

# The development of socioeconomic inequalities in anxiety and depression symptoms over the lifecourse

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## Abstract

**Purpose** Socioeconomic inequalities in anxiety and depression widen with increasing age. This may be due to differences in the incidence or persistence of symptoms. This paper investigates the widening of inequalities in anxiety and depression over the lifecourse.

**Methods** Data were from the West of Scotland Twenty-07 Study, constituting three cohorts aged approximately 16, 36 and 56 years at baseline and re-visited at 5-yearly intervals for 20 years. Symptoms were measured using the Hospital Anxiety and Depression Scale. Adjusting for age and sex, multilevel models with pairs of interviews ( $n = 6,878$ ) nested within individuals ( $n = 3,165$ ) were used for each cohort to estimate associations between current symptoms and education or household social class for both those with and without earlier symptoms, approximating socioeconomic differences in incidence and persistence.

**Results** Inequalities in current symptom levels were present for both those with and without earlier symptoms. In the youngest cohort, those with less education were more likely to experience persistent depression and to progress from anxiety to depression. At older ages there were educational and social class differences in both the persistence and incidence of symptoms, though there was more evidence of differential persistence than incidence in

the middle cohort and more evidence of differential incidence than persistence in the oldest cohort.

**Conclusions** Differential persistence and symptom progression indicate that intervening to prevent or treat symptoms earlier in life is likely to reduce socioeconomic inequalities later, but attention also needs to be given to late adulthood where differential incidence emerges more strongly than differential persistence.

**Keywords** Anxiety · Depression · Socioeconomic status · Lifecourse · Longitudinal · Co-morbidity

## Introduction

Anxiety and depression are common mental disorders which are often co-morbid [1, 2] and result in disease burdens for those experiencing them including disability, impairment and heightened mortality risks [3]. The most severe outcomes tend to be associated with depression [3–5] and with co-morbid anxiety and depression [1, 2, 6, 7]. These disorders have long been observed to occur more frequently among those in disadvantaged social circumstances [8–10], and there is evidence that socioeconomic inequalities in anxiety and depression increase with age [11–13]. It is therefore important to understand how such inequalities develop over the lifecourse; they may widen with age because of higher incidence levels among people who are disadvantaged and/or because symptoms are more likely to persist once developed for those in disadvantaged circumstances. Understanding the relative contribution of these explanations is important for the effective timing of interventions to reduce socioeconomic inequalities in mental health. If inequalities primarily widen through the persistence of symptoms over time, then intervening earlier

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in life may be appropriate, but if the differences are mostly due to new cases occurring throughout the lifecourse, then the treatment of early life cases will have little impact on inequalities and preventative measures may be needed across the lifecourse [10, 14, 15].

Recent data covering almost 20 years from the British National Child Development study has shown that about 80 % of the differences by educational level in psychological distress at age 42 were already present within the same individuals at age 23 [15]. This suggests that once socioeconomic inequalities develop they tend to remain within the same individuals over long periods, though it remains unclear how they persist into later adulthood. Our paper both extends research on this issue into older ages and examines how much of the widening (rather than the perpetuation) of socioeconomic inequalities can be explained by differences in the persistence and the incidence of symptoms.

A meta-analysis of data on socioeconomic status (SES) and these common mental disorders indicated both greater persistence and greater incidence of symptoms in disadvantaged social strata, with slightly larger effects for persistence [16], but few longitudinal studies were found and a substantial proportion of those identified had only 1 year of follow-up. Persistence effects were relatively independent of how SES was measured, whilst only those studies which had employed education as a measure of SES showed significant differences in incidence. Although measures of SES are usually correlated, associations with symptoms may differ between measures of SES as each will represent a somewhat varying mix of social and economic resources or be more pertinent to particular life stages [17]. Different associations for different measures of SES may therefore provide clues as to the importance for mental health of different resources and/or the timing of those resources within the lifecourse.

A further issue is that of temporal co-morbidity (i.e. one type of symptoms following on from another). Identification of prodromal symptoms could help pinpoint those at risk for subsequent serious illness. It has been suggested that anxiety disorders represent a prodrome or risk factor for later depression [1, 7, 18], and may therefore be an integral part of the causal pathway into depression. Moffitt et al. [19] have challenged this view, showing major depression occurring prior to generalised anxiety disorder almost as often as vice versa. As anxiety and depression disorders share many symptoms, however, it is important to understand this issue at the symptom level. The tripartite model of anxiety and depression posits three categories of symptoms: negative affectivity—common to both anxiety and depression; somatic arousal—unique to anxiety; and low positive affect—unique to depression [20, 21]. Co-morbid symptom trajectories may have different risk

factors to symptoms that develop in isolation [22], but there is little information on how different types of anxiety and depression symptoms relate longitudinally and it is not known whether socioeconomic factors influence progression from one type of symptoms to another. If they do, then this may improve understanding of how socioeconomic inequalities in anxiety and depression develop and widen over the lifecourse.

The aim of this paper is to investigate the longitudinal patterning of anxiety and depression symptoms in relation to two different measures of SES (education and social class) using repeated measurements from three age cohorts in the West of Scotland Twenty-07 Study [23]. Specifically, we aim to investigate how much of the socioeconomic inequalities in anxiety and depression at a given point in time are perpetuated from earlier time points and how much is attributable to differences in the incidence and persistence of symptoms. We additionally examine whether conclusions differ by life stage and type of SES measurement and investigate whether there are socioeconomic differences in progression from one type of symptoms to another.

## Methods

### Participants

The Twenty-07 Study [23] includes 4,510 people from three age cohorts—born around 1932, 1952 and 1972. Each cohort was selected using two-stage stratified sampling; areas were stratified by deprivation indicators from the 1981 Census and postcode sectors randomly selected proportionate to population size. In addition, ten postcode sectors (the localities sample) were selected purposefully to capture different socioeconomic experiences and environments. Individuals of the target ages for each cohort were then selected randomly from within these postcode sectors. Baseline interviews were carried out in 1987/1988 when respondents were aged approximately 16, 36 and 56 years, and response rates were 85.1, 88.9 and 87.1 %, respectively [23]. There have been four repeat interviews covering 20 years of follow-up in 1990/1992 (overall response rate 86.1 % of baseline sample still alive), 1995/1997 (68.8 %), 2000/2004 (64.3 %) and 2007/2008 (67.4 %). Baseline respondents have been shown to be representative of the general population of the sampled area [24]. Ethical approval was obtained for each visit from the NHS and/or Glasgow University Ethics Committees. All participants gave written informed consent prior to interview at each follow-up. This paper focuses on analysing symptom patterns between consecutive pairs of interview visits. Only those respondents who participated in and had valid data

for at least two consecutive interviews were included ( $n = 3,165$ ), and all pairs of consecutive interviews with valid data were included ( $n = 6,878$ ). The relevant questions were not all included in the baseline interviews for the younger two cohorts, so this analysis approximately follows the youngest cohort from ages 19 to 37, the middle cohort from ages 41 to 57, and the oldest from 56 to 76. Although there is some overlap in age between the first measurement in the oldest cohort and the last measurement in the middle cohort, there are no pairs of waves of similar age from different cohorts. This means that age and cohort are confounded and the implications of this are addressed in the discussion. The mean difference in years between included pairs of interviews was 5.3 (standard deviation: 1.5).

## Measures

The Hospital Anxiety and Depression Scale (HADS) [25] was administered as part of a self-completed questionnaire at each of the four follow-up visits, and additionally at baseline for the oldest cohort. At the third visit in 1995/1997, the localities samples (approximately, one-third of the total sample) were not asked to complete the HADS. The HADS correlates well with interview-based measures and other screening questionnaires that identify psychiatric distress [26]. It has two sub-scales, respectively, for anxiety and depression, each with seven items scored between zero and three, giving a maximum score of 21. If only one or two items on a sub-scale were missing, the score was calculated as the mean of valid responses multiplied by seven [27]. Total scores of eight or more on each sub-scale have been used to define the presence of anxiety and depression symptoms; these thresholds have been shown to have sensitivity and specificity of approximately 80 % for identifying psychiatric morbidity [26]. Previous research on these three cohorts and on other UK cohorts has indicated that the factor structure of the HADS is reasonably stable across different age and cohort groups [28, 29]. In order to achieve an understanding of the interplay between different types of symptoms, the two sub-scales were combined for statistical modelling into a categorical variable (referred to as symptom status) with four categories: no symptoms (reference category), anxiety symptoms only, depression only and anxiety combined with depression.

It is important to understand what is being represented by the HADS sub-scales. It has been suggested, based on confirmatory factor analysis within this sample, that the HADS anxiety sub-scale corresponds to the somatic arousal and negative affectivity components of the tripartite model (the latter of which can be common to both anxiety and depressive disorders), whereas the HADS depression sub-scale corresponds only to the low positive affect

component [29]. Although these scales have reasonable sensitivity and specificity for identifying psychiatric morbidity, they may not be specific to the diagnostic categories of anxiety and depression, and it is not intended that they be read as such in this paper. When anxiety symptoms are referred to here, these represent a mix of negative affectivity and somatic arousal symptoms, and when depression symptoms are discussed these refer to low positive affect or depressed mood.

Education and household social class were included as measures of SES. Education is viewed as stratifying opportunities for socioeconomic success in adulthood [17]. Education was measured at the person level and distinguished between those who stayed in school beyond the age of 16 years and those who had left by or at the age of 16. This variable was treated as constant over time, and associations are viewed as representing the enduring effects of this early adulthood resource as it plays out over the lifecourse.

Household social class was coded according to the Registrar General's 1980 classification [30]. This represents the material resources available to the household as well as their social standing [17, 31]. For couple households the higher status class was used, and so this measure is seen as more representative of household status than of the respondents' own personal occupational status. The most recent occupation was used if neither the respondent nor their partner had a current occupation. For the adolescents in the 1970s cohort, many still lived with their parents at the first and second interview and so the higher of their mother's or father's class was used for those time points. A binary variable was created comparing manual (III manual, IV and V) to non-manual classes (I, II and III non-manual), with non-manual used as the reference category. In contrast to education, household social class was treated as a time-varying covariate, and is therefore viewed as a more proximate representation of adult SES.

## Statistical analysis

Analyses were conducted in Mplus version 7 [32]. Our aim was to investigate the extent to which the associations between SES and subsequent anxiety and depression symptoms were contingent upon existing symptoms of anxiety and depression. Consecutive pairs of interviews were therefore taken as the main unit of analysis in this paper. Most respondents contributed multiple pairs of interviews. Within each pair of interviews, the later interview is referred to as  $t$  and the earlier as  $t-1$ . Symptoms at  $t-1$  are referred to as prior symptoms. The research questions were addressed using multinomial logistic regression models of symptom status at  $t$ . Initial models

included respondents from all cohorts (results not shown); however, significant interactions by cohort were found for the effects of social class, education and prior symptoms ( $p < 0.05$ ), so results are presented stratified by cohort. All single-cohort models were adjusted for age (within cohort) and sex, but other parameters were assumed not to interact with age or sex. To keep estimates for the other parameters, neutral gender was coded  $-0.5$  for men and  $0.5$  for women, and age, measured as a continuous variable, was centred on its mean across all interview pairs within each cohort. Responses within pairs of interviews from the same respondent were more similar than responses within pairs of interviews from different respondents: unadjusted intra-class correlation coefficients (ICC) were  $0.65$  for anxiety symptoms and  $0.58$  for depression symptoms. A multilevel data structure was used to adjust for these correlations, modelling pairs of interviews nested within individuals to produce parameter estimates that were not biased by the inter-dependence of some observations. ICC values decreased substantially when adjusting for prior symptom status (new values were between  $0.01$  and  $0.08$  in the older cohorts and between  $0.18$  and  $0.43$  in the youngest cohort), indicating that, especially in the older cohorts, most of the correlations between pairs of interviews from the same respondent were explained by symptom status at  $t-1$ . Models were estimated using maximum likelihood estimators which assume that missing data were random given the other variables in the model [33]. This means that in order to bias the results, missing responses would need to systematically differ from observed responses other than as expected from their age, gender, SES and prior symptoms. As a sensitivity test, a weighted repeat analysis was performed with the sub-sample of respondents who had participated in each wave of the study [34] and the results were broadly consistent (not shown).

Parallel analyses were performed for education and social class. Consistent findings across the two measures of SES were seen as representing the overall effects of socioeconomic stratification over the lifecourse. Discrepant results were seen as representative of the more unique features of each measure, i.e. early adult experiences and critical skills for education, as opposed to the more recent family resources and status represented by household social class. We first aimed to establish whether SES was associated with anxiety and depression at  $t$  and second whether adjustment for prior symptom status affected this association. This was achieved by regressing symptom status at  $t$  on SES (either social class at  $t-1$ , or education at the person level), and then additionally adjusting for symptom status at  $t-1$ . The unadjusted effect of SES is viewed as representing the overall socioeconomic inequality in symptom prevalence across the interview pairs. Adjusting for symptom status at  $t-1$  indicates how much of this

overall effect is explained by pre-existing inequalities in symptom levels from approximately 5 years earlier. Thus, any remaining association with SES after adjustment represents a widening of socioeconomic inequalities over the 5 years between the two interviews.

Any widening of socioeconomic inequalities may be the result of differential incidence of symptoms, or differential persistence of symptoms, between the two interviews. Therefore, we next investigated whether the effect of SES differed depending on prior symptoms by introducing an interaction between SES and symptom status at  $t-1$  to the model described above. If socioeconomic inequalities primarily widen because of differential incidence of symptoms, then one would expect to observe a strong, positive main effect of SES and a strong, negative interaction effect, suggesting a weaker effect of SES for those with prior symptoms. If, on the other hand, socioeconomic inequalities primarily widen because of differential persistence of symptoms between the two interviews, then one would expect to see a weak main effect of SES and a strong, positive interaction effect between SES and prior symptoms. A strong, positive main effect of SES combined with weak interaction effects for prior symptoms (positive or negative) suggests the presence of both differential incidence and persistence of symptoms. The statistical significance of interactions between SES and prior symptom status was assessed using a Wald test (with four degrees of freedom) to compare against a nested model where the interaction effects were constrained to equal zero. The categorisations used for symptom status at  $t$  and  $t-1$  also allow for consideration of differential progression from one symptom type to another.

## Results

Table 1 displays the sample characteristics and symptom levels at each of the five interviews by cohort. The balance of males and females in the sample remained relatively consistent over time, whereas there was a decline in the proportion of those from manual social class households and those with less education. There were considerably fewer respondents who stayed in school beyond the age of 16 years in the oldest cohort compared to the younger cohorts. Respondents with anxiety symptoms alone were the most common of those with symptoms, followed by those with both anxiety and depression symptoms. Depression symptoms rarely occurred without anxiety symptoms, especially in the younger cohorts. Table 1 also allows for comparison of the analysis and baseline samples. There was little difference in terms of gender, except perhaps in the youngest cohort where women were more

**Table 1** Sample characteristics and symptom prevalence by cohort

	Characteristics at each wave					Characteristics of the analysis sample	
	Baseline	Second visit	Third visit <sup>a</sup>	Fourth visit	Fifth visit	Analysis <i>N</i> (pairs) <sup>b</sup>	Analysis <i>N</i> (individuals) <sup>c</sup>
<b>1970s</b>							
Total <i>N</i>	1,515	1,343	691	843	942	n/a	n/a
Mean age (sd)	15.7 (0.3)	18.6 (0.3)	24.3 (0.6)	30.2 (1.3)	36.7 (0.4)	30.4 (5.4)	15.7 (0.3)
<i>N</i> (%) female	778 (51.4)	705 (52.5)	366 (53.0)	459 (54.4)	518 (55.0)	972 (54.9)	493 (54.7)
<i>N</i> (%) manual social class	598 (39.5)	503 (37.5)	229 (33.1)	172 (20.4)	161 (17.1)	588 (33.2)	309 (34.3)
<i>N</i> (%) left school by 16 years	n/a	894 (66.6)	579 (63.2)	521 (61.8)	553 (58.7)	1,107 (62.5)	561 (62.3)
<i>N</i> (%) no symptoms	n/a	792 (59.0)	348 (50.4)	476 (56.5)	561 (59.6)	1,021 (57.7)	n/a
<i>N</i> (%) anxiety only	n/a	457 (34.0)	261 (37.8)	240 (28.5)	283 (30.0)	606 (34.2)	n/a
<i>N</i> (%) depression only	n/a	8 (0.6)	4 (0.6)	9 (1.1)	10 (1.1)	10 (0.6)	n/a
<i>N</i> (%) anxiety and depression	n/a	74 (5.5)	47 (6.8)	80 (9.5)	76 (8.1)	133 (7.5)	n/a
<i>N</i> (%) missing HADS	n/a	12 (0.9)	31 (4.5)	38 (4.5)	12 (1.3)	n/a	n/a
<i>N</i> with valid data <sup>d</sup>	n/a	n/a	637	477	675	1,770	901
<b>1950s</b>							
Total <i>N</i>	1,444	1,225	754	980	999	n/a	n/a
Mean age (sd)	36.2 (0.8)	40.5 (0.9)	44.7 (0.8)	50.2 (1.3)	57.1 (0.8)	50.9 (5.4)	36.1 (0.8)
<i>N</i> (%) female	788 (54.6)	676 (55.2)	423 (56.1)	534 (54.5)	542 (54.3)	1,184 (56.0)	564 (55.4)
<i>N</i> (%) manual social class	494 (34.2)	374 (30.5)	206 (27.3)	264 (26.9)	263 (26.3)	638 (30.2)	302 (29.7)
<i>N</i> (%) left school by 16	968 (67.0)	819 (66.9)	671 (65.4)	624 (63.7)	631 (63.2)	1,420 (67.1)	667 (65.5)
<i>N</i> (%) no symptoms	n/a	658 (53.7)	391 (51.9)	547 (55.8)	591 (59.2)	1,213 (57.3)	n/a
<i>N</i> (%) anxiety only	n/a	400 (32.7)	245 (32.5)	242 (24.7)	255 (25.5)	616 (29.1)	n/a
<i>N</i> (%) depression only	n/a	21 (1.7)	14 (1.9)	20 (2.0)	11 (1.1)	34 (1.6)	n/a
<i>N</i> (%) anxiety and depression	n/a	131 (10.7)	90 (11.9)	135 (13.8)	118 (11.8)	253 (12.0)	n/a
<i>N</i> (%) missing HADS	n/a	15 (1.2)	14 (1.9)	36 (3.7)	24 (2.4)	n/a	n/a
<i>N</i> with valid data <sup>d</sup>	n/a	n/a	731	596	811	2,116	1,018
<b>1930s</b>							
Total <i>N</i>	1,551	1,266	723	838	663	n/a	n/a
Mean age (sd)	56.2 (0.6)	59.6 (0.8)	63.8 (0.6)	69.1 (1.0)	76.2 (0.6)	65.4 (6.2)	56.2 (0.6)
<i>N</i> (%) female	849 (54.7)	686 (54.2)	400 (55.3)	470 (56.1)	384 (57.9)	1,672 (55.9)	676 (54.3)
<i>N</i> (%) manual social class	710 (45.8)	580 (45.8)	317 (43.8)	355 (42.4)	273 (41.2)	1,150 (38.4)	532 (42.7)
<i>N</i> (%) left school by 16 years	1390 (89.6)	1134 (89.6)	911 (88.4)	730 (87.1)	566 (85.4)	2,631 (87.9)	1,113 (89.3)
<i>N</i> (%) no symptoms	712 (45.9)	682 (53.9)	399 (55.2)	530 (63.2)	440 (66.4)	1,802 (60.2)	n/a
<i>N</i> (%) anxiety only	447 (28.8)	348 (27.5)	182 (25.2)	168 (20.0)	113 (17.0)	723 (24.2)	n/a
<i>N</i> (%) depression only	44 (2.8)	44 (3.5)	23 (3.2)	26 (3.1)	37 (5.6)	109 (3.6)	n/a
<i>N</i> (%) anxiety and depression	229 (14.8)	170 (13.4)	103 (14.2)	80 (9.5)	57 (8.6)	358 (12.0)	n/a
<i>N</i> (%) missing HADS	119 (7.7)	22 (1.7)	16 (2.2)	34 (4.1)	16 (2.4)	n/a	n/a
<i>N</i> with valid data <sup>d</sup>	n/a	1,210	696	517	569	2,992	1,246

<sup>a</sup> At the third visit, the two locality samples only received a shortened postal questionnaire which did not include the HADS instrument, so these respondents ( $n = 804$ ) have been excluded from the total *N* for this visit

<sup>b</sup> Statistics for social class in this column represent the proportion in a manual social class at  $t-1$  (the first interview from each pair), whilst all other statistics presented in this column refer to data at  $t$  (the second interview from each pair)

<sup>c</sup> Summary statistics in this column are based on baseline characteristics

<sup>d</sup> Valid data for analysis was defined as valid responses on all analysis variables across a pair of interviews

likely to be included. Those with a non-manual class at baseline were more likely to be included in the analysis in all cohorts, indicating a tendency for those in non-manual social classes to remain longer in the study.

Table 2 compares symptom status at  $t$  and  $t-1$  for all pairs of interviews. Stability was the most common pattern across cohorts. Of those with no symptoms at  $t-1$ , around three-quarters did not report symptoms 5 years later.

**Table 2** Current symptom status ( $t$ ) by symptom status 5 years earlier ( $t-1$ )

Symptoms at $t-1$	Symptoms at $t$				Total
	No symptoms	Anxiety only	Depression only	Anxiety and depression	
1970s cohort					
No symptoms (%)	752 (72.8)	238 (23.0)	4 (0.4)	39 (3.8)	1,033 (100.0)
Anxiety only (%)	234 (38.1)	309 (50.3)	5 (0.8)	66 (10.7)	614 (100.0)
Depression only (%)	7 (70.0)	3 (30.0)	0 (0.0)	0 (0.0)	10 (100.0)
Anxiety and depression (%)	28 (24.8)	56 (49.6)	1 (0.9)	28 (24.8)	113 (100.0)
Total (%)	1,021 (57.7)	606 (34.2)	10 (0.6)	133 (7.5)	1,770 (100.0)
1950s cohort					
No symptoms (%)	923 (77.4)	207 (17.4)	16 (1.3)	46 (3.9)	1,192 (100.0)
Anxiety only (%)	229 (35.6)	319 (49.5)	10 (1.6)	86 (13.4)	644 (100.0)
Depression only (%)	20 (60.6)	6 (18.2)	3 (9.1)	4 (12.1)	33 (100.0)
Anxiety and depression (%)	41 (16.6)	84 (34.0)	5 (2.0)	117 (47.4)	247 (100.0)
Total (%)	1,213 (57.3)	616 (29.1)	34 (1.6)	253 (12.0)	2,116 (100.0)
1930s cohort					
No symptoms (%)	1,373 (79.8)	233 (13.5)	54 (3.1)	60 (3.5)	1,720 (100.0)
Anxiety only (%)	316 (38.7)	387 (47.4)	12 (1.5)	102 (12.5)	817 (100.0)
Depression only (%)	41 (48.8)	2 (2.4)	19 (22.6)	22 (26.2)	84 (100.0)
Anxiety and depression (%)	72 (19.4)	101 (27.2)	24 (6.5)	174 (46.9)	371 (100.0)
Total (%)	1,802 (60.2)	723 (24.2)	109 (3.6)	358 (12.0)	2,992 (100.0)

Similarly, of those with only anxiety symptoms at  $t-1$ , almost half reported only anxiety symptoms at  $t$ , and among the older two cohorts, almost half of those with both anxiety and depression at  $t-1$  also reported both symptoms at  $t$ . However, of those with anxiety and depression symptoms at  $t-1$  in the youngest cohort, the most common status 5 years later was anxiety symptoms only. Those with only depression symptoms at  $t-1$  were more likely to have no symptoms 5 years later than to be in any of the symptomatic categories. There is also evidence of a tendency for anxiety symptoms to precede and then accompany depression symptoms. If those with no symptoms at  $t-1$  had symptoms 5 years later, they were more likely to be anxiety symptoms only than to include depression symptoms. Those with anxiety and depression symptoms at  $t$  were more likely to have had only anxiety symptoms 5 years earlier than either no symptoms or depression symptoms only.

For the statistical models, those with depression symptoms only were too small in number in each of the three cohorts to be treated as a separate category, and so were combined with those experiencing both depression and anxiety symptoms. This resulted in three categories: no symptoms, anxiety only and depression (where depression is usually combined with anxiety). Younger age (within cohort), female sex and prior symptoms of anxiety or depression were all associated with increased odds of experiencing anxiety only at  $t$ . Prior symptoms of anxiety and depression were associated with raised odds of

depression symptoms at  $t$ , but age was not and female sex raised the odds of depression symptoms in the youngest cohort only. Table 3 shows the odds ratios, 95 % confidence intervals (ORs; 95 % CI) and  $p$  values for associations between education and symptoms at  $t$ . Table 4 shows those for household social class. In each table, model 1 indicates whether there is an overall association between prior SES and later symptom status. In the 1970s cohort, ageing between approximately 19 and 37 years, neither education nor social class exhibited significant associations with symptom status at  $t$  ( $p > 0.05$ ). In the 1950s and the 1930s cohorts, who were respectively ageing between approximately 41–57 and 56–76 years, both education and social class were significantly associated with depression symptoms ( $p < 0.05$ ), with those in manual households or with less education faring worse. Similar associations were present in the older two cohorts for experiencing anxiety symptoms only, but the odds ratios were smaller in magnitude and were not significant for social class in the 1950s cohort.

Model 2 made further adjustment for prior symptoms from approximately 5 years earlier. This attenuated the ORs associated with disadvantaged SES by between 44.2 and 76.9 %, but only the association between education and depression symptoms in the 1950s cohort passed into non-significance. Thus, whilst a large portion of the inequalities in symptom status present in the older two cohorts at  $t$  represented perpetuation of existing inequalities from  $t-1$ , for the most part some further widening of these inequalities between the two interviews was evident.

**Table 3** Associations between current symptom status ( $t$ ) and education, with and without adjustment for earlier symptoms ( $t-1$ )

	Odds ratio (OR) for symptom status associated with leaving school by 16 years (ref: post-16 education)								
	Model 1 <sup>a</sup>			Model 2 <sup>b</sup>			Model 3 <sup>c</sup>		
	OR	95 % CI	<i>P</i> -value	OR	95 % CI	<i>P</i> -value	OR	95 % CI	<i>P</i> -value
Anxiety symptoms only at $t$ (reference: no symptoms)									
1970s cohort	0.90	0.62–1.29	0.558	0.91	0.69–1.20	0.517			
No symptoms at $t-1$							0.68	0.42–1.11	0.123
Anxiety only at $t-1$							1.40	0.90–2.17	0.132
Depression at $t-1$							1.21	0.49–2.99	0.682
1950s cohort	1.82	1.42–2.33	<0.001	1.45	1.06–1.99	0.019			
No symptoms at $t-1$							1.06	0.81–1.37	0.684
Anxiety only at $t-1$							1.84	1.05–3.22	0.032
Depression at $t-1$							2.19	1.13–4.25	0.021
1930s cohort	2.23	1.30–3.81	0.003	1.56	1.18–2.04	0.001			
No symptoms at $t-1$							2.15	1.38–3.36	0.001
Anxiety only at $t-1$							0.96	0.64–1.42	0.820
Depression at $t-1$							1.25	0.37–4.24	0.724
Depression symptoms at $t$ (inclusive of anxiety; reference no symptoms)									
1970s cohort	1.38	0.77–2.47	0.272	1.34	0.86–2.09	0.194			
No symptoms at $t-1$							0.64	0.29–1.43	0.277
Anxiety only at $t-1$							2.26	1.15–4.44	0.017
Depression at $t-1$							4.17	1.20–14.48	0.024
1950s cohort	4.06	2.18–7.58	<0.001	1.80	0.88–3.67	0.107			
No symptoms at $t-1$							1.84	0.77–4.39	0.167
Anxiety only at $t-1$							2.77	0.83–9.27	0.098
Depression at $t-1$							1.32	0.39–4.50	0.660
1930s cohort	6.28	3.35–11.78	<0.001	2.22	1.38–3.57	0.001			
No symptoms at $t-1$							5.69	1.68–19.34	0.005
Anxiety only at $t-1$							0.94	0.45–1.97	0.868
Depression at $t-1$							1.73	0.67–4.44	0.255

<sup>a</sup> This model is adjusted for age and sex only

<sup>b</sup> This model is adjusted for age, sex and symptom status at  $t-1$

<sup>c</sup> This model is adjusted for age, sex and symptom status at  $t-1$  and includes an interaction allowing the ORs for education to differ depending on symptom status at  $t-1$

In order to investigate the extent to which this widening of inequalities resulted from differences in either new incidence or the persistence of symptoms across these 5-year intervals, interactions between SES and symptom status at  $t-1$  were added in model 3. For presentation, the relevant main and interaction effects have been combined to calculate a separate OR for those in each symptom category at  $t-1$  (i.e. none, anxiety only or depression inclusive of anxiety), and the *p*-values in the table indicate whether each OR is significantly different from 0. In all cohorts, interactions significantly improved model fit for education (Wald test;  $p < 0.05$ ) but not for social class, though the results for social class did show similar patterns to those for education. After adding this interaction, there was some evidence of differential persistence by SES in the

youngest cohort, though as stated this was only an improvement in terms of model fit for education, where the inequalities were concentrated among those with prior anxiety or depression symptoms. The raised odds of experiencing anxiety symptoms only for those with less education in the 1950s cohort appeared to be concentrated among those with prior symptoms of anxiety or depression (i.e. differential persistence). For both education and social class, the inequalities in the oldest cohort for anxiety symptoms without depression were concentrated among those without prior symptoms (i.e. differential incidence). With respect to inequalities in depression symptoms, the associations with social class in the 1950s and 1930s cohorts appeared to be spread fairly evenly between those with and without symptoms at  $t-1$  (i.e. evidence of

**Table 4** Associations between current symptom status ( $t$ ) and social class, with and without adjustment for earlier symptoms ( $t-1$ )

	Odds ratio (OR) for symptom status associated with manual class (ref: non-manual)								
	Model 1 <sup>a</sup>			Model 2 <sup>b</sup>			Model 3 <sup>c</sup>		
	OR	95 % CI	<i>P</i> -value	OR	95 % CI	<i>P</i> -value	OR	95 % CI	<i>P</i> -value
Anxiety symptoms only at $t$ (reference: no symptoms)									
1970s cohort	1.37	0.94–2.01	0.103	1.27	0.93–1.73	0.136			
No symptoms at $t-1$							1.09	0.77–1.53	0.632
Anxiety only at $t-1$							1.56	0.91–2.66	0.103
Depression at $t-1$							1.57	0.56–4.40	0.393
1950s cohort	0.97	0.67–1.42	0.884	1.02	0.77–1.35	0.886			
No symptoms at $t-1$							1.13	0.79–1.61	0.506
Anxiety only at $t-1$							1.03	0.61–1.76	0.901
Depression at $t-1$							0.70	0.37–1.30	0.260
1930s cohort	1.43	1.10–1.85	0.008	1.24	1.07–1.44	0.004			
No symptoms at $t-1$							1.32	1.06–1.66	0.015
Anxiety only at $t-1$							1.16	0.89–1.52	0.279
Depression at $t-1$							1.09	0.65–1.81	0.750
Depression symptoms at $t$ (including those with anxiety and depression symptoms; reference no symptoms)									
1970s cohort	1.57	0.87–2.83	0.134	1.43	0.83–2.47	0.202			
No symptoms at $t-1$							1.18	0.51–2.75	0.693
Anxiety only at $t-1$							1.37	0.61–3.05	0.445
Depression at $t-1$							3.88	1.10–13.62	0.034
1950s cohort	4.01	2.24–7.19	<0.001	2.38	1.74–3.26	<0.001			
No symptoms at $t-1$							2.22	1.17–4.21	0.015
Anxiety only at $t-1$							2.56	1.41–4.63	0.002
Depression at $t-1$							1.95	1.09–3.49	0.024
1930s cohort	4.04	2.67–6.11	<0.001	1.95	1.55–2.46	<0.001			
No symptoms at $t-1$							2.32	1.47–3.66	<0.001
Anxiety only at $t-1$							1.75	1.17–2.63	0.006
Depression at $t-1$							1.67	1.01–2.75	0.044

<sup>a</sup> This model is adjusted for age and sex only

<sup>b</sup> This model is adjusted for age, sex and symptom status at  $t-1$

<sup>c</sup> This model is adjusted for age, sex and symptom status at  $t-1$  and includes an interaction allowing the ORs for social class to differ depending on symptom status at  $t$

differential persistence and incidence), whereas the association with education in the 1930s cohort was concentrated among those without prior symptoms (i.e. differential incidence only). It is worth noting though that even where the ORs appear similar for those with and without current symptoms, this will result in a greater difference in the probability of symptoms for those with prior symptoms than for those without, as the odds of symptoms are higher among those with prior symptoms.

## Discussion

The overall aim of this study was to investigate the extent to which the widening of socioeconomic inequalities in

anxiety and depression symptoms over the lifecourse is the result of differences in either the persistence or incidence of symptoms. Previous research on the British National Child Development Study has indicated that a substantial proportion of the socioeconomic inequalities in anxiety and depression at age 42 can be attributed to the perpetuation of inequalities in symptom levels that were already present at earlier ages [15], and our findings indicate that this is also true of inequalities among older adults. This suggests that interventions to prevent or treat symptoms among disadvantaged individuals at early ages could have substantial benefits on inequalities later in life. However, both our findings and those from other studies concur in suggesting that socioeconomic inequalities are not just perpetuated but widen with increasing age [11–13, 15]. This paper agrees

with others in showing that this happens because those in disadvantaged socioeconomic strata experience both greater persistence and incidence of symptoms [16, 35]. That a portion of the widening in inequalities over the lifecourse is attributable to differential persistence of symptoms within the same individuals underlines the above point about intervening early in life. Since there is also evidence of differences in incidence, however intervening early in life, whilst likely to be effective and beneficial, will not catch those cases which arise later in life and will not be able to completely remove socioeconomic inequalities in anxiety and depression.

Three cohorts ageing from 19 to 37, 41 to 57 and 56 to 76 years, respectively, were examined in this study to see if the role of SES differed by life stage. There was less evidence of socioeconomic inequalities in the youngest cohort than in the older cohorts, which may be because SES is less important for anxiety and depression at younger ages, or because resources and stressors associated with SES have had less time to accumulate over the lifecourse. There was evidence in this cohort, however, of educational differences in the persistence of depression symptoms, and in the likelihood of those with only anxiety symptoms progressing to depression symptoms. Inequalities may therefore widen through early adulthood, as those with anxiety symptoms and higher levels of education recover, whilst those with anxiety symptoms and lower levels of education progress to experiencing depression symptoms and maintain their depression symptoms longer once they arise.

Inequalities in the middle cohort widened via differences in persistence and incidence, though there was more evidence of differential persistence. In contrast, differences in incidence were more evident than differences in persistence within the oldest cohort, though again there was some evidence for both processes. This apparent switch from persistence to incidence in the older cohort highlights late adulthood as a potentially sensitive period for the development of symptoms. This stage of life tends to include various potentially distressing changes such as retirement or the onset of age-related health conditions, and the coping resources associated with SES may help in managing these changes without distress.

Common explanations for socioeconomic inequalities in anxiety and depression are that SES stratifies life stressors and coping resources [36, 37]. Adverse life events, poorer coping styles and weaker social support are examples of factors that are associated with disadvantaged SES and account for some of the socioeconomic variation in depression [37–39]. Although the incidence and persistence of symptoms were both stratified by SES in this study, it may not be the same resources and stressors that are responsible for these effects. Investigating whether particular stressors or coping resources are primarily

associated with the persistence or incidence of anxiety and depression might help further understanding of how inequalities develop and how they could be alleviated. For example, two measures of SES were employed in this study in order to see if there were informative differences in the associations with symptoms over the lifecourse. Education was seen as a key factor stratifying later adult socioeconomic opportunities [17]. Social class on the other hand was seen as more dynamic over the lifecourse and as representative of household SES actually achieved in adulthood. It has also been suggested that education is especially relevant for emotional well-being, because it represents development of personal characteristics such as critical thinking and problem-solving which instil a sense of control over one's life and thereby protect against anxiety and depression [40]. Findings for education and social class were largely consistent, which is unsurprising considering the role of education in stratifying adult opportunities. The main difference between the two measures was that social class tended to be associated with some differences in the persistence of depression symptoms in the older cohorts which were not evident for education. It has been argued that education becomes less indicative of current SES as a person ages and other more proximate factors such as their achieved occupation and income take precedence [41]. The comparatively weak associations between education and the persistence of symptoms in later adulthood compared to social class may be because education is a less proximate measure of SES as achieved in adulthood, emphasising the importance of recent socioeconomic circumstances for anxiety and depression in later life. On the other hand, associations with the incidence of symptoms in later life are present for both social class and education. If the critical problem-solving skills developed through education represent a coping resource that is instrumental in preventing symptoms from arising, then this might explain why education continues to be strongly associated with incidence, even in later life.

A further aim was to investigate whether SES influenced progression from one type of symptoms to another. The findings indicate that anxiety symptoms tend to precede depression symptoms, though this link may be associative rather than causal [1]. Disadvantaged SES was associated with higher rates of both anxiety and depression symptoms. Additionally, progression from anxiety to depression symptoms seemed to be more likely for those of disadvantaged SES. One suggested explanation for anxiety preceding depression is that uncontrollable adverse circumstances initially provoke anxiety and agitation, but despair and learnt helplessness follow as attempts to alter the situation are unsuccessful [18, 21]. If stressors are more common and coping resources are more scarce for those of disadvantaged SES, then this may explain why depressive

symptoms are more likely to follow on from anxiety symptoms for those with socioeconomic disadvantage. Randomised clinical studies with a longitudinal design have been proposed to investigate whether the treatment of anxiety decreases the risk for subsequent depression [1]. The findings here concur with the view that early treatment of anxiety symptoms may have potential for preventing later depression symptoms and, additionally, indicate that such an approach could contribute to the reduction of socioeconomic inequalities in depression.

There are some limitations to this study. The effects estimated represent approximations of incidence and persistence over the 5-year intervals studied. No data were available on symptoms prior to the study commencing and data on symptoms were repeated snapshots rather than complete histories, with no data on symptoms between interviews. It is therefore unclear whether incidence and persistence effects are over- or underestimated by the approximations used here. This is a problem in much of the epidemiological literature around this issue [35, 42], but given the unreliability of retrospective reporting [43–45], this sort of analysis provides the best information currently available. This also means we cannot be entirely confident that SES was always temporally prior to the symptoms under study in these analyses. Indeed, it may be that those with more persistent symptoms, or those more vulnerable to developing symptoms, find it more difficult to succeed in education and labour markets and thus their SES is the result rather than the cause of their symptoms [46, 47].

The lack of a gender difference in depression symptoms in the older cohorts is perhaps surprising, but is consistent with other findings using the HADS in ageing cohorts [28]. This may be because the HADS depression sub-scale only includes low positive affect, with gender differences concentrated in the somatic and negative affectivity symptoms on the anxiety scale. Having already stratified the analysis into the broad age bands of the three cohorts, we did not investigate whether the associations between SES and symptoms varied further by gender or age (within cohort) as the sample size was deemed insufficient. This issue could be a useful avenue for further research in larger samples.

Whilst two different measures of SES have been investigated, we acknowledge that these may not fully capture the SES variation within the population and that the findings could differ informatively if other measures were used. Income or wealth particularly might be better measures of proximate SES than household social class for individuals who have moved out of employment and into retirement [31, 41], though this would only apply to the later interview pairs from the oldest cohort here.

Finally, effects of age and cohort could not be disentangled due to limited age overlap between the cohorts and

therefore the differences in symptom patterning between the three cohorts could be interpreted as an effect of age or cohort. For example, the relative lack of inequalities in the youngest cohort, rather than being due to age, could be due to secular changes in labour markets, whereby the distinction between a manual and a non-manual social class may be becoming less representative of SES [17, 31], or SES may actually be becoming less important in more recent cohorts where some would argue that life experiences are becoming more individualised and less structured by socioeconomic factors [48].

In conclusion, this paper has investigated the development of socioeconomic inequalities in anxiety and depression over the lifecourse. At younger ages, much of the widening of inequalities with increasing age appears due to the differential persistence of symptoms, or to differences in the likelihood of progressing from anxiety to depression symptoms. In old age, however, differences in the incidence of symptoms appear to become more important.

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