**Community ethnic density, ethnic segregation, and ethnic minorities’ common mental disorders in the UK**

**Abstract**

Studies in the UK demonstrate evidence that ethnic minorities living in communities with a higher proportion of co-ethnics report better mental health: co-ethnic density effects. This paper aims to address three gaps in this literature. Firstly, most UK research has focused on acute mental disorders (e.g., psychosis), with little work examining co-ethnic density effects for more common mental disorders. Secondly, there is a paucity of research exploring the role that residential segregation may play alongside co-ethnic density in minority mental health. Thirdly, little systematic testing has examined at what geographic-scale co-ethnic density effects are most salient for minority-group mental health. To address these potential gaps, we apply multi-level linear regression modelling to a large-scale, nationally-representative UK panel dataset, containing an ethnic minority booster-sample, to study the community-level drivers of mental health-related quality-of-life (SF-12 Mental Component Summary Score). The results demonstrate mixed support for the protective-effects of co-ethnic density on mental well-being. However, they demonstrate broadly consistent support for the impact of residential segregation on mental well-being. In particular, that segregation exerts a non-linear effect: mental well-being is at its most positive at medium-levels of segregation, somewhat more negative at low-levels of segregation, and much more negative at higher-levels of segregation. These patterns are present for the ‘all ethnic minority’ sample, and stronger for Black sub-groups compared to Asian sub-groups. These relationships appear most consistent at meso-local geographic scales (Middle Super Output Areas). These findings have important implications for theorising our understanding of the nexus between the community and mental health among minority-groups.

**Keywords: Co-**Ethnic Density, Ethnic Minorities, Mental Health, Multi-Level Analysis, Segregation

1. **Introduction**

Studies show co-ethnic density can offer a protective-effect for minorities’ mental health (Bécares et al. 2009; Schofield et al. 2011; Richardson 2018). However, results are not always consistent, with stronger effects for acute mental health outcomes than common mental health disorders and mental well-being (Vogt Yuan 2007; Bécares et al. 2018), and heterogeneous-effects across ethnic groups (Bécares et al. 2018). Current research has been invaluable for developing our knowledge of how the ethnic structure of communities is linked to minorities’ mental health; however, potential gaps remain in our understanding of this relationship.

Firstly, fewer studies, especially in the UK, explore the association between co-ethnic density and common mental health disorders and well-being (relative to more acute outcomes, such as suicidal ideation). Studying the former is important. It helps reduce some bias and ethnocentrism directed against clinical diagnostics whose design and development disadvantage non-white, non-Anglo minorities (Halpern and Nazroo 2000). It also reduces possible health-seeking selection biases resulting from minorities lack of inclusion in mental health studies’ samples, given lower likelihoods of engaging with mental health services (Halpern and Nazroo 2000; Das-Munshi et al. 2012). Finally, it such measures also provide insights into general mental wellbeing as an equally important indicator of quality of life compared to most UK-based studies focusing on acute mental disorders, such as schizophrenia (Das-Munshi et al. 2012).

Secondly, differences in the geographic-scale at which ‘communities’ are operationalised across studies (from neighbourhoods up to broader city-wide areas) means that differences in findings between studies may result from choice of geographic-scale rather than substantive differences in contextual-processes. This also makes it difficult to crystallise the optimal geographical-scale at which co-ethnic density operates for minorities’ mental health (Das-Munshi et al. 2012).

Thirdly, alongside the co-ethnic density literature, a largely separate literature explores the role of segregation in shaping minorities’ mental health; yet these two literatures rarely overlap (Lee 2009; Do et al. 2019). Considering the role of co-ethnic density and segregation *simultaneously* is crucial as Laurence et al. (2019) show these measures capture two relatively distinct characteristics of a community’s ethnic-structure, and that capturing co-ethnic density alone gives little indication of how unevenly ethnic groups are distributed across a community. For example, one can imagine two high co-ethnic density areas, where 50 percent of the area is Black. However, in one of these areas, all the Black residents may be clustered together on a street or two, cut-off from the rest of the area i.e., a high co-ethnic density, segregated area. In the other area, all the Black residents may be equally spread out across every street in the area i.e., a high co-ethnic density, integrated area. In other words, the level of co-ethnic density in an area alone does not tell us how (un)evenly groups are distributed across it (its level of segregation) and areas with equal levels of co-ethnic density can have substantially different levels of segregation (Figure 1 below will visualise this point in more detail). Accordingly, little consideration has been paid to the role that both measures may simultaneously play for minorities’ mental health, which is potentially problematic, given they may exert potentially competing/complementary effects on mental health (*although see* Nobles et al. 2017).

This paper therefore aims to test the relative importance of both co-ethnic density and residential segregation in shaping ethnic minorities’ general mental health in the UK, and explore at what geographic-scale of the ‘community’ such contextual-processes are most salient. We draw on a large-scale, nationally-representative UK panel study, which includes an ethnic minority booster (EMB) sample, to test how communities matter for minorities’ mental health. The EMB contains large samples of minority sub-groups (Black African, Black Caribbean, Indian, Bangladeshi/Pakistani, Chinese, Arab, Other White, and Other Ethnicity) to test whether processes differ across minority groups. In a novel approach, we focus on self-reported mental health experiences, the SF-12, instead of specific mental health symptomology or mental health hospital admission rates. We also model the association across three geographical scales, from the neighbourhood up to the (sub-)city area, to explore at which scale effects appear most pronounced.

1. **Co-Ethnic Density, Segregation and Mental Health**

*2.1 Co-Ethnic density effect and mental health*

Several theories have been developed to explain why co-ethnic density may benefit individuals’ mental health. One set of theories relate to its role in protecting minorities from the well-established deleterious effects of racial harassment on mental health. Drawing on an opportunities-structure argument, living amongst co-ethnics might reduce the risk of exposure to experiences of racial prejudice from the majority-group (Halpern and Nazroo 2000; Bécares et al. 2009). Relatedly, co-ethnic members might provide a ‘protective shield’, through social capital accrued from co-ethnic cohabitation, against prejudice’s harm, by changing minorities’ appraisal-processes for stressful events, permitting them to recognise common experiences of discrimination among their group, in turn, mitigating its harm to themselves (Bécares et al. 2009). Simultaneously, higher concentrations of minorities may also facilitate stronger social support and community cohesion, with known benefits for mental health (Bécares et al. 2009).

Considerable work investigates whether the residential concentration of co-racial/ethnic minorities in a neighbourhood fosters better mental health (Bécares et al. 2009; Schofield et al. 2011; Das-Munshi et al. 2012; Richardson 2018). Studies from the UK and US generally suggest that minorities do accrue benefits from living near co-ethnic members in their neighbourhoods (Boydell et al. 2001; Bécares et al. 2009; Bhavasar et al. 2014). However, heterogeneity also exists in these results (Heslin et al.’s 2018; Jun et al. 2020).

Firstly, effects appear stronger and more consistent for Black minorities (Boydell et al. 2001; Bhavasar et al. 2014), where Black African and Caribbean respondents’ co-ethnic density resulted in lower symptoms of schizophrenia (Bhavsar et al. 2014), although Schofield et al. (2011) suggested this may be non-linear with declining returns to mental health beyond a threshold of approximately 25-percent (and work has even showed heterogeneity between Caribbeans and Africans e.g., Bécares et al. 2009). The results for South Asian groups, however, are mixed, with co-ethnic-density benefits for Indians’ neurotic and psychosis symptoms (Halpern and Nazroo 2000), and to a lesser extent Bangladeshis (Das-Munshi 2012), but with an inverse association for Pakistanis (Halpern and Nazroo 2000). Another driver of heterogeneity in the results is the mental health outcome studied. Early work largely tested institutional statistics such as mental health hospital admission rates (*see* Rabkin 1979), while more recent studies examining measures of acute mental health, such as psychosis symptomology (Halpern and Nazroo 2000; Bécares et al. 2009; Schofield 2011; Richardson 2018) and schizophrenia symptomology (Bhavsar 2014) draw from self-assessment questionnaires. As Bécares et al. (2018) note in their review of the literature, density-effects appear stronger and more consistent for these more acute mental health symptoms, and are often smaller and non-significant for more common mental disorders, such as anxiety and depression (Bécares et al. 2018). Fewer studies also examine co-ethnic density effects for more common mental disorders in the UK, making it more difficult to draw conclusions as to how these processes operate in this context.

Another potential source of heterogeneity in co-ethnic density findings may stem from the geographical scale at which the ‘community’ (and thus, level of co-ethnic density) is measured. Overall, researchers have not yet agreed on the optimal geographical scale in which co-ethnic density operates for minorities’ mental health (Das-Munshi et al. 2012). UK studies tend to apply a range of census/administrative boundaries as proxies for the ‘community.’ Schofield et al. (2011) and Jun et al. (2020), for example, tested the effect at Lower-layer Super Output Areas (LSOA); Das-Munshi et al. (2012) tested relationships at the Middle-Super Output Area (MSOA). By comparison, Becares et al (2009) analysed UK census wards while Dorsett et al. (2019) used larger Local Authority areas. With little systematic testing of relationships across different geographical scales it is difficult to know whether different results across studies may simply emerge from the geographies used to capture co-ethnic density.

*2.2 Segregation and mental health*

A significant volume of work thus explores how co-ethnic density affects minority members’ mental health. However, a smaller, parallel literature, predominantly from the US, proposes that minority physical- (Eschbach et al. 2004), and mental- (Lee 2009; Nobles et al. 2017; Do et al. 2019) health is strongly affected by residential segregation (how unevenly groups are distributed across an area), but in a deleterious way. Several theories have been proposed for why segregation may matter for minority mental health. Firstly, segregation may affect minorities’ social capital; particularly their social ties within (bonding capital) and between (bridging capital) ethnic groups (Portes 1998; Portes and Sensenbrenner 1993). Low-segregation may afford minorities opportunities for forming bridging-ties with majority-group members, forming more positive cross-group attitudes. This, in turn, may buffer their appraisal of negative intergroup contact experiences (e.g. harassment), mitigating the harm discrimination and prejudice may have (Lee 2009). Concurrently, high-segregation may limit opportunities for such bridging social capital (Granovetter 1973). According to Lee (2009), bridging social ties may also act as a resource for obtaining information and resources, important for mental health. In addition, although co-ethnic cohabitants may more readily form cohesive, supportive communities (including the formation of protective ethnic identities) through bonding ties, where segregation is high, too much bonding social capital may result in members imposing rigid social control on other members, which can restrict residents’ expression and freedom, affecting mental health, while also limiting their access to external sources of health-related information. The relative benefits/detriments of too much/too little bridging/bonding social capital among minorities has led to suggestions that segregation could exert a non-linear effect on mental health. In low-segregated areas, the benefits of higher bridging capital may be offset by lower bonding social capital, while in high-segregated areas, more bonding capital may be countered by less bridging. In this way, mental health might be better in areas of moderate segregation, providing the optimal mix of both forms of social capital (Lee 2009).

A second possible explanation links segregation to minority-groups’ experiences of racism. The co-ethnic density perspective assumes the likelihood of experiencing racism is a function of the size of one’s own group in an area. Yet increasingly studies have shown that racism is strongly linked not simply to the size of ethnic groups in an area but to the amount of segregation (Enos and Celaya 2018; Laurence et al. 2019). This work suggests segregation can harden divisions between ethnic groups, generating perceptions of threat and accentuating perceptions of group-difference, fostering more prejudicial attitudes. Accordingly, another reason why segregation may affect ethnic minorities’ mental health is via increasing exposure to racism and harassment.

Generally speaking, studies find segregation has a detrimental effect on minorities’ anxiety and depression (Lee 2009; Nobles et al. 2017; Do et al. 2019). However, this may depend on which groups are studied, with stronger effects for Hispanics (as a single grouping) (Lee 2009; Nobles et al. 2017), Black minorities (Do et al. 2019) and weaker or absent effects for Hispanic sub-groups, such as Puerto Ricans (Lee 2009; Nobles et al 2017). At the same time, no conclusion has been drawn on whether segregation effects are more pronounced for common mental disorders than severe mental distress (Lee et al. 2009; Nobles et al. 2017; Do et al. 2019).

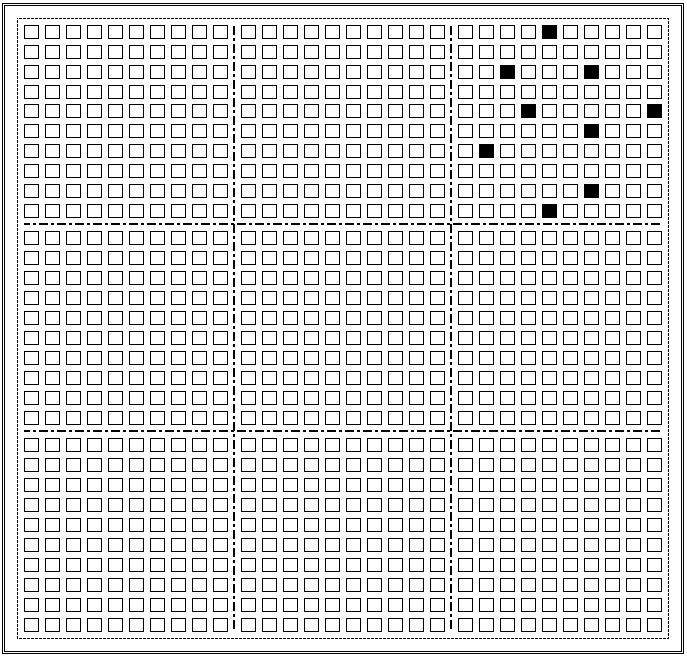
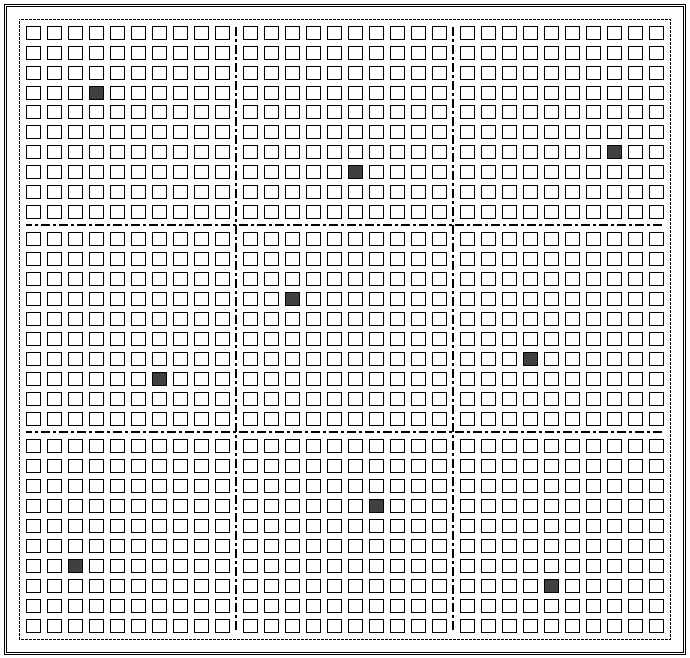
*2.3 Current paper*

This paper therefore aims to address key gaps in the current literature by testing the role of both co-ethnic density and residential segregation in shaping common mental health disorders among minorities in the UK, while examining the saliency of geographic-scale for these processes. Firstly, we examine the protective role co-ethnic density has for ethnic minorities’ general mental health. As outlined, previous work among UK minorities has largely focused on more acute mental health problems (e.g., suicide ideation) (*although see* Nazroo & Halpern 2000). However, studying self-reported indicators of mental well-being is important to help reduce bias/ethnocentrism levelled against some clinical diagnostics. For example, Halpern and Nazroo (2000) propose that mental health differences across minority groups might be the result of their different levels of acculturation, where Westernised psychiatric questionnaires fail to identify mental illness amongst less Western-accultured individuals. Alternatively, such general mental well-being measures may reduce possible health-seeking selection biases (Halpern and Nazroo 2000; Das-Munshi et al 2012). At the same time, “self-rated mental health measures the extent to which individuals are satisfied with their mental health and their ability to perform their usual activities, not whether they have received an official diagnosis of a mental disorder” (Hong et al. 2014: 119). Accordingly, such measures acknowledge that more general emotional well-being is also critical for people’s quality of life; not simply the absence of acute mental health problems.

Secondly, the paper examines the role residential segregation may play *alongside* co-ethnic density for minority mental health. Most work focuses on the role of ethnic density, with a smaller number of studies exploring how segregation affects mental health, with little overlap between these literatures. We suggest there is a key need to examine the role of *both* density and segregation simultaneously given they capture largely separate dimensions of a community’s ethnic structure. As we seek to show, measuring co-ethnic density alone gives little insight into how (un)evenly groups are distributed across an area i.e., how segregated it is; and vice versa. To illustrate this point, Figure 1 presents four hypothetical communities (communities A to D), divided into nine sub-areas, with each sub-area containing 100 households. The communities are distinguished across two dimensions: size of the ethnic minority population and level of residential segregation. Communities A and B contain equally large minority populations of 400 households (44% ethnic co-density). Communities C and D contain equally small minority populations of 9 households (1% co-ethnic density). However, despite containing equally large minority populations, Communities A and B differ substantially on their levels of segregation: in community A, ethnic groups largely live next door to their own group, being very unevenly concentrated across the community in their own sub-areas (high segregation: 95 as calculated using the Index of Dissimilarity). In community B, each group is evenly represented in each sub-area, resulting in an even spread across the community (low segregation: 0 Index of Dissimilarity). Similarly, despite containing equally small minority populations, Communities C and D also differ substantially on levels of segregation, with C being highly segregated (90 Index of Dissimilarity) and C being perfectly integrated (0 Index of Dissimilarity). This demonstrates a key point: that communities with equally high or low levels of co-ethnic density can have substantially different levels of segregation, and measures of co-ethnic density alone give little indication of how segregated/integrated an area is. As such, to properly gauge the impact of both co-ethnic density and segregation, and investigate whether these two characteristics exert complementary/competing effects, we intend to simultaneously model the effects of both, and, as the literature has shown, test for both linear and quadratic relationships for these effects.

**Figure 1:** Example of a high ethnic density segregated and high ethnic density integrated communities

Ethnic minority household Ethnic majority household



**COMMUNITY C**

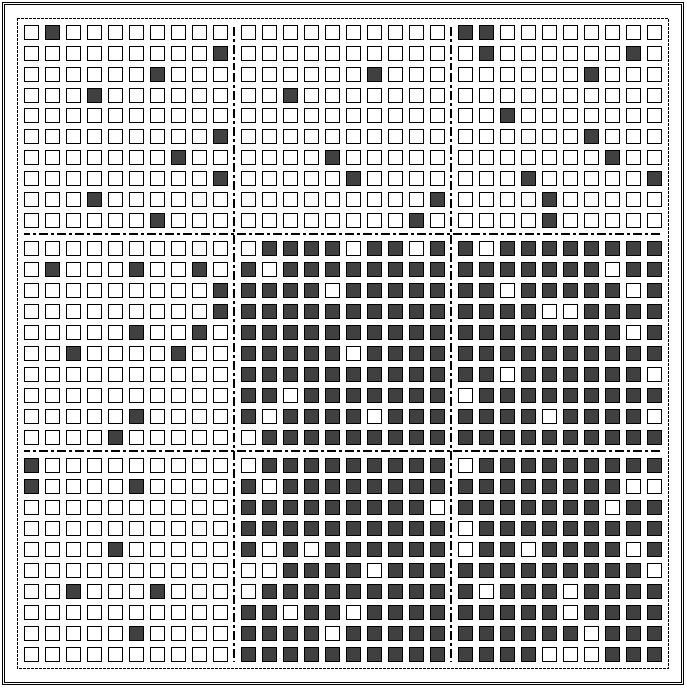
**COMMUNITY D**

Proportion ethnic minority: 1%

Index of Dissimilarity: 90 (high)

Proportion ethnic minority: 1%

Index of Dissimilarity: 0 (low)



Proportion ethnic minority: 44%

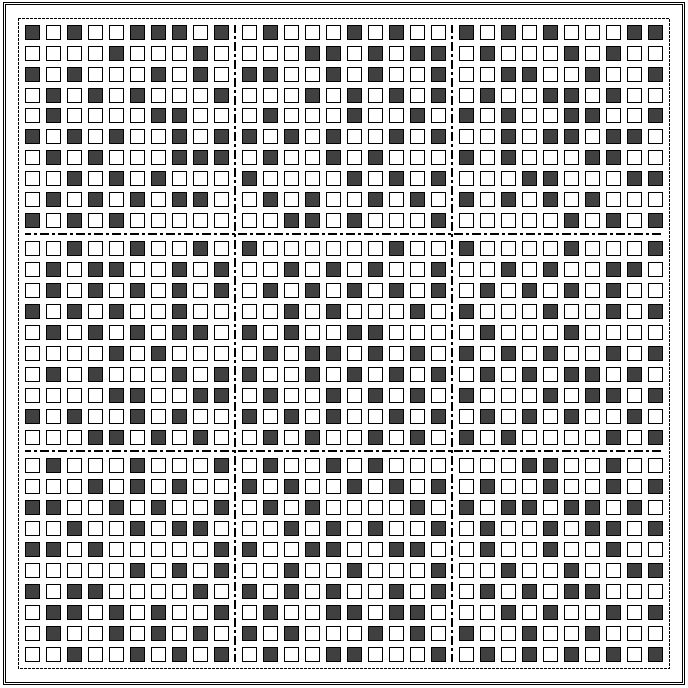
Index of Dissimilarity: 95 (high)

Proportion ethnic minority: 44%

Index of Dissimilarity: 0 (low)

**COMMUNITY A**

**COMMUNITY B**



Thirdly, we will examine the effects of co-ethnic density and segregation across multiple geographic-scales of the ‘community’. As outlined, different studies have tested the effects of co-ethnic density/segregation at different geographical-scales (Das-Munshi et al. 2012; Veldhuizen et al. 2017). For example, Schofield et al. (2011) and Jun et al. (2020) tested the effect at small-scale Lower-layer Super Output Areas (LSOA); Das-Munshi et al. (2012) tested relationships at the meso-scale Middle-Super Output Area (MSOA), while Dorsett et al. (2019) used larger, Local Authority areas. Differences in scale between studies could thus drive differences in apparent relationships between studies, if co-ethnic density processes are more/less salient at different scales. However, given these studies have used different outcomes and covariates and looked at different ethnic groups we cannot directly compare differences in effect sizes in geographical scales across these studies. Furthermore, larger/smaller geographic-scales may have different salience for different ethnic groups; for example, if protective networks extend across broader geographical areas for some groups but are more spatially constrained for others (Das-Munshi et al. 2012). This may emerge for groups that are highly dispersed as an artefact of their immigration history, such as asylum seekers whose residential concentration is contingent on NASS dispersal policies, or groups such as the Chinese, who are composed of individuals from diverse backgrounds and spatially diverse because of the ethnic food industry in which many are employed (Simpson and Finney, 2009). If this is the case, then larger geographic scales may better capture processes of co-ethnic density than smaller scales, which may fail to pick up effects extending across broader spatial areas.

To address this issue, we model co-ethnic density/segregation effects across three-levels (*see below*) using the same sample of respondents, for multiple ethnic sub-groups, to examine at which scale processes of co-ethnic density/segregation are most salient, and whether effects differ by scale for different groups.

1. **Methods**

*3.1 Sample*

Data on ethnic minorities is drawn from the UK Household Longitudinal Study (UKHLS); a nationally representative survey comprising approximately 26,000 household in the UK, with an Ethnic Minority Boost Sample (EMBs) of 4,000 households (where at least one respondent identifies as coming from an ethnic minority group) (Feng et al. 2017). We use data from the adult (16+) interviews at Waves 1 through 9 (2009-2019), and include data from the UK’s main ethnic groups (Asian Other, Black African, Black Other, Black Caribbean, Chinese, Indian, Pakistani/Bangladeshi and Other Ethnicity). Hence, we can test not only if co-ethnic density/segregation affect mental health among the single ‘all ethnic minority’ group, but examine heterogeneity in effects across sub-groups. Response rates vary between waves, and thus, we use weights to adjust differences between panels (Feng et al. 2017). Initial testing did not show significant differences among individuals with missing data. Our final full sample is 52693 person-observations.

*3.2 Geographical Scale*

Community-level data is drawn from the 2011 Census and merged with the UKHLS. As outlined, we seek to test community-effects across three different levels: the Lower Super Output Areas (LSOAs); Middle-Layer Super Output Areas (MSOAs), and Local Authorities (LAs). At the lowest level, LSOAs contain approximately 650 households; whereas MSOAs contain around 7,200 households. Moreover, LAs are political boundaries rather than geographical areas (with an average of around 120,000 people). Moreover, the mean km2 size of LSOAs in England and Wales is 4.39 km2; for MSOAs it is: 21.0 km2, and for LAs it is 253.0 km2 (ONS, 2011).

*3.3 Outcome Measure: SF-12 Mental Component Score (MCS-12)*

Individuals’ self-reported mental health outcomes were drawn from the Short-Form 12 Health Survey (SF-12) included in the UKHLS (Waves 1-9). SF-12 is a health-related quality of life instrument (Vilagut et al. 2013). The SF-12 includes questions relating to mental health and is composed of 5 items of the Mental Health Inventory, and is a sensitive test to capture common mental health disorders. Extensive work has demonstrated the strong validity and reliability of this scale as a measure of mental health, compared to the longer form SF-36 scale, as well as showing it to be an efficacious independent predictor of mental health outcomes, both across general population samples and sub-groups (e.g., Jenkinson and Layte 1997; Salyers et al. 2000). Though the SF-12 contains self-reported measures of individual’s mental health, they are still based on western psychiatric diagnostic criteria. While we cannot eliminate ethnocentric bias, we believe that our approach reduces the bias compared to alternative methods e.g., clinician diagnoses.

Respondents are asked multiple questions to test for symptoms associated with the current Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria for common depressive and anxiety disorders alongside other items relating to functional impairment and experiences of distress. Once respondents have completed the SF-12 their answers are scored using a method proposed by Ware et al. (2001). More specifically, the MCS-12 score (mental health component of the SF-12) is calculated by using item weight for response categories and results in a single continuous score ranging from 0 (low functioning) to 100 (high functioning).

*3.4 Key community-level measures: co-ethnic density and segregation*

To measure co-ethnic density we calculate the proportion of the non-White British population in an area. When testing relationships across minority sub-groups, we use the proportion of one’s own group as the indicator of co-ethnic density e.g., for the Indian sub-group we use proportion of Indians in an area. To measure residential segregation we aim to capture how (un)evenly groups are distributed across an area. To do so, we apply the often-used Index and Dissimilarity (ID) (Massey and Denton 1988), to test the association between residential segregation and mental health outcomes (Lee et al. 2009; Do et al. 2019).

Diagram, schematic

Description automatically generated

bi = the population of non-White British in the *i*th area, the “lesser area”; B = the total population of non-White British in the “greater area”; wi = the population of White British in the ith area, the “lesser area”; W= the total population of White British in the “greater area.”

The ID output ranges from 0 (perfectly integrated) to 100 (perfectly segregated), interpreted as the proportion of minorities who would need to move between the lesser-areas to result in an even distribution of groups across the greater-area. When examining the role of segregation for all ethnic minorities, we compare the relative distribution of White British compared to non-White British in an area. However, when conducting the minority sub-group analysis, we generate ethnic sub-group specific measures of residential segregation. Each ethnic sub-group will therefore have their own unique measure of segregation. For example, for Black Caribbean respondents, their egocentric measure of segregation is the relative distribution of Black Caribbeans compared to non-Black Caribbeans in an area[[1]](#endnote-1). When testing the salience of geographical-scale (measuring the “greater area” at the LSOA-, MSOA- and LA-level) we hold the “lesser area” constant at the Output Area level (average 300 people).

*3.5 Individual and community level covariates*

We adjust for multiple individual-level covariates, such as age (quadratic), gender, single/cohabiting, country of residence (England, Wales, Scotland), national identity, religion, economic status, housing tenure, year of arrival in the UK, and education level, alongside dummies for survey year. At the community-level, we control for urban-rural classification of an area and the percentage of people aged 65 and over. We also controlled for area density in the models given studies link population density to health outcomes (Chaktraborty and McKenzie 2020), and socio-economic disadvantage using one indicator from a factor analysis of three variables from the 2011 Census: percentage of all economically active people over the age of 16 who are unemployed; the percentage of households comprised of female lone-parents; and the percentage of households socially renting (Nobles et al. 2017). We also measure these variables across the three geographical scales (LSOA, MSOA and LA; although urban-rural classification is only available at the LSOA- and MSOA-levels; accordingly, for the LA-level analysis we use MSOA-level type) (*see* appendix X.1 for full descriptives).

*3.6 Modelling and Analytical Approach*

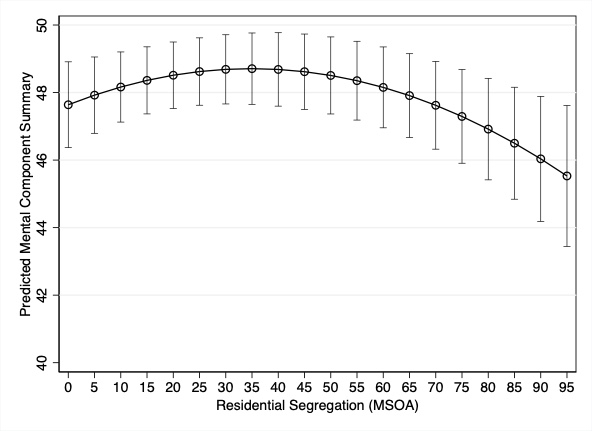
We use STATA MP (Version 16) to conduct the analysis on the UKHLS. We use a significance level of p<.05 in line with the convention in the social sciences in which we are working, allowing us to directly compare our findings to similar studies within the field. Our modelling approach begins with pooling all the available data from Waves 1 through to 9 of the UKHLS. To control the clustering of respondents at all levels, we correct for standard errors by applying random-intercept multilevel linear regression models (observations nested in individuals nested in communities). We weight our regression models to adjust for non-response and ensure the samples are representative.

Our analytic approach is split into three sections. The first involves testing whether co-ethnic density and/or residential segregation are associated with ethnic minorities’ (treated as a single group) common mental disorders. We test the relative importance of these characteristics across three geographical scales (LSOA-, MSOA- and LA-levels) to examine at which level the effect is most pronounced. Given observed non-linearity and threshold effects within the literature, we test both linear and quadratic associations. The second stage involves exploring these processes across ethnic minority sub-groups, given known sub-group differences from the literature. We examine the processes across nine ethnic minority sub-groups (Other White, Indian, Pakistani and Bangladeshi (single group), Asian Other, Black Caribbean, Black African, Black Other, Other Ethnic, and Chinese). The third stage of analysis aims to examine the robustness of any observed associations by drawing on the longitudinal panel component of the survey. One issue in studies of community-effects on mental health outcomes is that individuals’ mental health may affect neighbourhood-selection decisions. For example, worse/better mental health may trigger moves into/out of areas with higher levels of co-ethnic density/segregation. This may confound apparent associations between community-type and mental health. To explore this, we test a lagged dependent variable approach. In particular, whether community characteristics (fixed at their 2011 value[[2]](#endnote-2)) predict mental health at t0 while adjusting for a lagged measure of mental health at t-1, while also adjusting for present individual covariates (t0). If associations are driven more by processes of selection, for example, then we would expect adjusting for lagged mental health will render community-level predictors non-significant. Unfortunately, given community-level census data is only collected every 10 years we cannot take a fixed-effects panel data approach of studying yearly within-person change over time in community characteristics.

1. **Results**

*4.1 Co-Ethnic Density, Segregation, and common mental disorders among ethnic minorities, across multiple geographical scales*

The first stage of the analysis tests the linear effects of co-ethnic density (ranging from 0 to 100), and its association with all ethnic minorities’ (single group) reported MCS-12, capturing the community at the LSOA-, MSOA- and LA-level (Models 1, 4, and 7, Table 1). The results demonstrate no association between density and minorities’ mental health at any geographic-scale. We next include our measure of residential segregation (White British/non-White British segregation Index of Dissimilarity, ranging from 0 to 100), testing its linear association with respondents MCS-12 scores (at the three geographic scales) (Models 2, 5 and 8). We observe no significant linear association with segregation across any geographic-scale. Nonetheless, as suggested, these relationships may be non-linear. We therefore add quadratic-terms for co-ethnic density and segregation into our models (Models 3, 6 and 9). While we observe no non-linear association for co-ethnic density, we observe that residential segregation has a significant non-linear association with mental health: significant at the p<.1 level across LSOAs, but stronger at the MSOA-level (p<.01), and absent at the LA-level.

**Figure 1:** Graph of quadratic effect of segregation on predicted common mental disorders at MSOA level (all ethnic minorities) 

*Notes*: Maximum and minimum value of segregation set at maximum/minimum values present for the ‘all ethnic minority’ group.

**Table 1:** Community-level predictors of common mental disorders among non-Whites (LSOA-LA)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 |
| Ethnic group | All minority | All minority | All minority | All minority | All minority | All minority | All minority | All minority | All minority |
| Geographic-scale | LSOA | LSOA | LSOA | MSOA | MSOA | MSOA | LA | LA | LA |
|  |  |  |  |  |  |  |  |  |  |
| Co-Ethnic Density | 0.004  (0.007) | 0.004  (0.008) | 0.032+  (0.019) | 0.013  (0.010) | 0.009  (0.010) | 0.009  (0.021) | 0.041+  (0.023) | 0.039+  (0.023) | -0.008  (0.030) |
| Segregation |  | -0.003  (0.008) | 0.036+  (0.020) |  | -0.014  (0.010) | 0.061\*  (0.027) |  | -0.009  (0.020) | 0.045  (0.060) |
| Co-Ethnic Density Quadratic |  |  | -0.000  (0.000) |  |  | 0.000  (0.000) |  |  | 0.001  (0.000) |
| Segregation Quadratic |  |  | -0.001+  (0.000) |  |  | -0.001\*\*  (0.000) |  |  | -0.000  (0.001) |
|  |  |  |  |  |  |  |  |  |  |
| Constant | 54.141\*\*\*  (2.022) | 54.248\*\*\*  (2.041) | 54.635\*\*\*  (2.122) | 55.292\*\*\*  (2.204) | 55.923\*\*\*  (2.216) | 54.721\*\*\*  (2.454) | 53.898\*\*\*  (2.858) | 54.444\*\*\*  (3.044) | 52.448\*\*\*  (3.245) |
| N | 52693 | 52693 | 52693 | 52693 | 52693 | 52693 | 52693 | 52693 | 52693 |

*Notes*: + p<0.1; \* p<0.05; \*\* p<0.01; \*\*\* p<0.001; standard errors in parentheses; models contain all individual-level and community-level covariates (although not shown); We adjust for individual-level covariates: age (quadratic), gender, single/cohabiting, country of residence (England, Wales, Scotland), national identity, religion, economic status, housing tenure, year of arrival in the UK, and education level, alongside dummies for survey year. We also adjust for community-level covariates: urban-rural classification of an area, the percentage of people aged 65 and over, area density, socio-economic disadvantage, percentage of all economically active people over the age of 16 who are unemployed; the percentage of households comprised of female lone-parents; and the percentage of households socially renting.

To observe what this quadratic function means for mental health, we plot predicted MCS-12 scores (based on Model 6, Table 1) across levels of community segregation (at the MSOA-level). Figure 1 shows an inverted-u shaped plot: mental health is best in moderately segregated areas (around an ID of 40), becomes somewhat worse in low-segregated areas, but becomes much worse at high-levels of segregation

Overall, these findings suggest that, at least for more common mental disorders, co-ethnic density does not appear to offer a protective effect. Instead, residential segregation appears the more salient dimension of community ethnic structure for mental health[[3]](#footnote-1). These spatial processes appear strongest and most significant when captured at the meso-local level (MSOA) rather than more immediate locales (LSOA), while being completely absent at larger scales (LAs)

*4.2 Co-Ethnic Density, Segregation, and Common Mental Disorders across ethnic minority subgroups (MSOA)*

The next stage of analysis examines the above identified relationships across ethnic minority sub-groups, applying ‘egocentric’ measures of density/segregation, where each ethnic group has a unique measure of percent ethnic in-group (density) and level of segregation depending on their own ethnicity (as discussed above). We perform these tests at the MSOA-level given the previous results show community-level processes most salient here (although we explore effects across LSOA-/LA-levels to examine potential differences – *see* appendix). Hence, Table 2a and 2b examines the relationship between co-ethnic density, segregation and the linear/quadratic effects of density/segregation for each minority sub-groups at the MSOA-level.

**Table 2a:** Community-level predictors of common mental disorders among minority sub-groups (MSOA)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MSOA-level | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 | Model 13 | Model 14 | Model 15 |
| Ethnic Group | White Other | White Other | White Other | Indian | Indian | Indian | Pak & Bang | Pak & Bang | Pak & Bang | Asian Other | Asian Other | Asian Other | Black Car | Black Car | Black Car |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Co-Ethnic Density | -0.093\*  (0.042) | -0.093\*  (0.043) | 0.153  (0.655) | -0.022  (0.020) | -0.021  (0.021) | -0.029  (0.048) | -0.009  (0.013) | -0.009  (0.013) | -0.029  (0.038) | -0.134  (0.085) | -0.149+  (0.088) | -0.020  (0.291) | -0.070  (0.074) | -0.184\*  (0.088) | -0.228  (0.270) |
| Segregation |  | 0.001  (0.038) | 0.371\*  (0.144) |  | -0.009  (0.021) | 0.087  (0.060) |  | -0.010  (0.019) | 0.118+  (0.067) |  | -0.017  (0.033) | 0.208+  (0.108) |  | -0.100\*\*  (0.032) | 0.085  (0.091) |
| Co-Ethnic Density  Quadratic |  |  | -0.002  (0.004 |  |  | 0.000  (0.001) |  |  | 0.000  (0.001) |  |  | -0.001  (0.014) |  |  | 0.007  (0.014) |
| Segregation Quadratic |  |  | -0.008\*\*  (0.003) |  |  | -0.001+  (0.001) |  |  | -0.002\*  (0.001) |  |  | -0.002\*  (0.001) |  |  | -0.002\*  (0.001) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | 58.53\*\*\*  (5.205) | 58.54\*\*\*  (5.189) | 45.91  (28.544) | 59.77\*\*\*  (2.753) | 59.91\*\*\*  (2.770) | 58.61\*\*\*  (3.054) | 56.69\*\*\*  (2.876) | 56.92\*\*\*  (2.937) | 55.32\*\*\*  (3.129) | 50.38\*\*\*  (3.570) | 50.91\*\*\*  (3.710) | 44.98\*\*\*  (4.808) | 53.04\*\*\*  (2.831) | 56.97\*\*\*  (3.173) | 53.79\*\*\*  (3.584) |
| N | 8513 | 8513 | 8513 | 9560 | 9560 | 9560 | 12105 | 12105 | 12105 | 2912 | 2912 | 2912 | 5221 | 5221 | 5221 |

*Notes*; + p<0.1; \* p<0.05; \*\* p<0.01; \*\*\* p<0.001; standard errors in parentheses; models contain all individual-level and community-level covariates (although not shown). We adjust for individual-level covariates: age (quadratic), gender, single/cohabiting, country of residence (England, Wales, Scotland), national identity, religion, economic status, housing tenure, year of arrival in the UK, and education level, alongside dummies for survey year. We also adjust for community-level covariates: urban-rural classification of an area, the percentage of people aged 65 and over, area density, socio-economic disadvantage, percentage of all economically active people over the age of 16 who are unemployed; the percentage of households comprised of female lone-parents; and the percentage of households socially renting.

**Table 2b:** Community-level predictors of common mental disorders among minority sub-groups (MSOA)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MSOA-level | Model 16 | Model 17 | Model 18 | Model 19 | Model 20 | Model 21 | Model 22 | Model 23 | Model 24 | Model 25 | Model 26 | Model 27 |
| Ethnic Group | Black African | Black African | Black African | Black  Other | Black  Other | Black  Other | Other Ethnic | Other Ethnic | Other Ethnic | Chinese | Chinese | Chinese |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Co-Ethnic Density | 0.112\*  (0.044) | 0.087+  (0.045) | 0.353\*\*  (0.118) | -0.946\*  (0.433) | -1.099\*  (0.510) | -3.394+  (1.947) | -0.053  (0.149) | -0.071  (0.162) | 0.277  (0.441) | 0.053  (0.144) | 0.127  (0.154) | 0.212  (0.406) |
| Segregation |  | -0.055+  (0.030) | 0.109  (0.075) |  | -0.036  (0.057) | -0.345  (0.220) |  | -0.011  (0.031) | -0.009  (0.109) |  | 0.055  (0.042) | -0.188  (0.173) |
| Co-Ethnic Density  Quadratic |  |  | -0.007  (0.003) |  |  | 0.278  (0.311) |  |  | -0.023  (0.024) |  |  | -0.012  (0.028) |
| Segregation  Quadratic |  |  | -0.002\*  (0.001) |  |  | 0.002  (0.002) |  |  | 0.000  (0.001) |  |  | 0.003  (0.002) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | 53.36\*\*\*  (2.835) | 55.32\*\*\*  (2.869) | 50.35\*\*\*  (3.302) | 77.12\*\*\*  (6.960) | 79.92\*\*\*  (8.296) | 91.17\*\*\*  (9.210) | 59.15\*\*\*  (3.960) | 59.35\*\*\*  (3.903) | 58.61\*\*\*  (4.909) | 68.63\*\*\*  (5.827) | 65.38\*\*\*  (6.443) | 69.99\*\*\*  (7.529) |
| N | 5971 | 5971 | 5971 | 444 | 444 | 444 | 1999 | 1999 | 1999 | 1219 | 1219 | 1219 |

*Notes*:; + p<0.1; \* p<0.05; \*\* p<0.01; \*\*\* p<0.001; standard errors in parentheses; models contain all individual-level and community-level covariates (although not shown). We adjust for individual-level covariates: age (quadratic), gender, single/cohabiting, country of residence (England, Wales, Scotland), national identity, religion, economic status, housing tenure, year of arrival in the UK, and education level, alongside dummies for survey year. We also adjust for community-level covariates: urban-rural classification of an area, the percentage of people aged 65 and over, area density, socio-economic disadvantage, percentage of all economically active people over the age of 16 who are unemployed; the percentage of households comprised of female lone-parents; and the percentage of households socially renting.

Several key findings emerge from this analysis. Firstly, similar to previous studies that specifically focused on Black minorities, co-ethnic density does appears to have a positive linear association with mental health for Black African respondents, who report better scores of common mental disorder with higher co-ethnic density (Model 16, Table 2b). However, we see an opposite relationship for Black Other respondents (Model 19, Table 2b), and the Black Caribbean group (particularly after adjusting for segregation) (Model 14, Table 2a): for these groups higher density is associated with worse mental health outcomes. Co-ethnic density also has a negative association with mental health among White Other respondents (Model 1, Table 2a). No significant association was found for other minority sub-groups. We also observed no nonlinear association between density and mental health for any sub-group.

Regarding residential segregation, increasing segregation has a significant linear negative association with mental health among Black Caribbeans (Model 14, Table 2a) and Black Africans (Model 17, Table 2b) i.e., respondents in more segregated areas report worse mental health. However, when we test for non-linearity in the segregation/mental health relationship we observe a significant non-linear relationship for the main UK sub-groups: White Other, Indian, Pakistani and Bangladeshi, Asian Other, Black Caribbean and Black African (while observing no association for Chinese, Black Other, and the Other Ethnic group). To understand these relationships, we generate predicted SF-12 mental health scores across levels of segregation (bounded by the maximum/minimum levels of segregation experienced by each group), only for those groups exhibiting a significant relationship (Figure 2). These predicted scores show several interesting similarities/differences. Firstly, for the Black group (African and Caribbean), segregation has a stronger negative association. Furthermore, for these groups, we do not find that mental health improves from low to moderate levels of segregation (as in the ‘all ethnic minority’ analysis). Instead, mental health is generally similar between low and moderate levels of segregation before dropping precipitously as segregation increases beyond this level. This is particularly pronounced for Black Caribbeans, where the SF-12 score drops by around 13-points from moderate- to high-segregation. We also observe a relatively strong association between segregation and mental health for the White Other group (although we do see the slight improvement in mental health between low and moderate segregation). The relationships for Asian groups (Indians, Pakistanis/Bangladeshis, Other Asian) is somewhat different. Firstly, the effects of segregation are weaker, with the decline in mental health between moderate- and high-segregation areas appearing smaller. Secondly, among these groups we do observe the improvement in mental health between low- and moderately-segregated areas (before the subsequent decline).

**Figure 2:** Graph of Quadratic Effect of segregation on predicted marginal scores of self-reported measures of common mental disorders at MSOA level

Engineering drawing

Description automatically generated with medium confidence

*Notes*:Top Left: Asian Other, Pakistani and Bangladeshi, Indian; Bottom Left: Black African, Black Caribbean, White Other; Maximum and minimum values of segregation set at maximum/minimum values present for each group in the data

On the whole, despite some differences, we observe that segregation (across MSOAs) appears more important for common mental health outcomes than co-ethnic density, across the main UK minority sub-groups, and that general mental health is at its worse in high-segregated areas. We also tested these relationships at the LSOA- and LA-levels. Again, effect-size and -significance were strongest at the MSOA-level (with exceptions for the Chinese and Black Other group where segregation is only significant at the LA-level).

*4.3 Lagged dependent variable approach*

To examine the robustness of this relationship we next apply a lagged dependent variable approach, essentially replicating all prior analyses (at the MSOA-level) but including a lagged mental health score in each model (Table 3). These findings show that the above analysis holds, even under more robust approaches, with significant (albeit somewhat reduced in some cases) quadratic associations observed for the ‘all ethnic minority’ sample, and sub-groups of White Other, Indian, Pakistani and Bangladeshi, Black Caribbean and Black African (with only the Asian Other group no longer being significant).

**Table 3:** Community-level predictors of common mental disorders among minority sub-groups (MSOA) lagged dependent variable model

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MSOA-level | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
| Ethnic Group | All  Minority | White  Other | Indian | Pak &  Bang | Asian  Other | Black  Caribbean | Black  African | Black  Other | Other  Ethnic | Chinese |
|  |  |  |  |  |  |  |  |  |  |  |
| Lagged MCS | 0.461\*\*\* | 0.394\*\*\* | 0.458\*\*\* | 0.458\*\*\* | 0.416\*\*\* | 0.463\*\*\* | 0.461\*\*\* | 0.289\*\*\* | 0.438\*\*\* | 0.487\*\*\* |
|  | (0.009) | (0.023) | (0.019) | (0.019) | (0.039) | (0.029) | (0.029) | (0.067) | (0.042) | (0.053) |
| Co-Ethnic Density | 0.023  (0.015) | -0.211  (0.561) | 0.003  (0.040) | 0.046  (0.032) | -0.217  (0.293) | -0.175  (0.221) | 0.193+  (0.108) | -2.621  (3.364) | 0.377  (0.519) | 0.395  (0.339) |
| Quadratic Density | -0.000  (0.000) | 0.001  (0.003) | -0.000  (0.001) | -0.001  (0.001) | 0.006  (0.014) | 0.006  (0.010) | -0.004  (0.003) | 0.197  (0.618) | -0.031  (0.028) | -0.037+  (0.022) |
| Segregation | 0.032  (0.020) | 0.207+  (0.120) | 0.068  (0.043) | 0.077  (0.047) | 0.019  (0.100) | 0.083  (0.084) | 0.100  (0.065) | -0.226  (0.220) | -0.037  (0.125) | -0.166  (0.152) |
| Quadratic Segregation | -0.001\*  (0.000) | -0.004\*  (0.002) | -0.001\*  (0.001) | -0.001\*  (0.001) | -0.000  (0.001) | -0.002+  (0.001) | -0.002\*  (0.001) | 0.001  (0.002) | 0.000  (0.001) | 0.002  (0.002) |
|  |  |  |  |  |  |  |  |  |  |  |
| Constant | 26.723\*\*\*  (2.155) | 36.000  (24.258) | 27.457\*\*\*  (2.682) | 32.266\*\*\*  (2.464) | 22.026\*\*\*  (4.947) | 25.251\*\*\*  (3.050) | 31.618\*\*\*  (4.576) | 55.158\*\*\*  (11.522) | 30.348\*\*\*  (6.411) | 33.060\*\*\*  (6.894) |
| N | 29586 | 5406 | 5710 | 6273 | 1756 | 3120 | 3141 | 277 | 1102 | 741 |

*Notes*:; + p<0.1; \* p<0.05; \*\* p<0.01; \*\*\* p<0.001; standard errors in parentheses; models contain all individual-level covariates (although not shown); We adjust for individual-level covariates: age (quadratic), gender, single/cohabiting, country of residence (England, Wales, Scotland), national identity, religion, economic status, housing tenure, year of arrival in the UK, and education level, alongside dummies for survey year. We also adjust for community-level covariates: urban-rural classification of an area, the percentage of people aged 65 and over, area density, socio-economic disadvantage, percentage of all economically active people over the age of 16 who are unemployed; the percentage of households comprised of female lone-parents; and the percentage of households socially renting.

1. **Discussion**

This paper had three key aims: to examine the protective role of co-ethnic density for common (rather than acute) mental disorders among minorities in the UK (applying self-reported measures of common mental disorders (MCS-12) as opposed to clinical diagnostics); examine the role of segregation alongside co-ethnic density; and explore whether the geographical-scale at which the ‘community’ is operationalized affects our understanding of the processes linking space to individuals’ mental health. Through the mobilization of a large-scale, nationally representative UK data set, containing an ethnic minority booster sample, we also examined whether processes differed across ethnic minority sub-groups.

We find little evidence that co-ethnic density offers a protective-effect for UK minorities’ mental well-being. These findings appear to mirror the general literature outside the UK where, compared to more acute measures of mental health (e.g. suicide ideation) density is a less consistent predictor of minorities’ more general mental well-being (*see* Becares et al. 2018). We do observe some significant associations between co-ethnic density and common mental disorders for certain minority groups; yet, these findings tend to be mixed: for example, for White Other, Black Caribbean and Black Other respondents, density has a negative association (associated with worse mental health), whereas for Black Africans it has a positive association (associated with better mental health).

Prior work has also identified discrepancies in the effects of co-ethnic density between Black Africans and Caribbeans. Bécares et al. (2009) found no buffering for Caribbeans but one present for Africans. Das-Munshi et al. (2010) showed reported discrimination (a posited mediator of the co-ethnic density effect) actually increasing with co-ethnic density for Caribbeans but not Africans. Similarly, Becares et al. 2011, show that co-ethnic density is negatively related to perceptions of social cohesion (another posited mediator of the co-ethnic density effect) for Black Caribbeans but not Black Africans. Such findings have led some scholars to suggest that “some cultural groups are better able than others to protect the mental health of their members” (Halpen and Nazroo 2000: 44). Explanations for the difference could be the result of the groups’ exogenous linguistic diversity (Caribbeans being more proficient in English), recency of immigration histories (Africans being a more recent group) and residential settlement patterns (Caribbeans more concentrated in de-industrialised inner-city areas) (Finney and Simpson 2009). These factors may influence the operation of co-ethnic density. For example, a much greater proportion of Black Africans are immigrants (compared to Black Caribbeans, who are more likely to be second or third generation), and immigrants may more readily form stronger co-ethnic ties, such as when English may not be their primary language. Black Caribbeans may also have experienced significant disadvantage for longer periods, undermining the ability of co-ethnic density to buffer, while their dispersal patterns may have concentrated them in areas where they are more likely to experience discrimination and harassment. We suggest that future research which is potentially able to further breakdown the heterogeneous Black African group into region of origin, better explore the potential role of migration status, recency of migration and language ability, and also examine in more detail the types of relations formed in co-ethnic African and Caribbean communities, will be critical to further exploring these differences.

As outlined, to our knowledge, no UK study has tested co-ethnic density effects for common mental disorders among minority sub-groups (*see* Vogt Yuan 2007, for effects on well-being in US). Previous studies have shown different effects of density across different minority sub-groups for acute mental disorders; especially that co-ethnic density appears more important for Black minorities, who report better acute mental health outcomes in areas of high co-ethnic density (Boydell et al. 2001; Bhavsar et al. 2014). Therefore, our findings on common mental disorders partially support the idea of the protective role of density, at least for Black Africans, although they diverge with respect of the role of density for the Black Caribbean group.

Compared to the weaker/mixed evidence for co-ethnic density effects, we find strong and relatively consistent associations between residential segregation and common mental disorders among UK minorities; in particular, one of non-linearity. Our findings indicate that mental health is better around a mid-point of an Index of Dissimilarity of 30-40 (low to moderately-segregated areas) and somewhat worse in low segregated areas. However, it is particularly worse in highly-segregated areas. Interestingly, this non-linear effect is present across most main ethnic minority sub-groups (Indian, Pakistani and Bangladeshi, Black Caribbean, Black African, Asian Other, White Other), with effects particularly prominent for Black Caribbean, White Other and Black African groups. Importantly, these effects are evident whilst also controlling for co-ethnic density. In other words, even accounting for the size of one’s own group in an area, how (un)evenly they are distributed across it plays a key role in common mental disorders. In addition, there is some evidence to suggest prior co-ethnic density effects may (in part) be driven by its association with segregation; for example, the positive co-ethnic density/mental health association for Black Africans is attenuated after accounting for the negative effect of residential segregation.

These findings correspond to US studies suggesting segregation may be harmful for minority-group mental health (Lee 2009; Do et al 2019); in particular, we also observe similar patterns of non-linearity in the segregation/mental health relationship as in several US studies (e.g., Portes 1998; Lee 2009). As outlined, two potential mechanisms could be driving this relationship. Firstly, the social capital explanation proposes that segregation’s effects hinge on how it structures patterns of bonding and bridging social ties between ethnic majority/minority groups (Portes 1998; Lee 2009). Here, high-segregation especially produces the wrong mix of bridging-/bonding-social capital; where the lower likelihood of forming bridging ties across ethnic groups can hinder the access to information/resources enabling positive mental health outcomes, while also leading to excessive *bonding ties* with members of one’s own ethnic community, which may impose rigid social control, regulating members’ behaviour. The second explanation suggests segregation is posited to be a key driver of prejudice and, in turn, harassment (Enos and Celaya 2018; Laurence et al. 2019). Accordingly, minority mental health may be particularly worse in high segregated areas given experiences of racism and harassment are likely much higher. Overall, these results extend US studies to show that segregation is a key predictor of common mental disorders in the UK, even after accounting for co-ethnic density, and is present across most minority sub-groups. However, key questions remain on the relationship between co-ethnic density and segregation, and ethnic composition more broadly. Future work aims to generate more detailed typologies of different area types, both across dimensions of co-ethnic density/segregation (e.g., high/low co-ethnic density/segregation areas), and also in terms of the composition of individuals’ ethnic out-group in an area after adjusting for co-ethnic density (e.g., is the outgroup in a community composed of a single ethnic out-group or small numbers of multiple different outgroups, or whether it is made up of majority or other minority outgroup members).

The novel approach of our study also revealed several key findings relating to geographical-scale. Our findings tend to show greater effect size and statistical significance at more local levels, especially the MSOA. This may be due to explanations that social tie formation and experiences of harassment are likely better detected by capturing the characteristics of respondents’ more localised spatial environment. It remains interesting, however, that the segregation relationship is more consistent at the MSOA-level and not the smallest scale of the LSOA-level. This may be because in very local areas (LSOAs), segregation may do little to affect bridging/bonding tie-formation, as the small size of these areas means that even where groups are spatially segregated from one another their close proximity likely means they still have opportunities for inter-group contact. Concurrently, it may be segregation across the MSOA-level that is most likely to trigger stronger perceptions of ‘us versus them’, fostering prejudice and harassment, as other studies have observed (Laurence et al. 2019). Here, MSOAs are posited to capture the broader social environment that residents have knowledge of, beyond their more immediate neighbourhoods. Where individuals rarely come into contact with ethnic out-groups in their immediate locale but are aware of ethnic out-groups in neighbouring, proximate locales, the conditions for prejudice developing may be highest. Using model fit tests (between R-square) we determine that at MSOA our community-level predictor variables associated with the ethnic structure of community capture the most variance and are most salient for minorities’ general mental health. Future work would benefit from making national comparisons testing contextual-effects over multiple scales to ascertain the level in which contextual processes are most significant for general mental health.

Despite the insights this study produces there remain limitations. Our study’s main limitation relates to the causal robustness of the findings. We find some supportive evidence that the association between segregation and common mental disorders is not solely endogenous, given segregation predicts present levels of common mental disorders even after controlling for past levels of common mental disorders. Yet, potential bias from neighbourhood-selection remains. Future research applying more robust longitudinal methods is needed. Furthermore, more detailed analysis of the mechanisms which may account for the observed relationships was beyond the scope of this paper, and future work is needed before we can isolate the precise reasons why segregation exerts the impact it does. Additionally, while the use of the SF-12 mental health component measure provides much needed insights into how a community’s ethnic structure affects more common mental health disorders and well-being among UK minorities, it remains only a single indicator. Future research, which examines how segregation may also relate to more acute mental health outcomes in the UK, while also drawing on a wider array of mental well-being measures (e.g., positive mental well-being), can examine how pervasive the effects of segregation are for minorities. Lastly, our use of the self-reported SF-12 mental health measure sought to circumvent, to some extent, some of the limitations from using clinical diagnostics; not least, how ethnocentrism may bias clinic diagnoses among ethnic minority groups. However, as previously discussed, bias may continue within such measures given they were designed within a western psychiatric context. For example, differences in cultural norms across groups may influence their interpretation of the questions, and the symptoms they may/may not report. Indeed, work has suggested measures like the SF-12 may evince less measurement invariance among ethnic minority groups relative to the majority (e.g. Galenkamp et al. 2018). Future work will therefore seek to better test the validity/reliability of self-reported scales among minority populations in our work, potentially creating sub-scales evincing better measurement invariance across groups, while also testing a wider array of mental health and wellbeing measures to cross-validate findings.

In conclusion, it is noticeable that current mental health policy in England (Parkin 2020: 11) necessitates the importance of the community as a conduit to help resolve mental health inequalities “for young people, especially black communities”. However, there is an absence of inclusion of any of the factors related to the ethnic structure of the community and how these might impede progress. Our findings indicate a strong link between segregation and common mental disorders among minority and minority sub-groups that necessitate its inclusion in future mental health policy, particularly focused at remedying the mental health inequalities experienced by ethnic minorities.

REFERENCES

BÉCARES, L., DEWEY, M. E. & DAS-MUNSHI, J. 2018. Ethnic density effects for adult mental health: systematic review and meta-analysis of international studies. *Psychological medicine,* 48**,** 2054.

BÉCARES, L., NAZROO, J. & STAFFORD, M. 2009. The buffering effects of ethnic density on experienced racism and health. *Health & place,* 15**,** 700-708.

BÉCARES, L., SHAW, R., NAZROO, J., STAFFORD, M., ALBOR, C., ATKIN, K., KIERNAN, K., WILKINSON, R. & PICKETT, K. 2012. Ethnic density effects on physical morbidity, mortality, and health behaviors: a systematic review of the literature. *American journal of public health,* 102**,** e33-e66.

BHAVSAR, V., BOYDELL, J., MURRAY, R. & POWER, P. 2014. Identifying aspects of neighbourhood deprivation associated with increased incidence of schizophrenia. *Schizophrenia research,* 156**,** 115-121.

BOYDELL, J., VAN OS, J., MCKENZIE, K., ALLARDYCE, J., GOEL, R., MCCREADIE, R. G. & MURRAY, R. M. 2001. Incidence of schizophrenia in ethnic minorities in London: ecological study into interactions with environment. *Bmj,* 323**,** 1336.

CHAKRABORTY, A. & MCKENZIE, K. 2002. Does racial discrimination cause mental illness? *The British Journal of Psychiatry,* 180**,** 475-477.

DAS-MUNSHI, J., BÉCARES, L., BOYDELL, J. E., DEWEY, M. E., MORGAN, C., STANSFELD, S. A. & PRINCE, M. J. 2012. Ethnic density as a buffer for psychotic experiences: findings from a national survey (EMPIRIC). *The British Journal of Psychiatry,* 201**,** 282-290.

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.

DO, D. P., LOCKLAR, L. R. & FLORSHEIM, P. 2019. Triple jeopardy: the joint impact of racial segregation and neighborhood poverty on the mental health of black Americans. *Social psychiatry and psychiatric epidemiology,* 54**,** 533-541.

DORSETT, R., RIENZO, C. & WEALE, M. 2019. Intergenerational and interethnic mental health: An analysis for the United Kingdom. *Population, Space and Place,* 25**,** e2195.

ENOS, R. D. & CELAYA, C. 2018. The effect of segregation on intergroup relations. *Journal of Experimental Political Science,* 5**,** 26-38.

ESCHBACH, K., OSTIR, G. V., PATEL, K. V., MARKIDES, K. S. & GOODWIN, J. S. 2004. Neighborhood context and mortality among older Mexican Americans: is there a barrio advantage? *American journal of public health,* 94**,** 1807-1812.

FENG, Z., VLACHANTONI, A., FALKINGHAM, J. & EVANDROU, M. 2017. Ethnic differentials in health: The additional effect of ethnic density. *Population, Space and Place,* 23**,** e2030.

GALENKAMP, H., STRONKS, K., MOKKINK, L. B. & DERKS, E. M. 2018. Measurement invariance of the SF-12 among different demographic groups: The HELIUS study. *PloS one,* 13**,** e0203483.

GRANOVETTER, M. S. 1973. The strength of weak ties. *American journal of sociology,* 78**,** 1360-1380.

HALPERN, D. & NAZROO, J. 2000. The ethnic density effect: results from a national community survey of England and Wales. *International Journal of Social Psychiatry,* 46**,** 34-46.

HESLIN, M., KHONDOKER, M., SHETTY, H., PRITCHARD, M., JONES, P. B., OSBORN, D., KIRKBRIDE, J. B., ROBERTS, A. & STEWART, R. 2018. Inpatient use and area-level socio-environmental factors in people with psychosis. *Social psychiatry and psychiatric epidemiology,* 53**,** 1133-1140.

HONG, S., ZHANG, W. & WALTON, E. 2014. Neighborhoods and mental health: Exploring ethnic density, poverty, and social cohesion among Asian Americans and Latinos. *Social science & medicine,* 111**,** 117-124.

JENKINSON, C. & LAYTE, R. 1997. Development and testing of the UK SF-12. *Journal of health services research & policy,* 2**,** 14-18.

JUN, J., JIVRAJ, S. & TAYLOR, K. 2020. Mental health and ethnic density among adolescents in England: A cross-sectional study. *Social Science & Medicine,* 244**,** 112569.

LAURENCE, J., SCHMID, K., RAE, J. R. & HEWSTONE, M. 2019. Prejudice, contact, and threat at the diversity-segregation nexus: A cross-sectional and longitudinal analysis of how ethnic out-group size and segregation interrelate for inter-group relations. *Social Forces,* 97**,** 1029-1066.

LEE, M.-A. 2009. Neighborhood residential segregation and mental health: a multilevel analysis on Hispanic Americans in Chicago. *Social science & medicine,* 68**,** 1975-1984.

MASSEY, D. S. & DENTON, N. A. 1988. The dimensions of residential segregation. *Social forces,* 67**,** 281-315.

NOBLES, C. J., VALENTINE, S. E., ZEPEDA, E. D., WANG, Y., AHLES, E. M., SHTASEL, D. L. & MARQUES, L. 2017. Residential segregation and mental health among Latinos in a nationally representative survey. *J Epidemiol Community Health,* 71**,** 318-323.

ONS. 2011. Census Geographies.

PARKIN, E. 2020. Mental health policy in England. *In:* LIBRARY, H. O. C. (ed.).

PORTES, A. 1998. Social capital: Its origins and applications in modern sociology. *Annual review of sociology,* 24**,** 1-24.

PORTES, A. & SENSENBRENNER, J. 1993. Embeddedness and immigration: Notes on the social determinants of economic action. *American journal of sociology,* 98**,** 1320-1350.

RABKIN, J. G. 1979. Ethnic density and psychiatric hospitalization: hazards of minority status. *The American Journal of Psychiatry*.

RICHARDSON, L., HAMEED, Y., PEREZ, J., JONES, P. B. & KIRKBRIDE, J. B. 2018. Association of environment with the risk of developing psychotic disorders in rural populations: findings from the social epidemiology of psychoses in East Anglia study. *JAMA psychiatry,* 75**,** 75-83.

ROBINSON, V. & ANDERSSON, R. 2003. Spreading the'burden'?: A review of policies to disperse asylum seekers and refugees.

SALYERS, M. P., BOSWORTH, H. B., SWANSON, J. W., LAMB-PAGONE, J. & OSHER, F. C. 2000. Reliability and validity of the SF-12 health survey among people with severe mental illness. *Medical care***,** 1141-1150.

SCHOFIELD, P., ASHWORTH, M. & JONES, R. 2011. Ethnic isolation and psychosis: re-examining the ethnic density effect. *Psychological medicine,* 41**,** 1263.

SIMPSON, L. & FINNEY, N. 2009. Spatial patterns of internal migration: evidence for ethnic groups in Britain. *Population, Space and Place,* 15**,** 37-56.

VELDHUIZEN, E. M., IKRAM, U. Z., DE VOS, S. & KUNST, A. E. 2017. The relationship between ethnic composition of the residential environment and self-reported health among Turks and Moroccans in Amsterdam. *International journal of health geographics,* 16**,** 12.

VILAGUT, G., FORERO, C. G., PINTO-MEZA, A., HARO, J. M., DE GRAAF, R., BRUFFAERTS, R., KOVESS, V., DE GIROLAMO, G., MATSCHINGER, H. & FERRER, M. 2013. The mental component of the short-form 12 health survey (SF-12) as a measure of depressive disorders in the general population: results with three alternative scoring methods. *Value in Health,* 16**,** 564-573.

VOGT YUAN, A. S. 2007. Racial composition of neighborhood and emotional well-being. *Sociological Spectrum,* 28**,** 105-129.

WARE, M. E., KOSINSKI, M. & DEWEY, J. E. 2001. *How to score version 2 of the SF-36 health survey (standard & acute forms)*, Quality Metric Incorporated.

**Appendix X.1 – Sample Descriptives**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Mean | Standard Deviation | Minimum | Maximum |
|  |  |  |  |  |
| *Individual-level variables* |  |  |  |  |
| SF-12 Mental Component Summary | 48.51 | 10.31 | 0 | 77.67 |
| Cohabits with partner | 0.48 |  | 0 | 1 |
| Year of Arrival | 1990 | 15.47 | 1939 | 2018 |
| Country: England | 0.96 |  | 0 | 1 |
| Country: Scotland | 0.01 |  | 0 | 1 |
| Country: Wales | 0.01 |  | 0 | 1 |
| Tenure: Home-owner | 0.58 |  | 0 | 1 |
| Tenure: Social Renting | 0.24 |  | 0 | 1 |
| Tenure: Private renting/Other | 0.17 |  | 0 | 1 |
| Religion: No religion | 0.16 |  | 0 | 1 |
| Religion: Christian | 0.22 |  | 0 | 1 |
| Religion: non\_Christian | 0.47 |  | 0 | 1 |
| Religion: Unknown | 0.13 |  | 0 | 1 |
| Ethnic: White Other | 0.27 |  | 0 | 1 |
| Ethnic: Indian | 0.17 |  | 0 | 1 |
| Ethnic Pakistani: | 0.14 |  | 0 | 1 |
| Ethnic: Bangladeshi | 0.07 |  | 0 | 1 |
| Ethnic: Chinese | 0.02 |  | 0 | 1 |
| Ethnic: Other Asian | 0.05 |  | 0 | 1 |
| Ethnic: Black Caribbean | 0.09 |  | 0 | 1 |
| Ethnic: Black African | 0.11 |  | 0 | 1 |
| Ethnic: Black Other | 0.01 |  | 0 | 1 |
| Ethnic: other ethnic group | 0.04 |  | 0 | 1 |
| Economic status: employed | 0.54 |  | 0 | 1 |
| Economic status: unemployed | 0.08 |  | 0 | 1 |
| Economic status: Inactive | 0.22 |  | 0 | 1 |
| Economic status: in education | 0.15 |  | 0 | 1 |
| Qualifcations: degree/other higher qualification | 0.41 |  | 0 | 1 |
| Qualification: pre-higher (A-level, etc.) | 0.27 |  | 0 | 1 |
| Qualification: GCSE/16 years old | 0.27 |  | 0 | 1 |
| Qualification: other | 0.03 |  | 0 | 1 |
| National id: British only | 0.56 |  | 0 | 1 |
| National id: English and British | 0.04 |  | 0 | 1 |
| National id: English only | 0.08 |  | 0 | 1 |
| National id: other | 0.30 |  | 0 | 1 |
| Age | 38.5 | 15.75 | 16 | 101 |
| Female (cf. Male) | 1.55 | 0.49 | 1 | 2 |
| Born in the UK | 0.38 | 0.48 | 0 | 1 |
|  |  |  |  |  |
| *Community-level variable* |  |  |  |  |
| Urban/rural: Urban city and town | 0.73 |  | 0 | 1 |
| Urban/rural: Rural Village | 0.23 |  | 0 | 1 |
| Urban/rural: rural hamlets | 0.01 |  | 0 | 1 |
| Urban/rural: rural town and fringe | 0.01 |  | 0 | 1 |
| Population density | 68.4 | 46.96 | 0.025 | 253.03 |
| Socio-economic Disadvantage | 0.7 | 1.02 | -1.49 | 3.56 |
| Percent aged 65+ | 11.26 | 4.66 | 1.48 | 38.9 |
| Ethnic densirt | 14.15 | 16.24 | 0 | 77.57 |
| Residential Segregation | 29.88 | 14.49 | 0 | 97.96 |

1. We also tested whether it was the level of segregation between a sub-group and the White British population. For example, for Black Caribbeans we tested segregation from the White British population (not all non-Black Caribbeans). Similar results were observed. However, the relationships were stronger for the former. [↑](#endnote-ref-1)
2. This is because data on the ethnic make-up of communities at small geographic scales is only available with the decennial UK Census, last conducted in 2011) [↑](#endnote-ref-2)
3. We also tested an interaction-term between co-ethnic density and segregation to examine whether these effects were conditional on one another but found no interactive-relationship. [↑](#footnote-ref-1)