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Is the work ability index useful to evaluate absence days in ankylosing spondylitis patients? A cross-sectional study.

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Abstract

Objectives:

Background: The work incapacity of ankylosing spondylitis (AS) ranges between 3-50% in Europe. Due to a lack of central registers in many countries, work incapacity is difficult to quantify. The Work Ability Index (WAI) is applied to measure the work ability in workers, but it is not well investigated in patients.

Aims: To investigate the work incapacity in terms of absence days in patients with AS and to evaluate whether the WAI reflects the absence from work.

Hypothesis: Absence days can be estimated based on the WAI and other variables.

Design: Cross-sectional design.

Setting: In a secondary care centre in Switzerland the WAI and a questionnaire about work absence were administered in AS patients prior to a cardiovascular training. The absence days were estimated by using multiple regression analysis.

Participants: 92 AS patients (58 men (63%)). Inclusion criteria: AS diagnosis, ability to cycle, age between 18 and 65 years. Exclusion criteria: Severe heart disease.

Primary and secondary outcome measures: Absence days.

Results: Of the 92 patients, 14 received a disability pension and 78 were in the working process. The median absence days per year of the 78 patients due to AS alone and including other reasons was 0 days (IQR 0-12.3) and 2.5 days (IQR 0-19), respectively. The WAI score (regression coefficient = -4.66 (p<0.001, CI -6.1 to -3.2), “getting a disability pension” (regression coefficient = -106.8 (p<0.001, 95% CI -141.6 to -72.0), and other not significant variables explained 70% of the variance in absence days (p<0.001) and therefore, may estimate the number of absence days.

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Conclusions: In groups of AS patients with absence days, the WAI and other variables validly assesses incapacity for work. In economic evaluations, the indirect costs may be calculated by estimating the absence days by using the WAI.

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Article summary:

Article focus

- To measure the work incapacity in terms of absence days in patients with AS in Switzerland
- To evaluate whether the WAI reflects the absence from work.

Key messages

- There is no valid measurement to assess absence days.
- This study shows that the WAI score together with specific variables can be used in ankylosing spondylitis patients to calculate absence days.
- This cost-saving method of measuring absence days may be implicated to compute indirect costs in future studies.

Strengths and limitations of this study

- The study showed, that the WAI is not only feasible in prevention, but also in a clinical setting for patients with AS.
- We took into account that the data are skewed and checked the goodness of fit of the regression model by splitting half the group.
- Perhaps patients with a high motivation to influence their health were overrepresented in this study. This could lead to an underestimation of the absence days.

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Introduction:

People affected with ankylosing spondylitis (AS) are impaired in their daily living activities. This is a problem for both the patients and the society in terms of the high costs associated with the loss of productivity. The magnitude of the disability should be determined in order to manage AS-patients with restrictions in the work status effectively. The range of employment in different countries varies widely from 34 to 96%, and the work disability ranges from 3 to 50% depending on the disease duration. Prevalence of AS in western Europe is estimated at 0.86% [1 2] to 1.4% [3]. Incapacity to work is higher in patients affected with AS than in the general population. Mean national sick leave per working individual annually has been measured to be between 7 and 16 days in the Netherlands, France and Belgium [4], in comparison to 12 to 46 days of sick leave per patient with AS per year [5] in the same countries. In Switzerland, two studies about the work status of AS patients show different numbers regarding the incapacity to work. In one study, 42.5% patients reported occasional incapacity for work due to AS, whereas 13.5% were permanently disabled and received a partial (10.2%) or full disability pension (3.3%). Days of sick leave were not reported [6]. In an earlier study, the point estimate of the working ability was measured at 97.3% and disability at 2.7 % [7]. This may reflect that the evaluation of the work status is rather complicated because of the different possible endpoints or definitions of the working ability [5]. In Switzerland and in most of the other countries, reliable data about absence days do not exist [8].

In various studies, information about sickness absence is gathered from the registered data of companies [9] or from the civil service register [10]. But these measurements are not validated. Nevertheless, there is no direct access to absence data in many countries, and moreover, to gather such information in the daily practise is too costly and hardly feasible.

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In musculoskeletal rehabilitation, there is a growing demand for evaluating relevant outcome parameters. In Switzerland, the loss of one working day costs about 600 Euro in average [11], and therefore, work loss is a significant cost factor in back and musculoskeletal disorders. To our knowledge, no validated questionnaires exist which encompass the complicated nature of the construct of the incapacity for work. There is however an assessment for the working ability, the so-called “Work Ability Index” WAI [12-14], which is well investigated in the work environment and in occupational health care, where it has been shown to be predictive[14] in terms of future incapacity for work and disability pension. Its internal reliability and concurrent validity has proven to be satisfactory[15]. The test-retest reliability revealed acceptable values[16]. Recently, it has also been used in some studies with groups of patients, for example in workers with musculoskeletal disorders [17], heart disease, hypertension [18], for groups of patients with psychiatric disorders [19], rheumatoid arthritis [20] or osteoarthritis [21]. The WAI has however not been applied to patients with AS.

The main aim of this study was to investigate how big the problem of incapacity to work is in a subgroup of people with AS in Switzerland. A further aim was to evaluate whether the WAI, in combination with other variables, could potentially serve as a simple instrument for measuring absence days in AS patients.

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Study population and methods

Participants

The participants for this study were AS patients taking part in a cardiovascular training study for which the sample size was computed to detect the effect of the training. The patients were recruited from the national Ankylosing Spondylitis Association and from the Rheumatology outpatient facilities in our country in 2008/2009. The last follow-up of the intervention was in 2010. Inclusion criteria for the cardiovascular training intervention and thus this sub-study were: AS diagnosis following the modified New York criteria, the ability to cycle, sufficient German language ability (for questionnaires), age between 18 and 65 years, willingness to follow the study protocol, and an informed consent. Chronic heart failure and functional NYHA Class III and IV were criteria for exclusion. The study was approved from the local Ethics Committee and the patients provided written informed consent. All patients were randomised to either the cardiovascular training or an attention control.

Design

In a cross-sectional study, we investigated the dimension of the incapacity for work and the feasibility of the WAI to estimate absence days.

Measurements of the WAI-study

A comprehensive assessment was conducted before cardiovascular training. The measurements of this sub-study included the WAI and additional questions about the work status (QW).

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The WAI is a 13-item questionnaire about a) the work conditions, b) the perception of the present health condition, and c) the perceived prognosis for work. It is easy to use and takes about 10 minutes to fill out [12 14]. The scores range from 7 to 49 points, with 49 points describing the best ability to work. The rules to compute the scores are described in detail [12]. The scores of the WAI can be divided into four categories: 7-27 = poor, 28-36 = moderate, 37-43 = good, 44-49 = excellent ability to work.

Different substantial questions about the work ability composed a second questionnaire about work status (QW) to calculate the absence days. In contrast to the brief WAI, the comprehensive QW should reveal more accurate information on the complex construct of the incapacity for work. We selected the questions of the QW by means of another study [22], addressing the disability to work, and on the basis of the clinical experience on determining the work ability. The items of the QW include working tasks (mental, physical or mixed), full or part-time work, full or partial work disability during the last year, sick days during the last year, duration of the work disability, reasons for the incapacity for work (AS versus other health reasons), and disability leading to financial support.

Procedure

The absence days were computed by means of the QW: The work disability for the previous year is expressed in days off work due to health reasons. Only working days are counted, weekends and holidays are not included. The work disability is composed of the number of complete sick days and of the partial presence at work due to health reasons. For instance, 30% incapacity for work in a full time job during a distinct period is converted into the corresponding number of sick days. The numbers are adjusted for part-time work, e.g. if someone is employed for 50%, then the days of sick leave consists of only half of the absence days of those of a full time employment. The work disability, days off work and early retirement due to AS in contrast to other health problems were considered separately from each other as was also done in a review [5]. One could argue that the WAI contains an item that assesses self-reported sick leave over the previous twelve months; therefore, it would not be necessary to measure the absence days with the more complicated QW. But Radkiewicz et al. pointed out that the above mentioned item of the WAI should be excluded from the WAI, because there is no substantial relationship between this item and the overall score[15]. Furthermore, this item diminishes the internal validity and thus, the QW was introduced to measure absence days.

Statistics

The data were checked for normal distribution. Appropriate parametric and non-parametric statistics, depending on the distribution, were applied. Non-parametric statistics were used to compare the distributions for the demographic variables and the absence days across the groups. The level of significance was set at alpha = 0.05. With regard to the main aim of the study, descriptive statistics was used to depict demographic data, the absence days (on the basis of the QW) and the WAI score. The WAI score and the absence days in the QW were correlated to evaluate the relation and the concurrent validity between the two questionnaires. Pertaining to the second aim of the study, namely to get a simple way to measure absence days, a multiple regression analysis was performed. The regression was applied in order to estimate the absence days as a constructed value in prospective studies. The number of absence days calculated by the QW represents the dependent variable in the multiple regression model. The statistical software PASW statistics (version 18) was used for the analysis.

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Results

Of the 182 eligible patients 77 refused to participate and 16 were excluded due to exclusion criteria. Table 1 shows the demographic variables, the work status and the mental or physical job demands of the included 92 patients in the working age. Four of these received a full pension (three patients because of AS, one patient because of other reasons) and ten a partial disability pension. The remaining 78 individuals (84.7%) were still in the working process and worked 88.9% of a full time job per year. Table 2 shows the WAI-scores and the absence days computed on the basis of the QW. Where data are skewed, median values are presented. A patient may have absence days due to a) AS alone, b) other health problems (e.g. depression), or c) both. Therefore, the median is zero for a) and b), but bigger than zero for c). There were no missing values concerning the main variables.

The mean of the absence days is expressed as the percentage of the working time per year, allowing a comparison of the absence days to those of other studies. The 78 patients had a mean of 17.9 absence days (SD ±43.7) due to AS only, which is equivalent to 8.1% work disability. Due to other health reasons, a work disability of 2.5% was calculated. When the 14 patients receiving a disability pension were included (n=92), then the mean absence days due to all reasons was 47.9 days (SD ±79.1). These correspond to a disability of 21.6%. The ten patients with a partial disability pension were still partially in the working process and had a mean working time of 41% (SD ±31).

Sensitivity analysis: It is unknown whether patients with a full or a partial disability pension would work 88.9% of the annual working time, if they would not receive any disability pension. Hence, the percentage of the disability for this group (n=92), presuming the patients would work 100% or 80% of a full time job, was calculated. Under this presumption the disability due to all health problems would be 19.2% and 24.0%, respectively.

The Spearman-correlation between the WAI and the absence days on the basis of the QW, which expresses the concurrent validity, was -0.736 (p<0.001) for all of the 92 patients. The scatter plot revealed an overrepresentation of cases without absence days. However, a rang correlation should not be analysed, if there are tied ranks such as the multiple cases with zero absence days. Therefore, the correlation was calculated for the subgroup of AS patients which had at least one absence day per year due to all health problems (n=58), irrespective of getting a disability pension. The correlation reveals an r= -0.755 with a significant p-value of p<0.001 (Figure 1).

Additionally, a multiple regression analysis with the QW as dependent variable was performed to answer the second study question. All significant baseline variables, namely the work ability index score (WAI), the number of diagnoses (<3/>2), age and a disability pension (yes/no) as well as gender, were included in the model. Because age and gender have often an influence on the health status, age and gender were introduced to check for possible confounding. For the subgroup of patients with absence days (n=58), multiple regression analysis revealed that 70% of the variance in the dependent variable absence days (measured by the complex QW) can be explained by the independent variables of age, gender, WAI, the number of diagnoses and a disability pension (Table 3). However, only WAI and “getting a disability pension” significantly contributed to the model. Thus, the absence days of an AS patient can be estimated by multiple regression with the unstandardized regression coefficients: y = b1*x1 + b2*x2 + … + bn*xn + a, where y is the estimated value of the absence days, n is the number of independent variables, x1 to xn are the independent variables (age, gender, WAI, the number of diagnoses and getting a disability pension), and *a* is a constant (Table 3). Due to the skewed distribution of the absence days and the WAI, we verified our presented regression model by splitting the sample into two halves. We estimated each with the shown regression model. We then correlated the estimates and the true values of each group. The result of this was squared and compared with the R Square of the same group (results not shown). The squared correlation and the R Square should be similar in order to confirm that the regression model is capable of predicting the absence days of another sample quite accurately (e.g. the other half of the group). The differences were 0.18 for the first half and 0.05 for the second half, indicating a good fit of the model.

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Discussion

Key results:

Individuals without a disability pension had an 8.1% work disability, if it was solely due to AS. The absence days increased by 2.5%, when AS patients, who have had work disability due to other health reasons, were included. The percentage of absences due to AS and other health reasons, including the individuals receiving a disability pension, was 21% evaluated by the QW. Multiple regression analysis explained 70% of the variance of the absence days. The two variables 'WAI' and 'disability pension' made a significant contribution to this model. Thus, the WAI, in combination with other variables, can serve as a simple instrument for measuring absence days in the various groups of AS patients.

Discussing important differences to other studies:

The results regarding the absences of a group of AS patients who underwent a cardiovascular training are comparable to the findings of another Swiss cohort [6]. But the number of absence days in our study is slightly lower than in the review by Boonen [5]. Higher rates of disability pension are found in other studies [23-26]. The differences in the ability to work in different studies are dependent on several factors such as disease duration and activity, the perceived self-efficacy to perform a job, the general health condition and the kind of job (physical/mental demands) [27]. However, influences from different structures of the social insurance system, the job market situation, and cultural differences in absence behaviour may also be relevant. This also has been observed in other musculoskeletal disorders [28].

Our study showed much higher work disability measured in absence days than in another Swiss study [7]. However, in this other study the working ability of 97.3% was a point measurement, and the number of patients only working part-time due to their health condition had not been identified. These distinctions in the methods and the low return rate of questionnaires in this other study could explain the difference in the results of these studies. The correlation coefficient of r= -0.755 reveals a good correlation between the WAI and the QW. This supports the concurrent validity of the QW. The negative relationship means that having a low score in the WAI leads to more absence days. Implications of this study: The WAI reflected the absence days in a subgroup of AS patients with absences from work by the help of the above-mentioned regression equation. Age and gender did not confound the results. Based on the regression equation, the indirect costs can be computed by multiplying the number of estimated absence days with the costs of one absence day. This is useful for economic evaluations of groups for rehabilitation programmes. Usually, absence days are very time-consuming and difficult to measure because of part-time work, partial incapacity for work, partial or full invalidity pension and the potential incapability of the patients to recall all the subtle differences in their absences. Therefore, the WAI offers some advantages in contrast to questionnaires with a huge set of questions: it takes only 10 minutes to be completed, it reflects the subjective view of the patients and the scoring is clearly understandable.

Strength of this study: The study showed that the use of the WAI is not only feasible in a prevention setting such as occupational health care, but also in a clinical setting for patients with AS. We took into account that the data are skewed and checked the goodness of fit of the regression model by splitting the group into two halves, estimating the values of the other half and by correlating the true with the estimated values. The procedure confirmed the stability of the regression model.

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Weaknesses of the study: The absence days were gathered retrospectively and the results of this study are not generalizable for other subjects than people with AS. Perhaps patients with a high motivation to influence their health were overrepresented in this study, since they were readily willing to undergo a cardiovascular training. Such patients may also have been more willing to maintain their ability to work. This could lead to an underestimation of the absence day.

Since a questionnaire encompassing the complicated nature of the construct of the incapacity for work does not exist, we made use of the new not validated QW. The substantial correlation of the WAI and QW however implicates an acceptable concurrent validity. The sample size is not very big to conduct a multiple regression analysis. However, we had 11 patients per variable and this lies above the recommended number of patients (5 to 10 times the number of included variables).

In summary, the WAI offers an innovative and cost-saving approach in studies in which socioeconomic outcomes such as indirect costs are targeted.

Conclusions:

Incapacity for work in a sample of AS patients was equal to pan-European countries. The WAI was feasible for use in AS patients. It validly assesses incapacity for work evaluating groups of participants suffering of AS with absence days. In the future, the indirect costs as a part of cost benefit and cost effectiveness estimates may be calculated by computing the absence days through a regression analysis including the WAI score as a variable. This economic aspect may be increasingly relevant. Future research may evaluate whether these results are replicable in patients with other health conditions than AS.

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Conflicts of interest statement

The authors declare no conflict of interests.

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References

1. Braun J, Bollow M, Remlinger G, Eggens U et al. Prevalence of spondylarthropathies in HLA-B27 positive and negative blood donors. *Arthritis Rheum* 1998;41(1):58-67.
2. Van der Linden SM, Valkenburg HA, De Jong BM et al. The risk of developing ankylosing spondylitis in HLA-B27 positive individuals. A comparison of relatives of spondylitis patients with the general population. *Arthritis Rheum* 1984;27(3):241-9.
3. Gran JT, Husby G, Hordvik M. Prevalence of ankylosing spondylitis in males and females in a young middle-aged population of Tromsø, northern Norway *Ann Rheum Dis* 1985;44(6):359-67.
4. Boonen A, van der Heijde D, Landewe R et al. Work status and productivity costs due to ankylosing spondylitis: comparison of three European countries. *Ann Rheum Dis* 2002;61(5):429-37.
5. Boonen A, de Vet H, van der Heijde D et al. Work status and its determinants among patients with ankylosing spondylitis. A systematic literature review. *J Rheumatol* 2001;28(5):1056-62.
6. Brunner R, Kissling RO, Auckenthaler C et al. Clinical evaluation of ankylosing spondylitis in Switzerland. *Pain Physician* 2002;5(1):49-56.
7. Fellmann J, Kissling R, Baumberger H. Socio-professional aspects of ankylosing spondylitis in Switzerland. *Z Rheumatol* 1996;55(2):105-13.
8. Quadrello T, Bevan S, McGee R. Fit for work? Erkrankungen des Bewegungsapparats und der Schweizer Arbeitsmarkt. London, The Work foundation 2009:16

Work ability index, ankylosing spondylitis

9. Niedhammer I, Bugel I, Goldberg M et al. Psychosocial factors at work and sickness absence in the Gazel cohort: a prospective study. *Occup Environ Med* 1998;55(11):735-41.

10. North F, Syme SL, Feeney A et al. Explaining socioeconomic differences in sickness absence: the Whitehall II Study. *BMJ* 1993;306(6874):361-6.

11. Läubli T, Müller C. Arbeitsbedingungen und Erkrankungen des Bewegungsapparates – geschätzte Fallzahlen und Kosten für die Schweiz. *Die Volkswirtschaft* 2009;82: 22-25.

12. Tuomi K, Ilmarinen J, Jahkola A et al. *Work ability index*. Helsinki: Finnish Institute of occupational health ICOH, 2003.

13. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin. Why WAI?- Der Work Ability Index im Einsatz für Arbeitsfähigkeit und Prävention. Erfahrungsberichte aus der Praxis. Dortmund, Bundesanstalt für Arbeitsschutz und Arbeitsmedizin 2011:8-13.

14. Tuomi K, Ilmarinen J, Seitsamo J et al. Summary of the Finnish research project (1981-1992) to promote the health and work ability of aging workers. *Scand J Work Environ Health* 1997;23 Suppl 1:66-71.

15. Radkiewicz P, Widerszal-Bazyl M. Psychometric properties of Work Ability Index in the light of comparative survey study. *International Congress Series* 2005;1280:304-09.

16. de Zwart BC, Frings-Dresen MH, van Duivenbooden JC. Test-retest reliability of the Work Ability Index questionnaire. *Occup Med (Lond)* 2002;52(4):177-81.

17. Walsh IA, Corral S, Franco RN et al. Work ability of subjects with chronic musculoskeletal disorders. *Rev Saude Publica* 2004;38(2):149-56.

Work ability index, ankylosing spondylitis

18. Jedryka-Góral A, Bugajska J, Lastowiecka E et al. Work activity and ability in aging patients suffering from chronic cardiovascular diseases. *International Congress Series* 2005;1280:190-95.

19. Knekt P, Lindfors O, Laaksonen MA et al. Effectiveness of short-term and long-term psychotherapy on work ability and functional capacity--a randomized clinical trial on depressive and anxiety disorders. *J Affect Disord* 2008;107(1-3):95-106.

20. Hoving JL, Bartelds GM, Sluiter JK et al. Perceived work ability, quality of life, and fatigue in patients with rheumatoid arthritis after a 6-month course of TNF inhibitors: prospective intervention study and partial economic evaluation. *Scand J Rheumatol* 2009;38(4):246-50.

21. Lastowiecka E, Bugajska J, Najmiec A et al. Occupational work and quality of life in osteoarthritis patients. *Rheumatol Int* 2006;27(2):131-9.

22. Labriola M, Lund T, Burr H. Prospective study of physical and psychosocial risk factors for sickness absence. *Occup Med (Lond)* 2006;56(7):469-74.

23. Schramm AB, Pastusko T, Jaskal AM. Permanent disablement for work in patients with ankylosing spondylitis and rheumatoid arthritis. *Scand J Rheumatol* 1975(Suppl 8):12-02.

24. Wordsworth BP, Mowat AG. A review of 100 patients with ankylosing spondylitis with particular reference to socio-economic effects. *Br J Rheumatol* 1986;25(2):175-80.

25. Guillemin F, Briancon S, Pourel J et al. Long-term disability and prolonged sick leaves as outcome measurements in ankylosing-spondylitis - possible predictive factors. *Arthritis Rheum* 1990;33(7):1001-06.

Work ability index, ankylosing spondylitis

26. Ward MM, Kuzis S. Risk factors for work disability in patients with ankylosing spondylitis. *J Rheumatol.* 2001;28(2):315-21.

27. Barlow JH, Wright CC, Williams B et al. Work disability among people with ankylosing spondylitis. *Arthritis Rheum.* 2001;45(5):424-29.

28. Waddell G. The biopsychosocial model In: Waddell G, editor. *The back pain revolution*. London: Churchill Livingston, 2004:265-82.

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Table 1: Baseline variables (n=92)

	Overall, n=92
Age in years, mean (SD)	46.34 (11.15)
Gender:	
men (%)	58 (63.0)
women (%)	34 (37.0)
Duration in years since AS diagnosis	
mean (SD)	14.55 (12.74)
Number of current diseases	
AS alone	22
+ 1-2	45
+ > 2	25
Education, n (%)	
<=12 years	60 (65.2)
>12 years	26 (28.3)
Not known	6 (6.5)
Employment status, n (%)	
Paid work	68 (73.9)
Unpaid work	6 (6.5)
Unemployed	4 (4.4)
Partial disability pension	10 (10.9)
Full disability pension	4(4.3)
Job demands (n=78, no disability pension)	
physical	11%

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mental	41%
both	48%

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Table 2: Absence days (AD) and WAI-scores for the patients in the working age

		All patients in the working age (n=92)	Patients without disability pension (n=78)
Absence days during the last year, Median (IQR) [2)]	Due to		
	AS[1)] alone	0 (0 - 37.8)	0 (0 - 12.3)
	Other health problems	0 (0 - 2)	0 (0 - 2)
	AS[2)] and other health problems	4.5 (0 - 61.1)	2.5 (0 - 19)
WAI, Mean (SD)	-	34.18 (9.77)	35.93 (9.29)

Absence days measured by the QW

1) Ankylosing spondylitis

2) Interquartile range

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Table 3: Multiple regression with absence days as dependent variable (n=58)

Model Constant and independent variables	Unstandardized regression coefficients (B)	Standardized regression coefficients (Beta)	Significance p-value	95%-Confidence Interval for B Lower / Upper	
Constant	427.2	-	0.000	317.32	537.08
Disability pension[1)]	-106.81	-0.52	0.000	-141.60	-72.02
WAI	-4.66	-0.51	0.000	-6.13	-3.18
Age	-0.498	-0.07	0.429	-1.75	0.76
Gender	-10.71	-0.06	0.414	-36.82	15.40
N° of diagnoses[2)]	10.24	0.06	0.461	-17.45	37.93

1) Disability pension (yes/no)

2) Number of diagnoses (<3/>2)

R- Squared 0.724, R-squared adjusted 0.7, model is significant with p<0.001

Independent variables were simultaneously entered into the model.

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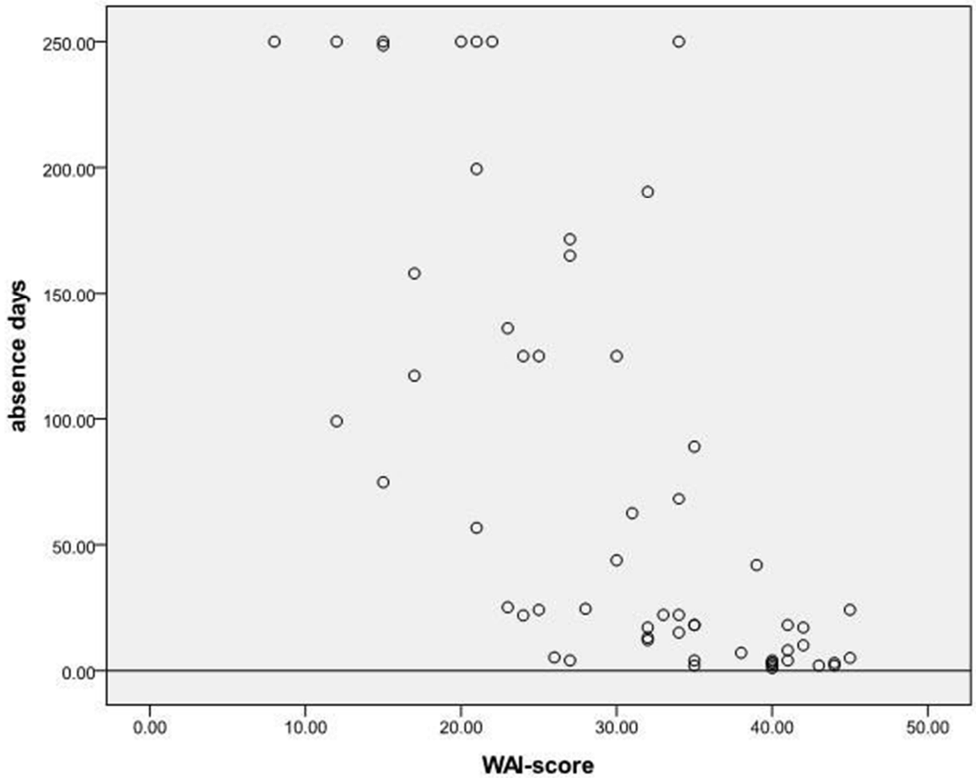
Figure 1 Scatterplot of the WAI and absence days for the subgroup with absence days (n= 58)



165x132mm (96 x 96 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Was this done in the manuscript? Yes or no or explanation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	yes
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	yes
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	yes
Objectives	3	State specific objectives	yes
Methods			
Study design	4	Present key elements of study design early in the paper	yes
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Yes. Exposure not applicable
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Yes
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Yes. Confounders and effect modifiers not applicable, because descriptive study.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Yes Only one group
Bias	9	Describe any efforts to address potential sources of bias	Discussed in the limitations
Study size	10	Explain how the study size was arrived at	Yes
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Yes, in the statistic section
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Yes, in the statistic section and in the results section
		(*b*) Describe any methods used to examine subgroups and interactions	Not applicable because of the descriptive nature of the study

		(*c*) Explain how missing data were addressed	There were no missing values of the total WAI-score nor the QW
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	yes
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	yes
		(b) Give reasons for non-participation at each stage	yes
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Yes, table 1
		(b) Indicate number of participants with missing data for each variable of interest	No missing data for the two main questionnaires
Outcome data	15*	Report numbers of outcome events or summary measures	Not applicable
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval).	Yes
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Yes
Discussion			
Key results	18	Summarise key results with reference to study objectives	Yes, in the discussion
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Yes
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Yes

Generalisability	21	Discuss the generalisability (external validity) of the study results	Yes
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	No funding was done

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Is the work ability index useful to evaluate absence days in ankylosing spondylitis patients? A cross-sectional study.

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Work ability index, ankylosing spondylitis

Is the work ability index useful to evaluate absence days in ankylosing spondylitis patients? A cross-sectional study.

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Keywords: Outcome assessment, incapacity for work, spondylarthropathies

Word count: 3816

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Abstract

Objectives:

Background: The work incapacity of ankylosing spondylitis (AS) ranges between 3-50% in Europe. In many countries, work incapacity is difficult to quantify. The Work Ability Index (WAI) is applied to measure the work ability in workers, but it is not well investigated in patients.

Aims: To investigate the work incapacity in terms of absence days in patients with AS and to evaluate whether the WAI reflects the absence from work.

Hypothesis: Absence days can be estimated based on the WAI and other variables.

Design: Cross-sectional design.

Setting: In a secondary care centre in Switzerland the WAI and a questionnaire about work absence were administered in AS patients prior to a cardiovascular training. The number of absence days was collected retrospectively.

The absence days were estimated using a two-part regression model.

Participants: 92 AS patients (58 men (63%)). Inclusion criteria: AS diagnosis, ability to cycle, age between 18 and 65 years. Exclusion criteria: Severe heart disease.

Primary and secondary outcome measures: Absence days.

Results: Of the 92 patients, 14 received a disability pension and 78 were in the working process. The median absence days per year of the 78 patients due to AS alone and including other reasons was 0 days (IQR 0-12.3) and 2.5 days (IQR 0-19), respectively. The WAI score (regression coefficient = -4.66 (p<0.001, CI -6.1 to -3.2), "getting a disability pension" (regression coefficient = -106.8 (p<0.001, 95% CI -141.6 to -72.0), and other not significant variables explained 70% of the variance in absence days (p<0.001) and therefore, may estimate the number of absence days.

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Conclusions: Absences in our sample of AS patients were equal to pan-European countries. In groups of AS patients, the WAI and other variables are valid to estimate absence days by the help of a two-part regression model.

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Article summary:

Article focus

- To measure the incapacity for work in terms of absence days in patients with AS in Switzerland
- To evaluate whether the WAI reflects the absence from work.

Key messages

- Incapacity for work in a Swiss cohort of AS patients is similar to the results from other European studies.
- This study shows that the WAI score, together with specific variables, can be used in ankylosing spondylitis patients to calculate their absence days.
- Measuring absence days with the help of the WAI is feasible and cost saving.

Strengths and limitations of this study

- The study showed, that the WAI is not only feasible in prevention, but also in a clinical setting for patients with AS.
- We took into account that the data are skewed and checked the goodness of fit of the regression model by splitting half the group.
- Perhaps patients with a high motivation to influence their health were overrepresented in this study. This could lead to an underestimation of the absence days.

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Introduction:

People affected with ankylosing spondylitis (AS) are impaired in their daily living activities. This is a problem for both the patients and the society in terms of the high costs associated with the loss of productivity. The magnitude of the disability should be determined in order to manage AS-patients with restrictions in the work status effectively. The range of employment in different countries varies widely from 34 to 96%, and the incapacity for work ranges from 3 to 50% depending on the disease duration. Prevalence of AS in western Europe is estimated at 0.86% [1 2] to 1.4% [3]. Incapacity to work is higher in patients affected with AS than in the general population. Mean national sick leave per working individual annually has been measured to be between 7 and 16 days in the Netherlands, France and Belgium [4], in comparison to 12 to 46 days of sick leave per patient with AS per year [5] in the same countries. In Switzerland, two studies about the work status of AS patients show different numbers regarding the incapacity for work. In one study, 42.5% patients reported occasional incapacity for work due to AS, whereas 13.5% were permanently disabled and received a partial (10.2%) or full disability pension (3.3%). Days of sick leave were not reported [6]. In an earlier study, the point estimate of the work ability was measured at 97.3% and disability at 2.7 % [7]. This may reflect that the evaluation of the work status is rather complicated because of the different possible endpoints or definitions of the work ability [5]. In Switzerland and in most of the other countries, reliable data about absence days do not exist [8]. But in musculoskeletal rehabilitation, there is a growing demand for evaluating relevant outcome parameters. In various studies, information about sickness absence is gathered from the registered data of companies [9] or from the civil service register [10]. But these measurements are not validated. Nevertheless, there is no direct access to absence data in many countries, and moreover, to gather such information in the daily practise is too costly and hardly feasible. Absence days are a composite of full or part-time work, full or partial work disability, full or partial performance because of illness. Questionnaire-based evaluations of absence days are complicated, time consuming and possibly not valid. Additionally, it remains unclear, whether absences are due to the disease or due to co-morbidities. An alternative is a comprehensive person to person assessment. In Switzerland, the loss of one working day costs about 600 Euro in average [11], and therefore, work loss is a significant cost factor in back and musculoskeletal disorders. To our knowledge, only one validated questionnaire for patients with AS[12] exists that however takes into account only to a small part the above mentioned complicated construct of the incapacity for work. The time span of this questionnaire covers the past seven days. However, such a short period may not reflect adequately the course of a disease such as AS. There is another assessment for the working ability, the so-called "Work Ability Index" WAI [13-15] which is well investigated in the work environment and in occupational health care, where it has been shown to be predictive[15] in terms of future incapacity for work and disability pension. In a big study with 40'000 nurses its internal reliability with a Cronbach's alpha of 0.72 has been proved to be satisfactory and the concurrent validity expressed by correlations to other questionnaires showed consistent and expected correlation coefficients r of around +/-0.5[16]. The test-retest reliability revealed acceptable values with a percentage of observed agreement of 66% between the baseline measurement and the second measurement which was four weeks later. At group level the WAI is stable and did not show any significant difference of the mean between the points of time[17]. Recently, the WAI has also been used as an outcome measurement in some intervention and cross-sectional studies with groups of patients (instead of workers) with different diseases, e.g. musculoskeletal disorders [18], heart disease, hypertension [19], psychiatric disorders [20], rheumatoid arthritis [21] or osteoarthritis [22]. In all these studies the WAI has been shown to be feasible and validly assesses the ability to work. So far, the WAI has not been applied to patients with AS.

The aim of this study was to investigate how big the problem of incapacity to work is in a subgroup of people with AS in Switzerland. A secondary aim was to develop a simple method to measure absence days to avoid the use of complicated and time-consuming assessments or inaccurate registers. Therefore, the hypothesis was that the WAI, in combination with other variables, could potentially serve as a simple instrument for measuring absence days in AS patients.

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Study population and methods

Participants

The participants for this study were all AS patients taking part in a cardiovascular training study for which the sample size was computed to detect the effect of the training. The patients were recruited from the national Ankylosing Spondylitis Association and from the Rheumatology outpatient facilities in our country in 2008/2009. The last follow-up of the intervention was in 2010. Inclusion criteria for the cardiovascular training intervention and thus this study were: AS diagnosis following the modified New York criteria, the ability to cycle, sufficient German language ability (for questionnaires), age between 18 and 65 years, willingness to follow the study protocol, and an informed consent. Chronic heart failure and functional NYHA Class III and IV were criteria for exclusion. The study was approved from the local Ethics Committee and the patients provided written informed consent. All patients were randomised to either the cardiovascular training or an attention control.

Design

We investigated retrospectively the dimension of incapacity for work with questions about the work status (QW) and evaluated the feasibility of an estimation of absence days by the WAI and other variables. For the latter, a two-part regression model was built, including the results of the QW as dependent and the WAI with other variables as the independent variables. The WAI and the QW were administered in a cross-sectional design.

Measurements of the WAI-study

A comprehensive assessment was conducted before the cardiovascular training. The measurements included the WAI and additional questions about the work status (QW) which were gathered retrospectively.

The WAI is a 13-item questionnaire about a) the work conditions, b) the perception of the present health condition, and c) the perceived prognosis for work. The WAI is an assessment for the general health and measures the work ability in terms of all health conditions. A part of the WAI deals with a recall period of the last 12 months. One item of the WAI collects the number of current diseases or co-morbidities. The WAI is easy to use and takes about 10 minutes to fill in[13 15]. The scores range from 7 to 49 points, with 49 points describing the best ability to work. The rules to compute the scores are described in detail [13]. The scores of the WAI can be divided into four categories: 7-27 = poor, 28-36 = moderate, 37-43 = good, 44-49 = excellent ability to work.

Different substantial questions about the work ability composed a second questionnaire about work status (QW) to calculate the absence days. In contrast to the brief WAI, the comprehensive QW ought to reveal more accurate information on the complex construct of the incapacity for work. We selected the questions of the QW by means of another study [23], addressing the disability to work, and on the basis of the clinical experience on determining the work ability. The items of the QW include working tasks (mental, physical or mixed), full or part-time work, full or partial work disability during the last year, sick days during the last year, duration of the work disability, reasons for the incapacity for work (AS versus other health reasons), and disability leading to financial support.

Procedure

The absence days were computed by means of the QW: The work disability for the previous year is expressed in “days off work due to health reasons”. The QW measures absence days due to the following reasons: AS alone, not AS-related health conditions or AS together with other health problems. Only working days are counted, weekends and holidays are not included. The work disability is composed of the number of complete sick days and of the partial presence at work due to health reasons. For instance, 30% incapacity for work in a full time job during a distinct period is converted into the corresponding number of sick days. The numbers are adjusted for part-time work, e.g. if someone is employed for 50%, then the days of sick leave consists of only half of the absence days of those of a full time employment. The work disability, days off work and early retirement due to AS in contrast to other health problems were considered separately from each other as was also done in a review [5]. One could argue that the WAI contains an item that assesses self-reported sick leave over the previous twelve months; therefore, it would not be necessary to measure the absence days with the more complicated QW. But Radkiewicz et al. pointed out that the above mentioned item of the WAI should be excluded from the WAI, because there is no substantial relationship between this item and the overall score[16]. Furthermore, this item diminishes the internal validity and thus, the QW was introduced to measure absence days.

Statistics

The data were checked for normal distribution. Appropriate parametric and non-parametric statistics, depending on the distribution, were applied. Non-parametric statistics were used to compare the distributions for the demographic variables and the absence days across the groups. The level of significance was set at alpha = 0.05. With regard to the main aim of the study, descriptive statistics was used to depict demographic data, the absence days (on the basis of the QW) and the WAI score. The WAI score and the absence days in the QW were correlated to evaluate the relation and the concurrent validity between the two questionnaires. Pertaining to the second aim of the study, namely to get a simple way to measure absence days, a two-part regression model was conducted. If the dependent variable has many zero-values like in our study the cases without absence days, two-part models are suitable to get unbiased estimators and therefore, unbiased prediction for the values of the dependent variable. Firstly, we performed a logistic regression analysis to assess the logarithmic odds for the predicting variables which can be used to compute the probability for a patient to have absence days. The logistic regression model is: Logit = $b_0 + b_1x_1 + b_2x_2 + \ldots + b_5x_5$. The logit of one observation "i" for the absence days can be transformed in the logarithmic odds (exp(Logit)) and in a second step the probability for absence days is computed by dividing the "odds" through (odds + 1). In a second step of the two-part model we estimated with a multiple linear regression analysis the number of the absence days in patients with absences. By multiplying the probability of the logistic regression with the result of the linear regression an estimation of the absence days is obtained. These regression models allow the estimation of the absence days as a constructed value in prospective studies. The number of absence days calculated by the QW represents the dependent variable in the multiple regression model. Age and gender were assessed as confounding variables. The statistical software PASW statistics (version 18) was used for the analysis.

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Results

Of the 185 eligible patients 77 refused to participate and 16 were excluded due to exclusion criteria. Table 1 shows the demographic variables and AS-specific functional health indices like the BASDAI (perceived disease activity)[24], BASFI (physical function)[25], BASMI (spinal mobility)[26] and ASDAS $_{(CRP)}$ (calculated by using parameters from BASDAI and C-reactive protein values)[27]. Further, Table 1 shows the work status and the mental or physical job demands of the included 92 patients in the working age. Four of these received a full pension (three patients because of AS, one because of other reasons) and ten a partial disability pension. The remaining 78 individuals (84.7%) were still in the working process and worked 88.9% of a full time job per year. There were 34 (37%) people without any absence days. Table 2 shows the WAI-scores and the absence days computed on the basis of the QW. Where data are skewed, median values are presented in Table 2. A patient may have absence days due to a) AS alone, b) other health problems (e.g. depression), or c) both. Therefore, the median is zero for a) and b), but bigger than zero for c). There were no missing values in the main variables.

Although the data were skewed, we calculated also the mean values for absence days, expressed as the percentage of the working time per year. This will allow a comparison of the absence days to those of other studies. The 78 patients had a mean of 17.9 absence days (SD ±43.7) due to AS only, which is equivalent to 8.1% incapacity for work. Due to other health reasons, an incapacity for work of 2.5% was calculated. When the 14 patients receiving a disability pension were included (n=92), then the mean absence days due to all reasons was 47.9 days (SD ±79.1). These correspond to a disability of 21.6%. The ten patients with a partial disability pension were still partially in the working process and had a mean working time of 41% (SD ±31).

Sensitivity analysis: It is unknown whether patients with a full or a partial disability pension would work 88.9% of the annual working time, if they would not receive any disability pension. Hence, the percentage of the disability for this group (n=92), presuming the patients would work 100% or 80% of a full time job, was calculated. Under this presumption the disability due to all health problems would be 19.2% and 24.0%, respectively.

The Spearman-correlation between the WAI and the absence days on the basis of the QW, which expresses the concurrent validity, was -0.736 (p<0.001) for all of the 92 patients. The scatter plot revealed an overrepresentation of cases without absence days. However, a rang correlation should not be analysed, if there are tied ranks such as the multiple cases with zero absence days. Therefore, the correlation was calculated for the subgroup of AS patients which had at least one absence day per year due to all health problems (n=58), irrespective of getting a disability pension. The correlation reveals an r= -0.755 with a significant p-value of p<0.001 (Figure 1).

Secondary study aim

The results of the logistic regression analysis to estimate the logarithmic odds for a person with AS to have absence days are shown in Table 3. The variables “age” and “WAI” were found to be significant predictors in this multiple logistic regression model. The assumption of linearity of the logits has been met and the residual statistics showed acceptable values. A multiple linear regression analysis with the QW as dependent variable was performed. All significant baseline variables, namely the work ability index score (WAI), the “number of additional co-morbidities” that were collected by the WAI (split into values up to 2/>2), age and disability pension (yes/no) as well as gender, were included in the model. The multiple regression analysis revealed that 70% of the variance in the dependent variable absence days (measured by the complex QW) can be explained by the independent variables of age, gender, WAI, the number of diagnoses and a disability pension (Table 3). However, only WAI and “getting a disability pension” significantly contributed to the model. Thus, the absence days of an AS patient can be estimated by multiple regression with the unstandardized regression coefficients: $y = b1*x1 + b2*x2 + … + bn*xn + a$, where y is the estimated value of the absence days, n is the number of independent variables, x1 to xn are the independent variables (age, gender, WAI, the number of diagnoses and getting a disability pension), and *a* is a constant (Table 3). Due to the skewed distribution of the absence days and the WAI, we verified our presented regression model by splitting the sample into two halves. We estimated each with the shown regression model. We then correlated the estimates and the true values of each group. The result of this was squared and compared with the R Square of the same group (results not shown). The squared correlation and the R Square should be similar in order to confirm that the regression model is capable of predicting the absence days of another sample quite accurately (e.g. the other half of the group). The differences were 0.18 for the first half and 0.05 for the second half, indicating a good fit of the model.

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Discussion

Key results:

Individuals without a disability pension had an 8.1% incapacity for work, if it was solely due to AS. The absence days increased by 2.5%, when AS patients who have had incapacity for work due to other health reasons, were included. The percentage of absences due to AS and other health reasons, including the individuals receiving a disability pension, was 21% evaluated by the QW. Multiple regression analysis explained 70% of the variance of the absence days. The two variables 'WAI' and 'disability pension' made a significant contribution to this model. Thus, the WAI, in combination with other variables, can serve as a simple instrument for measuring absence days in the various groups of AS patients.

Discussing important differences to other studies:

The results regarding the absences of a group of AS patients who underwent a cardiovascular training are comparable to the findings of another Swiss cohort [6]. But the number of absence days in our study is slightly lower than in the review by Boonen [5]. Higher rates of disability pension are found in other studies [28-31]. The differences in the ability to work in different studies are dependent on several factors such as disease duration and activity, the perceived self-efficacy to perform a job, the general health condition and the kind of job (physical/mental demands) [32]. However, influences from different structures of the social insurance system, the job market situation, and cultural differences in absence behaviour may also be relevant. This also has been observed in other musculoskeletal disorders [33].

Our study showed much higher incapacity for work measured in absence days than in another Swiss study [7]. However, in this other study the working ability of 97.3% was a point measurement, and the number of patients only working part-time due to their health condition had not been identified. These distinctions in the methods and the low return rate of questionnaires in this other study could explain the difference in the results of these studies. The correlation coefficient of r= -0.755 reveals a good correlation between the WAI and the QW. This supports the concurrent validity of the QW. The negative relationship means that having a low score in the WAI leads to more absence days. Implications of this study: The WAI reflected the absence days in a group of AS patients by the help of a two-part regression model. In the future, absence days may be estimated by multiplying the probability of the logistic regression with the results of the linear regression. This may be useful for some aspects of economic evaluations to quantify the productivity loss[34]. Age and gender did not confound the results. Usually, absence days are very time-consuming and difficult to measure because of part-time work, partial incapacity for work, partial or full invalidity pension and the potential incapability of the patients to recall all the subtle differences in their absences. Therefore, the WAI offers some advantages in contrast to questionnaires with a huge set of questions: it takes only 10 minutes to be completed, it reflects the subjective view of the patients and the scoring is clearly understandable.

Strength of this study: The study showed that the use of the WAI is not only feasible in a prevention setting such as occupational health care, but also in a clinical setting for patients with AS. We took into account that the data are skewed and checked the goodness of fit of the regression model by splitting the group into two halves, estimating the values of the other half and by correlating the true with the estimated values. The procedure confirmed the stability of the regression model.

Weaknesses of the study: The absence days were gathered retrospectively. The precision of people's memory to report the number of absence days of the previous year is questionable[35] and therefore, the absence days computed by the QW may not be accurate. Severens et al. postulated that a 64% agreement between self-reported and register gathered absence days are resulting, if a three days discrepancy of absence days is regarded as acceptable. The results of this study are not generalizable for other subjects than people with AS. Perhaps patients with a high motivation to influence their health were overrepresented in this study, since they were readily willing to undergo a cardiovascular training. Such patients may also have been more willing to maintain their ability to work. This could lead to an underestimation of the absence day.

Since a questionnaire encompassing the complicated nature of the construct of the incapacity for work does only exist to report absence days over a very short time span, we made use of the new not validated QW. The substantial correlation between the WAI and the QW implicates an acceptable concurrent validity. The sample size is not very big to conduct a multiple regression analysis. However, we had 11 patients per variable and this lies above the recommended number of patients (5 to 10 times the number of included variables).

In summary, statistical models using the WAI for estimating absence days offers an innovative and time-saving approach for studies where incapacity for work has to be measured.

Conclusions:

Incapacity for work in a sample of AS patients was equal to pan-European countries. The WAI was feasible for use in AS patients. It validly assesses incapacity for work evaluating groups of participants suffering of AS. In the future, absence days may be calculated by computing the absence days through a regression analysis including the WAI score as a variable. Further research may evaluate whether these results are replicable in patients with other health conditions than AS.

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Conflicts of interest statement

The authors declare no conflict of interests.

Funding statement

There was no funding.

Contributorship

K. Meyer, K. Niedermann and A. Klipstein conceived the idea of the study and were responsible for the design of the study. K. Meyer and A. Tschopp were responsible for undertaking for the data analysis and produced the tables and graphs. K. Niedermann and A. Klipstein provided input into the data analysis. The initial draft of the manuscript was prepared by K. Meyer and then circulated repeatedly among all authors for critical revision.

K. Niedermann and K. Meyer was responsible for the acquisition of the data and all authors contributed to the interpretation of the results.

References

1. Braun J, Bollow M, Remlinger G et al. Prevalence of spondylarthropathies in HLA-B27 positive and negative blood donors. *Arthritis Rheum* 1998;41(1):58-67.

2. Van der Linden SM, Valkenburg HA, De Jong BM et al. The risk of developing ankylosing spondylitis in HLA-B27 positive individuals. A comparison of relatives of spondylitis patients with the general population. *Arthritis Rheum* 1984;27(3):241-9.

3. Gran JT, Husby G, Hordvik M. Prevalence of ankylosing spondylitis in males and females in a young middle-aged population of Tromsø, northern Norway *Ann Rheum Dis* 1985;44(6):359-67.

4. Boonen A, van der Heijde D, Landewe R et al. Work status and productivity costs due to ankylosing spondylitis: comparison of three European countries. *Ann Rheum Dis* 2002;61(5):429-37.

5. Boonen A, de Vet H, van der Heijde D et al. Work status and its determinants among patients with ankylosing spondylitis. A systematic literature review. *J Rheumatol* 2001;28(5):1056-62.

6. Brunner R, Kissling RO, Auckenthaler C et al. Clinical evaluation of ankylosing spondylitis in Switzerland. *Pain Physician* 2002;5(1):49-56.

7. Fellmann J, Kissling R, Baumberger H. [Socio-professional aspects of ankylosing spondylitis in Switzerland]. *Z Rheumatol* 1996;55(2):105-13.

8. Quadrello T, Bevan S, McGee R. Fit for work? Erkrankungen des Bewegungsapparats und der Schweizer Arbeitsmarkt. London The Work foundation, 2009:16.

9. Niedhammer I, Bugel I, Goldberg M et al. Psychosocial factors at work and sickness absence in the Gazel cohort: a prospective study. *Occup Environ Med* 1998;55(11):735-41.

10. North F, Syme SL, Feeney A et al. Explaining socioeconomic differences in sickness absence: the Whitehall II Study. *BMJ* 1993;306(6874):361-6.

11. Läubli T, Müller C. Arbeitsbedingungen und Erkrankungen des Bewegungsapparates – geschätzte Fallzahlen und Kosten für die Schweiz. *Die Volkswirtschaft* 2009;82:22-25.

12. Reilly MC, Gooch KL, Wong RL et al. Validity, reliability and responsiveness of the Work Productivity and Activity Impairment Questionnaire in ankylosing spondylitis. *Rheumatology (Oxford)* 2010;49(4):812-9.

13. Tuomi K, Ilmarinen J, Jahkola A et al. *Work ability index*. Helsinki: Finnish Institute of occupational health ICOH, 2003.

14. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin. Why WAI?- Der Work Ability Index im Einsatz für Arbeitsfähigkeit und Prävention. Erfahrungsberichte aus der Praxis. Dortmund, Bundesanstalt für Arbeitsschutz und Arbeitsmedizin 2011:8-13.

15. Tuomi K, Ilmarinen J, Seitsamo J et al. Summary of the Finnish research project (1981-1992) to promote the health and work ability of aging workers. *Scand J Work Environ Health* 1997;23 Suppl 1:66-71.

16. Radkiewicz P, Widerszal-Bazyl M. Psychometric properties of Work Ability Index in the light of comparative survey study. *International Congress Series* 2005;1280:304-09.

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17. de Zwart BCH, Frings-Dresen MHW, van Duivenbooden JC. Test-retest reliability of the Work Ability Index questionnaire. *Occup Med (Lond)* 2002;52(4):177-81.

18. Walsh IA, Corral S, Franco RN et al. Work ability of subjects with chronic musculoskeletal disorders. *Rev Saude Publica* 2004;38(2):149-56.

19. Jedryka-Góral A, Bugajska J, Lastowiecka E et al. Work activity and ability in aging patients suffering from chronic cardiovascular diseases. *International Congress Series* 2005;1280:190-95.

20. Knekt P, Lindfors O, Laaksonen MA et al. Effectiveness of short-term and long-term psychotherapy on work ability and functional capacity-a randomized clinical trial on depressive and anxiety disorders. *J Affect Disord* 2008;107(1-3):95-106.

21. Hoving JL, Bartelds GM, Sluiter JK et al. Perceived work ability, quality of life, and fatigue in patients with rheumatoid arthritis after a 6-month course of TNF inhibitors: prospective intervention study and partial economic evaluation. *Scand J Rheumatol* 2009;38(4):246-50.

22. Lastowiecka E, Bugajska J, Najmiec A et al. Occupational work and quality of life in osteoarthritis patients. *Rheumatol Int* 2006;27(2):131-9.

23. Labriola M, Lund T, Burr H. Prospective study of physical and psychosocial risk factors for sickness absence. *Occup Med (Lond)* 2006;56(7):469-74.

24. Garrett S, Jenkinson T, Kennedy LG et al. A new approach to defining disease status in ankylosing spondylitis: the Bath Ankylosing Spondylitis Disease Activity Index. *J Rheumatol* 1994;21(12):2286-91.

Work ability index, ankylosing spondylitis

25. Calin A, Garrett S, Whitelock H et al. A new approach to defining functional ability in ankylosing spondylitis: the development of the Bath Ankylosing Spondylitis Functional Index. *J Rheumatol* 1994;21(12):2281-5.

26. Jenkinson TR, Mallorie PA, Whitelock HC et al. Defining spinal mobility in ankylosing spondylitis (AS). The Bath AS Metrology Index. *J Rheumatol* 1994;21(9):1694-8.

27. Lukas C, Landewe R, Sieper J et al. Development of an ASAS-endorsed disease activity score (ASDAS) in patients with ankylosing spondylitis. *Ann Rheum Dis* 2009;68(1):18-24.

28. Schramm AB, Pastusko T, Jaskal AM. Permanent disablement for work in patients with ankylosing spondylitis and rheumatoid arthritis. *Scand J Rheumatol* 1975(Suppl 8):12-20.

29. Wordsworth BP, Mowat AG. A review of 100 patients with ankylosing spondylitis with particular reference to socio-economic effects. *Br J Rheumatol* 1986;25(2):175-80.

30. Guillemin F, Briancon S, Pourel J et al. Long-term disability and prolonged sick leaves as outcome measurements in ankylosing-spondylitis - possible predictive factors. *Arthritis and Rheumatism* 1990;33(7):1001-06.

31. Ward MM, Kuzis S. Risk factors for work disability in patients with ankylosing spondylitis. *The Journal of Rheumatology* 2001;28(2):315-21.

32. Barlow JH, Wright CC, Williams B et al. Work disability among people with ankylosing spondylitis. *Arthritis Rheum* 2001;45(5):424-29.

33. Waddell G. The biopsychosocial model In: Waddell G, editor. *The back pain revolution*. London: Churchill Livingston, 2004:265-82.

Work ability index, ankylosing spondylitis

34. Zhang W, Bansback N, Anis AH. Measuring and valuing productivity loss due to poor health: A critical review. *Soc Sci Med* 2011;72(2):185-92.

35. Severens JL, Mulder J, Laheij RJF et al. Precision and accuracy in measuring absence from work as a basis for calculating productivity costs in The Netherlands. *Social Science & Medicine* 2000;51(2):243-49.

Table 1: Baseline variables (n=92)

	Overall, n=92
Age in years, mean (SD)	46.34 (11.15)
Gender:	
men (%)	58 (63.0)
women (%)	34 (37.0)
Duration in years since AS diagnosis	
mean (SD)	14.55 (12.74)
BASDAI (0-10), mean (SD)	3.45 (2.0)
BASFI (0-10), mean (SD)	2.4 (2.0)
BASMI (0-10), mean (SD)	2.85 (2.0)
ASDAS$_{(CRP)}$, mean (SD)	6.95 (9.25)
Number of current diseases	
AS alone	22
+ 1-2	45
+ > 2	25
Education, n (%)	
<=12 years	60 (65.2)
>12 years	26 (28.3)
Not known	6 (6.5)
Employment status, n (%)	
Paid work	68 (73.9)
Unpaid work	6 (6.5)
Unemployed	4 (4.4)

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Partial disability pension	10 (10.9)
Full disability pension	4(4.3)
Job demands (n=78, no disability pension)	
physical	11%
mental	41%
both	48%

BASDAI= Bath AS Disease Activity Index, BASFI=The Bath AS Functioanl Index, BASMI= Bath AS Metrology Index, ASDAS $_{(CRP)}$ = Ankylosing Spondylitis Disease Activity Score (calculated with C-reactive protein values)

Table 2: Absence days (AD) and WAI-scores for the patients in the working age

	People with > 0 absence days, n=58 (63%)	Due to	All patients in the working age (n=92)	Patients without disability pension (n=78)
Absence days during the last year, Median (IQR) [2]	24 (6.5-127.7)	• AS[1] alone	0 (0 - 37.8)	0 (0 - 12.3)
		• Other health problems	0 (0 - 2)	0 (0 - 2)
		• AS[2] and other health problems	4.5 (0 - 61.1)	2.5 (0 - 19)
WAI, Mean (SD)	-	-	34.18 (9.77)	35.93 (9.29)

Absence days measured by the QW

1) Ankylosing spondylitis

2) Interquartile range

Table 3: Two-part model: multiple logistic and multiple linear regression analysis

Model	Independent variables	B coefficients	Standardized regression coefficients (Beta)	Significance p-value	95%-Confidence Interval for B Lower / Upper	
Multiple logistic regression Predicted variable: Absence days#	Constant	11.039		0.000	6.14	15.93
	Age	-0.065		0.013	-0.116	-0.014
	WAI	-0.203		0.000	-0.293	-0.113
Multiple linear Regression Predicted variable: number of absence days	Constant	427.2*	-	0.000	317.32	537.08
	Disability pension 1)	-106.81*	-0.52	0.000	-141.60	-72.02
	WAI	-4.66*	-0.51	0.000	-6.13	-3.18
	Age	-0.498*	-0.07	0.429	-1.75	0.76
	Gender	-10.71*	-0.06	0.414	-36.82	15.40
	N° of diagnoses 2)	10.24*	0.06	0.461	-17.45	37.93

1) Disability pension (yes/no)

2) Number of diagnoses (up to 2/>2)

* Unstandardized regression coefficients (B)

The logistic regression has a Nagelkerke R=0.458, the Hosmer and Lemeshow test was not significant (p=0.09), the Omnibus test was very small (p= 0.000)

For the multiple regression the R- Squared was 0.724, R-squared adjusted 0.7, the model is significant with p<0.001

1 **Figure 1** Scatterplot of the WAI and absence days for the subgroup with absence days (n=
2 58)

Is the work ability index useful to evaluate absence days in ankylosing spondylitis patients? A cross-sectional study.

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Abstract

Objectives:

Background: The work incapacity of ankylosing spondylitis (AS) ranges between 3-50% in Europe. In many countries, work incapacity is difficult to quantify. The Work Ability Index (WAI) is applied to measure the work ability in workers, but it is not well investigated in patients.

Aims: To investigate the work incapacity in terms of absence days in patients with AS and to evaluate whether the WAI reflects the absence from work.

Hypothesis: Absence days can be estimated based on the WAI and other variables.

Design: Cross-sectional design.

Setting: In a secondary care centre in Switzerland the WAI and a questionnaire about work absence were administered in AS patients prior to a cardiovascular training. The number of absence days was collected retrospectively.

The absence days were estimated using a two-part regression model.

Participants: 92 AS patients (58 men (63%)). Inclusion criteria: AS diagnosis, ability to cycle, age between 18 and 65 years. Exclusion criteria: Severe heart disease.

Primary and secondary outcome measures: Absence days.

Results: Of the 92 patients, 14 received a disability pension and 78 were in the working process. The median absence days per year of the 78 patients due to AS alone and including other reasons was 0 days (IQR 0-12.3) and 2.5 days (IQR 0-19), respectively. The WAI score (regression coefficient = -4.66 (p<0.001, CI -6.1 to -3.2), “getting a disability pension” (regression coefficient = -106.8 (p<0.001, 95% CI -141.6 to -72.0), and other not significant variables explained 70% of the variance in absence days (p<0.001) and therefore, may estimate the number of absence days.

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Conclusions: Absences in our sample of AS patients were equal to pan-European countries. In groups of AS patients, the WAI and other variables are valid to estimate absence days by the help of a two-part regression model.

Work ability index, ankylosing spondylitis

Article summary:

Article focus

- To measure the incapacity for work in terms of absence days in patients with AS in Switzerland
- To evaluate whether the WAI reflects the absence from work.

Key messages

- Incapacity for work in a Swiss cohort of AS patients is similar to the results from other European studies.
- This study shows that the WAI score, together with specific variables, can be used in ankylosing spondylitis patients to calculate their absence days.
- Measuring absence days with the help of the WAI is feasible and cost saving.

Strengths and limitations of this study

- The study showed, that the WAI is not only feasible in prevention, but also in a clinical setting for patients with AS.
- We took into account that the data are skewed and checked the goodness of fit of the regression model by splitting half the group.
- Perhaps patients with a high motivation to influence their health were overrepresented in this study. This could lead to an underestimation of the absence days.

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Introduction:

People affected with ankylosing spondylitis (AS) are impaired in their daily living activities. This is a problem for both the patients and the society in terms of the high costs associated with the loss of productivity. The magnitude of the disability should be determined in order to manage AS-patients with restrictions in the work status effectively. The range of employment in different countries varies widely from 34 to 96%, and the incapacity for work ranges from 3 to 50% depending on the disease duration. Prevalence of AS in western Europe is estimated at 0.86% [1 2] to 1.4% [3]. Incapacity to work is higher in patients affected with AS than in the general population. Mean national sick leave per working individual annually has been measured to be between 7 and 16 days in the Netherlands, France and Belgium [4], in comparison to 12 to 46 days of sick leave per patient with AS per year [5] in the same countries. In Switzerland, two studies about the work status of AS patients show different numbers regarding the incapacity for work. In one study, 42.5% patients reported occasional incapacity for work due to AS, whereas 13.5% were permanently disabled and received a partial (10.2%) or full disability pension (3.3%). Days of sick leave were not reported [6]. In an earlier study, the point estimate of the work ability was measured at 97.3% and disability at 2.7 % [7]. This may reflect that the evaluation of the work status is rather complicated because of the different possible endpoints or definitions of the work ability [5]. In Switzerland and in most of the other countries, reliable data about absence days do not exist [8]. But in musculoskeletal rehabilitation, there is a growing demand for evaluating relevant outcome parameters. In various studies, information about sickness absence is gathered from the registered data of companies [9] or from the civil service register [10]. But these measurements are not validated. Nevertheless, there is no direct access to absence data in many countries, and moreover, to gather such information in the daily practise is too costly and hardly feasible. Absence days are a composite of full or part-time work, full or partial work disability, full or partial performance because of illness. Questionnaire-based evaluations of absence days are complicated, time consuming and possibly not valid. Additionally, it remains unclear, whether absences are due to the disease or due to co-morbidities. An alternative is a comprehensive person to person assessment. In Switzerland, the loss of one working day costs about 600 Euro in average [11], and therefore, work loss is a significant cost factor in back and musculoskeletal disorders. To our knowledge, only one validated questionnaire for patients with AS[12] exists that however takes into account only to a small part the above mentioned complicated construct of the incapacity for work. The time span of this questionnaire covers the past seven days. However, such a short period may not reflect adequately the course of a disease such as AS. There is another assessment for the working ability, the so-called "Work Ability Index" WAI [13-15] which is well investigated in the work environment and in occupational health care, where it has been shown to be predictive[15] in terms of future incapacity for work and disability pension. In a big study with 40'000 nurses its internal reliability with a Cronbach's alpha of 0.72 has been proved to be satisfactory and the concurrent validity expressed by correlations to other questionnaires showed consistent and expected correlation coefficients r of around +/-0.5[16]. The test-retest reliability revealed acceptable values with a percentage of observed agreement of 66% between the baseline measurement and the second measurement which was four weeks later. At group level the WAI is stable and did not show any significant difference of the mean between the points of time[17]. Recently, the WAI has also been used as an outcome measurement in some intervention and cross-sectional studies with groups of patients (instead of workers) with different diseases, e.g. musculoskeletal disorders [18], heart disease, hypertension [19], psychiatric disorders [20], rheumatoid arthritis [21] or osteoarthritis [22]. In all these studies the WAI has been shown to be feasible and validly assesses the ability to work. So far, the WAI has not been applied to patients with AS.

The aim of this study was to investigate how big the problem of incapacity to work is in a subgroup of people with AS in Switzerland. A secondary aim was to develop a simple method to measure absence days to avoid the use of complicated and time-consuming assessments or inaccurate registers. Therefore, the hypothesis was that the WAI, in combination with other variables, could potentially serve as a simple instrument for measuring absence days in AS patients.

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Study population and methods

Participants

The participants for this study were all AS patients taking part in a cardiovascular training study for which the sample size was computed to detect the effect of the training. The patients were recruited from the national Ankylosing Spondylitis Association and from the Rheumatology outpatient facilities in our country in 2008/2009. The last follow-up of the intervention was in 2010. Inclusion criteria for the cardiovascular training intervention and thus this study were: AS diagnosis following the modified New York criteria, the ability to cycle, sufficient German language ability (for questionnaires), age between 18 and 65 years, willingness to follow the study protocol, and an informed consent. Chronic heart failure and functional NYHA Class III and IV were criteria for exclusion. The study was approved from the local Ethics Committee and the patients provided written informed consent. All patients were randomised to either the cardiovascular training or an attention control.

Design

We investigated retrospectively the dimension of incapacity for work with questions about the work status (QW) and evaluated the feasibility of an estimation of absence days by the WAI and other variables. For the latter, a two-part regression model was built, including the results of the QW as dependent and the WAI with other variables as the independent variables. The WAI and the QW were administered in a cross-sectional design.

Measurements of the WAI-study

A comprehensive assessment was conducted before the cardiovascular training. The measurements included the WAI and additional questions about the work status (QW) which were gathered retrospectively.

The WAI is a 13-item questionnaire about a) the work conditions, b) the perception of the present health condition, and c) the perceived prognosis for work. The WAI is an assessment for the general health and measures the work ability in terms of all health conditions. A part of the WAI deals with a recall period of the last 12 months. One item of the WAI collects the number of current diseases or co-morbidities. The WAI is easy to use and takes about 10 minutes to fill in[13 15]. The scores range from 7 to 49 points, with 49 points describing the best ability to work. The rules to compute the scores are described in detail [13]. The scores of the WAI can be divided into four categories: 7-27 = poor, 28-36 = moderate, 37-43 = good, 44-49 = excellent ability to work.

Different substantial questions about the work ability composed a second questionnaire about work status (QW) to calculate the absence days. In contrast to the brief WAI, the comprehensive QW ought to reveal more accurate information on the complex construct of the incapacity for work. We selected the questions of the QW by means of another study [23], addressing the disability to work, and on the basis of the clinical experience on determining the work ability. The items of the QW include working tasks (mental, physical or mixed), full or part-time work, full or partial work disability during the last year, sick days during the last year, duration of the work disability, reasons for the incapacity for work (AS versus other health reasons), and disability leading to financial support.

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Procedure

The absence days were computed by means of the QW: The work disability for the previous year is expressed in “days off work due to health reasons”. The QW measures absence days due to the following reasons: AS alone, not AS-related health conditions or AS together with other health problems. Only working days are counted, weekends and holidays are not included. The work disability is composed of the number of complete sick days and of the partial presence at work due to health reasons. For instance, 30% incapacity for work in a full time job during a distinct period is converted into the corresponding number of sick days. The numbers are adjusted for part-time work, e.g. if someone is employed for 50%, then the days of sick leave consists of only half of the absence days of those of a full time employment. The work disability, days off work and early retirement due to AS in contrast to other health problems were considered separately from each other as was also done in a review [5]. One could argue that the WAI contains an item that assesses self-reported sick leave over the previous twelve months; therefore, it would not be necessary to measure the absence days with the more complicated QW. But Radkiewicz et al. pointed out that the above mentioned item of the WAI should be excluded from the WAI, because there is no substantial relationship between this item and the overall score[16]. Furthermore, this item diminishes the internal validity and thus, the QW was introduced to measure absence days.

Statistics

The data were checked for normal distribution. Appropriate parametric and non-parametric statistics, depending on the distribution, were applied. Non-parametric statistics were used to compare the distributions for the demographic variables and the absence days across the groups. The level of significance was set at alpha = 0.05. With regard to the main aim of the study, descriptive statistics was used to depict demographic data, the absence days (on the basis of the QW) and the WAI score. The WAI score and the absence days in the QW were correlated to evaluate the relation and the concurrent validity between the two questionnaires. Pertaining to the second aim of the study, namely to get a simple way to measure absence days, a two-part regression model was conducted. If the dependent variable has many zero-values like in our study the cases without absence days, two-part models are suitable to get unbiased estimators and therefore, unbiased prediction for the values of the dependent variable. Firstly, we performed a logistic regression analysis to assess the logarithmic odds for the predicting variables which can be used to compute the probability for a patient to have absence days. The logistic regression model is: Logit = $b_0 + b_1x_1 + b_2x_2 + \ldots + b_5x_5$. The logit of one observation "i" for the absence days can be transformed in the logarithmic odds (exp(Logit)) and in a second step the probability for absence days is computed by dividing the "odds" through (odds + 1). In a second step of the two-part model we estimated with a multiple linear regression analysis the number of the absence days in patients with absences. By multiplying the probability of the logistic regression with the result of the linear regression an estimation of the absence days is obtained. These regression models allow the estimation of the absence days as a constructed value in prospective studies. The number of absence days calculated by the QW represents the dependent variable in the multiple regression model. Age and gender were assessed as confounding variables. The statistical software PASW statistics (version 18) was used for the analysis.

Results

Of the 185 eligible patients 77 refused to participate and 16 were excluded due to exclusion criteria. Table 1 shows the demographic variables and AS-specific functional health indices like the BASDAI (perceived disease activity)[24], BASFI (physical function)[25], BASMI (spinal mobility)[26] and ASDAS $_{(CRP)}$ (calculated by using parameters from BASDAI and C-reactive protein values)[27]. Further, Table 1 shows the work status and the mental or physical job demands of the included 92 patients in the working age. Four of these received a full pension (three patients because of AS, one because of other reasons) and ten a partial disability pension. The remaining 78 individuals (84.7%) were still in the working process and worked 88.9% of a full time job per year. There were 34 (37%) people without any absence days. Table 2 shows the WAI-scores and the absence days computed on the basis of the QW. Where data are skewed, median values are presented in Table 2. A patient may have absence days due to a) AS alone, b) other health problems (e.g. depression), or c) both. Therefore, the median is zero for a) and b), but bigger than zero for c). There were no missing values in the main variables.

Although the data were skewed, we calculated also the mean values for absence days, expressed as the percentage of the working time per year. This will allow a comparison of the absence days to those of other studies. The 78 patients had a mean of 17.9 absence days (SD ±43.7) due to AS only, which is equivalent to 8.1% incapacity for work. Due to other health reasons, an incapacity for work of 2.5% was calculated. When the 14 patients receiving a disability pension were included (n=92), then the mean absence days due to all reasons was 47.9 days (SD ±79.1). These correspond to a disability of 21.6%. The ten patients with a partial disability pension were still partially in the working process and had a mean working time of 41% (SD ±31).

Sensitivity analysis: It is unknown whether patients with a full or a partial disability pension would work 88.9% of the annual working time, if they would not receive any disability pension. Hence, the percentage of the disability for this group (n=92), presuming the patients would work 100% or 80% of a full time job, was calculated. Under this presumption the disability due to all health problems would be 19.2% and 24.0%, respectively.

The Spearman-correlation between the WAI and the absence days on the basis of the QW, which expresses the concurrent validity, was -0.736 (p<0.001) for all of the 92 patients. The scatter plot revealed an overrepresentation of cases without absence days. However, a rang correlation should not be analysed, if there are tied ranks such as the multiple cases with zero absence days. Therefore, the correlation was calculated for the subgroup of AS patients which had at least one absence day per year due to all health problems (n=58), irrespective of getting a disability pension. The correlation reveals an r= -0.755 with a significant p-value of p<0.001 (Figure 1).

Secondary study aim

The results of the logistic regression analysis to estimate the logarithmic odds for a person with AS to have absence days are shown in Table 3. The variables “age” and “WAI” were found to be significant predictors in this multiple logistic regression model. The assumption of linearity of the logits has been met and the residual statistics showed acceptable values. A multiple linear regression analysis with the QW as dependent variable was performed. All significant baseline variables, namely the work ability index score (WAI), the “number of additional co-morbidities” that were collected by the WAI (split into values up to 2/>2), age and disability pension (yes/no) as well as gender, were included in the model. The multiple regression analysis revealed that 70% of the variance in the dependent variable absence days (measured by the complex QW) can be explained by the independent variables of age, gender, WAI, the number of diagnoses and a disability pension (Table 3). However, only WAI and “getting a disability pension” significantly contributed to the model. Thus, the absence days of an AS patient can be estimated by multiple regression with the unstandardized regression coefficients: y = b1*x1 + b2*x2 + … + bn*xn + a, where y is the estimated value of the absence days, n is the number of independent variables, x1 to xn are the independent variables (age, gender, WAI, the number of diagnoses and getting a disability pension), and *a* is a constant (Table 3). Due to the skewed distribution of the absence days and the WAI, we verified our presented regression model by splitting the sample into two halves. We estimated each with the shown regression model. We then correlated the estimates and the true values of each group. The result of this was squared and compared with the R Square of the same group (results not shown). The squared correlation and the R Square should be similar in order to confirm that the regression model is capable of predicting the absence days of another sample quite accurately (e.g. the other half of the group). The differences were 0.18 for the first half and 0.05 for the second half, indicating a good fit of the model.

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Discussion

Key results:

Individuals without a disability pension had an 8.1% incapacity for work, if it was solely due to AS. The absence days increased by 2.5%, when AS patients who have had incapacity for work due to other health reasons, were included. The percentage of absences due to AS and other health reasons, including the individuals receiving a disability pension, was 21% evaluated by the QW. Multiple regression analysis explained 70% of the variance of the absence days. The two variables 'WAI' and 'disability pension' made a significant contribution to this model. Thus, the WAI, in combination with other variables, can serve as a simple instrument for measuring absence days in the various groups of AS patients.

Discussing important differences to other studies:

The results regarding the absences of a group of AS patients who underwent a cardiovascular training are comparable to the findings of another Swiss cohort [6]. But the number of absence days in our study is slightly lower than in the review by Boonen [5]. Higher rates of disability pension are found in other studies [28-31]. The differences in the ability to work in different studies are dependent on several factors such as disease duration and activity, the perceived self-efficacy to perform a job, the general health condition and the kind of job (physical/mental demands) [32]. However, influences from different structures of the social insurance system, the job market situation, and cultural differences in absence behaviour may also be relevant. This also has been observed in other musculoskeletal disorders [33].

Our study showed much higher incapacity for work measured in absence days than in another Swiss study [7]. However, in this other study the working ability of 97.3% was a point measurement, and the number of patients only working part-time due to their health condition had not been identified. These distinctions in the methods and the low return rate of questionnaires in this other study could explain the difference in the results of these studies. The correlation coefficient of r= -0.755 reveals a good correlation between the WAI and the QW. This supports the concurrent validity of the QW. The negative relationship means that having a low score in the WAI leads to more absence days. Implications of this study: The WAI reflected the absence days in a group of AS patients by the help of a two-part regression model. In the future, absence days may be estimated by multiplying the probability of the logistic regression with the results of the linear regression. This may be useful for some aspects of economic evaluations to quantify the productivity loss[34]. Age and gender did not confound the results. Usually, absence days are very time-consuming and difficult to measure because of part-time work, partial incapacity for work, partial or full invalidity pension and the potential incapability of the patients to recall all the subtle differences in their absences. Therefore, the WAI offers some advantages in contrast to questionnaires with a huge set of questions: it takes only 10 minutes to be completed, it reflects the subjective view of the patients and the scoring is clearly understandable.

Strength of this study: The study showed that the use of the WAI is not only feasible in a prevention setting such as occupational health care, but also in a clinical setting for patients with AS. We took into account that the data are skewed and checked the goodness of fit of the regression model by splitting the group into two halves, estimating the values of the other half and by correlating the true with the estimated values. The procedure confirmed the stability of the regression model.

Weaknesses of the study: The absence days were gathered retrospectively. The precision of people's memory to report the number of absence days of the previous year is questionable[35] and therefore, the absence days computed by the QW may not be accurate. Severens et al. postulated that a 64% agreement between self-reported and register gathered absence days are resulting, if a three days discrepancy of absence days is regarded as acceptable. The results of this study are not generalizable for other subjects than people with AS. Perhaps patients with a high motivation to influence their health were overrepresented in this study, since they were readily willing to undergo a cardiovascular training. Such patients may also have been more willing to maintain their ability to work. This could lead to an underestimation of the absence day.

Since a questionnaire encompassing the complicated nature of the construct of the incapacity for work does only exist to report absence days over a very short time span, we made use of the new not validated QW. The substantial correlation between the WAI and the QW implicates an acceptable concurrent validity. The sample size is not very big to conduct a multiple regression analysis. However, we had 11 patients per variable and this lies above the recommended number of patients (5 to 10 times the number of included variables).

In summary, statistical models using the WAI for estimating absence days offers an innovative and time-saving approach for studies where incapacity for work has to be measured.

Conclusions:

Incapacity for work in a sample of AS patients was equal to pan-European countries. The WAI was feasible for use in AS patients. It validly assesses incapacity for work evaluating groups of participants suffering of AS. In the future, absence days may be calculated by computing the absence days through a regression analysis including the WAI score as a variable. Further research may evaluate whether these results are replicable in patients with other health conditions than AS.

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Conflicts of interest statement

The authors declare no conflict of interests.

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References

1. Braun J, Bollow M, Remlinger G et al. Prevalence of spondylarthropathies in HLA-B27 positive and negative blood donors. *Arthritis Rheum* 1998;41(1):58-67.
2. Van der Linden SM, Valkenburg HA, De Jong BM et al. The risk of developing ankylosing spondylitis in HLA-B27 positive individuals. A comparison of relatives of spondylitis patients with the general population. *Arthritis Rheum* 1984;27(3):241-9.
3. Gran JT, Husby G, Hordvik M. Prevalence of ankylosing spondylitis in males and females in a young middle-aged population of Tromsø, northern Norway *Ann Rheum Dis* 1985;44(6):359-67.
4. Boonen A, van der Heijde D, Landewe R et al. Work status and productivity costs due to ankylosing spondylitis: comparison of three European countries. *Ann Rheum Dis* 2002;61(5):429-37.
5. Boonen A, de Vet H, van der Heijde D et al. Work status and its determinants among patients with ankylosing spondylitis. A systematic literature review. *J Rheumatol* 2001;28(5):1056-62.
6. Brunner R, Kissling RO, Auckenthaler C et al. Clinical evaluation of ankylosing spondylitis in Switzerland. *Pain Physician* 2002;5(1):49-56.
7. Fellmann J, Kissling R, Baumberger H. [Socio-professional aspects of ankylosing spondylitis in Switzerland]. *Z Rheumatol* 1996;55(2):105-13.
8. Quadrello T, Bevan S, McGee R. Fit for work? Erkrankungen des Bewegungsapparats und der Schweizer Arbeitsmarkt. London The Work foundation, 2009:16.

9. Niedhammer I, Bugel I, Goldberg M et al. Psychosocial factors at work and sickness absence in the Gazel cohort: a prospective study. *Occup Environ Med* 1998;55(11):735-41.

10. North F, Syme SL, Feeney A et al. Explaining socioeconomic differences in sickness absence: the Whitehall II Study. *BMJ* 1993;306(6874):361-6.

11. Läubli T, Müller C. Arbeitsbedingungen und Erkrankungen des Bewegungsapparates – geschätzte Fallzahlen und Kosten für die Schweiz. *Die Volkswirtschaft* 2009;82:22-25.

12. Reilly MC, Gooch KL, Wong RL et al. Validity, reliability and responsiveness of the Work Productivity and Activity Impairment Questionnaire in ankylosing spondylitis. *Rheumatology (Oxford)* 2010;49(4):812-9.

13. Tuomi K, Ilmarinen J, Jahkola A et al. *Work ability index*. Helsinki: Finnish Institute of occupational health ICOH, 2003.

14. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin. Why WAI?- Der Work Ability Index im Einsatz für Arbeitsfähigkeit und Prävention. Erfahrungsberichte aus der Praxis. Dortmund, Bundesanstalt für Arbeitsschutz und Arbeitsmedizin 2011:8-13.

15. Tuomi K, Ilmarinen J, Seitsamo J et al. Summary of the Finnish research project (1981-1992) to promote the health and work ability of aging workers. *Scand J Work Environ Health* 1997;23 Suppl 1:66-71.

16. Radkiewicz P, Widerszal-Bazyl M. Psychometric properties of Work Ability Index in the light of comparative survey study. *International Congress Series* 2005;1280:304-09.

17. de Zwart BCH, Frings-Dresen MHW, van Duivenbooden JC. Test-retest reliability of the Work Ability Index questionnaire. *Occup Med (Lond)* 2002;52(4):177-81.

18. Walsh IA, Corral S, Franco RN et al. Work ability of subjects with chronic musculoskeletal disorders. *Rev Saude Publica* 2004;38(2):149-56.

19. Jedryka-Góral A, Bugajska J, Lastowiecka E et al. Work activity and ability in aging patients suffering from chronic cardiovascular diseases. *International Congress Series* 2005;1280:190-95.

20. Knekt P, Lindfors O, Laaksonen MA et al. Effectiveness of short-term and long-term psychotherapy on work ability and functional capacity-a randomized clinical trial on depressive and anxiety disorders. *J Affect Disord* 2008;107(1-3):95-106.

21. Hoving JL, Bartelds GM, Sluiter JK et al. Perceived work ability, quality of life, and fatigue in patients with rheumatoid arthritis after a 6-month course of TNF inhibitors: prospective intervention study and partial economic evaluation. *Scand J Rheumatol* 2009;38(4):246-50.

22. Lastowiecka E, Bugajska J, Najmiec A et al. Occupational work and quality of life in osteoarthritis patients. *Rheumatol Int* 2006;27(2):131-9.

23. Labriola M, Lund T, Burr H. Prospective study of physical and psychosocial risk factors for sickness absence. *Occup Med (Lond)* 2006;56(7):469-74.

24. Garrett S, Jenkinson T, Kennedy LG et al. A new approach to defining disease status in ankylosing spondylitis: the Bath Ankylosing Spondylitis Disease Activity Index. *J Rheumatol* 1994;21(12):2286-91.

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25. Calin A, Garrett S, Whitelock H et al. A new approach to defining functional ability in ankylosing spondylitis: the development of the Bath Ankylosing Spondylitis Functional Index. *J Rheumatol* 1994;21(12):2281-5.

26. Jenkinson TR, Mallorie PA, Whitelock HC et al. Defining spinal mobility in ankylosing spondylitis (AS). The Bath AS Metrology Index. *J Rheumatol* 1994;21(9):1694-8.

27. Lukas C, Landewe R, Sieper J et al. Development of an ASAS-endorsed disease activity score (ASDAS) in patients with ankylosing spondylitis. *Ann Rheum Dis* 2009;68(1):18-24.

28. Schramm AB, Pastusko T, Jaskal AM. Permanent disablement for work in patients with ankylosing spondylitis and rheumatoid arthritis. *Scand J Rheumatol* 1975(Suppl 8):12-20.

29. Wordsworth BP, Mowat AG. A review of 100 patients with ankylosing spondylitis with particular reference to socio-economic effects. *Br J Rheumatol* 1986;25(2):175-80.

30. Guillemin F, Briancon S, Pourel J et al. Long-term disability and prolonged sick leaves as outcome measurements in ankylosing-spondylitis - possible predictive factors. *Arthritis and Rheumatism* 1990;33(7):1001-06.

31. Ward MM, Kuzis S. Risk factors for work disability in patients with ankylosing spondylitis. *The Journal of Rheumatology* 2001;28(2):315-21.

32. Barlow JH, Wright CC, Williams B et al. Work disability among people with ankylosing spondylitis. *Arthritis Rheum* 2001;45(5):424-29.

33. Waddell G. The biopsychosocial model In: Waddell G, editor. *The back pain revolution*. London: Churchill Livingston, 2004:265-82.

Work ability index, ankylosing spondylitis

34. Zhang W, Bansback N, Anis AH. Measuring and valuing productivity loss due to poor health: A critical review. *Soc Sci Med* 2011;72(2):185-92.

35. Severens JL, Mulder J, Laheij RJF et al. Precision and accuracy in measuring absence from work as a basis for calculating productivity costs in The Netherlands. *Social Science & Medicine* 2000;51(2):243-49.

Table 1: Baseline variables (n=92)

	Overall, n=92
Age in years, mean (SD)	46.34 (11.15)
Gender:	
men (%)	58 (63.0)
women (%)	34 (37.0)
Duration in years since AS diagnosis	
mean (SD)	14.55 (12.74)
BASDAI (0-10), mean (SD)	3.45 (2.0)
BASFI (0-10), mean (SD)	2.4 (2.0)
BASMI (0-10), mean (SD)	2.85 (2.0)
ASDAS$_{(CRP)}$, mean (SD)	6.95 (9.25)
Number of current diseases	
AS alone	22
+ 1-2	45
+ > 2	25
Education, n (%)	
<=12 years	60 (65.2)
>12 years	26 (28.3)
Not known	6 (6.5)
Employment status, n (%)	
Paid work	68 (73.9)
Unpaid work	6 (6.5)
Unemployed	4 (4.4)

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Partial disability pension Full disability pension	10 (10.9) 4(4.3)
Job demands (n=78, no disability pension) physical mental both	 11% 41% 48%

BASDAI= Bath AS Disease Activity Index, BASFI=The Bath AS Functioanl Index, BASMI= Bath AS Metrology Index, $ASDAS_{(CRP)}$ = Ankylosing Spondylitis Disease Activity Score (calculated with C-reactive protein values)

Table 2: Absence days (AD) and WAI-scores for the patients in the working age

	People with > 0 absence days, n=58 (63%)	Due to	All patients in the working age (n=92)	Patients without disability pension (n=78)
Absence days during the last year, Median (IQR) [2]	24 (6.5-127.7)	• AS[1] alone	0 (0 - 37.8)	0 (0 - 12.3)
		• Other health problems	0 (0 - 2)	0 (0 - 2)
		• AS[2] and other health problems	4.5 (0 - 61.1)	2.5 (0 - 19)
WAI, Mean (SD)	-	-	34.18 (9.77)	35.93 (9.29)

Absence days measured by the QW

1) Ankylosing spondylitis

2) Interquartile range

Table 3: Two-part model: multiple logistic and multiple linear regression analysis

Model	Independent variables	B coefficients	Standardized regression coefficients (Beta)	Significance p-value	95%-Confidence Interval for B Lower	Upper
Multiple logistic regression Predicted variable: Absence days#	Constant	11.039		0.000	6.14	15.93
	Age	-0.065		0.013	-0.116	-0.014
	WAI	-0.203		0.000	-0.293	-0.113
Multiple linear Regression Predicted variable: number of absence days	Constant	427.2*	-	0.000	317.32	537.08
	Disability pension[1)]	-106.81*	-0.52	0.000	-141.60	-72.02
	WAI	-4.66*	-0.51	0.000	-6.13	-3.18
	Age	-0.498*	-0.07	0.429	-1.75	0.76
	Gender	-10.71*	-0.06	0.414	-36.82	15.40
	N° of diagnoses[2)]	10.24*	0.06	0.461	-17.45	37.93

1) Disability pension (yes/no)

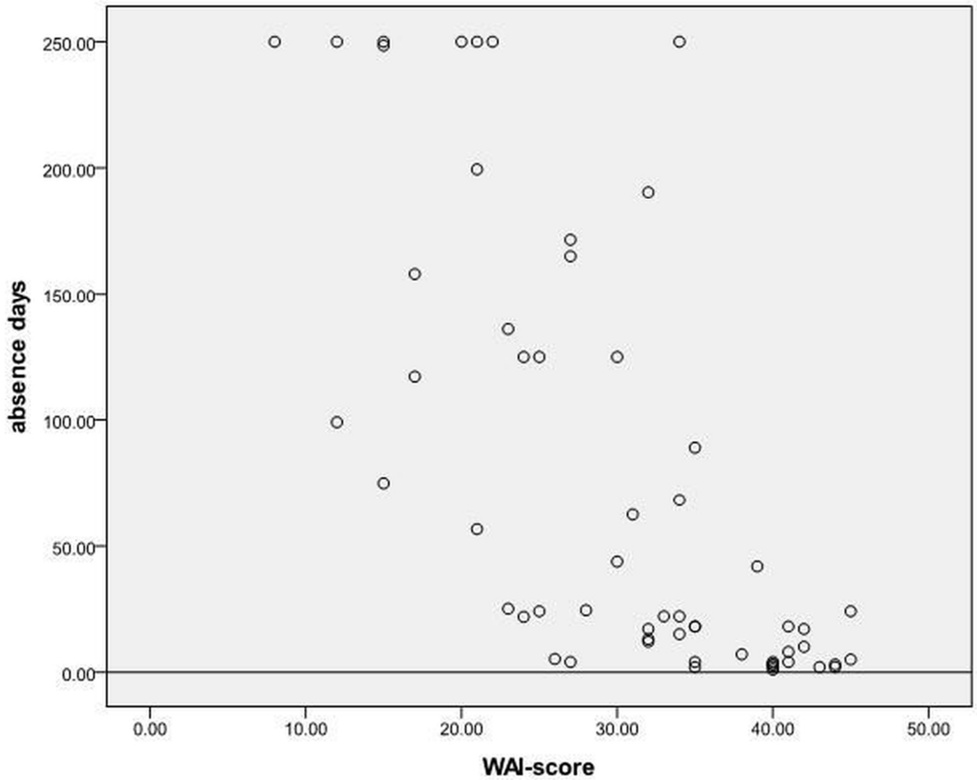
2) Number of diagnoses (up to 2/>2)

* Unstandardized regression coefficients (B)

The logistic regression has a Nagelkerke R=0.458, the Hosmer and Lemeshow test was not significant (p=0.09), the Omnibus test was very small (p= 0.000)

For the multiple regression the R- Squared was 0.724, R-squared adjusted 0.7, the model is significant with p<0.001

1 **Figure 1** Scatterplot of the WAI and absence days for the subgroup with absence days (n=
2 58)



112x90mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Was this done in the manuscript? Yes or no or explanation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	yes
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	yes
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	yes
Objectives	3	State specific objectives	yes
Methods			
Study design	4	Present key elements of study design early in the paper	yes
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Yes. Exposure not applicable
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Yes
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Yes. Confounders and effect modifiers not applicable, because descriptive study.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Yes Only one group
Bias	9	Describe any efforts to address potential sources of bias	Discussed in the limitations
Study size	10	Explain how the study size was arrived at	Yes
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Yes, in the statistic section
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Yes, in the statistic section and in the results section
		(*b*) Describe any methods used to examine subgroups and interactions	Not applicable because of the descriptive nature of the study

		(*c*) Explain how missing data were addressed	There were no missing values of the total WAI-score nor the QW
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	yes
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	yes
		(b) Give reasons for non-participation at each stage	yes
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Yes, table 1
		(b) Indicate number of participants with missing data for each variable of interest	No missing data for the two main questionnaires
Outcome data	15*	Report numbers of outcome events or summary measures	Not applicable
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval).	Yes
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Yes
Discussion			
Key results	18	Summarise key results with reference to study objectives	Yes, in the discussion
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Yes
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Yes

Generalisability	21	Discuss the generalisability (external validity) of the study results	Yes
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	No funding was done

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.