Driving difficulties in patients with axial spondyloarthritis: Results from the Scotland Registry for Ankylosing Spondylitis

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Abstract:

Objectives: To describe the driving difficulties experienced by individuals with axial spondyloarthritis (axSpA), and characterise associated clinical and sociodemographic features, and impact on work.

Method: The Scotland Registry for Ankylosing Spondylitis (SIRAS) is a cohort study of patients with a clinical diagnosis of axSpA. Baseline information was collected on clinical and patient-reported measures, and work participation measures (Work Productivity and Activity Impairment Questionnaire: Specific Health Problem (WPAI: SHP)). Patient-rated difficulties with nine driving tasks were used in a factor analysis, and relationships between driving difficulty and work participation investigated.

Results: 718 patients provided data for analysis, of which 642 (89%) had some difficulty with at least one driving task and 72 (10%) had some difficulty with all nine tasks. Three domains of driving difficulty were identified: dynamic driving scenarios, crossing traffic, and the physical act of driving. Chronic widespread pain, knee and back pain, fatigue, high disease activity and anxiety/depression were significantly associated with reporting driving difficulties across all three domains, particularly the physical act of driving. After adjusting for socio-demographic, disease activity, physical and mental health, driving difficulties in each domain were associated with a 2-3 times increased likelihood of restricted work productivity and with an increased risk of sickness absence in the past seven days.

Conclusion: Driving difficulties are common in individuals with axSpA and impact on work, even after adjusting for clinical status. Improving understanding and awareness of driving disability will help direct advice and resources to enable individuals to remain independent and economically active.

Significance and Innovation:

- Driving difficulties are common in patients with axSpA and are associated with restricted work participation.
- There is a need for a standardised approach to assessing driving difficulties that focuses on the full range of issues
- The characterisation of specific driving difficulties domains forms a useful basis for developing practical solutions to support driving.

Driving is a key functional ability that plays an integral role in daily life, facilitating access to shops and healthcare, social activities and participation in work. Driving is a very common choice compared with other forms of transportation because it offers personal control and autonomy (1). This is particularly the case in sparsely populated areas, where the car provides the only opportunity for travelling long distances because of limited public transport options. Amongst people with reduced mobility, driving is often the only option to retain independent mobility (2). Not surprisingly therefore, having to give up driving has been found associated with social isolation, restricted mobility, and depression(3, 4).

Driving presents a unique set of challenges for those with musculoskeletal disease (5). In a recent cross-sectional survey of older drivers, Kandasamy et al (6) found that musculoskeletal health conditions were the most prevalent self-reported diagnoses and were associated with the greatest reduction in driving over the past year. Yet surprisingly, it has received little attention. The limited number of studies that we found predominantly focused on people with Rheumatoid Arthritis (RA) (7, 8). The most common clinical manifestations of axial spondyloarthritis (axSpA) affect the neck and spine and yet we know very little about how axSpA impacts driving ability (9). Individuals with axSpA are usually of working age when diagnosed and therefore live with functional impairment throughout their working life and into older age. It is only by developing an understanding of which aspects of driving are affected in axSpA, and the relationship between these and the clinical and socio-demographic features of axSpA, that we may be able to develop appropriate solutions.

Furthermore, driving is important for participating in work. In the UK, out of 26.5 million workers in England and Wales aged 16-74 years, 16.7 million either drove themselves or carshared to work (10). In rural areas, almost three quarters of workers travel by car to work (10). In a snapshot of the UK governments Find a Job database, 1 in 5 jobs required the applicant to have a driving license (11). Equivalent data from the US show that an even greater number (115 million US workers (90%)) commute to work in their car, mostly (76%) alone. (12) The ability to work is important to individuals with axSpA and we have recently identified that commuting to/from work can be a particular issue (13). However, to our knowledge, little is currently known about the prevalence of driving difficulties experienced by people with axSpA, the nature of those difficulties, their association with socio-demographic and clinical features of the disease and the impact of driving difficulties in work ability. We investigated these questions in a comprehensive countrywide register.

Materials and Methods

Setting and patients

The Scotland Registry for Ankylosing Spondylitis (SIRAS) is a disease register of patients with a clinical diagnosis of axSpA in Scotland. The study protocol has been published elsewhere (14). In brief, all patients seen in secondary care rheumatology departments in Scotland between October 2010 and October 2013 with a clinical diagnosis of AS were recruited. Clinical data were collated from medical records, and socio-economic/lifestyle characteristics were determined by postal questionnaire. All individuals who had indicated in the baseline questionnaire that they currently drove a motor-vehicle were included in the first part of the current analysis and current drivers who were also in paid employment were included in the second part of the analysis.

Measures

Clinical and sociodemographic factors

Clinical measures collected from medical notes included the Bath Ankylosing Spondylitis Indices for disease activity (BASDAI) (15) and relevant medical history about peripheral joint disease and uveitis. For the purposes of this analysis, BASDAI scores were dichotomised to indicate either low (<4) or high (≥4) disease activity. This cut-off is consistent with guidelines from the UK National Institute for Health and Clinical Excellence for the use of tumour necrosis factor-α (TNF-α) inhibition therapy. The baseline questionnaire collected information on pain experienced "for at least a day" during the past month and invited participants to indicate the site(s) on a 35-segment body manikin. From this, participants were classified as having: chronic widespread pain (CWP) (coded according to the "Manchester definition") (16); widespread pain (not chronic); or regional pain. Regional pain sites of particular interest included the knee, lower back, and mid-upper spine (cervical and thoracic). Information on fatigue was collected using the Chalder Fatigue Scale (a score ≥4/11 indicating moderate-severe fatigue) (17). Individuals' current experience of any anxiety or depression was assessed using a dichotomised score from the anxiety/depression domain (one item) within the EuroQol 5D-3L questionnaire (18).

Sociodemographic information collected in the baseline questionnaire included the participant's age, gender, level of education, current employment status, and whether their paid employment involved mainly sedentary or physical work. The Scottish Index of Multiple Deprivation (SIMD) is a postcode-derived index comprised of indicators of deprivation across the domains of employment, income, health, education, skills and training, crime, housing and geographic access to services (19). SIMD score was ranked by quintiles, where 1

= resident in most deprived area and 5 = resident in most affluent area; these five values were reduced to two levels for subsequent analysis due to the distribution of participants, with scores of 1 and 2 representing those in the most deprived areas. Individuals were also classified according to their access to an urban area: living in an urban area (settlement ≥10,000 people); living within an average drive time of ≤30 minutes to an urban area (accessible); or living in a setting with an average drive time of >30 minutes to an urban area (rural).

Driving difficulties

Assessment of driving difficulty was informed by a list of specific driving tasks that are assessed by the Scottish Driving Assessment Service (Table 3). For each of the list of nine tasks, participants were asked to rate their ability to perform that task on a Likert scale from 0 (no difficulty) to 3 (severe difficulty). For descriptive purposes we tabulated the proportion of current drivers who had any difficulty with each task (i.e. a score >0 on each task).

Work absenteeism and presenteeism

The Work Productivity and Activity Impairment Questionnaire: Specific Health Problem (WPAI:SHP) was used to assess whether individuals had missed any work due to their axSpA in the past seven days, as well as their percent impairment while working (0-100%, where 0% reflects no effect of axSpA on work and 100% reflects being completely prevented from working) due to their axSpA (20).

Analysis

Exploratory factor analysis

An exploratory factor analysis was conducted using a polychoric correlation matrix of the ordinal driving difficulty scores for the nine tasks. A principal axis factor extraction method was used as this method does not require a normal distribution of item scores (21). As it was expected that identified factors may be correlated to some degree, identified factors were rotated using the oblique oblimin method and factor loadings of >0.3 were considered meaningful (22, 23). The number of extracted factors to retain was determined by inspecting eigenvalues of the factors on a scree plot in relation to those obtained by parallel analysis. Parallel analysis is a simulation method which compares the eigenvalues from the factor analysis to those generated by a simulated dataset (21). This comparison gives an indication of the point at which extracted factors are potentially meaningful and at what point they become no more informative than random noise.

Using a regression-based method, factor scores were then generated for each individual for each identified factor. This method generates a factor score for each participant using the coefficients of each item on the factor, adjusted for correlations between items. This method is considered superior to generating a score based on simply multiplying item scores by their factor loadings, as it takes correlations between items into account (22, 24).

Regression analyses

Due to the distribution of factor scores, scores were dichotomised based on an upper-quartile cut-off to identify individuals with a high level of difficulty in each driving domain. The upper quartile cut-off was chosen in order to identify individuals who struggled the most with each driving domain. Associations between clinical and sociodemographic factors and the identified driving difficulty domains were investigated within all current drivers using univariate logistic regression.

Amongst current drivers who were in paid employment, we subsequently focused on relationships between domains of driving difficulty and work-related outcomes. We investigated two models for the relationships between each identified driving difficulty domain and presenteeism and absenteeism (any in past 7 days) using logistic regression. Due to the distribution of presenteeism scores, a dichotomised variable was generated in order to investigate relationships between each driving difficulty domain and the upper quartile of presenteeism scores (which, in our sample, was represented by scores ≥40% impairment). In the first model we adjusted for all sociodemographic and clinical variables, with the exception of self-reported anxiety/depression (anxiety/depression item within EQ-5D-3L), and in the second we included the self-reported anxiety/depression score. We chose to show both models as it is not clear if anxiety and depression lies on the path between driving difficulties and work factors, or is a confounding factor.

Ethical approval

The SIRAS received ethical approval from the North of Scotland Research Ethics Service (reference: 09/S0802/7).

Results

Participant characteristics

Figure 1 illustrates the flow of SIRAS participants who were included in the current analyses. The mean age of current drivers who had complete data on the driving difficulty items and could therefore be included in the factor analysis was 52 years (SD=12), 23% were female, and 66% were either employed, a student or worked full-time (unpaid) in the home.

Insert Figure 1.

Full clinical and sociodemographic characteristics of the study sample of current drivers who had complete data on the driving difficulty items are presented in Table 1 and Table 2. 718 out of 729 current drivers had complete data on the driving difficulty items.

Insert Table 1 and Table 2.

Of the 718 current drivers who had complete data on driving difficulty items, 642 (89%) had some difficulty with at least one driving task and 72 (10%) had some difficulty with all nine tasks. The median number of difficulties (i.e. having any difficulty with each task) was two (IQR: 1-4). Getting in/out of a car and sitting for long periods were the most frequently reported difficulties. The proportion of drivers with any difficulty in each of the driving tasks is presented in Table 3.

Insert Table 3.

Factor analysis

The results from the parallel analysis indicated that three domains, which accounted for 84% of the variance in the factor model, should be retained (see Supplementary Figure 1). Loadings between each driving item and the three domains are shown in Supplementary Table 1.

These three domains appear to reflect the following driving domains:

- Dynamic driving scenarios (Domain 1)
- Crossing traffic (Domain 2)
- Physical act (and comfort) of driving (Domain 3)

Correlations between the generated factor scores are provided in Supplementary Table 2, and as expected, indicated that difficulties across the three domains were associated with one another.

Characteristics associated with driving difficulty domains

Next, the univariate relationships between the three identified domains of driving difficulty and clinical and sociodemographic characteristics was explored (see Table 4). Some variations were shown. For example, patients with a history of peripheral joint disease were more likely to report difficulties crossing traffic and with the physical act of driving. In contrast, individuals with higher disease activity; regional, widespread, or chronic widespread pain; knee pain; lower back pain; mid-upper spinal pain; and moderate-severe fatigue were more likely to have difficulties with all three driving difficult domains.

Insert Table 4.

Driving difficulties and work

Participants who had retired early or who were unemployed due to their health were more likely to have difficulties with all three driving difficulty domains when compared with employed individuals (dynamic driving scenarios OR: 1.97, 95% CI 1.30, 3.00; crossing traffic OR: 2.65, 95% CI 1.75, 4.01; physical act of driving OR: 3.81, 95% CI 2.54, 5.71). Individuals in paid employment who had predominantly physical/labour intensive jobs were more likely than those who had sedentary jobs to have driving difficulties, in particular, with the physical act of driving (OR: 1.76, 95% CI 1.11, 2.79). Individuals who had only completed secondary school or further college education were also more likely to have difficulty with the physical act of driving relative to those who had completed a university degree (OR: 1.95, 95% CI 1.23, 3.11; OR: 1.64 95% CI 1.04, 2.61, respectively).

64% of individuals in paid employment reported that work productivity was affected to some degree by their axSpA and 8% had missed some work in the past seven days. Relationships between each driving difficulty domain and the upper quartile of presenteeism scores (>40% presenteeism) and any absenteeism are presented in Table 5. Individuals who had complete data (and who were therefore included in these models) did not consistently differ from those with missing data on most sociodemographic and clinical variables when we checked this using chi-squared tests. However those with missing data were more likely to report any anxiety/depression (39%) than those without (28%) and a higher percentage of those without missing data in the presenteeism model had a history of peripheral joint involvement (57% vs 47%). These differences are unlikely to affect interpretation of models, in particular as models were adjusted for these factors. After adjustment for sociodemographic and clinical characteristics, each of the identified driving difficulty domains were associated with work-related presenteeism and absenteeism due to axSpA.

Insert Table 5.

Discussion

Driving difficulties are common in patients with axSpA and are associated with restricted work participation. Almost 90% of individuals reported difficulty with at least one driving task and 10% reported some difficulty with all nine tasks. We identified three specific domains of driving difficulty in axSpA: dynamic driving scenarios, crossing traffic, and the physical act of driving. Chronic widespread pain, knee and back pain, fatigue, high disease activity and anxiety/depression were associated with driving difficulties across all three domains, in particular the physical act of driving. After adjusting for a range of clinical and sociodemographic factors including disease activity, each driving difficulty domain was associated with a greater likelihood of work presenteeism and absenteeism. Those with a physically demanding job were more likely to report difficulties with the physical act of driving.

There are some limitations to consider when interpreting these findings. Within SIRAS, patients were identified based on clinical diagnosis. No formal criteria were applied e.g. ASAS because these criteria are not routinely collected in clinic. Therefore, the proportion of SIRAS participants fulfilling them is not clear. However, these are classification criteria and are not intended to be used as diagnostic criteria. Thus, we argue that participants identified because of a clinical diagnosis are more closely representative of a real-world clinical population. We have identified factors associated with driving difficulties, however we are unable to account for the full range of factors associated with impaired driving, for example, range of joint movement, strength, reaction time and other co-morbidities e.g. neurological conditions that may impair driving. The data collected for this research were cross-sectional so that causation cannot be inferred. Whilst we demonstrated that individuals with driving difficulties were more likely to report sickness absence in the past seven days, the numbers reporting absenteeism were small and therefore we cannot determine the magnitude of effect with any certainty.

Most studies to date exploring driving difficulties in rheumatic disease have either tended to use very broad questions (e.g. do you have difficulties with driving) or focus only on physical aspects of driving (7). This study enables us to further define the concept of driving disability and determine which aspects of driving cause difficulties. The factors identified have content validity and match those identified in other studies regarding difficulties with the physical act of driving, dynamic driving scenarios, and crossing traffic (5, 9, 25). They also reflect the types of adaptations individuals with musculoskeletal conditions report making in order to keep driving (such as making detours to avoid certain routes that involve crossing traffic or dynamic driving situations, and choosing a car to improve the physical act and comfort of driving) (5, 13, 26). The study also suggests the importance of disease-associated factors such as pain, fatigue, disease activity and anxiety/depression in specific driving difficulties. Our findings suggest that driving difficulties are complex so that tailored solutions might be needed for people with axSpA to enable them to keep their mobility. This also offers opportunities for targeting patient-focussed treatment.

The characterisation of specific driving difficulties domains forms a useful basis for developing practical solutions to support driving. A recent review, Cammarata et al (8) identified a series of environmental factors that influenced driving in those with arthritis (including RA, ankylosing spondylitis, systemic lupus erythematosus, osteoarthritis and gout). The driving domains identified in this study map onto a number of these environmental factors which reflect opportunities for targeting patient-focussed treatment. For example, difficulties getting in/out of a car maps to products and technology (car features and modifications) and features of the natural environment (accessible car parking). Difficulties with dynamic driving situation relate to support and relationships (driving with a passenger), and attitudes (route avoidance, and use (or not) of driving aids).

In keeping with studies in other musculoskeletal conditions, we have shown that disease activity, widespread pain, back pain and fatigue are associated with driving difficulties (7, 9). However, we have additionally demonstrated that these features were associated with driving difficulties across all three domains, especially the physical act and comfort of driving. Holden et al, 2005 reported that neck pain had a significant impact on driving in individuals with axSpA (9) particularly in driving scenarios which involved merging with traffic and crossing junctions, and some participants indicated that they were completely dependent on a passenger in order to safely undertake these manoeuvres. Similarly, in a study of driving difficulties in patients referred to a Chronic Pain Rehabilitation Service (not specifically with arthritis), Fan et al, 2012, found that the main factors limiting driving were pain, fatigue and limited joint mobility/stiffness. Patients with pain (predominantly neck and back pain) reported difficulties with the physical act and comfort of driving (sitting/getting in and out of a car) and dynamic driving scenarios e.g. shoulder checks and merging with traffic.

Several medications commonly prescribed for pain, including opioids and anticonvulsants have been associated with various measures of impaired driving performance (27). We recently found that side effects of opiates were a problem for those operating machinery and driving as part of their job (13). Whilst clinical guidelines aim to reduce the use of opioids for chronic pain (28, 29) they are commonly prescribed to people with musculoskeletal conditions (30, 31). It is therefore important for clinicians to acknowledge the importance of driving and work participation and consider the risks and benefits of strategies to manage pain.

However, our findings also support the observation that patterns of driving difficulties appear to differ across different rheumatic diseases. In studies of driving difficulties in RA, where peripheral disease involvement predominates, particularly hand/wrist, individuals have tended to report more problems with starting the car, turning keys etc. (7, 25). It should be acknowledged that only a small number of individuals had peripheral joint involvement in this study, but similar problems were not reported. However, knee pain was associated with difficulties in the physical act of driving e.g. getting in and out of the car and sitting for long periods.

Our findings highlight the importance of driving for work participation amongst people with axSpA. Work participation is an outcome of prime importance to individuals with axSpA; specifically in terms of self-identity, providing social interactions as well as enabling financial security (13). It is not perhaps surprising that if someone is struggling to get to and from work, or carry out their job which involves driving, then this will adversely affect their ability to attend work and productivity whist at work. We have recently reported that individuals with axSpA find commuting to work challenging, and have problems with accessing workplaces e.g. suitable car parking spaces (13). The few studies exploring the relationship between work participation and rheumatic disease have not specifically explored driving, rather overall transport mobility (combining driving difficulties with use of other forms of transport) (32, 33) or assessing overall difficulties commuting to work (34, 35). Albers et al (32) found that: increasing age, impaired function and work disability in patients with a recent diagnosis of RA was associated with reduced 'transport mobility' (defined as being transported either by others, driving, or use of public transport). Allaire et al (34) and Lacaille et al (35) found commuting difficulty was an independent predictor of work disability in RA, however, in these studies, driving difficulty was not specifically explored and "commuting difficulty" was dependent upon whether or not participants reported physical difficulty getting to and from work.

We found no differences in reported driving difficulties between rural and urban dwellers. Given the car-dependent nature of rural living, this is perhaps surprising. However, the number of study participants in this study living in remote small town or rural areas who currently drove was small (n=124) which may have limited our statistical power to find an association. Most current drivers were urban dwellers. Furthermore, the driving questions were weighted towards urban driving scenarios, which were not necessarily as relevant to rural driving. It is also possible that individuals who had experienced significant driving difficulties in the past had made an active decision to stop working or to live in more accessible urban areas before this study.

Driving is a challenging topic to study amongst patients. We, like others researching driving difficulty, previously encountered concerns that participants felt vulnerable about reporting problems driving proactively to their clinicians for fear of being "reported" or losing their driving licence (5). Researchers need to approach this topic sensitively with people with rheumatic and musculoskeletal conditions and encourage them to be open and honest if we are to better understand the extent of the problem and develop appropriate interventions.

In summary, driving difficulties are common in patients with axSpA and, after adjusting for a range of clinical and sociodemographic factors, are adversely associated with work participation. Improving understanding and awareness of driving disability in axSpA will help direct advice and resources to enable patients to remain independent and economically active. Clinicians need to be enablers rather than arbiters of driving so that patients feel able to seek help. We suggest that future studies adopt a standardised approach to assessing driving difficulties that focus on the full range of issues and outcomes, including work, to enable comparison across studies. It is also important to examine driving difficulties amongst people with different musculoskeletal conditions separately as they may differ by condition.

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Contributors

RJH and GJM conceived the idea for the study and in conjunction with GTJ and LM designed the study and wrote the analysis plan. LM undertook data analysis and interpretation, supported by RJH, GJM, GTJ and K-WB. The manuscript was written by LM and RJH, with contribution from GJM, GJT and KW-B. All authors reviewed the data and critically reviewed the manuscript for important intellectual content, and approved the version of the article to be published.

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Tables

Table 1. Sociodemographic characteristics of current drivers with axSpA

	n = 718 *n* (%)
Age, *mean (SD)*	52 (12)
Gender	
Male	519 (72.3)
Female	168 (23.4)
Missing	31 (4.3)
Employment status	
Full-/part-time/student/full-time unpaid work at home	470 (65.5)
Retired	108 (15.0)
Retired early or unemployed due to health/seeking work	134 (18.7)
Missing	6 (0.8)
Job type	
Mainly desk/sedentary	277 (38.6)
Mainly physical/labour intensive	174 (24.2)
Not in paid employment	256 (35.7)
Missing	11 (1.5)
Education	
University/further degree	184 (25.6)
Secondary school	208 (29.0)
Apprenticeship	88 (12.3)
Further education, college	231 (32.2)
Missing	7 (1.0)
Deprivation status	
1 – most deprived	65 (9.1)
2	100 (13.9)
3	168 (23.4)
4	188 (26.2)
5 – most affluent	156 (21.7)
Missing	41 (5.7)
Rural - urban status	
Large/other urban area	341 (47.5)
Accessible small town or rural	212 (29.5)
Remote small town or rural	124 (17.3)
Missing	41 (5.7)

Table 2. Clinical characteristics of current drivers with axSpA

	n = 718 *n* (%)
Disease activity	
BASDAI <4	338 (47.1)
BASDAI ≥4	234 (32.6)
Missing	146 (20.3)
Pain status	
No pain	129 (18.0)
Regional or non-chronic widespread pain	241 (33.6)
Chronic widespread pain	343 (47.8)
Missing	5 (0.7)
Fatigue	
CFS <4	411 (57.2)
CFS ≥4	290 (40.4)
Missing	17 (2.4)
Knee pain	220 (30.6)
Lower back pain	415 (57.8)
Mid-upper spinal pain	368 (51.3)
Peripheral joint disease	
No history of PJD	304 (42.3)
History of PJD	413 (57.5)
Missing	1 (0.1)
Uveitis	
No history of uveitis	396 (55.2)
History of uveitis	239 (33.3)
Missing	83 (11.6)
Anxiety/Depression	
EQ-5D-3L Level 1 (no anxiety/depression)	451 (62.8)
EQ-5D-3L Level 2-3 (any anxiety/depression)	266 (37.1)
Missing	1 (0.1)

CFS – Chalder Fatigue Scale
BASDAI – Bath Ankylosing Spondylitis Disease Activity Index

Table 3. Frequency of having any difficulty with each driving task

	n = 718 *n* (%)
Getting in or out of the motor-vehicle	515 (71.7)
Manoeuvring the motor-vehicle	254 (35.4)
Sitting in the motor-vehicle for long periods	561 (78.1)
Turning right at traffic lights or across traffic	205 (28.6)
Crossing major road or T-junctions	213 (29.7)
Merging with fast moving traffic	184 (25.6)
Going through roundabouts	138 (19.2)
Making lane changes	147 (20.5)
Driving through a congested high street	130 (18.1)

Table 4. Univariate associations between clinical and sociodemographic characteristics and different driving difficulty domains

	Dynamic driving scenarios – Domain 1 (worst quartile)		**Crossing traffic– Domain 2 (worst quartile)**		**Physical act of driving – Domain 3 (worst quartile)**	
	OR*	95%CI	OR*	95%CI	OR*	95%CI
Age (per year), *n = 678*	1.01	0.99, 1.02	1.02	1.00, 1.03	1.00	0.99, 1.01
Gender, *n = 687*						
Male	1.00	*ref*	1.00	*ref*	1.00	*ref*
Female	1.40	0.95, 2.07	0.89	0.59, 1.34	1.94	1.34, 2.87
Deprivation, *n = 677*						
Category 3-5, least deprived	1.00	*ref*	1.00	*ref*	1.00	*ref*
Category 1-2, most deprived	1.35	0.91, 2.01	1.63	1.11, 2.40	1.91	1.32, 2.78
Rural – urban status, *n = 677*						
Large/other urban area	1.00	*ref*	1.00	*ref*	1.00	*ref*
Accessible small town or rural	1.21	0.82, 1.79	0.89	0.59, 1.32	0.75	0.51, 1.12
Remote small town or rural	0.94	0.57, 1.53	0.92	0.57, 1.48	1.12	0.72, 1.75
Disease activity, *n = 572*						
BASDAI <4	1.00	*ref*	1.00	*ref*	1.00	*ref*
BASDAI ≥4	1.48	1.01, 2.18	1.87	1.27, 2.75	4.67	3.15, 6.96
Widespread body pain, *n = 713*						
No pain	1.00	*ref*	1.00	*ref*	1.00	*ref*
Regional or widespread pain	2.26	1.20, 4.26	1.99	1.07, 3.71	4.71	1.95, 11.36
Chronic widespread pain	4.04	2.22, 7.34	3.78	2.11, 6.78	14.48	6.21, 33.78
Fatigue, *n = 701*						
CFS <4	1.00	*ref*	1.00	*ref*	1.00	*ref*
CFS ≥4	2.76	1.95, 3.93	1.95	1.39, 2.76	5.26	3.66, 7.56
Knee pain, *n = 713*						
No knee pain	1.00	*ref*	1.00	*ref*	1.00	*ref*
Knee pain	1.87	1.32, 2.67	1.75	1.23, 2.50	3.70	2.61, 5.24
Lower back pain, *n = 713*						
No lower back pain	1.00	*ref*	1.00	*ref*	1.00	*ref*
Lower back pain	1.95	1.36, 2.80	1.70	1.19, 2.43	3.92	2.65, 5.79
Mid-upper spinal pain, *n = 713*						
No mid-upper spinal pain	1.00	*ref*	1.00	*ref*	1.00	*ref*
Mid-upper spinal pain	2.20	1.54, 3.13	2.20	1.54, 3.13	2.96	2.08, 4.22
Peripheral joint disease, *n = 717*						
No history of PJD	1.00	*ref*	1.00	*ref*	1.00	*ref*
History of PJD	1.24	0.87, 1.74	1.65	1.16, 2.34	1.54	1.09, 2.16
Uveitis, *n = 635*						
No history of uveitis	1.00	*ref*	1.00	*ref*	1.00	*ref*
History of uveitis	1.46	1.01, 2.10	1.38	0.96, 1.99	1.09	0.76, 1.56
EQ-5D-3L anxiety/depression, *n = 717*						
Level 1 (none)	1.00	*ref*	1.00	*ref*	1.00	*ref*
Level 2-3 (some)	2.28	1.62, 3.22	2.31	1.64, 3.27	4.83	3.40, 6.87

OR – odds ratio
CI – confidence interval

Table 5. Relationships between each driving difficulty domain and work participation (presenteeism and absenteeism) due to axSpA, adjusted for clinical and sociodemographic factors

	Presenteeism (worst quartile of presenteeism scores)		**Absenteeism (any in past 7 days due to AS)**	
Driving difficulty domains	**Model 1^** OR; 95% CI *n = 273*	**Model 2~** OR, 95% CI *n = 272*	**Model 1^** OR, 95% CI *n = 220*	**Model 2~** OR, 95% CI *n = 220*
Dynamic driving situations (worst quartile)	2.81; 1.28, 6.17	2.80; 1.26, 6.25	4.03; 1.20, 13.51	4.13; 1.14, 15.04
Crossing traffic (worst quartile)	2.54; 1.18, 5.50	2.48; 1.12, 5.54	3.76; 1.20, 11.79	3.83; 1.10, 13.32
Physical act of driving (worst quartile)	2.31; 1.02, 5.19	2.46; 1.06, 5.72	2.89; 0.79, 10.53	4.87; 1.19, 19.95

^ Model 1 for each driving difficulty factor adjusted for: gender, age, education, level of deprivation, access to urban area, job type, BASDAI, chronic widespread pain status, knee pain, lower back pain, mid-upper spinal pain, Chalder fatigue scale, peripheral joint disease, uveitis
~ Model 2 for each driving difficulty factor adjusted for Model 1 factors and EQ-5D-3L anxiety/depression score
OR – odds ratio
CI – confidence interval

Figure Legends

Figure 1. Flowchart of SIRAS participants included in the current analyses.