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Review

The current status of urban-rural differences in psychiatric disorders

Peen J, Schoevers RA, Beekman AT, Dekker J. The current status of urban–rural differences in psychiatric disorders.

Objective: Reviews of urban–rural differences in psychiatric disorders conclude that urban rates may be marginally higher and, specifically, somewhat higher for depression. However, pooled results are not available.
Method: A meta-analysis of urban–rural differences in prevalence was conducted on data taken from 20 population survey studies published since 1985. Pooled urban–rural odds ratios (OR) were calculated for the total prevalence of psychiatric disorders, and specifically for mood, anxiety and substance use disorders.
Results: Significant pooled urban–rural OR were found for the total prevalence of psychiatric disorders, and for mood disorders and anxiety disorders. No significant association with urbanization was found for substance use disorders. Adjustment for various confounders had a limited impact on the urban–rural OR.
Conclusion: Urbanization may be taken into account in the allocation of mental health services.

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Key words: meta-analysis; mental illness; prevalence; rural health; urban health

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Summations

- Pooled total prevalence rates for psychiatric disorders were found to be significantly higher in urban areas compared with rural areas. Specific pooled rates for mood disorders and anxiety disorders were also significantly higher in urban areas, while rates for substance use disorders did not show a difference.
- Adjustment for confounders had limited impact on urban–rural odds ratios found, which shows that urban–rural differences in prevalence rates are only partly explained by population characteristics.
- Urbanization may be taken into account in the allocation of mental health services.

Considerations

- There was heterogeneity in the dataset which might not be explained by urban–rural differences. However, possible sources of this heterogeneity that were analysed (culture, diagnostic method, diagnostic variation within diagnostic categories analysed) did not show significant differences in outcome.
- The meta-analysis was limited to developed countries.
- Schizophrenia was not included as a separate category.

Introduction

Generally, social problems and environmental stressors are more prevalent in cities than in the country. Areas with high population densities are characterized, for instance, by higher rates of criminality, mortality, social isolation, air pollution and noise (1). As the extent of various social problems is related to urbanization, it is often assumed that rates of psychiatric disorders are also correlated with urbanization. A frequently cited milestone in the study area of urban–rural differences in the prevalence of psychiatric disorders is the study by Dohrenwend and Dohrenwend (2).

This review of nine urban–rural comparisons was based on studies from 1942 to 1969 from quite diverse countries. The authors concluded that there was a tendency towards higher total rates of psychiatric disorders in urban areas. However, there was a variation in the difference depending upon the specific diagnostic category. Rates for neurosis and personality disorders were higher in urban areas, while rates for functional psychoses combined and manic-depressive psychoses separately were higher in rural areas. There was no clear trend in the rates for schizophrenia.

Since Dohrenwend and Dohrenwend (2) a number of reviews have followed (3–7), generally showing marginally higher overall rates in urban areas and, specifically, somewhat higher rates for depression. However, there is no clear trend in the outcomes, which often lack statistical significance as the studies were not pooled.

Furthermore, a number of factors may have complicated the study of a possible association between urbanization and psychopathology. First of all, definitions of 'urban' and 'rural' may vary (4). Generally, 'urban' refers to large conglomerates of people, usually in a relatively small area, resulting in relatively high population densities. The use of the term 'relatively' makes it clear that what some countries define as 'urban' using definitions from national statistical institutions or research may be defined as 'rural' in another country. The United Nations have defined an 'urban locality' as having at least 20 000 people, and a city as having at least 100 000 people (8). However, this definition was not used in any study cited here. Secondly, the concrete manifestation of urban and rural phenomena varies widely around the world. The Netherlands, for instance, does not have any metropolis such as London or New York, and the Dutch countryside is much more populated than the countryside of Arkansas.

Thirdly, there may be other cultural differences between studies and countries. The Dohrenwend & Dohrenwend review (2) covers a wide variety of cultures (7), and this may detract from the external validity of its findings.

Fourthly, there is considerable heterogeneity in the methods used in the available literature. Outcome measures vary from self-report psychological wellbeing scales to case definition by structured interviews, and prevalence rates may or may not be adjusted for different types of confounders. Since 1984, study designs have gradually improved, enhancing the validity of results. The five reviews from Dohrenwend and Dohrenwend to Marsella (2–7) were based partially on older designs, and partially on more recent, and more sophisticated designs. In line with this heterogeneity, none of the previous reviews was able to pool the data and perform meta-analyses.

Aims of the study

This study sought to investigate the links between urbanization and psychopathology in a meta-analysis using only studies of higher methodological quality with adjustment for important confounders. Bias through cultural and environmental variation was limited by including only studies from developed countries. This allowed us to establish more accurately the existence and magnitude of potential urban–rural differences in levels of psychopathology. Establishing urban–rural differences for psychiatric disorders not only has scientific value – by extending our models with factors that affect the onset of mental disorders – but may also have consequences for the allocation of mental health resources to areas with higher levels of urbanization.

Material and methods

Selection criteria

We included population surveys presenting urban–rural differences in psychiatric disorders since 1985. We restricted our study to developed countries. The studies included were all based on reliable diagnostic processes using standardized structured interviews.

We present studies dealing with total rates of psychiatric morbidity, mood disorders, anxiety disorders and substance use disorders. For 'mood disorders', rates for major depressive episodes were used when available. In the absence of rates for major depressive episodes, rates for combinations of mood disorder were used. In the area of 'substance use disorders', rates for alcohol abuse or alcohol dependence (combined in some cases) were used when there were no total rates for substance use disorders. As stated above, there was variation in the diagnostic content within the diagnostic groups of which prevalence rates were pooled in this study. The rationale for this was that we wanted to include a reasonable number of studies in each diagnostic group. Furthermore, we have performed additional analyses if possible, to check for within-group variation in urban–rural associations due to differences in diagnostic content.

As reliable rates are generally difficult to establish for schizophrenia in standard population surveys due to the low prevalence of schizophrenia in the non-institutionalized community, we did not

include results for schizophrenia. Finally, we included only studies of adults or of all age groups.

Search strategy

Our database search comprised all publications from 1985 onwards containing the subject headings 'mental health' or 'mental disorders' and i) 'urban' and 'rural' or with ii) 'city residence', 'city born', 'city living'. The databases used were: all EBM reviews, Embase psychiatry, Medline and Psycinfo. A selection based on the abstracts was made from the initial search results (n = 620). Studies concerning less developed countries were also left out. We were left with 110 studies relating to the subject. Figure 1 shows the subsequent stepwise exclusion process.

Data extraction and statistical analysis

All the selected studies provided basic urban and rural prevalence rates or urban–rural odds ratios (OR) which had been at least controlled for age and gender. However, most studies also presented rates or OR adjusted for a wider range of variables (these are summed up for each study in Table 1). In this study, we refer to the first group of rates as 'unadjusted OR' (controlled for age and gender at best) and to the second group as 'adjusted OR' (adjusted for more than age and gender). If available, a 12-month rate was chosen as the outcome measure. Another available rate was used in other cases.

Unadjusted and adjusted OR with 95% confidence intervals were collected for all included studies. Some OR and confidence intervals could be calculated from the available numbers, even though they were not stated in the studies. Some stated only that there was no significant difference for urbanization or that urbanization was not a significant predictor in a logistic model. An OR of 1 is used for these cases in the figures.

When studies provided more than two categories of urbanization, the most extreme dichotomy – metropolis vs. rural, for instance – was chosen for the analysis. In all selected studies, the level of urbanization concerns the level or urbanization at the time of measurement.

The Review Manager (RevMan 4.2, Cochrane IMS, Oxford, UK) was used to perform meta-analyses. Log OR and their standard errors were entered in the program. The generic inverse variance option was used. Pooled ORs were estimated using random effect modelling as there was a high level of heterogeneity between included studies.

Two authors (JP and JD) acting independently were responsible for the reading and the extraction of data (including cross-checking) from the studies selected for the meta-analysis. Any differences in outcome were resolved by discussion.

Selected from database/literature search: 110

1) No urban–rural comparison related to the subject: 58

2) No population survey (utilization data): 11

3) Restricted to a diagnostic group outside our focus: 10

4) Restricted to a demographic subgroup: 1

5) No clear urban–rural distinction: 1

6) No dichotomous outcome measure: 1

7) Duplicate use of same data in different publications: 8

Remaining urban–rural comparisons for meta–analysis: 20

Fig. 1. The selection process within the initial search result.

Findings

Table 1 lists the 20 studies that were included. Looking at the number of studies per country, Great Britain, the Netherlands, Canada and the USA appear to be well represented. As far as the year of publication is concerned, 12 of the 20 studies were published after 2000, six in the 1990s and two in the period 1985–1989. Two European multi-country studies are presented in the table. The first is the ODIN study of depression covering Norway, Finland, Great Britain and Ireland (13). The second is the Esemed study covering France, Italy, Spain, Belgium, Germany and the Netherlands (15). Most studies presented 12-month prevalence rates (13/20). The age ranges ≥18 and 18–64 years were most common. Ten studies used the composite international diagnostic interview as the diagnostic instrument, three studies used the general health questionnaire screening instrument (other n = 7). The distinction between urban and rural areas was made in different ways. Straightforward approaches are 'interviewer judgement' (separately for each respondent), 'population size' and 'population density'. 'Concentration of addresses' is a measure of human activity, including industrial activity. 'Demographic characteristics' was also used for area classification.

Most studies used two categories to differentiate between urban and rural (the maximum number of

Table 1. Population-based prevalence studies included in meta-analysis of urban–rural differences in psychiatric disorders

Studies	Year of publication	Country	Disorder(s) (unadjusted rate)*	Disorder(s) (adjusted rate)*	Outcome measure	Age range (years)	Screening/ diagnostic instrument	Classification system	Sample size	Urban/rural categorization based on	No. categories	Adjusted for†
Europe												
Madianos & Stefanis (9)	1992	Greece	2	–	Point prev	18–64	CES-D	DSM-III-R	3706	Demogr. charact.	4	–
Hodiamont et al. (10)	1992	Netherlands	1	–	Point prev	18–65	GHQ/PSE	–	3232	Demogr. charact.	2	–
Lewis & Booth (11)	1994	Great Britain	1	1	Point prev	>18	GHQ	–	6572	Interviewer judgement	3	1,2,4,8,chronic illness
Paykell et al. (12)	2000	Great Britain	1.4	1.4	1 wk prev	16–64	CIS-R/US-NAS	–	9777	Interviewer judgement	3	1,2,3,4,5,6,8,life events,prim. supp. group, perceived soc. support,tenure,accomm. type
Ayuso-Mateos et al. (13)	2001	Finland, Great Britain, Ireland, Norway	2	–	12 m prev	18–64	BDI/SCAN	DSM-IV	7622	Demogr. charact.	2	–
Kovess-Masfety et al. (14)	2005	France	2	2	12 m prev	≥18	CIDI-S	DSM-IV	2628	Demogr. charact.	2	1,2,3,life events
Kovess-Masfety et al. (15)	2005	Belgium, France, Germany, Italy, The Netherlands, Spain	1,2,3,4	1,2,3,4	12 m prev	≥18	CIDI	DSM-IV	21425	Pop. size	2	1,3,8
Weich et al. (16)	2006	Great Britain	1	1	12 m inc	16–74	GHQ	–	7659	Pop. density/demogr. charact.	2	1,2,3,4,6,8,9,curr. health probl.,housing tenure, overcrowding,housing probl., househ. type
Kringlen et al. (17)	2006	Norway	1,2,3,4	–	12 m prev	18–65	CIDI	DSM-III-R	3146	Demogr. charact.	2	–
Peen et al. (18)	2007	The Netherlands	1,2,3,4	1,2,3,4	12 m prev	18–64	CIDI	DSM-III-R	7076	Concentration of addresses	5	1,2,5,9,occup. status,househ. comp.
Dekker et al. (19)	2008	Germany	1,2,3,4	1,2,3,4	12 m prev	18–64	CIDI	DSM-IV	4181	Pop. size/demogr. charact.	2	1,2,3,4, and interactions with urb.
North America												
Blazer et al. (20)	1985	United States	2,3,4	2,3,4	12 m prev	≥18	DIS	DSM-III	3798	Demogr. charact.	2	1,2,3,5,7,residential mob.
Kovess et al. (21)	1987	Canada	2	2	12 m prev	≥18	SCL29/WellB	DSM-III	3080	Demogr. charact.	3	1,2,3,5,life events
Kessler et al. (22)	1994	United States	–	1,2,3,4	12 m prev	15–54	CIDI	DSM-III-R	8098	Demogr. charact.	3	1,2,3,5,7,living arrangem.,region
Parikh et al. (23)	1996	Canada	2	–	12 m prev	≥15	UM-CIDI	DSM-III-R	9953	Demogr. charact.	2	–
Wang (24)	2004	Canada	2	2	12 m prev	≥12	CIDI	DSM-III-R	17244	Demogr. charact./pop. density	2	3,7,8,immigr. st.
Kessler et al. (25)	2005	United States	–	2,4	12 m prev	≥18	CIDI	DSM-IV	3199	Demogr. charact.	6	1,2,3,5,6,7,9
Rohrer et al. (26)	2005	United States	1	1	1 m prev	≥18	BRFSS	FMD	5757	Demogr. charact.	3	1,2,3,5,7,9,BMI
Other												
Lee et al. (27)	1990	South Korea	1,2,3,4	–	Lifet. prev	18–65	DIS-III	DSM-III	5100	Demogr. charact.	2	–
Andrews et al. (28)	2001	Australia	1,2,3,4	1,2,3,4	12 m prev	≥18	CIDI	ICD-10	10641	Pop. size	3	1,2,3,5,8,country of birth

*1 = total rate of psychiatric disorders; 2 = mood disorders; 3 = anxiety disorders; 4 = substance use disorders.
†1 = age; 2 = gender; 3 = marital status; 4 = social class; 5 = educational level; 6 = ethnicity; 7 = race; 8 = unemployment; 9 = income.
CIBI, composite international diagnostic interview; GHQ, general health questionnaire.

categories used was six). Eighteen of the 20 studies presented unadjusted OR, while 14 out of 20 presented adjusted ratios (12 presented both). Of the six studies without adjusted ratios, four dated from before 2000. Adjusted odds were generally adjusted for a large number of confounders (up to a maximum of 14). In Wang (24), the adjusted odds were not adjusted for age and sex in a logistic regression model, because these factors were not found to be a potential confounder in a preceding bivariate analysis.

In Table 2 the contents of the prevalence rates used in the pooled analyses are specified. Concerning prevalence rates for 'any disorder' some rates were based on diagnoses while other rates were based on cut-off scores. Concerning mood disorders some studies report total prevalence rates for mood disorders, while other studies report figures of major depression plus dysthymia or only major depression. Two of the studies reporting anxiety disorders only reported prevalence rates of distinct anxiety categories, as a total of anxiety disorders was not available. The studies reporting on substance use disorders can be divided in a group reporting on both alcohol and drug abuse and dependence, and in a second group only reporting on alcohol abuse and dependence.

Figure 2 presents a forest plot of unadjusted OR for 'any disorder' (16 comparisons), ordered by year of publication. The number of comparisons from European countries was much higher ($n = 13$) than from outside Europe ($n = 3$). Of the unadjusted OR, 56% indicated an urban–rural OR significantly higher than 1. Thirty-eight per cent of the studies presented no significant OR and one Belgian study (6%) found an urban–rural OR significantly less than 1 (15). Given the heterogeneity of the 14 studies, we used random effect modelling for the pooled result. The pooled unadjusted OR was 1.38 (1.17–1.64), $P < 0.001$. The pooled adjusted OR was slightly lower: 1.21 (1.09–1.34), $P < 0.001$ (14 comparisons; data not shown).

Figure 3 shows the unadjusted OR for mood disorders (21 comparisons). By contrast to the unadjusted odds for 'any disorder', the proportion of non-European comparisons was higher (29%; $n = 6$ non-European and $n = 15$ European). Thirty-three per cent of the studies found a significant urban–rural unadjusted OR higher than 1 for urban areas compared to rural areas,

Table 2. Specific contents of prevalence rates used in the meta-analysis of urban–rural differences in psychiatric disorders

	Unadjusted rates				Adjusted rates			
Studies	Total	Mood disorders	Anxiety disorders	Substance use disorders	Total	Mood disorders	Anxiety disorders	Substance use disorders
Europe								
Madianos & Stefanis (9)		1a						
Hodiamont et al. (10)	GHQ-30 ≥ 10/PSE > 4							
Lewis & Booth (11)	GHQ-30 ≥ 5				GHQ-30 ≥ 5			
Paykell et al. (12)	CIS-R ≥ 12			US-NAS-12 ≥ 3	CIS-R ≥ 12			US-NAS-12 ≥ 3
Ayuso-Mateos et al. (13)		1a						
Kovess-Masfety et al. (14)		1a			1a			
Kovess-Masfety et al. (15)	1a,b,2a,b,c,d,e,g,3a,b	1a,b	2a,b,c,d,e,g	3a,b	1a,b,2a,b,c,d,e,g,3a,b	1a,b	2a,b,c,d,e,g	3a,b
Weich et al. (16)	GHQ-12 ≥ 3				GHQ-12 ≥ 3			
Kringlen et al. (17)	1,2a,b,c,d,e,f,3a,b,c,d,4,5a,6	1a	2c	3a,b				
Peen et al. (18)	1,2a,b,c,d,e,f,3a,b,c,d,4,6	1	2a,b,c,d,e,f	3a,b,c,d	1,2a,b,c,d,e,f,3a,b,c,d,4,6	1	2a,b,c,d,e,f	3a,b,c,d
Dekker et al. (19)	1,2a,b,c,d,e,f,3a,b,e,4c,5	1	2a,b,c,d,e,f	3a,b,e	1,2a,b,c,d,e,f,3a,b,e,4c,5	1	2a,b,c,d,e,f	3a,b,e
North America								
Blazer et al. (20)		1a	2a	3a,b		1a	2a	3a,b
Kovess et al. (21)		1a,b				1a,b		
Kessler et al. (22)					1,2a,b,c,d,e,3a,b,c,d,4,8	1	2a,b,c,d,e	3a,b,c,d
Parikh et al. (23)		1						
Wang (24)		1a				1a		
Kessler et al. (25)						1a		3a,b,c,d
Rohrer et al. (26)	FMD ≥ 14 van 30				FMD ≥ 14 van 30			
Other								
Lee et al. (27)	1,2a,b,c,d,e,f,3a,b,c,d,4a,b, 5a,6a,7,8,9a,b	1	2a,b,c,d,e,f	3a,b,c,d				
Andrews et al. (28)	1a,b,2a,b,d,e,f,g,3a,b,c,d	1a,b	2a,b,d,e,f,g	3a,b,c,d	1a,b,2a,b,d,e,f,g,3a,b,c,d	1a,b	2a,b,d,e,f,g	3a,b,c,d

1 = mood disorders; 1a = major depression; 1b = dysthymia; 1c = bipolar disorder; 2 = anxiety disorder; 2a = agoraphobia; 2b = social phobia; 2c = simple phobia; 2d = panic disorder; 2e = GAD; 2f = OCD; 2g = PTSD; 3 = substance use; 3a = alcohol dependence; 3b = alcohol abuse; 3c = drug dependence; 3d = drug abuse; 3e = illicit drug use; 4 = non-affective psychosis; 4a = schizophrenia; 4b = schizophreniform disorder; 4c = possible psychotic disorder; 5 = somatoform disorder; 5a = somatization disorder; 6 = eating disorder; 6a = anorexia; 7 = gambling; 8 = antisocial personality disorder; 9a = mild cognitive impairment; 9b = severe cognitive impairment.
GHQ, general health questionnaire.

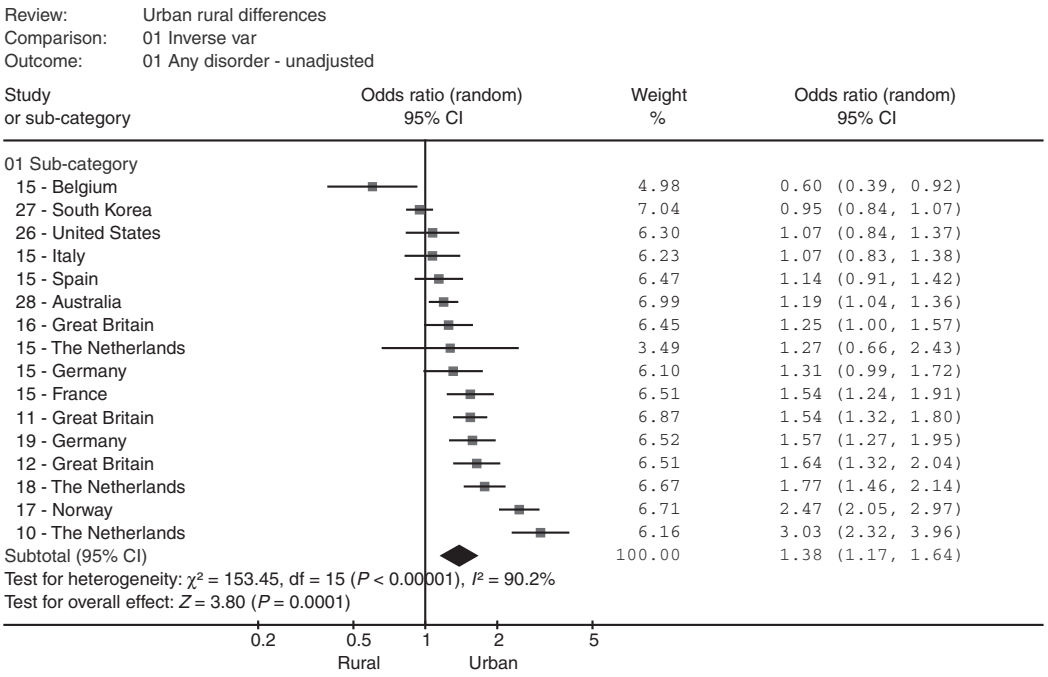

Fig. 2. Urban–rural comparisons of any disorder, unadjusted OR with 95% CI.

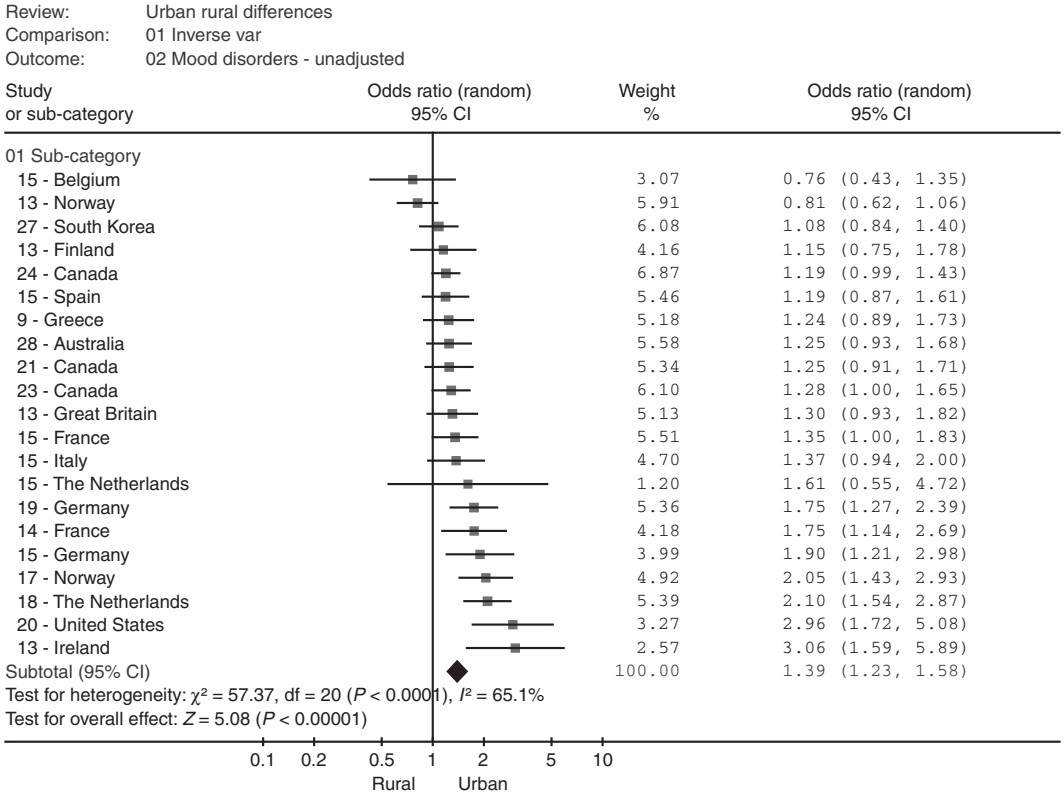

Fig. 3. Urban–rural comparisons of mood disorders, unadjusted OR with 95% CI.

while 67% of the studies presented no significant unadjusted OR. None of the studies found a significant urban–rural OR less than 1. The pooled unadjusted OR for mood disorders was 1.39 (1.23–1.58), $P < 0.0001$. The pooled adjusted OR was somewhat lower: 1.28 (1.13–

1.44), $P < 0.001$ (15 comparisons; data not shown).

Figure 4 shows the unadjusted OR for anxiety disorders (12 comparisons). The number of comparisons in this figure is lower ($n = 12$) than those for 'any disorder' ($n = 16$) or 'mood disorder' ($n = 21$). Of these 12, nine were from Europe and three from outside Europe. The majority of unadjusted OR indicated no difference (67%). Thirty-three per cent indicated an urban–rural OR significantly higher than 1. The pooled unadjusted OR for anxiety disorders was 1.21 (1.02–1.42), $P = 0.03$. The pooled adjusted OR was 1.13 (1.00–1.28), $P = 0.06$ (11 comparisons; data not shown).

Figure 5 shows the unadjusted OR for substance use disorders (13 comparisons). Of the 13 available comparisons, 10 were from Europe and three from outside Europe. As was the case with anxiety disorders, the majority of unadjusted OR indicated no difference (69%). Three studies found a significant urban–rural OR higher than 1 (23%) and

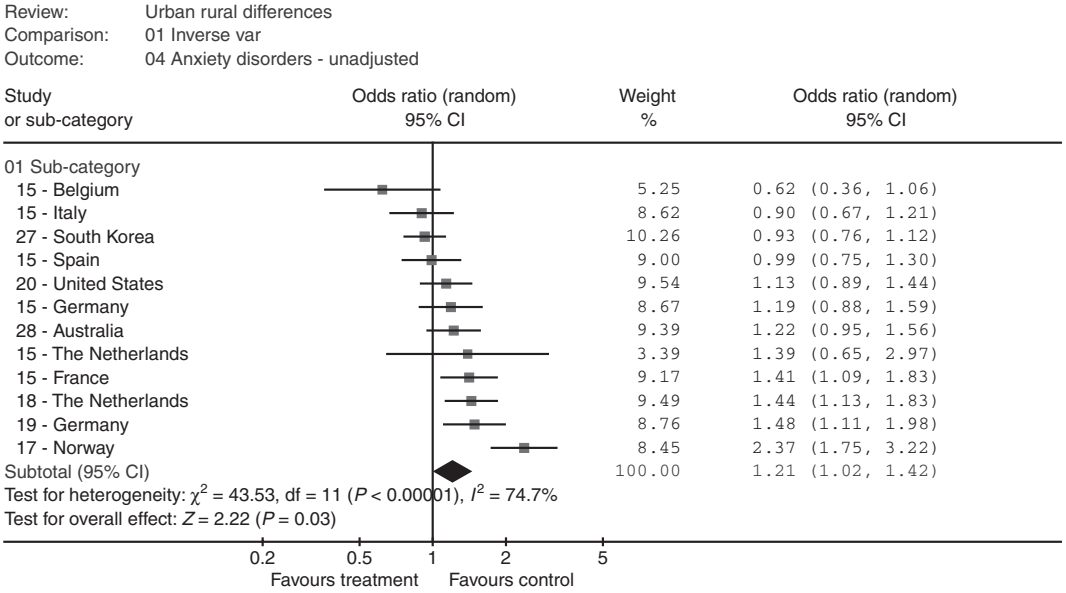

Fig. 4. Urban–rural comparisons of anxiety disorders, unadjusted OR with 95% CI.

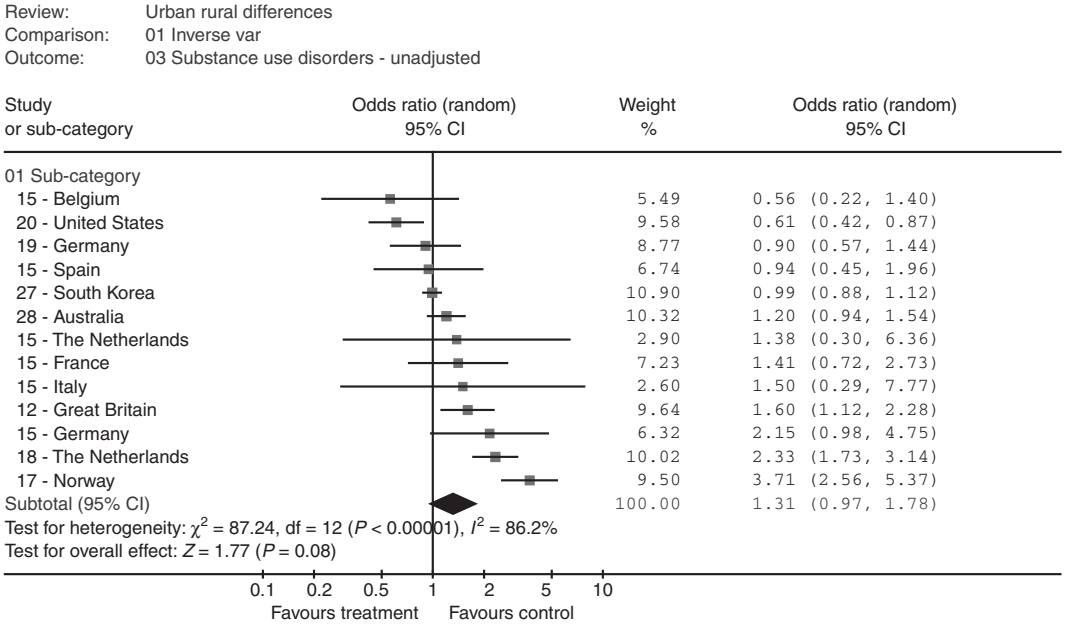

Fig. 5. Urban–rural comparisons of substance use disorders, unadjusted OR with 95% CI.

one study (8%) found a significant urban–rural OR less than 1. The pooled unadjusted OR was 1.31 (0.97–1.78), $P = 0.08$. The adjusted OR was 1.03 (0.85–1.26), $P = 0.74$ (13 comparisons; data not shown).

Heterogeneity

Several possible sources of heterogeneity, apart from urban–rural variations, can be put forward. These sources can be differences in culture or socioeconomic status of the countries involved, but also differences in the contents of the prevalence rates used and the way in which they were established (see Table 2). Therefore, we made some additional comparisons within the diagnostic categories reported in this study (if the available number of studies was sufficient to do so). To analyse possible heterogeneity due to culture, we compared the pooled (unadjusted) prevalence rate for mood disorders for European studies to the pooled rate for the North American studies (see Tables 1 and 2). No difference was found [1.44 (CI: 1.20–1.71) and 1.40 (CI: 1.08–1.82) respectively]. Furthermore, we analysed possible heterogeneity due to method in which prevalence rates were established in each study. Therefore, we compared prevalence rates for 'any disorder' based on diagnostic instruments to rates based on cut-off scores (see Tables 1 and 2). No differences were found in both unadjusted [1.30 (CI: 1.05–1.60) and 1.59 (CI: 1.18–2.13)] and adjusted rates [1.17 (CI: 1.01–1.35) and 1.29 (CI: 1.16–1.44)]. Subsequently, possible heterogeneity within diagnostic groups was analysed. First, within (unadjusted) rates for mood disorders, studies from which rates of major depression were used compared with other studies (mainly containing mood disorders in general; see Table 2). No difference was found [1.48 (CI: 1.15–1.90) and 1.36 (CI: 1.19–1.56)]. Likewise, within (unadjusted) rates for substance use disorders, we compared studies presenting rates for alcohol dependence and abuse to studies also including drug dependence and abuse. No difference was found [1.33 (CI: 0.79–2.25) and 1.26 (CI: 0.86–1.86)].

Discussion

This is the first meta-analysis investigating urban–rural differences in prevalence rates for common mental disorders. Using only higher quality studies performed since 1985 in high income countries, it was shown for both 'any disorder' (38% higher), mood disorders (39%) and anxiety disorders (21%) that the pooled urban prevalence rate was higher in urban areas compared with rural areas. No difference was found for substance use disorders. In addition, when controlling for important confounders, we found slightly lower, but statistically significant, pooled OR. While the number of confounders was generally considerable, this difference between adjusted and unadjusted ratios was limited, showing that urban–rural differences are only partly explained by population characteristics.

Although both the use of standardized diagnostic instruments and the extent to which findings are adjusted for potential confounders has significantly increased since the period before 1985, the current study thus confirms less systematically evaluated findings from earlier reviews (2–7).

One could argue that the association with urbanization presented here is low at 1.21 (1.09–1.34) for 'any disorder'. Compared to other factors associated with the prevalence of psychiatric disorders – such as being unmarried or childhood abuse – the strength of the association with urbanization is limited. Nevertheless, it remains intriguing that, even when controlling for a relatively large number of confounders, the urban environment seems to be associated with the prevalence of psychopathology. This association does not appear to be explained solely by population characteristics such as age, gender, marital status, social class or ethnicity. In line with studies examining the association between the urban environment and schizophrenia (29), we found that the urban environment appears to be associated with mental health. Further study is needed to establish whether this association can partly be explained by gene–environment interactions (30).

Furthermore, the practical implications of 34% more cases in urbanized areas are significant in terms of service allocation and healthcare budget. The allocation of more services to urban areas is not only desirable because of the prevalence rates, but also because comorbidity rates tend to be higher in urban areas (18, 22). Generally, the distribution of funds does not keep up with the extra need for services in urban areas. The consequences are, for instance, relatively long waiting lists and pressure to keep treatments and admissions short, putting the quality of care at risk. Ideally, a match between the provision of services and demand for mental health care is the best option. Based on our findings, urbanization may be a useful indicator for allocating mental health funds and services.

When interpreting these findings, a number of potential limitations should be addressed. Several possible sources of heterogeneity apart from urban–rural variation can be mentioned concern-

ing this study. As the analysis contains studies in a period of 20 years from all over the world there is possible heterogeneity due to diagnostic methods, culture and socioeconomic status for instance. Apart from this, also differences in the diagnostic contents of the prevalence rates used may be a source of heterogeneity. For instance, rates used for the analysis of mood disorders containing 'only' major depression may have a different relation to urbanization compared to rates containing all mood disorders. In addition, the latter contrast may also represent a difference in severity. In a secondary analysis we made some comparisons concerning possible heterogeneity due to culture (Europe vs. North America), diagnostic method (diagnostic instruments vs. cut-off scores) and diagnostic content (major depression vs. mood disorders as a whole and alcohol abuse/dependence vs. substance use disorders as a whole). These comparisons did not show any significant differences, which may lower concerns about systematic heterogeneity in this study.

It has to be taken into account that there is comorbidity between diagnostic groups reported in this study, for instance between anxiety and mood disorders. This means that some research subjects will be present in more than one comparison. A more or less similar point is that studies which are included in two or more diagnostic groups analysed here, have a relatively larger weight compared to studies which are only included in one diagnostic group.

A limitation of the study is that schizophrenia was not included as a separate diagnostic category. It is difficult to generate reliable prevalence rates for schizophrenia from general population studies due to both the low prevalence of schizophrenia in the non-institutionalized community, and to selective exclusion of these patients from population surveys (31). Accordingly, most of the studies in our analysis did not present rates for schizophrenia.

Our review included two multi-country studies (13, 15) (one deals with mood disorders only), and we presented the results for each of the individual countries. As there is a wide variation of outcomes between countries within these studies, and as the findings do not systematically differ from other studies, we believe this is the preferred strategy. Presenting ratios for the total study area only would have resulted in the loss of information about variation between countries within the areas. The Esemed study, for example, found that Belgium, which has higher total rural rates compared to urban rates, differs substantially from its neighbouring countries (15).

One could argue that using dichotomized measures for urbanization would underestimate the influence of this factor on levels of psychopathology. Using continuous measures or comparing the extremes of more than two categories of urbanization, would probably yield a significant difference more easily. However, most studies did not provide such data. Furthermore, this rule applies only to studies of large connected areas (countries, for example). However, the choice of either one or the other separate area in a 'twin study' has implications for the possibility of finding differences (7). When one chooses to compare one typically rural area with a metropolitan area, the initial differences in urbanization are probably greater than between the extremes of a division into five categories of a whole country. After all, 'urban' and 'rural' are relative concepts, and their operationalization will probably always differ between studies.

To explain inner-city and urban–rural variations in psychiatric morbidity, there are two main theoretical concepts, which originated from the early ecological research of schizophrenia (32) and from the Chicago School of Sociology (33): the drift hypothesis and the breeder hypothesis. The drift hypothesis assumes on the one hand that sick and vulnerable people are more or less doomed to remain in socially unstable, deprived neighbourhoods, while better off people move away (social residue theory; 34). On the other hand, socially deprived neighbourhoods can also have a 'pull-function' on sick and vulnerable people, as they move to these areas with low social control and greater tolerance towards deviant behaviour (social drift hypothesis). Evidence concerning drift processes is still sparse (6, 35). However, concentration of schizophrenic patients in deprived inner-city areas has been described in numerous ecological studies (32, 36). It remains to be seen however, if these supposed drift processes apply to all psychiatric illnesses. The second theory, the breeder hypothesis, assumes that various environmental factors cause illness. These can be physical factors (air pollution, small housing, population density) and also social factors (stress, life events, perinatal aspects, social isolation). A lot of the stress factors mentioned above are more common in urbanized areas (1, 37).Urbanization is modestly but consistently associated with the prevalence of psychopathology. This should be further examined in studies of the aetiology of mood and anxiety disorders in particular. Levels of urbanization should also be taken into account

when planning the allocation of mental health services.

Declaration of interest

None.

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