Chapter 7

Urbanisation as a risk indicator for psychiatric admission

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Abstract

Objective: This study examines the independent effect of urbanisation on the risk for admission irrespective of age, sex and marital status.
Method: Logit analysis was performed on a dataset containing all first admissions to Dutch general psychiatric hospitals and psychiatric teaching clinics in 1991.
Results: Unmarried people and people living in urbanised municipalities have an increased risk of admission in all diagnostic groups analysed. People over 45 have an increased risk of admission for affective psychosis and organic psychosis. Women have an increased risk of affective psychosis.
Conclusion: A high level of urbanisation increases the risk of admission in the diagnosis groups studied. However, being unmarried is a higher risk factor.

7.1 Introduction

In general, admission rates for mental disorders are higher in urban areas than in rural areas (Eaton, 1974; Cagle & Banks, 1986; Keatinge, 1987; Thornicroft et al., 1993). In the Netherlands, it has also been found that this applies to inpatient utilisation rates (Sytema, 1991; Dekker et al., 1997; Peen & Dekker, 1997). Sytema (1991) found, in the province of Drenthe, that urbanisation was positively correlated to admission rates for four different diagnostic groups, after correction for sex, age and marital status. In a national study, Dekker et al. (1997) found that the admission rate for the whole of the Netherlands was twice as high in the group of most highly urbanised municipalities (in a set of five categories in total) as in the group of least urbanised municipalities. It is important to point out here that inpatient capacity is spread almost evenly across all municipalities in the whole of the Netherlands, with the exception of the allocation of a small amount of additional capacity to the four largest municipalities of the Netherlands (Amsterdam, Rotterdam, Den Haag and Utrecht).

Recently, it emerged that the urban/rural variations in admission rates in the Netherlands is reflected in true psychiatric morbidity rates. The Netherlands Mental Health Survey and Incidence Study (NEMESIS) (Bijl et al., 1998) found an urban/rural difference in total annual prevalence figures for psychiatric disorders in the population (Peen et al., 2002). The difference was also found for the separate disorders, mood disorders and substance-induced disorders, but not for anxiety disorders. The variations found were large compared to other findings outside the Netherlands (Dohrenwend & Dohrenwend, 1974; Mueller, 1981; Blazer et al., 1985).
In this article, we wish to examine the relative influence of sex, age, marital status and urbanisation in the Netherlands on the admission rate in total and on the rate for separate diagnostic groups. It is expected that urbanisation, even after correction for sex, age and marital status, will be a significant explanatory factor for admission rate.

7.2 Methods

7.2.1 Dependent and independent variables

First of all, in 1991, it was established how many people in all Dutch municipalities were admitted to inpatient psychiatric facilities. In the Netherlands, psychiatric patients can be admitted to two sorts of hospital: General Psychiatric Hospitals (GPH) or General Hospitals (GH). Most psychiatric patients are admitted to the former. In 1991, there were 50 GPHs with a capacity of approximately 21,900 beds for a resident population of approximately 15,000,000. In addition, psychiatric patients are often admitted to Psychiatric Units (GHPU) or Psychiatric Teaching Clinics (PTC) linked to General Hospitals. In the Netherlands in 1991, there were 54 GHPUs and 6 PTCs with a joint capacity of approximately 2,200 beds.
This study collated all admissions to GPHs and PTCs in 1991. A national registration system (Patient Registration for Inpatient Mental Health Care (PRIMHC), 1993) records all admissions to these units. It was not possible to include admission data for the GHPUs (14,400 admissions in 1991; Jacobs et al., 1993) in the analysis because marital status is not included in the National Medical Register for General Hospitals in which these admissions are recorded.
The PRIMHC was used to establish a dataset with all first admissions in 1991 to a GPH or PTC. The information for each patient included age, sex, marital status, diagnosis at admission (ICD-9), and the municipality in which the patient was resident. The level of urbanisation was linked to the municipality.
The Dutch Central Statistical Office, Statistics Netherlands, determines the degree of urbanisation for every municipality, revising its findings annually. Since 1992, the simple single-dimensional and numerical unit of measurement it uses for this

purpose is the 'area address density' (den Dulk et al., 1992), which measure (of the year 1992) was used in this study. In simple terms: the number of addresses in the immediate vicinity is determined for every address (of a residence, business or organisation) in the Netherlands. An address here is a postal address, i.e. individual house/flat number + street name, town and post code. The area address density is calculated by means of a screen of squares of 500 by 500 meters 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 neighbouring/surrounding squares of which the centre lies within a radius of 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 area address density has some advantages over the widely-used population density measure, especially when it is applied at the level of municipalities. Municipalities differ in terms of uncultivated surface area. It is therefore possible for two municipalities to vary considerably in terms of population density while the actual living conditions of the inhabitants are on average the same. The area address density provides partial correction for this artefact since addresses in the neighbouring area of municipalities are also incorporated in the calculation. Another difference is that addresses of businesses and organisations are included in the area address density. All economic buildings, i.e. all buildings, are incorporated. In the population density, by contrast, only places of residence are processed. This means that industrial areas have the same impact as, for instance, agriculture. Despite these differences, there is still a strong correlation between these two measures of urbanisation (.85 ; $p < .000$; $n=647$).

After determining the average area address density for every municipality, Statistics Netherlands placed each municipality in one of five categories: very highly urbanised, highly urbanised, moderately urbanised, not very urbanised, not urbanised. In addition, data is also available concerning the size of municipal populations (Peen & Dekker, 1997).

7.2.2 Statistical analyses

In order to determine the effects of the individual risk factors, and also to determine possible interactions between risk factors, it was decided to use logit analysis (Wickens, 1989; Sytema, 1991). This technique uses the independent variable as the natural logarithm of the odds of two frequencies (the log odds). Here, the odds are the quotient of the number of patients and the number of non-patients. The number of non-patients per population category (here, there are $2^4=16$ categories) is determined on the basis of Statistics Netherlands population data.

The independent variables can have several interval categories but, in order to limit the number of possible interactions, the independent variables are also broken down as follows:

sex: male/female;
age: 15-45 years of age/45 and older;
marital status: married/unmarried;
urbanisation: urban/rural.
With respect to urbanisation, the very highly urbanised and highly urbanised categories make up the category 'urban' and the other three municipal categories constitute 'rural'.
The logit analysis was conducted for five categories of diagnosis: schizophrenia (ICD-9 code 295), affective psychosis (code 296), organic psychosis (codes 290, 293-294), other psychoses (codes 291-292, 297-299), and neurotic and personality disorders (codes 300-319, V61 and V62).

7.3 Results

Table 1 shows the logit models for each diagnosis category.

The result of a logit model, the log odds, is determined by adding up the constant and the parameters. The odds can then be determined using the anti-log of the log odds. The more negative the log odds, the shorter the odds. The models only include variables and their parameters which make a significant contribution to the models ($p < .05$). The category to which the given parameter applies is stated between brackets alongside each independent variable in the first column. When the category is not stated (for example, men for the variable sex) the sign for the stated parameter is reversed. In the case of the interactions, the stated parameter is applicable if the interacting variables have the same sign (for example, women aged 45 or older or men under the age of 45), and for other combinations the sign is reversed. For example, the odds (patients/non-patients) of affective psychosis in unmarried aged 45 or older living in a rural setting is: the anti-log of (-8.00+0.28+0.40+0.38-0.13-0.04-0.08+0.08) = 0.00082.
It is clear that all risk factors in all diagnosis categories play a role in terms of the risk of admission, either as independent factors, or in interaction with another factor. As an independent factor, sex plays a role in affective psychosis (the risk for women is higher) and organic psychoses (risk higher for men). Being aged under 45 is a slight risk factor in schizophrenia, other psychoses and neurotic/personality disorders. By contrast, an age of 45 or older is the major risk factor in affective and organic psychoses. Being unmarried turned out to be a considerable risk factor in all models and most of all in schizophrenia. Living in urban areas

Table 1: Logit models and correlation between estimated and observed risk of admission (in Dutch municipalities, n=647) for five diagnostic categories and all admissions.

	Schizophrenia	Affective psychosis	Organic psychosis	Other psychoses	Neurotic and personality disorders	All patients (incl. other diagnoses)
Constant	−8.79	−8.00	−9.60	−8.31	−7.30	−6.35
Sex (women)		0.28	−0.11		0.03	0.05
Age (≥ 45 years)	−0.07	0.40	1.28	−0.04	−0.14	0.08
Marital status (married)	−1.15	−0.38	−0.52	−0.68	−0.57	−0.62
Urbanisation (rural)	−0.35	−0.13	−0.23	−0.14	−0.18	−0.19
Sex × age		−0.04			−0.10	−0.03
Sex × marital status	0.32	0.08	−0.09	−0.17	0.12	0.13
Age × marital status		−0.08	−0.16	−0.12		−0.03
Sex × urbanisation					−0.03	
Age × urbanisation				0.05		0.02
Marital status × urbanisation						
Number of admissions	3,151	4,164	1,312	3,370	9,349	22,729
Likelihood ratio	3,674, df = 4, p < 0.001	1,511, df = 7, p < 0.001	1,944, df = 6, p < 0.001	1,556, df = 6, p < 0.001	3,770, df = 7, p < 0.001	8,882, df = 8, p < 0.001
Correlation between the observed and estimated admission risk (Dutch municipalities, n = 647)	R = 0.34, p < 0.001	R = 0.17, p < 0.001	R = 0.18, p < 0.001	R = 0.23, p < 0.001	R = 0.26, p < 0.001	R = 0.37, p < 0.001

increased the risk of admissions slightly in all groups but is not a major influence anywhere. There are some interactions which make a substantial contribution to the models. Sex in combination with marital status has a particularly strong effect on schizophrenia, other psychoses and the total. Age in combination with marital status plays a particularly important role in the case of organic psychoses and other psychoses. Married people in the youngest age group and unmarried people in the oldest age group have an increased risk of admission for these disorders.
The correlations between the observed odds for the Dutch municipalities (n=647) and on the basis of the odds calculated on the basis of the models (bottom row of table 1) are all significant and highest for the total and for schizophrenia. Closer inspection showed that the correlations were higher among the group of highly urbanised municipalities (n=53) than among the less urbanised municipalities (n=594) at .57 and .29 respectively (both p<0.001).

7.4 Discussion

One might ask what effect the absence of GHPU admissions had on the results. There is relatively little GHPU capacity in the very highly urbanised areas so that the effect of urbanisation will be slightly overestimated when the GHPU admissions are left to one side. Previous studies have shown, however, that there is a fairly strong positive correlation between admission rates and urbanisation when GHPU admissions are included (Dekker et al., 1994).

For two of the diagnosis groups distinguished here, namely schizophrenia and affective psychoses, it is possible to make a comparison with the study carried out by Sytema (1991) in the Dutch province of Drenthe. The logistical models found here for these two diagnosis groups broadly matched the models which were found on the basis of admissions in Drenthe. One difference is that Sytema (1991) found an interaction for schizophrenia between marital status and age which was not found here. Sytema (1991) provides no assessment of the predictive value of the models. The explanatory power of the models proved to be limited in the national situation, particularly for municipalities with low levels of urbanization (generally small municipalities in terms of the number of inhabitants).

The high admission rates found previously in highly urbanised municipalities (Dekker et al., 1997) can now be explained mainly by the larger proportion of unmarried inhabitants there and, to a limited extent, by the level of urbanisation as such. It is legitimate to ask what the underlying factors are for the independent effect of urbanisation, in addition to the effect exerted by the make-up of the population.

It is probable that the link we found between the increase in the prevalence of psychiatric disorders and urbanisation (Bijl et al., 1998; Peen et al., 2002) (adjusted for sex, age and marital status) constitutes an important explanation for higher admission rates. Another explanation for the independent factor urbanisation is that, in general, most urban municipalities have a relatively large population of homeless people with psychiatric problems and chronic psychiatric patients, especially since the deinstitutionalisation in the past decade.

In addition to the increase in the prevalence of psychiatric disorders with urbanisation, it is also possible that there may be differences in 'the pathway to care' (Goldberg & Huxley, 1980). The Nemesis study, however, found that urban inhabitants with a psychiatric disorder did not use mental health care facilities more often than rural inhabitants (Bijl & Ravelli, 2000) so this explanation for higher admission rates seems unlikely. Other possible explanatory factors of this kind, some of which were examined in foreign studies but not in the Dutch literature, are differences in referral patterns (Goldberg & Huxley, 1980), distance to facilities (Joseph & Phillips, 1984), less community support in the more urbanised areas, selective migration (social residue hypothesis; Freeman & Alpert, 1986), more social stress because of the high population density and the small average size of housing.

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