('White British/Irish')	'Asian' ('Indian', 'Pakistani', 'Bangladeshi', 'Chinese', 'other Asian')	0.165	0.128	1.290	0.198	-0.086	0.416
	'Black'; (Black African, Caribbean, Black other'	-0.226	0.176	-1.290	0.198	-0.571	0.118
	'mixed/other' ('white' & 'black' or 'Asian' 'Arab' 'other')	0.177	0.208	0.850	0.395	-0.231	0.586
Tenure status (whether outright ownership) at wave 4 (not outright owner)	outright owner	-0.376	0.093	-4.060	<0.001	-0.557	-0.194
Whether became an outright home owner (Did not become an outright owner)	became outright owner wave 4-7	-0.122	0.135	-0.900	0.368	-0.386	0.143
Whether reported receiving welfare or disability benefits in wave 4 (0 = none reported)	reported receipt of benefit(s)	1.474	0.125	11.820	<0.001	1.230	1.719
Change in reported receipt of benefits wave 4 to wave 7 (no change)	came off benefits : benefits received in wave 4 but not wave 7	-0.911	0.152	-6.010	<0.001	-1.208	-0.614
	came onto benefits (benefits not received wave 4 but received wave 7)	0.917	0.170	5.400	<0.001	0.584	1.249
Constant		-1.951	0.144	-13.550	<0.001	-2.233	-1.669

**Combined indicator of economic disadvantage (based on quintile on IMD2010 employment domain for LSOA and quintile on average loss due to welfare reform for LAD)

Number of obs = 17,212
Wald chi2(215) = 2816.33
Prob > chi2 = 0.0000
Log pseudolikelihood = -20718.383
Pseudo R2 = 0.0739

Study of trends in adult mental health following the 2008 'great recession'.

Data on 17,212 individuals in England, from the *Understanding Society Survey*.

Individual data linked to information on places of residence.

Risk of declining mental health (compared with stable good health) is analysed.

Area deprivation, welfare reforms, socio-economic mobility are important risk factors.