BRIEF REPORT

Association of Polymyalgia Rheumatica With Socioeconomic Status in Primary Care: A Cross-Sectional Observational Study

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Objective. Polymyalgia rheumatica (PMR) is an inflammatory musculoskeletal condition predominantly diagnosed and managed in the community. Socioeconomic status (SES) is known to be associated with many inflammatory rheumatologic conditions, but has not been investigated in relation to PMR. This study aimed to investigate the association between PMR and SES at both the area and individual levels.

Methods. Patients ages >50 years registered with 8 general practices in North Staffordshire were sent a questionnaire requesting details of their general health, SES, and lifestyle. Individual SES was measured using occupation, educational level, and perceived adequacy of income. Area-level SES was measured using the Index of Multiple Deprivation, derived from respondents' postcodes. Electronic primary care medical records were searched for Read code diagnoses of PMR 2 years before and after the survey.

Results. Of the 13,831 respondents, 141 had a recorded PMR diagnosis in their electronic medical records, a prevalence of 10 per 1,000 patients. No association between PMR and SES was seen at either the individual or area level.

Conclusion. No association was found between PMR and SES at either the area or individual level. Unlike several of the inflammatory arthritides that are more common in the more deprived areas, PMR shows no such association. In part this may be due to PMR affecting an older population. Although socioeconomic factors are important for clinicians and researchers to consider, in patients with PMR, further epidemiologic work is needed to fully characterize this disabling disorder.

Introduction

Polymyalgia rheumatica (PMR) is an inflammatory musculoskeletal condition predominantly managed in primary care. PMR is more common in women than in men (ratio 2:1) and almost exclusively occurs in those ages >50 years, with the incidence rising with increasing age (1,2). The age-adjusted incidence has been shown to be rising in the UK, from 6.9 per 10,000 in 1991 to 9.3 per 10,000 in 2001,

which, combined with the aging population, make this a growing public health concern (2,3).

It is of importance to understand the association of a disease with the socioeconomic status (SES) of the community, since this may significantly affect the provision and distribution of health care resources and may help provide explanations of etiology. People in the community with lower SES have poorer physical and mental health, higher rates of ischemic heart disease, and poorer access to health care (4–6). Specifically, increasing deprivation is known to be associated with musculoskeletal diseases such as rheumatoid arthritis and osteoarthritis (7,8). Increasing deprivation is also known to be associated with higher C-reactive protein and interleukin-6 levels, inflammatory mediators that are commonly elevated in PMR (9).

SES can be measured at the individual or area level. To date, no studies have investigated the relationship between PMR and deprivation in the community either at the individual or area level. A study has shown a link between

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Significance & Innovations

- There was no association between polymyalgia rheumatica (PMR) and socioeconomic status at either the area or individual level.
- This study provides further information concerning the etiology of PMR.
- Health planners need to understand the associations of deprivation to musculoskeletal disease when providing services in the community.

deprivation and ischemic manifestations of the associated condition of giant cell arteritis (GCA) in patients selected from specialist care settings (10).

Although the incidence of PMR is low, its prolonged course makes this a significant cause of morbidity in the community (11). When planning provision of health services to an aging population, managers and clinicians need more information regarding the etiology of PMR and its association with possible risk factors. This study aimed to investigate the association between SES and PMR in the community at both the individual and area levels using both patient questionnaires and general practice consultation data.

Patients and methods

The North Staffordshire Osteoarthritis Project (NorStOP) is a prospective population-based cohort study that recruited participants ages ≥50 years from 8 general practices in North Staffordshire, UK, between 2002 and 2005 (12). Information regarding general health and sociodemographic and lifestyle information was extracted from a baseline questionnaire mailed to the participants. Respondents to this baseline health survey were asked for consent to review their electronic primary care medical records. Information from these respondents at baseline formed the basis for this cross-sectional study. The 8 participating general practices are members of the Keele GP Research Partnership (12). This study fully complies with the Helsinki Declaration. Ethical approval was obtained from the North Staffordshire Local Research Ethics Committee (LREC 1351).

Identification of patients with PMR. Patients with a clinical diagnosis of PMR were defined by having a Read-coded PMR entry in their electronic medical records. Read codes can be mapped to International Statistical Classification of Diseases and Related Health Problems, Tenth Revision codes (e.g., PMR code N20). A list of the Read codes used to identify patients with PMR is available from the corresponding author upon request. For the purposes of this study, patients were recorded as not having PMR if they did not consult their general practitioner (GP) about PMR in the 4-year period.

Since this was a primary care–based study, we took the pragmatic approach of including all patients in whom the GP had made a diagnosis of PMR. However, to further validate the diagnosis of PMR, we performed a sensitivity analysis including only patients with a Read code for PMR and at least 2 prescriptions for prednisolone recorded in their medical record in the year following diagnosis.

Deprivation measures. *Area-level deprivation.* Deprivation in the UK is measured by the Index of Multiple Deprivation (IMD), which is derived from postcodes. Each localized area (known as lower super output areas [LSOAs]) is populated by a mean of 1,500 people. There are 32,482 such areas in the UK. The 7 weighted domains of the IMD are income (22.5%); employment (22.5%); health deprivation and disability (13.5%); education, skills, and training (13.5%); barriers to housing and services (9.3%); living environment (9.3%); and crime (9.3%). The IMD score is hierarchical; therefore, quintiles of neighborhood deprivation were created ranking areas from 1–5, where 1 = the most deprived and 5 = the least deprived.

Individual-level deprivation. Three self-reported measures of individual-level deprivation from the baseline health survey were used.

First, occupational class was based on the 2002 National Statistics Socio-economic Classification (NS-SEC) categorization, which divided the respondents into 3 occupational class groups according to their self-reported current or most recent occupation: 1) managerial/professional (nonmanual), 2) intermediate occupations/self-employed (self-employed), and 3) lower supervisory/lower technical/semiroutine/routine occupations (manual).

Second, participants were characterized by their educational level as to whether the individual reported if they attended further education after leaving school.

Third, participants commented on the adequacy of their income to cope with daily living. Respondents perceived their income as "adequate" if they had responded "quite comfortably off" or "able to manage" or perceived their income as "inadequate" if they had responded "find it a strain to get by from week to week" or "have to be careful with money."

Potential confounders. Age, sex, body mass index (BMI; <25 kg/m^2 = normal weight, 25–30 kg/m^2 = overweight, and >30 kg/m^2 = obese) calculated from self-reported height and weight, smoking status, and general practice were adjusted for in the analysis because they are potential confounding factors.

Statistical analysis. Differences in demographic variables between participants with and without PMR were examined using the chi-square test and *t*-test, as appropriate. Unadjusted odds ratios (ORs) were used to assess the association between the deprivation measures, demographic variables, and having a clinical diagnosis of PMR. Possible clustering of groups of individuals within the LSOAs was determined using logistic random intercept multilevel modeling. The variance partition coefficient was calculated, which gives the proportion of variation explained by the LSOA-level differences for an individual within an LSOA (13).
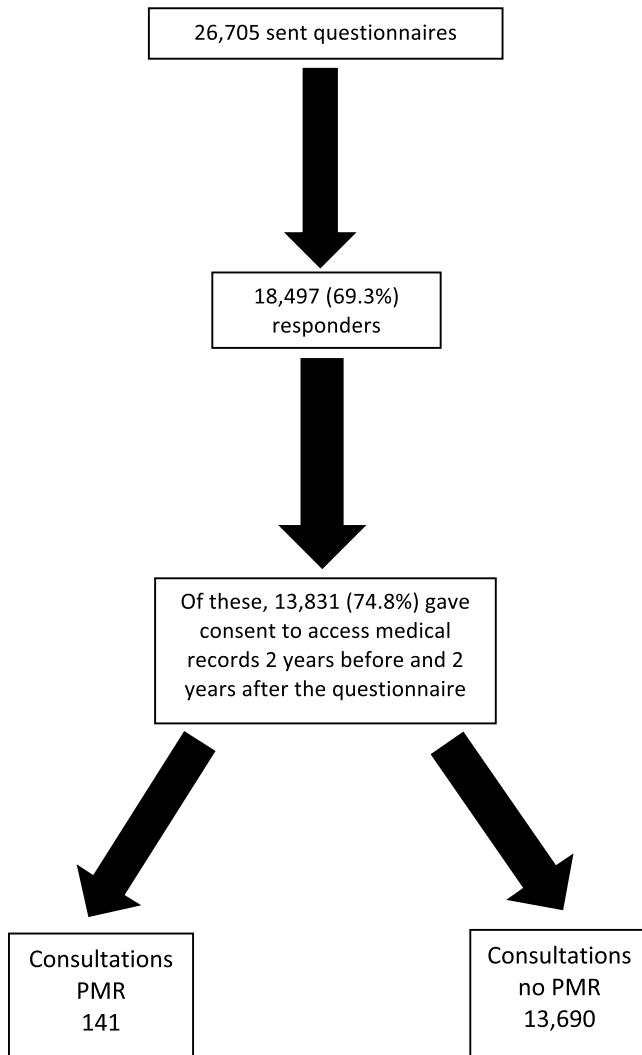
Figure 1. Numbers of persons responding to the questionnaire and consenting to medical record search. PMR = polymyalgia rheumatica.

Models were adjusted for age, sex, neighborhood deprivation, and the 3 individual measures of deprivation plus the confounding factors. Cross-level interactions between individual-level deprivation measures and area-level neighborhood deprivation were added to the model when these covariates were statistically significant (*P* less than 0.05), which, if significant, would show the association between PMR and individual-level deprivation measures varied between different levels of area deprivation. Results are shown as ORs with 95% confidence intervals (95% CIs). Analysis was performed in MLwiN, version 2.25 (14).

Results

A total of 13,831 participants responded to the baseline survey and consented for review of their medical records (Figure 1). The mean ± SD age of the respondents was 65.9 ± 10.1 years, 7,401 (53.5%) were women, and participants originated from 253 LSOAs. In the most deprived areas, 2,061 participants (76.9%) had manual occupations, whereas in the least deprived areas, 1,155 participants

(46.7%) had manual occupations. There was a significant association between occupation and area-level deprivation.

PMR consultation. During the 4-year period, 141 participants (1.2%) had a record of PMR. Participants with PMR were older than those without PMR (mean ± SD age 74.6 ± 8.5 versus 65.8 ± 10.0 years). Of the 141 people with PMR, 105 (74.5%) were women, with a ratio of women to men of 3:1. One hundred sixteen (82%) of those patients with PMR were between ages 65 and 85 years.

There were 5 self-employed PMR cases (0.6%) and 846 non-PMR cases (99.4%); due to low numbers, a sensitivity analysis was performed to determine whether excluding the self-employed group affected the ORs and SEs. Results were similar; therefore, the self-employed group was excluded from further analyses, reducing the number of PMR cases to 136 (1.1%).

Neither in the unadjusted nor in the adjusted analyses was there any association between PMR and SES at either the individual or area level (Table 1). The variance partition coefficient from the null model was extremely close to zero; therefore, diagnoses of PMR did not vary between the LSOAs.

Of the patients with a Read code for PMR, 89% had ≥2 prescriptions for prednisolone recorded in their medical record in the year following diagnosis. The sensitivity analysis found that when adjusted for age, sex, BMI, and smoking status, the results were very similar to those of the analysis using the Read code data alone.

Discussion

No previous study has examined the potential association between PMR and deprivation. This study used data from a large population-based study with linked primary care medical record review to demonstrate the lack of association between PMR and both individual- and area-level deprivation.

A recent study of 271 patients with GCA (a condition commonly co-occurring with PMR) from 8 secondary care centers in the UK found that vascular complications, defined as blurring or loss of vision, diplopia, tongue/jaw claudication, or myocardial or cerebral ischemia, were significantly associated with area-level deprivation using the IMD (OR 4.2, 95% CI 1.3–13.6) (10). However, the authors were not able to examine an association between deprivation and the condition itself. Mackie et al found no association between smoking status and ischemic manifestations of GCA. Of the 259 patients with available data, 54 (21%) had PMR prior to the diagnosis of GCA. Mackie et al found that in this group, PMR was negatively associated with having a higher IMD area deprivation score (*P* = 0.004). However, our study is the first to examine PMR and SES at the individual level.

All of the practices in this study belong to the Keele GP Research Partnership. These practices undergo regular training and assessment to ensure that their diagnostic coding of consultations is of the highest standard, giving confidence in the diagnosis of PMR (15). Moreover, since most patients with PMR are diagnosed and managed ex-

Table 1. Comparison of demographic characteristics, socioeconomic status, obesity, and alcohol use between those with and without PMR*

Variable	Consultation for PMR		Unadjusted, OR (95% CI)	Adjusted, OR (95% CI)†
	No (n = 12,844 [99.0%])	Yes (n = 136 [1.0%])		
Age at baseline, mean ± SD years‡	65.8 ± 10.1	74.5 ± 8.6	1.09 (1.07–1.10)	1.09 (1.07–1.11)
Sex‡				
Female	7,069 (98.5)	105 (1.5)	1.00	1.00
Male	5,775 (99.5)	31 (0.5)	0.36 (0.24–0.54)	0.37 (0.24–0.59)
Neighborhood deprivation‡				
Least deprived	2,451 (98.7)	33 (1.3)	1.00	1.00
Second least deprived	2,516 (99.5)	14 (0.6)	0.41 (0.22–0.77)	0.48 (0.24–0.96)
Mid-deprived	2,684 (98.9)	30 (1.1)	0.83 (0.50–1.37)	0.90 (0.50–1.59)
Second most deprived	2,428 (98.6)	34 (1.4)	1.04 (0.64–1.68)	0.99 (0.55–1.77)
Most deprived	2,761 (99.1)	25 (0.9)	0.67 (0.40–1.13)	0.60 (0.30–1.23)
Occupational class‡				
Manual	7,713 (99.0)	76 (1.00)	1.00	1.00
Nonmanual	4,086 (99.0)	40 (1.00)	0.99 (0.68–1.46)	1.32 (0.86–2.01)
Education				
School-age education	10,942 (98.9)	124 (1.1)	1.00	1.00
Further education	1,618 (99.4)	10 (0.6)	0.54 (0.29–1.04)	0.64 (0.31–1.31)
Perceived adequacy of income				
Adequate income	7,186 (99.1)	66 (0.9)	1.00	1.00
Inadequate income	5,404 (98.8)	67 (1.2)	1.35 (0.96–1.90)	1.46 (0.99–2.15)
Body mass index				
Normal	4,890 (98.9)	56 (1.1)	1.00	1.00
Overweight	5,082 (99.0)	54 (1.1)	0.93 (0.64–1.35)	1.34 (0.88–2.05)
Obese	2,349 (99.2)	20 (0.8)	0.74 (0.45–0.24)	1.23 (0.69–2.17)
Smoking status				
Never smoked	5,455 (98.8)	64 (1.2)	1.00	1.00
Used to smoke	5,363 (99.0)	53 (1.0)	0.84 (0.58–1.21)	1.14 (0.75–1.74)
Current smoker	1,901 (99.2)	16 (0.8)	0.72 (0.41–1.24)	1.26 (0.65–2.43)

* Values are the number (percentage) unless indicated otherwise. The self-employed group was removed from the analysis. PMR = polymyalgia rheumatica; OR = odds ratio; 95% CI = 95% confidence interval.
† Adjusted for general practice.
‡ Statistically significant by the chi-square test or *t*-test for age.

clusively in primary care, few diagnoses are likely to be unrecorded (1). A further strength of this study is the high response rate to the questionnaire of 69.3%. In addition, we also used a variety of different methods to assess deprivation, all of which have been demonstrated to be valid measures.

Despite the large size of the NorStOP study sample, the number of patients with PMR was relatively small (n = 141). This reflects the low prevalence of this condition estimated in this study in the community to be 10 per 1,000, an estimate similar to that calculated by Salvarani et al from general practice records in Olmsted County in the US at 6 per 1,000 (3). It is unlikely that many studies could produce a larger sample with this level of detailed information on SES in the general population.

Staffordshire is an area of the UK where socioeconomic deprivation is higher than the national average, with educational attainment and income being below both regional and national levels (www.staffordshireobservatory.org. uk). This reduced variability in the sample, combined with the small number of PMR cases, may have biased our findings toward the null. However, with point estimates close to the null in many cases and different directions of effect in different markers of SES, it seems unlikely that

conclusions would be different in more diverse populations.

In the 2 years before and 2 years after the NorStOP baseline survey, of the 141 PMR consulters identified, there were 2 consultations for GCA and 7 for rheumatoid arthritis. In those diagnosed with PMR by the GP, it is possible that in some patients their symptoms are part of a paraneoplastic syndrome or a precursor to the development of rheumatoid arthritis.

This study used GP diagnosis of PMR as an inclusion criterion. Although this might not represent a gold standard rheumatology diagnosis for PMR, a sensitivity analysis of patients with 2 or more prescriptions for corticosteroids (a group most likely to have true PMR) found no significant difference in our findings, giving us confidence in our results.

The lack of association between PMR and SES is perhaps surprising given the strong socioeconomic association shown with other inflammatory musculoskeletal conditions (7). However, this adds important information to our currently very sparse knowledge of the population epidemiology of this condition. Further studies of the patterns of occurrence of the condition and its associa-

tions with social, lifestyle, and environmental factors are needed.

AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be published. Dr. Hayward had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study conception and design. Hayward, Muller, Hider, Mallen.

Acquisition of data. Hayward, Muller.

Analysis and interpretation of data. Hayward, Rathod, Muller, Hider, Roddy, Mallen.

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