Indirect costs due to RD

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Background: Rheumatic diseases (RD) cause physical disability that may lead to early exit from work, generating indirect costs to society. We aimed to measure these costs in a population approaching the statutory retirement age. Methods: The analysis was based on the prevalence of self-reported RD using a bottom-up approach. Health and sociodemographic data were retrieved from the fourth National Health Survey (INS), for all people between 50 and 64 years of age (3762 men and 4241 women), whereas an official national database was used to estimate productivity values by gender, age group and region, using the human capital approach. The effects of RD on the likelihood of early exit from paid employment and the attributable fractions estimates were obtained at the individual level by logistic regression. Results: At the time of the survey, 37.2% of the population aged 50–64 years self-reported at least one RD. Among these, 52.6% were not employed, compared with 40.7% of those without RD (P<0.001). The annual indirect costs following premature exit from work attributable to RD were €650 million (€892 per RD patient). Early retirement amounted to €367 million, whereas early retirement and unemployment totalized €385 million (€504 and €528 per RD patient, respectively). Females are responsible for about 60% of these costs; however, males contribute with higher individual productivity losses. Conclusion: Early exit from work attributable to RD amounts to approximately 0.4% of the national GDP. The public health concern and the economic impact highlight the need to prioritize investments in health and social protection policies targeting patients with rheumatic conditions.

Introduction

Rheumatic diseases (RD) are characterized by pain and physical disability that may lead not only to a substantial consumption of health resources but also to productivity losses and early retirement.¹–³ Knowledge about the economic burden of this group of disorders has progressed in recent years confirming that the total economic burden of RD is often more substantial than other chronic conditions, including cardiovascular diseases and cancer; and that the impact of the disability caused by these conditions is significant on both direct and indirect costs, such as early exit from work.⁴ Foregone productivity due to premature withdrawal from work decreases the wealth of society and thus should be considered in the estimation of the economic impact of these illnesses.⁵

Available evidence suggest that RD play a key role on overall early exit from work because usually they are both highly prevalent and disabling, in particular for occupations where working conditions...
are difficult to modify or adjust to the impaired work abilities of employees.\textsuperscript{6,7} Nevertheless, most published works on indirect costs address specific rheumatic conditions (e.g. rheumatoid arthritis\textsuperscript{6–10} and ankylosing spondylitis\textsuperscript{11}) and there is a general lack of research about the costs associated with RD as a whole. Considering all RD, instead of dealing with specific RD forms, puts the focus on common characteristics of all forms of rheumatic conditions (for instance, highly prevalent in lower social classes, progressive physical disability).

Considerable changes in labour force rates have been observed in the last decades with a shrinking number of economically active people supporting a growing economically dependent elderly population.\textsuperscript{12} This has led to heavy financial demands and to Social Protection systems sustainability problems for countries with high unemployment, early retirement and disability pensions, likely influenced by progressively prevalent chronic diseases, such as RD. Nowadays, in developed countries, over a third of the population approaching the statutory retirement age suffers some type of RD.\textsuperscript{13–16} This situation will deteriorate in the coming future and therefore RD are expected to have a growing impact in indirect costs, in particular those caused by premature departure from the labour market. This makes RD good candidates to be the target of specific public health policies, which in turn should be preceded by research supporting informed decision making. Calculating this specific type of indirect costs attributable to RD may help to prioritize not only this group of illnesses as a whole but also to identify particular subgroups at higher risk, thereby justifying higher investments on activities to reduce their risk of early withdrawal from work.

The main aim of this study is to measure the indirect costs associated with early exit from work attributable to all RD in a population approaching the statutory retirement age.

\section*{Methods}

\subsection*{Sample}

The source data for this study was the Fourth Portuguese National Health Survey (INS), which was conducted in 2005 and 2006 in all regions of Portugal. The methodology of the INS has been detailed elsewhere.\textsuperscript{17,18} Briefly, the primary sampling unit was the housing unit, which were randomly selected within each geographically defined unit. Subjects living in the sampling unit were then surveyed by trained staff. The sample was considered representative of the main regions of Portugal.\textsuperscript{18,19}

In this study, the subsample of all INS surveyed people approaching the statutory pension age, between 50 and 64 years, was analysed. The sample under analysis composed of 3762 men and 4241 women. Cases of RD were defined according the participant’s self-reported history of any RD (‘Do you or did you have any rheumatic disease (e.g. osteoarthritis, tendinitis)?’)

\subsection*{Indirect costs}

Early retirement was considered as being out of paid work before age 65 years, which is the most common statutory retirement age, including Portugal. There are different channels of exiting from the labour market, including unemployment, disability and pure early retirement.\textsuperscript{19–21} These pathways are related to the same economic behaviour, which implies an exit from the labour market in the later stages of working life and subsequent loss of productivity for society. However, it was still considered relevant and more informative to separately analyse and report results for three main types of early exit from work: Type 1, pure retirement; Type 2, pure retirement and unemployment and Type 3, all forms of exit from paid employment.

We adopted the society’s perspective and used the human capital approach to estimate productivity costs by valuing healthy time lost due to the disease using market wage rates, which can be viewed as the loss of an investment in a person’s human capital.\textsuperscript{22} The friction cost approach has been proposed as an alternative to calculate indirect costs; however, it is considered less appropriate to estimate the productivity losses for retirees and other forms of early exit from paid employment, which was the focus of our research.\textsuperscript{23–25}

The value of lost production was assessed by obtaining the market wage rates from national public sources concerning year 2005.\textsuperscript{26} These figures needed to be adjusted for social security contributions, since the economic cost of lost production is calculated on gross incomes and includes employers’ contributions to social security. We obtained an annual average value of €19 455 for men and a €12 899 for women, for ages between 50 and 64 years. All unit values of lost production were stratified by age range, gender and geographic region (Supplementary Appendix S1).

Estimation of the sole impact of RD on the probability of early exit from paid employment was assessed using logistic regression models for the three types of outcome explained earlier (Supplementary Appendix S2). The following relevant covariates were included in the initial models: age, gender, region, other comorbidities, self-perceived health status, lifestyle factors, marital status, socioeconomic characteristics and occupational social class. In the final logistic models, only covariates with a statistically significant association to the dependent variable ($P<0.05$) were considered.

A good measure of the impact of RD in the early exit from paid employment may be the population attributable fractions (PAF), which take into account both the strength of the association between RD and early exit from work, as measured in the logistic models, and the prevalence of RD in the surveyed population. PAF were calculated as the resulting proportional change in the probability of exit from paid employment after a counterfactual exercise where the presence of RD is artificially eliminated from the sample. This recalculated probability of early work exit was used to estimate the indirect costs attributable to RD. Thus, annual indirect costs associated with early exit from work and attributable to RD were obtained after multiplying each observation’s probability change with the corresponding unit value of production (previously assigned in the INS sample according to age group, gender and geographic region).

Descriptive analysis was also performed comparing the RD population against the non-RD population. All variables were tested at the bivariate level using the chi-square test. Prevalence of exit from work and other characteristics were computed as weighted proportions, to take into account the sampling design of the survey.

\section*{Results}

At the time of the survey, 37.2\% of the population with ages between 50 and 64 years self-reported at least one RD. The baseline characteristics of RD and non-RD sub-populations are presented in more detail in table 1. As expected, RD were more prevalent among older people and women. The same applies for those with lower education, lower household income and manual type of work. RD are highly associated with other comorbidities, such has chronic pain, hypertension, depression and anxiety. Almost all disorders surveyed were more often self-reported among those with RD (table 1), and higher average number of comorbidities per capita was found in the RD group (comorbidity score = 2.7 vs. 0.9, $P<0.001$). Additionally, more than a third (37\%) of RD individuals reported ‘poor’ to ‘very poor’ health, whereas less than half of that proportion (14.9\%) was found among those without RD, meaning a clear worse self-perceived health associated with RD.

\subsection*{Exit from work}

Almost half of the surveyed population with ages between 50 and 64 years were out of paid work (45.1\%, table 2). Among those who self-reported RD, 52.6\% were not employed, compared with 40.7\% of
those without RD (P < 0.001, table 2—Type 3). In particular, 22.7% of RD participants declared to be officially retired (i.e. Type 1) compared with only 17.9% of those without RD. When considering all forms of exit from paid employment, women are more present than men, most likely due to higher proportion of female housewives; however, men are more likely to be out of work when narrow definitions of exit of work are used (Type 1: 23.7% vs.

15.7%; Type 2: 32.8% vs. 21.9%; Type 3: 35.4% vs. 53.8%, respectively, for men and women). This observation stills holds true if the population with RD is analysed separately from the non-RD sub-population (table 2).

**Logistic models and attributable fractions**

In this nation-wide representative sample, a high association was obtained between RD and early exit from work, regardless of the definition used. For example, when using the Type 3 definition, the univariate odds ratio (OR) for RD was 1.62 (CI: 1.36–1.92, P < 0.001, Supplementary Appendix S2). This OR became 1.31 (CI: 1.12–1.52, P < 0.001) when adjusted. Also regarding Type 3, the PAF of RD calculated with adjusted and unadjusted ORs were 5% and 9.8%, respectively (table 3). The observed average probability of the sample to be out of paid work (Type 3) according to the model developed was 46.9%, whereas after transforming all observations into non-RD status, the model delivered a reduced average probability of 44.6%. After summing the products of each observation’s probability change with the corresponding unit value of production (Supplementary Appendix S1), an overall estimate of €650 million per year of indirect costs caused by premature exit from work attributable to RD was obtained. This represents an annual indirect cost per person with RD of €892. When using other definitions of early exit from work, estimates of annual indirect costs of €367 million for pure reforms (Type 1) and €385 million for pure reforms and unemployment (Type 2, figure 1) were found; with annual indirect costs per person with RD of €504 and €528, respectively (table 3). Figure 1 depicts the evolution of estimated indirect costs attributable to RD by early exit out of work type. Females have higher indirect costs than males, particularly when using the Type 3 definition (€403 million vs. €247 million, respectively).

Figure 2 shows the gender and age group contributions for the overall productivity losses according to each type of exit from work definition. Not surprisingly, both advanced age and female gender are associated with higher indirect costs. However, costs per person with RD are higher for men (€788 vs. €390 for Type 1; €784 vs. €426 for Type 2 and €1185 vs. €775 for Type 3), regardless of the age group considered (Supplementary Appendix S3).

**Discussion**

This study estimated that RD-related productivity losses due to early exit from paid employment are potentially associated with an annual cost between €367 million and €650 million (depending on the type of early exit from work considered). More than half of the sample with RD was not employed at the time of the survey and that translates into substantial costs for society. This research is based on a large and representative sample of the country’s population approaching the statutory age of retirement, and thus, it is likely to reflect accurately the economic impact on Portuguese society.

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**Table 2 Description of the sample by type of exit from work for ages 50–64 years: National Health Survey (n = 8003)**

<table>
<thead>
<tr>
<th>Type 1, % (N)</th>
<th>Type 2, % (N)</th>
<th>Type 3, % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD</td>
<td>Males</td>
<td>33.9 (69983)</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>17.9 (87041)</td>
</tr>
<tr>
<td></td>
<td>All gender</td>
<td>22.7 (157024)</td>
</tr>
<tr>
<td>Non-RD</td>
<td>Males</td>
<td>20.6 (139871)</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>13.4 (65742)</td>
</tr>
<tr>
<td></td>
<td>All gender</td>
<td>17.6 (205613)</td>
</tr>
<tr>
<td>Global (RD + non-RD)</td>
<td>Males</td>
<td>23.7 (209854)</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>15.7 (152783)</td>
</tr>
<tr>
<td></td>
<td>All gender</td>
<td>19.5 (362636)</td>
</tr>
</tbody>
</table>

All results are based on weighted data. Type 1, pure retirement; Type 2, pure retirement + unemployment; Type 3, all forms of exit from paid employment.
Considering the timeframe of the survey (2005/2006), this sort of costs is about 0.4% of the national GDP.

As RD are more prevalent in women, overall indirect costs split by gender were unbalanced with greater overall economic burden on females. The trend to even wages between genders and the worsening of the epidemiology of RD particularly in women lead to the expectation that these costs will grow faster in the coming future if nothing is done to the contrary, namely by controlling RD burden. The evidence around the gender decomposition of indirect costs per capita may be useful to raise awareness concerning the case of male RD patients, whose higher mean individual contribution of RD to indirect costs deserves concern. However, more importantly, along with the abovementioned reduction of gender inequalities in wages, female gender is more vulnerable to RD, meaning that public health policies on this regard should aim predominantly at women.

Of note, when housewives are not included in the analysis, men are more likely to be out of paid employment earlier than women. Ill health seems to play a particular role in early decisions of retirement among males. Men reporting more comorbidities and/or lower self-perceived health status are significantly more likely to be out of work earlier in their careers (data not shown). This topic in itself deserves further research as there may be great potential for targeted policies to achieve productivity gains.

Although age groups closer to retirement age have lower unit values of production, they are contributing more for overall indirect costs, because there is substantial higher prevalence or early retirees in these ages. Meaning that not only it is relevant to act in earlier ages but also it is still worthwhile to do so for older ones.

The reduced average probability of exit from work following the artificial removal of RD from the sample (counterfactual simulation) suggests that upon an alternative ideal exposure scenario, with no rheumatic disorders in the population, there could be a reduction of up to almost a tenth of the overall likelihood of early exit from paid work. We must highlight the fact that RD are not only highly associated with other comorbidities but that they are also established risk factors for some of these comorbidities. For example, RD are associated with an increased risk of chronic pain, cardiovascular risk, depression and anxiety. In its turn, these comorbidities are also associated with early exit from work. This means that RD may contribute further to the increased risk of early work exit through these alternative ill-health routes and that the herein presented indirect costs could have risen if these other secondary effects of RD had been considered. For instance, the univariate OR for chronic pain is between 1.36 and 1.62, for Type 1 and Type 3.
outcomes, respectively. This means that RD underlying chronic pain are also expected to be affecting labour force participation through this disability route.

Studies have shown that the total economic burden of RD is often more substantial than other chronic conditions due to both direct and indirect costs. In fact, depending on the specific condition, the indirect costs of RD may equal or even exceed the direct costs. However, most cost-of-illness studies on RD are restricted to specific rheumatic forms and the literature still suffers from a general lack of research on the indirect costs associated with RD as a whole. To our knowledge, the current research is among the few studies of the indirect costs of RD specifically analysing early exit from work. Nonetheless, some authors have addressed the impact of RD in similar forms of indirect costs and they all came up with high estimates. For example, in 1998, a major share of the total cost of musculoskeletal disorders in Canada came from indirect costs (roughly 2.4% of the Canadian gross domestic product at that time). This large share of indirect costs is in line with results from seminal studies in the United States done by Rice and Yelin et al. and it was even more pronounced in Sweden, where indirect costs (specially from early retirement) were accounted as 90% of all costs caused by RD. More recently, in Australia, arthritis caused an annual loss of approximately 0.7% of GDP due to early retirement, which is in line with our results and much higher than the same type of costs caused by other disabling diseases, such as cardiovascular disease (~0.06% of GDP), diabetes (~0.08%) and mental conditions (~0.1%). Anyway, one as to bear in mind that comparing results of cost-of-illness studies is hampered by discrepancies between study designs, definition of RD, methodological choices and sources of data used.

Our results were mostly based on self-reported data. We do not expect to have a significant bias due to low reliability of the participants' reported data, because RD are expected to inflict significant disability and/or impact in quality of life and therefore should be associated with high predictive values. On the other hand, we do not expect our results to be influenced by justification bias (i.e. some people may want to justify their early retirement through health problems, which is a common limitation in this type of research), as this study was based on the INS, which was not focused on retirement and did not generate any pressure for responders to justify their retirement condition. However, some limitations must be taken into account in interpreting the results of this study. First, this study may be limited by its cross-sectional design, which does not allow evaluation of the temporal relationship between the onset of RD and the timing of labour force departure, meaning that some cases may have had RD onset after exit from work. Lack of available national longitudinal data made this limitation impossible to overcome. Nevertheless, onset of most forms of RD is likely to start before the statutory age of retirement. Second, early exit from paid work is reportedly influenced by many other factors not included in the regression models used, therefore maybe not all possible confounders were addressed in this research. However, adjustment was done with a considerable number of available cofactors in the INS dataset. In fact, to our knowledge, this might be among one of the studies with higher number of addressed cofactors. Third, the human capital method has been criticized for its overestimation of indirect costs, since the real paid production loss to society is likely to be lower (for instance, for long-term absence, the work can be done by someone drawn from the unemployment pool or by reallocating existing employees). Nevertheless, as explained before, to address the objectives of this study, we considered this approach as the most appropriate and widely used method. Gender wage differences impact the estimates in particular when studying RD, a disease more likely affecting women with lower average wages. Because there is no definitive method to solve this methodological dispute, we opted for a more conservative approach by allowing gender differences on unit production values. Finally, unit values of production were estimated through official statistics based on gender, region and age group. Necessarily, this methodology is a rough estimate of individual unit values of production. Still, from all available options, to our knowledge, this approach is the most appropriate.

This comprehensive population-based research underlines the high economic burden of RD concerning early retirement, justifying more attention when discussing policies facing the most relevant sustainability challenges of ageing western countries. Demographic trends and the epidemiological shift to an enduring chronic diseases paradigm will worsen this scenario if nothing is done.

Rheumatic disorders are still undervalued in health policies. However, we cannot afford to be inactive regarding this topic any longer and should address possible interventions intended to stop early exit from work due to RD. A prolongation of working life in these patients must be accomplished without threatening their well-being. Some intervention programs specifically addressing rheumatic patients have already been put in place and tested. For example, vocational rehabilitation delivered to RD patients at risk for job loss, but while they were still employed, delayed job loss. Working conditions are potentially important modifiable risk factors. On this regard, Chorus et al. found that individuals with rheumatoid arthritis who had received at least one form of workstation accommodation (included shortening work hours, slowing pace of work, changing tasks and being allowed to manage work) were 2.5 times less likely to be work disabled; but these interventions require further investigation and should be addressed to other prevalent and/or disabling rheumatic conditions as well. Also, Abásolo et al. reported a successful case in which rheumatologists following detailed proceedings in a specialist-run early intervention program had an effect on work disability, at least for some forms of RD.

Although, there is already some amount of evidence on the effect of certain interventions on the likelihood of early departure from work attributable to RD, it is unquestionable the need to research further this topic. From a societal perspective, some of these interventions are likely to be cost-effective by providing long-term productivity gains, which should offset the investment costs in this crucial area. Our results underlines the high economic burden of RD coming from early retirement and offer useful background information to help prioritize investments in health and social protection policies targeting patients with rheumatic conditions.

Supplementary data

Supplementary data are available at EURPUB online.

Conflicts of interest: None declared.

Key points

- Data suggest a strong association between rheumatic diseases (RD) and likelihood of early exit from paid employment.
- There is a great potential concerning the risk reduction of early exit from work by eliminating or controlling rheumatic disorders in the population.
- Estimated indirect costs of early exit from work attributable to RD amounts to approximately 0.4% of the national GDP.
- Early retirement attributable to RD is therefore an important public health issue and its economic impact highlights the need for sustainable health policies.

References


