Review: The Wider Social Environment and Schizophrenia

Judith Allardyce[1,2] and Jane Boydell[3]

[2]Department of Clinical Research, Crichton Royal Hospital, Dumfries DG1 4TG, Scotland; [3]Divison of Psychological Medicine, Institute of Psychiatry, Denmark Hill, London SE5 8AF, UK

Rates of schizophrenia differ significantly between groups defined at the social level, eg, urban/rural comparisons, neighborhoods, and ethnic minority status. While earlier studies were not able to determine if the social environment influenced the development of schizophrenia (causation) or whether individuals at risk aggregated in adverse social environments (selection), the recent development of multilevel modeling should inform this debate. To date, there are few examples of multilevel analyses in schizophrenia research; however, the small number of studies suggest that there may be a neighborhood social contextual effect that influences rates of schizophrenia and other psychotic disorders.

Further research is urgently required to progress our knowledge of how individuals, their genes, and the neighborhoods they live in, interact with each other. Studies need to use well-specified multilevel models, and until then, we should remain cautious in our interpretation of such findings.

Key words: schizophrenia/psychosis/multi-level/ecological/deprivation/social cohesion/ethnic minority status

Introduction

The last decade has witnessed a shift from individualistic approaches in chronic disease epidemiology to the exploration of a wider set of risk factors, defined at levels higher (eg, families, neighborhoods, countries, or cultural context) and lower (eg, genetic or molecular) than the person. With this has come a rapid growth in studies examining the influence of the shared social environment on health.[1,2]

The study of schizophrenia has only recently started to reflect this methodological transition, due to the accretion of evidence showing consistently higher incidence rates for schizophrenia in urban as compared with rural areas with a dose-response relationship, possibly pointing toward a social causation rather than a social drift explanation for the observed urban-rural gradient.[3] However, growing up in an urban area is a proxy environmental risk factor, and the correlates of this urban exposure, acting to increase the risk of schizophrenia, require elucidation. At an ecological level a neighborhood's social and economic structure may be an important explanatory factor for this urban effect.[4]

The social environment varies widely and systematically across neighborhoods, along the dimensions of deprivation, residential stability (eg, tenured housing and migration), family structure (eg, living alone), and ethnic composition.[5] Social stratification by place is inherent and pervasive,[6,7] and many health outcomes vary across them.[8] This ecological perspective is not new in schizophrenic research; as far back as 1939, Faris and Dunham[9] demonstrated differential rates of schizophrenia across city zones in Chicago, with the highest rates in areas characterized by high ethnic conflict, residential mobility, and social disorganization. Later studies from Bristol[10] and Nottingham[11] demonstrated similar associations. However, we abandoned ecological studies concentrating our effort on individual approaches in the 1970s; with the demonstration that schizophrenia was a biological brain disorder, we thought that its causes, effective treatments, and prevention strategies would also be biological and lie at the individual level and assumed that differential rates across neighborhoods were due to social (selection) drift.[12]

In this review, we describe the current state of published research examining neighborhood-level social environmental factors and schizophrenia. Studies were included (see Appendix) if (1) they were published after 1995, a period where multilevel modeling were established; (2) the area measured was the "neighborhood" or geographically defined small area; (3) outcomes were rates of psychosis or schizophrenia; and (4) there was an area-level measure of social context. Only 13 studies fulfilled these criteria. Deconstructing a neighborhood's social environment in a way that is susceptible to scientific inquiry is difficult; we have chosen to organize this review around

[1]To whom correspondence should be addressed; tel: 44-1387-244000, fax: 44-1387-257735, e-mail: j.allardyce@clinmed.gla.ac.uk.

the classical social area dimensions (stratifications) seen in neighborhoods such as (1) deprivation; (2) community organizational structure, ie, family composition and housing characteristics which support stable neighborhoods; and (3) ethnic composition.

Area-Level Measures of the Social Environment and Their Relationship to Rates of Schizophrenia

Deprivation

Ecological studies have consistently found a relationship (not necessarily linear) between derivation and incidence of psychosis[13] first admission rates for schizophrenia,[4,14] prevalence of schizophrenia,[15,16] and admission rates for schizophrenia.[17–20] The majority of these studies have used only aggregate-level data, reflecting their primary aim of assessing whether area measures of deprivation (used to determine formulas for national funding) can effectively predict use of mental health services. They describe the association but do not explain it. They do not differentiate between "compositional" effects (aggregations of persons each with increased individual risk) and "contextual" explanations where the features of the social (or physical) environment of the neighborhood influence the health of those exposed to it (either in addition to or in interaction with individual risk factors).

With the recent development of multilevel (hierarchical) statistical modeling, it is now possible to tease out the effects of individual-level risk factors and neighborhood contextual effects. The first study to examine both individual and neighborhood deprivation data[15] on prevalence rates of schizophrenia showed that both individual characteristics and area-level deprivation were independently and significantly related to rates of schizophrenia. However, further analyses of the same data set[16] including a specific measure of individual-level deprivation (household income) attenuated and rendered the neighborhood deprivation effect nonsignificant. The attenuation was due solely to individual deprivation indicators. Further studies have shown a similar attenuation in the neighborhood effect of deprivation after adjustment of individual-level risk factors (and other neighborhood measures).[21,22]

"Controlling away" the neighborhood deprivation effect could be (1) individuals predisposed to schizophrenia aggregating in deprived areas; (2) it may be that an individual's deprivation status is a function of neighborhood social characteristic not adequately captured by deprivation indices, eg, social disorganization; and (3) methodological artifact, area deprivation, is not conceptualized independently of the individuals living in the area.[23] This may be overcome by using income/deprivation distribution or inequality measures rather than deprivation indices.[24] One study has examined the relationship of inequality and schizophrenia.[25] They found that (social) inequality was not associated with higher incidence rates

for schizophrenia except in the most deprived electoral wards, after controlling for individual ethnic minority status and area derivation. However, they did not measure individual social economic status, so it may be that, in the deprived/high inequality areas where there is likely to be very high concentrations (as compared with areas with less disparity) of deprived people, the contextual effect may have been overestimated.

Neighborhood Organization (levels of disorganization)

To date, most studies have used objective measurements of disorganization, generated from single or composite (Social Fragmentation index [SFI]) aggregates of the census variables—unmarried, 1-person household, population turnover, and private rents.

Two studies have shown that area measures of SFI have a strong influence on rates of psychosis[4] and schizophrenia[18] independent of area-level deprivation and ethnic composition. Another cross-sectional study from Sweden used subjective survey methods and found higher rates of schizophrenia in areas characterized by high levels of disorder, fear of crime, and victimization.[26] These studies had no individual-level data and, therefore, could not examine whether this is a contextual effect of the neighborhood. There are 2 published studies using multilevel analyses to explore organizational structure of neighborhoods. In Maastricht, single people were at greatest risk of schizophrenia in neighborhoods with smaller proportions of single people, ie, individual risk was conditioned on the neighborhood organization.[22] The second study from the United States[16] found residential mobility (population turnover and rented accommodation)–predicted prevalence of schizophrenia independent of area deprivation, ethnic composition, and individual social economic status. It is possible that important individual risk factors, eg, family histories, which were not controlled for, confound these results. Finally, we cannot assess the direction of this association, social disorganization might increase the risk of schizophrenia or possibly the social behavior of people with schizophrenia may increase the social disorganization in the areas where they live.

Ethnic Composition (minority status)

Again, we find a strong ecological relationship between proportion of people from an ethnic minority in an area and its rate of service use[16,18,21] which is attenuated when individual-level ethnicity is adjusted for.[16,21] When people with a particular characteristic live in an area where this characteristic is less common, we observe higher rate of mental illness.[27] Boydell et al[21] examined this with regard to ethnicity and found incidence rates of schizophrenia to increase in ethnic minority groups as the proportion of ethnic minorities in the locality fell; this association has recently been replicated (not yet published).[28] Further work is required, including measures of individual-level social disadvantage. It may be interesting

to measure how minority groups are integrated/segregated in a neighborhood, along with subjective measures of how they perceive their environment, to clarify what aspect of the social experience (eg, discrimination) increases risk.

Is There Evidence of Contextual Neighborhood Effect?

Multilevel modeling is a recent advancement, but the initial findings are promising and suggest that high rates of psychosis in the most socially disorganized areas (rather than the most deprived areas) are contextual neighborhood effects. Individual risks of psychosis for minorities' groups seem to be conditioned on neighborhood ethnic density. These findings need to be replicated and study designs developed to extend the hypothesis of a neighborhood contextual influence.

Social cohesion may be the concept, which bridges these 2 neighborhood effects. Both may reflect populations that are generally less likely to form stable neighborhood ties, residential mobility impeding bonding in disorganized area, while people from minority groups may be more vulnerable to discrimination, perceived alienation, and anomie when they are a smaller minority. A socially cohesive area has richly endowed stocks of social capital (features such as levels of interpersonal trust, norms of reciprocity, and mutual aid, which act as resources for individuals and facilitate collective action).[29,30] Social capital may be a protective factor for development of schizophrenia, though the potential mechanisms for this effect need to be developed. Social capital may work as a "buffer" modulating stress and dopamine regulation, mechanisms in the development of psychosis,[31] or through psychological mechanisms; areas of low social capital may promote development of persecutory attribution styles, which in people with a genetic liability, may eventually manifest as a fully blown psychotic episode.[32] Further research using more sophisticated measures of the social environment[33,34] examining its effect across the life course, at different aggregation levels, and using well-specified multilevel models should help elucidate the influence of the wider social environment on schizophrenia.

Appendix

Search Strategy

The studies included in this review were identified by keyword searches MEDLINE, EMBASE, PsychINFO, and Science and the Social Science Citation Index using combinations of the keywords "schizophrenia" OR "psychosis" AND "neighbourhood," "ecological," "multi-level", "hierarchical", "socioeconomic factor" "socioeconomic deprivation" "deprivation" "material deprivation", "social disadvantage" "inequality" "poverty" "social cohesion" "social disorganisation", "social fragmentation", "social capital" "residential mobility" "ethnicity".

Table 1. Social Ecological Studies of Schizophenia Over the Last Decade

Reference	Geographical Area	Area Measure of Social Environment[a]	Individual Risk Factors Included	Outcome Psychosis Measure[b]	Statistical Analysis[c]	Effect Measure[d]	Results/ Conclusions[e]
Curtis et al[18]	Zip codes (New York) Electoral wards (London)	D: index of multiple deprivation SFI EPB	None	SARs, all admissions, ICD 9/10 schizophrenia, 15–64 age group	Bayesian Poisson regression	Mean values of beta coefficient	Deprivation[f] +, 0.73 (0.61, 0.85) SFI +, 0.34 (0.19, 0.45) EPB NSS −0.09 (−0.20, −0.037) EPB +, in New York
Allardyce et al[4]	Postcode sectors (all of Scotland)	D: Carstairs scores SFI	None	SARs, first ever admissions, ICD 9 psychosis, 15–64 age group Dichotomized into high/low rates at 75th percentile	Logistic regression	OR High rate category	SFI +OR for the most fragmented category, 12.84 (5.71, 28.88) Carstairs scores +OR for the most deprived category, 5.29 (1.49, 18.75)

Table 1. Continued

Reference	Geographical Area	Area Measure of Social Environment[a]	Individual Risk Factors Included	Outcome Psychosis Measure[b]	Statistical Analysis[c]	Effect Measure[d]	Results/ Conclusions[e]
Boydell et al[25]	Electoral wards in London	Index of inequality D: categories of absolute deprivation Proportion of ethnic minorities	Age Sex Member of nonwhite ethnic minorities Ethnicity × area proportion of ethnic minorities	Treated incidence of RDC schizophrenia	Multilevel Poisson regression	SIRs	Inequality: NSS for whole sample Interaction with absolute deprivation and inequality demonstrated that in the most derived areas there was an inequality +, most deprived areas IRR, 3.79 (1.25, 11.49)
Logdberg et al[26]	87 administrative units in Sweden	Community questionnaire of fear of crime Factor 1: characterized social cohesion and victimization and fear of property crime Factor 2: victimization and fear of crime to the person	None	I year prevalence, DSM (IV) schizophrenia	Product moment correlation of factors and prevalence rates of schizophrenia	Correlation and partial correlation	Factor 1 +, r = 0.63, P < .001 Factor 2 +, r = 0.47 P < .47 Both were correlated Partial correlation Factor 1, 0.51 P < .001 Factor 2, 0.19 P < .001
Silver et al[16]	Census tracts in 4 US cities	D: factor analyses of census variables created 2 factors Neighborhood disadvantage Residential mobility Racial homogeneity (>90% ethnic same proportions)	Sex Age Race Education Marital status Household income	Prevalence of schizophrenia, DIS-interviewed DSM (III) schizophrenia, 18–96 age group	Binomial hierarchical linear regression	OR presence of schizophrenia in year of interview with 1 SD change in predictor variable	Neighborhood disadvantage was NSS 1.16 (0.92, 1.46) After adjustment for individual, education, household income, and marital status Social mobility +, 1.27 (1.02, 1.59) Ethnic mix NSS 0.90 (0.73, 1.11)

Table 1. Continued

Reference	Geographical Area	Area Measure of Social Environment[a]	Individual Risk Factors Included	Outcome Psychosis Measure[b]	Statistical Analysis[c]	Effect Measure[d]	Results/ Conclusions[e]
Boydell et al[21]	Electoral wards in London	Proportion of nonwhite ethnic minorities Deprivation: composite Index of local conditions	Age Sex Self-assigned nonwhite ethnic minority	All new cases, RDC schizophrenia	Multilevel Poisson regression	SIRs	Proportion of ethnic minorities NSS 0.83 (0.63, 1.1) However, evidence cross-level interaction ethnicity Stratified analysis: IRR 4.4 (2.49, 7.75) areas with lowest ethnic density Deprivation NSS 1.05 (0.98, 1.13)
Peen and Dekker[14]	81 neighborhoods in Amsterdam	D: EFA identified Housing factor Socioeconomic deprivation	None	First admissions rates, ICD 9 schizophrenia, 4-year period	Categories of area deprivation generated 1 least-deprived to 4 most deprived ANOVA Pearson's correlation factor scores with SARs	SARs	1-way ANOVA 1 < 2, 3, 4 and 2, 3 < 4 f = 17.18 df = 3, $P < .001$ r = 0.54 ($P < .001$)
van Os et al[22]	Small traditional neighborhoods in Maastricht	Proportion of single and divorced Area-level proportions of rental support Nonvoters Welfare dependent Foreign born Unemployed Residential mobility New housing	Gender Age Marital status	Incidence of clinically diagnosed schizophrenia, age, 15–64	Multilevel Poisson regression	SIRs	Neighborhood proportion single +, IRR 1.02 (1, 1.03) Proportion divorced +, IRR 1.12 (1.04, 1.21) per 1% increase Individual-level single risk conditioned on the cross-level interaction with neighborhood single proportions
Croudace et al[13]	Electoral wards in Nottingham	D: Mental Illness Needs Index	None	Treated incidence of ICD 10 psychosis	Generalized linear models, generalized additive models Poisson regression	Rank correlation SIRs	Deprivation +, correlation Spearman's ρ 0.44 (z = 4.52, $P < .01$) Nonlinear

Table 1. Continued

Reference	Geographical Area	Area Measure of Social Environment[a]	Individual Risk Factors Included	Outcome Psychosis Measure[b]	Statistical Analysis[c]	Effect Measure[d]	Results/ Conclusions[e]
Koppel et al[20]	Electoral wards in South Glamorgan	D: Jarman, Carstairs, Townsend Single census variables	None	Episode-based admissions, ICD 9 schizophrenia	Product moment correlation Linear regression to determine which single wards-level indicator best predicted for crude rates of schizophrenia	Crude admission rates	Deprivation + Jarman 0.74 Townsend 0.69 Carstairs $r = 0.68$ Single-level no car best predicted admissions for schizophrenia
Goldsmith et al[15]	Census tracts in 5 US cities	D: median household income Proportion of nonwhite	Age Gender Marital status Race Education	Prevalence of schizophrenia, DIS-interviewed DSM (III) schizophrenia	Main-effects logistic multiple regression model	OR presence of schizophrenia in year of interview	Deprivation +, 2.14 (1.01, 4.53) in the most deprived category compared with least Ethnic proportion NSS
Boardman et al[17]	Electoral wards in North Staffordshire	D: Jarman, Townsend Single census variables	None	Episode-based admissions, ICD 9 schizophrenia, nonaffective psychosis	Pearson correlation Linear regression	SARs	Deprivation +, r ranged from 0.24 to 0.59
Harvey et al[19]	Electoral wards in Camden	D: Jarman Single-component variables	None	All cases in contact with service Broad Feigner DSM (III R) schizophrenia	Normal linear regression Logistic regression	Point prevalence	Deprivation + Unemployment NLR: $t = 4.74$, $P < .0005$ Predictive error > Narrow definitions of schizophrenia

[a]D: deprivation; EPB: ethnic proportion black; EFA: exploratory factor analysis.
[b]SAR: standardized admission ratio; ICD: international classification of diseases; RDC: research diagnostic criteria; DIS: diagnostic interview schedule; DSM: diagnosis and statistical manual of mental disorders.
[c]ANOVA: analysis of variance.
[d]OR: odds ratio; SIR: standardized incidence ratio; SD: standard deviation.
[e]IRR: incident rate ratio; +: positive association, which is statistically significant; NSS: no statistically significant association; NLR: normal linear regression.
[f]Effect size only shown for London males.

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