Chapter 2

Is the prevalence of psychiatric disorders associated with urbanization?

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Social Psychiatry and Psychiatric Epidemiology (2007) 42: 984-989

Abstract

Objectives: In many countries, the total rate of psychiatric disorders tends to be higher in urban areas than in rural areas. The relevance of this phenomenon is that it may help in identifying environmental factors that are important in the pathogenesis of mental disorders. Moreover, urban preponderance suggests that the allocation of funds and services should take urbanization levels into account.
Method: The Netherlands Mental Health Survey and Incidence Study (NEMESIS) used the Composite International Diagnostic Interview (CIDI) to determine the prevalence of DSM-III-R disorders in a sample of 7076 people aged 18 to 64. The sample was representative of the population as a whole. The study population was assigned to five urbanization categories defined at the level of municipalities. The association between urbanization and 12-month prevalence rates of psychiatric disorders was studied using logistic regression taking several confounders into account.
Results: The prevalence of psychiatric disorders gradually increased over five levels of urbanization. This pattern remained after adjustment for a range of confounders. Comorbidity rates also increased with level of urbanization.
Conclusion: This study confirms that psychiatric disorders are more common and more complex in more urbanized areas. This should be reflected in service allocation and may help in identifying environmental factors of importance for the aetiology of mental disorders.

2.1 Introduction

In many countries, the rate of psychiatric disorders tends to be higher in urban areas than in rural areas (Dohrenwend & Dohrenwend, 1974; Mueller, 1981; Neff, 1983; Webb, 1984; Verheij, 1996; Marsella, 1998; Peen et al., 2009). In our recent meta-analysis of population surveys of urban-rural differences over the last twenty years (Peen et al., 2009), rates for psychiatric disorders in general

and rates for mood, anxiety and substance use disorders were found to be higher in urban areas. However, there are differences between countries/continents and even between studies within countries. Population surveys of the last decades from the US for instance, show that there is no clear trend in urban-rural differences between rates for any disorder (Blazer et al., 1985; Kessler et al., 1994; Kessler et al., 2005). Blazer et al. (1985) found that major depressive disorders were twice as prevalent in urban areas. However, this was not confirmed in recent studies (Kessler et al., 1994; Kessler et al., 2005). In the National Comorbidity Survey, Kessler et al. (1994) only found evidence of a greater probability of comorbidity (> two disorders) in the very large cities compared to the countryside. The recent NCS Replication study also found no significant urban-rural differences (Kessler et al., 2005). The differences in the results between countries and within countries are probably due – at least in part – to the different use of diagnostic instruments, sample selection and to variations definitions of urbanization. Most studies use an urban-rural dichotomy, but some studies have more categories, adding useful information. For instance, the recent multi-country ESEMeD study in Europe (Belgium, Netherlands, France, Germany, Italy, Spain)(Kovess-Masfety et al., 2005), using a division of the urban category into medium-size cities and metropolitan areas versus rural areas, revealed interesting differences between medium-size cities and metropolitan areas. In France, for instance, rates for psychiatric disorders in medium-size cities were found to be significantly higher than those in rural areas, while rates in metropolitan areas were not significantly different from rural areas. In this study we also want to specify the relationship between urbanization and the prevalence of psychiatric disorders. In the Netherlands, we are able to present prevalence rates divided into five categories of urbanization (den Dulk et al., 1992), which reflect an ordinal measure of increasing population density. Using this measure we will be able to reveal if there is an urban-rural gradient of gradually rising rates that follows the level of urbanization. Possible urban-rural differences might be partly explained by differences in demographic features (Paykell et al., 2000; Kovess-Masfety et al., 2005; Weich et al., 2006), so prevalence rates controlled for a range of demographic characteristics will also be presented. In this way we will be able to find if there are robust remaining urban-rural differences. If so, the level of urbanization may be a useful indicator for the allocation of funds for services.

2.2 Method

2.2.1 Sampling and procedure

The Netherlands Mental Health Survey and Incidence Study (NEMESIS) was based on a multi-stage, stratified, random sampling procedure (Bijl et al., 1998a, 1998b).

A sample of 90 municipalities was established, using urbanization and adequate distribution over the 12 Dutch provinces as stratification criteria. The second step was to establish a sample of private households taken from post office records. The number of households selected in each municipality was determined by the size of its population. The third step was to choose which individuals to interview. The selected households were first sent a letter of introduction, and then contacted by telephone. Households with unlisted numbers or no telephone (18%) were visited in person. In each household, the member with the most recent birthday was selected, on condition that he/she was between 18 and 64 years of age and sufficiently fluent in Dutch to be interviewed. To establish contact, the interviewers made a minimum of 10 phone calls or visits to a given address at different times of the day and week. In the initial data collection phase, 7076 respondents were interviewed (response rate 69.7%). The participants in the survey constituted a good reflection of the Dutch population of 1996 in terms of gender, marital status, and urbanization (Bijl et al., 1998b). Only the 18-24 age group was significantly under-represented and therefore the data were post-stratificated by sex, age (9 categories), marital status (married/not married) and urbanization (5 categories). For each of the 182 strata a weighing factor was calculated using the formula:
$w_{(asmu)} = (N_{asmu}/n_{asmu})*(n/N)$, where

$w_{(asmu)}$ = weighting factor for persons in NEMESIS with age a, sex s, marital status m and urbanicity u
N_{asmu} = number of persons in the Netherlands with age a, sex s, marital status m and urbanicity u
n_{asmu} = number of persons in NEMESIS with age a, sex s, marital status m and urbanicity u
n = total number of respondents in NEMESIS
N = total population in the Netherlands

2.2.2 Diagnostic instrument

Psychiatric disorders were assessed using DSM-III-R criteria. The instrument used was the Composite International Diagnostic Interview (CIDI; Robins et al., 1988). The Dutch version of the CIDI (Smeets & Dingemans, 1993) is a fully computerized psychiatric interview. The CIDI can be used by trained lay interviewers. The CIDI is known to have high inter-rater and test-retest reliability (Wittchen, 1994).
The following DSM-III-R diagnoses were recorded in the NEMESIS dataset: mood disorders (depression (296.20-296.34), dysthymia (300.40), bipolar disorder (296.41-296.70)), anxiety disorders (panic disorder (300.01; 300.21), agoraphobia (300.22), simple phobia (300.29), social phobia (300.23), generalized anxiety disorder (300.02), obsessive-compulsive disorder (300.30)), psychoactive substance use disorders (alcohol (305.00) and drug abuse (305.20-305.92) and

alcohol (303.90) and drug dependence (304.00-304.90), including sedatives, hypnotics and anxiolytics), eating disorders (anorexia (307.10), bulimia (307.51)), schizophrenia and other non-affective psychotic disorders (295.00-295.70).
Twelve-month prevalence rates of disorders and cormorbidity prevalence rates were used to calculate the percentage of cases with respectively one, two, three, or four or more diagnoses. In calculating comorbidity prevalence rates the DSM-III-R exclusion rules were not applied.

2.2.3 Demographics

The five categories of urbanization used in the study are based on the 'address density' (den Dulk et al., 1992) used by Statistics Netherlands, which represents the degree of concentration of residents. To establish this measure, the number of addresses in the immediate vicinity is determined for every address (of a residence, business or organization) in the Netherlands. An address here is a postal address, i.e. individual house/flat number + street name, town and postcode. The area address density is calculated using a grid of squares measuring 500 by 500 metres each. The address density for each address in a square is then determined as the number of addresses in the square in which the address is located, plus the number of addresses in the twelve squares of which the centres are 1 km from the centre of the square in which the address is situated. The area address density for a municipality is determined by taking the average for the address density of all the individual addresses in a municipality.
The mean address densities are categorized as follows (in accordance with Statistics Netherlands): not urbanized (< 500 addresses/km2), not very urbanized (500-1000), moderately urbanized (1000-1500), highly urbanized (1500-2500), very highly urbanized (> 2500).

2.2.4 Statistical analyses

Weighted demographic characteristics according to the degree of urbanization (5 categories) were compared using chi-square tests. Demographic figures and prevalence rates were weighted through post-stratification for sex, age (9 categories) and marital status (married/not married). To test for urban-rural differences in prevalence rates, linear trend analysis was performed on the five categories of urbanization (see demographics). We only presented prevalence rates of diagnostic (sub-)categories with a prevalence of 2% or higher, to assure that there was sufficient power to test urban-rural differences.
Logistic regression (Altman, 1991) was used to compute unadjusted odds ratios as well as odds ratios adjusted for gender, age (5 categories), educational level (4 categories), household (net) income (3 categories), occupational status (5 categories), and household composition (5 categories). Linear trend analysis was

used to test for urban-rural differences in both unadjusted and adjusted odds ratios.
The analyses were performed using STATA (Statacorp, 2003).

2.3 Results

2.3.1 Demographics

Table 1 shows the demographic characteristics (weighted) of the sample according to degree of urbanization.

Table 1: Demographic characteristics of the NEMESIS sample (n=7076; percentages weighted by sex, age and marital status)

	Degree of urbanization					χ^2-test
	Urbanized Very highly	Urbanized Highly	Urbanized Moderately	Urbanized Not very	Urbanized Not	
Gender						
Male	52.3	48.4	50.4	50.4	52.0	0.250
Female	47.7	51.6	49.6	49.6	48.0	
Age						
18–24 years	15.2	14.7	13.5	12.6	14.9	0.000
25–34 years	31.0	26.6	25.8	22.5	25.0	
35–44 years	23.8	23.1	24.1	24.5	25.0	
45–54 years	17.6	20.4	21.9	23.2	21.1	
55–64 years	12.4	15.1	14.8	17.2	14.0	
Educational level						
Primary, basic vocational	6.7	6.4	5.5	6.3	6.8	0.000
Lower secondary	31.0	34.4	35.8	40.4	41.2	
Higher secondary	24.6	30.1	31.9	28.4	31.7	
Higher professional, university	37.7	29.2	26.8	24.9	20.3	
Household income (net)						
Lowest 25% (≤fl 2,200)	29.6	25.4	25.8	22.1	19.2	0.000
Mean 50% (fl 2,201–4,400)	48.0	49.9	50.2	48.7	47.4	
Highest 25% (>fl 4,400)	22.3	24.7	24.0	29.2	33.4	
Household composition						
Lives with parent(s)	4.6	6.7	10.2	10.4	11.9	0.000
Lives alone	32.1	21.4	13.8	11.3	9.5	
Single-parent family	5.5	3.7	3.2	2.8	2.7	
Lives with partner (with or without children)	53.5	66.9	71.3	75.0	75.2	
Lives with other(s)	4.2	1.4	1.5	0.5	0.8	
Occupational status						
Homemaker	11.8	17.5	16.7	18.8	18.5	0.000
Student	10.7	7.3	6.8	6.5	5.1	
Employed	62.3	61.5	64.9	60.9	65.8	
Disabled/unemployed	8.7	6.4	5.5	7.1	5.6	
Retired/others	6.5	7.2	6.1	6.7	5.0	

The very highly urbanized category was younger ($p<.001$), more educated ($p<.001$), had a higher household (net) income ($p<.001$), and were more likely to be living alone ($p<.001$) and be disabled/unemployed ($p<.001$). Since these demographic characteristics, and gender, are often related to the risk of psychiatric disorder, the presented odds ratios will be adjusted for these confounders.

2.3.2 Prevalence rates

Table 2 presents the prevalence rates according to the level of urbanization.

Table 2: 12-Month prevalence of psychiatric disorders among adults (18-64 years) in the Netherlands by degree of urbanization (percentages weighted by sex, age and marital status).

	Degree of urbanization										
	Very highly urbanized *n* = 1,242		Highly urbanized *n* = 1,497		Moderately Urbanized *n* = 1,541		Not very urbanized *n* = 1,611		Not urbanized *n* = 1,185		
DSM-III-R diagnosis	% (SE)	*n* of cases	% (SE)	*n* of cases	% (SE)	*n* of cases	% (SE)	*n* of cases	% (SE)	*n* of cases	*P* for trend
Mood disorders*	10.4 (0.9)	129	8.9 (0.7)	133	7.3 (0.7)	112	6.2 (0.6)	100	5.3 (0.7)	63	0.000
Major depression (296.20–296.34)	7.9 (0.8)	98	6.8 (0.7)	102	5.4 (0.6)	84	4.9 (0.5)	78	3.6 (0.5)	43	0.000
Dysthymia (300.40)	2.8 (0.5)	35	2.5 (0.4)	38	2.2 (0.4)	34	2.6 (0.4)	41	2.3 (0.4)	27	0.469
Anxiety disorders**	14.4 (1.0)	179	13.7 (0.9)	205	11.5 (0.8)	178	11.4 (0.8)	184	10.8 (0.9)	128	0.002
Panic disorder (300.01;300.21)	2.5 (0.4)	31	2.7 (0.4)	40	2.1 (0.4)	33	1.9 (0.3)	31	1.7 (0.4)	20	0.069
Simple phobia (300.29)	7.9 (0.8)	98	7.7 (0.7)	115	6.6 (0.6)	102	7.0 (0.6)	112	6.0 (0.7)	72	0.069
Social phobia (300.23)	6.4 (0.7)	79	5.0 (0.6)	75	4.2 (0.5)	64	4.1 (0.5)	67	4.2 (0.6)	49	0.007
Substance use disorders	11.2 (0.9)	139	9.3 (0.8)	139	11.2 (0.8)	173	6.6 (0.6)	107	5.8 (0.7)	69	0.000
Substance abuse disorders	5.8 (0.7)	72	6.0 (0.6)	90	6.1 (0.6)	95	2.8 (0.4)	46	3.5 (0.5)	42	0.000
Substance dependence disorders	5.7 (0.7)	71	3.5 (0.5)	53	5.3 (0.6)	82	4.0 (0.5)	64	2.6 (0.5)	31	0.006
Alcohol abuse (305.00)	4.9 (0.6)	61	5.6 (0.6)	84	6.0 (0.6)	93	2.6 (0.4)	42	3.5 (0.5)	42	0.003
Alcohol dependence (303.90)	5.1 (0.6)	63	3.1 (0.5)	47	4.2 (0.5)	65	3.4 (0.5)	55	2.3 (0.4)	27	0.007
One or more DSM-III-R-diagnoses***	28.0 (1.3)	347	24.5 (1.1)	366	24.2 (1.1)	373	20.5 (1.0)	330	18.6 (1.1)	221	0.000

* Includes major depression, dysthymia and bipolar disorder
** Includes panic disorder, simple phobia, social phobia, agoraphobia, generalized anxiety disorder, obsessive compulsive disorder
*** Includes mood disorders, anxiety disorders, substance use disorders, schizophrenia and other non-affective psychotic disorders, and eating disorders

The prevalence of one or more disorders increased linearly with the level of urbanization (see last line in table 2). Trend analysis showed a significant urban-rural trend ($p < .001$). The relationship to urbanization was clear for the category of mood disorders ($p < .001$). This pattern was also found specifically for major depression ($p < .001$). However, the prevalence of dysthymia was not related to urbanization.

The prevalence of the category of anxiety disorders also showed a significant urban-rural trend ($p = .002$). Looking at the separate anxiety disorders, there was also a significant difference for the categories of social phobia. There was no significant urban-rural trend for the categories of panic disorder and simple phobia.

There was a significant urban-rural trend for rates of substance use disorders ($p < .001$). In addition, there were significant trends in all subcategories of substance use disorders. Most rates of substance use disorders did indicate a 'gap' between the three most urbanized categories and the two least urbanized categories.

2.3.3 Comorbidity

For patients with at least one diagnosis, the association between the number of comorbid disorders and urbanization is presented in table 3.

Table 3: 12-Month psychiatric comorbidity percentage among cases (12-month prevalence) in the Netherlands by degree of urbanization (percentages weighted by sex, age and marital status).

	Degree of urbanization					
Number of diagnoses (%) of people with one or more DSM-III-R-diagnoses	Very highly urbanized % (*n*)	Highly urbanized % (*n*)	Moderately urbanized % (*n*)	Not very urbanized % (*n*)	Not urbanized % (*n*)	χ^2-test
1 diagnosis	61.6% (232)	59.9% (214)	69.3% (243)	70% (216)	67.8% (146)	$Chi^2 = 25.6$
2 diagnoses	19.8% (76)	21.8% (80)	14.8% (53)	16.2% (51)	22.2% (49)	$F = 1.94$
3 diagnoses	7.6% (31)	10.3% (40)	7.6% (29)	7.1% (24)	6.3% (15)	$P = 0.026$
4 or more diagnoses	11.0% (42)	8.1% (29)	8.2% (30)	6.7% (21)	3.8% (8)	
% Comorbidity of cases	38.4% (149)	40.1% (149)	30.7% (112)	30.0% (96)	32.2% (72)	
Total	100% (381)	100% (363)	100% (355)	100% (312)	100% (218)	

Overall, there was a significant positive relation between urbanization and the number of diagnoses (p = .026). The percentage of four or more diagnoses was highest in the most urbanized category. However, the percentage of three diagnoses was highest in the second most urbanized category. Overall, the percentage of detected cases with two or more diagnoses is highest in the most urbanized categories.

2.3.4 Adjustment for confounders

In addition to unadjusted Odds Ratios, we calculated ORs adjusted for sex, age, education, household income, occupational status and composition of the household (table 4).

The adjusted ORs show whether urbanization remains related to prevalence rates after adjustment for the influences of competing determinants. The relative difference between unadjusted rates and adjusted rates in order of size was –2% for anxiety disorders, +13% for total prevalence rates, +20% for mood disorders and +34% for substance abuse disorders. If we consider a difference greater than 10% as important (Rothman & Greenland, 1998) then these differences are important, with the exception of the difference for anxiety disorders. However, after these adjustments, urbanization was still positively related to the prevalence of one or more disorders and to the prevalence of the separate categories of mood disorders, anxiety disorders and substance use disorders. Although the range of the odds ratios for the five categories of urbanization was generally narrower after adjustment, the trend analysis still indicated highly significant urban-rural trends for all main diagnostic groups (all p <.005).

Table 4: Odds ratios by degree of urbanization, based on the 12-month prevalence of psychiatric disorders among adults (18-64 yrs) in the Netherlands (adjusted for gender, age, education, household income, social and occupational status and household composition).

Degree of urbanization	Mood disorders			Anxiety disorders			Substance abuse disorders			One or more DSM-III-R-diagnoses		
	Adj. odds-ratio	95% BI	Unadj. odds-ratio	Adj. odds-ratio	95% BI	Unadj. odds-ratio	Adj. odds-ratio	95% BI	Unadj. odds-ratio	Adj. odds- ratio	95% BI	Unadj. odds-ratio
Very highly urbanized	1.75	1.25–2.45	2.1	1.47	1.13–1.91	1.44	1.74	1.23–2.47	2.33	1.56	1.27–1.93	1.77
Highly urbanized	1.66	1.20–2.31	1.71	1.41	1.10–1.81	1.3	1.49	1.05–2.11	1.72	1.4	1.15–1.73	1.42
Moderately urbanized	1.32	0.94–1.85	1.32	1.13	0.87–1.46	1.06	1.78	1.26–2.50	1.81	1.31	1.07–1.60	1.27
Not very urbanized	1.30	0.93–1.82	1.22	1.22	0.95–1.57	1.13	1.10	0.77–1.58	1.14	1.25	1.02–1.53	1.16
Not urbanized	1.00	–	1.00	1.00	–	1.00	1.00	–	1.00	1.00	–	–
P for trend	0.000		0.000	0.002		0.002	0.001		0.000	0.000		0.000

2.4 Discussion

The distinction between five categories of urbanization did show that differences in prevalence rates are considerable, particularly between the very highly urbanized municipalities on the one hand and the non-urbanized municipalities. The most urbanized category had a prevalence rate for one or more disorders that was 77% higher than the least urbanized category. After adjustment for demographic differences, the prevalence rate was still 56% higher, showing that demographic differences only partly explain the urban-rural difference. Not only did the prevalence rates show a positive relation with urbanization, comorbidity rates did also as the percentage of detected cases having two or more diagnoses was highest in the most urbanized categories. Furthermore, the distinction between five categories of urbanization revealed that, for most diagnostic groups, there is a linear trend of rising prevalence rates according to degree of urbanization.

Before discussing the significance of these results for mental health services, we should know how survey data and utilization data relate. There are no utilization data available for all Dutch inhabitants relating to the degree of urbanization. However, we learnt from the NEMESIS survey that the proportion of people with a psychiatric disorder attending mental health services did not differ between rural and urban communities (Bijl & Ravelli, 2000). This implies that utilization rates will have approximately the same urban-rural ratio as the prevalence rates found in this study, since they are 77% higher in urban areas compared to rural areas, while the proportion of cases with comorbidity is also higher. This higher utilization figure puts a strain on the mental health services in urban areas since the distribution of funds does not generally keep up with the need for services. The consequences are, for instance, longer waiting lists and pressure to keep treatments and admissions short. When the availability of services is limited, the quality of care has to be monitored closely. An indirect way of coping with higher demand for mental health care in strongly urbanized areas is to put extra effort into prevention activities. Ideally, maintaining a match between the provision of services and demand for mental health care would be the best option since, in the case of under-provision, other social institutions and society will have to bear the 'costs'. Urbanization may therefore be a useful indicator for allocating mental health funds and services.

When comparing our findings from NEMESIS with the Dutch figures from the European ESEMeD 2000 study (Kovess-Masfety et al., 2005), we suppose that the sample sizes primarily account for the difference between the findings. While our study has 7076 respondents (17% of whom are from strictly rural municipalities), the Dutch part of ESEMeD comprised only 2371 respondents (5% of whom were from rural municipalities). Furthermore, people over 65 were included in ESEMeD,

while our sample only covers people in the range 18-64 years. These differences may explain why, contrary to our findings, no significant urban-rural differences were found in ESEMeD for the Netherlands.

Comparison with surrounding countries shows that Great Britain (Paykell et al., 2000; Weich et al., 2006), France (Kovess-Masfety et al., 2005) and Germany (Kovess-Masfety et al., 2005; Dekker et al., 2008) also have urban-rural odds ratios above one which are, however, not always significant. On the other hand, the findings for the neighbouring country of Belgium were strikingly different (Kovess-Masfety et al., 2005) as the rate for any disorder was significantly higher than total urban rates. This is an exceptional finding in the field, which should caution us against generalizing results.

A limitation of this study is that homeless people were not included in the sample. Nor were people staying in psychiatric hospitals. These factors result in the underestimation of prevalence rates for the most urbanized municipalities in particular. So when generalizing these results we have to keep in mind that the real urban-rural difference is actually slightly more pronounced.

NEMESIS was the first large national representative population study of psychiatric morbidity in the Netherlands (Bijl et al., 1998a, 1998b). This study opened up the opportunity to adjust for a range of confounders. There were urban-rural trends in unadjusted prevalence rates, and this relationship remained after adjustment for these confounders. Generally, ratios were lowered by adjustment, but the trends remained significant. It is difficult to give an unequivocal explanation for the robust urban-rural differences found in the Netherlands. The two main hypotheses used in the field are the "breeder hypothesis" and the "drift hypothesis" (Verheij et al., 1998). The first hypothesis is that people in highly urbanized communities suffer from psychiatric syndromes because of environmental stressors, such as a lack of social cohesion, restricted living space, over-stimulation, low-quality housing and the higher prevalence of criminality (Halpern, 1995; Dalgard & Tambs, 1997; Pedersen & Mortensen, 2001). The second explanatory hypothesis – the "drift hypothesis" – assumes that selective migration may take place, resulting in a concentration of the mentally ill in more urbanized environments. Although concentrations of, in particular, schizophrenic patients in deprived inner-city areas have often been documented (Faris & Dunham, 1939; Giggs & Cooper, 1987), evidence concerning the drift process within cities is sparse (Dauncey et al., 1993). The number of available studies, and therefore evidence, about urban-rural drift is also sparse (Moorin et al., 2006; Pedersen & Mortensen, 2006). In summary, the literature provides some evidence for the breeder hypothesis, but there is no evidence available for urban-rural drift processes, possibly due to the low number of studies.

2.5 Conclusion

By presenting five categories of urbanization, this study was able to specify further the relationship between urbanization and the prevalence of psychopathology in the Netherlands. In summary, the study confirms that psychiatric disorders are both more common and more complex (comorbidity) in more urbanized areas. This should be reflected in service allocation. The urban-rural differences found may be related to environmental risk factors, although drift processes cannot be ruled out.

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