

1 **Arthritis-related work outcomes experienced by younger to middle-aged adults: a**
2 **systematic review** *4,500 words*

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26 **Contributors:** DB, AMB and INA contributed to the development of the search strategy. DB and CP
27 conducted screening and data extraction. DB prepared the methods, results, and discussion. AMB, DA
28 and INA contributed substantially to the results and discussion. All authors read and approved the
29 final manuscript.

30 **Funding:** DB received a scholarship from Musculoskeletal Australia (PURE ID #230581862).

31 **Competing Interests:** DB, AMB, DA, CP and INA declare no competing interests.

32 **Data Sharing:** All data included in this review is available in-text or as supplementary material.

33 **Patient Consent for Publication:** Not required.

34 **ABSTRACT** (247 words)

35 **Objective:** The aim of this review was to systematically identify, appraise and synthesise evidence
36 on work-related outcomes experienced by younger to middle-aged adults (aged 16-50 years) with
37 arthritis.

38 **Methods:** Eligible studies were identified in Medline, PsycINFO, Embase, and CINAHL in
39 January 2020. Quantitative and qualitative studies containing self-reported data on work-related
40 outcomes on younger/middle-aged adults with arthritis were included. Quality assessment was
41 undertaken using validated quality appraisal tools from the Joanna Briggs Institute.

42 **Results:** Thirty-four studies were identified for inclusion. Work outcomes were organised around
43 five themes: (1) arthritis-related work productivity outcomes; (2) arthritis-related work
44 participation outcomes; (3) other arthritis-related workplace outcomes; (4) barriers to work
45 participation associated with arthritis, and (5) enablers to work participation associated with
46 arthritis. Arthritis was associated with work limitations on the Workplace Activity Limitations Scale
47 (average scores ranging from 5.9 (indicating moderate workplace difficulty) to 9.8 (considerable
48 workplace difficulty)); and higher work disability prevalence rates (range: 6% - 80%) relative to
49 healthy populations. Arthritis was not associated with decreased absenteeism on the Work
50 Productivity and Activity Impairment Questionnaire (mean (SD) 7.9% (14.0%)), indicating low
51 levels of absenteeism, similar to healthy populations. As work outcomes were commonly binary,
52 person-centred (qualitative) perspectives on barriers and enablers augmented the quantitative
53 findings.

54 **Conclusion:** Arthritis is commonly associated with poorer work outcomes for younger/middle-
55 aged adults relative to healthy populations. Additional research focusing solely on the workplace
56 needs of younger/middle-aged population groups is required to inform tailored interventions and
57 workplace support initiatives to maximise productive working years.

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63 **KEY MESSAGES**

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65 What is already known about this subject?

- 66 • Research suggests that younger adults with arthritis are less likely to be employed, more
67 likely to face productivity challenges at work, and are at increased risk of early retirement
68 compared with healthy peers. The work-related impacts of arthritis on adults in their peak
69 income-earning years remain largely unexplored in a systematic manner and rarely
70 considered within routine arthritis care.

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72 What are the new findings?

- 73 • Moderate to high quality evidence indicates that arthritis in younger and middle-aged
74 people is associated with work limitations and a higher work disability prevalence rates to
75 healthy populations. The magnitude of impact may increase with age. There are a number
76 of barriers to work participation among people with arthritis, including lack of workplace
77 support and discord with colleagues; identified enablers include motivation to work, and
78 managerial and collegiate support.

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80 How might this impact on policy or clinical practice in the foreseeable future?

- 81 • Increased attention to work-related impacts of arthritis on young and middle-aged people
82 may facilitate work participation and inform tailored interventions and workplace support
83 programs to maximise productive working years.

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92 **INTRODUCTION**

93 Arthritis is typically characterised by joint pain, swelling and stiffness that limits normal function
94 and reduces participation in productive work (1). Globally, it is estimated that adults in their peak
95 income-earning years (18-64 years) are disproportionately impacted by arthritis (2). Younger adults
96 with arthritis experience unique school-to-work transitions associated with lower levels of
97 employment (3) and increased productivity challenges at work, compared to healthy peers (4-6).
98 Evidence suggests that many middle-aged adults living with inflammatory arthritis (IA) or
99 osteoarthritis (OA) are forced into early retirement (7).

100 The work-related impacts of arthritis on younger to middle-aged adults remain largely unexplored
101 in a systematic manner and are rarely considered within routine arthritis care (8). In current arthritis
102 literature, work outcomes are generally measured through presenteeism and absenteeism measures,
103 for example, via validated tools, economic costs, or employment rates (9). These measures provide
104 objective data on work-related outcomes, but do not provide a broader perspective on work
105 experiences.

106 To date, only one (non-systematic) literature review has focused on arthritis-related work
107 experiences among younger adults. However, the included studies were homogenous and
108 comprised small samples of participants with juvenile idiopathic arthritis (JIA) (3). Another
109 systematic review assessed workplace disclosure and accommodations for adults with disabilities.
110 Four studies within this review focused on arthritis populations (ages 8-71 years); yet the studies
111 only included participants with JIA, systemic lupus erythematosus (SLE), or 'general disability' (10).
112 The extant literature therefore provides limited insights into the work-related impacts of arthritis,
113 as more common arthritis conditions (for example, rheumatoid arthritis (RA)) disproportionately
114 affect people of working age; that is, younger to middle-aged adults (11, 12).

115 This systematic review aimed to identify, appraise and synthesis the work-related outcomes
116 associated with arthritis experienced by younger to middle-aged adults (defined for this review as
117 those aged 16-50 years).

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123 **METHODS**

124 **Design**

125 A systematic literature review was undertaken. The systematic review protocol was registered on
126 the PROSPERO International Prospective Register of Systematic Reviews (registration number
127 106919). The review is reported according to the Preferred Reporting Items for Systematic
128 Reviews and Meta-Analysis (PRISMA) statement (Figure 1) (13).

129 **Search Strategy**

130 An electronic literature search was undertaken in Medline, PsycINFO, CINAHL, and Embase
131 databases. With specialist research librarian assistance, a comprehensive search strategy was
132 designed using customised search terms. Supplementary File 1 contains the Medline search strategy
133 as an example, which was adapted accordingly for the other databases (available from the authors
134 on request). The reference lists of previously identified key literature and systematic reviews
135 identified in the initial search yield were hand searched to identify any additional primary studies.
136 The search strategy was limited to English language and to papers published January 2000-January
137 2020, to focus on data relating to contemporary work contexts. The search strategy did not include
138 grey literature, intervention studies, or systematic reviews.

139 **Study Selection**

140 Eligible studies were primary qualitative, quantitative or mixed-methods design studies that
141 reported on participants aged 16-50 years with IA and/or OA. The lower age limit of 16 reflects a
142 common entry point to the part-time workforce. The upper age limit of 50 years is consistent with
143 existing arthritis-related literature (11, 14). Where studies involved a broader range of age groups,
144 these were included if data within the 16-50 year age band were reported separately. Studies where
145 the outcomes were not directly reported by people who lived with IA or OA (for example, where
146 outcomes were only reported by employers or spouses); studies focusing on non-arthritis
147 musculoskeletal conditions; and studies where the full-text was not available in English or
148 unavailable in its entirety were excluded.

149 Two reviewers (DB, CP) independently screened the titles and abstracts of all retrieved studies
150 using Covidence software (Veritas Health Innovation Ltd, Melbourne, Australia) to determine
151 eligibility. All potentially eligible studies were reviewed independently at the full text stage and their
152 reference lists were checked for potentially relevant studies (DB, CP). At each review stage,
153 discordance regarding eligibility was discussed and resolved through consensus.

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155 **Data Extraction**

156 Two reviewers (DB, CP) independently extracted data using a custom template. Variables included
157 the study design, country, proportion of participants aged 16-50 years, gender, arthritis type, years
158 since diagnosis, and relevant outcomes (qualitative and quantitative) concerning work outcomes.

159 **Outcome Measures**

160 As there is no accepted gold standard outcome for work (15), all work-related definitions and
161 instruments reported in primary studies were included. Qualitative outcomes emerged through
162 second order author-derived themes; categorised through first order examination of direct quotes.

163 **Quality and Risk of Bias Assessment**

164 The methodologic quality of all included studies was assessed independently by two reviewers (DB,
165 CP) using validated critical appraisal tools from the Joanna Briggs Institute (JBI) (16). The JBI is
166 an international research organisation based at the University of Adelaide in South Australia. Its
167 aim is to improve health outcomes across the globe by working with universities and hospitals to
168 synthesise and implement the best available evidence to inform healthcare decisions (17).

169 The critical appraisal tools included 8 (for cross-sectional studies) – 11 (for cohort studies) items
170 depending on the study design. Scores were converted to percentages to allow for comparison of
171 evidence quality scores across different study types (Supplementary File 2). The JBI Reviewer's
172 manual states that the higher the score of the study, the less bias present (18). This manual also
173 advises that studies should not be included in the analysis if they are of low quality (score $\leq 50\%$);
174 as such, we excluded these studies. We included all moderate quality studies (51-70%) and good
175 quality studies (80-100%) (18). Two reviewers (DB, CP) independently conducted the quality
176 assessment; where there was disagreement, the study was assessed in tandem and a consensus
177 score derived (16).

178 **Data Synthesis**

179 For the quantitative studies, study characteristics and participant demographics were reported
180 descriptively and by age bracket where possible. Given the considerable heterogeneity in
181 participant samples and outcome measures, data were unable to be pooled for meta-analysis. Given
182 heterogeneity across qualitative studies, a narrative meta-synthesis approach was undertaken to
183 categorise verbatim participant quotes into representative themes (19). This was deemed more
184 suitable than thematic analysis of second order data, as themes within the qualitative studies varied

185 by participant samples, arthritis diagnoses, and work-related results. Narrative meta-synthesis of
186 participant quotes facilitated an examination of work outcomes based on primary data.

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188 **RESULTS**

189 **Study Selection and Inclusion**

190 The study selection and inclusion process is shown in Figure 1 (13). The screening process yielded
191 36 articles for quality and risk of bias assessment. Seven articles were deemed to be of low
192 methodological quality and were excluded from the review (Supplementary file 3) (20-26).

193 **Study Characteristics**

194 Twenty-nine studies from 13 countries (Australia (6, 14), Canada (27-33), Denmark (34-36), Italy
195 (37), India (38), Japan (39), Lithuania (40), Netherlands (41-44), Norway (45, 46), Sweden (47),
196 Turkey (48), United Kingdom (UK) (49-52), US (53) with a wide range of work-related outcomes
197 were included in this systematic review. The included studies were published from 2000-2019. Of
198 the 29 studies, 17 adopted a cross-sectional design with quantitative outcomes (Table 1) (14, 27,
199 29-33, 37, 39-46, 53) and 12 adopted a qualitative design (Table 2) (6, 28, 34-36, 38, 47-52). Ten
200 of the qualitative studies collected data through interviews, (6, 28, 34, 36, 38, 47, 48, 50-52), one
201 used focus groups (35), and one used both techniques (49).

202 While all studies reported an overall sample size, 19 of the 29 included studies (65%) specifically
203 reported the number of participants aged 16-50 years (6, 14, 28-31, 34-38, 45-50, 52, 53). This
204 number ranged from one (in a qualitative study where most participants were >50 years) to a
205 sample size of 2,120 participants (34, 53). Where the mean age of participants was reported, the
206 range spanned 21.1-52.1 years (39, 49). Three studies did not report the number or mean age of
207 participants but still reported stratified results (33, 44, 51). Both male and female participants were
208 included in 25 studies; three studies included males only (36, 47, 52), and one study only included
209 one female participant between 16-50 years (34).

210 A range of arthritis conditions were included: 11 (38%) studies included participants with RA (28,
211 35, 38-40, 43-45, 47, 50, 51); five (17%) included participants with SLE (27-30, 52); four (14%)
212 included participants with OA (14, 28, 34, 41); four (14%) included participants with ankylosing
213 spondylitis (AS) (36, 42, 47, 48); three (10%) included participants with JIA (29, 30, 49); two (7%)
214 included participants with psoriatic arthritis (PsA) (46, 47); one (3%) included participants with
215 spondyloarthritis (37). Three (10%) studies additionally defined their diagnostic criteria as doctor-

216 diagnosed arthritis (31), arthritis-associated disability (33), or arthritis-attributable work limitation
217 (53). Two further studies described participants as having arthritis (7%) (28, 32). One study (3%)
218 included participants with OA and a range of IA types (6).

219 **Work Outcomes**

220 Due to varying arthritis types and outcome measures used (Table 3), work outcomes were diverse.
221 For data reporting purposes, quantitative outcomes were classified into three key categories: (1)
222 arthritis-related work productivity outcomes (29, 30, 32, 37, 39); (2) arthritis-related work
223 participation outcomes (29, 31, 33, 37, 40-44); and (3) other arthritis related workplace outcomes
224 (14, 27, 30, 40, 42, 44-46, 53). Within these three categories, outcomes were subcategorised by age
225 band, to examine outcomes for individuals beginning their career, versus individuals with a longer
226 work history. For the qualitative studies, the derived themes were classified into barriers (6, 28, 35,
227 36, 38, 48-52) or enablers (6, 34, 35, 38, 47-51) to work participation associated with arthritis, each
228 supported by relevant sub-themes (Supplementary File 4). Emergent themes were independent of
229 age, and for this reason were not disaggregated by age band.

230 ***Arthritis-Related Work Productivity Outcomes***

231 There is no evidence to show any association between arthritis-related work productivity outcomes
232 and age.

233 *Ages 16-34*

234 Two studies assessed absenteeism and presenteeism as a measure of work productivity (29, 32).
235 Absenteeism and presenteeism amongst employed participants (ages 25-34) with arthritis were no
236 different than for the age and gender matched Canadian population (absenteeism and presenteeism
237 OR=1 (95% CI not provided) (32). A separate Canadian study reported the mean (SD) number of
238 work days missed due to disease in the last six months was 6.4 (7.8) amongst 143 employed
239 Canadian participants (ages 18-30) with SLE or JIA (29).

240 Two studies assessed career satisfaction as a measure of work productivity (29, 30). On average,
241 career satisfaction for employed participants (ages 18-30) with SLE or JIA was moderate
242 (mean=3.4 (SD 1.0)) (29). A similar level of career satisfaction was evident when unemployed
243 participants with SLE or JIA were included in the analysis (mean=3.5 (SD 0.95)), although how
244 unemployment was classified was unclear. Employed and unemployed participants viewed job
245 accommodations and benefits as major enablers to work productivity, yet experienced moderate
246 workplace accommodations themselves (mean=6.1 (SD 4.2)) (30). Employed participants with

247 SLE or JIA had high perceptions of remaining employed (mean=4.4 (SD 1.0)) and were content
248 with managerial support (mean=4.0 (SD 1.0)), both of which aided career satisfaction, but had
249 moderate levels of perceived job control (mean=3.2 (SD 1.4)). Opportunities for disease disclosure
250 in the workplace were very low (mean=2.4 (SD 1.3)) (29).

251 One study assessed job disruptions and perceived productivity loss as a measure of work
252 productivity (29). Nearly half (44%) of employed Canadian participants (ages 18-30) with SLE or
253 JIA reported high levels of job disruptions (mean=3 (SD 2.2)) in the last six months, and
254 productivity loss was perceived to be low (mean=2.7 (SD 0.9)) (29).

255 *Ages ≤45*

256 Three studies assessed absenteeism and presenteeism as a measure of work productivity (32, 37,
257 39). In two studies (37, 39), results were not stratified by smaller age brackets for participants aged
258 16-45. For 35 employed participants with spondyloarthritis, mean (SD) proportion of absenteeism
259 was 7.9% (14.0%) per week. When participants who undertook non-paid work were included in
260 the analyses, mean (SD) absenteeism was 8.3% (13.9%). Mean (SD) presenteeism was 32.6%
261 (31.2%) per week. When participants who undertook non-paid work were included in the analysis,
262 mean (SD) presenteeism was 18.6% (28.8%). All proportions were reported as similar to the
263 general Italian population (37). Similar to employed Italian participants with spondyloarthritis,
264 employed Japanese participants with RA (ages 18-≤45) reported low levels of overall productivity
265 loss, which was calculated by multiplying self-reported presenteeism and absenteeism rates by
266 participants' annual salaries (mean=20.3 (SD 20.9)) (39). For participants with arthritis in Canada,
267 odds of absenteeism were lower than the general population (OR=0.75 95% CI 0.66-0.84), but
268 arthritis was positively associated with increased presenteeism (OR=1.18 95% CI 1.07-1.31) (32).

269 *Arthritis-Related Work Participation Outcomes*

270 There is moderate evidence to show an association between lower labour force participation (LFP)
271 rates, employment and age, for adults at both ends of the 16-50 years age spectrum. Younger adults
272 in the age band 24-29 years experienced lower LFP rates than healthy populations the same age,
273 based on the National Health Interview Survey (31). Based on current LFP prevalence, middle-
274 aged adults in the age band 45-49 years also experienced lower employment rates (40).

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278 *Ages 16-34*

279 Two studies assessed LFP as a measure of work participation (31, 33). Amongst Canadian
280 participants aged 18-23 years with doctor-diagnosed arthritis, LFP rates were comparable to the
281 general population (60.3% versus 57.3%). LFP rates were lower for older participants (ages 24-29
282 years) from the same sample compared to the general population (63.6% versus 76.0%) (31).
283 Similar LFP outcomes were reported in Canadian participants relative to the general population
284 (ages 25-34 years OR=1) (33).

285 One study assessed hours worked per week as a measure of work participation. Average hours
286 worked per week for Canadian participants aged 18-30 with SLE and/or JIA were 31.2 (SD 13.2).
287 These rates were not compared to the general population (29).

288 *Ages 20-49*

289 Two studies assessed employment rates as a measure of work participation for participants aged
290 20-49 years (42, 44). Employment rates for Dutch participants with RA were low 43.9% (44),
291 although these rates were not compared to the general population. For male and female Dutch
292 participants with AS across all age groups (ages 20-24, 25-29, 30-34, 35-39, 40-44, 45-49 years),
293 employment rates tended to be lower compared to the general population, yet significance testing
294 was not reported (42). One study assessed hours worked per week amongst participants aged ≤ 45
295 years. Hours worked per week were stated to be similar amongst participants with
296 spondyloarthritis compared to the general Italian population, although general population rates
297 were not reported (37).

298 *Ages 35-50*

299 One study assessed LFP for Canadian participants with arthritis aged 35-44 relative to the general
300 population and found no difference (ages 35-44 years men OR=1.48 95% CI 0.43-5.12; ages 35-
301 44 years women OR=1.71 95% CI 0.74-3.98) (33). Two studies assessed LFP for participants aged
302 45-49 (41, 44). Comparable LFP rates were reported in Dutch participants (ages 45-49 years) with
303 hip or knee OA compared to the general population, regardless of gender and level of education
304 (41). Lower LFP rates were reported in Dutch participants with RA compared to the general
305 population, however, a difference was only found in men aged 45-49 years whose highest
306 educational attainment was primary school (55.2% versus 70.4%) (44).

307 Two studies assessed employment rates for participants aged 20-49 with RA relative to the healthy
308 Lithuanian and Dutch population. In Lithuania, significant findings were found for three

309 subpopulations (women aged 35-49=57.1%; men aged 45-49=52.2%; women aged 45-49=61.1%)
310 (40). General population rates were not presented to interpret these data; rather study authors note
311 that a significant difference was found between participants with RA and normative data for the
312 general population within the same age bands. In the Netherlands, employment rates for Dutch
313 participants with RA were low (43.9%) although these rates were not compared to the general
314 population (43).

315 ***Other Arthritis Related Workplace Outcomes***

316 There is moderate evidence to show an association between high work disability (WD) rates for
317 those aged 30-34 years (80%), in contrast to younger populations aged 25-29 years (12.5%) based
318 on days absent from paid work during the last year (40). Based on the Vocational Health
319 Questionnaire, younger adults were more likely to report withdrawal from the workforce due to
320 physical symptoms than middle-aged adults (ages 20-29=1.8%; ages 30-39=10.2%) (44).

321 *Ages 18-39*

322 Two studies assessed work disability (WD). Dutch participants with AS reported higher
323 percentages of WD compared to the general population (ages 22-34 AS total=6.3%, Dutch
324 total=2.7%), although the reported WD was from all causes and not exclusively AS-attributable
325 (42). Lithuanian participants with RA reported high WD, ranging from 12.5% (ages 25-29 years)
326 to 80% (ages 30-34 years) (40).

327 Two studies assessed work limitations both using the Workplace Activity Limitations Scale
328 (WALS). Moderate scores of work limitations were found amongst employed Canadian
329 participants (ages 18-30 years) with SLE or JIA (median = 5.9 (SD 4.9)) (30). Among participants
330 with OA aged 20-39 in Australia, the mean (SD) WALS score was high: 8.1 (6.9) (14). One study
331 assessed labour force withdrawal following arthritis diagnosis. Based on the Vocational Health
332 Questionnaire, Dutch participants with RA reported need to withdraw from the labour force due
333 to physical symptoms (ages 20-29=1.8%; ages 30-39=10.2%) (44).

334 *Ages 35-50*

335 Two studies assessed WD. Living with SLE was associated with greater self-reported WD
336 (OR=1.68 (95% CI 1.03-2.78) amongst Canadian participants aged 36-50 years (27). Dutch
337 participants with AS also reported higher percentages of WD compared to the general population
338 (ages 35-44 AS total=18.1%, Dutch total=4.2%) (42).

339 One study assessed work limitations for participants aged 40-49; the mean (SD) WALIS score was
340 9.8 (6.7) (14). Based on the Vocational Health Questionnaire, 27.5% of Dutch participants with
341 RA aged 40-49 reported need to withdraw from the labour force due to physical symptoms (44).

342 *Age ≤45*

343 Two studies assessed WD. In both studies, results were not stratified by smaller age brackets.
344 Norwegian females with RA aged 18-45 years reported higher WD rates compared to non-WD
345 rates amongst the same population with RA (of 372 included females, 277 (75.3%) participants
346 reported no WD, and 91 (24.7%) reported WD. Younger age was associated with WD (mean
347 WD=38.5%, mean non-WD=35.4%, $p < 0.001$), with no difference between male groups
348 ($p = 0.91$) (45). Participants with PsA in Norway reported similar levels of WD and non-WD
349 (females $p = 0.24$; males $p = 0.56$) (46).

350 One study assessed arthritis-attributable work limitation (AAWL) for US participants aged 25-44
351 years with doctor-diagnosed arthritis. The odds of experiencing AAWL were not different to the
352 general population (OR=1.3 95% CI 0.8-2.3) (53). Finally, 27.5% of Dutch participants aged 40-
353 49 with RA reported labour force withdrawal following arthritis diagnosis (44).

354 ***Barriers to Work Participation Associated with Arthritis***

355 Ten qualitative studies (6, 28, 35, 36, 38, 48-52) explored barriers to work participation associated
356 with arthritis. Selected quotes are presented for each subtheme and other supporting quotes are
357 provided in Supplementary File 4.

358 Four studies explored incapacity to work (6, 38, 48, 52). Participants with AS explained: "*this*
359 *condition increased my pain, I quit my job*" (48). For men with AS, negative perceptions of self were
360 reported in relation to work: "*I am frustrated that I have no stamina... that I can't just suck it up and stay*
361 *work, that I have to go home*" (36).

362 Four qualitative studies explored lack of workplace support (6, 35, 38, 49). Participants with RA
363 repeatedly stated "*I have a joint disease*" when their workplace contribution was questioned (35).
364 Other participants with RA described the stigma when requesting workplace accommodations:
365 "*When you stand up and your desk is going [makes sound of desk moving] and you are the only one you might as*
366 *well wear a big hat 'look at me - disabled'* (50).

367 Four qualitative studies explored discord with colleagues (28, 48, 50, 51). Participants with RA
368 attempting to return to work explained that "*if I go back and fail they'll [colleagues] regard it as worse than*

369 *if I stay off that bit longer*" (50). Participants with AS acknowledged the effects of their disease on
370 colleagues: *"when I am absent, the burden of the work is put on the shoulders of my colleagues, this makes them*
371 *feel uneasy*" (48).

372 ***Enablers to Work Participation Associated with Arthritis***

373 Nine qualitative studies (6, 34, 35, 38, 47-51) explored enablers to work participation associated
374 with arthritis. Further supporting quotes are provided in Supplementary File 4.

375 Five qualitative studies explored motivation to work (38, 48-51). Participants with RA from two
376 UK studies explained that *"whenever I can I push myself to go to work"* (50). Participants with RA in
377 India provided insight that they *"come to work to keep [their] mind balanced"* (38). Participants with AS
378 explained that internal motivation to work was beneficial for psychosocial health: *"I became quite*
379 *depressed inside... Even if I've only made it to work for two hours I feel better in myself"* (48).

380 Six qualitative studies explored managerial and collegiate support as enablers to work participation
381 (6, 38, 47, 49-51). Participants with RA explained that their *"bosses are quite supportive"* (51), that
382 *"they have allowed me to work as I can"* (50), and that *"they care about me all day at work"* (38). Participants
383 with JIA explained that they were *"lucky because I get on with my managers so they're understanding"* (49).

384 Five qualitative studies explored flexible working arrangements and their perceived benefits (6, 34,
385 38, 47, 51). Participants with OA explained that *"initially I worked in the goods department which was very*
386 *tough on my fingers; luckily it has been arranged that I can also work in the typing department"* (34). Similar
387 sentiments were echoed in other studies, with participants explaining *"I have negotiated flexible working*
388 *arrangements"* (51).

389 Four qualitative studies explored participants' understanding of legislation and workplace
390 antidiscrimination policies (6, 35, 38, 49). Participants with IA conditions viewed this as a
391 protective mechanism to continue to work, as *"you don't want to be discriminated against if there's another*
392 *job opening up"* (6), and that *"you're more likely to be made redundant"*. (49). In contrast, participants with
393 RA viewed workplace regulations through a positive paradigm: *"it is a gift that the system helps you*
394 *maintain work so you can earn money"* (35).

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398 **DISCUSSION**

399 There is a paucity of high-quality research examining the work-related outcomes of arthritis for
400 younger people commencing their career through to the peak income-earning years in middle-age.
401 To the best of our knowledge, this review is the first to systematically identify, appraise and report
402 the available evidence (both quantitative and qualitative) on work outcomes in this area. Our
403 findings indicate that work outcomes are highly variable, and depend on participant samples,
404 arthritis diagnoses, and the outcome measures used to quantify work-related constructs. Although
405 there were some signals in the data that age was positively associated with work impact, the
406 evidence for this association was weak and inconsistent. This creates challenges in making
407 recommendations regarding workplace practice and policy yet provides a starting point to consider
408 work-related concerns within routine clinical care for arthritis.

409 The impact of arthritis on work productivity was a prominent outcome, represented in five
410 quantitative studies. This impact likely relates to the multitude of physical impairments commonly
411 associated with arthritis, including but not limited to joint pain, stiffness, and fatigue. Existing
412 patient-reported outcome measures (PROMs) appear to focus on measuring permanent work
413 disability and/or work loss, and this may partly explain why we found no associations between age
414 and work productivity outcomes. PROMs that instead focus on work limitations and quality of
415 life domains rather than time away from work (in addition to qualitative research findings) highlight
416 the impact of arthritis on workplace productivity, providing insight into younger age groups at risk
417 of at-work productivity loss and providing opportunities for early intervention (54).

418 The association between arthritis and lower work participation was a common outcome,
419 represented in nine quantitative studies. Although heterogeneous in definition and measurement,
420 similarities existed in that work participation was seldom measured beyond paid employment. This
421 is important to note, as people of younger age groups are more likely provide informal and unpaid
422 care to dependent children or parents. Our results highlight that participation in these unpaid work
423 roles need to be quantified to provide a more complete picture of 'work' participation, including
424 in low-and-middle income countries where unpaid work is more common, to more fully capture
425 the types of work undertaken by younger adults living with arthritis (56).

426 Findings related to other arthritis-related workplace challenges provide further insight into younger
427 populations at risk of experiencing work impairment. In two studies in this review, the WALS
428 scores highlighted high levels of work limitations for employees with arthritis (14, 30). Assessing
429 arthritis-related work impairment within routine arthritis care (for example, by rheumatologists or

430 allied health professionals), is a necessary starting point and would be best undertaken prior to
431 progression towards long-term productivity loss (55). Regular re-review of work impairment would
432 enable deterioration to be detected and suitable management plans and appropriate vocational
433 specialist referral to be implemented. Effective communication with employers is also needed, to
434 avoid individuals with arthritis being viewed as a workplace burden which can perpetuate the cycle
435 of limitations and reduced productivity (6, 48).

436 The quotes provided from the qualitative studies provide a starting point to filling the 'gaps' in our
437 understanding, that to date have been largely based on quantitative data. For example, where
438 quantitative research has identified that younger people with arthritis have minimal opportunity
439 for workplace disease disclosure (29), qualitative data highlight that self-disclosed arthritis in the
440 workplace results in reduced workplace stress (57). This review highlights the importance of
441 participants' narratives to inform the development of person-centred interventions and policies to
442 support younger/middle-aged people with arthritis to maintain employment and thrive in their
443 careers (58).

444

445 **Strengths and Limitations**

446 This systematic review has incorporated both quantitative and qualitative evidence focusing on
447 work outcomes for younger and middle-aged adults with a broad range of arthritis conditions.
448 Further strengths include a comprehensive and systematic search of the literature spanning 20
449 years, and examination of study design, quality of evidence, and outcome measures to compile the
450 best evidence-base of work-related outcomes for this group. The quality of the included evidence
451 was also strong; on average, quantitative and qualitative studies scored 79.4% and 79.1%
452 respectively, on the JBI critical appraisal tools.

453 We also acknowledge the review limitations. First, only observational and qualitative studies
454 published in English were included. Second, the relationship between arthritis and work outcomes
455 may be influenced by factors that were not measured or reported, including the temporal
456 relationship between disease progression and impact and co-morbid conditions. Third,
457 generalisability of results is potentially limited due to small sample sizes, a lack of comparators,
458 and the majority of studies being conducted in high-income countries (93%). Results may not be
459 transferrable to specific workplaces, or low and middle-income countries, where the impact of
460 persistent musculoskeletal pain on work is known to be substantial (59).

461 **Conclusion**

462 Although current evidence varies greatly in how work and work outcomes are defined and
463 measured, there are consistent signals in the data to suggest that arthritis is associated with work
464 limitations and the magnitude of impact may increase with age. Qualitative data provide individual
465 patient perspectives and augment our understanding of barriers and enablers to working
466 productively with arthritis. Additional research focusing solely on the workplace needs of
467 younger/middle-aged population groups is required, to inform tailored interventions and
468 workplace support initiatives that maximise productive working years.

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Table 1: Summary of Included Quantitative Studies

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results			Were the study results compared to the general population?	Interpretation of Study Results
								Arthritis-Related Productivity Outcomes	Arthritis-Related Participation Outcomes	Other Arthritis-Related Workplace Outcomes		
Ackerman et al (14) Australia	Cross-sectional	20-29 30-39 40-49 50-55	101	-	Knee OA Hip OA	-	WALS			WALS mean (SD) Age 20–39: 8.13 (6.90) Age 40–49: 9.84 (6.72)	Yes.	Participants reported high levels of work limitations based on WALS.
Baker et al (27) Canada	Cross-sectional	36-50 51-65 >65	NR	-	SLE	-	Researcher-developed questionnaire: (1) Work disabled (not being able to work due to illness); (2) A homemaker – FT; (3) Retired; (4) A student; (5) Working for pay for 10 or more hours per week.			Self-reported WD (1 selected from researcher-developed questionnaire) Age 36-50: OR=1.69 (1.03-2.78)**	No.	Participants with SLE were more likely to report levels of WD compared to no WD.
Bieleman et al (41) Netherlands	Cross-sectional	45-49 50-54 55-59 60-64	NR		Knee OA Hip OA	-	EARA. Researcher-developed questionnaire: Employed participants asked about their present condition and whether they'd like to adapt their work (tasks/hours/workplace).			LF Participation RR (Graduated Secondary School) Age 45-49 Men 1.15 (0.5-1.6)* Age 45-49 Women 1.1 (0.9-1.4)*	Yes.	The rate ratio for all subgroups equalled, or was >1, but did not reach levels of significance (95% CI includes 1).

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results	Were the study results compared to the general population?	Interpretation of Study Results	
							Non-employed participants asked the reason for not having a job.	LF Participation RR (Graduated High School) <i>Age 45–49 Men</i> 1.1 (0.3–1.19)* <i>Age 45–49 Women</i> 1.0 (0.6–1.4)*			
Boonen et al (42) Netherlands	Cross-sectional	15-25 22-34 35-44 45-54 55-60	NR	-	AS	-	HLQ. WD as defined by the Dutch social security benefit programme.	% Employed (FT Employed) <i>Age <20:</i> 0 (0) <i>Age 20-24:</i> 50.0 (42.9) <i>Age 25-29:</i> 70.4 (55.8) <i>Age 30-34:</i> 74.2 (57.8) <i>Age 35-39:</i> 73.1 (53.9) <i>Age 40-44:</i> 70.2 (51.5) <i>Age 45-49:</i> 64.5 (43.9)	% WD (FT WD) <i>Age 15-25:</i> 0 (0) <i>Age 22-34:</i> 15.3 (6.3) <i>Age 35-44:</i> 27.0 (18.1)	Yes.	Participants with AS were more likely to experience reduced LFP and increased WD.
Chorus et al (43) Netherlands	Cross-sectional	20-29 30-39 40-49 50-59	NR	-	RA	-	Researcher-developed questionnaire: participants indicated whether or not they had a paid job at the time of diagnosis, and indicated what their current work status was.	LF Participation RR (Graduated Primary School) Rates Men <i>Age 20 - 29:</i> 0	Yes.	Male participants with RA with primary level education had reduced LFP in 20-29 and 40-49 age brackets. Female	

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results	Were the study results compared to the general population?	Interpretation of Study Results
							LF participation defined as having a paid job at the time of the study.	<p><i>Age 30 - 39:</i> 77.8 (50.9 - 100.0)*</p> <p><i>Age 40 - 49:</i> 55.2 (45.2 - 65.0) *†</p> <p>Rates Women <i>Age 20 - 29:</i> 22.2 (0.0 - 49.1)* <i>Age 30 - 39:</i> 20.0 (6.5 - 33.5)* <i>Age 40 - 49:</i> 23.9 (16.6- 31.2)*</p> <p>LF Participation (Graduated Secondary School) Rates Men <i>Age 20 - 29:</i> 75.0 (32.7 - 100)* <i>Age 30 - 39:</i> 84.2 (8.3 - 100)* <i>Age 40 - 49:</i> 85.5 (77.3 - 93.7)*</p> <p>Rates Women <i>Age 20 - 29:</i> 78.8 (65.3 - 92.3)*</p>		participants with RA with higher level education had reduced LFP in the 40-49 age bracket. An association between arthritis and LFP was not found across other age brackets.

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results	Were the study results compared to the general population?	Interpretation of Study Results	
								<i>Age 30 – 39:</i> 45.2 (36.2 - 54.2)* <i>Age 40 – 49:</i> 46.3 (37.9 - 54.7)* LF Participation (Graduated Higher Education) Rates Men <i>Age 20 – 29:</i> 50.0 (0.0 - 100.0)* <i>Age 30 – 39:</i> 80.0 (45.1 - 100.0)* <i>Age 40 – 49:</i> 89.5 (76.7 - 100.0)* Rates Women <i>Age 20 – 29:</i> 66.7 (29.9 - 100)* <i>Age 30 – 39:</i> 75.0 (59.5 - 90.5)* <i>Age 40 – 49:</i> 54.8 (40.9 - 68.7)*			
Chorus et al (44) Netherlands	Cross-sectional	20-29 30-39 40-49	NR	-	RA	-	VHQ Researcher-developed questionnaire: reasons for LF withdrawal:	% Paid Employment <i>Age 20-29:</i> 6.2 <i>Age 30-39:</i> 10.2	LF Withdrawal % Post Diagnosis <i>Age 20-29:</i> 1.8 <i>Age 30-39:</i> 10.2	No.	The percentage of employed participants with RA compared to

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results		Were the study results compared to the general population?	Interpretation of Study Results	
		50-59					1. Work-related reasons; 2. Disease related reasons; 3. Other personal reasons.		<i>Age 40-49:</i> 27.5	<i>Age 40-49:</i> 27.5		those withdrawn from the workforce is detailed, but the significance between the two figures is unclear.
Dadoniene et al (40) Lithuania	Cross-sectional	20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64	NR	-	RA	-	Researcher-developed questionnaire: current and past LFP, days absent from work during the last year in those with a paid job.		% Employed <i>Age 20-24:</i> - <i>Age 25-29:</i> 75.0 <i>Age 30-34:</i> 40.0 <i>Age 35-39:</i> 57.1 <i>Age 40-44:</i> 75.0 <i>Age 45-49:</i> 52.2†	% WD <i>Age 20-24:</i> 0 <i>Age 25-29:</i> 12.5 <i>Age 30-34:</i> 80 <i>Age 35-39:</i> 80 <i>Age 40-44:</i> 41.7 <i>Age 45-49:</i> 56.6	Yes.	Women aged 35-39 and women and men 45-49 years had reduced employment. Other age brackets were comparable to the general population.
de Hooge et al (37) Italy	Cross-sectional	<45	51	59	Spondyloarthritis	-	WPAI	WPAI, mean (SD) <i>Age 16-45:</i> 36.6 (30.0) WPAI Absenteeism, mean (SD) 7.9 (14.0) WPAI Presenteeism, mean (SD) 32.6 (31.2) †	Paid hours worked per week, mean (SD) 35.7 (12.9) Hours missed per week, mean (SD) 3.4 (6.8)	Yes.	All outcomes were comparable to the Italian population.	

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results	Were the study results compared to the general population?	Interpretation of Study Results
Jetha et al (29) Canada	Cross-sectional	18-30	143	79	JA SLE	Mean (SD) 10.2 (7.1)	Researcher-developed questionnaire: Employment status; Job characteristics; Career satisfaction scale (1=not at all satisfied, 5=extremely satisfied); Perceived likelihood of remaining employed and perceived job control (1=very unlikely, 5=very likely); Workplace support and disclosure (1=not at all, 5=a great deal); Absenteeism and job disruptions (the number of workdays missed in the last 6 months and ten items about job disruptions); Perceived productivity loss (1=not at all, 5=a great deal).	<p>Absenteeism, mean (SD) 6.4 (7.8)</p> <p>Job disruptions, mean (SD) 3.0 (2.2)</p> <p>Perceived productivity loss, mean (SD) 2.7 (0.87)</p> <p>Career Satisfaction, mean (SD) 3.4 (1.0)</p> <p>Job Control, mean (SD) 3.2 (1.4)</p> <p>Perceived Likelihood of Remaining Employed, mean (SD) 4.4 (0.90)</p> <p>Managerial Support, mean (SD) 4.0 (1.1)</p> <p>Workplace Disease Disclosure, mean (SD) 2.4 (1.3)</p> <p>Hours worked per week, mean (SD) 31.2 (13.2)</p> <p>Years employed, mean (SD) 2.1 (2.4)</p>	No.	Employment rates and hours worked per week are comparable to the national average, but nearly half of employed participants reported absenteeism, job disruptions, and perceived productivity loss. Participants reported moderate levels of career satisfaction and job control, but high levels of perceived likelihood of remaining employed.

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results	Were the study results compared to the general population?	Interpretation of Study Results	
Jetha et al (30) Canada	Cross-sectional	18-30	143	79	JA SLE	Mean (SD) 10.8 (6.2)	WALS 5-item Career Satisfaction Scale (1=not at all satisfied, 5=extremely satisfied); Researcher-developed scale of perceived helpfulness of job accommodations (12 benefits)	<p>Career Satisfaction, median (SD) <i>Employed: 3.4 (1.0)</i> <i>Not working: 3.3 (0.90)</i></p> <p>Perceived Helpfulness of Job Accommodations Benefits, median (SD) <i>Employed: 5.0 (3.5)</i> <i>Not working: 8.1 (4.8)</i></p>	<p>WALS median*** <i>Employed: 5.9</i> <i>Unemployed: 7.5</i></p>	No.	Participants reported moderate levels of work limitations based on WALS. The majority of participants were satisfied with their career progression, but reported 50% of job accommodations missing from the researcher-provided list to help with future career progression.
Jetha et al (31) Canada	Cross-sectional	18-29	1393	64	Doctor-diagnosed arthritis	-	1. NHIS	<p>% Employment participation <i>Age 18-23: 60.3 (53.7-66.6)*</i> <i>Age 24-29: 63.6 (59.6-67.4)*</i></p>	Yes.	The prevalence of employment participation is lower for participants aged 24-29 years compared to the population. Employment participation is similar for participants aged 18-23 compared to the population	

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results		Were the study results compared to the general population?	Interpretation of Study Results
											without arthritis.
Kaptein et al (33) Canada	Cross-sectional	25-34 35-44 45-54 55-64	NR	-	Arthritis-attributable disability	-	Researcher-developed questionnaire: 1. Employed 2. Not in the labour force 3. Unemployed	Non-participation OR men <i>Age 25-34:</i> 1.00 <i>Age 35-44:</i> 1.71 (0.43-5.12)* Non-participation OR women <i>Age 25-34:</i> 1.00 <i>Age 35-44:</i> 1.71 (0.74-3.98)*		No.	For men and women aged 35-44, odds of non-participation in the workplace are high, yet the figure does not reach significance. For men and women aged 25-34, there is no difference in workplace participation rates.
Sruamsiri et al (39) Japan	Cross-sectional	18-≤45 45-55 >55	NR	-	RA	-	WPAI % of absenteeism and presenteeism multiplied by participants' annual salaries to calculate productivity loss in monetary values.	\$USD Value, mean (SD) <i>Age ≤45:</i> 6881 (9284) % Productivity loss, mean (SD) <i>Age <45:</i> 20.28 (20.94)		No.	Productivity loss for participants is expressed in USD, but the significance of the value relative to population levels is not discussed.
Theis et al (53) USA	Cross-sectional	18-25 25-44 45-64	2120	-	Arthritis-attributable work limitation	-	NHIS. Researcher-developed questionnaire: In the past week, 1. Worked for pay at a job or business 2. Been employed with a job or business		OR AAWL <i>Age 18-24:</i> 1.0 <i>Age 25-44:</i> 1.5 (0.7-3.2)*	No.	Participants aged 25-44 have increased odds of experiencing AAWL, but this does not reach levels of significance (95% CI

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results		Were the study results compared to the general population?	Interpretation of Study Results
							3. Worked but not for pay at a job or business 4. Looked for work 5. Did not work and did not look for work				includes 1). There is no difference in AAWL for participants aged 18-24.
Wallenius et al (46) Norway	Cross-sectional	18-45	271	38	PsA	Mean (SD) Women: 6.9 (7.1) Men: 5.6 (6.4)	WD Pension in Norway		% WD Women 32.7 % WD Men 17.4	No.	Percentage WD is detailed, but significance or comparison to the population is not discussed.
Wallenius et al (45) Norway	Cross-sectional	18-45	474	78	RA	Mean (SD) Women: 5.9 (6.0) Men: 4.8 (6.2)	WD Pension in Norway		% WD Women 24.7 % WD Men 8.1	No.	Percentage WD is detailed, but significance or comparison to the population is not discussed.
Wei et al (32) Canada	Cross-sectional	25-34 35-44 45-54 55-64	NR	-	Arthritis	-	Canadian Community Health Survey		OR Absenteeism Age 25-34: 1.00 Age 35-44: 0.75 (0.66-0.84)** OR Presenteeism Age 25-34: 1.00 Age 35-44: 1.18 (1.07-1.31)**	Yes.	Arthritis was positively associated with increased presenteeism for participants aged 35-44. Absenteeism rates for the same age bracket were negatively associated with arthritis. No difference was found in presenteeism

Author and Country	Study Design	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis diagnosis	Years since Diagnosis	Tools used to measure work	Results		Were the study results compared to the general population?	Interpretation of Study Results
											or absenteeism rates for participants aged 25-34 compared to the population.

AS (Ankylosing Spondylitis); EARA (Economic Aspects in Rheumatoid Arthritis); FT (Full Time); HLQ (Health and Labour Questionnaire); HR (Hazard Ratio); JIA (Juvenile Idiopathic Arthritis); LF (Labour Force); NHIS (National Health Interview Survey); NR (Not Reported) OA (Osteoarthritis); OR (Odds Ratio); PsA (Psoriatic Arthritis); RA (Rheumatoid Arthritis); RR (Rate Ratio); SLE (Systemic Lupus Erythematosus); ULR (Univariate Logistic Regression); VHQ (Vocational Handicap Questionnaire); WALS (Work Activity Limitations Scale); WD (Work Disability); WPAI (Work Productivity and Activity Impairment).

* Reported measure of effect = 95% Confidence Interval (CI)

** Statistically significant 95% CI

***IQR not reported

† Statistically significant compared to general population rates

‡ p<0.05

Table 2: Summary of Included Qualitative Studies

Author	Country	Age Range Included (Years)	Participants aged 16 – 50 (n)	% Female	Arthritis Diagnosis	Years since Diagnosis	Data Collection Technique	Data Analysis Technique
Bagcivan et al (48)	Turkey	Reported as 18+	23	30	AS	Mean 5.39 ± 3.52	Interviews	Descriptive phenomenological approach
Bukhave et al (34)	Denmark	Reported as 35+	1	100	Hand OA	Not stated	Interviews	Interpretive phenomenological analysis
Berkovic et al (6)	Australia	18-50	21	90	RA, OA, PsA, AS, SLA, JIA	Not stated	Interviews	Thematic analysis
Crooks (28)	Canada	Reported as 18+	6	84	SLE, OA, RA, Arthritis	Not stated	Interviews	Thematic analysis
Hanson et al (49)	UK	16-25 26-31	29	66	JIA	Range 5 - 21	Interviews Focus groups	Thematic analysis
Holland et al (50)	UK	32-58	9	89	RA	Range 1-15	Interviews	Thematic analysis
Jain et al (38)	India	28-63	16	31	RA	Range 6 months - 23	Interviews	Thematic analysis
Kristiansen et al (35)	Denmark	31-81	10	80	RA	Range 2 months - 15	Focus groups	Content analysis
Lempp et al (51)	UK	25-45 Reported as other	Not reported*	-	RA	-	Interviews	Content analysis
Osterholm et al (47)	Sweden	25-65	5	0	RA, PsA, AS	-	Interviews	Empirical Phenomenological Psychological method
Pendeke et al (52)	UK	20-69	6	0	SLE	Range 1 - 3	Interviews	Interpretive phenomenological analysis
Primholdt et al (36)	Denmark	21-37	5	0	AS	Mean 5.4	Interviews	Meaning condensation

AS (Ankylosing Spondylitis); JIA (Juvenile Idiopathic Arthritis); OA (Osteoarthritis); PsA (Psoriatic Arthritis); RA (Rheumatoid Arthritis); SIA (Seronegative Inflammatory Arthritis); SLE (Systemic Lupus Erythematosus); UK (United Kingdom)

* Data were derived from in-text quotations from participants aged between 16-50 years

Table 3: Work Outcome Measures used in Quantitative Studies

Work Constructs Identified from Included Quantitative Studies	Definition and/or Measurement of Work Outcomes Mapped to Quantitative Studies		
	Arthritis-Related Work Productivity Outcomes	Arthritis-Related Work Participation Outcomes	Other Arthritis-Related Workplace Outcomes
Work limitations			Work Activity Limitations Scale (WALS): 0 (no workplace activity limitations) – 36 (greatest workplace activity limitations).
Presenteeism	Work Productivity and Activity Impairment Questionnaire (WPAI): 0 – 10 scale, reduced productivity due to disease (35)		
	Researcher-developed definition: “sometimes or often reducing activities at work due to long-term physical or health problems” (30)		
Absenteeism	WPAI: 0 – 10 scale, percentage of hours missed due to disease (35)		
	Number of workdays missed in the last 6 months (27)		
	Researcher-developed definition: “those who indicated that they had a job or business from which they were absent in the last week” (30)		
Job disruptions	Number of workdays missed in the last 6 months (27)		

Perceived productivity loss	Researcher-developed questionnaire: 1 – 5 scale (27)		
% of overall productivity loss	WPAI (37)		
Labour force participation (LFP)		Researcher-developed categories: employed, not in the labour force, and unemployed (31)	
		Work entry – the duration of time until first reported work entry among those unemployed at baseline (22)	
		Working status in the last week (29)	
		Having a paid job at the time of the study (41)	
		Having a paid job for ≥ 8 hours per week (17, 39)	
Employment		Paid hours worked per week (27, 35)	
		Having a paid job at the time of the study (42)	
		Working 32 hours a week or more (23, 38, 40)	
		Years employed (27)	
		Missed hours worked per week (35)	
Unemployment		Days on unemployment benefits in the past year (21)	

Work disability (WD)			Do arthritis or joint symptoms now affect whether you work, the type of work you do, or the amount of work you do? (51)
			Patients who received a permanent or part time (50% minimum) national WD pension (43, 44)
			Recognised work disability under the Lithuanian social security system (38)
			Self-reported final date the patient was working, followed by continuous work disability attributed to RA (18)
			“Officially recognised inability to perform paid production because of AS” under the Dutch social security system (23, 40)
			Researcher-developed definition: “the inability to do paid work due to illness” (25)
Withdrawal from labour force			Risk of work loss – the duration of time until first reported work loss among those employed at baseline (22)
			Vocational Handicap Questionnaire: those who reported withdrawing from the labour force were asked to indicate whether this

			was for work, disease, or personal reasons. (42)
			Those who had a paid job before diagnosis and had to leave their job completely because of AS related work disability (23, 40)
Sick leave	Temporary inability to work as a consequence of RA treatment complications, resulting in absence from work (19)		
	Days with sickness benefit registered by the Swedish Social Insurance Agency (SSIA) (20)		
	Annual days sick leave (21)		
Career satisfaction	5-item Career Satisfaction Scale (27, 28)		
Job control	Researcher-developed 1 – 5 scale question: “in the past 6 months, to what extent have you had control over your work activities”? (27)		
Perceived likelihood of remaining employed	Researcher-developed 1 – 5 scale delivered to participants about their perceived likelihood of remaining employed over the next year (27)		
Managerial support	Researcher-developed 1 – 5 scale about the extent to which participants perceive that		

	their manager/supervisor was supportive (27)		
Workplace disease disclosure	Researcher-developed 1 – 5 scale about the extent to which participants discussed the details of their health condition with their employer (27)		
Job accommodations and benefits	Researcher-developed list of 12 health benefits and job practices where respondents were asked to indicate whether they believed the accommodation/benefit would help them maintain or enable employment (28)		

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Accepted version