

Ethnic Density of Neighborhoods and Incidence of Psychotic Disorders Among Immigrants

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Objective: A high incidence of psychotic disorders has been reported in immigrant ethnic groups in Western Europe. Some studies suggest that ethnic density may influence the incidence of schizophrenia. The authors investigated whether this increased incidence among immigrants depends on the ethnic density of the neighborhoods in which they live.

Method: This was a prospective first-contact incidence study of psychotic disorders in The Hague, by ethnicity and neighborhood of residence. Over a 7-year period, individuals who made contact with a physician for a suspected psychotic disorder underwent diagnostic interviews and received DSM-IV diagnoses. A comprehensive municipal registration system provided the denominator for incidence rates. Data were sufficient to examine incidence rates in native Dutch and in first- and second-generation immigrants from Morocco, Suriname, and Turkey. The ethnic density of a neighborhood was computed for each immigrant group as the proportion of residents belonging to that

group. Multilevel regression analyses predicted the incidence of psychotic disorders as a function of individual ethnicity and neighborhood ethnic density. Models were fitted for all immigrants together and for each immigrant group separately.

Results: A total of 226 native Dutch and 240 immigrants were diagnosed as having a psychotic disorder. Compared with native Dutch, the adjusted incidence rate ratio for immigrants was significantly increased in low-ethnic-density neighborhoods (2.36) but not in high-ethnic-density neighborhoods (1.25). There was a strong interaction between individual ethnicity and neighborhood ethnic density as predictors of incidence of illness. These findings were consistent across all immigrant groups.

Conclusions: The incidence of psychotic disorders was elevated most significantly among immigrants living in neighborhoods where their own ethnic group comprised a small proportion of the population.

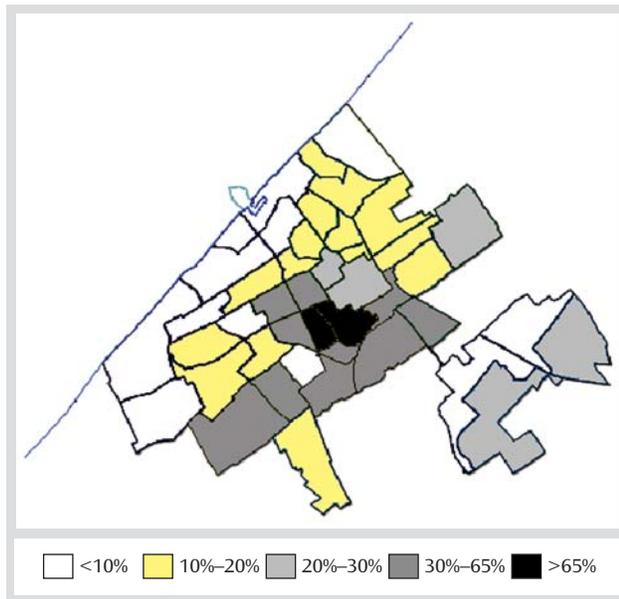
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Schizophrenia is ranked by the World Health Organization as one of the leading causes of long-term disability (1). Like many complex disorders, schizophrenia has both genetic and nongenetic causes, which remain largely unknown (2). A striking finding from epidemiological studies is the high incidence rate of schizophrenia and other psychotic disorders among several ethnic minority groups, mainly in Western Europe (3, 4). A recent meta-analysis of 18 incidence studies of schizophrenia and other psychotic disorders estimated relative risks of 2.7 and 4.5 for first- and second-generation immigrants, respectively, compared with native populations (5). While this finding may offer clues to the etiology of psychotic disorders, thus far it has defied explanation. High incidence rates in the countries of origin, selective migration, diagnostic bias, or variation in the frequency of putative risk factors, such as cannabis use, obstetric complications, and exposure to viruses, do not account for the elevated risk in immigrants (5, 6).

Increasingly, investigators suspect that the social experiences of immigrant groups after migration contribute to

their elevated risk (5, 6). However, few studies have collected data to test this hypothesis. One way to examine whether social experience is related to schizophrenia risk is to test whether the increased incidence among immigrants depends on the social context in which they live. In this study, we focused on the context of neighborhood ethnic density, which is pivotal in shaping the everyday social experience of ethnic minorities. In the United States, a landmark study in the 1930s reported higher hospital admission rates for schizophrenia among ethnic minorities who lived in neighborhoods with a low proportion of persons belonging to their own ethnic group (7). This area of research was recently rejuvenated by a study in London (8) that reported an increased incidence of schizophrenia in ethnic minorities who lived in neighborhoods with a low proportion of ethnic minorities. The London study provided stronger evidence for an ethnic density effect, using data from all mental health services rather than hospital admission data, but it still had some limitations, leaving room for the criticism that the ethnic density effect may be an artifact.

FIGURE 1. Average Proportion of Non-Western Immigrants Over the Years of the Study (1997–2005) in the 44 Neighborhoods of The Hague^a



^a Source: “The Hague in Figures” (2007), municipality of The Hague (<http://denhaag.buurtmonitor.nl>).

In The Hague, the conditions were met to test whether the relationship between immigration and psychosis is dependent on or modified by ethnic density in a prospective first-contact incidence study of psychotic disorders over 7 years; the study yielded a large number of incident cases in one geographical area for which reliable, detailed population data are available and in which several immigrant groups of sufficient size reside.

Method

Classification of Ethnicity

The municipality of The Hague classifies ethnicity according to citizens' country of birth and that of their parents. Dutch ethnicity is assigned to citizens who are Dutch-born and whose parents were also born in the Netherlands (hereafter referred to as native Dutch). If a citizen was born abroad, he or she is assigned to the group of people born in the same country. A Dutch-born citizen is considered a second-generation immigrant if at least one parent was born abroad. If the parents were born in different foreign countries, the country of birth of the mother determines the assignment to a particular group. On January 1, 2005, the city of The Hague had 472,087 inhabitants, of whom 34.5% were first- or second-generation immigrants from any non-Western country. For this study, the three largest groups of first- and second-generation non-Western immigrants were included: Moroccans (24,144), Surinamese (45,388), and Turks (32,228). Thirteen percent of the population comprised more than 100 other non-Western ethnic groups. The proportion of these groups was less than 5 percent in all neighborhoods, which made it impossible to study ethnic density within these groups.

Neighborhood Characteristics

The Hague consists of 44 neighborhoods, classified according to postal codes, with a maximum number of 38,000 inhabitants

per neighborhood. The ethnic density of a neighborhood was computed for each immigrant group as the proportion of residents belonging to that group. The analyses in this article use only this group-specific measure of ethnic density.

Neighborhood deprivation, defined by high proportions of unemployed persons, low average income, poor housing quality, and high crime rates, negatively influences health (9) and has been associated with high rates of schizophrenia in some studies (10). Therefore, investigations of ethnic density should take neighborhood deprivation into account. A measure of the socioeconomic levels of the neighborhoods was provided by the municipality; this was a score based on average income, housing quality, proportion of residents who are long-term unemployed, and mean educational level (but not proportion of ethnic minorities). The average socioeconomic level of the city was set at zero, and neighborhood scores ranged from –21.8 to 26.9. The municipal authorities also provided population data for the years of the study, including neighborhood, age, sex, marital status, and ethnicity.

The distribution of cases across neighborhoods is summarized in Table 1. Non-Western immigrants clustered in deprived neighborhoods; there was a strong negative correlation between proportion of immigrants and socioeconomic level of a neighborhood (Pearson's $r = -0.71$, $p < 0.0005$). The highest concentrations of non-Western immigrants were found in the two most deprived neighborhoods, where the proportion of all non-Western immigrants, averaged across the years of the study, was 82.6%. The ethnic density of the separate large ethnic minority groups was highest in these two neighborhoods as well: 16.8% for Moroccans, 23.9% for Surinamese, and 26.3% for Turks. Since the proportions of non-Western immigrants in other neighborhoods were considerably smaller (Figure 1), we classified these two neighborhoods as high ethnic density and the other 42 neighborhoods as low ethnic density.

Identification of Cases

This was a first-contact incidence study over 7 years (from April 1, 1997, to April 1, 1999, and October 1, 2000 to October 1, 2005) that sought to identify and diagnose every citizen of The Hague 15–54 years of age who made a first contact with a physician for a possible psychotic disorder. The study's methods and descriptive data on incidence rates up to 2002 have been detailed elsewhere (4, 11). Briefly, the criteria for a possible psychosis were similar to those used in the World Health Organization 10-country study of the incidence of psychotic disorders (12). There was extensive collaboration with the local general practitioners, psychiatrists, and psychiatric residents in the effort to identify every possible case. Except in the first 2 years, when the protocol was used primarily for research purposes (11), patients were being identified for inclusion in an early psychosis treatment service.

Patients with possible psychosis were referred to the early psychosis department for evaluation and treatment. They were interviewed by Dutch psychiatric residents using the Comprehensive Assessment of Symptoms and History (13), a semistructured diagnostic interview. Relatives were interviewed by trained nurses using the Instrument for the Retrospective Assessment of the Onset of Schizophrenia (14). Official interpreters were available to help in the administration of these instruments when necessary. In addition, the psychiatric residents asked the patients' physicians for detailed clinical information. Based on data from the interviews and clinical information, the residents compiled a narrative history of each patient's illness. For patients who could not be evaluated in this way (e.g., those who declined to participate in a full diagnostic interview), a history was created with anonymized clinical information. During a diagnostic meeting, two psychiatrists made a consensus DSM-IV diagnosis on the basis of the narrative history.

TABLE 1. Characteristics of the Neighborhoods of The Hague and Distribution of Cases of Psychotic Disorders Across the Neighborhoods, 1997–2005

Proportion of Immigrants ^a	Number of Neighborhoods	Socioeconomic Level ^b		Number of Cases	
		Mean	SD	Native Dutch ^c	Immigrants ^d
High ethnic density ^e					
>0.65	2	-20.2	2.3	12	73
Low ethnic density					
0.40–0.65	4	-8.2	4.6	19	66
0.30–0.40	6	-6.8	3.7	63	64
0.20–0.30	5	2.4	8.5	32	11
0.10–0.20	15	13.6	6.4	60	17
<0.10	12	12.2	7.9	38	8

^a Proportion of all non-Western immigrants in the neighborhood, averaged across the study period.

^b Socioeconomic level of all neighborhoods in each stratum, with 0 defined as the city's average socioeconomic level (see text).

^c Native Dutch are those who are Dutch-born and whose parents were also born in the Netherlands.

^d First- and second-generation immigrants from Morocco, Suriname, and Turkey.

^e In the two neighborhoods in this category, group-specific neighborhood ethnic density was highest for each separate immigrant group.

Using this protocol, we identified 678 patients with a possible psychotic disorder over 1,870,408 person-years of observation. Of these, 522 patients (77%) received a full evaluation, and 156 patients (23%) were diagnosed on the basis of anonymized clinical information. A total of 60 patients were excluded because they had a diagnosis of a substance-induced psychotic disorder, a psychotic disorder due to a somatic condition, or a nonpsychotic disorder. Among the remaining 618 cases, 466 patients had Moroccan, Surinamese, Turkish, or Dutch ethnicity and were used in this analysis. Each patient's postal code was documented at first contact.

Statistical Analysis

To take into account the two-level grouping structure of the data (individuals clustered in neighborhoods), we used the XT-POISSON multilevel Poisson regression modeling procedure in the Stata statistical software program (15). For each individual, the proportion of that person's ethnic group in the neighborhood was used as the measure of ethnic density. To obtain count data, individual data were aggregated by sex, age group (eight 5-year age groups from 15 to 54 years), marital status (single or other), neighborhood socioeconomic level, the four categories of ethnicity, and neighborhood ethnic density. The model used in the analysis of ethnicity and ethnic density was adjusted for the fixed effects of all aggregated predictors. A neighborhood-specific random intercept with a gamma distribution was included in the model. Main effects and interactions were tested for statistical significance by Wald tests (16).

First, we carried out indirect standardization with the rates of psychotic disorders for the total 7-year population as the standard and applied them to each neighborhood, stratifying for age, sex, marital status, and ethnic minorities using the Stata ISTDIZE procedure. The standardization used the stratum-specific rates of the standard population to calculate the expected number of cases for each neighborhood and the adjusted incidence rates at neighborhood level. We calculated the standardized incidence ratio by dividing the number of cases observed by the expected number (8).

Second, we examined the fixed effects of individual ethnicity on the incidence of psychotic disorders. We calculated incidence rate ratios and 95% confidence intervals (95% CI) for psychotic disorders with native Dutch as the reference category.

Third, we used a stratified analysis to examine whether the effect of individual ethnicity was modified by ethnic density. The effect of individual ethnicity on the incidence of psychotic disorders was computed separately for immigrants living in high- and low-ethnic-density neighborhoods. This was done for each immigrant group and for all immigrant groups together. Effect sizes from the interactions were calculated and fitted with this two-

level variable using the appropriate linear combinations in the Stata LINCOM command. Fourth, the continuous variable of neighborhood ethnic density was used. The interaction between individual ethnicity and ethnic density was included in the multi-level model.

Additional analyses addressed the potential for bias due to differences in case ascertainment in high- versus low-ethnic-density neighborhoods. If immigrants were more averse to seeing a physician in high- than in low-ethnic-density neighborhoods, we would expect that, on average, immigrants would be older at the time of first treatment in high- than in low-ethnic-density neighborhoods. If immigrants were more likely in high- than in low-ethnic-density neighborhoods to be repatriated to their country of origin, we would expect to observe a stronger ethnic density interaction in first-generation than in second-generation immigrants (first-generation immigrants are more likely to be repatriated). We evaluated these predictions in our data.

Results

During the study period, 91 Moroccan, 94 Surinamese, 55 Turkish, and 226 native Dutch subjects made a first contact with a physician for a psychotic disorder. Table 2 summarizes the sociodemographic characteristics and DSM-IV diagnoses of the study subjects. Three patients were homeless and thus could not be assigned to a particular neighborhood, leaving 463 patients for analysis.

The incidence of psychotic disorders, adjusted for individual level age, sex, marital status, and non-Western ethnic minority status, varied from 0 to 64 per 100,000 person-years across neighborhoods. The standardized incidence ratios of psychotic disorders across neighborhoods are shown in Figure 2.

The incidence rate ratio of psychotic disorders for all immigrants together, compared with native Dutch and adjusted for age, sex, marital status, and neighborhood socioeconomic level, was 2.22 (95% CI=1.78–2.76). The incidence rates were elevated in all immigrant groups separately as well (Table 3).

In the stratified multilevel analysis of neighborhood ethnic density, the adjusted incidence rate ratio was 2.36 (95% CI=1.89–2.95) among immigrants living in low-density neighborhoods and 1.25 (95% CI=0.66–2.37) among immigrants in high-density neighborhoods. Also, for each

TABLE 2. Sociodemographic Characteristics and Diagnoses of Individuals Making a First Contact for a Psychotic Disorder in The Hague, 1997–2005

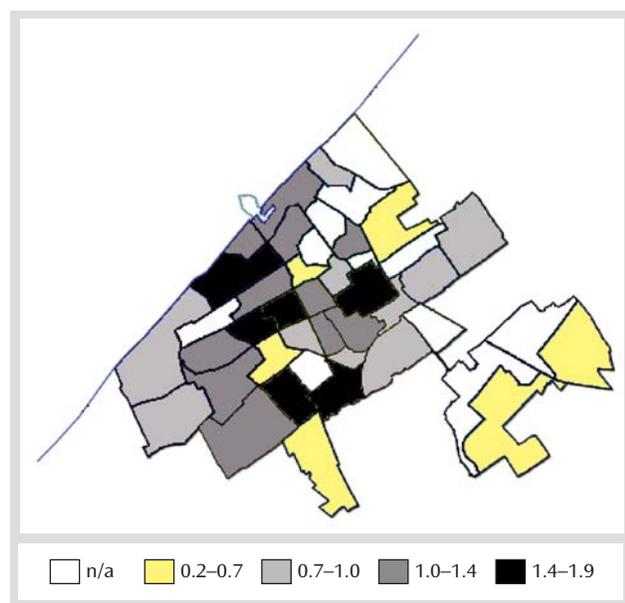
	Native Dutch ^a (N=226)		Immigrants ^b (N=240)		Total (N=466)	
	N	%	N	%	N	%
Gender						
Male	157	69	173	72	330	71
Female	69	31	67	28	136	29
Age (years)						
15–34	176	78	203	85	379	81
35–54	50	22	37	15	87	19
Diagnosis						
Schizophrenia spectrum disorder ^c	142	63	179	75	321	69
Major depressive disorder with psychotic features	9	4	11	4	20	4
Bipolar disorder with psychotic features	20	9	6	2	26	6
Delusional disorder	4	2	2	1	6	1
Brief psychotic disorder	19	8	9	4	28	6
Psychotic disorder, not otherwise specified	32	14	33	14	65	14

^a Native Dutch are those who are Dutch-born and whose parents were also born in the Netherlands.

^b First- and second-generation immigrants from Morocco, Suriname, and Turkey.

^c Includes the DSM-IV diagnoses of schizophrenia, schizophreniform disorder, and schizoaffective disorder.

FIGURE 2. Standardized Incidence Ratios of Psychotic Disorders in Total Study Population, Across Neighborhoods^a



^a Ratio of observed versus expected cases, based on incidence rates indirectly standardized to age, sex, marital status, and ethnic minorities in total study population, with 1.0 as the rate in the standard population; n/a indicates no cases observed.

separate immigrant group, the incidence rate ratio was higher for immigrants living in low-density neighborhoods (Table 4).

The multilevel Poisson regression model indicated a strong negative interaction between ethnicity at the individual level and the continuous measure of neighborhood ethnic density. The adjusted incidence rate ratio of the interaction variable was below 1 for all immigrants together (incidence rate ratio=0.95, $\chi^2=15.04$, $df=1$, $p=0.0001$) and for each immigrant group separately (Moroccans: incidence rate ratio=0.93, $p=0.002$; Surinamese: incidence rate ratio=0.98, $p=0.334$; Turks: incidence rate ratio=0.97, $p=$

0.109). This negative interaction can be interpreted to mean that the elevation in incidence rates of psychotic disorders was higher among immigrants in neighborhoods with a lower proportion of residents of the same ethnicity.

Additional analyses were undertaken to check for ascertainment bias. The mean age at first treatment contact was similar for immigrants in high- and low-ethnic-density neighborhoods: 26.97 (SD=7.37) and 26.24 (SD=7.49), respectively. The difference in the adjusted incidence rate ratios for high- versus low-ethnic-density neighborhoods was similar for first-generation immigrants (1.20 [95% CI=0.62–2.34] versus 2.51 [95% CI=1.95–3.23]) and second-generation immigrants (1.27 [95% CI=0.61–2.64] versus 2.13 [95% CI=1.53–2.97]).

Discussion

We found that the increased incidence of psychotic disorders among immigrants in The Hague depended strongly on neighborhood context. Compared with native Dutch, the incidence among immigrants was higher in those who lived in neighborhoods where their own ethnic group comprised a smaller proportion of the population. In low-ethnic-density neighborhoods, immigrants had a markedly increased incidence, whereas in high-ethnic-density neighborhoods, the incidence rate was not significantly higher than that of native Dutch.

Similar patterns were evident for Moroccan, Surinamese, and Turkish immigrant groups examined separately. The incidence rate of psychotic disorders was significantly increased only among immigrants living in low-ethnic-density neighborhoods (Table 4). The Moroccan group exhibited the highest incidence rates of psychotic disorders, and the difference between low- and high-ethnic-density neighborhoods was largest for Moroccan immigrants.

The effect of ethnic density was not due to confounding by neighborhood deprivation. Neighborhood socioeconomic level was measured by municipal data and adjusted for in the analysis. Moreover, such confounding would

TABLE 3. Incidence Rate Ratios (IRRs) of First Contact for Psychotic Disorders in Different Ethnic Groups in The Hague, 1997–2005

Ethnic Group ^a	Cases	Person Years	IRR ^b	95% CI
Native Dutch	226	1,056,172	1.0	
All immigrants	240	413,586	2.22	1.78–2.76
Moroccans	91	88,249	3.69	2.78–4.90
Surinamese	94	203,088	1.88	1.45–2.44
Turks	55	122,249	1.75	1.25–2.46

^a As defined in the text, immigrant groups include first- and second-generation immigrants.

^b Fixed effect of individual ethnicity on incidence of psychotic disorders, in multi-level Poisson regression model, adjusted for age, sex, marital status, and neighborhood socioeconomic level.

tend to suppress the contribution of low ethnic density to psychosis among immigrants because the most deprived neighborhoods had the highest concentration of immigrants (see Figure 1 and Table 1).

Our results are consistent with those from the seminal ecological study of Faris and Dunham during the 1930s in Chicago, which found higher hospital admission rates for schizophrenia among African Americans living in predominantly white neighborhoods (7). As noted earlier, our findings also extend those of Boydell and colleagues in London, who reported a “dose-response” relationship with an increasing incidence of schizophrenia in ethnic minorities as the proportion of such minorities in an area fell (8). The London study used appropriate multilevel statistical techniques and investigated treated incidence rates rather than hospital admission rates. Cases were identified by studying case records of a past 10-year period. The association between ethnic density and schizophrenia could not be fully investigated in that study, however, because it was not possible to investigate differential case ascertainment across neighborhoods or prodromal drift to low-ethnic-density neighborhoods and because information on ethnicity was limited. Ethnicity had to be assessed by a description in the case notes, and population data were not precise enough to study ethnic minority groups separately. Comparisons could be made between a “white” group and a “nonwhite” group. The latter group consisted largely of ethnic groups that may describe themselves as Black British, but although it may be hypothesized that such a shared identity is relevant to the ethnic density effect, there are many social, demographic, economic, and cultural differences among these ethnic groups. Finally, a recent study reported an association between ethnic fragmentation and the incidence of schizophrenia in southeast London as well as some evidence for an ethnic density effect, as the risk of schizophrenia was highest among ethnic minorities living in neighborhoods with the lowest ethnic density (17).

Building on these studies, we used a prospective incidence study involving a first contact with both secondary and primary health care services. We were able to assess the confounding effect of marital status (18) and to con-

TABLE 4. Incidence Rate Ratios (IRRs) of Psychotic Disorders in Immigrants Compared With Native Dutch in The Hague, by Neighborhood Ethnic Density, 1997–2005^a

Ethnic Group	Ethnicity Stratified by Ethnic Density ^b			
	Low Density		High Density	
	IRR	95% CI	IRR	95% CI
Native Dutch	1.0		1.0	
All immigrants	2.36	1.89–2.95	1.25	0.66–2.37
Moroccans	4.43	3.28–5.97	1.56	0.75–3.21
Surinamese	1.88	1.42–2.50	1.19	0.58–2.44
Turks	1.74	1.16–2.60	1.12	0.55–2.30

^a All associations are adjusted for age, sex, marital status, and socioeconomic level of neighborhood.

^b Ethnicity effect sizes are stratified as the two neighborhoods with the highest ethnic density and all other neighborhoods.

duct additional analyses to investigate alternative explanations for the findings. Moreover, we obtained population data that enabled us to calculate ethnic density as the proportion of the subjects’ own ethnic group in the neighborhood. This approach took into account the heterogeneity of ethnic minorities and allowed us to study each ethnic group separately.

Strengths and Limitations

This study was large enough to examine neighborhood variation in the incidence of psychotic disorders for several immigrant groups within a single urban area. The numbers of cases in both low- and high-ethnic-density neighborhoods were sufficient to test interactions between individual ethnicity and neighborhood ethnic density in a multi-level analysis. The numerators of the incidence rates were reliable, since the incident cases were derived from all sources of treatment in a defined geographical area and were assessed with a rigorous diagnostic protocol.

The denominators of the incidence rates were reliable. The person-years were not derived from a census but from a comprehensive, continuously updated municipal registration system. Registration with municipal authorities is compulsory for all individuals residing legally in the Netherlands and a prerequisite for obtaining essential documents and possible aid (e.g., income support). The data from a recent report on illegal foreigners in the Netherlands (19) suggest that the number of Moroccan, Surinamese, and Turkish immigrants residing illegally in The Hague is less than 2,000. Thus, underenumeration of ethnic minorities is unlikely to explain the findings.

We were able to adjust for single marital status, which has been associated with higher rates of schizophrenia, particularly in neighborhoods with fewer single-person households (18). The results remained statistically significant, indicating that the ethnic density effect cannot be attributed to a greater probability of single marital status among individuals living in low-ethnic-density neighborhoods.

A limitation of the study may be that all psychotic disorders were included in the analysis rather than only schizophrenia. However, this approach minimized the potential for diagnostic bias. It has been suggested that

immigrant patients with affective psychosis may present with more severe psychotic symptoms than nonimmigrant patients, which may lead to misclassification of affective psychosis as schizophrenia (20). In addition, many investigators argue that the validity of psychotic disorders as a group may be greater than that of schizophrenia, which is a diagnosis of uncertain validity (21). When we restricted our analysis to patients with schizophrenia spectrum disorders, we obtained similar results (adjusted incidence rate ratio, ethnic density interaction, all immigrants=0.96, $\chi^2=6.36$, $df=1$, $p=0.012$).

In the stratified analysis, we classified two neighborhoods with large immigrant populations as high density and the other 42 neighborhoods as low density. Since the threshold for the ethnic density effect is not known, other stratifications may be more valid. When we used alternative approaches to stratify ethnic density, the results were similar (data available from the first author).

Neighborhood ethnic density was assessed and investigated at the time of first treatment contact. In future studies, it might be feasible to collect longitudinal data on neighborhood context in childhood and adolescence. This approach could be used to verify that exposure to a low-ethnic-density neighborhood is antecedent to the onset of psychotic symptoms and to determine the developmental period during which neighborhood ethnic density is most important.

The socioeconomic status of the family of origin could not be adjusted for. Previous studies have found variable and modest associations of low family socioeconomic status and incidence of psychotic disorders (22, 23). In addition, it is difficult to see how low ethnic density would be related consistently to low individual socioeconomic status, because neighborhoods with the highest proportion of non-Western immigrants are deprived to a level not paralleled anywhere in the primarily Dutch neighborhoods in The Hague.

A paramount concern in the interpretation of these results is the potential for differences in case ascertainment between low- and high-ethnic-density neighborhoods. If immigrants who are clustered together in high-density neighborhoods are less likely to use Dutch health services when they develop psychotic symptoms, this could produce an artifactual ethnic density effect. For several reasons, however, this potential ascertainment bias is unlikely to account for our findings. Health insurance is compulsory for all individuals residing legally in the Netherlands, and immigrants visit their general practitioners more often than native Dutch do (24). Ascertainment in this study was an integral part of an early psychosis treatment program, which entailed active collaboration with general practitioners throughout the city. Furthermore, additional analyses conducted to detect such ascertainment bias were reassuring. Immigrants ascertained in low- and high-ethnic-density neighborhoods had a similar age at onset, and the variation in rates between low-

and high-ethnic-density neighborhoods pertained to both first- and second-generation immigrants.

Our results could reflect a process of social selection rather than social causation. It is conceivable that individuals with psychotic disorders moved from high- to low-density neighborhoods prior to their first treatment contact, perhaps during the prodromal period of their illness. However, the mean proportion of the subjects' own ethnic group in the neighborhood did not differ significantly between the immigrants who still lived with their parents (35% of the cases) and those who did not (mean density 11.62% and 10.68%, respectively; $t=-0.82$, $p=0.41$). Thus, there is no evidence that patients who had already left the parental home selected neighborhoods of residence with a lower ethnic density. One might still speculate that the parents of the immigrants who developed psychotic disorders had previously moved from high- to low-ethnic-density neighborhoods as a result of these parents' genetic predisposition to psychosis. However, genetic risk for psychosis is not associated with upward social mobility (25). In The Hague, moving from a high- to a low-ethnic-density neighborhood generally means moving to a neighborhood with a higher socioeconomic level.

Implications

The most plausible interpretation of our findings is that our measure of neighborhood ethnic density captured a social experience that had a quantifiable impact on the incidence of psychotic disorders. Animal and human studies indicate that social experiences can affect brain development and the risk of mental disorders (26, 27). At present, we can only speculate on how the particular social experiences of immigrants could influence the emergence of psychoses. The finding of a similar ethnic density effect among first- and second-generation immigrants implies that ethnic density represents social experiences that are relevant for both generations.

Several mechanisms may be considered, which are not mutually exclusive. One possibility is that high ethnic density mitigates the pathogenic effects of discrimination (8, 28). We have reported elsewhere that the increased risk of schizophrenia for non-Western ethnic minority groups was associated with the groups' experiences of discrimination (29), and some studies have found that perceived discrimination may foster the emergence of psychotic symptoms (30, 31). Conceivably, living in a high-ethnic-density neighborhood could buffer the impact of discrimination and stigma (32, 33) by enhancing positive identification with one's own ethnic group, or it could reduce exposure to discrimination by reducing daily contact with the native Dutch majority.

Another possibility is that high ethnic density, which is likely to be associated with a greater probability of social support, increases access to normalizing explanations for anomalous perceptual experiences and abnormal beliefs that are present in individuals at high risk of developing

psychosis (34). Whereas social isolation may contribute to the acceptance of a psychotic appraisal of these early abnormal mental states, a social network may have a normalizing function, thus preventing transition into psychosis (35).

Conclusions

The relationship between immigration and psychosis in Western Europe is a major public health concern, but it is still not understood. Our findings suggest that this relationship depends in part on the neighborhood characteristic of ethnic density. These findings also have broader implications in suggesting that social context can play an important role in the etiology of schizophrenia and other psychotic disorders.

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The authors report no competing interests.

Dr. Veling had full access to all of the data in this study, takes responsibility for the integrity of the data and the accuracy of the data analysis, and had final responsibility for the decision to submit for publication. All remaining authors declare that they have seen and approved the final version.

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