Work status and its determinants among patients with systemic sclerosis: a systematic review

Schouffoer, A.A.; Schoones, J.W.; Terwee, C.B.; Vlieland, T.P.M.V.

RHEUMATOLOGY

Rheumatology 2012;51:1304–1314
doi:10.1093/rheumatology/ker523
Advance Access publication 15 March 2012

Original article

Work status and its determinants among patients with systemic sclerosis: a systematic review

Anne A. Schouffoer[1], Jan W. Schoones[2], Caroline B. Terwee[3] and Theodora P. M. Vliet Vlieland[4]

Abstract

Objective. To describe work status and factors associated with work disability (WD) in patients with SSc.

Methods. A systematic search strategy in various electronic databases from 1990 to 2011 was performed. All clinical studies concerning SSc patients containing quantitative information on work status and/or factors associated with WD were selected. Extracted were study characteristics, data on work status and/or factors associated with WD. The methodological quality was evaluated in three quality aspects (selection bias, information bias and statistical analysis bias). A best evidence synthesis was employed to analyse the association between potential determinants and WD.

Results. Twelve studies, described in 13 papers, including 2758 SSc patients were selected. The methodological quality of one study was high. Employment rates varied between 11 and 82% after an average disease duration ranging from 2.5 to 14 years. There was moderate evidence for an association between more functional disability, more disease-specific symptoms and poorer quality of life on one side and presence of WD on the other. There was moderate evidence for the absence of an association between WD and age, sex and disease subset. Inconsistent evidence was seen for an association between WD and education and disease duration.

Conclusion. WD is a major consequence of the disease in patients with SSc and is associated with more functional disability, more disease-specific symptoms and poorer quality of life. This emphasizes the need for research into interventions to prevent or reduce WD in patients with SSc, especially in those with a poorer health status.

Key words: systemic sclerosis, employment status, work, disability, productivity, socio-economic burden, predictors.

CLINICAL SCIENCE

Introduction

SSc is a chronic, multisystem disease with unknown aetiology, characterized by skin sclerosis, vasculopathy and complications of internal organs [1]. Despite the variable course of symptoms, the associated morbidity is considered to be substantial. Two major subsets are defined: lcSSc and dcSSc [2]. In lcSSc, RP and a slowly progressive thickening of the skin of distal extremities may have been present for years before patients seek medical attention. dcSSc has a rapid onset of skin thickening at proximal sites and involvement of internal organs. SSc disease manifestations include pain, fatigue and malaise, disabling digital tip ischaemia, limited range of joint motion and flexion contractures, calcinosis, organ fibrosis and pulmonary arterial hypertension [3]. Emotional distress is common in SSc, including depression, low self-esteem, concerns with physical appearance and feelings of uncertainty about the future [4, 5]. Although medical treatment in SSc may alleviate symptoms, prevent complications or influence inflammation, so far a cure is not available.

Using the International Classification of Functioning, Disability and Health to describe patients' health

[1]Department of Rheumatology, [2]Walaeus Library, Leiden University Medical Center, Leiden, [3]Department of Epidemiology and Biostatistics and the EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam and [4]Department of Orthopaedics, Leiden University Medical Center, Leiden, The Netherlands.

Submitted 10 July 2011; revised version accepted 23 December 2011.

Correspondence to: Anne A. Schouffoer, Department of Rheumatology (C1-R), Leiden University Medical Center, PO Box 9600, 2300 RC Leiden, The Netherlands.
E-mail: a.a.schouffoer@lumc.nl

status [6], considerable disability (impairments of body functions and structures, activity limitations and participation restrictions) has been demonstrated in SSc patients [7–9]. Work disability (WD) in rheumatic conditions is usually defined as complete or partial work cessation due to the disease before the age of retirement [10]; however, in some studies a broader definition is used, also concerning any restriction in the work status, such as absenteeism or sick leave, or any reduction in productivity while present at work (so called presenteeism). Apart from WD, productivity loss is also used as an umbrella term for work cessation, sick leave/absenteeism or reduction in productivity while present at work.

The impact of the disease on participation, in particular on work status, is overall well documented [11, 12]. The results of recent studies in SSc all point to substantial WD [13–15]. This is unfavourable, as it was also found that in SSc patients greater work ability was associated with more satisfaction with occupations in general and better well-being [16]. In addition, a number of recent studies aimed to identify risk factors for WD in SSc patients [17, 18]. These studies found that low educational level, less social support, poor functional ability and longer disease duration were associated with WD.

The growing number of publications on work status in SSc underlines the importance of the subject. So far the literature has not been summarized by means of a systematic review. Therefore the aim of the present study was to perform a systematic literature review on work status in SSc patients, defined as the ability or inability to perform a paid job. More specifically, we describe the prevalence of WD in SSc as compared with other inflammatory diseases as well as the risk factors for WD. For the latter purpose, medical and rehabilitative interventions were included as potential determinants of work status in SSc.

Methods

Search strategy

In cooperation with a trained librarian (J.W.S.), a search strategy was composed. The following databases were searched: PubMed, EMBASE (OVID version), Web of Science, COCHRANE Library, CINAHL (EbscoHost-version), PsycINFO (EbscoHost-version), Academic Search Premier and ScienceDirect. The search strategy consisted of the AND combination of two main concepts: WD and SSc. For the different concepts, all relevant key word variations were used, not only key word variations in the controlled vocabularies of the various databases, but the free-text word variations of these concepts as well (supplementary Appendix S1, available as supplementary data at *Rheumatology* Online).

The search strategy was optimized for all consulted databases, taking into account the differences of the various controlled vocabularies as well as the differences of database-specific technical variations (e.g. the use of quotation marks). The search was performed on 23 May 2011.

Data collection and analysis

Five steps in the selection and data collection were defined. All steps were performed by two of the authors independently (A.A.S. and T.P.M.V.V.) and any discrepancies were resolved by consensus.

Step 1: screening of titles and abstracts

First, duplicates were removed. Subsequently, titles and/or abstracts that were not directly related to a full-text paper were removed. For screening of the remaining titles and abstracts, the following criteria were used: (i) the publication concerned a clinical study; (ii) the study population consisted of subjects with a diagnosis of SSc according to the criteria as set by the ACR criteria and/or Leroy and Medsger criteria [2]; studies with a mixed patient population were included if data on SSc patients were available separately; and (iii) the publication contained information on work status or derivates.

Step 2: selection of full-text papers

Titles and abstracts identified as potentially eligible were selected for full-article review. The following selection criteria were used for the full-text papers: (i) studies contained quantitative information on work status, including working full-time, working part-time, number of hours working, early retirement, unemployment, absenteeism and/or presenteeism, permanent WD (job loss and/or partial or full disability pension); (ii) the study concerned quantitative information on predictors for work status as defined under (i), including the potential impact of interventions such as medical treatment or vocational rehabilitation; and (iii) the article was written in the English language.

Step 3: data extraction

From the included full-text papers, the following study characteristics were systematically extracted: author, year of publication, country where the study was conducted, study design (cross-sectional or longitudinal), number of SSc patients, patient recruitment or selection criteria, average age (years), number of female patients (percentage in parentheses), average disease duration (years), number of patients with a dcSSc (percentage in parentheses). Regarding the outcomes of studies in terms of work status, the definitions of work status and associated outcome measures were recorded.

If a study included an analysis of determinants of work status, the dependent variable (any outcome measures related to work status) was extracted and the potential determinants examined were categorized into (i) socio-demographic characteristics (age, sex, educational level or other) (ii) disease characteristics (SSc subset, disease duration, functional ability, disease-specific symptoms, quality of life or other disease characteristics); (iii) work characteristics and (iv) other.

Step 4: assessment of methodological quality

To assess the quality of the included studies, a quality checklist (supplementary Appendix S2, available as

supplementary data at *Rheumatology* Online) was developed, based on items described in a review of tools for quality assessment [19] and on a review of the quality of prognostic studies in systematic reviews [20]. Two authors independently assessed the quality of each study by scoring 23 items (supplementary Appendix S2, available as supplementary data at *Rheumatology* Online), divided into three categories: (i) selection bias (items 1–6); (ii) information bias (items 7–18) and (iii) statistical analysis of potential determinants of work status (items 19–23). Bias was considered present if the majority of the items within a category pointed in this direction. The quality of the study was rated as high if there was no evidence for selection bias, information bias or analyses bias. The quality of the study was rated as moderate if there was evidence of bias in one of two categories in descriptive studies (statistical analysis of factors associated with WD not applicable), or two of three categories in studies comprising an analysis of associations between various factors on the one side and work status on the other. The quality of the study was rated as low if there was evidence of bias in two categories in descriptive studies and all three categories in the other studies.

Step 5: best evidence synthesis

A best evidence synthesis was applied in order to synthesize the results of the studies, while taking into account the number of studies, the methodological quality of the studies and the consistency of the results. This rating system (supplementary Appendix S3, available as supplementary data at *Rheumatology* Online) was based on levels of evidence as described by review groups from the Cochrane Collaboration.

Results

Selection of papers

The bibliographic databases yielded 417 references in total (Fig. 1). Twenty-four duplicates were excluded; in addition, three titles were excluded because data were presented only in abstract form.

The first screening of the remaining 390 titles and abstracts resulted in exclusion of 365 abstracts because these did not concern a clinical study, did not include SSc patients or provided no information on work status or derivates. Full-text screening of 25 remaining potentially eligible papers resulted in exclusion of 12 papers because (quantitative) data on work status were missing ($n = 11$) or they were not written in English ($n = 1$). Finally, 13 papers were selected for inclusion [13–18, 21–27]. In two included papers the same inclusion criteria were used, a similar number of patients was included and similar demographic characteristics were reported [16, 27]. Therefore these two papers were considered as one study, resulting in a final number of 12 studies. For data extraction and the assessment of quality, the information of both studies was combined.

Study characteristics

The characteristics of the selected studies are presented in Table 1. The studies were all performed in Europe or North America. Eleven of the 12 studies had a cross-sectional design, whereas one study had a prospective design with a mean follow-up of 4.4 years [18]. Eight of 12 studies comprised an analysis of associations between various factors on the one side and work status on the other hand.

Fig. 1 Flow diagram.

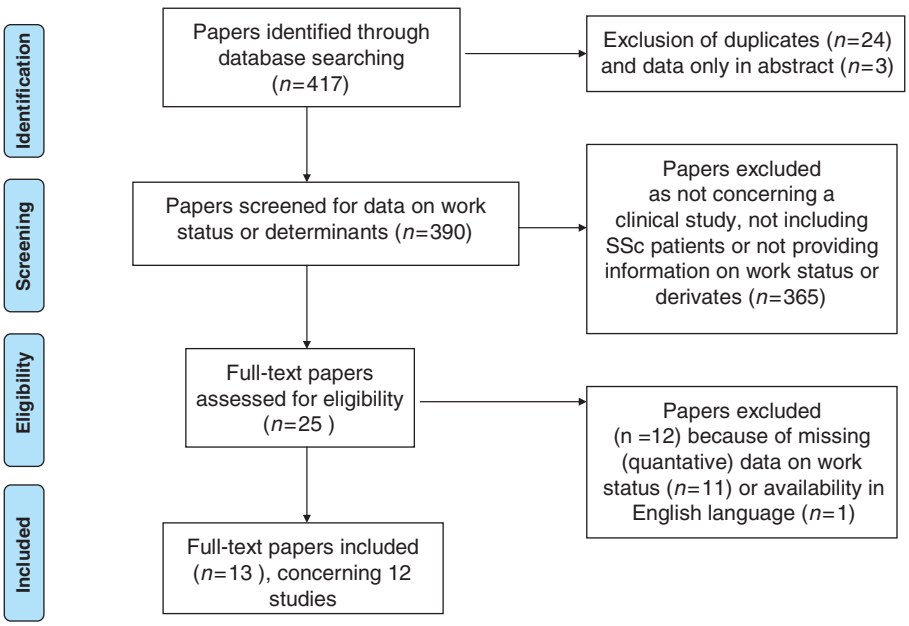

TABLE 1 Characteristics and reported outcomes of 12 studies on work status in patients with SSc

Reference, country	Study design	Number of patients	Patient recruitment and selection	Age, mean (S.D.), years	Female, *n* (%)	Disease duration, mean (S.D.), years	dcSSc, *n* (%)	Definition of work status	Results
Moser *et al.* [25], USA	Cross-sectional	94	Referrals from scleroderma clinics, private practice physicians and announcements in newsletters	55 (12)	83 (88.3)	8 (7)	NA	Working part-time or full-time, being a homemaker, being retired, being disabled	Working part- or full-time outside the house 23/94 (24.5%), homemaker 17/94 (18.1%), retired 27/94 (28.7%), disabled 23/94 (24.5%)
Mau *et al.* [24], Germany	Cross-sectional	802	National registry, age 20–59 years	47 (10)	667 (83)	361 (48%) ⩽5 years, 212 (28%) 6–10 years, 186 (25%) >10 years	NA	Gainful employment; SER = observed/expected employment (95% CI)	SER for women: new Federal states 0.70 (0.52, 0.92), old Federal states 0.77 (0.67, 0.87); SER for part-time employment: 1.06 (0.82, 1.35); SER for men: new Federal states 0.90 (0.51, 1.46), old Federal states 0.84 (0.66, 1.05)
Sandqvist *et al.* [26], Sweden	Cross-sectional	36	Women aged 20–60 years with lcSSc living in the Southern region of Sweden	Median 52 (range 24–59)	100	Median 9 (range 2–44)	0	Working between 50 and 100% of full-time, combining work with sick pension, temporarily sick, full sick pension	16/36 (44.4%) working between 50 and 100%, 3/36 (8%) temporarily sick, 12/36 (33.3%) partial sick pension, 5/36 (14%) full-time sick pension
Sandqvist *et al.* [16, 27], Sweden	Cross-sectional	44		Median 52 (range 24–60)	100	Median 8 (range 2–44)	0	Partial sick leave (20–50% of ordinary working day), full-time sick leave or disability pension	21/44 (48%) working full-time; paid work 6.25 (range 0–11) h/day, 15/44 (34%) partial sick leave, 8/44 (18%) full-time sick leave or full-time disability pension
Ouimet *et al.* [14], Canada	Cross-sectional	61	Outpatient clinic; SSc patients who were retired or had never worked were excluded	52 (1.18)	85.2	11.02 (1.22)	26 (43)	Working, working at home (not work disabled) or having stopped working due to illness (work disabled)	27/61 (44%) working or working at home, 34/61 (56%) patients with work disability
Bernatsky *et al.* [23], Canada	Cross-sectional	457	National scleroderma registry	55.1 (12.1)	401 (87.7)	10.5 (8.6)	185 (40)	Lost productivity based on self-reported days that the patient was unable to work (market work and unpaid labour)	Average cost per patient in 2007 in Canadian dollars: paid labour lost productivity 5.345 (4.598, 6.092), Unpaid labour lost productivity 8.070 (7.167, 8.973)
Hudson *et al.* [17], Canada	Cross-sectional	643	National scleroderma registry, age >18 years	50.2 (8.2) in work-disabled patients (*n* = 133); 48.4 (9.4) in working patients (*n* = 232)	84% in work-disabled patients (*n* = 133); 83% in working patients (*n* = 232)	11.0 (8.6) in work-disabled patients (*n* = 133); 9.0 (7.7) in working patients (*n* = 232)	59 % in work-disabled patients (*n* = 133); 42% in working patients (*n* = 232)	Currently working, part-time, full-time or self-employed; currently retired, student, disabled, on sick leave, unemployed, homemaker or other	232/643 (36%) working, 133/643 (21%) work disabled, remainder > 65 years, retired, students, homemakers or unemployed
Nguyen *et al.* [13], France	Cross-sectional	87	SSc patient association and hospitalized patients	48.6 (8.5)	72 (82.8)	8.1 (6.4)	30 (34.5)	Current full-time sick leave status (yes/no); presence and duration of WD pension; work-time duration (part-time or full-time); changes of working time; occupational changes	34/87 (39%) working, [24/87 (28%) full-time, 10/34 (11%) part-time]; 15/34 (44%) changed working time after the diagnosis, 53/87 (61%) on full-time sick leave, 31/87 (36%) had a disability pension, 27/87 (31%)

(continued)

Table 1 Continued

Reference, country	Study design	Number of patients	Patient recruitment and selection	Age, mean (s.d.), years	Female, *n* (%)	Disease duration, mean (s.d.), years	dcSSc, *n* (%)	Definition of work status	Results
									experienced occupational changes after diagnosis
Minier *et al*. [22], Hungary	Cross-sectional	80	Tertiary care centre, SSc patients ⩾ 18 years	57.4 (9.6)	72 (90)	6.2 (6.6)	20 (25)	Working (full-time, part-time); sick leave; disability pension; retired	9/80 (11.3%) working [7 (9%) full-time, 2 (2%) part-time]; 1/80 (1.3%) permanent sick leave; 39/80 (48.8 %) disability allowance; 32/80 (40%) retired
Sandqvist *et al*. [21], Sweden	Cross-sectional	57	Patients aged 20–65 years with SSc living in the Southern region of Sweden	Median 58 (IQR 47–62)	53 (93)	Median 14 (IQR 9–19)	10 (18)	WAI (range 7–49); employment status: working without sickness benefit, partially on sick leave, full-time sick leave or disability pension	Median WAI score 32 (range 16.8–37) and 13/57 (23%) good or excellent WAI (>36); 15/57 (26%) less good WAI (28–36); 20/57 (35%) poor WAI (<28); 16/57 (28%) working without sickness benefit; 20/57 (35%) partial sick leave; 21/57 (37%) full-time sick leave
Berezne *et al.* [15], France	Cross-sectional	189 (113 patients, 18–61 years)	SSc patient association and hospitalized patients	54.1 (13.3)	164 (86.8)	9.3 (8.4)	78/179 (43.6)	Employed, retired, homemaker, student, on sick leave or looking for a job	67/113 (59.3%) employed [42 (37.2%) full-time, 23 (20.3%) part-time]; 27/113 (23.9%) on sick leave at time of inclusion, duration of sick leave 3.4 (4.6) weeks; 7/113 (6.2%) retired early due to SSc; 6/113 (31.8%) full disability pension
Sharif *et al.* [18], USA	Prospective	284	⩾ 18 years, disease onset <5 years at enrolment, defined ethnicity; three hospitals	48.7 (13.2)	237 (83.5)	2.5 (1.6)	162 (57.0)	Work disabled, working and retired or homemaker	Baseline: 131 (46.1%) non-work disabled (Group A), 124 (43.7) work disabled (Group B), 29 (10.2) retired or homemaker (Group C); follow-up: Group A after 3.9 (3.6) years for whole group, 96/131 (73.3%) still working, 35 (26.7%) became work disabled

IQR: interquartile range; NA: not applicable.

TABLE 2 Quality assessment of 12 included studies concerning 13 papers

References	Selection bias present[a]	Information bias present[a]	Statistical analysis bias present[a]	Total score	Level of quality[b]
Descriptive studies					
Minier *et al*. [22]	1	1	NA	2/2	L
Bernatsky *et al*. [23]	1	0	NA[c]	1/2	M
Sandqvist *et al*. [26]	0	0	NA	0/2	H
Moser *et al*. [25]	1	0	NA[c]	1/2	M
Studies concerning an analysis of factors associated with work ability					
Ouimet *et al*. [14]	1	0	0	1/3	M
Mau *et al.* [24]	1	0	0	1/3	M
Hudson *et al.* [17]	0	0	0	0/3	H
Sandqvist *et al.* [16, 27]	0	0	1	1/3	M
Berezne *et al.* [15]	1	0	0	1/3	M
Nguyen *et al.* [13]	1	0	0	1/3	M
Sharif *et al.* [18]	1	0	0	1/3	M
Sandqvist *et al.* [21]	0	0	1	1/3	M

[a]1 = risk of bias; 0 = no risk of bias present. [b]H: high quality—no evidence of selection bias, information bias or analyses bias; M: moderate quality—in one or two quality aspects evidence of risk of bias; L: low quality—all evidence of risk of bias. [c]Multivariate analysis not concerning a work ability outcome.

Patients were recruited through department registers of rheumatology centres/outpatient clinics [14, 16, 21, 22, 27], multicentre registers [17, 23], a national registry [24] or using various recruitment strategies including public announcements or advertisements [13, 15, 18, 25]. The numbers of participants included in the studies varied from 36 to 802, the average ages from 47 to 58 years, the proportions of being female from 82.8 to 100%, the proportions with diffuse subtype SSc from 0 to 59% and the mean/median disease duration from 2.5 to 14 years. Some of the studies employed an inclusion criterion regarding the maximum age of patients [16, 21, 24, 26, 27] in order to only include patients of working age. In addition, none of the studies included only patients who had a paid job at the time of diagnosis.

Methodological quality

Table 2 summarizes the result of the quality assessment. Four studies [22, 23, 25, 26] were only descriptive with respect to work status (maximum 2 points), whereas eight studies [13–18, 21, 24, 27] concerned an analysis of factors associated with work status (maximum 3 points). The methodological quality was rated as high in two studies [17, 26], moderate in nine [13–16, 18, 23–25, 27] and low in one study [22].

Work status in SSc

Measurement methods

Table 1 shows the measurement methods for work status of the 12 studies. One study used a standardized method using data from the general population [24]. In that study, standardized employment ratios (SERs) were used, defined as the ratios of observed and expected numbers of patients with gainful employment. One study used the Work Ability Index (WAI), a combined measure of absenteeism, presenteeism and work ability in relation to demands of the work, psychological resources, number of diagnosed diseases and estimation of own impairment and prognosis [21]. One study reported work status in terms of productivity, defined as the number of self-reported days that the patient was unable to work (market work and unpaid labour) [23]. The other included studies used various operationalizations of work status, mostly proportions of patients who were working, stopped working, were on sick leave or a combination of those [13–18, 22, 25–27]. In some studies, information on work status was gathered as part of other research questions and analyses, including cost of illness [22, 23], psychosocial adjustment [25] and time use and satisfaction with occupation [27].

Work ability outcomes

In the one study that used work ability rates that were standardized using data from the general population, SERs of 0.70 (95% CI 0.52, 0.92) and 0.77 (95% CI 0.67, 0.87) were observed in women with SSc in the new and old federal states of Germany, respectively. The SER of men with SSc also indicated WD; however, these results did not reach statistical significance.

Regarding the outcomes in terms of proportions of patients being employed, Table 1 shows that all but one study [23] provided information in this way. The highest reported percentage was 82% in a Swedish study with 44 female patients with lcSSc and a median disease duration of 8 years [16]. The lowest reported proportion of patients being employed (either part-time or full-time) was 11.3%, observed in a cross-sectional study with 80 patients with SSc with a mean age of 57.4 years and mean disease duration of 6.2 years, of whom 90% were females [22]. Direct comparisons of proportions of patients working need to be interpreted with caution, as the selection of

patients and disease duration varied widely among studies.

With respect to sick leave rates, six studies [13, 15, 16, 22, 26, 27] reported proportions of patients being on partial or full-time sick leave in mostly cross-sectional design, with the rates for full-time sick leave ranging between 1.3 and 61% and part-time sick leave ranging between 8 and 35% in patients with a disease duration varying from 6.2 to 14 years.

Two studies provided information on work status in terms of productivity: Berezne *et al.* [15] reported an estimated SSc-related decreased work productivity of 3.4 (3.8) h/month; Bernatsky *et al*. [23] estimated a lost productivity of paid labour of 5345 Canadian dollars/patient/year.

Work status in patients with SSc as compared with other rheumatic conditions

Two studies included a direct comparison of WD rates in patients with SSc as compared with other rheumatic diseases [14, 24]. In one study, more WD was seen in SSc patients as compared with an age- and sex-matched cohort of RA patients; 55.7 *vs* 34.6% ($P = 0.009$) after a mean disease duration of 11 *vs* 12 years. [14]. In another study [24], the SER was 0.77 in patients with SSc, 0.78 in RA, 0.94 in AS, 0.92 in PsA, 0.81 in SLE and 0.76 in granulomatosis with polyangiitis (Wegener's), with the SERs being significantly different from the general population for all these patient groups.

Determinants of work status

Table 3 shows the results of the eight studies examining determinants of work status [13–18, 21, 24]. In case of both univariate and multivariate analyses, only the results of the multivariate analyses were presented. Overall, there was a large heterogeneity in the included potential determinants of work status, the definitions of the work status, the possible confounders as well as the used analyses.

Table 3 shows that there is moderate evidence for an association between more functional disability, decreased quality of life, more disease-specific symptoms and more WD. Also, moderate evidence was found for the absence of an association between the age, sex and disease subset and WD. Results concerning other predictors of WD, including educational level and other demographic or job characteristics and disease duration, were not consistent.

Discussion

This systematic review on work status and its determinants in SSc included 12 studies. Although the definitions of work status varied widely among studies, the results indicate substantial WD. Moderate evidence was found for an association between functional disability, quality of life and disease-specific symptoms and WD. Also, moderate evidence was found for the absence of an association between the age, sex and disease subset and WD. Results concerning other predictors of WD were not consistent.

With respect to the extent of WD, the majority of studies reported outcomes in terms of proportions of patients working as opposed to proportions of patients who stopped working or were on sick leave or the combination of both. In the included studies, the proportions of patients working varied from 11 [22] to 82% [16], the highest number concerning patients with lcSSc. Only one study [24] used standardized employment rates, demonstrating significantly reduced participation in patients with SSc.

Most studies included in this review had a cross-sectional design and used employment rates and permanent WD as outcome measures, while data on sick leave or presenteeism were presented in relatively few [15, 16, 21, 23]. This is unfortunate, as it was demonstrated in other inflammatory disease that sick leave is an independent risk factor for job loss [28]. Moreover, information on any degree of productivity loss is essential in establishing the economic impact of SSc.

Comparisons of WD rates among studies are hampered by differences in patient populations with respect to disease duration and severity, age and employment rate before the established diagnosis as well as definitions of work status. Comparison between studies performed in the various countries is further limited by differences in populations, differences in work force participation in female and general populations and social security systems.

To facilitate the interpretation and comparison of work status rates within and among patient groups, standardized assessments of WD are recommended, including consensus on the definitions of the various aspects of work status as well as standardization using data from the general population.

In addition, it is questionable whether cross-sectional studies are suitable to describe the impact of SSc on WD. Preferably work ability should be regarded as a continuum in which periods of decreased work productivity while present at work, temporary absence or sick leave may precede or follow periods during which patients are not working at all due to official unemployment, WD, early retirement and/or stopping work voluntarily [29]. Prospective cohort studies are needed to describe productivity gains and losses over time in this continuum model, taking factors such as age, sex, education and other socio-demographic variables, as well as an appropriate description of jobs and job demands into account.

As for the determinants of WD, moderate evidence was found for an association between functional disability, quality of life and disease-specific symptoms and WD. Many factors may influence WD; personal factors (personality, coping mechanisms, education), environmental influences (financial resources, social security systems), work characteristics (physical demanding or not, flexibility in working hours, aids and other occupational interventions), pharmacological or non-pharmacological treatment and vocational therapy. Sandqvist *et al*. [16] observed less sick leave in patients with less physically demanding

Table 3 Results of eight studies describing factors associated with WD in patients with SSc

Study	Methodological quality[a]	Dependent variable, method	Independent variables							
			Age	Sex	Educational level and other demographic or job characteristics	Subset dcSSc	Disease duration	Functional disability	(Self-perceived) disease specific symptoms	Quality of life and other characteristics of health status
Mau *et al.* [24]	M	SER = observed/expected employment (95% CI)	NA	NA	Significantly higher SER in old Federal states (0.90) compared with new Federal states (0.80) in subgroup of women with SSc and >9 years of education[b]	NA	Significantly higher SER in subgroups of women with a disease duration 6–10 years and >10 years but not in women with disease duration ⩽ 5 years	NA	NA	NA
Sandqvist *et al.* [16, 27]	M	Work status: working full-time *vs* partial sick leave *vs* full-time sick leave or disability pension	NS	NA	NA	NA	NA	Greater working ability significantly associated with: better dexterity, more grip force, better capacity to perform occupations, more occupations performed, more satisfaction with occupations	Greater working ability significantly associated with: better skin score, less fatigue, less breathlessness	Greater working ability significantly associated with better self-rated health and greater general life satisfaction
Ouimet *et al.* [14]	M	WD *vs* non-WD	NS	NS	Significantly less patients who completed high school in WD *vs* non-WD group	NS	NS	Significantly higher HAQ-DI score in work disabled *vs* non-work disabled group.	NS regarding HAQ pain score	NA
Hudson *et al.* [17]	H	WD (multivariate) generalized linear mixed models (number 4 AUC 84.7%)	Unclear	Unclear	Unclear	NS (but models 1–3 significantly more dcSSc in WD)	Longer disease duration significantly associated with WD	Worse physical function significantly associated with WD	Worse pain and fatigue significantly associated with WD except if association with HAQ was added	Worse comorbidity score significantly associated with WD
Nguyen *et al.* [13]	M	Sick leave *vs* no sick leave; and WD pension *vs* no WD pension	NS	NS	NA	NS	NS	Significantly worse scores regarding global disability (HAQ, Karnofsky performance status), hand disability, mouth disability in patients on sick leave as compared with no sick leave, significantly worse Karnofsky performance status in patients with WD pension	Higher proportion of patients with myalgia in the sick leave group	Worse depression score in sick leave group, no significant differences in quality of life (SF-36) or emotional status (HADS)

(continued)

Table 3 Continued

Study	Methodological quality[a]	Dependent variable, method	Independent variables							
			Age	Sex	Educational level and other demographic or job characteristics	Subset dcSSc	Disease duration	Functional disability	(Self-perceived) disease specific symptoms	Quality of life and other characteristics of health status
Sandqvist *et al.* [21]	M	WAI; three subgroups good, less good and bad	NS	NS	NS	NS	NS	Visual analogue scale for hand function better in patients with better WAI scores. Scleroderma functional score and satisfaction with activities better in patients with better WAI scores	Visual analogue scales for fatigue, general pain, general stiffness, scars/ulcers better in patients with better WAI scores	Significantly greater life satisfaction and empowerment scores in patients with better WAI scores
Berezne *et al.* [15]	M	Workers *vs* work disabled non-workers	Significantly higher age in work disabled[c]	NS	NA	NS	Significantly longer disease duration in work disabled[c]	Significantly more global disability (HAQ) and hand disability (CHFS) in work disabled[c]	NA	Worse SF-36 physical component scale score in work disabled non-workers[c]
Sharif *et al.* [18]	M	WD at baseline or development of WD between baseline and follow-up	NS[d]	NS	Lower level of education and less social support associated with more WD at baseline; non-white ethnicity associated with development of WD at follow-up[d]	NS	NS	NS[d]	Higher Medsger Severity Index, higher Fatigue Severity Score significantly associated with more WD at baseline [d]; poorer lung function and higher Fatigue Severity Score associated with development of WD during follow-up	NA
Best evidence synthesis			Moderate evidence for lack of association	Moderate evidence for lack of association	Inconsistent Evidence	Moderate evidence for lack of association	Inconsistent evidence	Moderate evidence for positive association	Moderate evidence for positive association	Moderate evidence for positive association

[a]H: high; M: moderate; L: low. [b]In old Federal states unemployment rates were lower than in new Federal states. [c]Multivariate analysis; higher age, higher disease duration, poorer functional ability (HAQ and CHFS) independent risk factors forWD. [d]Multivariate analysis; higher age, not being married, poorer functional ability (HAQ), poorer lung function, more pain and shortness of breath, poorer Quality of Life (SF-36), poorer scores on helplessness and illness behaviour and more comorbidities associated with more WD at baseline in univariate analyses. AUC: area under the ROC curve; CHFS: Cochin Hand Function Scale; HAQ-DI: Health Assessment Questionnaire-Disability Index; SF-36: short form 36; HADS: Hospital Anxiety and Depression Scale depression dimension; NA: not applicable, i.e. not included in the analysis; NS: not significant.

work. As for work-dependent influences on WD, no other determinants were evaluated, nor the effect of any kind of medical or rehabilitative treatment on WD. Given the general observation that WD in SSc is substantial, more research targeted at potentially modifiable factors (e.g. disease severity by optimizing medical treatment and job demands by vocational rehabilitation) is urgently needed.

The question remains how the severity of WD in SSc compares with that in other rheumatic conditions. Comparisons of WD rates in patients with other rheumatic conditions reported in other individual studies or reviews are difficult to make, as patient populations may differ largely with respect to age, sex and disease duration, and the definitions of outcomes related to work status also vary. However, two studies included in this review included one or more populations of patients with other inflammatory rheumatic conditions, allowing a direct comparison. In one study it appeared that WD in SSc was more frequent than in RA [14], whereas in another study the relative risk of higher/lower SER was comparable with RA [24].

Limitations of this review include the fact that statistical pooling of data was not applied due to the heterogeneity of data. A best evidence synthesis was employed, which accounted for the methodological quality of the studies. Moreover, this systematic review focused on paid labour only. The female predominance and older age in SSc patients warrants more research on the impact of the disease on unpaid labour. Future studies on WD should therefore distinguish between paid and non-paid work in order to establish the full impact of SSc on any kind of productivity.

Although the differences in outcomes and definitions of WD make the generalization of results challenging, this review shows that WD in SSc is substantial. The validity of data on WD and its predictors could be improved by prospective studies with clearly defined patient characteristics as well as end-points for all dimensions of work productivity loss. An important question remains if a patient's risk of permanent WD can be diminished. Much knowledge could be gained if work status was used as an outcome measure in trials concerning pharmacological or non-pharmacological treatment. In other rheumatic diseases, the effectiveness of biological therapy [30] and vocational therapy on the prevention of WD [31] was demonstrated, whereas no studies on this subject in SSc patients are known.

Rheumatology key messages

- WD in patients with SSc is substantial.
- WD is related to functional ability, disease-specific symptoms and quality of life.

Disclosure statement: The authors have declared no conflicts of interest.

Supplementary data

Supplementary data are available at *Rheumatology* Online.

References

1 Clements PJ, Furst DE. Systemic sclerosis, 2nd edn. Philadelphia, PA: Lippincott Williams & Wilkins, 2004:17–28.

2 LeRoy EC, Black C, Fleischmajer R *et al*. Scleroderma [systemic sclerosis]: classification, subsets and pathogenesis. J Rheumatol 1988;15:202–5.

3 Denton CP, Black CM. Scleroderma–clinical and pathological advances. Best Pract Res Clin Rheumatol 2004;18:271–90.

4 Haythornthwaite JA, Heinberg LJ, McGuire L. Psychologic factors in scleroderma. Rheum Dis Clin North Am 2003;29:427–39.

5 Richards HL, Herrick AL, Griffin K *et al*. Systemic sclerosis: patients' perceptions of their condition. Arthritis Rheum 2003;49:689–96.

6 World Health Organization. ICF: International Classification of Functioning, Disability and Health. Geneva, Switzerland: WHO, 2001.

7 Hudson M, Thombs BD, Steele R *et al*. Clinical correlates of quality of life in systemic sclerosis measured with the World Health Organization Disability Assessment Schedule II. Arthritis Rheum 2008;59:279–84.

8 Merkel PA. Measurement of functional status, self-assessment, and psychological well-being in scleroderma. Curr Opin Rheumatol 1998;10:589–94.

9 Rannou F, Poiraudeau S, Berezne A *et al*. Assessing disability and quality of life in systemic sclerosis: construct validities of the Cochin Hand Function Scale, Health Assessment Questionnaire, Systemic Sclerosis HAQ, and Medical Outcomes Study 36-Item Short Form Health Survey. Arthritis Rheum 2007;57:94–102.

10 Allaire SH. Update on work disability in rheumatic diseases. Curr Opin Rheumatol 2001;13:93–8.

11 Verstappen SM, Bijlsma JW, Verkleij H *et al*. Overview of work disability in rheumatoid arthritis patients as observed in cross-sectional and longitudinal surveys. Arthritis Rheum 2004;51:488–97.

12 Boonen A, de Vet H, van der Heijde D, van der Linden S. Work status and its determinants among patients with ankylosing spondylitis. A systematic literature review. J Rheumatol 2001;28:1056–62.

13 Nguyen C, Poiraudeau S, Mestre-Stanislas C *et al*. Employment status and socio-economic burden in systemic sclerosis: a cross-sectional survey. Rheumatology 2010;49:982–9.

14 Ouimet JM, Pope JE, Gutmanis I, Koval J. Work disability in scleroderma is greater than in rheumatoid arthritis and is predicted by high HAQ scores. Open Rheumatol J 2008;2:44–52.

15 Berezne A, Seror R, Morell-Dubois S *et al*. Impact of systemic sclerosis on occupational and professional activity with attention to patients with digital ulcers. Arthritis Care Res 2011;63:277–85.

16 Sandqvist G, Scheja A, Eklund M. Working ability in relation to disease severity, everyday occupations and well-being in women with limited systemic sclerosis. Rheumatology 2008;47:1708–11.

17 Hudson M, Steele R, Lu Y, Thombs BD, Baron M. Work disability in systemic sclerosis. J Rheumatol 2009;36: 2481–6.

18 Sharif R, Mayes MD, Nicassio PM *et al*. Determinants of work disability in patients with systemic sclerosis: a longitudinal study of the GENISOS Cohort. Semin Arthritis Rheum 2011;41:38–47.

19 Shamliyan T, Kane RL, Dickinson S. A systematic review of tools used to assess the quality of observational studies that examine incidence or prevalence and risk factors for diseases. J Clin Epidemiol 2010;63:1061–70.

20 Hayden JA, Cote P, Bombardier C. Evaluation of the quality of prognosis studies in systematic reviews. Ann Intern Med 2006;144:427–37.

21 Sandqvist G, Scheja A, Hesselstrand R. Pain, fatigue and hand function closely correlated to work ability and employment status in systemic sclerosis. Rheumatology 2010;49:1739–46.

22 Minier T, Pentek M, Brodszky V *et al*. Cost-of-illness of patients with systemic sclerosis in a tertiary care centre. Rheumatology 2010;49:1920–8.

23 Bernatsky S, Hudson M, Panopalis P *et al*. The cost of systemic sclerosis. Arthritis Rheum 2009;61:119–23.

24 Mau W, Listing J, Huscher D, Zeidler H, Zink A. Employment across chronic inflammatory rheumatic diseases and comparison with the general population. J Rheumatol 2005;32:721–8.

25 Moser DK, Clements PJ, Brecht ML, Weiner SR. Predictors of psychosocial adjustment in systemic sclerosis. The influence of formal education level, functional ability, hardiness, uncertainty, and social support. Arthritis Rheum 1993;36:1398–405.

26 Sandqvist G, Akesson A, Eklund M. Daily occupations and well-being in women with limited cutaneous systemic sclerosis. Am J Occup Ther 2005; 59:390–7.

27 Sandqvist G, Eklund M. Daily occupations—performance, satisfaction and time use, and relations with well-being in women with limited systemic sclerosis. Disabil Rehabil 2008;30:27–35.

28 de Buck PD, de Bock GH, van Dijk F *et al*. Sick leave as a predictor of job loss in patients with chronic arthritis. Int Arch Occup Environ Health 2006;80:160–70.

29 Boonen A, Severens JL. The burden of illness of rheumatoid arthritis. Clin Rheumatol 2011;30(Suppl. 1): S3–8.

30 van den Hout WB, Goekoop-Ruiterman YP, Allaart CF *et al*. Cost-utility analysis of treatment strategies in patients with recent-onset rheumatoid arthritis. Arthritis Rheum 2009;61:291–9.

31 Vliet Vlieland TPM, de Buck PDM, van den Hout WB. Can anti-TNF agents protect against rheumatoid arthritis associated work disability? Int J Clin Rheum 2009;4: 523–31.