Socio-economic inequalities in occurrence and health care costs in rheumatic and musculoskeletal diseases: results from a Spanish population-based study including 1.9 million persons

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Abstract

Objective

To explore and compare the impact of socio-economic deprivation on the occurrence of the major rheumatic and musculoskeletal diseases (RMDs) and health care costs.

Methods

Data on diagnoses, socio-demographics and health care costs of the entire adult population of the Basque Country (Spain) was used. Area deprivation index included five categories (1 to 5 (most deprived)). Cost categories included primary and specialist care, emergency room, hospitalisations, and drug prescriptions. Twenty-nine RMDs were grouped into seven groups: Rheumatoid Arthritis, Spondyloarthritis, Crystal Arthropathies, Osteoarthritis, Soft Tissue Diseases, Connective Tissue Diseases, and Vasculitis. The relations between the deprivation and the occurrence of RMD and costs were explored in regression models adjusted for relevant confounders.

Results

Data from 1,923,156 adults were analysed. Mean age was 49.9 (SD18.4) years, 49% were males. Soft tissue diseases were the most prevalent RMD (5.5%, n=105,656), followed by osteoarthritis (2.2%, n=41,924). Socio-economic deprivation was associated with higher likelihood to have any of the 29 RMDs. The strongest socio-economic gradient was seen for the soft tissue diseases (OR 1.82 [95%CI 1.78;1.85], most vs. least deprived), followed by osteoarthritis (OR 1.59 [1.54;1.64]). Deprivation was also associated with higher costs across the majority of the conditions however patterns were more blurred, and inverse relationship was observed for connective tissue diseases, gout, hip osteoarthritis and undifferentiated (poly)arthritis.

Conclusion

Socio-economic deprivation is associated with increased occurrence of all RMDs, and in most cases more deprived patients incur higher health care costs.

Key words

rheumatic and musculoskeletal diseases (RMDs), socio-economic factors, health care costs

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Background

Rheumatic and musculoskeletal diseases (RMDs) are highly prevalent and according to the burden of disease report present a major cause of disability adjusted life years worldwide. Globally, all RMDs combined accounted for 21.3% of the total years lived with disability, second to mental and behavioural problems (23.2%) (1).

The burden of disease report invites researchers to improve our understanding on the underlying factors related to occurrence of disease. A study based on the World Health Survey among 41 countries explored arthritis among other chronic diseases and concluded that there were socio-economic inequalities by education and household wealth. Authors concluded that disaggregated research is warranted to assess the impact of socio-economic status (SES) on individual non-communicable diseases (2). Several studies in patients with different rheumatic conditions have attempted to shed light on the role of the socio-economic deprivation on prevalence and incidence, however, evidence remains inconsistent. On this line, studies from a number of countries showed that patients with lower socio-economic background are at higher risk to have the RA (3, 4). Notwithstanding, another two studies could not confirm a role of social class or formal education in the incidence of RA (5, 6). Systemic Lupus Erythematosus (SLE) was shown to present earlier and lead to worse outcomes in certain non-Caucasian ethnicities, which could be partially attributed lower SES (7, 8). Callahan *et al*. observed that knee OA was more frequent in less educated individuals and those living in areas with more poverty (9), however, a recent study by Rodriguez-Amado *et al*. (10) reported the OA is less prevalent in communities characterised by higher social underdevelopment. Lower SES and belonging to ethnical minority have been significantly associated with the occurrence of gout (11, 12). It is apparent that the debate on the roles of socio-economic factors on incidence and prevalence of RMDs is not closed (13).

Substantially fewer studies have explored the relationship between SES and costs. On the one hand, higher severity in most of RMDs in persons with lower SES may result in higher costs. Additionally, these patients may be more insecure about the disease, and thus seek medical attention. On the other hand, in some countries patients may experience barriers in access to health care or certain treatments, as these for example have been shown for biologic therapies in RA (14). The pattern of costs may also vary depending on the manifestation of diseases. For example, persons with lower SES may not seek physician help if symptoms are not severe. Naturally, this might change (or not for diseases with less hindering symptoms) over time when delays in care result in health loss and higher costs. Study by Fitzpatrick *et al*., which did not specifically focus on RMDs, has revealed that low income and education, as well as living in deprived neighbourhoods greatly increased the odds of future high costs on health care utilisation (15).

While the literature suggests that for several individual RMDs a socio-economic gradient in the occurrence or healthcare utilisation exists, direct comparisons across the various RMDs are hindered by differences in study design as well as operationalisation of SES (13). So far it is not known whether socio-economic deprivation is equally relevant for various RMDs while this could further inform physicians and policy-makers about the role of contextual factors in the specific disease patterns. Insight into the costs distribution within these diseases is important for economic evaluations and management. The objective of this study was to explore and compare the impact of socio-economic deprivation on the occurrence of the main RMDs and on health care costs (HCC).

Methods

Data from an administrative dataset linking information on diagnoses, socio-demographics, and health care costs were used. No ethical approval was required for this study in accordance with the rules of Medical Ethical Committee of Maastricht University. The study population included every

adult individual (≥18 y.o.) covered by public health insurance in the Basque Country on August, 31st 2011 and who had been covered for at least 6 months in the previous year, even if no contact with health system has been registered. Basque health care system is based on universal coverage and care free at the point of use with exception of drugs for which co-payments up to 40% apply. Vulnerable population groups (disabled, elderly) pay reduced rate or are exempted from co-payment. Data on age, gender, health care costs and current diagnoses were collected on an individual level between September, 1st 2010 and August, 31st 2011. Deprivation index (1 to 5 (most deprived), classified according to quintiles distribution) for each individual was based on area of residence and accounted for percentages of residents who perform manual work, are unemployed or temporary employed, or have a low level of educational attainment, overall and specifically among young people. Construction and validation of the index is described elsewhere (16). Costs included annual primary and specialist care, emergency visits, hospital admissions, and ambulatory drug prescriptions (some expensive drugs, such as the biologic ones, are delivered directly to outpatients in specialised care, and not included in our study). Diagnostic information was extracted and combined from general practitioners (GP) electronic health records, hospital discharge reports, outpatient specialised care, emergency services, day hospital and home hospitalisation and was registered according to International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Drug prescriptions were coded using the Anatomical Therapeutic Chemical (ATC) classification. In total, 725 ICD-9-CM codes representing 29 RMDs were preselected based on the relevance and prevalence. Codes were extracted by two researchers with clinical background (AB, internist/rheumatologist and SR, rheumatologist in training) (Online appendix Table S1). Disagreement was resolved by consensus. The 29 individual diseases belonged to seven larger diagnostic groups: Rheumatoid Arthritis, Spondyloarthritis (SpA), Crystal Arthropathies, Osteoarthritis, Soft tissue diseases, Connective Tissue Diseases, and Vasculitis (Table I). Further, a list of 52 chronic diseases was used to calculate the Rheumatic Diseases Comorbidity index (RDCI) (score 0–8, information on fractures was not available) (Online appendix Table S2).

Occurrence of the diseases and total costs were the outcomes of interest. To explore the relationship between the deprivation index and the occurrence of the diseases logistic regression models were computed. When the highly skewed total HCC was the outcome, Poisson models were used to compute incidence rate ratio (IRR). All models were adjusted for age and gender, and models with costs as an outcome were additionally adjusted for the RDCI. Interactions between deprivation index and age and gender were tested.

Table I. Relationship between socio-economic deprivation and the occurrence of rheumatic and musculoskeletal diseases and health care costs.

Disease	OR [95% CI] to have disease (most deprived vs least deprived)	IRR [95% CI] total costs (most deprived vs least deprived)
Rheumatoid arthritis	1.32 [1.19;1.46]	1.18 [1.18;1.19]
Rheumatoid arthritis	1.30 [1.17;1.45]	1.25 [1.25;1.25]
Undifferentiated (poly)arthritis	1.51 [1.13;2.01]	0.73 [0.73;0.73]
Spondyloarthritis	1.43 [1.22;1.68]	1.49 [1.49;1.5]
Ankylosing spondylitis	1.72 [1.31;2.25]	1.81 [1.80;1.82]
Psoriatic arthritis	1.35 [1.08;1.68]	1.48 [1.47;1.48]
Reactive arthritis	n/a	n/a
Undifferentiated spondyloarthritis	1.66 [0.91;3.04]	1.23 [1.21;1.24]
Crystal Arthropathies	1.65 [1.47;1.84]	1.01 [1.01;1.02]
Gout	1.63 [1.46;1.83]	0.97 [0.97;0.98]
Other crystal arthropathy	1.74 [1.22;2.48]	1.40 [1.39;1.41]
Osteoarthritis	1.59 [1.54;1.64]	1.10 [1.10;1.10]
Knee Osteoarthritis	1.90 [1.78;2.03]	1.12 [1.12;1.12]
Hip Osteoarthritis	1.33 [1.21;1.46]	0.92 [0.92;0.93]
Hand Osteoarthritis	1.12 [1.01;1.25]	1.18 [1.18;1.18]
Osteoarthritis other	1.59 [1.45;1.74]	1.14 [1.13;1.14]
Degenerative neck disease (cervical spine)	1.53 [1.36;1.72]	1.14 [1.13;1.14]
Chronic low back pain (excluding degenerative)	1.62 [1.53;1.72]	1.14 [1.13;1.14]
Osteoarthritis generalised	1.61 [1.49;1.75]	1.11 [1.11;1.11]
Soft tissue diseases	1.82 [1.78;1.85]	1.11 [1.11;1.12]
Chronic low back pain (excluding degenerative)	1.86 [1.81;1.91]	1.13 [1.13;1.13]
Chronic neck pain (excluding degenerative)	1.99 [1.89;2.09]	1.05 [1.05;1.05]
Fibromyalgia	1.70 [1.51;1.91]	1.23 [1.23;1.24]
Soft tissue disease	1.67 [1.61;1.72]	1.15 [1.15;1.15]
Connective Tissue Diseases	1.33 [1.04;1.69]	0.96 [0.96;0.96]
Systemic lupus erythematosus	1.31 [1.00;1.72]	0.98 [0.97;0.98]
Sjögren's disease	n/a	n/a
Systemic sclerosis	n/a	n/a
Myositis	n/a	n/a
Other connective tissue disease	n/a	n/a
Vasculitis	1.10 [0.74;1.63]	1.41 [1.4;1.42]
ANCA-associated vasculitis	n/a	n/a
Non-ANCA-associated vasculitis	1.08 [0.72;1.62]	1.43 [1.42;1.44]
Other		
Osteoporosis	1.09 [1.03;1.14]	1.19 [1.19;1.19]
Polimyalgia rheumatica	1.21 [1.04;1.41]	1.10 [1.10;1.11]
Undifferentiated monoarthritis	1.48 [1.07;2.04]	1.09 [1.08;1.10]

Results from logistic and Poisson regression models.
OR: odds ratio; IRR: incidence rate ratio; CI: confidence interval; n/a: not available due to small sample size.

Results

Data from 1,923,156 individuals were available. Mean age was 49.9 (SD 18.4), 49% were males. Soft tissue diseases were the most prevalent RMD (5.5%,

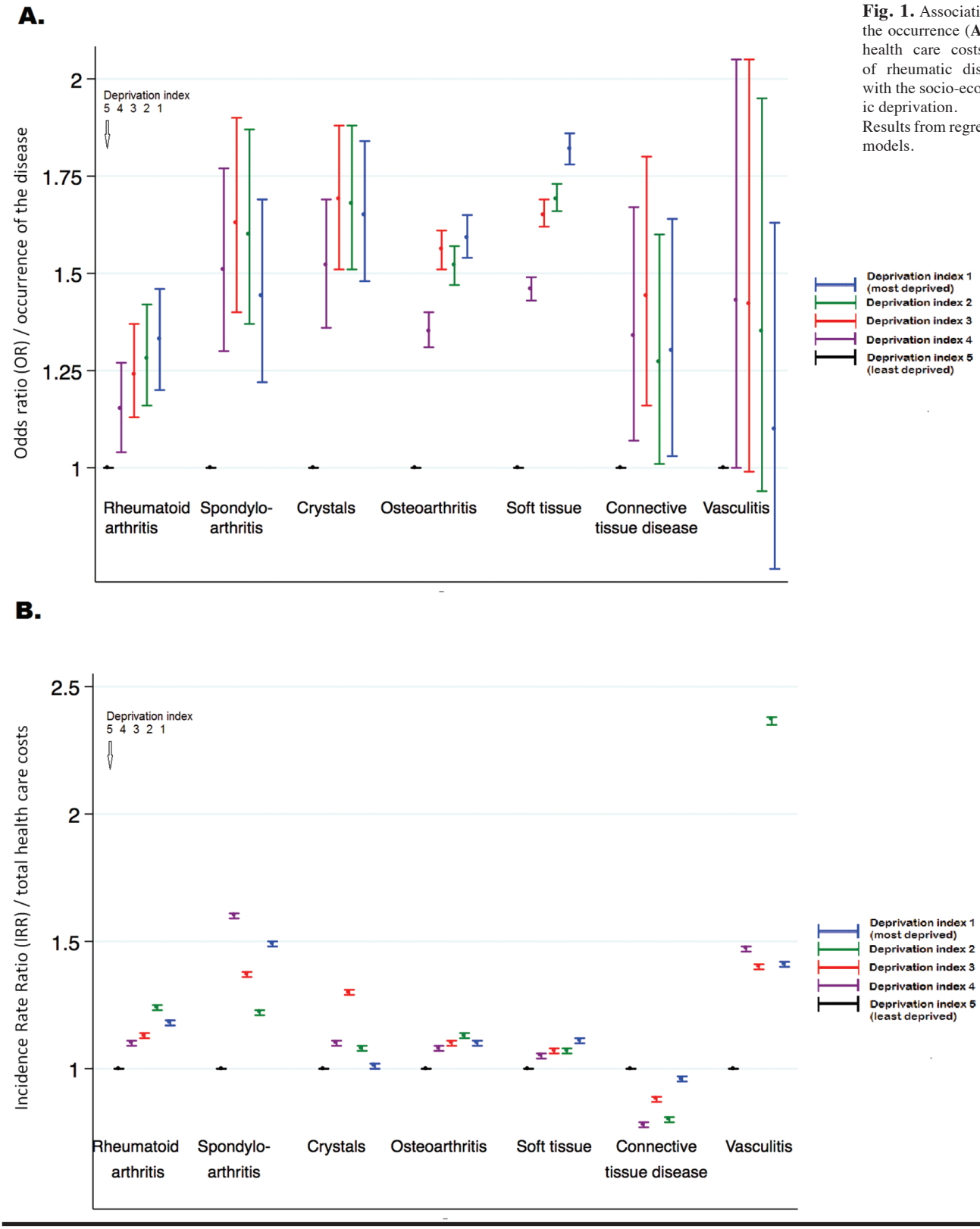

Fig. 1. Association of the occurrence (**A**) and health care costs (**B**) of rheumatic diseases with the socio-economic deprivation.
Results from regression models.

n=105,656), followed by osteoarthritis (2.18%, n=41,924). Vasculitis (€5,236 per person/year), rheumatoid arthritis (€3,866 per person/year) and connective tissue disease (€3,496 per person/year) were the disease groups with the highest average annual health care costs per patient (online appendix Table S3). When accounting for the prevalence, total budget impact was highest for soft tissue diseases (€240,003,943). Health care costs for the different cost categories are presented per disease in online appendix Table S4.

Socio-economic deprivation was associated with a higher likelihood to have any of the RMDs. The strongest socio-economic gradient was seen for

the occurrence of soft tissue diseases (OR 1.82 [95%CI 1.78;1.85], for most vs. least deprived), followed by osteoarthritis (OR 1.59 [95% CI 1.54;1.64]). (Table I, Fig. 1A)). ORs in RA, Soft tissue diseases and OA were gradually lower for each next decreasing level of deprivation so that a clear socio-economic deprivation gradient was seen in each of the RMDs groups considered. Patterns in SpA, crystal disease, connective tissue diseases and vasculitis were less clear, however, a gradient in the same direction was apparent.

Deprivation was also associated with higher costs across the majority of the RMDs. However, different patterns across diseases were observed as compared to the occurrence. Namely, the strongest gradients were found in patients with spondyloarthritis (IRR 1.43 [95% CI 1.22;1.68], most deprived *vs*. least deprived), in particular with ankylosing spondylitis (IRR 1.72 [1.31;2.25]), and vasculitis (IRR 1.41 [1.40;1.42]) (Table I, Fig. 1B). An inverse gradient was observed in the Connective tissue diseases group, as well as in gout, hip OA and undifferentiated (poly)arthritis, indicating that those more deprived incurred lower healthcare costs (Table I). Interactions between deprivation and gender were either not significant or not judged as clinically relevant after stratification.

Discussion

In a large population healthcare database of adults, we observed that socio-economic deprivation was consistently associated with a higher frequency of occurrence across all RMDs. This pattern persisted to a certain extent with higher costs, with a few exceptions seen for connective tissue diseases, gout, hip OA and undifferentiated (poly)arthritis, where more deprived persons incurred less costs. When occurrence of diseases was considered the outcome, the gradient in most cases was linear, indicating that every step down the deprivation ladder the odds for adverse outcome was higher, while this could not be as clearly observed when the more complex concept of costs was the outcome. Notably, gradients in occurrence and costs across RMDs studied were of a similar magnitude across all seven major RMDs studied. Among them, soft tissue diseases were not only the most prevalent, but also showed the largest gradient in relation to the occurrence of disease, while vasculitis and SpA had the largest variation in relation to costs incurred by most *versus* least deprived group.

The major question raised by the current and previous studies concerns the common pathway that connects deprivation and onset of the RMDs. Deprivation is undoubtedly a "wicked" problem with multiple dimensions, which affects nearly all facets of human functioning in the society, including education, income, justice, social support but also access to health-related information. Khatun *et al*. have followed more than a 1000 Swedish men and women from age of 16 to 30 who did not have social class gradients in health at ages 16 and 21. Authors observed that accumulation of adverse behaviour and social circumstances from adolescence to early adulthood may explain the socio-economic differences in musculoskeletal health at the age of 30, when blue-collar workers were twice as likely to have a musculoskeletal disease compared to a white-collar worker (17). Of note, some of the RMDs have a genetic factor, while social deprivation is known to be likely carried forward to next generation (18). The paradox in distribution of health care costs for connective tissue diseases (SLE), gout, hip OA and undifferentiated (poly)arthritis deserves consideration. While these diseases are more prevalent in persons living in more deprived areas, these patients appear to make less use of health care services. The explanation can be in the fact that connective tissue diseases, gout and undifferentiated (poly)arthritis are complex and often not associated with pain and severe function limitation. Thus, it is probable that higher SES individuals, who exert more control over their health state, are more likely to seek medical health for this type of conditions. For gout, low adherence to prescribed treatment plans is recognised and the current data suggest this might be particularly true in the lowest socio-economic classes, although this has not been formally confirmed in a population-based study (19). Lower costs associated with hip OA among more deprived appeared at first a puzzling finding. One of the explanations could be that hip OA develops into a more severe form and causes more perceived physical limitations in those who practice more sport, and these are commonly higher SES groups. These patients may demand surgery more frequently, thus explaining the reverse pattern in incurred costs. For all the remaining conditions studied, both prevalence and costs were higher in more deprived persons. The major strength of the current study is that it provides a comparison across major RMD groups in a large representative sample of the population. Moreover, the database is population-based and contains information on individual demographic, clinical and healthcare utilisation at the different levels of the system, including primary as well as specialised care. Hence, potential sample selection biases are avoided. To our knowledge, this is the first study to compare epidemiological patterns and costs in a number of RMDs with the focus on socio-economic inequity, and provides valuable insights on the costs distribution within the RMDs that could be used for economic evaluations and health system management.

This study has also several limitations. First, it is a cross-sectional study that hinders conclusions about causality. Furthermore, data on the age at the onset of the disease was not available as well as on severity of the condition, while those could have added an important insight into the role of the deprivation in the epidemiology of RMDs. Some misclassification could have occurred as diagnoses were extracted from administrative datasets. To mitigate this issue and be more certain about the diagnoses of RMDs, we have set a requirement that the disease should have been coded twice to be recognised as such. Last but not least, in-hospital drugs were not included in the costs which can lead to underestimation of total costs in some disease groups where such pharmaceutical treatment plays an important role.

While the notion of social gradient has received substantial attention since

Black report in 1980, this study is, to the best of our knowledge, the first to explore in great detail the socio-economic gradients in occurrence and costs across all major rheumatic and musculoskeletal diseases. The findings imply a leading role of generic rather than disease-specific factors connecting deprivation and development of RMDs. In most cases, deprivation was also associated with higher health care costs, indicating higher healthcare need for deprived persons once they are diagnosed with a rheumatic disease.

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