The association between neighbourhood socio-economic status and the onset of chronic widespread pain: Results from the EPIFUND study

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Background: Cross-sectional studies have reported an inverse relationship between socio-economic status and the prevalence of chronic widespread pain (CWP). However, the extent to which this relationship is explained by psychological factors is unknown. The aim of this study was to examine the hypothesis that socio-economic status predicts the onset of CWP but that this relationship would be explained by psychological factors.

Methods: Subjects from three diverse socio-economic areas were recruited into a population-based prospective survey of pain. Subjects completed a questionnaire at baseline that assessed pain status and psychological factors and occupation. Fifteen months later subjects completed a follow-up questionnaire which assessed pain status.

Results: A total of 3489 subjects were free of CWP at baseline and eligible for follow-up, of whom 2782 (79.7%) participated. Of those, 281 (10%) subjects were classified as having new CWP. Logistic regression analysis revealed that compared to subjects from the most affluent socio-economic area, those from the moderate and least affluent areas were respectively, 1.47 (95% CI: 1.08–2.01) and 1.35 (95% CI: 1.00–1.82) times more likely to have new CWP. However, in a stepwise multivariate logistic regression analysis, controlling for psychological factors, the relationship between new onset CWP and socio-economic status was no longer evident.

Conclusions: This study has demonstrated that socio-economic status is related to new onset CWP, but the association is explained by psychological factors. Understanding the factors underlying the association between socio-economic status and pain should help to design intervention strategies which may reduce the burden of chronic pain in identified high risk population groups.
Socio-economic status may be a direct risk factor explained by such mechanisms as increased exposure to manual occupations. However, it is more likely that low socio-economic status is a risk marker, i.e. it may be associated with other factors that themselves are risk factors for the onset of chronic pain (Everson et al., 2002). Socio-economic status has been associated with a number of psychological factors (Adler et al., 1994; Everson et al., 2002) for a review. These same psychological factors are associated with the onset of CWP (McBeth et al., 2001). It is therefore possible that differences in psychological risk factors, rather than socio-economic status per se, underlie differences in the onset of CWP between different socio-economic groups.

We have previously published results from the EPIFUND study demonstrating that psychological factors are associated with new onset CWP (Gupta et al., 2007). We took advantage of this data set which has group level socio-economic status data to examine the role of socio-economic status in the onset of CWP. The aims of this study were firstly, to quantify the role of socio-economic status in predicting the onset of CWP and secondly, to examine the hypothesis that any relationship observed would be explained by psychological factors.

2. Method

2.1. Summary of design

Subjects were 5190 adults aged between 18 and 65 years who had participated in a population-based study of pain. All subjects were recruited from the age–sex registers of three general practices in the north-west of England. Subjects were mailed a questionnaire that assessed pain status from which those subjects who were free of CWP were identified. The questionnaire asked about current employment status and assessed a number of psychological factors. Fifteen months later subjects completed a follow-up questionnaire that examined pain status from which with new CWP were identified. (The recruitment to this study has been described in detail elsewhere (Gupta et al., 2007)). Subjects' written consent was obtained according to the Declaration of Helsinki. The study was approved by the local NHS Research Ethics Committees.

2.2. Recruitment and assessment of area level socio-economic status

Recruitment to the study came from three areas which differed in socio-economic status. Area A was in a relatively affluent area, area B was moderately affluent whilst area C was the least affluent. Census data (2001) for the three areas (A, B and C) is shown in Table 1. Area level deprivation was measured using Townsend index scores (an area based deprivation score) which are derived from four indices: home ownership, car ownership, unemployment and overcrowding (see Table 1) (Townsend et al., 1988). Townsend index scores were calculated at postcode sector level and were grouped into quintiles (ESRC/JISC Census Programme). The Townsend index score for England and Wales has values ranging from −7.55 to 11.80. The higher the Townsend Index score the more deprived an area is thought to be. Individual level socio-economic status was operationalised into three employment status categories: employed (full-time or part-time workers) not in labour force (retired, student, homemaker), unemployed (unemployed, not working due to ill health) (Winkleby and Cubbin, 2003).

2.2.1. Baseline questionnaire

All subjects were mailed a postal questionnaire that assessed their pain and psychological state. The questionnaire asked about current employment status as characterised above. In addition, the questionnaire assessed a number of psychological factors including levels of psychological distress, recent life events, somatic symptom reporting, medical help-seeking behaviour and sleep problems. Non-responders were mailed a reminder postcard 2 weeks after the first mailing. Subjects who had still not responded 2 weeks after receiving the postcard were mailed another full study questionnaire. Finally, a short (two page) questionnaire was mailed to the remaining non-responders after a further 2 weeks. The short questionnaire contained items to assess pain status.

2.2.2. Baseline pain assessment

Pain status was assessed using blank body manikins (four line drawings of the body: front, back and sides) on which subjects were asked to indicate site(s) of pain they had experienced for one day or longer in the past month. Questions enquiring about the occurrence (pain lasting more than 24 h in the last month) and chronicity (lasting for more than three months) accompanied the line drawings. These methods have been used previously to determine the location and duration of pain (Benjamin et al., 2000; Macfarlane et al., 1996). Based on the information on pain status subjects were classified into those with and without CWP. CWP was defined using the American College of Rheumatology (ACR) criteria for fibromyalgia (Wolfe et al., 1990) that require that pain must have been present for at least three months and that pain be present in two contra-lateral areas of the body, above and below the waist and in the axial skeleton.

2.2.3. Baseline psychological assessment

The questionnaire also contained a number of scales to examine psychological factors which may be associated with socio-economic status or may be indicative of the psychological burden of living in a socio-economically deprived area. These factors have previously been shown to be associated with CWP (Gupta et al., 2007; McBeth et al., 1999; McBeth et al., 2001).

(i) Hospital anxiety and depression scale (Zigmond and Snaith, 1983).

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### Table 1

|                      | Home ownership | Car ownership | Unemployment | Townsend scores |
|----------------------|---------------|--------------|--------------|----------------|
|                      | N (%)         | N (%)        | N (%)        | N (%)          |
| Area A              | 2443/3300     | 2636/3143    | 104/5304     | 104/5304       |
| Area B              | 2330/5056     | 2893/5056    | 445/10779    | 445/10779      |
| Area C              | 2307/4985     | 2849/4985    | 570/11402    | 570/11402      |

**Notes:**
- Office for National Statistics, 2001 Census: Standard Area Statistics (England and Wales) [website]. [No citation definition] from National Statistics: 2001 Census.
- ESRC/JISC census programme. Census dissemination unit, MIMA (University of Manchester)/Census interaction data service (University of Leeds) 1991.
- The total numbers differ between categories because data is based on various criteria: Home-ownership is based on the total number of dwellings; car ownership is based on the total number of households; and, unemployment and education is based on the total number of people aged between 16 and 74. The study population Townsend Index ranged from −6.7 to 8.21.
The hospital anxiety and depression (HAD) scale contains a seven-item depression subscale and a seven-item anxiety subscale. Subjects rate each item on a four-point scale scored from 0 to 3 with total scores ranging from 0 to 21. Higher scores indicate an increased likelihood of having a depressive or anxiety disorder.

(i) General health questionnaire (Goldberg and Williams, 1988).

The 12 item version of the general health questionnaire (GHQ) was used to examine levels of psychological distress. Each item has four possible responses, ranging from 1 to 4, and is dichotomised at the midpoint (responses 1 to 2 = 0 and responses 3 to 4 = 1). Scores are summed to give a total ranging from 0 to 12. Higher scores indicate higher levels of psychological distress.

(ii) Somatic symptoms checklist (Othmer and DeSouza, 1985).

The somatic symptoms checklist (SSC) was originally designed and validated as a screening test for somatisation disorder. The scale contains 7 items. To avoid associations with CWP only non-pain items were included (the items regarding menstrual cramps and pain in fingers and toes were excluded), leaving a five item scale. Subjects are required to answer yes or no to questions regarding the occurrence of symptoms (e.g., “Have you ever had trouble breathing?”). Scores are summed to provide a total number of somatic symptoms reported. One item, “have you ever had difficulties swallowing or had an uncomfortable lump in your throat that stayed with you for at least an hour?”, was excluded from the analysis due to a high proportion of missing answers.

(iv) Illness attitudes scales (Kellner, 1987).

The illness attitudes scales (IAS) examine beliefs, attitudes and fears about illness and health. The IAS contain nine scales each containing three items. The scales assess worry about health, concern about pain, health habits, hypochondriacal beliefs, thanatophobia (fear of death), disease phobia, bodily preoccupation, treatment experience and effect of symptoms. Speckens et al. (1996) conducted a principal components analysis and reported that the IAS consists of two main subscales: Health anxiety and illness behaviour. The health anxiety subscale contains 11 items (e.g., “Does the thought of serious illness scare you?”) which are scored on a 5 point scale (0–4) with total scores ranging from 0 to 44. The Illness behaviour scale contains 6 items (e.g., “Do your bodily symptoms stop you from working?” “Do your bodily symptoms stop you from enjoying yourself?”) also scored on a 5 point scale from 0 “No” to 4 “Most of the time”, with total scores range from 0 to 24. Speckens et al. (1996) reported good test–retest reliability of the health anxiety and illness behaviour subscales and good internal consistency (Cronbach’s alpha = 0.87) in a general population sample. These subscales were used to examine illness behaviour and health anxiety.

(v) Estimation of sleep problems scale (Jenkins et al., 1988).

This 4 item scale asks about recent problems with sleep and contains items on the most commonly occurring symptoms of poor sleep quality (e.g., “During the past month did you have trouble falling asleep?”, “During the past month did you wake up after your normal amount of sleep feeling tired and worn out?”). Subjects are asked to indicate, on a five-point scale ranging from 0 (Not at all) to 5 (22–31 days), the number of days in the last month the statement applies to them. The items are summed giving a total score between 0 and 20.

(vi) Threatening life events (Brugha et al., 1985).

The threatening life events inventory contains a list of 12 threatening experiences. The inventory contains a range of threatening life events including: having a serious illness or injury; being sacked from your job; and, having a major financial crisis. Subjects are asked to indicate which, if any, of the life events they have experienced in the previous 12 months.

2.2.4. Follow-up

All subjects who agreed to further contact from the study team were eligible for follow up. Subjects were sent a follow-up questionnaire 15 months following the baseline survey that contained identical pain manikins to those used in the baseline survey. One observer, who was blind to all baseline data, classified pain status at follow-up. From this, those subjects with new CWP were identified.

2.2.5. Statistical analysis

Chi squared analysis was used to examine differences in deprivation between areas. Mann–Whitney U-test and Chi-squared analysis were used to examine differences in age and gender between groups. Area A (the more affluent area) was used as the referent group in all analyses. Logistic regression analysis was used to examine the association between area level socio-economic status (independent variable) and CWP at follow-up (dependent variable), adjusting for the effects of age and gender. Baseline regional pain status (i.e., reporting regional pain) was included in the model. Univariate logistic regression analysis was then used to examine the association between each of the psychological variables and CWP. For this analysis each of the scales were categorised into thirds based upon the distribution of subjects scores. All psychological variables in the univariate analysis that had an effect size of >1.5 or <0.7 or were significant (p < 0.05), were included in a stepwise logistic regression model to determine the association between area level socio-economic status and new onset CWP adjusted for the effects of those psychological variables. Area level socio-economic status was forced into the model. Finally, employment status was included in the multivariate model. The results are presented as odds ratios (OR) with 95% confidence intervals (95% CI). All analyses were conducted using the STATA statistical software (STATA, 1993).

3. Results

Of the 5190 participants, 4201 (81%) subjects consented to follow-up and provided contact details. 389 participants provided incomplete data at baseline and were excluded from this analysis. Two thousand seven hundred and eighty-two returned the follow-up questionnaire. The follow-up participation rate was 79.7% after adjusting for subjects who had moved and were therefore assumed not to have received a questionnaire (N = 318) or died (N = 5) (Fig. 1). Follow-up pain status data was available for 2782 (1213 males and 1569 females). There was a significant relationship between area and deprivation (Townsend index) (Chi-square). Area A had significantly lower levels of deprivation than areas B and C (p < 0.001). There was a significant relationship between area and employment status (Chi-square). Area A had significantly lower levels of unemployment than areas B and C (p < 0.001).

A total of 281 (10%) subjects reported new onset CWP at follow-up (Fig. 1). Those with new onset CWP were older than those who remained CWP free, although this difference was not significant (Table 2). Although these two groups did not significantly differ on gender, females were more likely to report new CWP at all ages. The prevalence of new CWP was significantly higher in areas B and...
C when compared to area A: area A: 8.85% (N = 139); area B: 12.12% (N = 67) and area C: 11.40% (N = 75), \( p < 0.004 \) for both comparisons.

Logistic regression analysis revealed that subjects in the two areas with lower socio-economic status were 47% (area B) and 35% (area C) more likely to report new onset CWP than subjects of higher socio-economic status (area A) (OR: 1.47, 95% CI: 1.08–2.01 and OR: 1.35, 95% CI: 1.00–1.82, respectively) (adjusted for age and gender). The association between area level socio-economic status and new onset CWP was not significant for area C in the crude model. However, after adjusting for age and gender the association was significant (Table 3).

Subjects in areas B and C had significantly higher levels of psychological distress, anxiety and depression, reported significantly more illness behaviour, somatic symptoms, sleep problems and threatening life events than subjects in area A (\( p < 0.05 \)). In addition, subjects in area B reported significantly more health anxiety than subjects in area A (\( p < 0.05 \)), although the confidence intervals overlapped for some of these comparisons.

Stepwise logistic regression showed that after adjusting for baseline psychological factors, the area of residence was no longer significantly associated with new onset CWP (Table 3). However, a number of psychological variables independently predicted the onset of new CWP. Specifically, high levels of somatic symptoms (OR: 2.04, 95% CI: 1.43–2.93), sleep disturbance (OR: 1.51, 95% CI: 1.05–2.17) and illness behaviour (OR: 3.31, 95% CI: 2.35–4.65) were all significantly associated with new onset CWP. The association between new onset CWP and area of residence remained non-significant when employment status and baseline regional pain status (Area B OR: 1.29, 95% CI: 0.92–1.08; Area C OR: 1.05, 95% CI: 0.75–1.46) were included in the stepwise model.

4. Discussion

Previous cross-sectional studies have shown that socio-economic status is associated with a number of chronic pain conditions (Portenoy et al., 2004; Roth et al., 2001; Saastamoinen
et al., 2005). The extent to which the relationship between socio-economic status and new CWP is confounded by other factors, namely psychological factors, is not known. We hypothesised that low area level socio-economic status would be associated with the onset of new CWP. However, we further hypothesised that this association would be explained by psychological factors rather than socio-economic status per se.

We found that subjects living in an area of lower socio-economic status were more likely to have new onset CWP than subjects living in an area of higher socio-economic status. However, this relationship was modest and was explained by co-morbid psychological factors. After controlling for individual psychological factors the relationship between CWP and the socio-economic area of residence was no longer evident. A number of psychological variables remained independently associated with new onset CWP: reporting somatic symptoms, high illness behaviour scores, reports of sleep disturbance.

Previous research has suggested that psychological factors may be important in explaining the difference in the prevalence of musculoskeletal pain in socio-economically contrasting areas (Brekke and Hjortdahl, 2004). Living in a deprived area is associated with psychological factors including depression and distress (Adler et al., 1994; Everson et al., 2002) for a review, which is associated with regional pain (Croft et al., 1995). It would be interesting to examine if the associations that we have reported for CWP also exist for regional pain.

Our study did not identify all the variables that explained the differences in CWP between the study areas. Thus our results show that, even after adjusting for psychological variables, subjects in area B remained more likely to develop CWP than subjects in area A, although this association was not significant (p = 0.26). Other factors that were unmeasured but that could potentially act to confound the relationship include, increased exposures to mechanically stressful occupations; having a higher body mass index; or, smoking, all of which in some, but not all, studies have been associated with regional pain (Croft et al., 1995). It would be interesting to examine if the associations that we have reported for CWP also exist for regional pain.

In interpreting these results a number of methodological issues relating to the socio-economic status and pain need to be considered. Firstly, socio-economic status was assessed at a group level. It is likely that there was some misclassification of socio-economic status, i.e., some subjects with high socio-economic status may have been classified as living in an area of low socio-economic status. Conversely, some subjects with low socio-economic status may have been included in the high socio-economic status area. Misclassification of socio-economic status was likely to be random and independent of pain status. However, misclassification may have attenuated the observed relationship and the true strength of the relationship may be greater than the modest increase in risk we have reported. Despite this there were large differences in pain risk between areas and these risks were importantly attenuated after adjustment for individual psychological factors. Furthermore, adjusting for employment status (a marker of individual socio-economic status) did not alter the nature of the associations in the final multivariate model. Secondly, although the areas in this study were distinct in terms of levels of deprivation they are not the most deprived or affluent areas in the UK. As such, we have underestimated the association between new onset CWP and area level socio-economic status. Finally, the statistical model that we have used does not enable us to examine the interaction between group level socio-economic status and individual psychological data. However, the aim of this study was to look at whether the relationship between living in a deprived area and new onset CWP may be explained by psychological status.

This study identified a group of subjects who were free of CWP at baseline and ascertained their pain status 15 months later. There were a number of non-responders at baseline and follow-up. It is possible that the relationship between area level socio-economic status, pain and psychological factors differs between the responders and non-responders. As such, we may have under- or over-estimated the relationship between socio-economic status and CWP. It is possible that some subjects who reported no CWP at follow-up may have experienced CWP in the interim period. This study assessed psychological factors and pain status at baseline and then contacted subjects at a second time point to obtain pain status. We did not investigate the period between the two data collection points. However, it is unlikely that CWP would have resolved in such a short time period. By its nature, CWP is a long-term syndrome and it has been shown to persist over a number of years (Macfarlane et al., 1996; Papageorgiou et al., 2002). However, the internal comparison of the association between psychological factors and CWP remains valid despite these study limitations. Finally, subjects were free of chronic widespread pain at baseline but may have reported some regional pain. However, we have shown that the association between new onset chronic widespread pain and area level socio-economic status remained after controlling for baseline regional pain status.

Overall, 10% of participants reported new onset CWP at 15 month follow-up. A previous prospective study of chronic widespread pain reported a lower incidence rate of 6% at 12 month follow-up (McBeth et al., 2001). However, this study was based in a more affluent area of the UK. This may account, in part, for the differences in incident rates between the two studies. We may have overestimated the incidence rate of CWP. Health seeking behaviour is associated with new onset CWP. If health seeking behaviour is also associated with participation in health survey research the incidence rate of CWP in the population may not be as high as 10% (Gupta et al., 2007) (please see Gupta et al. (2007) for a more detailed discussion of EPIFUND study response rates).

Our findings provide an explanation for the increased prevalence of CWP observed in low socio-economic groups and demonstrate that the association is explained by psychological factors. A previous cross-sectional study reported an association between low socio-economic status and chronic oro-facial pain (OR = 1.50; 95% CI 1.09–2.07) (Aggarwal et al., 2003). Adjusting for psychological factors including illness behaviour, somatic symptoms

| Table 3 |
The association between socio-economic status and new onset CWP adjusted for age, gender and psychological scores

|                | Complete data | Adjusted (age and gender) | Adjusted for psychological variables* |
|----------------|--------------|---------------------------|---------------------------------------|
|                | OR 95% CI    | OR 95% CI                 | OR 95% CI                             |
| Area A         | 1.00         | 1.00                      | 1.00                                  |
| Area B         | 1.42 (1.04–1.93) | 1.47 (1.08–2.01)     | 1.21 (0.88–1.67)                      |
| Area C         | 1.33 (0.98–1.78) | 1.35 (1.00–1.82)      | 1.06 (0.78–1.45)                      |

* Stepwise logistic regression analysis adjusted for psychological variables, age and gender.
reporting and sleep disturbance, reduced the association to 1.36 (OR = 1.36; 95% CI 0.81–2.30) indicating that psychological factors also contribute to the relationship between socio-economic status and oro-facial pain (Aggarwal et al., 2003).

To conclude, the present population-based prospective study has demonstrated that area level socio-economic status is related to new onset CWP. The strength of the relationship was modest and after controlling for psychological factors the relationship between CWP and are a level socio-economic status was no longer evident. However, a number of psychological factors remained independently associated with the onset of CWP: sleep disturbance, recent life events, somatic symptom reporting and illness behaviour. The mechanisms which underlie these associations are likely to differ. Sleep disturbance and experiencing threatening life events may be related to psychological distress and act directly to increase the risk of CWP whereas, somatic symptom reporting and illness behaviour are likely to be “risk markers” of symptom onset.

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