



## King's Research Portal

DOI:

[10.1017/S2045796017000142](https://doi.org/10.1017/S2045796017000142)

*Document Version*

Early version, also known as pre-print

[Link to publication record in King's Research Portal](#)

*Citation for published version (APA):*

Goodwin, L., Gazard, B., Aschan, L., MacCrimmon, S., Hotopf, M., & Hatch, S. L. (2017). Taking an intersectional approach to define latent classes of socioeconomic status, ethnicity and migration status for psychiatric epidemiological research. *Epidemiology And Psychiatric Sciences*, 1-12. Advance online publication. <https://doi.org/10.1017/S2045796017000142>

### **Citing this paper**

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

### **General rights**

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

### **Take down policy**

If you believe that this document breaches copyright please contact [librarypure@kcl.ac.uk](mailto:librarypure@kcl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.

# **Taking an intersectional approach to define latent classes of socioeconomic status, ethnicity and migration status for psychiatric epidemiological research**

L Goodwin<sup>1 2\*</sup>, B Gazard<sup>1\*®</sup>, L Aschan<sup>1</sup>, S MacCrimmon<sup>1</sup>, M Hotopf<sup>1 3</sup> and S L Hatch<sup>1</sup>

\* Joint first authors

®Corresponding author

<sup>1</sup> King's College London, Psychological Medicine, Institute of Psychiatry, Psychology and Neuroscience, 10 Cutcombe Road, London, UK

<sup>2</sup> Department of Psychological Sciences, University of Liverpool, Liverpool, UK

<sup>3</sup> South London and Maudsley NHS Foundation Trust, London, UK

®Address for correspondence: Billy Gazard, Psychological Medicine, Weston Education Centre, Cutcombe Rd, London, SE5 9RJ

Word Count: 3984

1

## 2 **Abstract**

3 **Aims:** Inequalities in mental health are well documented using individual social  
4 statuses such as socioeconomic status (SES), ethnicity and migration status.  
5 However, few studies have taken an intersectional approach to investigate inequalities  
6 in mental health using latent class analysis (LCA). This study will examine the  
7 association between multiple indicator classes of social identity with common mental  
8 disorder (CMD).

9 **Methods:** Data on CMD symptoms were assessed in a diverse inner London sample  
10 of 1052 participants in the second wave of the South East London Community Health  
11 study. LCA was used to define classes of social identity using multiple indicators of  
12 SES, ethnicity and migration status. Adjusted associations between CMD and both  
13 individual indicators and multiple indicators of social identity are presented.

14 **Results:** LCA identified six groups that were differentiated by varying levels of  
15 privilege and disadvantage based on multiple SES indicators. This intersectional  
16 approach highlighted nuanced differences in odds of CMD, with the economically  
17 inactive group with multiple levels of disadvantage most likely to have a CMD. Adding  
18 ethnicity and migration status further differentiated between groups. The migrant,  
19 economically inactive and White British, economically inactive classes both had  
20 increased odds of CMD.

21 **Conclusions:** This is the first study to examine the intersections of SES, ethnicity and  
22 migration status with CMD using LCA. Results showed that both the migrant,  
23 economically inactive and the White British, economically inactive classes had a  
24 similarly high prevalence of CMD. Findings suggest that LCA is a useful methodology  
25 for investigating health inequalities by intersectional identities.

26

## 27 **Introduction**

28 Research addressing inequalities in mental health has generally explored such  
29 differences by using individual indicators of socio-economic status (SES) or other key  
30 social identities, including ethnicity and migration status. The socioeconomic gradient  
31 observed for common mental disorder (CMD) is well documented (Lorant *et al.*, 2003).  
32 A systematic review found overwhelming evidence for the association between  
33 indicators of low SES and symptoms of CMD in developed countries, with the most  
34 consistent associations for unemployment, less education and low income  
35 (Butterworth *et al.*, 2013, Fryers *et al.*, 2003, Jenkins *et al.*, 2008). There are fewer  
36 studies examining the association between CMD with ethnicity and migration status.  
37 Although findings are not always consistent, studies generally find ethnic minorities  
38 have similar or higher levels of CMD than their ethnic majority counterparts (Weich *et al.*,  
39 2004, Williams *et al.*, 1997) while migrants have been found to have fewer  
40 symptoms of CMD (Dey and Lucas, 2006). Whilst health inequalities by ethnic group  
41 appear to be reduced when adjusting for socioeconomic indicators (Nazroo, 2003),  
42 there still remains an independent health inequality that may be accounted for by  
43 discrimination and social exclusion (Williams, 1999).

44 SES is a broad term encompassing a number of constructs, but in epidemiological  
45 research it is typically assessed by a single item, such as social occupational class  
46 (E.g. McFadden *et al.*, 2009) or educational attainment (Cutler and Lleras-Muney,  
47 2006). Relying on individual measures of SES does not account for short term  
48 fluctuations or changes, such as under-employment (Feldman, 1996). Utilising a  
49 number of sources of information that can account more holistically for an individual's  
50 SES may be a more reliable approach. These other factors include education, housing  
51 tenure, and household income, which have previously been used interchangeably as  
52 measures of SES even though they are based on different constructs (Geyer *et al.*,  
53 2006). A number of approaches have been used to create indices which use multiple  
54 SES indicators to reflect a more holistic picture of SES, such as principal component  
55 analysis (Psaki *et al.*, 2014, Vyas and Kumaranayake, 2006), yet as these indices  
56 summarise a number of variables into one continuous variable, they are still unable to  
57 describe and identify patterns regarding the intersection of these variables.

58 Epidemiological research that takes an intersectional approach can provide insight  
59 into the mechanisms of health inequality by identifying health burdens among those at  
60 different intersections of social position (Bauer, 2014). In particular, those identified to  
61 be in multiple disadvantaged social positions have been shown to be at more risk of  
62 reporting psychological distress than those in singly disadvantaged or privileged social  
63 positions (Grollman, 2014). Feminist theory, and particularly the concept of  
64 intersectionality (Collins, 2000, Crenshaw, 1991), proposes examination of multiple  
65 aspects of identity simultaneously to determine how privilege and disadvantage  
66 surrounding individuals' identities interlock and can impact on health. For example, the  
67 impact of becoming economically inactive on mental health may be very different  
68 depending on an individual's migration status. A commonly used intersectional method  
69 for quantitative analyses is latent class analysis (LCA). LCA can create a series of  
70 classes that allows for the study of not only multiple disadvantaged positions but also  
71 those positions of privilege, as well as positions that occupy both (Nash, 2008). In  
72 quantitative analyses, simply controlling for any one of these social categories may  
73 lead to misleading conclusions, given that the experiences within these social  
74 categories is largely shaped by one's membership to other categories (Garnett *et al.*,  
75 2014, Rosenfield, 2012).

76 The current study uses community data from South East (Hatch *et al.*, 2016, Hatch  
77 *et al.*, 2011), which compared to the national context, is not only diverse in terms of  
78 SES but also in terms of both ethnicity and migration status. For example, 60.3% of  
79 Southwark's population identify as an ethnic minority compared to 19.5% of the UK  
80 population and the migrant population is also large, at 39% (Office for National  
81 Statistics, 2011). Both migration status and ethnicity are likely to intersect with SES  
82 indicators in different ways in this sample (Gazard *et al.*, 2014). For example, ethnic  
83 minorities are more at risk of unemployment in South East London and migrants are  
84 less likely to be homeowners (Office for National Statistics, 2011).

85 The association between SES, ethnicity and migration status, used as individual  
86 indicators, with CMD is established. Therefore, the primary aim of this study is to  
87 develop understanding of these associations by using multiple indicators in LCA to  
88 take an intersectional approach. The South East London Community Health study  
89 (SELCoH) dataset, with its diversity across SES, ethnicity and migration status,  
90 represents an ideal opportunity to explore if different patterns of inequalities in mental

91 health emerge using these multiple indicators simultaneously, in contrast to using  
92 individual indicators independently.

93 The objectives for this study are:

- 94 1. To define latent classes characterised by multiple indicators of SES
- 95 2. To determine how the latent classes of SES change when intersected with ethnicity  
96 and migration status
- 97 3. To describe the associations between the individual indicators (SES indicators,  
98 ethnicity and migration status) with CMD and then with the new multiple indicator  
99 (latent classes) measures

## 100 **Methods**

### 101 *Study design and participants*

102 The South East London Community Health (SELCoH) study is a community survey of  
103 randomly selected households from two boroughs in South East London, Lambeth  
104 and Southwark (Hatch *et al.*, 2016). The survey assesses demographic and  
105 socioeconomic characteristics; physical and mental health symptoms; health service  
106 use; and a range of social stressors and psychosocial resources. Detailed information  
107 about the recruitment process for the study has previously been reported (Hatch *et al.*,  
108 2016, Hatch *et al.*, 2011). SELCoH I included 1698 adults from 1075 households  
109 interviewed from 2008 to 2010 (household participation rate: 51.9%, within-household  
110 participation rate: 71.9%). SELCoH II targeted 1596 participants who agreed to be re-  
111 contacted. The 1052 participants that were interviewed between 2011 and 2013  
112 (response rate: 73%) will be analysed in the current study.

### 113 *Measures*

#### 114 *Common mental disorder*

115 CMD was measured using the Revised Clinical Interview Schedule (CIS-R) (Lewis *et*  
116 *al.*, 1992), a structured interview that asks about 14 symptom domains: fatigue, sleep  
117 problems, irritability, worry, depression, depressive ideas, anxiety, obsessions,  
118 subjective memory and concentration, somatic symptoms, compulsions, phobias,  
119 physical health worries and panic. A total CIS-R score of 12 or more is used to indicate  
120 the overall presence of CMD, as used in previous SELCoH studies (Gazard *et al.*,  
121 2014, Hatch *et al.*, 2011).

#### 122 *Measures of Socioeconomic Status (SES)*

123 Three categories of SES were included in the LCA to account for an individual's SES;  
124 income and occupation, housing and educational attainment. For income and  
125 occupation we used social occupational class (SOC), employment status, household  
126 income, benefit receipt and debt (past year). SOC was measured by current  
127 occupation categorized according to the Registrar General's classification (Office of  
128 population censuses and surveys, 1980) into six categories: professional (I),  
129 managerial (II), skilled non-manual (III-NM), skilled manual (III-M), semi-skilled (IV)

130 and unskilled (V). For this analysis, social occupational class was collapsed into four  
131 categories: professional & managerial (class I and II); skilled (class III non-manual and  
132 manual); semi-skilled and unskilled (classes IV and V); and no SOC assigned.  
133 Employment status was reported and categorized as follows: full or part-time  
134 employment; student; unemployed; and other. Other employment status included  
135 temporary sick, permanently sick or disabled, retired, carer and at home looking after  
136 children. Gross annual household income was also reported and was collapsed into  
137 three categories (£0-£12,097; £12,098-£31,494; £31,495+). Binary variables for  
138 current benefit receipt (excluding state pension and child benefit) and debt in the past  
139 year (excluding mortgage) were also included in the analysis. For housing we used  
140 tenure type; own outright/mortgage, private rented, social housing, or rent free; and  
141 how many times participants had moved in the past 2 years (not moved or moved  
142 once; moved twice or more). For educational attainment, highest qualification obtained  
143 by the participant was recorded and were grouped into the following categories; no  
144 qualifications/GCSE, A-Level, degree or above.

#### 145 *Migration status and ethnicity*

146 In line with previous research, migration status was captured by asking participants  
147 their country of birth and length of stay in the UK to create four migration status  
148 categories; born in the UK, migrant 0-10 years, migrant 11-20 years, and migrant 21+  
149 years (Anderson and Blinder, 2011, Malmusi *et al.*, 2010). Participants were asked to  
150 self-identify their ethnicity using UK Census categories. Ethnicity categories were  
151 collapsed into the following categories; White British, Black Caribbean, Black African,  
152 White Other, Non White Other and Mixed ethnicity. The White Other ethnic group  
153 primarily includes participants from North Africa and other European countries while  
154 the Non White Other group includes Indian, Pakistani, Chinese, Latin American and  
155 other Black and Asian groups.

#### 156 *Other demographic characteristics*

157 Age, gender and marital status (single, married/cohabiting or  
158 separated/divorced/widowed) were also used to describe the resultant latent classes.

159

160



161 *Statistical analysis*

162 *Latent class analysis*

163 To meet the first two objectives of the study, two separate LCA analyses were  
164 conducted to define groups with similar SES profiles based on the 8 measures of SES  
165 (model 1) and to define groups based on the same 8 measures of SES plus migration  
166 status and ethnicity variables (model 2). All analyses were conducted in MPlus 6  
167 (Muthén and Muthén, 2012) and accounted for clustering by household and data were  
168 weighted using sampling weights which accounted for i) within household non-  
169 response and ii) sample attrition between SELCoH I and SELCoH II. LCA is an  
170 established data-driven statistical method which allows for the classification of  
171 individuals in a sample based upon conditional probabilities (Hagenaars and  
172 McCutcheon, 2002). Individuals within a class will have a similar pattern of responses  
173 to a series of categorical variables. Parameters for the latent class models were  
174 estimated using maximum likelihood techniques (Nylund *et al.*, 2007). All models were  
175 inspected for replication of the log likelihood value to increase confidence that the best  
176 fitting solution was found (Nylund *et al.*, 2007).

177 Decisions on optimal number of latent classes for the two separate LCA analyses were  
178 informed by using the following goodness of fit statistics: Akaike's Information Criteria  
179 (AIC) (Akaike, 1987), Bayesian Information Criteria (BIC) (Gideon, 1978), sample-size  
180 adjusted Bayesian Information Criteria (SABIC) (Sclove, 1987), entropy (Ramaswamy  
181 *et al.*, 1993), the number of bivariate residuals (BVR) (Maydeu-Olivares and Joe,  
182 2006) and the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) (Lo *et al.*, 2001).  
183 Lower values for AIC, BIC and SABIC all indicate a better fit in LCA models. Entropy  
184 is a measure of the classification accuracy for an individual participant and higher  
185 entropy reflects better classification (Ramaswamy *et al.*, 1993). The number of BVR  
186 can be used to assess model fit with greater than 4 bivariate residuals suggestive of  
187 poor fit (Maydeu-Olivares and Joe, 2006). The LMR-LRT statistic was used to  
188 compare classes with similar values across the other goodness of fit statistics. BIC  
189 and SABIC are measures of model fit with penalisation for additional classes and  
190 recent research has shown these measures to be two of the most reliable indicators  
191 of best fit (Nylund *et al.*, 2007). Where goodness of fit statistics were similar between  
192 classes, model selection was predominantly based on BIC/SABIC values and

193 response probability profiles were inspected to see which solution contained the most  
194 informative classes (Nylund *et al.*, 2007).

#### 195 Missing data

196 Maximum likelihood estimation was used to account for missing data, under the  
197 assumption of data missing at random (MAR), using all information that was available  
198 to estimate the full model. Any participants with full missing data were excluded from  
199 the models.

#### 200 *Comparing LCA models*

201 After the identification of the classes, persons were assigned to their most likely class  
202 based on model probabilities (Collins and Lanza, 2013). Further analyses were then  
203 conducted in STATA 11 (Statacorp, 2009) and accounted for clustering by household  
204 and data were weighted for within household non-response and sample attrition  
205 between SELCoH I and SELCoH II. We report the unweighted frequencies and  
206 weighted percentages. To meet the first objective of the study, we described LCA  
207 model 1 with the SES and sociodemographic indicators. To meet the second objective,  
208 we then described LCA model 2 with the same indicators (plus ethnicity and migration  
209 status). The two multiple indicators (LCA model 1 and 2) were cross tabulated to see  
210 how the LCA model changed after adding migration status and ethnicity.

#### 211 *Latent classes and CMD*

212 To meet the third objective of the study, odds ratios (ORs) with 95% confidence  
213 intervals (CI) are presented for logistic regression models which included CMD as the  
214 outcome and LCA model as the exposure, adjusted for age and gender.

## 215 **Results**

216

#### 217 *Class solutions*

218

219 Goodness of fit statistics for both LCA models are presented in Table 1. For model 1,  
220 the AIC decreased from the 2 to 7 class solution, the BIC decreased until the 5 class  
221 model and the SABIC decreased until the 6 class solution. Entropy was high for all  
222 solutions and the number of BVR was below the recommended threshold for the 4 to  
223 7 class solution. The 6 class solution was selected on the basis of the SABIC and

224 interpretability of the data. For model 2, AIC decreased from the 2 to 10 class solution.  
225 The SABIC decreased until the 9 class solution (minimal decrease from 7 to 9 class  
226 solution) and the BIC decreased until the 7 class solution. Entropy remained high for  
227 all solutions and the number of bivariate residuals was acceptable for the 4 to 10 class  
228 solutions. Overall, goodness of fit statistics suggest the seven, eight or nine class  
229 solution to all offer a good explanation of the data. Based on the SABIC and BIC  
230 values, high entropy, and interpretability of the data, the 7 class solution was chosen.

231

232 *[Insert Table 1 here]*

233

234 *Model descriptions*

235 The classes for models 1 and 2 are briefly summarised in Table 2 (full descriptions of  
236 classes for both models are provided in Supplementary Tables 1 and 2). Based on  
237 these characteristics we assigned the following labels to the classes: Model 1; (1)  
238 “Professional occupations, homeowners” (32.6%), (2) “Professional occupations,  
239 renters” (4.7%), (3) “Skilled occupations, renters” (22.6%), (4) “Students, renters”  
240 (12.5%), (5) “Economically inactive, renters” (19.5%), (6) “Economically inactive,  
241 homeowners” (8.1%) and Model 2; (1) “Professional occupations, homeowners, White  
242 British” (28.7%), (2) “Economically inactive, renters, White British” (9.3%), (3)  
243 “Students, mixed tenure, non-migrant, mixed ethnicity” (12.9%), (4) “Skilled  
244 occupations, renters, non-migrant, mixed ethnicity” (14.2%), (5) “Economically  
245 inactive, homeowners, mixed migration status, mixed ethnicity” (8.2%), (6)  
246 “Professional occupations, renters, migrant, mixed ethnicity” (17.1%), (7)  
247 “Economically inactive, renters, migrant, mixed ethnicity” (9.5%).

248 *[Insert Tables 2 here]*

249

250 *Changes to classes after adding migration status and ethnicity at SELCoH II*

251

252 After adding migration status and ethnicity, there were changes to the six classes from  
253 model 1 and an additional class was introduced (see supplementary table 3 for  
254 details). Class 1 ‘Professional, homeowners’ from model 1, which was predominantly  
255 UK born and White British, was split into the ‘Professional, homeowners, White British’  
256 (Class 1) and the ‘Professional, renters, migrant, mixed ethnicity’ (Class 6). Similarly,

257 class 2 'Professional, renters' from model 1, which was more mixed in terms of  
258 migration status and ethnicity, were split evenly into 'Professional, homeowners, White  
259 British' (Class 1) and 'Professional, renters, migrant, mixed ethnicity' (Class 6). The  
260 'Skilled, renters' (Class 3) from model 1 also split into two classes; 61.8% remained  
261 classed as 'Skilled, renters, non-migrant, mixed ethnicity' (Class 4) while 28.7% were  
262 classed as 'Professional, renters, migrant, mixed ethnicity' (Class 6) in model 2. Class  
263 4, 'Student, renters', was very similar to Class 3, 'Students, mixed tenure, non-migrant,  
264 mixed ethnicity', in model 2. Both student classes were predominantly UK born and  
265 mixed in terms of ethnicity. Class 5, 'Economically inactive renters', from model 1 was  
266 split into two classes; 'Economically inactive, renters, White British' (Class 2) and the  
267 'Economically inactive, renters, migrant, mixed ethnicity' (Class 7) in model 2. Class  
268 6, 'Economically inactive, homeowners' from model 1 remained largely unchanged in  
269 model 2, 'Economically inactive, homeowners, mixed migration status, mixed ethnicity'  
270 (Class 5) in terms of SES, ethnicity and migration status.

#### 271 *Health outcomes by individual indicators and latent class models*

272 Table 3 shows the prevalence of CMD by both individual indicators (entered  
273 separately) and multiple indicators (latent classes), as well as the associations  
274 between these indicators and CMD (adjusted for age and gender only). Only those  
275 with no assigned social occupational class were at increased risk of CMD in  
276 comparison to class I/II. Other social occupational classes were not associated with  
277 CMD. Similarly, being a student, unemployed or sick/disabled was associated with  
278 increased odds of CMD in comparison to those in employment. Low household  
279 income, low educational attainment, debt, benefit receipt and low household income  
280 were also associated with CMD. Notably, both debt and benefit receipt were  
281 associated with approximately four times the odds of CMD. In terms of tenure, living  
282 in social housing was associated with CMD compared to those who owned or  
283 mortgaged their homes. There were no associations between either ethnicity or  
284 migration status with CMD.

285 In model 1 (SES only), the adjusted analyses indicated that the 'Economically inactive,  
286 renters' (class 5) had almost five times the odds of reporting CMD in comparison to  
287 the 'Professional, homeowners' (class 1). The 'Skilled, renters' (class 3) and 'Student,

288 renters' (class 4) also had increased odds of CMD. The 'Economically inactive,  
289 homeowners' (class 6) did not have an increased risk of CMD.

290 In model 2, both the 'Economically inactive, renters, White British' (Class 2) and  
291 'Economically inactive, renters, migrant, mixed ethnicity' (Class 7) had five times the  
292 odds of reporting CMD in comparison to the 'Professional, homeowners, White British'  
293 (class 1). The Students, mixed tenure, non-migrant, mixed ethnicity' (Class 3) also had  
294 increased odds of CMD.

295 *[Insert Table 3 here]*

296

297 **Discussion**

298 Using an intersectional approach allowed us to identify groups who were differentiated  
299 by varying levels of privilege and disadvantage. For example, within the economically  
300 inactive sample there was both an advantaged and disadvantaged group that had  
301 different associations with CMD. The diversity of the SELCoH sample in terms of SES,  
302 ethnicity and migration status provided a unique opportunity to study the intersection  
303 of such social identities that, to the authors' knowledge, has not been performed  
304 before. This builds upon studies that have used multiple SES indicators in LCA (Fairley  
305 *et al.*, 2014, Savage *et al.*, 2013). Adding ethnicity and migration status further  
306 differentiated between groups; for example, 'Professional, homeowners' (Class 1) split  
307 into two groups who differed by migration status. Economically inactive classes with  
308 multiple levels of disadvantage (e.g. low education and receipt of benefits) were the  
309 most likely to report CMD symptoms. In model 2 (including ethnicity and migration  
310 status) it was the 'Economically inactive, renters, migrant, mixed ethnicity' (Class 7)  
311 and 'Economically inactive, renters, White British' (Class 2) who had the greatest odds  
312 of CMD.

313 Using an LCA approach allowed us to define more cohesive social groups and  
314 subsequently the reference group in the regression analyses was also likely to be a  
315 more homogenous group, which increases the validity of the analyses. The  
316 combination of these social indicators in LCA analysis produced classes that represent  
317 privileged, mixed and disadvantaged positions, reflective of the study sample. The  
318 'Professional, homeowners, White British' (Class 1) is perhaps more representative of  
319 privileged position compared to its component individual social status indicators:  
320 professional/managerial occupations, being a homeowner or being White British. This  
321 privileged position translates into a lower prevalence of CMD (13.2%) in comparison  
322 to what has previously been identified by the individual social statuses (e.g. 20.7% in  
323 the White British ethnic group and 15.5% in those who own/mortgage their home) in  
324 this sample.

325 Reported associations for single indicators of SES and CMD in this study are similar  
326 to what have been previously reported, with similar effect sizes for unemployment  
327 (Ford *et al.*, 2010), lower income and less education (Fryers *et al.*, 2003). Using LCA  
328 to combine multiple indicators of SES highlights nuanced differences that could not be

329 uncovered using other methods that combine indicators into a continuous variable,  
330 such as principal component analysis (Psaki *et al.*, 2014, Vyas and Kumaranayake,  
331 2006). For example, while being economically inactive was associated with CMD using  
332 data from the Adult Psychiatric Morbidity Survey 2007 (Ford *et al.*, 2010), this study  
333 identified further differences in economically inactive classes by tenure, with the  
334 'Economically inactive, renters' (Class 5) being at increased risk of CMD while there  
335 was no increased risk of CMD for the 'Economically inactive, homeowners' (Class 6).  
336 This may also relate to the other advantages in the latter group, e.g. higher educational  
337 attainment. This study can therefore tell us more about the complexities of mental  
338 health risk in those who are currently economically inactive.

339 Analyses of the individual SOC indicators did not find that those in skilled or semi-  
340 skilled occupations had higher odds of CMD compared to those in professional and  
341 managerial occupations, however, in the LCA analyses those individuals in the skilled  
342 or semi-skilled occupation class were more likely to have a CMD. This suggests that  
343 this mental health association is unlikely to just be about the type of employment, but  
344 may result from other vulnerabilities that are associated with being in a lower income  
345 occupation, including factors around housing tenure. Notably, the student classes in  
346 both LCA models were associated with increased odds of CMD, with effect sizes  
347 similar to the individual SES indicator findings. This supports previous findings  
348 suggesting that depression is more common in university students compared to the  
349 general population (Ibrahim *et al.*, 2013).

350 No associations were found for individual indicators of ethnicity and migration status  
351 with CMD in this study. This is consistent with previous studies conducted in South  
352 East London (Gazard *et al.*, 2014, Hatch *et al.*, 2011) but inconsistent with the findings  
353 nationally (Weich *et al.*, 2004), which may be a result of demographic differences by  
354 study area. Nuanced differences in mental health emerged by including indicators of  
355 ethnicity and migration status in the LCA. On adding ethnicity and migration status to  
356 the models, two distinct migrant classes emerged; 'Professional, renters, migrants,  
357 mixed ethnicity' (Class 6) and 'Economically inactive, renters, migrant, mixed ethnicity'  
358 (Class 7). Only the less privileged migrant class had increased odds of CMD. This is  
359 consistent with the wider literature which suggests a key role for SES factors in  
360 explaining any ethnic inequalities in health (Darlington *et al.*, 2015) and differences in

361 health at the intersection of ethnicity and migration status (Gazard *et al.*, 2014, Smith  
362 *et al.*, 2009). Another potential explanation for differences between these classes is  
363 whether the decision to migrate was by force or choice. Forced migration, often based  
364 on economic circumstances, can lead to differences in power relations and increased  
365 exposure to adversity and discrimination experiences (Castles, 2003). Given evidence  
366 for the role of both stressful life events and discrimination in accounting for differences  
367 in CMD for ethnic minorities (Karlsen and Nazroo, 2002), migrants (Hatch *et al.*, 2016)  
368 and those from low SES backgrounds (Fuller-Rowell *et al.*, 2012), further research is  
369 needed to understand the role of such inequalities in CMD at the intersection of SES,  
370 ethnicity and migration status.

371 This study found that both 'Economically inactive, renters, migrant, mixed ethnicity'  
372 (Class 7) and 'Economically inactive, renters, White British' (Class 2) had increased  
373 odds of CMD compared to the 'Professional, homeowners, White British' (Class 1).  
374 Post hoc tests did not indicate a difference in odds of CMD for Class 7 in comparison  
375 to Class 2 (results available from authors). This difference may have been expected  
376 given the higher educational attainment of the migrant class and previous research  
377 which has associated being a migrant with lower risk of CMD (Dey and Lucas, 2006).  
378 However, the equal effect sizes could have been explained by the increased risk  
379 associated with higher levels of discrimination in ethnic minority groups being  
380 counteracted with the advantages of higher levels of education.

### 381 **Strengths and limitations**

382 This study analyses data from a large representative community study, including a  
383 diverse sample of migrants and ethnic minorities. Seventy three percent of the sample  
384 was retained in SELCoH 2, with sample attrition more likely in participants who were  
385 younger, male and unemployed, but not in those with a CMD (Hatch *et al.*, 2016). A  
386 limitation of the study is that we were limited to exploring associations between classes  
387 and symptoms of CMD rather than individual symptom domains, such as depression,  
388 due to small cell sizes. However, this study is novel in using LCA to examine the  
389 intersection of SES, ethnicity and migration status. A limitation is that due to the  
390 classes being specific to the population of interest then the results may not be  
391 generalizable to other urban contexts or the national context. However, this can



392 provide a methodology for taking an intersectional approach in other contexts and we  
393 think that this method may be particularly useful in studying diverse urban contexts.

### 394 **Conclusions**

395 This is the first study to examine the intersections of SES, ethnicity and migration  
396 status together using LCA, which additionally examines associations with CMD.  
397 Findings restricted to multiple indicators of SES identified two economically inactive  
398 classes, only one of which had increased odds of CMD (those who were also renters  
399 with low education). This approach was more informative than relying on social  
400 occupational class alone, which would have categorised individuals in both of these  
401 classes as unclassifiable. Findings including both ethnicity and migration status  
402 showed that both 'Economically inactive, renters, migrant, mixed ethnicity' (Class 7)  
403 and 'Economically inactive, renters, White British' (Class 2) had a similarly high  
404 prevalence of CMD. This work has shown that using multiple indicators in LCA is a  
405 useful methodology for investigating health inequalities by intersectional identities and  
406 in uncovering more nuanced differences in diverse settings. The findings of this  
407 research are particular to the diverse urban setting of the study area and may be  
408 related to risk and resilience factors that are unique to urban areas, such as ethnic  
409 density (Das-Munshi *et al.*, 2010, Schofield *et al.*, 2011), more accessible health  
410 services (Casey *et al.*, 2001) and increased income inequality (Galea *et al.*, 2005).  
411 Future research should consider how these factors contribute to health inequalities at  
412 the intersection of SES, migration status and ethnicity in other urban settings and  
413 national contexts.

### 414 **Acknowledgements**

415 This paper represents independent research funded by the National Institute for Health  
416 Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS  
417 Foundation Trust and King's College London. The views expressed are those of the  
418 authors and not necessarily those of the NHS, the NIHR or the Department of Health.

### 419 **Financial support**

420 This work was partly funded by the Economic and Social Research Council [Grant  
421 number RES-177-25-0015]. B Gazard also received funding from an Economic and  
422 Social Research Council Studentship. The funders did not have a role in the study

423 design; collection, analysis or interpretation of data; the writing of the manuscript; or  
424 in the decision to submit the manuscript for publication.

425 **Conflicts of interest**

426 None.

427 **Ethical standards**

428 The authors assert that all procedures contributing to this work comply with the ethical  
429 standards of the relevant national and institutional committees on human  
430 experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical  
431 approval for SELCoH I was received from the King's College London Research Ethics  
432 Committee for non-clinical research populations (CREC/07/08-152) and for SELCoH  
433 II was received from the King's College London Psychiatry, Nursing and Midwifery  
434 Research Ethics Committee (PNM/10/11-106).

435 **Availability of Data and Materials**

436 Data available on request.

## **References**

- Akaike, H.** (1987). Factor analysis and AIC. *Psychometrika* **52**, 317-332.
- Anderson, B. & Blinder, S.** (2011). Who counts as a migrant? Definitions and their consequences. *Briefing, The Migration Observatory at the University of Oxford*.
- Bauer, G. R.** (2014). Incorporating intersectionality theory into population health research methodology: Challenges and the potential to advance health equity. *Social science & medicine* **110**, 10-17.
- Butterworth, P., Leach, L., McManus, S. & Stansfeld, S.** (2013). Common mental disorders, unemployment and psychosocial job quality: is a poor job better than no job at all? *Psychological medicine* **43**, 1763-1772.
- Casey, M. M., Call, K. T. & Klingner, J. M.** (2001). Are rural residents less likely to obtain recommended preventive healthcare services? *American journal of preventive medicine* **21**, 182-188.
- Castles, S.** (2003). Towards a sociology of forced migration and social transformation. *Sociology* **37**, 13-34.
- Collins, L. M. & Lanza, S. T.** (2013). *Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences*. John Wiley & Sons.
- Collins, P. H.** (2000). Gender, black feminism, and black political economy. *The Annals of the American Academy of Political and Social Science* **568**, 41-53.
- Crenshaw, K.** (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford law review*, 1241-1299.
- Cutler, D. M. & Lleras-Muney, A.** (2006). Education and health: evaluating theories and evidence. National Bureau of Economic Research.
- Darlington, F., Geography, H., Norman, P. & Exeter, D. J.** (2015). Exploring ethnic inequalities in health: evidence from the Health Survey for England, 1998-2011.
- Das-Munshi, J., Becares, L., Dewey, M. E., Stansfeld, S. A. & Prince, M. J.** (2010). Understanding the effect of ethnic density on mental health: multi-level investigation of survey data from England. *BMJ* **341**, 5367.
- Dey, A. N. & Lucas, J. W.** (2006). *Physical and mental health characteristics of US-and foreign-born adults, United States, 1998-2003*. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Fairley, L., Cabieses, B., Small, N., Petherick, E. S., Lawlor, D. A., Pickett, K. E. & Wright, J.** (2014). Using latent class analysis to develop a model of the relationship between socioeconomic position and ethnicity: cross-sectional analyses from a multi-ethnic birth cohort study. *BMC public health* **14**, 835.
- Feldman, D. C.** (1996). The nature, antecedents and consequences of underemployment. *Journal of Management* **22**, 385-407.
- Ford, E., Clark, C., McManus, S., Harris, J., Jenkins, R., Bebbington, P., Brugha, T., Meltzer, H. & Stansfeld, S.** (2010). Common mental disorders, unemployment and welfare benefits in England. *Public health* **124**, 675-681.
- Fryers, T., Melzer, D. & Jenkins, R.** (2003). Social inequalities and the common mental disorders - A systematic review of the evidence. *Social Psychiatry and Psychiatric Epidemiology* **38**, 229-237.
- Fuller-Rowell, T. E., Evans, G. W. & Ong, A. D.** (2012). Poverty and Health The Mediating Role of Perceived Discrimination. *Psychological science* **23**, 734-739.
- Galea, S., Freudenberg, N. & Vlahov, D.** (2005). Cities and population health. *Social science & medicine* **60**, 1017-1033.
- Garnett, B. R., Masyn, K. E., Austin, S. B., Miller, M., Williams, D. R. & Viswanath, K.** (2014). The intersectionality of discrimination attributes and bullying among youth: an applied latent class analysis. *Journal of youth and adolescence* **43**, 1225-1239.
- Gazard, B., Frissa, S., Nellums, L., Hotopf, M. & Hatch, S. L.** (2014). Challenges in researching migration status, health and health service use: an intersectional analysis of a South London community. *Ethnicity & health*, 1-30.

- Geyer, S., Hemström, Ö., Peter, R. & Vågerö, D.** (2006). Education, income, and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against a common practice. *Journal of epidemiology and community health* **60**, 804-810.
- Gideon, S.** (1978). Estimating the dimension of a model. *The Annals of Statistics* **6**, 461-464.
- Grollman, E. A.** (2014). Multiple Disadvantaged Statuses and Health The Role of Multiple Forms of Discrimination. *Journal of health and social behavior* **55**, 3-19.
- Hagenaars, J. A. & McCutcheon, A. L.** (2002). *Applied latent class analysis*. Cambridge University Press.
- Hatch, S., Gazard, B., Williams, D., Frissa, S., Goodwin, L., Hotopf, M. & Team, S. S.** (2016). Discrimination and common mental disorder among migrant and ethnic groups: findings from a South East London Community sample. *Social Psychiatry and Psychiatric Epidemiology*, 1-13.
- Hatch, S. L., Frissa, S., Verdecchia, M., Stewart, R., Fear, N. T., Reichenberg, A., Morgan, C., Kankulu, B., Clark, J., Gazard, B., Medcalf, R., Team, S. & Hotopf, M.** (2011). Identifying socio-demographic and socioeconomic determinants of health inequalities in a diverse London community: The South East London Community Health (SELCoH) study. *BMC Public Health*, 861.
- Ibrahim, A. K., Kelly, S. J., Adams, C. E. & Glazebrook, C.** (2013). A systematic review of studies of depression prevalence in university students. *Journal of psychiatric research* **47**, 391-400.
- Jenkins, R., Bhugra, D., Bebbington, P., Brugha, T., Farrell, M., Coid, J., Fryers, T., Weich, S., Singleton, N. & Meltzer, H.** (2008). Debt, income and mental disorder in the general population. *Psychological medicine* **38**, 1485-1493.
- Karlsen, S. & Nazroo, J. Y.** (2002). Relation between racial discrimination, social class, and health among ethnic minority groups. *American journal of public health* **92**.
- Lewis, G., Pelosi, A. J., Araya, R. & Dunn, G.** (1992). Measuring psychiatric disorder in the community: a standardized assessment for use by lay interviewers. *Psychological medicine* **22**, 465-486.
- Lo, Y., Mendell, N. R. & Rubin, D. B.** (2001). Testing the number of components in a normal mixture. *Biometrika* **88**, 767-778.
- Lorant, V., Delière, D., Eaton, W., Robert, A., Philippot, P. & Anseau, M.** (2003). Socioeconomic inequalities in depression: a meta-analysis. Oxford Univ Press.
- Malmusi, D., Borrell, C. & Benach, J.** (2010). Migration-related health inequalities: Showing the complex interactions between gender, social class and place of origin. *Social Science & Medicine* **71**, 1610-1619.
- Maydeu-Olivares, A. & Joe, H.** (2006). Limited information goodness-of-fit testing in multidimensional contingency tables. *Psychometrika* **71**, 713-732.
- McFadden, E., Luben, R., Bingham, S., Wareham, N., Kinmonth, A.-L. & Khaw, K.-T.** (2009). Self-rated health does not explain the socioeconomic differential in mortality: a prospective study in the EPIC-Norfolk cohort. *Journal of epidemiology and community health* **63**, 329-331.
- Muthén, L. K. & Muthén, B. O.** (2012). Mplus. *The comprehensive modelling program for applied researchers: User's guide* **5**.
- Nash, J. C.** (2008). Re-thinking intersectionality. *Feminist review* **89**, 1-15.
- Nazroo, J. Y.** (2003). The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism. *American journal of public health* **93**.
- Nylund, K. L., Asparouhov, T. & Muthén, B. O.** (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural equation modeling* **14**, 535-569.
- Office for National Statistics** (2011). Census 2011. Accessed 20 January, 2017. <http://www.nomisweb.co.uk>
- Office of population censuses and surveys** (1980). Classification of occupations. Office for National Statistics.
- Psaki, S. R., Seidman, J. C., Miller, M., Gottlieb, M., Bhutta, Z. A., Ahmed, T., Ahmed, A. S., Bessong, P., John, S. M. & Kang, G.** (2014). Measuring socioeconomic status in multicountry studies: results from the eight-country MAL-ED study. *Population health metrics* **12**, 8.

- Ramaswamy, V., DeSarbo, W. S., Reibstein, D. J. & Robinson, W. T.** (1993). An empirical pooling approach for estimating marketing mix elasticities with PIMS data. *Marketing Science* **12**, 103-124.
- Rosenfield, S.** (2012). Triple jeopardy? Mental health at the intersection of gender, race, and class. *Social Science & Medicine* **74**, 1791-1801.
- Savage, M., Devine, F., Cunningham, N., Taylor, M., Li, Y., Hjellbrekke, J., Le Roux, B., Friedman, S. & Miles, A.** (2013). A new model of social class? Findings from the BBC's Great British Class Survey experiment. *Sociology* **47**, 219-250.
- Schofield, P., Ashworth, M. & Jones, R.** (2011). Ethnic isolation and psychosis: re-examining the ethnic density effect. *Psychological medicine* **41**, 1263-1269.
- Sclove, S. L.** (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika* **52**, 333-343.
- Smith, N. R., Kelly, Y. J. & Nazroo, J. Y.** (2009). Intergenerational continuities of ethnic inequalities in general health in England. *Journal of Epidemiology and Community Health* **63**, 253-258.
- Statacorp** (2009). Stata Statistical Software: Release 11. College Station, TX: Statacorp.
- Vyas, S. & Kumaranayake, L.** (2006). Constructing socio-economic status indices: how to use principal components analysis. *Health policy and planning* **21**, 459-468.
- Weich, S., Nazroo, J., Sproston, K., McMANUS, S., Blanchard, M., Erens, B., Karlsen, S., King, M., Lloyd, K. & Stansfeld, S.** (2004). Common mental disorders and ethnicity in England: the EMPIRIC study. *Psychological medicine* **34**, 1543-1551.
- Williams, D. R.** (1999). Race, socioeconomic status, and health the added effects of racism and discrimination. *Annals of the New York Academy of Sciences*, 173-188.
- Williams, D. R., Yu, Y., Jackson, J. S. & Anderson, N. B.** (1997). Racial Differences in Physical and Mental Health Socio-economic Status, Stress and Discrimination. *Journal of Health Psychology* **2**, 335-351.

**Table 1 Goodness of fit statistics for LCA models**

Model: Number of classes	Model Fit Statistics					
	AIC <sup>a</sup>	BIC <sup>b</sup>	SABIC <sup>c</sup>	E <sup>d</sup>	BVR <sup>e</sup>	LMR-LRT <sup>f</sup> p-value
<i>Model 1</i>						
2 class	12215	12379	12274	0.999	25	1941 (<0.001)
3 class	11767	12015	11856	0.904	14	475 (<0.001)
4 class	11391	11723	11511	0.882	0	469 (<0.001)
5 class	11301	11717	11450	0.888	0	109 (<0.005)
<b>6 class</b>	<b>11268</b>	<b>11769</b>	<b>11448</b>	<b>0.893</b>	<b>1</b>	<b>(p&lt;0.005)<sup>g</sup></b>
7 class	11239	11824	11449	0.879	0	(p>0.05) <sup>g</sup>
<i>Model 2</i>						
2 class	17184	17416	17267	0.999	26	2020(<0.001)
3 class	16685	17036	16811	0.921	15	537(<0.001)
4 class	16309	16780	16478	0.890	2	538(0.766)
5 class	16102	16692	16314	0.897	2	359(0.761)
6 class	15907	16616	16162	0.909	2	251(0.764)
<b>7 class</b>	<b>15741</b>	<b>16569</b>	<b>16039</b>	<b>0.916</b>	<b>3</b>	<b>250(0.768)</b>
8 class	15658	16605	15999	0.916	3	211(0.801)
9 class	15609	16674	15992	0.916	0	96(0.773)
10 class	15577	16763	16003	0.921	0	77(0.779)

*Model 1- SES indicators only; Model 2- SES indicators, migration status and ethnicity.*

<sup>a</sup>Akaike's Information Criteria (AIC); <sup>b</sup>Bayesian Information Criteria (BIC); <sup>c</sup>Sample Size Adjusted Bayesian Information Criteria (SABIC); <sup>d</sup>Entropy; <sup>e</sup>Number of bivariate residuals; <sup>f</sup>Lo-Mendell-Rubin likelihood ratio test (LMR-LRT); <sup>g</sup>No adjusted LMR-LRT value reported – p value refers to LMR-LRT test

**Table 2 Description of latent classes from models 1 and 2**

<b>Model 1 (SES indicators only)</b>		<b>Model 2 (SES, ethnicity and migration status)</b>	
Class 1	<b>“Professional, homeowners”</b> Professional/managerial occupations (85%) High household income (93%), low debt (4%) and low benefit receipt (3%) High educational attainment (91%) Homeowners (69%)	Class 1	<b>“Professional, homeowners, White British”</b> Non-migrant (95%) and White British (86%) Professional/managerial occupations (84%), high household income (90%), low debt (6%) and benefit receipt (3%) High educational attainment (87%) Homeowners (67%)
Class 2	<b>“Professional, renters”</b> Professional/managerial occupations (64%) High household income (79%), low debt 6%) and low benefit receipt (10%) High educational attainment (73%) Private rented (86%) and high residential mobility (100%)	Class 2	<b>“Economically inactive, renters, White British”</b> Non-migrant (100%) and White British (97%) Economically inactive (100%), low household income (100%), high benefit receipt (68%) Low educational attainment (81%) Social housing (88%)
Class 3	<b>“Skilled, renters”</b> Skilled and semi-skilled occupations (67%), mixed household income and high debt (27%) Mixed educational attainment Private rented/social housing (79%)	Class 3	<b>“Students, mixed tenure, non-migrant, mixed ethnicity”</b> Non-migrant (77%) and mixed ethnicity (predominantly White British and Black African) Students (76%), high household income (66%) Mixed tenure
Class 4	<b>“Students, renters”</b> Students (76%) Medium level of debt (18%) and low benefit receipt (14.5%) Mixed tenure	Class 4	<b>“Skilled, renters, non-migrant, mixed ethnicity”</b> Non-migrant (75%) and mixed ethnicity (predominantly White British and Black Caribbean) Skilled and semi-skilled occupations (77%), mixed household income, high debt (31%) Low educational attainment (91%) Social housing (67%)
Class 5	<b>“Economically inactive, renters”</b> Economically inactive (100%), high debt (32%) and high benefit receipt (76.4%) Low educational attainment (62%) Social housing (84%)	Class 5	<b>“Economically inactive, homeowners, mixed migration status, mixed ethnicity”</b> Mixed migration status, mixed ethnicity (predominantly White British and White Other) Economically inactive (100%) High educational attainment (70%) Homeowners (89%)



Class 6	<p><b>“Economically inactive, homeowners”</b>  Economically inactive (100%) and mixed household income  No debt and low benefit receipt (12%)  High educational attainment (70%)  Homeowners (89%)</p>	Class 6	<p><b>“Professional, renters, migrant, mixed ethnicity”</b>  Migrant (93%) and mixed ethnicity (predominantly Black African, White Other, Non-White Other)  Professional/managerial occupations (61%), high household income (72%), low benefit receipt (10%)  High educational attainment (69%)  Private/Local authority rented (67%)</p>
		Class 7	<p><b>“Economically inactive, renters, migrant, mixed ethnicity”</b>  Migrant (72%) and mixed ethnicity (predominantly Black Caribbean, Black African White Other and Non-White Other)  Economically inactive (100%), low household income (92%), high debt (43%) and high benefit receipt (84%)  Mixed educational attainment  Local authority rented (80%)</p>

*Full descriptions of classes for both models are provided in Supplementary Tables 1 and 2*

**Table 3 Prevalence estimates, adjusted odds ratios and confidence intervals for common mental disorder by individual indicators and multiple indicators**

	<i>Common mental disorder</i>				<i>p</i>
	<i>n</i>	<i>%</i>	<i>OR</i> <sup>1</sup>	<i>(95%CI)</i>	
<b>Individual indicators</b>					
<i>Social occupational class</i>					
Class I/II	59	(14.6)	1.00		
Class III	25	(16.1)	1.12	(0.66-1.88)	0.679
Class IV/V	20	(20.5)	1.45	(0.81-2.59)	0.216
No SOC assigned	127	(31.5)	2.63	(1.81-3.81)	<0.001
<i>Employment status</i>					
Full/part-time employed	104	(15.8)	1.00		
Student	23	(26.6)	1.94	(1.07-3.49)	0.028
Unemployed	36	(36.7)	3.07	(1.86-5.06)	<0.001
Temporary sick/disabled	27	(67.3)	10.83	(5.38-21.83)	<0.001
Retired	28	(21.4)	1.47	(0.76-2.86)	0.257
Looking after children	13	(24.0)	1.34	(0.69-2.63)	0.380
<i>Household income</i>					
£0 - £31,494	121	(29.7)	2.39	(1.69-3.38)	<0.001
£31495+	80	(15.1)	1.00		
<i>Any debt</i>					
No	154	(17.3)	1.00		
Yes	77	(46.6)	4.27	(3.00-6.07)	<0.001
<i>Any benefits</i>					
No	124	(15.7)	1.00		
Yes	107	(41.9)	3.79	(2.76-5.21)	<0.001
<i>Tenure</i>					
Own outright/ mortgage	65	(15.5)	1.00		
Rent/private	47	(20.8)	1.46	(0.93-2.30)	0.104
Rent/council	103	(30.5)	2.32	(1.60-3.37)	<0.001
Other	8	(20.2)	1.39	(0.60-3.21)	0.446
<i>Moved in past 2 years</i>					
Not moved or moved once	208	(22.3)	1.00		
Moved twice or more	16	(19.4)	0.86	(0.46-1.62)	0.507

<i>Educational attainment</i>					
No qualifications/GCSE	78	(31.2)	2.56	(1.77-3.71)	<0.001
A Level	72	(27.2)	2.06	(1.42-2.99)	<0.001
Degree or above	81	(15.1)	1.00		
<i>Ethnicity</i>					
White British	109	(20.7)	1.00		
Black Caribbean	19	(21.7)	1.01	(0.57-1.79)	0.968
Black African	25	(18.5)	0.85	(0.50-1.43)	0.532
White Other	41	(28.2)	1.48	(0.95-2.29)	0.080
Non White Other	27	(27.8)	1.40	(0.85-2.31)	0.180
Mixed	10	(18.6)	0.92	(0.44-1.92)	0.821
<i>Migrant status</i>					
Born in the UK	142	(21.5)	1.00		
Migrant (0-10)	23	(17.9)	0.75	(0.44-1.28)	0.292
Migrant (11-20)	27	(25.1)	1.15	(0.70-1.91)	0.579
Migrant (21+)	37	(26.3)	1.34	(0.83-2.16)	0.234
<b>Multiple indicators (LCA)</b>					
<i>Model 1 (SES only)<sup>2</sup></i>					
Class 1	49	(13.8)	1.00		
Class 2	5	(10.3)	0.82	(0.26-2.62)	0.735
Class 3	50	(20.0)	<b>1.59</b>	<b>(1.00-2.51)</b>	<b>0.048</b>
Class 4	26	(25.0)	<b>2.48</b>	<b>(1.33-4.62)</b>	<b>0.004</b>
Class 5	84	(41.5)	<b>4.89</b>	<b>(3.05-7.76)</b>	<b>&lt;0.001</b>
Class 6	17	(16.9)	1.40	(0.73-2.70)	0.312
<i>Model 2 (SES, ethnicity, migration status)<sup>3</sup></i>					
Class 1	41	(13.2)	1.00		
Class 2	42	(41.1)	<b>5.04</b>	<b>(2.81-9.06)</b>	<b>&lt;0.001</b>
Class 3	28	(25.5)	<b>2.06</b>	<b>(1.13-3.74)</b>	<b>0.018</b>
Class 4	33	(20.6)	1.66	(0.97-2.83)	0.063
Class 5	15	(14.3)	1.13	(0.57-2.22)	0.732
Class 6	30	(16.2)	1.25	(0.72-2.16)	0.436
Class 7	42	(44.9)	<b>5.24</b>	<b>(2.99-9.20)</b>	<b>&lt;0.001</b>

OR=odds ratio; CI=confidence interval

Weighted percentages to account for survey design; frequencies are unweighted and may not add up due to missing values.

<sup>1</sup>Individual and multiple indicators adjusted for age and gender only

<sup>2</sup>**Model 1 classes;** Class 1-Professional, homeowners; Class 2- Professional, renters; Class 3-Skilled, renters; Class 4-Students, renters; Class 5-Economically inactive, renters; Class 6-Economically inactive, home owners.

<sup>3</sup>**Model 2 classes;** Class 1-Professional, homeowners, White British; Class 2-Economically inactive, renters, White British; Class 3-Students, mixed tenure, non-migrant, mixed ethnicity; Class 4-Skilled, renters, non-migrant, mixed ethnicity; Class 5-Economically inactive, homeowners, mixed migration status, mixed ethnicity; Class 6- Professional, renters, migrant, mixed ethnicity; Class 7- Economically inactive, renters, migrant, mixed ethnicity

**Supplementary Table 1: Describing the SES and sociodemographic (SD) characteristics for model 1**

	<b>Model 1 (n=1052)</b>					
<b>SES and SD indicators</b>	<b>Class 1 (n=351)</b>	<b>Class 2 (n=43)</b>	<b>Class 3 (n=244)</b>	<b>Class 4 (n=103)</b>	<b>Class 5 (n=213)</b>	<b>Class 6 (n=98)</b>
<b>Social occupational class</b>						
Class I	69 (19.9)	9 (22.9)	5 (1.6)	0	0	0
Class II	229(65.1)	19 (40.7)	58 (24.1)	0	0	0
Class IIINM	30 (8.7)	8 (19.6)	65 (26.5)	0	0	0
Class IIIM	18 (5.0)	0	34 (14.7)	0	0	0
Class IV	4 (1.0)	7 (16.9)	64 (25.9)	0	0	0
Class V	1 (0.3)	0	18 (7.2)	0	0	0
No SOC assigned	0	0	0	102 (100)	213 (100)	98 (100)
<b>Employment status</b>						
Full/part-time employed	351 (100)	43 (100)	244 (100)	0	0	0
Student	0	0	0	74 (75.9)	10 (6.3)	0
Unemployed	0	0	0	28 (24.1)	55 (29.5)	13 (14.6)
Temporary sick/disabled	0	0	0	0	38 (18.9)	3 (4.0)
Retired	0	0	0	0	84 (32.8)	55 (52.9)
Looking after children	0	0	0	0	26 (12.6)	27 (28.5)
<b>Educational attainment</b>						
No qualifications/GCSE	4 (1.0)	3 (6.9)	86 (34.9)	11 (10.2)	136 (61.5)	20 (18.7)
A Level	28 (7.7)	9 (20.1)	104 (44.0)	54 (53.6)	56 (28.1)	11 (11.1)
Degree or above	319 (91.3)	31 (73.0)	54 (21.1)	38 (36.1)	21 (10.4)	67 (70.2)
<b>Household income</b>						
£0-12,096	1 (0.3)	0	38 (16.1)	13 (15.7)	116 (63.0)	8 (8.7)
£12,097- £31,494	23 (6.6)	9 (20.7)	106 (47.3)	13 (16.9)	65 (32.8)	24 (28.9)
£31495+	314 (93.1)	32 (79.3)	79 (36.6)	49 (67.4)	7 (4.1)	50 (62.4)
<b>Any debt</b>						
No	337 (96.0)	40 (94.0)	179 (73.0)	84 (82.1)	153 (68.1)	98 (100)
Yes	14 (4.0)	3 (6.0)	65 (27.0)	19 (17.9)	60 (31.9)	0
<b>Any benefits</b>						
No	341 (97.2)	39 (90.2)	184 (76.9)	87 (85.5)	59 (23.6)	87 (88.1)
Yes	10 (2.8)	4 (9.8)	60 (23.1)	16 (14.5)	154 (76.4)	11 (11.9)
<b>Tenure</b>						

Own outright/ mortgage	237 (69.0)	5 (8.9)	41 (15.6)	31 (31.7)	4 (1.8)	87 (89.1)
Private rented	77 (25.4)	36 (86.2)	44 (20.4)	32 (30.8)	28 (14.1)	5(6.2)
Social housing	12 (3.6)	1 (2.3)	142 (58.7)	12 (11.3)	177 (83.7)	4 (4.7)
Rent free	7 (2.0)	1 (2.6)	11 (5.3)	25 (26.3)	1 (0.4)	0
<b>Moved in past 2 years</b>						
Not moved or moved once	330 (99.1)	0	223 (96.7)	86 (86.5)	199 (93.2)	96 (100.0)
Moved twice or more	3 (0.9)	43 (100)	7 (3.3)	14 (13.5)	12 (6.8)	0
<b>Gender</b>						
Male	163 (52.4)	22 (58.7)	96 (45.7)	44 (49.9)	79 (41.3)	33 (37.1)
Female	188 (47.6)	21 (41.3)	148 (54.3)	59 (50.1)	134 (58.7)	65 (62.9)
<b>Age (in years)</b>						
16-34	111 (38.0)	30 (74.7)	82 (43.0)	92 (92.8)	44 (26.7)	14 (17.4)
35-54	187 (50.5)	12 (23.6)	114 (42.3)	10 (6.6)	62 (30.5)	21 (22.3)
55+	53 (11.5)	1 (1.7)	48 (14.7)	1 (0.6)	107 (42.8)	63 (60.3)
<b>Ethnicity</b>						
White British	220 (62.4)	22 (46.5)	97 (38.9)	37 (37.0)	109 (49.1)	51 (51.7)
Black Caribbean	12 (3.3)	1 (2.0)	35 (15.3)	7 (7.5)	23 (11.1)	7 (7.5)
Black African	25 (7.3)	3 (7.6)	44 (17.6)	26 (25.4)	30 (15.2)	7 (7.7)
White Other	57 (15.9)	7 (17.4)	31 (12.4)	12 (10.0)	22 (10.9)	18 (17.7)
Non-White Other	24 (7.1)	6 (15.2)	26 (10.8)	13 (11.8)	17 (8.2)	12 (11.9)
Mixed ethnicity	13 (4.0)	4 (11.3)	11 (5.0)	8 (8.3)	11 (5.5)	3 (3.5)
<b>Migrant status</b>						
Born in the UK	243 (70.2)	25 (57.6)	136 (57.6)	69 (69.6)	139 (65.5)	54 (55.8)
0-10 years	45 (13.5)	8 (18.9)	36 (15.8)	18 (15.7)	11 (5.7)	9 (9.9)
11-20 years	29 (7.6)	8 (20.0)	33 (13.9)	11 (11.3)	25 (13.1)	5 (5.4)
21+ years	32 (8.7)	2 (3.5)	37 (12.7)	5 (3.4)	38 (15.7)	29 (28.9)

**Model 1 classes;** Class 1-Professional, homeowners; Class 2- Professional, renters; Class 3-Skilled, renters; Class 4-Students, renters; Class 5-Economically inactive, renters; Class 6-Economically inactive, home owners.

**Supplementary Table 2 Describing the SES and sociodemographic (SD) characteristics for model 2**

	Model 2 (n=1052)						
	Class 1 (n=305)	Class 2 (n=107)	Class 3 (n=106)	Class 4 (n=153)	Class 5 (n=100)	Class 6 (n=181)	Class 7 (n=100)
<b>SES and SD Indicators</b>							
<b>Social occupational class</b>							
Class I	59(19.4)	0	0	1(0.7)	0	23(13.3)	0
Class II	197(64.4)	0	0	23(14.6)	0	86(47.2)	0
Class III <sub>NM</sub>	30(10.2)	0	0	44(27.8)	0	29(16.9)	0
Class III <sub>M</sub>	16(4.9)	0	0	27(18.7)	0	9(5.1)	0
Class IV	3(1.0)	0	0	46(30.3)	0	26(14.0)	0
Class V	0	0	0	12(8.0)	0	7(3.5)	0
No SOC assigned	0	107(100)	106(100)	0	100(100)	0	100(100)
<b>Employment status</b>							
Full/part-time employed	305(100)	0	0	153(100)	0	180(100)	0
Student	0	0	78(76.0)	0	0	0	6(8.0)
Unemployed	0	27(28.8)	28(24.0)	0	16(16.6)	0	25(29.1)
Temporary	0	18(19.2)	0	0	4(5.0)	0	19(19.0)
sick/disabled							
Retired	0	56(45.8)	0	0	53(50.2)	0	30(24.2)
Looking after children	0	6(6.2)	0	0	27(28.2)	0	20(19.7)
<b>Educational attainment</b>							
No qualifications/GCSE	6(1.8)	88(80.7)	13(12.1)	75(47.9)	19(17.6)	12(6.8)	47(45.0)
A Level	32(11.1)	17(17.4)	55(52.3)	65(43.4)	13(12.7)	45(24.4)	35(36.9)
Degree or above	267(87.1)	2(1.9)	38(35.6)	13(8.7)	68(69.7)	124(68.8)	18(18.1)
<b>Household income</b>							
£0 - £12,096	3(0.8)	53(56.8)	14(17.0)	25(16.6)	11(11.7)	11(6.3)	59(68.6)
£12,097-£31,494	29(9.6)	41(43.2)	14(17.5)	71(51.1)	25(29.1)	38(21.5)	22(23.2)
£31495+	261(89.6)	0	49(65.5)	43(32.3)	49(59.2)	122(72.2)	7(8.2)
<b>Any debt</b>							
No	289(94.3)	86(76.7)	88(83.4)	104(69.1)	99(99.0)	164(90.3)	61(57.5)
Yes	16(5.7)	21(23.3)	18(16.6)	49(30.9)	1(1.0)	17(9.7)	39(42.5)
<b>Any benefits</b>							
No	294(96.6)	39(31.6)	87(83.8)	108(72.1)	87(86.5)	162(89.6)	20(16.4)

Yes	11(3.4)	68(68.4)	19(16.2)	45(27.9)	13(13.5)	19(10.4)	80(83.6)
<b>Tenure</b>							
Own outright/ mortgage	199(66.4)	3(2.9)	31(30.7)	27(16.3)	88(89.4)	57(29.3)	0
Private rented	68(26.9)	10(8.8)	32(29.9)	16(11.6)	5(6.2)	73(45.3)	18(19.9)
Social housing	15(4.6)	93(87.6)	17(15.2)	101(66.7)	4(4.4)	39(21.3)	79(80.1)
Other	6(2.1)	1(0.8)	24(24.2)	7(5.4)	0	7(4.1)	0
<b>Moved in past 2 years</b>							
Not moved or moved once	262(90.4)	106(98.8)	88(85.2)	145(94.6)	97(100)	157(85.7)	89(89.6)
Moved twice or more	26(9.6)	1(1.2)	16(14.8)	7(5.4)	0	20(14.3)	9(10.4)
<b>Ethnicity</b>							
White British	265(86.0)	103(97.2)	42(39.8)	74(46.5)	52(52.0)	0	0
Black Caribbean	11(3.6)	0	8(7.9)	37(25.4)	8(8.5)	0	21(20.8)
Black African	1(0.5)	0	27(26.0)	9(5.5)	6(6.4)	62(33.8)	30(29.8)
White Other	14(4.6)	0	8(6.6)	11(7.7)	19(18.3)	71(38.0)	24(24.3)
Non-White Other	6(2.3)	0	12(10.9)	11(6.7)	13(12.7)	39(22.5)	17(16.6)
Mixed	8(3.0)	3(2.8)	9(8.8)	11(8.2)	2(2.1)	9(5.7)	8(8.5)
<b>Migrant status</b>							
Born in the UK	285(95.1)	107(100)	79(76.8)	110(74.9)	52(54.7)	10(6.8)	25(28.0)
Migrant (0-10)	2(0.6)	0	17(14.4)	6(4.3)	9(10.1)	81(47.3)	11(12.1)
Migrant (11-20)	3(1.0)	0	8(8.2)	16(11.1)	4(4.4)	52(28.6)	27(28.5)
Migrant (21+)	10(3.3)	0	1(0.7)	17(9.7)	31(30.8)	37(17.2)	37(31.5)
<b>Gender</b>							
Male	144(53.6)	44(45.8)	48(52.3)	60(45.5)	32(35.2)	77(48.6)	32(35.5)
Female	161(46.4)	63(54.2)	58(47.7)	93(54.5)	68(64.8)	104(51.4)	68(64.5)
<b>Age</b>							
16-34	105(41.5)	13(16.6)	93(91.1)	52(44.0)	15(18.3)	67(44.3)	28(34.1)
35-54	155(47.5)	23(23.8)	13(8.9)	70(40.9)	22(22.2)	88(44.7)	35(35.5)
55+	45(11.0)	71(60.0)	0	31(15.1)	63(59.5)	26(11.0)	37(30.4)

**Model 2 classes;** Class 1-Professional, homeowners, White British; Class 2-Economically inactive, renters, White British; Class 3-Students, mixed tenure, non-migrant, mixed ethnicity; Class 4-Skilled, renters, non-migrant, mixed ethnicity; Class 5-Economically inactive, homeowners, mixed migration status, mixed ethnicity; Class 6- Professional, renters, migrant, mixed ethnicity; Class 7- Economically inactive, renters, migrant, mixed ethnicity



**Supplementary Table 3 Overlap between classes for the two different models**

Model 1 vs. model 2		Classes in model 2 (SES, migration status and ethnicity) <sup>2</sup>						
		Class 1 n	Class 2 n	Class 3 n	Class 4 n	Class 5 n	Class 6 n	Class 7 n
<b>Classes in model 1 (SES only)<sup>1</sup></b>	<b>Class 1 n (row %)</b>	258(74.0)	<b>0</b>	0	1 (0.2)	0	92 (25.8)	<b>0</b>
	<b>Class 2 n (row %)</b>	<b>24 (51.2)</b>	0	0	2 (5.1)	0	<b>17 (43.7)</b>	0
	<b>Class 3 n (row %)</b>	23 (9.5)	0	0	150(61.8)	<b>0</b>	71 (28.7)	0
	<b>Class 4 n (row %)</b>	0	0	<b>97 (95.6)</b>	0	3 (1.8)	1 (1.0)	2 (1.7)
	<b>Class 5 n (row %)</b>	0	106(47.3)	8 (4.6)	<b>0</b>	<b>3 (1.2)</b>	0	96 (47.0)
	<b>Class 6 n (row %)</b>	0	1 (1.0)	1 (1.4)	<b>0</b>	94 (95.5)	0	2 (2.2)

<sup>1</sup>**Model 1 classes;** Class 1-Professional, homeowners; Class 2- Professional, renters; Class 3-Skilled, renters; Class 4-Students, renters; Class 5-Economically inactive, renters; Class 6-Economically inactive, home owners.

<sup>2</sup>**Model 2 classes;** Class 1-Professional, homeowners, White British; Class 2-Economically inactive, renters, White British; Class 3-Students, mixed tenure, non-migrant, mixed ethnicity; Class 4-Skilled, renters, non-migrant, mixed ethnicity; Class 5-Economically inactive, homeowners, mixed migration status, mixed ethnicity; Class 6- Professional, renters, migrant, mixed ethnicity; Class 7- Economically inactive, renters, migrant, mixed ethnicity