Int J Public Health 54 (2009) 283–293
1661-8556/09/040283-11
DOI 10.1007/s00038-009-8029-1

Original article

Neighbourhood socioeconomic indicators and depressive symptoms in the Czech Republic: a population based study

Jitka Pikhartova[1], Tarani Chandola[1], Ruzena Kubinova[2], Martin Bobak[1], Amanda Nicholson[1], Hynek Pikhart[1]

[1] *Department of Epidemiology and Public Health, University College London, United Kingdom*
[2] *National Institute of Public Health, Prague, Czech Republic*

Submitted: 27 February 2008; revised: 17 November 2008, accepted: 20 January 2009

Published online first: 27 April 2009

Abstract

Objectives: Previous research shows only limited evidence on the contextual (neighbourhood-based) socioeconomic influences on mental health and depression. We investigated the association between individual and neighbourhood socioeconomic characteristics and depressive symptoms in the Czech Republic.

Methods: Dichotomized CESD score of depressive symptoms was used as the outcome in a random sample of 3534 men and 4082 women aged 45–69 years in the Czech HAPIEE Study. 220 small areas were characterized by the proportion of university educated persons and the proportion of unemployed from the economically active population in the 2001 Census. Multilevel logistic regression was used for the analysis.

Results: After controlling for individual-level variables, the effects of area-based characteristics were largely eliminated. The strongest area-based effect was that of the proportion of university educated persons; the ORs for 2nd, 3rd and 4th quartile, compared with the 1st quartile, were 1.02, 0.93, and 0.82, respectively (p-value for trend 0.06). There were no cross-level interactions between socioeconomic variables.

Conclusions: The effects of neighbourhood characteristics in this study were largely explained by individual socioeconomic variables.

Keywords: Depressive symptoms – Socioeconomic position – Central Europe – Small area.

Introduction

Depression is one of the major causes of ill-health and disability throughout the world [1,2]. The fact that prevalence of depression varies considerably between urban and rural populations[3] and between countries[4–6] suggests that environmental factors, including characteristics of the area of residence, can affect the prevalence of depression over and above individual level risk factors. The association between individual socioeconomic status and mental illness, morbidity or disability is well established. Low socioeconomic position is associated with higher rates of psychiatric morbidity and disability including depression and depressive symptoms.[7–13] The association between depression and various measures of socioeconomic position was recently summarized in a meta-analysis by Lorant et al[7] who used results from 60 prevalence, incidence and persistence studies.

The effect of area-level socioeconomic characteristics on mental disorders has been studied much less frequently than the effect of individual factors. Nevertheless, over the recent decades there have been several multilevel studies on this topic.[8,14–16] Most of these studies have shown an association between neighbourhood SES and depression or depressive symptoms[14–18], although some studies found no association after adjusting for individual-level socioeconomic factors[19,20]. Two longitudinal studies[21,22] reported that the SES of neighbourhood was associated with incidence of depression independent from individual socioeconomic status and other individual risk factors.

Multilevel studies, combining individual-level and area-level characteristics, usually assume that these variables independently affect health outcomes. However, area- and individual-

Table 1. Characteristics of the towns in the study (data from Census 2001).

	Total population	Men	Population 40-74	Primary education	Tertiary education	Economically active population	Unemployed*
	N	%	%	%	%	%	%
Jihlava	50,702	48.7	42.3	20.9	9.5	53.4	6.3
Karvina / Havirov	150,996	49.1	41.8	27.0	6.4	50.1	19.5
Kromeriz	29,225	47.4	42.6	18.8	12.4	50.7	10.0
Liberec	99,102	46.0	42.0	19.5	11.1	54.0	6.8
Usti nad Labem	95,436	48.2	40.4	23.7	8.2	52.8	13.5
Hradec Kralove	97,155	48.0	44.4	16.4	14.4	52.1	6.0
Czech Republic	10,230,060	48.7	41.4	19.7	10.3	51.2	9.3

** from economically active population*

level characteristics may also interact[23]; i. e. the effects of individual-level variables may differ by area-level characteristics and, conversely, the effects of area-level characteristics may differ by individual-level variables. It is not common in studies of depression (or mental health in general) to assess such interaction. The interaction between individual and neighbourhood-level socioeconomic factors were assessed by Yen and Kaplan[21] but no interaction effects were found. Stafford, in the analysis of mental health in Whitehall II participants,[18] reported non-significant interaction between neighbourhood deprivation and individual occupational class.

As shown above, virtually all of the existing research on social and economic factors and depression came from Western Europe and Northern America. Given the background of profound societal transformation, social factors – both individual and area-based – may be particularly important determinants of depression in Central and Eastern Europe.[24] To our knowledge, the Czech part of the Health, Alcohol and Psychosocial factors In Eastern Europe (HAPIEE) study is the first study in the region with sufficient data to investigate the effects of both individual and area level socioeconomic characteristics on mental health. The aim of this study is to examine the association between neighbourhood socioeconomic characteristics and depressive symptoms, and the role of individual factors in such a relationship, in random sample of urban middle-age population in 6 centres in the Czech Republic.

Methods

Study populations and study subjects

The data come from the Czech part of the HAPIEE (Health, Alcohol and Psychosocial factors In Eastern Europe) study which was conducted in six centres in the Czech Republic (Havirov/Karvina, Hradec Kralove, Jihlava, Kromeriz, Liberec and Usti nad Labem) in 2002–2005. Basic demographic characteristics of the study centres are summarized in table 1. The study has been described in detail elsewhere[25]. Briefly, men and women aged 45–69 years, stratified by gender and 5 year age groups and randomly selected from population registers, were invited to participate. The subjects were visited at home and asked to complete a structured questionnaire. From 8856 individuals who completed questionnaire (16260 individuals invited; response rate 55 %), 589 individuals were excluded because of missing data on depressive symptoms. Further, there were 485 people without small area identification (incomplete address or address that was not matched with information in address database in the Czech Statistical Office). These people were also excluded from the analyses. There were further 223 individuals with proper small area identification but Census data for these areas were not provided by the Czech Statistical Office due to confidentiality issues (areas too small and individuals could possibly be identified). Thus there were 7616 individuals with CESD data and valid small area socioeconomic characteristics in 220 small areas obtained from Census (the population size of small areas ranged between 181 and 10,336 with median 1,536). These individuals were used in the present analyses.

Individual-level variables

Participants completed a structured questionnaire covering health, socioeconomic factors and health behaviours and underwent a short examination in a clinic. Depressive symptoms were measured by the Centre for Epidemiologic Studies Depression (CESD) questionnaire[26]. The instrument, which has previously been used and evaluated in the Czech Republic[27], consists of 20 self-reported questions about presence of symptoms in the past week, and the total score range between 0 and 60. The depression score was calculated if at least 16 out of 20 questions were answered. If fewer than 20 questions were answered (but at least 16), the score was recalculated to

Int J Public Health 54 (2009) 283–293

have values between 0 and 60 (calculated as mean score from valid answers and multiplied by 20). Subjects with a score of 16 and above (shown to be predictive of major depressive disorder in a range of populations[28,29,30] have been classified as having depressive symptoms.

The following individual-level covariates were used in these analyses. Marital status was divided into four categories: married or cohabiting, single (never married), divorced and widowed. Education was divided into 4 categories: primary or less, vocational training (that normally started at age of 14 or 15 and lasted usually for 2 or 3 years), completed secondary education (with completed A-levels equivalent) and university education (a completed degree). Material deprivation was assessed by three questions about how often the subject's household had difficulties to buy enough food or clothes and to pay bills for housing, heating and electricity. The possible answers were 'never', 'rarely', 'sometimes', 'often' and 'always'. These responses were coded as 0, 1, 2, 3 or 4, and a deprivation score was calculated as their sum. Material deprivation score was used as categorical variable in statistical analysis: 0 (no deprivation), 1–2, 3–5, 6–12 (high deprivation).

Household amenities score was based on ownership of the following items: microwave, video recorder, colour television, washing machine, dishwasher, car, freezer, cottage for holidays or weekends, camcorder, satellite or cable TV, telephone and mobile phone. The score, ranging from 0 to 12, was calculated if at least 10 out of 12 questions were answered; if fewer than 12 questions were answered (but at least 10), the score was recalculated to have values between 0 and 12 (calculated as mean score from valid answers and multiplied by 12). The score was split into four groups in the statistical analysis: those who owned 4 items or less, those with less than 7 items, those with less than 9 items, and those with 9 or more items.

Occupational status was classified as currently employed, self-employed, working pensioner, pensioner, unemployed, staying at home (housewife) or farmer. In addition, currently employed were asked what is their current position at their main employment, and their answers were dichotomised into manager/supervisor with any inferiors and employee without inferiors. Physical activity was assessed by a question "How many hours during a typical week do you engage in sports, games or hiking?" Smoking status was assessed as current smoker, past smoker and never smoker. Alcohol consumption was measured by the graduated frequency method: how often during the past 12 months did the subjects drink more than X amount of alcohol. As describe elsewhere[31], from the graduated frequency responses we calculated for each participant the annual alcohol and the average dose per occasion were calculated. In addition, history of diabetes, cancer and CVD (myocardial infarction, angina, stroke) and the number of visits to doctor in last 12 months (categorized into 0 visits, 1–2 visits, 3–6 visits, 7 and more visits in last 12 months) were also used as covariates.

Area-based measures

We used data from the 2001 Census, obtained from the Czech Statistical Office. The addresses of the survey subjects were linked with the Census database and subjects were assigned an ID number of small geographical area (the Census enumeration district). Using this area ID number, the survey subjects were linked with two area characteristics derived from the Census: the proportion of university educated persons and the proportion of unemployed from the economically active population.

Statistical analysis

We firstly cross-tabulated the data and conducted simple bivariate analyses, including correlations between different area characteristics and between area-based and individual level variables. The primary outcome variable in the main analyses was the binary indicator of depressive symptoms, derived from the CESD score (using the cut off point of 16).

To assess relationship between depressive symptoms and their predictors, we first inspected the scatter plots of the prevalence of depressive symptoms against area-based variables. For the formal analysis of the association between depressive symptoms and small area characteristics, we used multilevel logistic regression to take into account the clustering of persons in areas. To allow for potential non-linear relationship, areas were divided into quartiles by their socio-economic characteristics. We estimated three models: first, we adjusted the effects of area characteristics for age, sex and town (model 1); second, we further adjusted for history of CVD, diabetes and cancer, visits to doctor in the last 12 months, smoking, alcohol consumption, and physical activity (model 2); finally, we added individual level socioeconomic characteristics (model 3). We also present the final model with all variables significantly associated with depressive symptoms. Throughout the analyses, the quantitative variables, such as mean dose of alcohol, were categorised into several groups, including a separate category for missing values and to keep as many individuals as possible in the analysis. Contribution of different variables to the fit of the model was assessed by the likelihood ratio test.

Although women had slightly higher rates of depressive symptoms and differed somewhat from men in several socioeconomic indicators, there were no statistically significant interactions between gender and any socioeconomic variable in the effects on depressive symptoms. Men and women were

Table 2. Descriptive characteristics of the study sample.

Variable		Men	Women
		N = 3,534	N = 4,082
CESD	16 and more	14.4 %	24.1 %
	Mean (SD)	9.2 (7.6)	11.4 (9.3)
Age	Years – mean (SD)	58.4 (7.2)	57.7 (7.1)
Education	Primary or less	5.7 %	18.1 %
	Vocational	43.4 %	30.4 %
	Secondary	31.8 %	41.1 %
	University	18.6 %	10.2 %
	Missing value	**0.5 %**	**0.3 %**
Deprivation	Score (0–12) – mean (SD)	1.46 (2.21)	1.83 (2.42)
	0 (low)	54.1 %	45.0 %
	1–2	21.9 %	26.2 %
	3–5	15.9 %	17.9 %
	6–12 (high)	7.0 %	10.0 %
	Missing value	1.1 %	0.8 %
Household amenities	Score (0–12) – mean (SD)	7.1 (2.2)	6.6 (2.2)
	9–12 (high)	26.7 %	19.2 %
	7–8.9	30.5 %	29.6 %
	4.1–6.9	24.6 %	28.0 %
	0–4 (low)	12.3 %	17.5 %
	Missing value	5.9 %	5.7 %
Occupational status	Employed – manager/supervisor	11.8 %	6.6 %
	Employed – employee	25.6 %	29.4 %
	Self-employed	12.0 %	4.4 %
	Working pensioner	8.2 %	7.8 %
	Pensioner	38.2 %	47.5 %
	Unemployed	3.2 %	2.7 %
	Housewife	0.0 %	1.2 %
	Farmer	0.3 %	0.1 %
	Missing value	0.9 %	0.6 %
Smoking	Never	31.6 %	54.0 %
	Past	38.0 %	21.6 %
	Currently	29.5 %	23.5 %
	Missing value	0.9 %	0.9 %
Alcohol – annual intake	Litres, mean (SD)	6.50 (10.25)	1.60 (4.84)
Alcohol – mean dose per occasion	ml – mean (SD)	37.01 (38.28)	20.34 (24.40)
	0 ml/occasion	6.1 %	17.2 %
	1–20	28.5 %	45.8 %
	21–50	41.8 %	27.9 %
	51–100	17.0 %	5.1 %
	> 100	5.0 %	1.4 %
	Missing value	1.6 %	2.7 %
Physical activity	Hours per week – mean (SD)	4.3 (5.5)	4.2 (5.3)
Characteristics of small areas (N = 220)			
% university educated (Census), mean (SD)		8.5 (4.2)	
% unemployed (Census), mean (SD)		11.0 (7.1)	

Int J Public Health 54 (2009) 283–293

		OR (95% CI)
Education	Primary or less (baseline)	1
	Vocational	0.73 (0.62–0.86)
	Secondary	0.63 (0.53–0.75)
	University	0.48 (0.38–0.62)
	Test for linear trend of OR	<0.001
Deprivation	0	1
	1–2	1.91 (1.61–2.26)
	3–5	2.76 (2.36–3.23)
	6–12	4.87 (4.07–5.82)
	Test for linear trend of OR	<0.001
Household amenities	9–12	1
	7–8.9	1.25 (1.03–1.53)
	4.1–6.9	1.82 (1.54–2.15)
	0–4	2.54 (2.10–3.08)
	Test for linear trend of OR	<0.001
Occupational status	Employed – manager/supervisor	1
	Employed – employee	1.00 (0.81–1.23)
	Self-employed	0.98 (0.76–1.26)
	Working pensioner	0.87 (0.63–1.20)
	Pensioner	1.60 (1.21–2.13)
	Unemployed	2.75 (2.05–3.70)
	Housewife	0.90 (0.45–1.80)
	Farmer	1.93 (0.39–9.54)
Marital status	Married/cohabiting	1
	Single	1.51 (1.09–2.11)
	Divorced	1.41 (1.19–1.67)
	Widowed	1.94 (1.63–2.30)

Table 3. Odds ratios (95% CI) of depression by individual socioeconomic variables in multivariate analysis, adjusted for age, sex, centre and clustering in small areas.

therefore analysed together and all analyses controlled for sex. We have also tested for interactions between area-based and individual socio-economic factors using the likelihood ratio test. The statistical analysis was conducted in Stata 10 statistical software (Stata Corp, Texas, USA).

Results

The mean CESD score was 9.2 in men and 11.4 in women, and the prevalence of depressive symptoms was 14 % in men and 24 % in women. Women tended to have slightly higher scores of deprivation and slightly lower levels of education and occupational status. Descriptive characteristics of the subjects are shown in table 2. There were 220 small areas, and the small-area socioeconomic characteristics are also shown in table 2. Two small area characteristics were associated in the expected direction, with correlation coefficient r = –0.53. Table 3 shows the effects of the main individual level socioeconomic characteristics on depressive symptoms after adjustment for age, sex and town. Education, deprivation score, household amenities, occupational status and marital status were all significantly associated with depressive symptoms; again, all associations were in the expected direction. Those who were less educated, deprived, unemployed or unmarried were more likely to report depressive symptoms. Figure 1 shows the ecological correlations between the prevalence of depressive symptoms and socioeconomic characteristics of the small areas. The figures show that both associations are in the expected direction but they also show the extent of the variations in depressive symptoms and in social characteristics among the small areas.

The results of logistic regression, assessing the association between small area characteristics and depressive symptoms, are shown in table 4. In models adjusted for age, sex and town, proportion of university educated was significantly associated with depressive symptoms in the expected direction and a graded fashion (model 1) but proportion of unemployed was not (the association was in expected direction but was very weak).

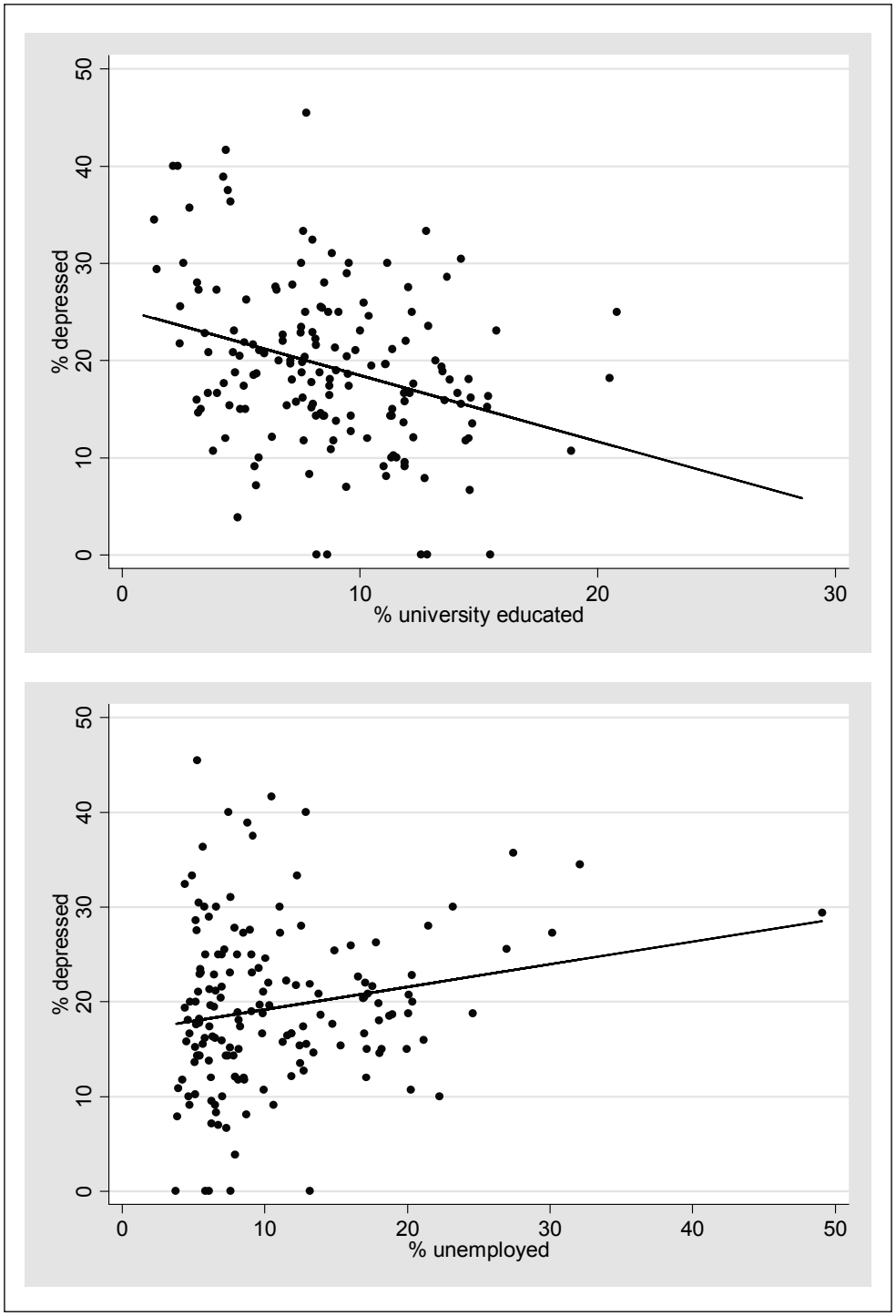

Figure 1. Small area-level socioeconomic characteristics and % of depression in small administrative areas.

Controlling for medical history and health behaviours did not materially change these estimates (model 2). Adjustment for individual-level socioeconomic characteristics largely eliminated the area effects; the proportion of population with university education remained of borderline significance (p = 0.06; model 3). The analysis was repeated when small areas with less than five (or ten) study participants were excluded, and the results virtually remained the same (not shown in the tables).

The final model, which included all variables that remained significantly associated with depressive symptoms in multivariate analysis, is shown in table 5. The significant socio-

Int J Public Health 54 (2009) 283–293

Table 4. Odds ratios (95% CI) of depressive symptoms by small area characteristics.

		Model 1	Model 2	Model 3
% university educated	1Q (low)	1	1	1
	2Q	0.90 (0.78–1.06)	0.96 (0.81–1.13)	1.02 (0.86–1.22)
	3Q	0.80 (0.67–0.97)	0.86 (0.70–1.05)	0.93 (0.75–1.14)
	4Q (high)	0.67 (0.56–0.81)	0.73 (0.60–0.89)	0.82 (0.67–1.01)
	p-value for linear trend	<0.001	0.003	0.06
% unemployed	1Q (least deprived areas)	1	1	1
	2Q	0.95 (0.79–1.13)	0.92 (0.76–1.12)	0.92 (0.76–1.11)
	3Q	1.19 (0.92–1.54)	1.14 (0.86–1.49)	1.06 (0.81–1.40)
	4Q (most deprived areas)	1.30 (0.96–1.76)	1.18 (0.85–1.63)	0.99 (0.72–1.36)
	p-value for linear trend	0.10	0.30	0.93

Model 1 = adjusted for age, sex and centre
Model 2 = adjusted for age, sex, centre, history of CVD, diabetes, cancer, visits to doctor in the last 12 months, smoking, alcohol consumption, physical activity
Model 3 = adjusted for age, sex, centre, history of CVD, diabetes, cancer, visits to doctor in last 12 months, smoking, alcohol consumption, physical activity and all individual socioeconomic characteristics

Table 5. Final model of individual and area-level socioeconomic influences on depressive symptoms.

Variable	Category	OR (95 % CI)
Deprivation score	0	1
	1–2	1.79 (1.51–2.13)
	3–5	2.31 (1.97–2.70)
	6–12	3.56 (2.88–4.40)
	p-value for linear trend	<0.001
Household amenities	9–12	1
	7–8.9	1.03 (0.84–1.27)
	4.1–6.9	1.22 (1.02–1.47)
	0–4	1.33 (1.06–1.68)
	p-value for linear trend	0.002
Occupational status	Employed – manager/supervisor	1
	Employed – employee	0.80 (0.65–1.00)
	Self-employed	0.99 (0.76–1.30)
	Working pensioner	0.64 (0.46–0.89)
	Pensioner	0.91 (0.68–1.22)
	Unemployed	1.46 (1.07–1.99)
	Housewife	0.48 (0.24–0.96)
	Farmer	1.67 (0.43–6.51)
Marital status	Married/cohabiting	1
	Single	1.32 (0.94–1.86)
	Divorced	1.05 (0.86–1.28)
	Widowed	1.74 (1.45–2.11)
% university educated	1Q (low)	1
	2Q	1.02 (0.86–1.22)
	3Q	0.93 (0.75–1.14)
	4Q (high)	0.82 (0.67–1.01)
	p-value for linear trend	0.06

* adjusted for age, sex, centre, history of CVD, diabetes, cancer, visits to doctor in last 12 months, smoking, alcohol consumption, physical activity and all variables in the table

economic influences include deprivation score, number of household amenities, occupational status, marital status and the proportion of persons with university education as the only area-based measure. Interestingly, education was not significantly associated with depressive symptoms in the full model.

Study centre	Adjusted 1	Adjusted 2	Adjusted 3
Hradec Kralove	1	1	1
Jihlava	1.31 (1.04–1.64)	1.26 (1.00–1.58)	1.18 (0.93–1.46)
Kromeriz	1.14 (0.93–1.40)	1.10 (0.89–1.36)	1.01 (0.81–1.26)
Karvina/Havirov	1.18 (0.96–1.44)	1.12 (0.92–1.38)	0.94 (0.76–1.16)
Liberec	1.05 (0.85–1.30)	1.03 (0.83–1.28)	0.94 (0.75–1.17)
Usti nad Labem	1.07 (0.88–1.30)	1.03 (0.85–1.26)	0.95 (0.77–1.16)

Table 6. Odds ratio (95% CI) of depressive symptoms by study centres in several levels of adjustment.

Adjusted 1 = adjusted for age, sex, reported history of diabetes, cancer, MI, angina, stroke, and number of visits to doctor/hospital in last 12 months
Adjusted 2 = as Adjusted 1 + additionally adjusted for smoking, mean dose of alcohol, physical activity
Adjusted 3 = as Adjusted 2 + additionally adjusted for SES variables from Table 5

Table 6 shows the differences in odds of depressive symptoms between study centres. The differences between centres have been reduced in every step of the analysis and were almost totally explained in final fully adjusted model. The odds of depression were slightly higher in Jihlava but this difference was not significant. The odds of depression in other 5 centres were almost identical.
In addition, we also tested for interactions between individual-level and area-based variables, but we did not identify any significant interaction (not shown in table).

Discussion

To our knowledge, this large population-based study is the first in Central and Eastern Europe which assessed the association between depressive symptoms and small area socioeconomic characteristics. We found that depressive symptoms were associated with socioeconomic characteristics at the individual level and (at least partly) with our area-based measures. However, controlling for individual-level socioeconomic indicators mostly eliminated the effects of area based measures. We found no evidence for interactions between individual-level and small area-level variables.
In Western Europe and North America, depression is typically more common in lower socio-economic groups[7]. Our results, and the HAPIEE pilot study[32], are consistent with this pattern. The higher rates of depressive symptoms in unmarried than married people (particularly among widowed individuals), are also consistent with studies in other populations[33] as are the increased rates of depressive symptoms in unemployed individuals[9]. Interestingly, although education was previously found to predict well other health outcomes[34,35] and parasuicide, psychiatric care and completed suicides[36] in Central and Eastern Europe, and although it was strongly associated with depression in the simple models in this study, its effect totally disappeared in the multivariate models. This was largely due to the inclusion of other socioeconomic variables such as deprivation or ownership of household amenities into the model. It is likely that the effect of education on depressive symptoms reflects its role of a proxy measure for other, more recent, socioeconomic exposures; in our earlier analyses, we found that depressive symptoms are associated with current social disadvantage but not with measures of earlier socioeconomic status, such as education or childhood circumstances[37].
The potential effects of area-based measures of socioeconomic disadvantage on depressive symptoms were the primary focus of these analyses. These effects were present (at least partly) in age-sex adjusted analyses but they were reduced and became insignificant when adjusted for individual level variables. The proportion of university educated subjects in the neighbourhood remained weakly (although not statistically significantly) associated with depressive symptoms. Interestingly, individual characteristics also explained the considerable differences in depressive symptoms between the participating towns. This suggests that our individual-level indicators included the important ones.
Our principal findings on area effects are consistent with most previous studies[38–40], although two studies have reported effects of neighbourhood SES on depressive symptoms which persisted in models controlling for individual-level SES[41,42]. It has been suggested that the effects of area-level variables may reflect weaknesses of individual-level model[43], such as missing important variables. As noted above, the wide range of individual-level variables was included in our analysis may have contributed to the virtually complete elimination of area effects. The absence of interactions between individual-level and small-area level socioeconomic variables is also in agreement with most of previous studies [21,38].
Several limitations of the study need to be considered. Firstly, although the CESD scale is an internationally recognised, extensively used and validated instrument[44], it is not a measure of clinical depression. It has relatively low specificity[45]. Participants with scores above the threshold of 16 points thus

include persons with minor distress states and anxiety disorders rather than major depression[46]. The scale may also detect some personality characteristics, for example high negative affectivity[47]. The CESD measure is therefore not specific to major depression.

Second, non-response bias must be considered. The findings may be partly influenced by response rate of the study. The overall response rate was below 60 %. Additional subjects were removed from the analysis because they could not be linked with geographical area or they did not answer some key questions needed in this analysis. In general, people who participate in health studies are on average healthier than those who do not. Thus, the rates of depressive symptoms in our study are probably underestimated. However, the non-response bias should not affect the association between depressive symptoms and socio-economic factors within the study.

Third, it is possible that the selected urban centres were not entirely representative of the whole country, although official data suggest that the participating towns cover a representative range of Czech towns. For example, while Havirov/Karvina and Usti nad Labem are industrial towns with high levels of unemployment, Hradec Kralove is relatively prosperous university town with low unemployment; Liberec is regional centre with healthy industry while Jihlava and Kromeriz are smaller towns; Jihlava is regional centre of relatively poor highland region while Kromeriz is part of a prosperous agricultural and industrial region with low unemployment. It seems likely that our centres represent well the urban population of the country.

Fourth, depressive symptoms and the covariates were self-reported in a cross-sectional survey. Some of the explanatory variables are (at least partly) subjective, such as material deprivation. It is therefore possible that some cross-contamination between reporting of depressive symptoms and explanatory variables (either main socioeconomic exposures or possible confounding variables) may have occurred, which might have led to overestimation of the strength of the relationships between depressive symptoms and the exposures. On the other hand, this bias should not affect the associations with area-based measures, particularly those from the Census, because they are based on reports on many persons and, in the case of Census, were collected at different point of time.

As this study is cross-sectional, the uncertainty about the causality of the associations is higher than in a longitudinal design. Alternatively, self selection of people with higher score of depressive symptoms into low SES areas is possible, e. g. because of downward mobility, and thus depressive symptoms would affect individual socio-economic measures more than their neighbourhood SES characteristics. Although this is unlikely, we need to be careful when drawing conclusions from such type of a study.

In conclusion, depressive symptoms in this Central European urban population were associated with a number of socioeconomic characteristics and with several area-based measures of socioeconomic disadvantage. Despite the wide variation in small area characteristics, the area effects were almost entirely explained by individual-level variables. This suggests that the effect of neighbourhood-level socioeconomic characteristics was, in this population at least, compositional, i. e. reflecting the socioeconomic composition of the individuals in this study. Prospective studies and studies in other countries of the region would be needed to assess the influence of individual and small area-level effects of socioeconomic factors on depression in post-communist countries.

Acknowledgements

This study is funded by grants from the Wellcome Trust "Determinants of Cardiovascular Diseases in Eastern Europe: A multi-centre cohort study" (Reference number 064947/Z/01/Z) and "Determinants of Cardiovascular Diseases in Eastern Europe: Longitudinal follow-up of a multi-centre cohort study (The HAPIEE Project)" (Reference number 081081/Z/06/Z); a grant from the National Institute on Aging "Health disparities and aging in societies in transition (the HAPIEE study)", grant number 1R01 AG23522-01; and a grant from MacArthur Foundation "Health and Social Upheaval (a research network)".

We would like to thank local collaborators and interviewers in Havirov, Karvina, Jihlava, Usti nad Labem, Liberec, Hradec Kralove, Kromeriz and Prague.

References

1. Global Burden of Disease and Risk Factors. Oxford University Press and The World Bank; 2006.

2. World Health Organization. The World Health Report 2001. Mental Health: New Understanding, New Hope. Geneva: WHO;2001.

3. Kovess-Masféty V, Alonso J, De Graaf R, Demyttenaere K, on behalf of the ESEMeD 2000 Investigators. A European Approach to Rural-Urban Differences in Mental Health: The ESEMeD 2000 Comparative Study. Can J Psychiat 2005;50:926–36.

4. Ayuso-Mateos JL, Vazquez-Barquero JL, Dowrick C, Lehtinen V, Dalgard OS, Casey P et al. Depressive disorders in Europe: prevalence figures from the ODIN study. Br J Psychiatry 2001;179:308–16.

5. Kessler RC. The global burden of anxiety and mood disorders: putting the European Study of the Epidemiology of Mental Disorders (ESEMeD) findings into perspective. J Clin Psychiatry 2007;68 Suppl 2:10–19.

6. Simon GE, Goldberg DP, Von KM, Ustun TB. Understanding cross-national differences in depression prevalence. Psychol Med 2002;32:585–94.

7. Lorant V, Deliege D, Eaton W, Robert P, Ansseau M. Socioeconomic Inequalities in depression: a meta-analysis. Am J Epidemiol 2003;157:98–112.

8. Muntaner C, Eaton WW, Miech R, O'Campo P. Socioeconomic Position and Major Mental Disorders. Epidemiol rev 2004;26:53–62.

9. Andrade L, Caraveo-Anduaga JJ, Berglund P. Cross-national comparisons of the prevalences and correlates of mental disorders. WHO International Consortium in Psychiatric Epidemiology. Bull World Health Organ 2000;78:413–26.

10. Regier DA, Farmer ME, Rae DS, Myers JK, Kramer M, Robins LN et al. One-month prevalence of mental disorders in the United States and sociodemographic characteristics: the Epidemiologic Catchment Area study. Acta Psychiatr Scand 1993;88:35–47.

11. Lehtinen V, Joukamaa M. Epidemiology of depression: prevalence, risk factors and treatment situation. Acta Psychiatr Scand Suppl 1994;377:7–10.

12. Lynch JW, Kaplan GA, Shema SJ. Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning. N Engl J Med 1997;337:1889–95.

13. Aluoja A, Leinsalu M, Shlik J, Vasar V, Luuk K. Symptoms of depression in the Estonian population: prevalence, sociodemographic correlates and social adjustment. J Affect Disorders 2004;78:27–35.

14. Propper C, Jones K, Bolster A, Burgess S, Johnston R, Sarker R. Local neighbourhood and mental health: evidence from the UK. ESRC Research Methods Programme 2004;6:1–35.

15. Matheson FI, Moineddin R, Dunn JR, Creatore MI, Gozdyra P, Glazier RH. Urban neighbourhoods, chronic stress, gender and depression. Soc Sci Mede 2006;63:2604–16.

16. Driessen G, Gunter N, Van Os J. Shared social environment and psychiatric disorder: a multilevel analysis of individual and ecological effects. Soc Psychiatry Psychiatr Epidemiol 1998;33:606–12.

17. Gresenz CR, Sturm R, Tang L. Income and mental health: unraveling community and individual level relationship. J Ment Health Policy Econ 2001;4:197–203.

18. Stafford M, Marmot M. Neighbourhood deprivation and health: does it affect us all equally? Int J Epidemiol 2003;32:357–66.

19. Henderson C, Diez Roux AV, Jacobs Jr DR, Kiefe CI, West D, Williams DR. Neighbourhood characteristics, individual level socioeconomic factors, and depressive symptoms in young adults: the CARDIA study. J Epidemiol Community Health 2005;59:322–8.

20. Weich S, Twigg L, Lewis G. Rural and nonrural differences in rates of commonn mental disorders in Britain. Br J Psychiatry 2006;188:51–7.

21. Yen IH, Kaplan GA. Poverty area residence and changes in depression and perceived health status: evidence from the Alameda County Study. Int J Epidemiol 1999;28:90–4.

22. Galea S, Ahern J, Nandi A, Tracy M, Beard J, Vlahov D. Urban neighbourhood poverty and the incidence of depression an a population-based cohort study. Ann Epidemiol 2007;17:171–9.

23. Diez Roux AV. Investigating neighborhood and area effects on health. Am J Public Health 2001;91:1783–9.

24. Gallo LC, Matthews KA. Understanding the association between socioeconomic status and physical health: do negative emotions play a role? Psychol Bull 2003;129:10–51.

25. Peasey A, Bobak M, Kubinova R, Malyutina S, Pajak A, Tamosiunas A et al. Determinants of cardiovascular disease and other non-communicable diseases in Central and Eastern Europe: rationale and design of the HAPIEE study. BMC Public Health 2006;6:255.

26. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. App Psychol Measurement 1977; 1:385–401.

27. Osecka L. Škála deprese CESD – psychometrická analýza. (CESD scale of depression – psychometric analysis) (In Czech). Brno: Akademie ved Ceské republiky – Psychologický ústav.;1999.

28. Beekman AT, Deeg DJ, Van Limbeek J, Braam AW, De Vries MZ, Van Tilburg W. Criterion validity of the Center for Epidemiologic Studies Depression scale (CES-D): results from a community-based sample of older subjects in The Netherlands. Psychol Med 1997;27:231–5.

29. Lyness JM, Noel TK, Cox C, King DA, Conwell Y, Caine ED. Screening for depression in elderly primary care patients. A comparison of the Center for Epidemiologic Studies-Depression Scale and the Geriatric Depression Scale. Arch Intern Med 1997;157:449–54.

30. Roberts RE, Vernon SW. The Center for Epidemiologic Studies Depression Scale: its use in a community sample. Am J Psychiatry 1983; 140:41–6.

31. Bobak M, Room R, Pikhart H, Kubinova R, Malyutina S, Pajak A et al. Contribution of drinking patterns to differences in rates of alcohol related problems between three urban populations. J Epidemiol Comm Health 2004;58:238–42.

32. Bobak M, Pikhart H, Pajak A, Kubinova R, Malyutina S, Sebakova H et al. Depressive symptoms in urban population samples in Russia, Poland and the Czech Republic. Br J Psychiatry 2006;188:359–65.

33. Van Grootheest DS, Beekman ATF, Broese van Groenou MI, Deeg DJH. Sex differences in depression after widowhood. Do men suffer more? Soc Psychiatry Psychiatr Epidemiol 1999;34:391–8.

34. Plavinski SL, Plavinskaya SI, Klimov AN. Social factors and increase in mortality in Russia in the 1990s: prospective cohort study. BMJ 2003;326:1240–2.

35. Bobak M, Hertzman C, Skodova Z, Marmot M. Own education, current conditions, parental material circumstances and risk of myocardial infarction in a former communist country. J Epidemiol Comm Health 2000;54:91–6.

36. Dzurova D, Vevera J, Motlova L, Dragomirecka E. Analysis of parasuicide, psychiatric care and completed suicides, implications for intervention strategy (Czech Republic, 1996–2000). Int J Public Health 2008;53:139–49.

37. Nicholson A, Pikhart H, Pajak A, Malyutina S, Kubinova R, Peasey A et al. Socio-economic status over the life-course and depressive symptoms in men and women in Eastern Europe. J Affect Disord 2008;105:125–36.

38. Aneshensel CS, Wight RG, Miller-martinez D, Botticello AL, Karlamangla AS, Seeman TE. Urban neighborhoods and depressive symptoms among older adults. J Gerontol: Soc Sci 2007;62B:s52–9.

39. Walters K, Breeze E, Wilkinson P, Price GM, Bulpitt CJ, Fletcher A. Local area deprivation and urban-rural differences in anxiety and depression among people older than 75 years in Britain. Am J Public Health 2004;94:1768–74.

40. Hybels CF, Blazer DG, Fieper CF, Burchett BM, Hays JC, Fillenbaum GG. Sociodemographic characteristics of the neighborhood and depressive symptoms in older adults: Using multilevel modeling in geriatric psychiatry. Am J Geriatric Psychiatry 2006;14:498–506.

41. Ostir GV, Markides KS, Goodwin JS. Neighbourhood composition and depressive symptoms among older Mexican Americans. J Epidemiol Comm Health 2003;57:987–92.

42. Kubzansky LD, Subramanian SV, Kawachi I, Fay ME, Soobader MJ, Berkman LF. Neigborhood Contextual Influences on Depressive Symptoms in Elderly. Am J Epidemiol 2005;162:253–60.

43. Diez-Roux AV. Invited commentary: Places, people, and health. Am J Epidemiol 2002;155:516–9.

44. Fountoulakis KN, Iacovides A, Kleanthous S, Samolis S, Gougoulias K, Tsiptsios I et al. Reliability, validity and psychometric properties of the Greek translation of the Major Depression Inventory. BMC Psychiatry 2003;3:2.

45. Mulrow CD, Williams JW, Jr., Gerety MB, Ramirez G, Montiel OM, Kerber C. Case-finding instruments for depression in primary care settings. Ann Intern Med 1995;122:913–21.

46. Beekman ATF, Deeg DJH, van Tilburg T, Smit JH, Hooijer C, Van Tilburg W. Major and minor depression in later life: a study of prevalence and risk factors. J Affect Disorders 1995;36:65–75.

47. Watson D, Clark LA. Negative affectivity: the disposition to experience aversive emotional states. Psychol Bull 1984;96:465–90.

Address for correspondence

Dr. Hynek Pikhart
Department of Epidemiology and Public Health
University College London,
1–19 Torrington Place
London WC1E 6BT
United Kingdom
Tel.: +44 2076791906
Fax: +44 2078130280
E-mail: h.pikhart@ucl.ac.uk