

# Disease activity, quality of life and indirect costs of reduced productivity at work, generated by Polish patients with ankylosing spondylitis

Paweł Kawalec, Krzysztof Malinowski

Institute of Public Health, Faculty of Health Sciences, Jagiellonian University Medical College, Krakow, Poland

## Abstract

**Objectives:** The aim of the study was to investigate the association between activity of ankylosing spondylitis (AS) and decrease in quality of life as well as productivity loss of affected patients in a specified group of patients in the Polish setting.

**Material and methods:** A questionnaire survey was conducted using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) to assess disease activity, as well as the Work Productivity and Activity Impairment Questionnaires to assess productivity loss; quality of life was presented as utility calculated using the EuroQol 5 questionnaire and also measured on a visual analogue scale (VAS). Indirect costs were assessed with the human capital approach implying gross domestic product per capita or gross value added per worker in Poland in 2014 and were expressed in Polish zlotys (PLN) as well as in euros. Correlation was presented using Spearman's rank correlation coefficient.

**Results:** We performed our analysis based on 78 full questionnaires collected. A mean BASDAI score of 5.91 in the analysed group of patients was detected and mean utility of 0.5135 was observed. Average quality of life measured on the visual analogue scale was 46.55. Mean number of days off work was 45.26 days per year and mean on-the-job productivity loss was 49.29%. Average annual indirect costs per patient were €4241 (17 686 PLN) calculated using gross domestic product and €10 172 (42 417 PLN) estimated using gross value added. Total productivity loss was significantly correlated with disease activity (strong correlation of 0.6005) and utility (moderate correlation of  $-0.3698$ ).

**Conclusions:** Ankylosing spondylitis causes a great decrease in quality of life as well as patients' productivity loss associated with both absenteeism and presenteeism. The greater the disease activity is, the lower is the utility, the lower is the quality of life measured on the VAS, and the greater are the total annual indirect costs. Total indirect costs were negatively correlated with utility; although the association was moderate, it was significant.

**Key words:** ankylosing spondylitis, quality of life, indirect costs, productivity loss.

## Introduction

Ankylosing spondylitis (AS) is an autoimmune rheumatic disease, which mainly affects the joints of the spine but may also affect peripheral joints. The dominant symptom of AS is inflammatory back pain, which may be associated with ongoing aseptic inflammation

of the intervertebral discs and ossification of spine ligaments with syndesmophytes formation, which leads to reduced spine mobility. The described changes cause functional impairment and great deterioration in quality of life. All pathological changes in the course of AS lead to disturbances related to the patient's activity in the

---

### Address for correspondence:

Paweł Kawalec, Drug Management Department, Institute of Public Health, Faculty of Health Sciences, Jagiellonian University Medical College, Grzegorzeczka 20, 31-531 Kraków, Poland, e-mail: pawel.kawalec@uj.edu.pl

Submitted: 16.11.2015; Accepted: 8.01.2016

labour market (loss of productivity). The prevalence of AS is between 0.1% and 1.4%, and it is more often diagnosed among men [1]. A recent study in Poland reported average prevalence around 7.48 for 10,000 persons; from 6.15 for female to 8.91 for male gender (based on data from the National Health Fund) [2]. As the disease occurs mostly in young people, it causes a long-lasting decrease in productivity.

People affected with AS require lifelong treatment, generating great direct costs (cost of treatment, reimbursed drugs, etc.) to the national health insurance system [2]. Also the value of lost productivity is an indirect cost – not due to incurred expenses, but due to the lack of work caused by the disease. A validated and simple diagnostic test that allows for measuring the disease activity in AS is the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) [3], while quality of life among patients with AS can be measured using the Euroqol questionnaire (EuroQol 5) [4].

BASDAI is a gold standard in AS activity assessment which takes into account five major symptoms of the disease: tiredness, spinal pain, joint pain (arthralgia), enthesitis (pain from areas of localized tenderness due to inflammation) and morning stiffness. For each domain patients report extent of a health problem – the higher the value, the greater the problem (pain, tiredness, etc.). Data are summarized as the BASDAI score, which can be obtained with the standardised on-line calculator [3].

EuroQol 5 is a standardized instrument for use as a measure of one of the most important health outcomes – quality of life. It takes into account five of the most important aspects of life: mobility, self-care, housekeeping activities, pain and anxiety. For each domain the patient can report no problems – represented by number 1; some problems – represented by number 2; or a lot of problems – represented by number 3. Combining answers from all five domains, a quality of life state is created; e.g., “1, 3, 2, 2, 2” quality of life state represents no problems with mobility, a lot of problems with self-care and some problems concerning the remaining three domains. Data obtained using EuroQol 5 can be presented as the health state combined from all domains or can be converted into utility using population tariffs. The EuroQol 5 questionnaire also allows patients to report their quality of life using a visual analogue scale (VAS) with which patients provide a subjective assessment of quality of life [4].

The indirect costs that follow AS are associated with absence from work (absenteeism) and a decrease in the efficiency of work done by the patient (presenteeism). These two types of indirect costs express the extent of productivity losses. Absenteeism refers to the number of days on sick leave, periods of unemployment caused

by disease, and early leaving of the labour market due to sickness (e.g. early retirement or early death). Leaving the labour market due to early death is calculated quite rarely in the case of inflammatory diseases of the axial skeleton because of the long life expectancy, although in some cases patients can suffer from infection, followed by malignancies and cardiovascular complications which could lead to death [1, 5]. Presenteeism refers to a situation when a sick person is present at work but his or her productivity is lower than average due to the disease. Productivity losses due to lower efficiency at work have been studied since the early 1990s, but this factor is commonly omitted in the indirect cost studies due to difficulties in estimation of the cost of lost productivity [6, 7].

Both absenteeism and presenteeism data were obtained in a questionnaire survey with the Work Productivity and Activity Impairment Questionnaire (WPAIQ), which is a well-validated instrument to measure impairments in work and activities and is a standard analytic tool commonly used to assess absenteeism and presenteeism in a number of diseases.

Each category of indirect costs (absenteeism, presenteeism) can be calculated using two methods: the Human Capital Approach and the Friction Cost Approach. The Human Capital Approach (HCA) converts the gross income which will not be obtained in the future due to disease into real costs from a social perspective; hence it assumes that the decrease in productivity is permanent (irreplaceable). The Friction Cost Approach (FCA) takes into account productivity losses until a new person is employed as a substitute for the sick one.

The aim of the study was to investigate the association between activity of AS and decrease in quality of life as well as productivity loss of AS patients in a Polish setting.

## Material and methods

A questionnaire survey was performed to collect data on disease activity, the quality of life of the population assessed, as well as productivity loss. Volunteers with AS from the whole country were recruited through the Polish Society of Ankylosing Spondylitis [8]. We used the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and paper EuroQol 5 questionnaires with a visual analogue scale (VAS) to obtain data on disease activity and patients' quality of life. EuroQol 5 was used because it allows for validated conversion into utilities using the European population and is a standard analytic tool to assess the activity of the disease used worldwide [9, 10]. Subjective general activity of AS, subjective tiredness and subjective pain caused by the disease were measured using the VAS.

The human capital approach was used to estimate indirect costs due to absenteeism and presenteeism. Two macroeconomic indicators for Poland were considered: gross domestic product per capita (GDP, equalled €10 774 or 44 928 PLN) and gross value added (GVA, equalled €25 838 or 107 744 PLN) per worker, presented in 2014 prices in euro (exchange rate used was 1 euro = 4.17 PLN) with a correction factor of 0.65 [11] (The conventional mean value of output elasticity of labour is 0.65 according to the Cobb-Douglas function of production. This approach is suggested by the European Commission because increasing the amount of a single factor of production, with all other factors of production held constant, results in a decrease in the marginal output of production) [12]. Gross domestic product per capita is a commonly used measurement for determining a country's economic development. Its weakness is that it considers not only employees but also people who are economically inactive, such as children and retirees. The gross value added per worker reflects the true economic development in areas of production. It was expressed as value per worker and omits economically inactive people. Because the gross value added represents the productivity of a country in all economic sectors, the gross value added per worker is the best measurement for examining the decrease in human capital due to illness.

Continuous variables were summarised using means and standard deviations or median with the first and the third quartile. Nominal variables were summarized using counts and percentages. Spearman's correlation was used to present the association between the dis-

ease activity, the quality of life as well as absenteeism and presenteeism. *P*-values less than 0.05 indicated statistical significance. Additionally, data on disease activity, patients' quality of life and generated indirect costs were presented in scatterplots. Absenteeism was presented as the number of days missed from work per year, while presenteeism was shown as the percentage of on-the-job productivity decreased by ankylosing spondylitis. Statistical analyses were performed in R 3.1.3 [13] and Microsoft Excel.

## Results

We obtained 83 questionnaires, of which five lacked any data, giving a total of 78 questionnaires of patients aged from 19 to 60 years old. Basic characteristics of the population are presented in Table I.

All patients provided data on disease activity with the BASDAI questionnaire. Data reported by the patients are presented in Table II.

Based on those values the mean BASDAI score of 5.91 (SD: 1.72) was evaluated. The minimum value of BASDAI score was 1.2, and the maximum observed value was as high as 8.8 points, which indicates active disease.

Mean subjective general activity of AS assessed using VAS was reported as 61.45 (SD: 20.77) and was highly correlated with BASDAI score (0.7582; *p*-value < 0.0001). Similar results were observed for subjective general tiredness caused by AS (assessed using VAS): mean value of 67.73 (SD: 20.77); correlation with BASDAI score of 0.7414 (*p*-value < 0.0001) and subjective

**Table I.** Basic characteristics of patients included in the study

Characteristic	Value for sample	Value for population [11]
Age [years]	33.5 (28.75–42.25)*	40.16***
Male	38 (48.72%)	48.39%
Disease duration [years] from onset	12.28 (SD: 10.17)**	–
Highest educational degree		
elementary school	0 (0%)	18%
high school	23 (29.49%)	33%
undergraduate	7 (8.97%)	35%
graduate bachelor's degree	12 (15.39%)	14%
graduate master's degree or higher	36 (46.15%)	
Place of living		
city	61 (79.22%)	60.34%
village	16 (20.78%)	39.66%
Household members	3 (2–4)*	2.73***

\*Median with the first and the third quartile; \*\*Mean with standard deviation; \*\*\*Mean

**Table II.** BASDAI characteristics

Characteristic	Value*
fatigue/tiredness	7 (6–8)
neck, back or hip pain	7 (6–8)
pain/swelling in joints other than neck, back or hips	5 (3–7)
discomfort from areas tender to touch or pressure	6 (4–8)
discomfort from the time you wake up	7 (5–8)
morning stiffness duration	3 (2–5)**

\*Median with the first and the third quartile; \*\*Five is maximum possible value representing more than two hours of morning stiffness

general pain caused by AS (assessed using VAS): 66.97 (SD: 20.33); correlation with BASDAI score of 0.8090 ( $p$ -value < 0.0001).

Data on productivity were collected for 73 patients, of which 58 (79.45%) are currently working. Among all working patients, 47 (81.03%) are on a full-time job contract. Eight patients reported that their unemployment is due to AS (57.14% of unemployed patients). Duration of AS-related unemployment varied from less than a year to 23 years, with median duration of 5 years (the first and the third quartiles were 1.25 and 12.25, respectively).

Patients reported between 0 and 7 days off work during a week before filling the questionnaire, with a mean value of 0.87 (SD: 1.95) days per week or 45.26 (SD: 101.54) days per year.

The relationship between absenteeism and disease activity (moderate correlation of 0.3145 with  $p$ -value of

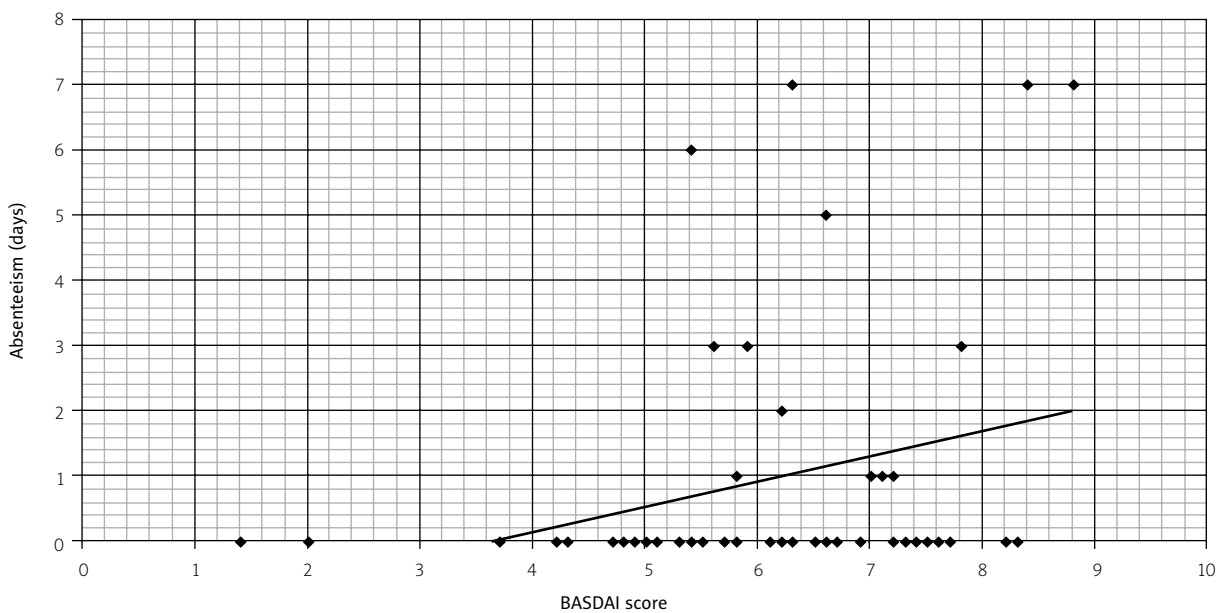
0.0231, which indicates statistical significance) is presented in Figure 1.

Most people reported a lack of days off work due to the disease, but generally there was revealed a significant association with disease activity. All of the patients who reported at least one day off work had disease activity, measured with the BASDAI score, greater than 5.

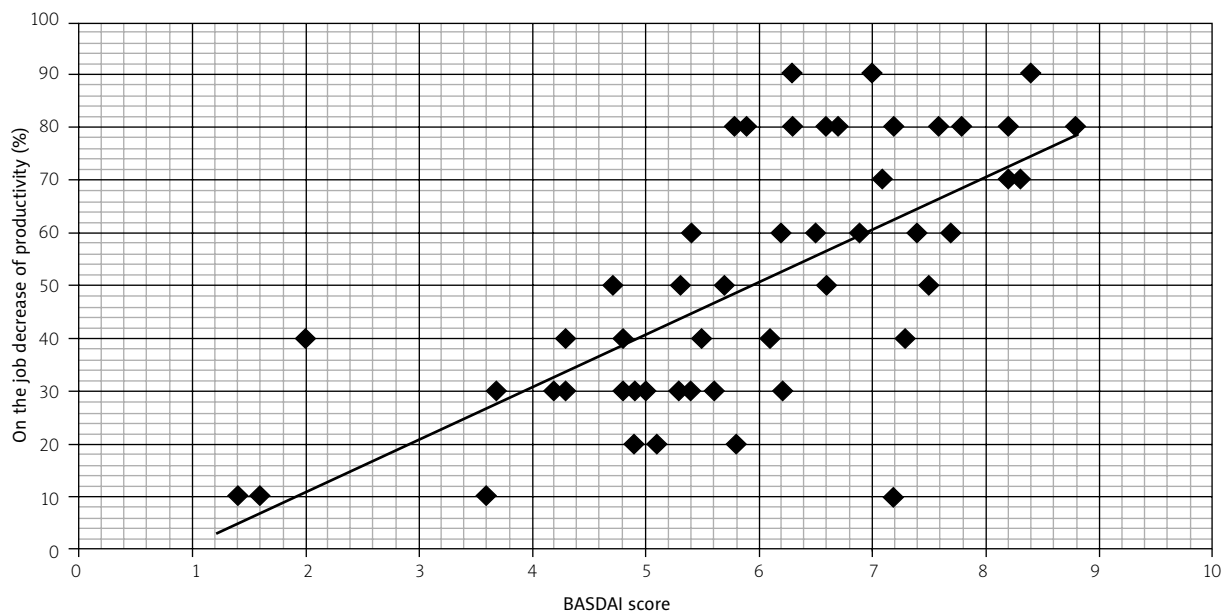
Average on-the-job productivity loss was 49.29% (23.96%), which represents the extent of presenteeism. The minimal reported value was 10% and the maximal value was 90%. Data are presented for 56 working AS patients; two working patients did not provide data on on-the-job productivity loss.

The relationship between presenteeism and disease activity (strong correlation of 0.6964 with  $p$ -value less than 0.0001, which indicates statistical significance) is presented in Figure 2. Loss of on-the-job productivity was positively correlated with disease activity. One patient reported high disease activity (7.2 on 10-point BASDAI scale) but only 10% of on-the-job decrease in productivity.

Data collected made it possible to assess annual indirect costs caused by both absenteeism and presenteeism generated by AS. Using gross domestic product (GDP) per capita we calculated indirect costs of absenteeism of €868 (SD: €1947); 3619 PLN (SD: 8118 PLN), presenteeism of €3452 (SD: €1678); 14393 PLN (SD: 6996 PLN) and total indirect costs of €4241 (SD: €2829); 17 686 PLN (SD: 11 799). Taking into account gross value added (GVA) per worker those costs were as follows: €2081 (SD: €4669); 8679 PLN (SD: 19 470 PLN), €8277 (SD: €4024); 34 516 PLN (SD: 16 778 PLN) and



**Fig. 1.** Relationship between absenteeism and disease activity. Total annual indirect cost per patient was €4241 (17 686 PLN) calculated using GDP and €10 172 (42 417 PLN) calculated using GVA.



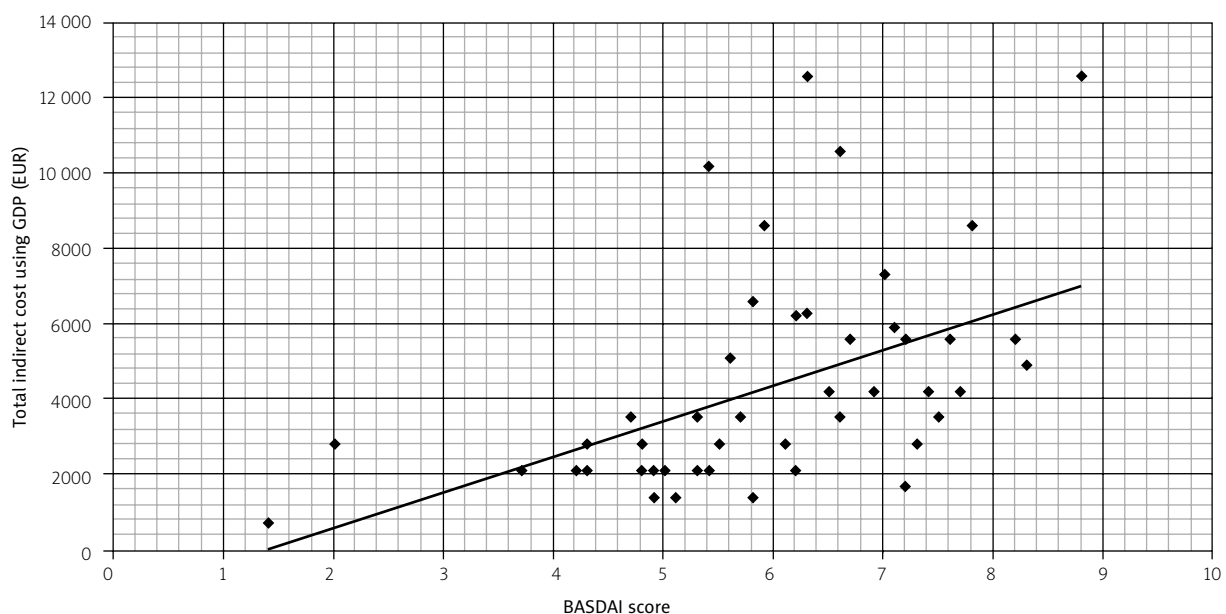
**Fig. 2.** Relationship between presenteeism and disease activity.

€10 172 (SD: €6786); 42 417 PLN (SD: 28 298 PLN) respectively.

As a sensitivity analysis results without a correction factor (marginal productivity of labour) are also presented. Total annual indirect costs per patient were €6525 (SD: €4353); 27 209 PLN (SD: 18 152 PLN) and €15 649 (SD: €10 440); 65 256 PLN (SD: 43 535 PLN) calculated using GDP and GVA, respectively.

The relationship between indirect costs calculated using GDP and disease activity (strong correlation of 0.6005 with  $p$ -value less than 0.0001, which indicates statistical significance) is presented in Figure 3. The correlation of disease activity with indirect costs calculated using GVA is the same.

Data on quality of life were also reported by a great majority (92%) of respondents.



**Fig. 3.** Relationship between total indirect costs calculated using GDP and disease activity. Total annual indirect cost per patient was €4241 (17 686 PLN) calculated using GDP.

**Table III.** Number of patients reporting lack of problems, some problems or a lot of problems in specific life domains took into consideration in EuroQol 5 questionnaire

Life domain	Problems reported with specific life domains		
	No	Some	A lot
Mobility	17 (22.37%)	59 (77.63%)	0 (0%)
Self-care	37 (48.68%)	39 (51.31%)	0 (0%)
Usual activities	15 (19.74%)	58 (76.31%)	3 (3.95%)
Pain	4 (5.26%)	59 (77.63%)	13 (17.11%)
Anxiety	12 (15.79%)	57 (75%)	7 (9.21%)

Based on data from Table III the health states were created. The most common state was “2, 2, 2, 2, 2” reported by 20 (26.32%) patients, followed by “2, 1, 2, 2, 2” reported by 11 (14.47%) patients. The highest (worse) state observed was “2, 2, 3, 3, 2” and occurred in 1 patient (1.32%).

Based on these data the utility was calculated using the European tariff [10]. Mean utility equalled 0.5135 (SD: 0.1912), the lowest calculated value was 0.1213, and the highest was 1. Additionally, patients reported their quality of life using the VAS. The mean VAS score was 46.55 (SD: 24.21). Both utility and VAS were significantly (strong correlation of  $-0.6206$  and  $-0.6082$ , respectively, with  $p$ -value less than 0.0001, which represents statistical significance) correlated with BASDAI score.

Patients' quality of life expressed in the form of utility was also correlated with presenteeism (correlation of  $-0.4109$ ;  $p$ -value of 0.0018, which indicates statistical significance). In general, utility showed a negative moderate but significant correlation with total indirect costs (correlation of  $-0.3698$ ;  $p$ -value of 0.0076). Different results were observed for quality of life measured on the VAS, which was correlated significantly with extent of on-the-job loss in productivity (moderate correlation of  $-0.3907$ ;  $p$ -value of 0.0038, which represents statistical significance). Presenteeism was significantly correlated with both utility and quality of life measured on the VAS. However, the general conclusion emerges that higher quality of life is associated with lower indirect costs.

## Discussion

Ankylosing spondylitis causes a great decrease in quality of life. The greater the disease activity is, the lower is the quality of life, and this association was significant for both utility and VAS. Moreover, our study proved that the greater the disease activity was, the greater were the annual indirect costs, and this association was strongly significant for presenteeism and less apparent for absenteeism.

Sliwczynski et al. [2] assessed the prevalence of ankylosing spondylitis (AS) in Poland and the costs generated by AS patients in the system of public health care. The database of the national payer (National Health Fund; NHF) was analysed to gather data on direct costs of therapy. In the years 2008–2013, from 28,800 to 32,800 persons diagnosed with AS as the main or co-existing diagnosis were registered in the NHF database. The healthcare expenses related to AS financed by the NHF increased from 13,200 million PLN (3.16 million euro) in 2008 to 72,600 million PLN (17,400 million euro) in 2013, so a significant increase in the burden of the disease (in terms of direct costs) was revealed [2].

Ankylosing spondylitis is a disease which occurs mainly in a population of young people (mostly middle aged men), contributing to a significant reduction of social and economic activity, and therefore reduces productivity as well as quality of life of the patients, which is particularly severe for the whole society.

The aim of our analysis was to acquire new knowledge on the indirect costs and quality of life of AS patients, which constitute an increasingly important social problem. According to our knowledge, this is the first and the only study referring to utility measurement as well as indirect cost assessment in a group of Polish patients with AS. The methodology used as well as the results provided novel data filling in the information gap. Some studies have focused on the assessment of lost productivity due to absence from work (absenteeism), ignoring issues related to reduced productivity at work during the course of the disease (presenteeism). Our project involves the assessment of the costs in both aspects based on our own survey questionnaire, to let us know the real costs they generate in affected patients. On the other hand, the results of our study due to some limitations should be interpreted cautiously and are preliminary, providing a good basis for further, more sophisticated studies of this topic.

A major limitation is due to recruitment of patients. The sample size was quite small and the methods of

respondents' inclusion without randomised allocation gave results that are not fully representative for the whole AS population. In the analysed group of patients we found a slight over-representation of females, whereas according to current literature males represent a majority of the population. We also recorded a high proportion of individuals with higher education, which can influence labour market activity and probably influenced our results. Patients were enrolled from the whole country, but data on patients' domicile were not collected.

In 2011 in the Polish population indirect cost assessment was performed for patients with rheumatoid arthritis (RA). This questionnaire study was conducted on 814 ambulatory patients of working age. The study revealed that patients suffering from RA incurred 29 727 PLN (7128 euro) in indirect costs annually, of which 12 922 PLN (3098 euro) were costs of absenteeism and 16 498 PLN (3956 euro) were costs of presenteeism. Researchers also used the WPAI questionnaire and GDP per worker methodology [14]. Although a large group involved only ambulatory patients, assessment could have significantly influenced the results of this study.

In order to compare our results with other elaborations, we performed a review of medical databases. We discovered only two studies considering both absenteeism and presenteeism in an AS population, but none of them was conducted in Poland. Rafia et al. [15] reported 3-month indirect cost per patient associated with absenteeism equal to £38.61 and associated with presenteeism equal to £531.83. This is in agreement with our results showing that presenteeism was responsible for almost 80% of total indirect costs, whereas 93% was reported by Rafia et al. [15]. We discovered that presenteeism was responsible for around 91% of total costs.

Boonen et al. [16] described the influence of ankylosing spondylitis on sick leave, presenteeism and unpaid work restrictions and to estimate related productivity costs. The annual production costs for the total group of 142 patients were 1451 euro (95% CI: 425–2742) per patient for sick leave (absenteeism) and 967 euro (95% CI: 503–1496) to compensate for hours worked inefficiently while at work (presenteeism) and 1930 euro (95% CI: 1404–2471) to substitute loss of unpaid work production.

In 2009, National Ankylosing Spondylitis Society (NASS) published a survey of their members on working with AS in response to their expressed concerns about employment. NASS distributed a questionnaire to 1000 members, receiving 324 responses from people with a current diagnosis of AS.

The study revealed that the disease had an impact on productivity of patients, whereas effective treatment made a significant difference to being able to remain in

work. In addition, people with more severe AS reported a greater impact on their working lives, and those with higher disease activity were twice as likely to report that their working life had been affected. Sixty-one percent were concerned about the impact of the deterioration of their condition on their job or employment prospects, and 30% had concerns about discrimination because of their AS, from employers or colleagues. Only 12% reported that AS had made no significant impact on their working lives, whilst one-third reported that they were able to perform fewer physical or manual tasks at work than before the onset of AS [17].

## Conclusions

Ankylosing spondylitis imposes a substantial personal burden and influences the ability to work. The observation concerning the influence of the disease on AS patients' functional abilities requires special attention in future studies on ankylosing spondylitis. AS generates huge indirect costs and decreases patients' quality of life. There is a need for further studies with a fully representative population of patients for better understanding of the relation with indirect costs generated and disease activity.

---

*The authors declare no conflict of interest.*

*The study was funded by a scientific grant of the Polish Ministry of Science and Higher Education (Jagiellonian University Medical College; science project number K/ZDS/004692).*

## References

1. Braun J, Sieper J. Ankylosing spondylitis. *Lancet* 2007; 369: 1379-1390.
2. Śliwczyński A, Raciborski F, Kłak A, et al. Prevalence of ankylosing spondylitis in Poland and costs generated by AS patients in the public healthcare system. *Rheumatol Int* 2015; 35: 1361-1367.
3. BASDAI Bath Ankylosing Spondylitis Disease Activity Index. <http://basdai.com/> Last Access: October 2015.
4. EuroQol. <http://www.euroqol.org/> Last Access: October 2015.
5. Mok CC, Kwok CL, Ho LY, et al. Life Expectancy, standardized mortality ratios, and causes of death in six rheumatic diseases in Hong Kong, China. *Arthritis Rheum* 2011; 63: 1182-1189.
6. Krol M, Brouwer W. How to estimate productivity costs in economic evaluations. *PharmacoEconomics* 2014; 32: 335-344.
7. Reilly MC, Zbrozek AS, Dukes EM. The validity and reproducibility of a work productivity and activity impairment instrument. *PharmacoEconomics* 1993; 4: 353-365.
8. Polish Society for Ankylosing Spodylitis. <http://zzsk.org.pl/>
9. Jankowska-Polańska B, Polański J. Metody oceny jakości życia w schorzeniach reumatycznych. *Reumatologia* 2014; 52: 69-76.

10. Szende, Oppe, Devlin (ed.). EuroQol 5 Value Sets: Inventory, comparative review, and user guide. Springer Netherlands, 2007.
11. Central Statistical Office of Poland, <http://stat.gov.pl/en/> Last Access: October 2015.
12. Havik K, Mc Morrow K, Raciborski R. The production function methodology for calculating potential growth rates and output rates, European Commission, Directorate-General for Economic and Financial Affairs (2014). [http://ec.europa.eu/economy\\_finance/publications/economic\\_paper/2014/pdf/ecp535\\_en.pdf](http://ec.europa.eu/economy_finance/publications/economic_paper/2014/pdf/ecp535_en.pdf)
13. R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>.
14. Bebrysz M, Fedyna M, Rutkowski J, Hałdaś M. Indirect Costs of Immune-mediated Inflammatory diseases in Poland. CEESTAHC, 2014.
15. Rafia R, Ara R, Packham J, et al. Healthcare costs and productivity losses directly attributable to ankylosing spondylitis. *Clin Exp Rheumatol* 2012; 30: 246-253.
16. Boonen A, Brinkhuizen T, Landewé R, et al. Impact of ankylosing spondylitis on sick leave, presenteeism and unpaid productivity, and estimation of the societal cost. *Ann Rheum Dis* 2010; 69: 1123-1128.
17. Survey on work, NASS data on File: RM 16094 (November 2009).