

# Ethnic density as a buffer for psychotic experiences: findings from a national survey (EMPIRIC)<sup>†</sup>

Jayati Das-Munshi, Laia Bécaries, Jane E. Boydell, Michael E. Dewey, Craig Morgan, Stephen A. Stansfeld and Martin J. Prince

## Background

Aetiological mechanisms underlying ethnic density associations with psychosis remain unclear.

## Aims

To assess potential mechanisms underlying the observation that minority ethnic groups experience an increased risk of psychosis when living in neighbourhoods of lower own-group density.

## Method

Multilevel analysis of nationally representative community-level data (from the Ethnic Minorities Psychiatric Illness Rates in the Community survey), which included the main minority ethnic groups living in England, and a White British group. Structured instruments assessed discrimination, chronic strains and social support. The Psychosis Screening Questionnaire ascertained psychotic experiences.

## Results

For every ten percentage point reduction in own-group density, the relative odds of reporting psychotic experiences increased 1.07 times (95% CI 1.01–1.14,  $P=0.03$  (trend)) for the total minority ethnic sample. In general, people living in areas of lower own-group density experienced greater social adversity that was in turn associated with reporting psychotic experiences.

## Conclusions

People resident in neighbourhoods of higher own-group density experience ‘buffering’ effects from the social risk factors for psychosis.

## Declaration of interest

None.

There is now a sizeable literature on the incidence of schizophrenia and other psychoses among migrant and minority ethnic groups, particularly in the UK and The Netherlands. Although in the main, the evidence suggests the incidence is elevated in most of the migrant and minority ethnic groups that have been studied,<sup>1</sup> the evidence is stronger and more consistent for some groups, and the extent to which rates are increased varies markedly between groups. In Britain, for example, elevated incidence rates for psychosis have been noted in Black African and Black Caribbean populations,<sup>2</sup> with less elevated risks among Irish and Indian<sup>3</sup> and Pakistani populations,<sup>4</sup> and specifically, among Pakistani and Bangladeshi women.<sup>5</sup> The most recent literature review further suggests that among some groups the incidence is greater among second-generation than first-generation migrants (such as Black Caribbean people in the UK).<sup>1</sup> These patterns of risk suggest that there may be strong social risk factors related to the post-migration settlement context, such as experiences of discrimination,<sup>1,6</sup> neighbourhood context,<sup>7</sup> and specifically ethnic density<sup>8</sup> that may account for this variation.

The neighbourhood may function as ‘a reservoir of risk or resilience’ in the aetiology of psychosis.<sup>7</sup> However, there have been few studies directly examining this notion. One study suggested that neighbourhood-level ethnic group density may buffer residents from experiences of racism and discrimination that may in turn be associated with less psychotic experiences,<sup>9</sup> but there have been no studies examining interactions of individual-level experiences of social support and chronic adversity with ethnic density and psychosis. Most previous work has tended to group ethnic minorities together<sup>8,10</sup> or has used service contact data,<sup>8,11,12</sup> to ascertain psychosis. Given the different settlement experiences of migrant groups in Britain, and the complex pathways to care reported in the literature for minority ethnic groups<sup>13</sup> this has been a limitation of previous work. With this

in mind, using a nationally representative community-level data-set, we hypothesised that minority ethnic groups living in areas of lower own-group density would be more likely to report previous-year psychotic experiences relative to people living in areas of higher own-group density. In this population-based survey we used the Psychosis Screening Questionnaire (PSQ)<sup>14</sup> to screen for previous-year self-reported psychotic experiences. Although the relationship between population-level self-reported psychotic experiences and case-definition psychotic disorders remains controversial, associations between the two have been noted with similar demographic correlates between clinical psychosis and psychotic experiences.<sup>15</sup> Associations between the reporting of community-level psychotic experiences and impairment of functioning<sup>16</sup> have also been noted. Additionally, psychotic experiences may convert to clinical psychosis, particularly in adolescent and young adults.<sup>17</sup> Therefore, examining ethnic density associations with psychotic experiences within this data-set had the advantage of understanding the experiences of minority ethnic groups within a community survey of private households, potentially helping to illuminate the broader aetiology of psychosis. We hypothesised that relative to people living in areas of a greater ethnic density, people resident in areas of lower own-group density would be more likely to report adverse psychosocial factors potentially associated with onset and course of psychosis. Finally, we aimed to test for ‘buffering’ effects of density; that is whether adverse associations of discrimination, chronic strains and poorer social support with psychotic experiences might be aggravated by living in areas of lower own-group density.<sup>9,18</sup>

## Method

### Survey design

Data from the Ethnic Minorities Psychiatric Illness Rates in the Community (EMPIRIC) survey, a cross-sectional, nationally

<sup>†</sup>See editorial, pp. 258–259, this issue.

representative survey of adults (aged 16–74) undertaken in England in 2000, was used.<sup>19</sup> The survey was a follow-up of two previous representative community-based surveys conducted in England (the Health Survey for England (HSE) 1998 and 1999).<sup>20</sup> Weights were used to account for the differing probability of selection: by postcode sector, for households within sectors and adults from within households.<sup>20</sup>

Of the 7009 individuals who originally took part and who were contacted for re-interview in 2000, there were 4281 achieved interviews (68.2% of individuals eligible for re-interview). Regression models using data from the HSE were used to derive non-response weights.<sup>20</sup> Wherever possible, these survey weights for non-response, and weights to account for differing probabilities of selection in the original surveys have been retained. Further details are available in the main report.<sup>19</sup>

Structured interviews were conducted in individuals' homes, by trained lay interviewers matched wherever possible to the respondent's gender.<sup>19</sup> Whenever survey respondents could not complete the interview in English, an interviewer fluent in their preferred language was provided.<sup>19</sup> Surveys were translated into Hindi, Gujarati, Bengali, Punjabi and Urdu by a professional translation service.<sup>19</sup>

### Individual-level variables

Ethnicity for Indian, Bangladeshi, Pakistani, Black Caribbean and White British respondents was defined according to self-report criteria from previous UK censuses.<sup>21</sup> Irish ethnicity was determined according to country of birth or country of parent's birth.<sup>19</sup> 'Generational status' was determined using country of birth and self-ascribed ethnicity. People who reported that they belonged to a minority ethnic group and were born in England, Scotland or Wales were categorised as 'second/late generation', and people reporting they were born outside of these countries but had migrated to England, Scotland or Wales within the same life-course were 'first generation'. Occupational social class was determined according to Registrar General Social Class. Respondents were asked about their highest educational qualifications, age, gender and marital status.

Experiences of racism, discrimination<sup>22</sup> and chronic strains and difficulties<sup>23</sup> were assessed using structured instruments. Social support was assessed using the Close Person's Questionnaire, a structured validated instrument that assesses social support provided from one's closest nominated person.<sup>24</sup> More details about these measures can be found in the online supplement.

### Neighbourhood-level measures

Area-level measures were carried out at the middle super output-area (MSOA) level (an administrative area with a minimum population of 5000 and a mean population of approximately 7200 people<sup>25</sup>). Index of Multiple Deprivation from 2000, in quintiles, was used to assess area-level deprivation and linked to MSOA.<sup>26</sup> Ethnic density was defined as the 'percentage of minority ethnic people living within each MSOA'. To protect confidentiality, 'random noise' was added per case; the correlation between the 'true' ethnic density value and provided values was 0.975.

### Assessment of psychotic experiences: the Psychosis Screening Questionnaire

To assess psychotic experiences, we used the PSQ.<sup>14</sup> This is an interviewer-administered structured instrument that assesses psychotic experiences within the previous year. It includes five symptom domains: auditory hallucinations, persecutory

delusions, hypomania, a feeling that 'something strange' is going on that others might find hard to believe and thought interference. Each section begins with an introductory stem question with interviewers directing respondents to further questions if a 'yes' response is endorsed. In order to screen positive on a symptom domain, respondents needed to answer 'yes' to all questions within that section. Respondents answered all questions in each domain.

The measure has a sensitivity of 96.9% and specificity of 95.3% against the Schedules for Clinical Assessment in Neuro-psychiatry (SCAN),<sup>27</sup> in clinical samples.<sup>14</sup> It has also been validated in two national surveys from Britain.<sup>28,29</sup> Notably, the UK National Psychiatric Morbidity Survey assessed respondents who were screen-positive on the PSQ as well as a random sample of screen-negatives in a second-stage interview,<sup>29</sup> using the SCAN. In this setting the PSQ was estimated to have a sensitivity of 0.49 and specificity of 0.96.<sup>30</sup> We took the reporting of one or more symptoms on the PSQ as indicative of having experienced psychotic experiences within the previous year.

### Statistical analysis

Analyses were performed in STATA 10 for Windows. For analyses not involving area-level measures, data were weighted and took into account survey structure, using the design-based Wald test to assess the strength of associations.

To account for intracluster correlation, and to enable the modelling of variance at both area-level and individual-level, a multilevel analysis of unweighted data was performed, with MSOA specified as the grouping variable, with individuals nested within these areas. Two-level multilevel models with random intercepts and fixed effects for each predictor variable were specified. Each model assumed that prevalence of psychotic experiences varied by neighbourhood and was run separately for each minority ethnic group. We repeated analyses retaining survey weights and using robust standard errors to account for geographical clustering. Sensitivity analyses comparing the two approaches suggested less than 5% difference in coefficients, using either approach. Therefore, findings from multilevel models are presented here.

We assessed cross-level interactions between own-group density and each of the measures for racism and discrimination, social support and chronic strains. The strength of cross-level interactions was assessed using likelihood ratio tests (LRTs).

### Analysis plan

*A priori* confounders were age, gender, social class, marital status, education and area-level deprivation. Using multivariable logistic regression we assessed the association of interpersonal racism and discrimination, chronic strains and social support with the odds of screening positive on the PSQ. Next, we assessed the association of own-group density with the relative odds of screening positive on the PSQ, and assessed interactions with gender and generational status. To assess whether living in areas of reduced density was associated with increased discrimination and chronic strains, or with reduction in the reporting of 'protective' factors such as social support, we assessed the association of decreasing own-group density with each of these variables. Finally, we assessed whether the association of discrimination, social support and chronic strains with the reporting of psychotic experiences, varied with different levels of ethnic density.

## Results

After taking into account survey structure and weights for non-response, 8% of the sample endorsed one or more items on the

PSQ, equivalent to a weighted total of 351 people (total weighted sample size: 4281). By ethnic group, the weighted proportion of people endorsing one or more items on the PSQ were: White British 6%, Irish 8%, Black Caribbean 12%, Bangladeshi 5%, Indian 9%, Pakistani 10%.

### Demographic features

Tables 1–3 shows the distribution of minority ethnic status against key demographic factors. Apart from the Irish group, second-generation minority ethnic respondents tended to be younger than first-generation comparison groups (Table 1). Additionally, second-generation groups had more education and higher social class than the first generation and were less likely to be married or cohabiting. With the exception of the Irish group, second-generation minority ethnic groups were more likely to report previous-year interpersonal racism than first-generation groups and second-generation Bangladeshi, Indian and Pakistani groups reported lower levels of practical support from their closest nominated person compared with first-generation counterparts (Table 2).

### Association of racism and discrimination, chronic strains and social support with psychotic experiences

Online Tables DS1–7 display the association of racism and discrimination, social support, chronic strains and difficulties

with the reporting of previous year psychotic experiences, after accounting for own-group density and all confounders, for each ethnic group. Taking the minority ethnic sample as a whole (net of White British people), after adjusting for confounders and own-group density, the association of each of the variables with psychotic experiences were: previous year interpersonal racism (odds ratio (OR) = 2.26, 95% CI 1.62–3.14,  $P < 0.001$ ), lifetime work-related discrimination (OR = 1.46, 95% CI 1.06–2.00,  $P = 0.02$ ), (high *v.* low) practical social support provided by closest person (OR = 0.75, 95% CI 0.56–0.99,  $P = 0.04$ ), (high *v.* low) confiding/emotional support provided by closest person (OR = 1.19, 95% CI 0.89–1.59,  $P = 0.24$ ), (high *v.* low) negative aspects of close relationships (OR = 1.15, 95% CI 0.88–1.51,  $P = 0.29$ ) and reporting one or more chronic strains (OR = 2.71, 95% CI 1.75–4.21,  $P < 0.001$ ).

### Association of own-group density with the reporting of psychotic experiences

After adjusting for confounders, in all the ethnic groups except the White British group, for each ten percentage point reduction in own-group density there was evidence of an increase in the relative odds of reporting one or more psychotic experiences, in the previous year (Table 4). The associations were strongest for Indian people and for the combined minority ethnic sample, with weaker effects noted for the Bangladeshi group (Table 4). No

	Minority ethnic group and generational status <sup>a</sup>										
	White British	Irish		Black Caribbean		Bangladeshi		Indian		Pakistani	
		1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation
Total, <i>n</i>											
Unweighted	837	268	464	332	361	553	95	464	178	468	256
Weighted	835	246	484	321	369	537	110	458	188	469	255
Age, years: %											
16–34	31	19	33	9	65	51	92	18	89	35	97
35–54	43	37	53	38	35	33	8	57	11	47	3
55–74	26	44	15	53	1	16	0	26	0	18	0
Gender, %											
Male	44	43	44	39	42	49	53	48	52	51	42
Female	56	57	56	61	58	51	47	52	48	49	58
Highest educational qualification, %											
Degree, equivalent or above	27	29	27	21	30	8	23	31	26	19	15
GCSE/A-level or equivalent	44	31	47	27	55	23	55	26	62	23	56
Foreign qualification/other	4	7	4	8	1	3	1	5	3	6	1
No qualifications	25	33	22	44	14	65	22	37	10	52	28
Social class, %											
Non-manual	58	46	54	44	57	17	32	43	60	28	44
Manual, student, never worked, or 'other'	42	54	46	56	43	83	68	57	40	72	56
Marital status, %											
Married or cohabiting	62	70	59	55	28	79	22	85	41	85	42
Divorced or separated	9	9	12	19	6	3	3	5	4	5	2
Widowed	4	6	2	6	0	5	0	4	0	3	1
Single and never married	25	16	27	20	66	13	76	6	55	7	56

a. 2nd generation: second generation or later.

<b>Table 2 Individual-level experiences of discrimination, adversities and social support</b>											
	Minority ethnic group and generational status <sup>a</sup>										
	White British	Irish		Black Caribbean		Bangladeshi		Indian		Pakistani	
		1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation
Total, <i>n</i>											
Unweighted	837	268	464	332	361	553	95	464	178	468	256
Weighted	835	246	484	321	369	537	110	458	188	469	255
Previous year interpersonal racism <sup>b</sup>											
None	93	93	94	88	83	93	83	89	83	91	80
One or more <sup>b</sup>	7	7	6	12	17	7	17	11	17	9	20
Lifetime work-related discrimination, <sup>c</sup> %											
None	96	89	95	65	62	93	88	80	83	84	85
At least once	4	11	5	35	38	7	12	20	17	16	15
Levels of practical support provided from closest nominated person, %											
Lowest two tertiles	60	56	56	61	66	26	53	48	63	43	56
Top tertile – high levels	40	45	44	39	34	74	47	52	37	57	44
Levels of confiding and emotional support provided from closest nominated person, %											
Bottom two tertiles	64	65	58	68	70	71	80	68	68	67	70
Top tertile – high levels	37	35	42	32	30	29	20	32	32	33	30
Negative social support from closest nominated person, %											
Bottom two tertiles	63	64	60	56	51	24	31	48	47	49	49
Top tertile – high levels	37	36	40	44	50	76	69	53	53	51	51
Chronic strains and difficulties, <sup>d</sup> %											
No chronic difficulties	27	33	23	32	17	14	18	27	28	26	27
1+ chronic difficulties	73	67	77	68	83	86	82	73	72	75	73

a. 2nd generation: second generation or later.  
b. Reports of insults, assaults or physical damage to property as a result of one's ethnic group, in the previous year.  
c. Reports of lifetime discrimination at work because of one's race, colour, religious or ethnic background.  
d. Problems with relatives, difficulties paying bills, difficulties with being able to afford food or clothing, problems with housing (such as damp), problems with the neighbourhood (such as unsafe streets, noise etc).

<b>Table 3 Area-level demographic factors</b>											
	Minority ethnic group and generational status <sup>a</sup>										
	White British	Irish		Black Caribbean		Bangladeshi		Indian		Pakistani	
		1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation	1st generation	2nd generation
Total, <i>n</i>											
Unweighted	837	268	464	332	361	553	95	464	178	468	256
Weighted	835	246	484	321	369	537	110	458	188	469	255
Area level deprivation (quintiles), %											
Least deprived quintile	27	12	15	1	2	0	0	13	12	1	0
Second quintile	24	13	20	7	4	0	2	13	11	3	3
Third quintile	19	20	19	14	15	1	2	19	18	9	9
Fourth quintile	16	29	23	27	28	9	19	31	27	24	25
Most deprived quintile	15	25	22	51	50	89	77	25	32	63	63
Own-group density, <sup>b</sup> %											
Lowest	0	28	30	48	46	36	49	73	75	43	43
Low	3	24	36	30	34	17	15	11	16	21	21
Middle	14	39	28	15	14	14	14	9	7	17	19
High	83	9	7	7	5	33	22	7	2	19	16

a. 2nd generation: second generation or later.  
b. Density cut-offs: White British – 25%, 50%, 75%; Irish – 1%, 2%, 5%; Black Caribbean – 6%, 12%, 18%; Indian, Bangladeshi and Pakistani – 15%, 30%, 45%.

**Table 4** Association of reporting psychotic experiences per ten percentage point reduction in own-group density

Ethnic group	n		Median (IQR) of own-group ethnic density variable	OR (95% CI) <sup>a</sup>	P (trend)
	Unweighted	Weighted <sup>b</sup>			
Combined minority ethnic sample	3444	3446	36.1 (14.40–59.74)	1.07 (1.01 to 1.14)	0.03
White British	837	835	93.1 (84.6–96.9)	0.91 (0.72 to 1.14)	0.38
Irish	733	733	1.7 (0.92–3.01)	5.44 (0.77 to 38.3)	0.09
Black Caribbean	694	691	6.9 (2.55–11.61)	1.05 (0.68 to 1.61)	0.83
Bangladeshi	650	650	28.9 (10.5–46.8)	1.26 (1.00 to 1.60)	0.07
Indian	643	648	6.5 (3.39–16.31)	1.38 (1.02 to 1.86)	0.03
Pakistani	724	724	19.3 (5.99–38.71)	1.17 (0.95 to 1.45)	0.15

a. Models adjusted for area-level deprivation, social class, education, marital status, age and gender  
b. Weighted for non-response.

interactions for gender and own-group density, or generation and own-group density were noted.

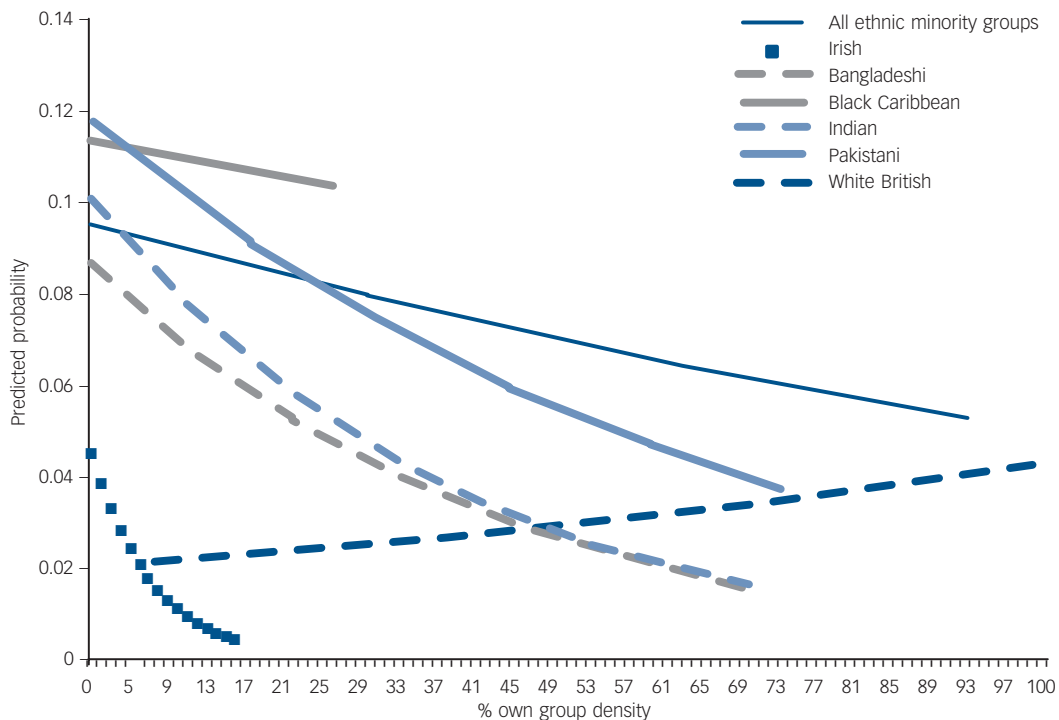
Figure 1 displays the predicted probability of screening positive on the PSQ according to actual own-group ethnic density. For each of the minority ethnic groups, the predicted probability of screening positive on the PSQ was greatest at the lowest levels of own-group ethnic density. The only group for whom the trend was reversed was the White British group.

**Association of own-group density with racism and discrimination, social support and chronic strains**

We have previously reported that for many minority groups living in areas of higher own-group density there is reduced reporting of discriminatory experiences and reports of enhanced social support.<sup>31</sup> Online Tables DS8 and DS9 show the association of living in areas of decreasing own-group density with the reporting of discrimination and social support. Although associations were

not always in the expected direction, in general with decreasing own-group density minority ethnic groups were more likely to report greater discrimination and poorer social support.<sup>31</sup>

Table 5 displays associations of reporting chronic strains with ethnic density. For every ten percentage point reduction in own-group density, Bangladeshi, Indian, Irish and the combined minority ethnic sample were more likely to report chronic strains due to relatives. Only the Irish group were more likely to report problems with money for food and clothing with every ten percentage point reduction in own-group density. Given that ethnically dense areas are more likely to be deprived,<sup>31</sup> it was unsurprising that difficulties with housing were less likely to be reported for each ten percentage point reduction in total ethnic density. Only the White British group appeared to report increasing ‘neighbourhood difficulties’ with decreasing own-group density. Irish people experienced an approximate four-fold increase in reporting one or more chronic strains for every ten percentage point reduction in own-group density.



**Fig. 1** Predicted probability of screening positive on the Psychosis Screening Questionnaire according to own-group density. All plots have been adjusted for *a priori* confounders (age, gender, social class, education, marital status and area-level deprivation) and take into account geographical clustering.



**Table 5** Relative odds (95% CI) of reporting chronic strains and difficulties per ten percentage point reduction in own-group density<sup>a</sup>

Chronic strains and difficulties	<i>n</i>	Total minority ethnic sample ( <i>n</i> = 3444)	White British ( <i>n</i> = 837)	Irish ( <i>n</i> = 733)	Black Caribbean ( <i>n</i> = 694)	Bangladeshi ( <i>n</i> = 650)	Indian ( <i>n</i> = 643)	Pakistani ( <i>n</i> = 724)
Problems with relatives OR (95% CI) <i>P</i> (trend)	1952	1.06 (1.02–1.11) 0.005	0.88 (0.78–0.99) 0.03	3.48 (1.33–9.07) 0.02	0.86 (0.63–1.17) 0.34	1.43 (1.18–1.74) <0.001	1.14 (1.02–1.27) 0.02	1.03 (0.89–1.19) 0.69
Problems with money for food or clothing OR (95% CI) <i>P</i> (trend)	1605	1.01 (0.97–1.06) 0.68	0.95 (0.84–1.07) 0.38	2.77 (0.87–8.85) 0.08	1.17 (0.83–1.63) 0.35	1.07 (0.95–1.20) 0.29	0.99 (0.82–1.20) 0.93	0.97 (0.83–1.12) 0.68
Difficulties with paying bills OR (95% CI) <i>P</i> (trend)	1265	1.01 (0.96–1.06) 0.67	0.94 (0.81–1.09) 0.39	3.01 (0.65–14.0) 0.15	1.02 (0.76–1.36) 0.91	0.99 (0.84–1.17) 0.94	1.14 (0.95–1.38) 0.17	0.94 (0.82–1.09) 0.41
Difficulties with housing OR (95% CI) <i>P</i> (trend)	1150	0.93 (0.88–0.99) 0.01	0.93 (0.79–1.09) 0.35	0.69 (0.16–2.97) 0.62	0.79 (0.56–1.12) 0.19	0.88 (0.73–1.05) 0.17	1.06 (0.88–1.27) 0.54	0.99 (0.83–1.19) 0.95
Neighbourhood difficulties OR (95% CI) <i>P</i> (trend)	940	1.00 (0.94–1.06) 1.00	1.14 (1.01–1.29) 0.04	1.61 (0.46–5.59) 0.45	0.84 (0.55–1.29) 0.43	0.84 (0.68–1.04) 0.12	1.23 (0.98–1.53) 0.08	1.02 (0.87–1.20) 0.77
Report one or more chronic strains OR (95% CI) <i>P</i> (trend)	3228	1.01 (0.96–1.06) 0.77	0.99 (0.87–1.13) 0.94	3.98 (1.26–12.57) 0.02	0.93 (0.61–1.41) 0.73	1.15 (0.83–1.58) 0.37	1.12 (0.98–1.29) 0.12	0.93 (0.79–1.11) 0.43

a. All models adjusted for area-level deprivation, gender, social class, age, marital status, education. Totals are unweighted.

### Ethnic density as an effect modifier

When the sample as a whole (net of White British people) was considered (*n* = 3444), interactive effects for social support and chronic strains with ethnic density were evident. Figures 2–4 display the predicted probabilities of reporting psychotic experiences, for people experiencing different levels of chronic strains and difficulties (Fig. 2), confiding and emotional support (Fig. 3), and practical support (Fig. 4) at different levels of own-group density, for the total minority ethnic sample. Figures 2–4 support the overall finding that in general, living in areas of increasing own-group density was associated with a lower predicted probability of reporting psychotic experiences. This reduction was more marked for people who reported high levels of practical or confiding support (Figs 3 and 4). People who did not report chronic strains and difficulties experienced a greater reduction in the predicted probability of reporting psychotic experiences, contrasted against people reporting one or more chronic strains and difficulties (Fig. 2). Interactive effects were not evident when assessed in individual minority ethnic groups.

### Contextual v. compositional associations with density

Finally, in models using the combined minority ethnic sample (*n* = 3444), LRTs assessing the strength of the evidence that the variability between areas was the same as within areas (i.e. LRT for  $\rho=0$ , ‘ $\rho$ ’ (‘rho’), also known as the intraclass correlation coefficient (ICC)<sup>32</sup>), suggested that the prevalence of reporting psychotic experiences varied by area, even after adjusting for area-level deprivation, as well as the individual-level covariates of age, gender, education, social class and marital status (ICC = 0.06, 95% CI 0.01–0.20, *P* = 0.05). After the individual-level variables of discrimination, social support and chronic strains were added to models, the variability between areas was reduced (ICC = 0.03, 95% CI 0.00–0.30, *P* = 0.21); suggesting that these latter individual-level variables ‘accounted’ for some of the area-level variability in the prevalence of psychotic experiences<sup>33</sup> (see online data supplement).

## Discussion

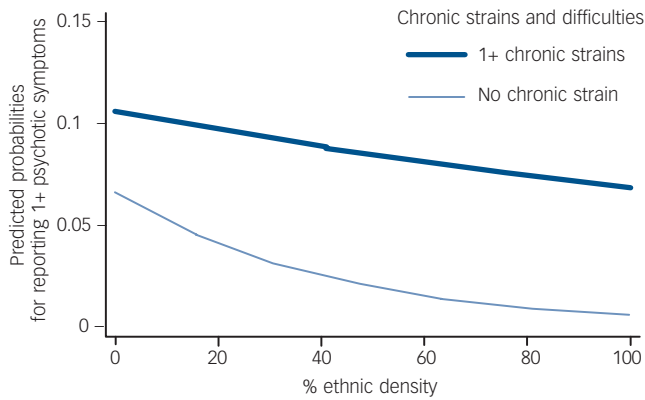
### Main findings

The findings from this study, using nationally representative data, largely confirm that for minority ethnic groups living in England, people living in areas of lower own-group density are more likely to have psychotic experiences. This was most marked for Indian people and the combined minority ethnic sample, with weaker effects noted for the Bangladeshi group, although the general trend was supportive of similar associations for all minority groups.

### Relationship to previous findings

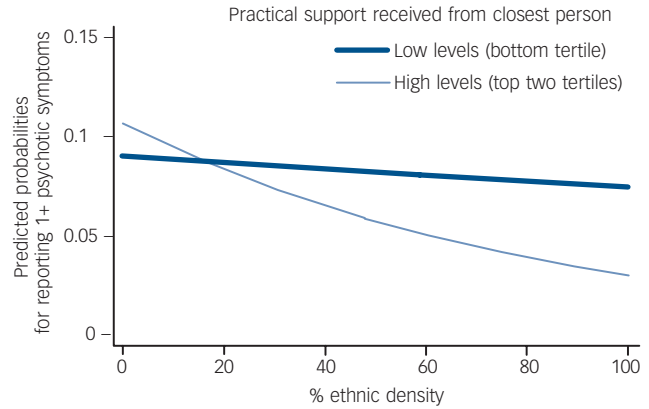
The findings support previous studies that have used service-contact data<sup>8,11,12</sup> although the present study had the advantage of using a community-level population data-set, reducing possible health-seeking selection biases. This is an important issue given the literature that has established complex pathways to care among minority ethnic groups living in Britain.<sup>13</sup> The national context of the data-set permitted examination of density effects over a range of own-group densities; most previous work has tended to focus on smaller geographical areas, usually within urban locations.<sup>8,11,12</sup>

Although each of the minority ethnic groups experienced an increase in the relative odds of screening positive on the PSQ per ten percentage point reduction in own-group density, it is surprising that the findings were less marked for the Black Caribbean group, given that in previous analyses the ethnic groups examined were predominantly<sup>8,10</sup> or exclusively<sup>12</sup> African–Caribbean. It may be that the geographical distance over which ethnic density associations operate differs by minority ethnic group. For example, a previous study found that ethnic density associations were evident for Black Caribbean people at the lower super output-level (with mean 1500 residents<sup>25</sup>) which disappeared when re-examined at the larger ward-level.<sup>12</sup> As we used a larger geographical area (of mean 7200 residents<sup>25</sup>), this



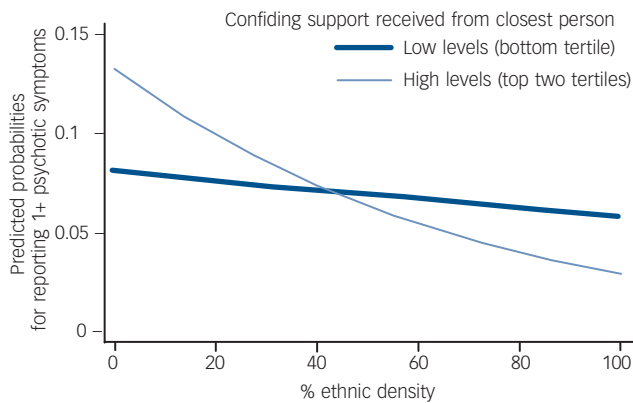
**Fig. 2** Predicted probability in total minority ethnic sample of reporting psychotic experiences at different levels of own-group density, stratified by chronic strains and difficulties.

*P* for tests of interaction (likelihood ratio test)=0.04.



**Fig. 4** Predicted probability in total minority ethnic sample of reporting psychotic experiences at different levels of own-group density, stratified by practical support.

*P* for tests of interaction (likelihood ratio test)=0.04.



**Fig. 3** Predicted probability in total minority ethnic sample of reporting psychotic experiences at different levels of own-group density, stratified by confiding support.

*P* for tests of interaction (likelihood ratio test)=0.03.

might account for our weaker findings for the Black Caribbean group, although, notably, there was evidence supporting ethnic density associations for the Indian and combined minority ethnic sample, with weaker evidence for the Bangladeshi group, at this level. Protective social networks may extend over larger geographical areas for these groups. More work is needed to understand the level at which density effects operate for different minority ethnic groups living in Britain and what this might mean from the perspective of residents.<sup>34</sup>

The actual ranges of own-group density for each of the minority groups in this study is commensurate with known ranges for minority ethnic settlement in Britain at MSOA-level.<sup>35</sup> The observations in this study should not be extrapolated outside these ranges; it is possible that at higher ranges of own-group density 'protective' associations cease to be beneficial.

In the main study,<sup>19</sup> the Social Functioning Questionnaire assessed, alongside other aspects of functioning, positive relationships with relatives.<sup>36</sup> Bangladeshi men and women were more likely to report 'severe' problems with their relationships, compared with the other minority ethnic groups.<sup>19</sup> The findings from the present analysis build on this individual-level association by showing that Bangladeshi people living in areas of lower own-group density were more likely to report problems with their

relatives compared with Bangladeshi people living in areas of higher own-group density. It may be that 'buffering' mechanisms also operate through non-kin social contacts and that these become less accessible to people living in lower own-group density areas, where difficult relationships within the household might exacerbate mental health problems. More research, potentially using qualitative approaches, is needed to understand the way in which interpersonal relationships vary according to contextual determinants.

Previous work has suggested that second-generation groups continue to experience an elevated risk of psychosis compared with first-generation groups. Although experiences such as discrimination and disadvantage varied according to generation, there were no interactions noted between generational status and own-group density in the reporting of psychotic experiences. This suggests that density effects were similar across first- and second-generation groups.

### Ethnic density as a 'buffer' for psychosis

Although findings are complex, the analysis supports the hypothesis that own-group density may buffer psychosocial adversity, thus reducing the risk of psychosis, through two potential pathways. First, in keeping with earlier work on this data-set,<sup>31</sup> for some groups in this study, living in areas of lower own-group density was associated with an increase in the reporting of racism, discrimination and poorer social support. Our findings also suggested that for some groups, chronic strains and difficulties were increased among people living in areas of lower own-group density. Given the associations of these variables with the reporting of psychotic-like experiences,<sup>37,38</sup> one potential interpretation might be that living in areas of lower own-group density may lead to adverse effects on mental health, as minority ethnic residents in such areas may be exposed to more discrimination,<sup>9</sup> poorer social support and greater chronic strains.<sup>37</sup> This is in keeping with earlier qualitative work that suggested that ethnically dense areas may function as a 'psychic shelter' for minority ethnic residents.<sup>34</sup>

Second, within the full minority ethnic sample, we found evidence of interactive effects for ethnic density and chronic strains, as well as with ethnic density and some of the social support measures. Our findings suggest that although living in areas of higher own-group density may reduce the risk of experiencing psychotic experiences, this protective effect may be lessened in people experiencing chronic strains, and enhanced in

people reporting high levels of practical support or confiding/emotional support from one's closest nominated person. There were a few unexpected associations. Although some of these associations may be related to measurement error in these variables, they also highlight the heterogeneity of experiences underlying 'ethnic density effects' which mirror the complex settlement experiences and individual histories of each of the groups studied in this analysis.

## Limitations

Limitations of the study include its cross-sectional design; temporality cannot be assumed. Recall bias may have influenced findings: people experiencing psychotic experiences may have been more likely to recall episodes of discrimination or adversity, or conversely people endorsing items on the PSQ that assess for persecutory delusions may have endorsed these items because they were experiencing discrimination rather than psychotic experiences. Related to the issue of temporality, the Black Caribbean group reported the highest prevalence of discrimination within the sample and reporting of work-related discrimination was greatest in areas of higher own-group density. The latter finding could be accounted for through reverse causality (i.e. people who experience lifetime work-related discrimination then move into areas of higher own-group density).

Insufficient power may have accounted for weaker ethnic density effects for some minority ethnic groups within this survey. We assessed socioeconomic position and area-level deprivation with multiple indices; it is possible that density effects were minimised by residual confounding effects of area-level deprivation and socioeconomic position, especially as ethnically dense areas were also more deprived. Finally, as the original investigation omitted Black African people from the survey,<sup>19</sup> we were unable to include this group, or more recent migrant groups, in the analyses. It should be borne in mind that the findings may not generalise to other minority ethnic groups.

Although the findings of this study are in keeping with previous work suggesting associations between ethnic density and incident schizophrenia or clinical psychosis,<sup>8,11</sup> another potential limitation was using an instrument to assess reporting of psychotic experiences, as opposed to clinical psychosis. Concerns have been raised when instruments like these are used in large population-based surveys, where the rigour in administering these tools may be reduced and 'masking of caseness' greater.<sup>30</sup> Additionally, compared with studies examining the incidence of clinical psychosis using service-contact data,<sup>39</sup> the reported prevalence of psychotic experiences for the Black Caribbean group was lower than would be expected in the present analysis. Similar findings have been noted in other analyses of nationally representative data-sets utilising the PSQ.<sup>19,28</sup> It has been suggested that if Black Caribbean people experience shorter episodes of psychotic illnesses<sup>40</sup> then this would account for the discrepancies between prevalence as demonstrated in this study and incidence as suggested in studies using service-contact data.<sup>16</sup> Given these concerns, the responses to the PSQ in this study should be treated as responses to a screening questionnaire ascertaining prevalence of psychotic experiences, and not clinical psychosis.

However, there are many similarities between the demographic correlates of people reporting psychotic-like experiences compared with people with clinical psychosis,<sup>15</sup> and evidence to indicate that psychotic-like experiences may exist on a continuum with severe psychotic disorders.<sup>41</sup> In most cases such phenomena are transitory and disappear over time, although for some these may persist and develop into severe disorders, especially in people exposed to environmental stressors.<sup>18,41</sup>

## Implications

This study suggests strong evidence for area-level or 'contextual' associations with psychotic experiences, in minority ethnic groups. These might be accounted for through individual-level factors such as experiences of discrimination and chronic strains and social support, but may also function in other ways. Strong social effects mediated through the environment may account for varying susceptibilities to psychosis among minority ethnic people. Our findings begin to unpack important social mechanisms that may underlie the aetiology of psychotic experiences in minority ethnic groups.

**Jayati Das-Munshi**, MSc, MRCPsych, Section of Epidemiology, Department of Health Service and Population Research, Institute of Psychiatry, King's College London; **Laia Bécáres**, PhD, MPH, Cathie Marsh Centre for Census and Survey Research, School of Social Services, University of Manchester; **Jane E. Boydell**, PhD, MRCPsych, Psychological Medicine, Institute of Psychiatry, King's College London; **Michael E. Dewey**, PhD, Section of Epidemiology, Department of Health Service and Population Research, Institute of Psychiatry, King's College London; **Craig Morgan**, PhD, Department of Health Service and Population Research, Institute of Psychiatry, King's College London; **Stephen A. Stansfeld**, PhD, FRCPSych, Wolfson Institute for Preventive Medicine, Centre for Psychiatry, Queen Mary University of London, Barts and the London School of Medicine, London; **Martin J. Prince**, MD, FRCPSych, Section of Epidemiology, Department of Health Service and Population Research, Institute of Psychiatry, King's College London, UK

**Correspondence:** Dr Jayati Das-Munshi, Department of Health Service and Population Research, Section of Epidemiology, PO 60 King's College London, Institute of Psychiatry, De Crespigny Park, London SE5 8AF, UK. Email: jayati.das-munshi@kcl.ac.uk

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**Measures**

<b>Measure</b>	<b>Questions</b>
<b>Close person's Questionnaire:</b> Social support	<p>Asked study participants to nominate the person to whom they felt closest in the previous twelve months and then asked questions rating levels of practical support provided (four items), negative aspects of the relationship (four items), and confiding and emotional support (seven items) e.g. Thinking about the person you are closest to, please tell us how you would rate the practical and emotional support they have provided you in the last twelve months? None/ A little/ Quite a lot/ A great deal</p>
<b>Interpersonal racism</b>	<p>For respondents reporting physical attacks or deliberate damage to property belonging to them in the previous year, they were further prompted: 1) <i>Do you think you were attacked for reasons to do with your ethnicity?</i> 2) <i>Do you think any of these attacks on your property were for reasons to do with your ethnicity?</i></p> <p>Respondents were also asked, <i>"In the last twelve months, has anyone insulted you for reasons to do with your ethnicity? By insulted, I mean verbally abused, threatened, or been a nuisance to you?"</i></p> <p>A binary summary variable which comprised affirmative responses to any of the above three questions, was utilised in analyses.</p>
<b>Lifetime work-related discrimination</b>	<p>1) Have you yourself ever been refused a job for reasons which you think were to do with your race, colour or religious or ethnic background?</p> <p>2) Have you yourself ever been treated unfairly at work with regard to promotion or a move to a better position for reasons which you think were to do with your religious or ethnic background (I don't mean when applying for a new job)?</p> <p>A binary summary response variable which comprised an affirmative response to either of these two questions was created.</p>
<b>Chronic strains and difficulties</b>	<p>1) How often do you have any worries or problems with other relatives, for example parents or in-laws? 2) How often does it happen to you that you do not have enough money to afford the kind of food or clothing you or your family should have?</p>

	<p>3) How much difficulty do you have in meeting the payment of bills?</p> <p>4) To what extent do you have problems with your housing, for example to small repairs, damp etc?</p> <p>5) To what extent do you have problems with the neighbourhood in which you live, for example noise, unsafe streets, few local facilities?</p> <p>Responses to each question were encoded with one of the following: Always/ Often/ Sometimes/ Seldom/ Never</p> <p>A binary summary variable was created for each response (never/ seldom versus sometimes/ often/ always). A total summary variable for 'any chronic strain experienced' was then created- comprising zero strains, versus one or more chronic strains.</p>
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**Table DS1** Multilevel models: associations with the reporting of psychotic symptoms, total minority ethnic sample

		Odds Ratio (95% CI)	P value for ORs	Odds Ratio (95% CI)	P value for ORs	P value for clusterin g*
<b>Model 1</b>						0.003
<b>Model 2</b>						0.05
<b>Own group density</b> (per 10% decrease)		1.07 (1.01, 1.14)	0.03 (trend)	1.07 (1.00, 1.14)	0.04 (trend)	
<b>Area-level deprivation</b> (per quintile increase)		1.28 (1.11, 1.47)	<0.001 (trend)	1.21 (1.05, 1.40)	<0.01 (trend)	
	<i>N (%)</i>					
<b>Age</b>						
16 to 34	1419 (41)	1.00 [ref]	<0.01	1.00 [ref]	0.01	
35 to 54	1351 (39)	0.89 (0.67, 1.20)		0.83 (0.62, 1.13)		
55 to 74	674 (20)	0.48 (0.31, 0.73)		0.53 (0.34, 0.82)		
<b>Gender</b>						
Male	1573 (46)	1.00 [ref]	0.36	1.00 [ref]	0.19	
Female	1871 (54)	1.14 (0.86, 1.50)		1.21 (0.91, 1.62)		
<b>Education</b>						
School-leaving or higher	1938 (58)	1.00 [ref]	0.85	1.00 [ref]	0.37	
Foreign qualifications	132 (4)	0.95 (0.48, 1.91)		1.04 (0.51, 2.09)		
None	1272 (38)	1.09 (0.79, 1.50)		1.27 (0.91, 1.78)		
<b>Occupational social class</b>						
Social class I/II	734 (22)	1.00 [ref]	<0.001	1.00 [ref]	0.02	
III skilled non manual	671 (20)	0.93 (0.62, 1.38)		1.01 (0.67, 1.53)		
III skilled manual	553 (16)	1.22 (0.79, 1.88)		1.30 (0.83, 2.03)		
IV semi skilled manual	719 (21)	0.95 (0.63, 1.43)		0.95 (0.61, 1.46)		
V unskilled manual	153 (5)	1.65 (0.92, 2.97)		1.65 (0.91, 2.99)		
Students/ never worked	530 (16)	0.47 (0.27, 0.80)		0.55 (0.31, 0.96)		
<b>Marital status</b>						
Married or cohabiting	2214 (64)	1.00 [ref]	<0.001	1.00	<0.01	
Single/ divorced/ separated	1230 (36)	1.74 (1.33, 2.28)		1.56 (1.17, 2.07)		
<b>Model 3</b>						0.21
<b>Social support</b>						
Practical support						
Lowest two thirds	1688 (50)	-		1.00	0.04	
Top one third	1698 (50)	-		0.75 (0.56, 0.99)		
Confiding/ emotional support						
Lowest two thirds	2291 (68)	-		1.00	0.24	
Top one third	1090 (32)	-		1.19 (0.89, 1.59)		
Negative social support						
Lowest two thirds	1576 (47)	-		1.00	0.29	
Top one third	1806 (53)	-		1.15 (0.88, 1.51)		
<b>Racism and discrimination</b>						
Previous year interpersonal racism						
None	3049 (89)	-		1.00	<0.001	
Has experienced this	395 (11)	-		2.26 (1.62, 3.14)		
Life-time discrimination at work						
None	2828 (82)	-		1.00	0.02	
Has experienced this	616 (18)	-		1.46 (1.06, 2.00)		
<b>Chronic strains</b>						
None	792 (23)	-		1.00 [ref]	<0.001	
One or more chronic strains	2627 (77)	-		2.71 (1.75, 4.21)		

**Table DS2** Multilevel models: associations with the reporting of psychotic symptoms, White British people

		<b>Odds Ratio (95% CI)</b>	<b>P value for ORs</b>	<b>Odds Ratio (95% CI)</b>	<b>P value for ORs</b>	<b>P value for clustering*</b>
<b>Model 1</b>						0.21
<b>Model 2</b>						
<b>Own group density</b> (per 10% decrease)		0.91 (0.72, 1.14)	0.39 (trend)	0.82 (0.63, 1.06)	0.11 (trend)	
<b>Area-level deprivation</b> (per quintile increase)		1.42 (1.08, 1.87)	0.01 (trend)	1.48 (1.11, 1.98)	<0.01 (trend)	
	<i>N (%)</i>					0.27
<b>Age</b>						
16 to 34	228 (27)	1.00 [ref]	0.05	1.00 [ref]	0.19	
35 to 54	371 (44)	1.00 (0.45, 2.23)		0.96 (0.41, 2.28)		
55 to 74	238 (28)	0.31 (0.10, 1.00)		0.39 (0.11, 1.310)		
<b>Gender</b>						
Male	368 (44)	1.00 [ref]	0.82	1.00 [ref]	0.99	
Female	469 (56)	1.09 (0.53, 2.25)		1.01 (0.46, 2.20)		
<b>Education</b>						
School-leaving or higher	578 (72)	1.00 [ref]	0.20	1.00 [ref]	0.22	
Foreign qualifications	31 (4)	-		-		
None	198 (25)	1.25 (0.53, 2.95)		1.33 (0.52, 3.43)		
<b>Occupational social class</b>						
Social class I/II	282 (34)	1.00 [ref]	0.02	1.00 [ref]	0.03	
III skilled non manual	220 (27)	0.28 (0.07, 1.06)		0.28 (0.07, 1.12)		
III skilled manual	140 (17)	2.15 (0.84, 5.46)		2.17 (0.82, 5.76)		
IV semi skilled manual	127 (15)	1.25 (0.45, 3.52)		0.93 (0.30, 2.92)		
V unskilled manual	50 (6)	1.51 (0.39, 5.90)		1.41 (0.33, 6.00)		
Students/ never worked	8 (1)	4.61 (0.61, 34.95)		4.63 (0.50, 42.78)		
<b>Marital status</b>						
Married or cohabiting	543 (65)	1.00 [ref]	0.06	1.00 [ref]	0.30	
Single/ divorced/ separated	294 (35)	1.97 (0.97, 4.02)		1.53 (0.69, 3.39)		
<b>Model 3</b>						0.27
<b>Social support</b>						
Practical support						
Lowest two thirds	495 (60)	-	-	1.00 [ref]	0.76	
Top one third	337 (41)	-		0.89 (0.41, 1.91)		
Confiding/ emotional support						
Lowest two thirds	523 (63)	-	-	1.00 [ref]	0.75	
Top one third	309 (37)	-		0.88 (0.40, 1.94)		
Negative social support						
Lowest two thirds	531 (64)	-	-	1.00 [ref]	<0.001	
Top one third	301 (36)	-		3.61 (1.67, 7.79)		
<b>Racism and discrimination</b>						
Previous year interpersonal racism						
None	782 (93)	-	-	1.00 [ref]	0.30	
Has experienced this	55 (7)	-		1.82 (0.61, 5.43)		
Life-time discrimination at work						
None	804 (96)	-	-	1.00 [ref]	<0.01	
Has experienced this	33 (4)	-		5.13 (1.61, 16.34)		
<b>Chronic strains</b>						
None	234 (28)	-	-	1.00 [ref]	0.47	
One or more chronic strains	601 (72)	-		1.41 (0.54, 3.69)		



**Table DS3** Multilevel models: associations with the reporting of psychotic symptoms, Irish people

		<b>Odds Ratio (95% CI)</b>	<b>P value for ORs</b>	<b>Odds Ratio (95% CI)</b>	<b>P value for ORs</b>	<b>P value for clustering*</b>
<b>Model 1</b>						0.35
<b>Model 2</b>						0.50
<b>Own group density</b> (per 10% decrease)		5.44 (0.77, 38.29)	0.09 (trend)	4.81 (0.65, 35.64)	0.11 (trend)	
<b>Area-level deprivation</b> (per quintile increase)		1.47 (1.14, 1.90)	<0.01 (trend)	1.45 (1.12, 1.88)	<0.01 (trend)	
	<i>N (%)</i>					
<b>Age</b>						
16 to 34	179 (24)	1.00 [ref]	<0.001	1.00 [ref]	<0.001	
35 to 54	360 (49)	0.58 (0.30, 1.09)		0.59 (0.31, 1.13)		
55 to 74	194 (26)	0.04 (0.00, 0.29)		0.04 (0.01, 0.33)		
<b>Gender</b>						
Male	329 (45)	1.00 [ref]	0.79	1.00 [ref]	1.00	
Female	404 (55)	1.10 (0.56, 2.15)		1.00 (0.50, 2.02)		
<b>Education</b>						
School-leaving or higher	489 (68)	1.00 [ref]	0.57	1.00 [ref]	0.59	
Foreign qualifications	39 (5)	0.53 (0.07, 4.34)		0.57 (0.07, 4.69)		
None	191 (27)	0.66 (0.27, 1.62)		0.65 (0.26, 1.63)		
<b>Occupational social class</b>						
Social class I/II	241 (33)	1.00 [ref]	0.10	1.00 [ref]	0.12	
III skilled non manual	140 (19)	1.15 (0.47, 2.82)		1.02 (0.40, 2.53)		
III skilled manual	136 (19)	2.50 (1.05, 5.92)		2.29 (0.95, 5.54)		
IV semi skilled manual	154 (21)	0.61 (0.20, 1.82)		0.53 (0.17, 1.62)		
V unskilled manual	51 (7)	1.70 (0.49, 5.94)		1.52 (0.42, 5.47)		
Students/ never worked	5 (1)	4.86 (0.32, 74.0)		3.76 (0.24, 59.70)		
<b>Marital status</b>						
Married or cohabiting	480 (65)	1.00 [ref]	0.02	1.00 [ref]	0.02	
Single/ divorced/ separated	253 (35)	2.14 (1.14, 4.03)		2.17 (1.12, 4.24)		
<b>Model 3</b>						0.50
<b>Social support</b>						
Practical support						
Lowest two thirds	402 (56)	-	-	1.00 [ref]	0.70	
Top one third	323 (45)	-		0.88 (0.44, 1.73)		
Confiding/ emotional support						
Lowest two thirds	439 (61)	-	-	1.00 [ref]	0.59	
Top one third	285 (39)	-		1.21 (0.60, 2.43)		
Negative social support						
Lowest two thirds	444 (61)	-	-	1.00 [ref]	0.93	
Top one third	281 (39)	-		1.03 (0.55, 1.93)		
<b>Racism and discrimination</b>						
Previous year interpersonal racism						
None	686 (94)	-	-	1.00 [ref]	0.20	
Has experienced this	47 (6)	-		0.40 (0.09, 1.87)		
Life-time discrimination at work						
None	681 (93)	-	-	1.00 [ref]	0.76	
Has experienced this	52 (7)	-		0.82 (0.22, 3.10)		
<b>Chronic strains</b>						
None	206 (28)	-	-	1.00 [ref]	0.04	
One or more chronic strains	526 (72)	-		2.58 (0.96, 6.92)		

**Table DS4** Multilevel models: associations with the reporting of psychotic symptoms, Black Caribbean people

		Odds Ratio (95% CI)	P value for ORs	Odds Ratio (95% CI)	P value for ORs	P value for clustering*
<b>Model 1</b>						0.497
<b>Model 2</b>						0.497
<b>Own group density</b> (per 10% decrease)		1.05 (0.68, 1.61)	0.83 (trend)	1.14 (0.71, 1.82)	0.59 (trend)	
<b>Area-level deprivation</b> (per quintile increase)		1.02 (0.77, 1.36)	0.88 (trend)	1.00 (0.74, 1.36)	1.00 (trend)	
	<i>N (%)</i>					
<b>Age</b>						
16 to 34	248 (36)	1.00 [ref]	0.61	0.92 (0.48, 1.76)	0.94	
35 to 54	270 (39)	1.03 (0.56, 1.89)		0.87 (0.38, 1.99)		
55 to 74	176 (25)	0.74 (0.34, 1.60)		0.95 (0.53, 1.71)		
<b>Gender</b>						
Male	280 (40)	1.00 [ref]	0.67	1.00 [ref]	0.87	
Female	414 (60)	0.89 (0.53, 1.51)		0.95 (0.53, 1.71)		
<b>Education</b>						
School-leaving or higher	448 (66)	1.00 [ref]	0.11	1.00 [ref]	0.10	
Foreign qualifications	27 (4)	2.41 (0.82, 7.11)		2.53 (0.81, 7.89)		
None	199 (30)	1.79 (0.96, 3.36)		1.88 (0.96, 3.70)		
<b>Occupational social class</b>						
Social class I/II	168 (25)	1.00 [ref]	0.73	1.00 [ref]	0.41	
III skilled non manual	182 (27)	1.16 (0.56, 2.41)		1.59 (0.72, 3.51)		
III skilled manual	121 (18)	0.91 (0.38, 2.19)		1.08 (0.42, 2.78)		
IV semi skilled manual	129 (19)	1.46 (0.68, 3.15)		1.89(0.80, 4.45)		
V unskilled manual	53 (8)	1.78 (0.69, 4.59)		2.54 (0.91, 7.11)		
Students/ never worked	21 (3)	1.62 (0.45, 5.92)		2.15 (0.53, 8.68)		
<b>Marital status</b>						
Married or cohabiting	286 (41)	1.00 [ref]	0.15	1.00 [ref]	0.41	
Single/ divorced/ separated	408 (59)	1.51 (0.86, 2.65)		1.29 (0.70, 2.38)		
<b>Model 3</b>						0.50
<b>Social support</b>						
Practical support						
Lowest two thirds	429 (63)	-	-	1.00 [ref]	0.13	
Top one third	251 (37)	-		0.65 (0.37, 1.14)		
Confiding/ emotional support						
Lowest two thirds	462 (68)	-	-	1.00 [ref]	0.02	
Top one third	216 (32)	-		1.87 (1.09, 3.23)		
Negative social support						
Lowest two thirds	365 (54)	-	-	1.00 [ref]	0.16	
Top one third	314 (46)	-		1.46 (0.86, 2.49)		
<b>Racism and discrimination</b>						
Previous year interpersonal racism						
None	594 (86)	-	-	1.00 [ref]	<0.001	
Has experienced this	100 (14)	-		4.24 (2.33, 7.72)		
Life-time discrimination at work						
None	433 (62)	-	-	1.00 [ref]	0.63	
Has experienced this	261 (38)	-		1.15 (0.66, 2.00)		
<b>Chronic strains</b>						
None	158 (23)	-	-	1.00 [ref]	0.04	
One or more chronic strains	531 (77)	-		2.14 (0.98, 4.63)		

**Table DS5** Multilevel models: associations with the reporting of psychotic symptoms, Indian people

		<b>Odds Ratio (95% CI)</b>	<b>P value for ORs</b>	<b>Odds Ratio (95% CI)</b>	<b>P value for ORs</b>	<b>P value for clustering*</b>
<b>Model 1</b>						0.04
<b>Model 2</b>						0.28
<b>Own group density</b> (per 10% decrease)		1.38 (1.02, 1.86)	0.03 (trend)	1.39 (1.00, 1.92)	0.04 (trend)	
<b>Area-level deprivation</b> (per quintile increase)		1.25 (0.96, 1.64)	0.10 (trend)	1.17 (0.88, 1.55)	0.28 (trend)	
<i>N (%)</i>						
<b>Age</b>						
16 to 34	227 (35)	1.00 [ref]	0.60	1.00 [ref]	0.55	
35 to 54	295 (46)	0.72 (0.33, 1.55)		0.67 (0.29, 1.52)		
55 to 74	121 (19)	0.62 (0.22, 1.75)		0.58 (0.19, 1.82)		
<b>Gender</b>						
Male	315 (49)	1.00 [ref]	0.13	1.00 [ref]	0.06	
Female	328 (51)	1.69 (0.84, 3.39)		2.03 (0.93, 4.42)		
<b>Education</b>						
School-leaving or higher	436 (69)	1.00 [ref]	0.14	1.00 [ref]	0.12	
Foreign qualifications	21 (3)	-		-		
None	172 (27)	1.04 (0.46, 2.31)		1.34 (0.30, 2.03)		
<b>Occupational social class</b>						
Social class I/II	175 (28)	1.00 [ref]	0.50	1.00 [ref]	0.77	
III skilled non manual	162 (26)	0.60 (0.24, 1.48)		0.78 (0.30, 2.03)		
III skilled manual	85 (13)	1.08 (0.33, 3.50)		1.43 (0.40, 5.13)		
IV semi skilled manual	150 (24)	1.21 (0.51, 2.86)		1.35 (0.52, 3.50)		
V unskilled manual	12 (2)	0.96 (0.10, 9.06)		1.38 (0.14, 14.01)		
Students/ never worked	48 (8)	0.35 (0.07, 1.80)		0.49 (0.09, 2.72)		
<b>Marital status</b>						
Married or cohabiting	479 (74)	1.00 [ref]	0.47	1.00 [ref]	0.87	
Single/ divorced/ separated	164 (26)	1.32 (0.62, 2.82)		1.07 (0.45, 2.54)		
<b>Model 3</b>						0.27
<b>Social support</b>						
Practical support						
Lowest two thirds	331 (52)	-	-	1.00 [ref]	0.74	
Top one third	300 (48)	-		0.88 (0.43, 1.82)		
Confiding/ emotional support						
Lowest two thirds	428 (68)	-	-	1.00 [ref]	0.74	
Top one third	203 (32)	-		1.14 (0.53, 2.43)		
Negative social support						
Lowest two thirds	300 (48)	-	-	1.00 [ref]	0.25	
Top one third	330 (52)	-		1.49 (0.76, 2.92)		
<b>Racism and discrimination</b>						
Previous year interpersonal racism						
None	552 (86)	-	-	1.00 [ref]	0.41	
Has experienced this	91 (14)	-		1.44 (0.61, 3.42)		
Life-time discrimination at work						
None	500 (78)	-	-	1.00 [ref]	0.55	
Has experienced this	143 (22)	-		1.27 (0.57, 2.83)		
<b>Chronic strains</b>						
None	166 (26)	-	-	1.00 [ref]	<0.01	
One or more chronic strains	472 (74)	-		4.59 (1.34, 15.72)		

**Table DS6** Multilevel models: associations with the reporting of psychotic symptoms, Bangladeshi people

		Odds Ratio (95% CI)	P value for ORs	Odds Ratio (95% CI)	P value for ORs	P value for clustering*
<b>Model 1</b>						0.091
<b>Model 2</b>						0.30
<b>Own group density</b> (per 10% decrease)		1.26 (1.00, 1.60)	0.07 trend	1.15 (0.91, 1.45)		0.25 trend
<b>Area-level deprivation</b> (per quintile increase)		1.88 (0.62, 5.71)	0.23 trend	1.37 (0.46, 4.09)		0.56 trend
	<i>N (%)</i>					
<b>Age</b>						
16 to 34	362 (56)	1.00 [ref]	0.54	1.00 [ref]		0.34
35 to 54	190 (29)	0.61 (0.22, 1.68)		0.47 (0.15, 1.42)		
55 to 74	98 (15)	0.57 (0.16, 2.05)		0.52 (0.14, 1.90)		
<b>Gender</b>						
Male	312 (48)	1.00 [ref]	0.48	1.00 [ref]		0.37
Female	338 (52)	1.49 (0.50, 4.43)		1.66 (0.55, 5.03)		
<b>Education</b>						
School-leaving or higher	210 (34)	1.00 [ref]	0.50	1.00 [ref]		0.55
Foreign qualifications	16 (3)	1.90 (0.32, 11.12)		2.82 (0.45, 17.78)		
None	400 (64)	0.70 (0.26, 1.88)		1.00 (0.35, 2.89)		
<b>Occupational social class</b>						
Social class I/II	42 (7)	1.00 [ref]	0.40	1.00 [ref]		0.32
III skilled non manual	70 (11)	1.73 (0.16, 18.71)		1.68 (0.15, 19.09)		
III skilled manual	99 (16)	5.08 (0.52, 49.53)		6.64 (0.63, 69.53)		
IV semi skilled manual	136 (22)	2.22 (0.24, 20.50)		2.30 (0.22, 23.66)		
V unskilled manual	23 (4)	2.46 (0.12, 49.15)		2.07 (0.10, 44.82)		
Students/ never worked	259 (41)	1.25 (0.12, 13.21)		1.69 (0.15, 18.62)		
<b>Marital status</b>						
Married or cohabiting	458 (70)	1.00 [ref]	0.31	1.00 [ref]		0.40
Single/ divorced/ separated	192 (30)	0.60 (0.22, 1.67)		0.63 (0.21, 1.89)		
<b>Model 3</b>						0.50
<b>Social support</b>						
<b>Practical support</b>						
Lowest two thirds	191 (30)	-	-	1.00 [ref]		0.16
Top one third	450 (70)	-		0.52 (0.21, 1.28)		
<b>Confiding/ emotional support</b>						
Lowest two thirds	469 (73)	-	-	1.00 [ref]		0.78
Top one third	171 (27)	-		0.88 (0.35, 2.20)		
<b>Negative social support</b>						
Lowest two thirds	137 (21)	-	-	1.00 [ref]		0.67
Top one third	503 (79)	-		1.23 (0.47, 3.27)		
<b>Racism and discrimination</b>						
<b>Previous year interpersonal racism</b>						
None	593 (91)	-	-	1.00 [ref]		<0.001
Has experienced this	57 (9)	-		6.87 (2.68, 17.63)		
<b>Life-time discrimination at work</b>						
None	607 (93)	-	-	1.00 [ref]		0.68
Has experienced this	43 (7)	-		1.32 (0.35, 4.88)		
<b>Chronic strains</b>						
None	87 (14)	-	-	1.00 [ref]		0.13
One or more chronic strains	556 (86)	-		3.94 (0.47, 33.22)		

**Table DS7** Multilevel models: associations with the reporting of psychotic symptoms, Pakistani people

		Odds Ratio (95% CI)	P value for ORs	Odds Ratio (95% CI)	P value for ORs	P value for clusterin $g^*$
<b>Model 1</b>						0.003
<b>Model 2</b>						0.05
<b>Own group density</b> (per 10% decrease)		1.17 (0.95, 1.45)	0.15 (trend)	1.15 (0.96, 1.37)	0.14 (trend)	
<b>Area-level deprivation</b> (per quintile increase)		1.31 (0.87, 1.96)	0.18 (trend)	1.22 (0.84, 1.76)	0.28 (trend)	
	<i>N (%)</i>					
<b>Age</b>						
16 to 34	403 (55)	1.00 [ref]	0.06	1.00 [ref]	0.25	
35 to 54	236 (33)	1.48 (0.76, 2.86)		1.22 (0.63, 2.33)		
55 to 74	85 (12)	0.38 (0.10, 1.42)		0.46 (0.13, 1.67)		
<b>Gender</b>						
Male	337 (47)	1.00 [ref]	0.40	1.00 [ref]	0.32	
Female	387 (53)	1.29 (0.70, 2.37)		1.36 (0.73, 2.53)		
<b>Education</b>						
School-leaving or higher	355 (51)	1.00 [ref]	0.57	1.00 [ref]	0.22	
Foreign qualifications	29 (4)	0.55 (0.11, 2.85)		0.56 (0.11, 2.88)		
None	310 (45)	1.22 (0.61, 2.41)		1.65 (0.81, 3.37)		
<b>Occupational social class</b>						
Social class I/II	108 (15)	1.00 [ref]	0.07	1.00 [ref]	0.13	
III skilled non manual	117 (17)	0.65 (0.26, 1.63)		0.64 (0.26, 1.57)		
III skilled manual	112 (16)	0.63 (0.25, 1.62)		0.57 (0.22, 1.45)		
IV semi skilled manual	150 (21)	0.49 (0.19, 1.24)		0.48 (0.19, 1.20)		
V unskilled manual	14 (2)	1.13 (0.23, 5.42)		0.79 (0.17, 3.57)		
Students/ never worked	197 (28)	0.23 (0.08, 0.64)		0.23 (0.08, 0.66)		
<b>Marital status</b>						
Married or cohabiting	511 (71)	1.00 [ref]	<0.001	1.00 [ref]	<0.001	
Single/ divorced/ separated	213 (29)	3.24 (1.61, 6.52)		3.23 (1.62, 6.44)		
<b>Model 3</b>						0.40
<b>Social support</b>						
Practical support						
Lowest two thirds	335 (47)	-	-	1.00 [ref]	0.87	
Top one third	374 (53)	-		1.05 (0.60, 1.84)		
Confiding/ emotional support						
Lowest two thirds	493 (70)	-	-	1.00 [ref]	0.46	
Top one third	215 (30)	-		0.79 (0.42, 1.48)		
Negative social support						
Lowest two thirds	330 (47)	-	-	1.00 [ref]	0.70	
Top one third	378 (53)	-		1.12 (0.64, 1.94)		
<b>Racism and discrimination</b>						
Previous year interpersonal racism						
None	624 (86)	-	-	1.00 [ref]	0.17	
Has experienced this	100 (14)	-		1.65 (0.82, 3.33)		
Life-time discrimination at work						
None	607 (84)	-	-	1.00 [ref]	<0.01	
Has experienced this	117 (16)	-		2.48 (1.27, 4.85)		
<b>Chronic strains</b>						
None	175 (24)	-	-	1.00 [ref]	0.001	
One or more chronic strains	542 (76)	-		3.68 (1.50, 9.05)		

**Key to Tables DS1–7**

**Model 1:** no fixed effects specified in models, intercept only.

**Model 2:** association of ethnic density and *a priori* confounders with the reporting of psychotic symptoms in the previous year.

**Model 3:** association of ethnic density, *a priori* confounders and variables for social support, discrimination and chronic strains with the reporting of psychotic symptoms in the previous year.

**Models 2-3:** multilevel models with random intercepts and fixed slope; unweighted data.

\*Likelihood ratio test to assess models against the null hypothesis that  $\rho$  or ICC=0 (i.e. LRT to assess the strength of the evidence that the variability between areas is the same as within areas).





**Table DS8** Relative odds (95% CI)\*\* of reporting experiences of racism and discrimination, per ten percentage point reduction in own-group density

		<b>White British</b>	<b>Irish</b>	<b>Black Caribbean</b>	<b>Bangladeshi</b>	<b>Indian</b>	<b>Pakistani</b>
<b>Total minority ethnic sample</b>		<b>837</b>	<b>733</b>	<b>694</b>	<b>650</b>	<b>643</b>	<b>724</b>
<b>Discrimination measure</b>	<b>N</b>						
previous year interpersonal racism†	450	1.19 (0.94, 1.51)	0.49 (0.08, 3.01)	1.12 (0.73, 1.70)	1.29 (1.04, 1.60)	1.29 (0.99, 1.69)	1.14 (0.98, 1.32)
value (trend)	0.10	0.16	0.45	0.61	0.03	0.06	0.09
life-time work related discrimination‡	649	1.56 (1.21, 2.00)	1.18 (0.17, 8.36)	0.66 (0.44, 0.98)	1.24 (0.99, 1.56)	1.18 (0.99, 1.40)	0.99 (0.84, 1.16)
value (trend)	0.04	<0.001	0.87	0.04	0.06	0.07	0.89

\*\* All models adjusted for area-level deprivation, gender, social class, age, marital status, education; Totals are unweighted.

† Reports having experienced 'insults, damage to property or physical assault because of ethnicity or race'.

‡ Reports having experienced work-related discrimination because of one's 'religious beliefs, ethnicity, race or colour'.

**Table DS9** Relative odds (95% CI)\*\* of reporting high levels practical support, confiding and emotional support, and negative social support from closest nominated person, per ten percentage point reduction in own-group density

	<b>N</b>	<b>Total minority ethnic sample</b>	<b>White British</b>	<b>Irish</b>	<b>Black Caribbean</b>	<b>Bangladeshi</b>	<b>Indian</b>	<b>Pakistani</b>
<b>Social support</b>		<b>3444</b>	<b>837</b>	<b>733</b>	<b>694</b>	<b>650</b>	<b>643</b>	<b>724</b>
Practical support (top third)	2035	0.93 (0.89, 0.98)	0.97 (0.88, 1.08)	1.26 (0.45, 3.52)	1.00 (0.72, 1.40)	0.71 (0.60, 0.84)	0.93 (0.80, 1.08)	0.90 (0.78, 1.04)
p value (trend)		0.003	0.60	0.65	0.99	<0.001	0.33	0.15
Confiding & emotional support (top third)	1399	1.01 (0.96, 1.06)	0.93 (0.83, 1.05)	2.89 (1.11, 7.55)	1.14 (0.77, 1.69)	0.95 (0.80, 1.14)	0.91 (0.76, 1.09)	1.00 (0.86, 1.17)
p value (trend)		0.72	0.26	0.03	0.52	0.60	0.29	0.97
Negative social support (top third)	2107	0.94 (0.90, 0.99)	1.02 (0.91, 1.14)	0.95 (0.30, 3.01)	0.95 (0.64, 1.43)	0.70 (0.56, 0.87)	0.90 (0.78, 1.05)	1.03 (0.93, 1.13)
p value (trend)		0.02	0.71	0.93	0.82	0.002	0.18	0.61

\*\*All models adjusted for area-level deprivation, gender, social class, age, marital status, education. Totals are unweighted.

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### Supplementary Material

Supplementary material can be found at:  
<http://bjp.rcpsych.org/content/suppl/2012/07/25/bjp.bp.111.102376.DC1.html>

### References

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