It is illegal to post this copyrighted PDF on any website. Social Fragmentation and Schizophrenia: A Systematic Review

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ABSTRACT

Objective: Accumulating evidence implicates social context in the etiology of psychosis. One important line of epidemiologic research pointing to a potentially causal role of social context pertains to what is termed *social fragmentation*. The authors conducted a systematic review of the relationship between area-level social fragmentation and psychosis.

Data Sources: Three databases (MEDLINE, PsycINFO, and Web of Science) were searched from inception to May 2, 2021. There were no language restrictions. Search terms were those that identify the area-level orientation, social fragmentation, sample, and outcome.

Study Selection: Inclusion criteria were the following: (1) social environment measured at the area level with (2) psychosis outcomes (incidence rates, prevalence of psychosis or schizophrenia, age at onset of psychosis, psychotic symptom severity, and duration of untreated psychosis). In total, 579 research articles were identified, and 19 were eligible to be included in this systematic review.

Data Extraction: Two reviewers independently screened, extracted data from, and coded all articles.

Results: Evidence from 14 of 19 articles indicates that arealevel characteristics reflecting social fragmentation are associated with higher psychosis rates and other outcomes of psychosis even after controlling for other area-level characteristics including deprivation, social capital, race/ ethnicity, and urbanicity and individual-level characteristics including age, sex, migrant status, and socioeconomic status.

Conclusions: In conclusion, this review finds evidence that measures of area-level social fragmentation are associated with higher psychosis rates. Further research into mechanisms is needed to better characterize this association.

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n the past few decades, there has been a burgeoning body L of research showing that environmental factors, including neighborhood characteristics (eg, urbanicity and social fragmentation), are associated with risk for psychosis.^{1,2} Importantly, urban environmental exposure during upbringing is a well-established risk factor in the development of schizophrenia.³ Although this association was previously thought to be largely explained by a move to urban places (drift) by individuals with schizophrenia or its prodrome rather than exposure to urban environment (causation), later studies have since provided evidence that drift is unlikely to fully account for this association based on evidence of temporality and doseresponse relationship.^{1,4,5} Recently, it has been suggested that socio-environmental characteristics such as social fragmentation⁶ may partly explain why youth in urban areas are more likely to report psychotic experiences.

The earliest investigators to explore the relationship between neighborhood characteristics and schizophrenia were Faris and Dunham.⁷ They demonstrated spatial heterogeneity of schizophrenia across city zones in Chicago, with highest rates in the inner city areas characterized by high foreign-born and Black populations, residential mobility (moving), and social disorganization.⁷ These findings were later replicated in multiple other cities and countries.⁸⁻¹⁰ However, these studies were criticized for their cross-sectional study design and lack of a multilevel analysis approach that would account for the hierarchical data structure of individuals clustering within neighborhoods.

There has been growing evidence suggesting that lack of social integration and inclusion may be an important determinant of incidence of psychosis.^{11,12} For example, social adversity,¹³ perceived discrimination,¹⁴ and moving during childhood and adolescence¹⁵ have been shown to be risk factors for psychosis. At the neighborhood level, several studies have consistently found an inverse relationship between the incidence of schizophrenia among non-White ethnic minorities and the proportion of minorities.^{16,17} In addition, neighborhoods with greater levels of residential instability,¹⁸ other indices of social fragmentation,¹⁹ and social isolation²⁰ have been shown to be associated with higher rates of schizophrenia and psychosis. In fact, social fragmentation has been shown to predict the association between urbanicity and psychosis,⁶ suggesting that the social stress of the living environment may play an important role in psychosis.

The term *social fragmentation* has been used interchangeably with *social disorganization*¹² and social fragmentation also shares many similar census variables with area-level social isolation.²⁰ A related and potentially overlapping term is *social capital*; social capital is characterized by high levels of civic participation,²¹

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Clinical Points

- Accumulating evidence implicates social context in the etiology of psychosis.
- Area-level measures of social fragmentation are associated with higher psychosis rates and may also be associated with other psychosis outcomes, including higher prevalence and earlier age at onset of psychosis.
- Further investigation into the mechanisms of these associations is needed.

social networks, and trust.²² Although social capital may seem to be inversely related to social fragmentation, these concepts have been studied separately-social capital has been measured by voter turnout²¹ and volunteering.²² Social disadvantage²³ is another distinct concept that has been measured using various individual-level indices, including unemployment, living alone, and being single.

If the social stress of living in a socially fragmented neighborhood leads to the development of psychosis, then social fragmentation would lead to not only the increase in psychosis rates, but also earlier age at onset of psychosis and greater psychotic symptom severity. Living in areas with greater social fragmentation also has been associated with poor access to health care,²⁴ which could delay treatment for psychosis. Further characterizing the components of social fragmentation in relation to these outcomes will allow us to better understand the various pathways through which the social environment might impact psychosis outcomes.

The last review examining the relationship between social fragmentation and psychosis⁴ suggested that social fragmentation partially explained the geographic variation of schizophrenia rates, but it was still unclear what aspects of "area-level social fragmentation" have clinical relevance to schizophrenia outcomes. Since then, a growing number of studies have further investigated the individual (or combination of) components of social fragmentation in relation to schizophrenia rates and other outcomes.

The present study aimed to provide a systematic review of the relationship between social fragmentation and psychosis rates and other outcomes, including prevalence, age at onset of psychosis, psychotic symptom severity, and duration of untreated psychosis (DUP).

METHODS

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines for conducting systematic reviews and meta-analyses²⁵ were followed. After we identified all potential articles meeting our eligibility criteria, it became apparent that the application of statistical procedures to perform a metaanalysis was not possible because of major heterogeneity in measures of social fragmentation and statistical methods across studies.

The search was conducted from inception to May 2, 2021, to identify relevant publications using MEDLINE, language restrictions.

Eligibility Criteria

Inclusion criteria were as follows: (1) social environment was measured at the neighborhood level or within a geographically defined area; (2) there was an objective measurement of social fragmentation, which included variables generated from single or composite measures (percentage of single-person households, single persons [marital status], people who moved, and renters); (3) study samples were diagnosed with psychosis or schizophrenia; (4) outcomes included incidence rates, first-ever admission rates, prevalence of psychosis or schizophrenia, age at onset of psychosis, psychotic symptom severity, and DUP; and (5) studies contained original data on these outcomes.

Terms That Identify Cases

The following search items were used, which were all combined using the logic operator AND:

- a. Terms that identify the area-level orientation: neighbourhood OR neighborhood OR area-level
- b. Terms that identify social fragmentation: social fragmentation OR socially fragmented OR social environment OR social composition OR social disorganization OR social isolation OR social factors OR single OR divorced OR married OR renting OR owner-occupied OR residential instability OR residential mobility OR residential stability
- c. Terms that identify the sample: psychosis OR psychotic OR schizophrenia
- d. Terms that identify the outcome: incidence OR rates OR prevalence OR age at onset OR duration of untreated psychosis OR psychotic symptoms

Study Coding and Data Analysis

For duplicate studies and studies that used the same or overlapping samples, only those that were published in peer-reviewed journals were included. All steps of screening, extraction, and coding were performed independently by two researchers (B.S.K. and B.G.D.). Discrepancies were reached through discussion by both researchers.

A modified quality assessment checklist adapted from Bosqui et al was used.^{26,27} This tool was chosen because it is used to assess the quality of population-based studies. This checklist of 11 items assessed the quality of each study with each item scoring either 0 (no), 1 (partial), or 2 (yes). The studies were first scored by one researcher (B.S.K.) independently and then discussed with a second (B.G.D.) to improve the reliability of the process. For quality scores, studies were assessed based on measures that have established reliability and validity, as well as controlling for potential confounders including age, sex, and area-level deprivation or other measures of socioeconomic status. For statistical validity, studies were assessed based on appropriate statistical tests and reported effect size.

It is illegal to post this copy The terms social fragmentation, social disorganization,²⁰ residential instability,²⁸ and residential mobility²⁹ shared many similar area-level characteristics, and they were defined heterogeneously in the literature. Social fragmentation index (SFI) is a combination of 4 area-level characteristics: percentage of single-person households, single persons (marital status), people who moved (residential instability), and renters. In this review, we refer to SFI only if all 4 components are summed together and otherwise specify the components.

RESULTS

Study Inclusion

In total, 579 studies were initially identified: 396 from PubMed, 68 from PsycINFO, and 115 from Web of Science. After the review process, 19 were included in this study (Figure 1).

Quality Categorization

The quality of the studies was assessed using adapted criteria²⁶ and shown in Table 1 and Supplementary Table 1. Studies in the higher-quality category used structured clinical assessments, the Diagnostic and Statistical Manual of Mental Disorders, and/or International Classification of Diseases (ICD) codes for diagnosis. Higher-quality studies also used smaller area sizes to measure environmental characteristics, such as schools, census tracts, or electoral wards instead of larger areas including counties or catchment areas. A smaller area would more precisely reflect the living environment for an individual. Other characteristics of higher-quality studies include a larger sample size and use of a multilevel approach to account for both individual- and area-level characteristics,²⁶ though studies using a multilevel approach with a smaller sample size might not be sufficiently powered to detect a significant association between social fragmentation and psychosis.³⁰ Higher-quality studies controlled for both individual- and area-level confounders including age, sex, and area-level deprivation or other measures of socioeconomic status.²⁶

Social Fragmentation Index and Psychosis Rates

Allardyce et al³¹ found that SFI was positively associated with first-admission rates for psychosis in a dose-dependent fashion. Later, O'Donoghue et al²² found a higher incidence of first-episode psychosis (FEP) after adjusting for social deprivation, social capital, and population density. But, after adjusting for age, the association was no longer significant. In a larger study with 722 individuals aged 15–24 years, Eaton et al¹⁹ found that neighborhoods with the greatest SFI were associated with higher rates of FEP and nonaffective FEP, but not with affective FEP. Although these studies show strong associations between SFI and psychosis rates, they did not account statistically for the hierarchical structure of individuals nested in neighborhoods.

Two studies used multilevel analyses to account for the hierarchical structure. Although these studies found positive

Figure 1. Social Fragmentation and Schizophrenia Screening Flowchart



correlations between SFI and nonaffective psychosis, not all associations were statistically significant. From the Cavan-Monaghan First Episode Psychosis Study (CAMFEPS) conducted in rural Ireland, Omer et al³² found a positive correlation between SFI scores and incidence of FEP only among women, but not among men. However, Kirkbride et al²¹ did not find a significant association between SFI and nonaffective psychosis in East London. Details of these studies' findings are shown in Table 2.

Other Measures of

Social Fragmentation and Psychosis Rates

Studies have also used multilevel modeling to investigate the associations between other measures of social fragmentation (ie, proportion of single persons, divorced persons, people who moved, and renters) and rates of psychosis (Table 3). Löffler and Häfner³³ found that in German cities, high proportion of single persons and immigration/emigration rates were significantly associated with higher schizophrenia rates; however, the association between proportion of divorced persons and schizophrenia rates did not reach statistical significance. Later, van Os et al³⁴ found that among small neighborhoods in Maastricht, the Netherlands, both the proportion of single persons and divorced persons were significantly associated with

Table 1. Compar	ison of Methodologies and Assigned Qual	lity Score					Kı
Reference	Geoorran hic Area	Sample Size (n) of Individuals With Psychosis or Schizonhrenia	Study Desian	Individual-Level Factors Controlled for	Area-Level Factors Controlled for	Quality Score (Maximum = 2	uetal tisi
Allardyce et al, 2005 ³¹	Postcode sectors, all of Scotland (average population is 5,000 per sector)	5,838	Cross-sectional	Age, sex	Deprivation, urban/rural index	20	lle
Drukker et al, 2006 ³⁵	36 Residential neighborhoods (administrative units) in Maastricht, a relatively small Dutch city	98	Case-control	Age, sex, marital status, education, employment, living conditions, postal code socioeconomic status	None	20	ga
Eaton et al, 2019 ¹⁹	59 Postcodes in Northern and Western Melbourne, Australia	722	Cohort	Age, sex, migrant status	None	19	l to
Jongsma et al, 2018 ²	17 Catchment areas in 6 counties (England, France, Italy, Netherlands, Spain, and Brazil)	2,774	Cross-sectional	Age, sex, age-sex interaction	Distance from equator, population density, owner-occupancy, single- person households, and unemployment	20	ро
Kirkbride et al, 2014 ²¹	60 Wards in East London (average population is 6,195 per ward)	313	Cross-sectional	Age group, sex, ethnicity, and social class	Index of multiple deprivation, income inequality and population density	20	st
Ku et al, 2020 ²⁸	128 Census tracts in the US (average population is approximately 4,000 per census tract)	143	Cross-sectional	Age at first cannabis use, sex, family history of psychosis, number of moves between ages 12 and 18 y (age at onset of psychosis); mode of onset, history of incarceration, age at first cannabis use, socioeconomic status (duration of untreated psychosis)	General socioeconomic status, race/ ethnicity/unemployment, residential instability, low household value	18	this co
Löffler and Häfner, 1999 ³³	14 Districts in Heidelberg and 23 districts in Mannheim	276	Cross-sectional	None	None	15	p
Luo et al, 2019 ³⁹	736 Counties in mainland China	7,628	Cross-sectional	Age group, marital status, region, residency, income, and education	Urbanization rate, socioeconomic condition	20	yri
O'Donoghue et al, 2016 ²²	139 Electoral divisions in Ireland (average population is 2,716 per electoral division)	292	Cross-sectional	Age	Social deprivation, social capital, population density	19	gh
Omer et al, 2014 ³²	155 Electoral divisions in rural Ireland (average population is 697 per electoral division)	255	Cross-sectional	Age, sex	None	19	ite
Omer et al, 2016 ³⁷	155 Electoral divisions in rural Ireland	186	Case-control	Age, sex	None	19	• C
Pignon et al, 2016 ³⁸	53 Geographical ("IRIS") areas in urban France (average population is 2,064 per area)	358	Cross-sectional	Age, sex	Deprivation	20	I P
Richardson et al, 2018 ²⁰	530 Statistical wards in rural East Anglia in England (median population is 3,992 per ward)	631	Cohort	Age, sex, race/ethnicity, socioeconomic status	Deprivation, urbanicity	22	D
Rotenberg et al, 2021 ³⁶	Postal codes in Ontario, Canada	25,686	Cohort	Age, sex	None	19	= 0
Silver et al, 2002 ²⁹	261 Census tracts in 4 US cities (New Haven, CT; Baltimore, MD; Durham, NC; Los Angeles, CA)	NA	Cross-sectional	Age, sex, race, education, marital status, household income	None	18	n
Tibber et al, 2019 ⁴⁰	Wards in West London	335	Cross-sectional	Age, sex, socioeconomic status	None	19	a
van Os et al, 2000 ³⁴	35 Small traditional neighborhoods in Maastricht (median population is 2,804 per neighborhood)	220	Cross-sectional	Age, sex, marital status	None	19	ny
Veling et al, 2015 ¹⁸	42 Postal codes in The Hague, the Netherlands (average population is 11,240 per postal code)	611	Cross-sectional	Age, sex, marital status, ethnicity	Socioeconomic level, residential mobility, ethnic diversity, proportion of single-person households, population density, crime rate, voter turnout	20	web
Zammit et al, 2010 ⁶	Schools in Sweden at age 16 y	881	Longitudinal	Birth year, family history, foreign-born parents, single parent, parent unemployment, parental education, parent receiving welfare benefits, family income, school grade, moved municipality	School level (foreign-born, deprivation) and municipality level (population density, social fragmentation, deprivation)	22	osite
Abbreviation: NA= n	ot available.				<i>L</i>		•

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Reference	Statistical Analysis	Outcome Measure, Diagnosis, and Age (y)	Results
Allardyce et al, 2005 ³¹	Logistic regression; top fifth vs lowest fifth	Standardized ratios of first-admissions rates, <i>ICD-9</i> psychosis, age 15–64	OR, 12.84; 95% Cl, 5.71 to 28.88
Omer et al, 2014 ³²	Multilevel Poisson regression	Incidence of FEP, <i>DSM-IV</i> , age 16+	IRR among men, 1.14; 95% Cl, 0.91 to 1.43 IRR among women, 1.72; 95% Cl, 1.33 to 2.24
Kirkbride et al, 2014 ²¹	Bayesian relative risks	Relative risk report relative change in incidence associated with a 1 SD increase in value of neighborhood variable, nonaffective FEP, DSM-IV, age 18–64	RR for SFI, 1.08; 95% CI, 0.87 to 1.34
O'Donoghue et al, 2016 ²²	Poisson regression	Incidence of FEP, <i>DSM-IV</i> , age 16–65	IRR for greatest social fragmentation adjusted for 1. Other neighborhood-level factors, 3.30; 95% Cl, 1.34 to 8.0 2. Age, 2.05; 95% Cl, 0.91 to 4.62
Eaton et al, 2019 ¹⁹	Negative binomial regression; top quarter vs lowest quarter	Incidence of FEP, <i>DSM-IV</i> , age 15–24	IRR, 1.42; 95% CI, 1.02 to 1.97

higher incidence of schizophrenia. Furthermore, they found a significant interaction between individual- and neighborhood- level single status such that the individuallevel effect of single marital status was higher in areas with fewer single individuals.

In a small Dutch city in the Netherlands, Drukker et al³⁵ conducted a factor analysis that grouped percentage of single persons and several measures of mobility together. Although this composite factor was positively correlated with treated incidence rates of schizophrenia, this association was nonsignificant, and the authors concluded that the study may have been underpowered with only 98 individuals with schizophrenia. In a larger city in the Netherlands, Veling et al¹⁸ found that neighborhood-level residential mobility, defined as the percentage of people who moved households in the past year and proportion of single-person households were both independently associated with higher incidence of first-contact psychotic disorders. However, in a large study across 6 counties and 17 catchment areas across both urban and rural areas, Jongsma et al² found that percentage of single-person households was not significantly associated with incidence of FEP in a multivariable model. Instead, the percentage of owner-occupied homes was significantly associated with lower incidence of nonaffective FEP and not affective FEP. This association remained significant even after controlling for other individual-level variables including age and sex, and area-level ethnicity.² Richardson et al²⁰ found that in rural East Anglia in England, social isolation, a combination of percentage of renter, population migration, percentage not owning a car, and percentage of single adults derived from factor analysis, was associated with higher incidence of nonaffective FEP, but not affective FEP. Rotenberg et al³⁶ measured the residential instability index at the census metropolitan area level in Ontario, Canada, and found that there was a higher risk of psychotic disorders in areas with highest (versus lowest) levels of instability.

Social Fragmentation and Other Psychosis Outcomes

Studies have also investigated the association between other measures of social fragmentation and other psychotic outcomes, including prevalence, age at onset of psychosis, psychotic symptoms, and DUP as shown in Table 4.

Prevalence

Silver et al²⁹ replicated the results of Faris and Dunham⁷ and found that in the US, census tract-level residential mobility, a combination of percentage of those who changed residences within the past 5 years and housing units that are rentals, derived from factor analysis, was associated with higher prevalence of schizophrenia.

In a longitudinal multilevel study,⁶ school-level social fragmentation, defined as proportion of children who migrated into Sweden, moved into a different municipality between ages 8 and 16 years, or were raised in single-parent households, was associated with nonaffective psychosis even after controlling for individual- and area-level characteristics. In fact, the association between urbanicity and nonaffective psychosis was explained primarily by school-level social fragmentation rather than individual and other area-level measures. Zammit et al⁶ also found a significant interaction between individual-level and school-level social fragmentation. Social fragmentation at the individual level was a summed score of being in a single-parent family, having immigrated during childhood, and having moved into a different municipality between ages 8 and 16 years. For individuals with a low social fragmentation score, the odds of psychosis increased as social fragmentation within the school increased, and for individuals with a high social fragmentation score, the odds of psychosis decreased as social fragmentation within the school increased.

Two smaller studies conducted in Europe, however, did not find significant associations between social fragmentation and psychosis. From the CAMFEPS, Omer et al³⁷ found that SFI at birth was not associated with psychosis diagnosis among a subset of 186 individuals with FEP who were born within the study area. Pignon et al³⁸ found that in an urban area in France, social fragmentation, as measured by the standardized proportion of people who had lived in an area for less than 2 years and the proportion of people

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Table 3. Of	ther Measures of Social	Fragmentation and Psychosis Rates		
Reference	Statistical Analysis	Measure of Social Fragmentation	Outcome Measure, Diagnosis, and Age (y)	Results
Löffler and Häfner, 1999 ³	Spearman correlation	1. Single persons per 100 2. Divorced persons per 100 3. Immigration/emigration rate	First-admissions rates of schizophrenia, <i>ICD-9</i> , age 12–59	Correlations between socioeconomic character and first admission rates of schizophrenia: 1. Single persons 0.43; <i>P</i> < .05 2. Divorced persons 0.43; <i>P</i> < .10 3. Immigration/emigration 0.59; <i>P</i> < .05
van Os et al, 2000 ³⁴	Multilevel Poisson regression	 Proportion who were single Proportion divorced 	Incidence of schizophrenia, ICD-9, age 15-64	1. IRR proportion single, 1.02; 95% Cl, 1.00 to 1.(2. IRR proportion divorced, 1.12; 95% Cl, 1.04 to
Drukker et al, 2006 ³⁵	Multilevel logistic regression	Residential instability (percentage single persons, mobility within neighborhoods, total mobility, mobility balance)	Incidence of schizophrenia, DSM-IV, age 20-65	OR predicting treated incidence of schizophren 1.25; 95% Cl, 0.96 to 1.63
Veling et al, 2015 ¹⁸	Multilevel Poisson regression	 Residential mobility (proportion of households that moved from the neighborhood during a year) Single-person households (average percentage of single-person households) 	First-contact incidence of psychotic disorders, DSM-IV, age 15–54	 IRR for residential mobility, 1.03; 95% CI, 1.01 IRR for single-person households, 1.01; 95% CI, 1.00 to 1.03
Richardson et 2018 ²⁰	t al, Multilevel Poisson regression	Social isolation (percentage of in- and out-migration, percentage privately rented housing, percentage of no car ownership, percentage non-cohabitating adults)	Incidence of FEP, <i>ICD-10</i> , age 16–35	IRR social isolation, 1.09; 95% Cl, 1.03 to 1.16
Jongsma et al 2018 ²	l, Random intercepts Poisson regression	 Percentage of owner-occupied homes Percentage of single-person households 	Incidence of FEP, <i>ICD-10</i> , age 18–64	 IR owner-occupied, 0.76; 95% Cl, 0.70 to 0.8 IRR single-person households, 1.06; 95% Cl, 0.78 to 1.43
Rotenberg et 2021 ³⁶	al, Poisson regression; top fifth vs lowest fifth	Residential instability index (proportion of the population living alone, proportion of the population aged 16+, average number of persons per dwelling, proportion of the population who are single/ divorced/widowed, proportion of dwellings that are apartment buildings, proportion of swellings that are not owned, proportion of the population who moved during the past 5 years)	Incidence of schizophrenia or schizoaffective disorder, <i>ICD-9110</i> or <i>DSM-IV</i> or minimum of 2 billing claims, age 14–40	IRR residential instability, 1.26, 95% Cl, 1.18 to 1
Abbreviations	:: DSM=Diagnostic and Statis	tical Manual of Mental Disorders, FEP = first-episode psychosis, ICD = Inte	national Classification of Diseases, IRR = incidence	ate ratio, OR=odds ratio.
residential instabi though individua disorder was asso	not dose depend fragmented neigh 0 and the second had a median DU second most frag median DUP of 6 fragmented neigh 3 months. Ku et a	 Psychotic Sympt One study exp SFI and psychotic with FEP. In a c: al⁴⁰ found that S presentation was a the severity of posis symptoms. This reduced fragmen of Dissimilarity, v extent to which W populations were less-severe positiv Duration of Untr O'Donoghue e with higher SFI median DUP; h 	Ku et al ²⁸ for residential instabil residents who char year, was associan psychosis. This a controlling for (1 age at onset, inclu- of psychosis, and individual-level ru- the number of m and (3) other nei- socioeconomic de	period. Authors of the lack of statistic of these findings. In a larger an level divorce ra found not to be the prevalence of analysis, but stratt rates were positi risk for schizoph not among men.

It is illegal to post this copyrighted PDF on any website living alone, was not significantly associated with populfective psychosis cases during an 8 week

nonaffective psychosis cases during an 8-week both studies acknowledged that al power limited the conclusion

more recent study,³⁹ countyes in mainland China were significantly associated with schizophrenia in the primary fied analyses found that divorce ely associated with increased enia only among women, but

sychosis

und that census tract-level ity, defined as the percentage of nged their address in the past ed with earlier age at onset of sociation persisted even after) known predictors of earlier ding male sex, family history age at first cannabis use; (2) sidential instability, defined as oves from ages 12 to 18 years; shborhood factors that reflect privation and race/ethnicity.

oms

ored the association between symptoms among individuals oss-sectional study, Tibber et FI of neighborhood at initial ot significantly associated with tive, negative, or disorganization study did find, however, that ation, measured by the Index ithin a given ethnic group (the hite and Black/minority/ethnic egregated) was associated with symptoms.

ated Psychosis

al²² found that neighborhoods exhibited significantly longer wever, this relationship was nt.²² Those living in the least orhood had a median DUP of east fragmented neighborhood P of 7 months, but those in the mented neighborhood had a months and those in the most orhood had a median DUP of ²⁸ found that census tract-level ity did not predict longer DUP, level perceived neighborhood iated with a longer DUP.

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Table 4. Measures of Social Fragmentation and Other Outcomes of Psychosis

Reference	Statistical Analysis	Measure of Social Fragmentation	Outcome Measure, Diagnosis, and Age (y)	Results
Prevalence	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Silver et al, 2002 ²⁹	Binomial hierarchical logistical regression	Residential mobility (percentage of persons over 5 years old who did not live at the same address 5 years earlier and percentage of housing units that are rentals [derived from factor analysis])	Prevalence of schizophrenia, <i>DSM-III</i> , age 18–96	OR predicting past year schizophrenia, 1.27; 95% Cl, 1.02 to 1.59
Zammit et al, 2010 ⁶	Multilevel logistic regression	Social fragmentation (proportion of children who migrated into Sweden, moved into a different municipality between ages 8 and 16 years, or were raised in single-parent household)	Odds of nonaffective psychosis, <i>ICD-8/9/10</i> , age up to 31	OR predicting nonaffective psychosis diagnosis, 1.09; 5% Cl, 1.01 to 1.18
Omer et al, 2016 ³⁷	Logistic regression	SFI at birth	Odds of psychosis, <i>DSM-IV</i> , age NA	OR predicting psychosis diagnosi 0.96; 95% Cl, 0.86 to 1.06
Pignon et al, 2016 ³⁸	Bayesian methods	Social fragmentation (standardized proportion of people who had lived in an IRIS for less than 2 years and the proportion of people living alone)	Prevalence of nonaffective psychosis, <i>DSM-IV-TR</i> (codes 295.xx, 297.x, 298.x) and receiving antipsychotic treatment prescribed during the consultation, age 18+	OR predicting nonaffective psychosis cases, 0.90; 95% Cl, 0.78 to 1.04
Luo et al, 2019 ³⁹	Multilevel logistic regression; top third vs lowest third divorce rate	Divorce rate	Prevalence of schizophrenia, ICD-10, age 18+	OR for the highest percentage divorced, 1.09; 95% Cl, 0.96 to 1.2 1. OR among men, 0.98; 95% Cl, 0.84 to 1.15 2. OR among women, 1.19; 95% Cl, 1.03 to 1.38
Age at Onset	of Psychosis			
Ku et al, 2020 ²⁸	Logistic regression; dichotomized into high/low at third quartile	Residential instability (percentage living in a different house in the United States or living abroad within the past year)	AOP in FEP, <i>DSM-IV</i> , age 18 to 40	OR predicting earlier AOP, 1.92; 95% Cl, 1.04 to 3.53
Psychotic Syr	nptoms			
Tibber et al, 2019 ⁴⁰	Multilevel linear regression	SFI	Psychotic symptoms among FEP, <i>DSM-III/IV</i> , age 16+	β coefficient predicting negative symptoms -0.02; 95% CI, -0.05 to 0.01; positive symptoms 0.01; 95% CI, -0.02 to 0.04; disorganization symptoms 0; 95% CI, -0.03 to 0.04
Duration of L	Intreated Psychosis			
O'Donoghue et al, 2016 ²²	Mann-Whitney	SFI	DUP in FEP, <i>DSM-IV</i> , age 16–65	DUP was 0, 7, 6, and 3 months in least to most fragmented neighborhoods; U=230.5, P=.02
Ku et al, 2020 ²⁸	Logistic regression; dichotomized into high/low at third quartile	Residential instability (percentage living in a different house in the United States or living abroad within the past year)	DUP in FEP, <i>DSM-IV</i> , age 18 to 40	OR predicting longer DUP, 1.06; 95% Cl, 0.64 to 1.76

Abbreviations: AOP = age at onset of psychosis, DSM = Diagnostic and Statistical Manual of Mental Disorders, DUP = duration of untreated psychosis, FEP = first-episode psychosis, ICD = International Classification of Diseases, NA = not available, OR = odds ratio, SFI = social fragmentation index.

DISCUSSION

In this review, 14 of 19 studies found that measures of social fragmentation were significantly associated with psychosis rates and other outcomes. Studies showed a 4- and 12-fold increase in schizophrenia prevalence and admission rates, respectively, between areas with highest as compared to lowest measures of social fragmentation.^{29,31} Studies with sample sizes greater than 500 and smaller geographic units yielded significant associations.^{6,20} Social fragmentation was more consistently associated with rates of nonaffective FEP compared to rates of affective FEP. These associations occurred in both urban and rural areas^{2,31} and persisted after controlling for individual- and area-level covariates.

Even though SFI was significantly associated with psychosis rates in 3 studies,^{19,22,31} these studies did not use multilevel approaches. The two studies^{21,32} that used hierarchical models to analyze SFI and psychosis rates did not yield significant associations in main analyses.

Instead, studies that used multilevel models and components of social fragmentation, especially area-level residential instability (proportion moving) and proportion of renting, found significant associations with higher psychosis rates. While many of these studies were cross-sectional, results from longitudinal studies were also consistent with these findings. School-level measures of social fragmentation that incorporated residential instability predicted a higher likelihood of developing psychosis even after controlling **It is illegal to post this copy** for covariates. In fact, the association between school-level social fragmentation (measured by residential instability as one of the indices) and psychosis was greater than—and may partially explain the association between—urbanicity and psychosis.⁶

Furthermore, area-level residential instability was found to predict an earlier age at onset of psychosis among individuals with first-episode psychosis, suggesting that living in a residentially unstable neighborhood may be an important predictor for future risk of developing psychosis. Measures of social fragmentation were not associated with other psychosis outcomes including psychosis symptom severity and not consistently associated with duration of untreated psychosis. However, the number of studies investigating these other outcomes was limited, so more studies would be needed.

Interestingly, two studies^{6,34} found significant interactions between individual-level and area-level measures of social fragmentation. In these studies, the discordance between individual- and area-level characteristics produced the highest risk for psychosis, suggesting that certain characteristics that define individuals as being different from most other people in their local environment may increase risk of psychosis. These findings are consistent with studies examining other individual- and area-level characteristics such as size of one' own ethnic group^{16,17} and ethnic identity,^{41,42} suggesting that contextual factors may play an important role in modifying individual risk in the development of schizophrenia.

Two studies, one from rural Ireland³² and one from mainland China,³⁹ found that measures of social fragmentation were significantly associated with psychosis among women but not men. Perhaps there may be gender differences in response to social environmental stressors.⁴³

Although the causal direction of social fragmentation and psychosis is still unclear, several studies^{6,18,21,22} have proposed that chronic social stress may partially explain the relationship between area-level characteristics measuring social fragmentation and psychosis. Prior studies^{24,44-47} have shown that communities with a higher percentage of people moving have more disrupted local friendship ties, lower levels of participation in informal social activities, higher violent crime rates, and higher perceived social environmental stress. These stressors are likely to be repetitive, at least in terms of cognitive expectations and perceptions, even if not in terms of actual events. Perhaps the cumulative stress of living in a neighborhood with a lack of social cohesion may lead to chronic feelings of social exclusion and heightened vigilance for perceived social threat, which has been shown to be associated with chronic hyperactivation of prefrontal areas of the brain.⁴⁸ Chronic hyperactivation would then lead to accelerated prefrontal gray matter volume loss,⁴⁹ which has been shown to predict the onset of psychosis.⁵⁰

This mechanism would apply not only to a specific characteristic of individuals but also to any characteristics (such as migrant status or ethnic minority group) that define an individual as being different from the majority in the surrounding environment. Perhaps social fragmentation, particularly population turnover in one's community, may **check PDF on any website**. be a proxy for an unstable social environment, in which individuals may find it more difficult to fit in and be integrated into the community.

Further investigation of this mechanism would have important implications for not only understanding the pathophysiology of schizophrenia but also determining the types of psychosocial interventions that could be helpful for prevention. Future studies may consider elucidating participants' perceptions of their social environment as a potential mediator to better understand how area-level characteristics leads to psychosis. For example, if negative schemata, low self-esteem, and cognitive biases mediated the relationship between measures of social fragmentation and psychosis, then targeted psychosocial interventions could be effective for youth who live in socially fragmented neighborhoods.

There are also important public health and social policy implications of this research in the context of a growing focus on early intervention services. As of 2009, there are more than 200 early intervention for psychosis services worldwide⁵¹; yet, there has been little discussion on where these services should be located and how limited resources should be allocated. The delivery of early intervention for psychosis services could be enhanced based on models that predict the incidence of psychosis.¹¹ Allocating more resources to places with greater need and better understanding what types of resources to provide would have the potential to identify more individuals at risk for psychosis and enhance the recovery of those suffering from this illness. Furthermore, the solution to social fragmentation may not lie solely in providing treatment at the individual level, but also in modifying the legislation and policies that allow certain social fragmentation conditions to exist.

Limitations

There were several limitations of this review. First, the inclusion criteria, and perhaps also the search terms, may not have fully captured all studies that tested the association of social fragmentation and psychosis. Second, the variability in measured constructs, statistical methods, and outcomes precluded a quantitative review of the literature on social fragmentation and psychosis. Social fragmentation has been heterogeneously measured, and the degree to which the underlying constructs captured in those measures may be associated with psychosis is still unclear. Third, our search approach may have favored the selection of findings that had statistically significant associations between social fragmentation and psychosis, and there is potential risk for publication bias. Lastly, there were only a few longitudinal studies, with different psychosis outcomes, limiting the interpretation about causality and the mechanism of social fragmentation on the development of psychosis.

CONCLUSION

In conclusion, this review finds evidence that measures of area-level social fragmentation are associated with

It is illegal to post this copyrighted PDF on any website. higher psychosis rates. In addition, there is also evidence Therefore, more longitudinal studies investigating the impact

that measures of social fragmentation, in particular arealevel residential instability, may be associated with psychosis prevalence and earlier age at onset of psychosis in first-episode psychosis. However, there were only 19 studies included in this review, with heterogeneous measures of social fragmentation, statistical methods, and outcomes, precluding meta-analysis. Therefore, more longitudinal studies investigating the impact of social fragmentation, including area-level residential instability, on the development of psychosis and other psychosis outcomes are needed. Nevertheless, this research has potential public health implications for allocating mental health resources to areas with greater psychosis risk for early intervention, treatment, and management.

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See supplementary material for this article at PSYCHIATRISTCOM.



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Supplementary Material

- Article Title: Social Fragmentation and Schizophrenia: A Systematic Review
- Author(s): Benson S. Ku, MD; Michael T. Compton, MD, MPH; Elaine F. Walker, PhD; and Benjamin G. Druss, MD, MPH
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List of Supplementary Material for the article

1. **Table 1** Quality score assessment breakdown

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Supplementary Table 1. Quality score assessment breakdown

Reference Allardyce et al.	Question sufficiently described?	Study design evident and appropriate? (e.g., longitudinal, cross- sectional, etc.?)	Method of subject/ comparison group selection or source of information variables described and appropriate?	Subject characteristics sufficiently described?	Area-level measure well defined and robust to measurement bias?	Sample size of individuals with psychosis or schizophrenia reported and large enough?	Analytic methods described/ justified and appropriate?	Confidence interval reported for main results?	Controlled for confounding?	Results reported in sufficient detail?	Conclusions supported by results?	Total Score (out of 22)
2005 ³¹	2	1	2	2	2	2	1	2	2	2	2	20
Drukker et al, 2006 ³⁵	2	2	2	2	2	1	2	2	1	2	2	20
Eaton et al, 2019 ¹⁹	2	2	2	2	1	2	1	2	1	2	2	19
Jongsma et al, 2018 ² Kirkbride et al,	2	1	2	2	1	2	2	2	2	2	2	20
2014 ²¹	2	1	2	2	2	1	2	2	2	2	2	20
Ku et al, 2020^{20}	2	1	2	2	2	1	1	2	1	2	2	18
Löffler et al, 1999^{33}	2	1	2	2	1	1	2	0	0	2	2	15
Luo et al, 2019 ³⁹ O'Donoghue et al,	2	1	2	2	1	2	2	2	2	2	2	20
2010^{-1}	2	1	2	2	2	1	1	2	2	2	2	19
Other et al, 2014^{37}	2	1	2	2	2	1	2	2	1	2	2	19
Omer et al, 2016^{37}	2	2	2	2	2	1	1	2	1	2	2	19
Richardson, et al, 2016^{30}	2	1	2	2	2	1	2	2	2	2	2	20
Rotenberg et al, 2021^{36}	2	2	2	2	1	2	1	2	1	2	2	19
Silver et al, 2002 ²⁹	2	1	2	2	2	0	2	2	1	2	2	18
Tibber et al, 2019 ⁴⁰	2	1	2	2	2	1	2	2	1	2	2	19
van OS et al, 2000 ³⁴	2	1	2	2	2	1	2	2	1	2	2	19
Veling et al, 2015 ¹⁸	2	1	2	2	1	2	2	2	2	2	2	20
Zammit et al, 2010 ⁶	2	2	2	2	2	2	2	2	2	2	2	22