

Research Paper

## Self-reported sickness absence as a risk marker of future disability pension. Prospective findings from the DWECS/DREAM study 1990-2004

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**Objectives:** This prospective cohort study examines number of self-reported days of sickness absence as a risk marker for future disability pension among a representative sample of employees in Denmark 1990-2004.

**Material and methods:** 4177 employees between 18 and 45 years were interviewed using a self-administered questionnaire in 1990 regarding sickness absence, age, gender, socioeconomic position, health behaviour, and physical and psychosocial work environment. They were followed for 168 months in a national disability pension register. Logistic regression analysis was performed in order to assess risk estimates for levels of absence and future disability pension.

**Results:** During follow-up, a total of 140 persons (3.4%) received disability pension. Of these, 82 (58.6%) were women, 58 (41.4%) were men. There was a 2.5 fold risk of future disability pension for the part of the population reporting more than 6 days of sickness absence per annum at baseline, when taking into account gender, age, socioeconomic position, health behaviour, physical and psychosocial work environment.

**Conclusion:** The findings suggest that information on self-reported days of sickness absence can be used to effectively identify "at risk" groups for disability pension.

**Key words:** Sickness absence, self-reported, disability pension, prospective, Denmark

### 1. Introduction

Costs of disability pensions are steadily growing in many European and Scandinavian countries and in the United States [1, 2]. In the UK, for example, expenditure on disability pensions accounted for 0.9% of Gross Domestic Product (GDP) in 1980, but two decades later had reached 2.6% of GDP [1]. Corresponding trends have been observed in other countries [3].

Currently, approximately 8% of the Danish population between 20 and 64 years of age receive permanent disability benefits [3]. According to Statistics Denmark, costs for disability pension and rehabilitation in Denmark have risen from 4.5 bn Euros in 1995 to 8.1 bn Euros in 2004 ([www.statistikbanken.dk](http://www.statistikbanken.dk)). Furthermore, work disability costs in terms of worsening of individual wellbeing due to exclusion from working life have also been proven to be substantial in previous studies: work disabled are more prone to experience various future consequences in terms of social inactivity and isolation, suicide, and poor financial circumstances [4].

There seems to be increasing recognition of the abilities of certain measures of sickness absence to measure physical, psychological, and social functioning as well as to predict hard end points such as mortality in working populations [5-7]. In contrast, only few studies have assessed predictive abilities of sickness absence in terms of future disability pension [8-10]. In the Finnish 10-town study among 46 589

municipal employees, sickness absence periods longer than 3 days were a stronger predictor of later disability pension than were shorter sickness absence periods [9]. Among 10 077 long-term sickness absentees from a random sample of the Norwegian population, disability pension was predicted by sickness absence periods exceeding 28 weeks [10]. In addition, there are a few small-scale studies with varying definitions of sickness absence and these studies have also reported a link between increased sickness absence and elevated risk of future disability pension [11-13].

As disability pensions are rare events, the sample size and follow-up periods in most previous studies may be too small for a detailed analysis of the association between absence duration and pension risk. Moreover, most studies were based on either company- or administratively collected absence data, which may not always be obtainable, and mostly in countries with a welfare system providing and registering compensation for absence and disability. We therefore studied the predictive abilities of an absence measure which does not presuppose such a system, and can be applied to surveys in various settings.

The aim of this study was to examine the associations between days of self-reported sickness absence and future disability pension in a population of employees in Denmark in 1990. To determine specifically whether self-reported sickness absence represents a risk marker sufficiently distant to provide time to in-

tervene and potentially prevent early disability pension, we performed analysis for 4174 employees between 18 and 45 years of age at study entry.

## 2. Methods

The study is based upon the database DWECS/DREAM [14]; a merger between the Danish Work Environment Cohort Study (DWECS) and the national register on social transfer payments (DREAM). DREAM is a register based on data from the Danish Ministry of Employment, the Ministry of Social Affairs and the Ministry of Education. DWECS was conducted in 1990, and featured a random sample drawn from the Central Population Register of Denmark of 9653 people aged 18-59. Of these, 8664 participated in the survey (response rate 90%). Of these, 5940 were employees, meaning they had been employed for at least two months prior to baseline interview. They were interviewed using a self-administered questionnaire regarding sickness absence during the 12 months prior to interview, and the covariates age, gender, socioeconomic position, health behavior and work environment exposures.

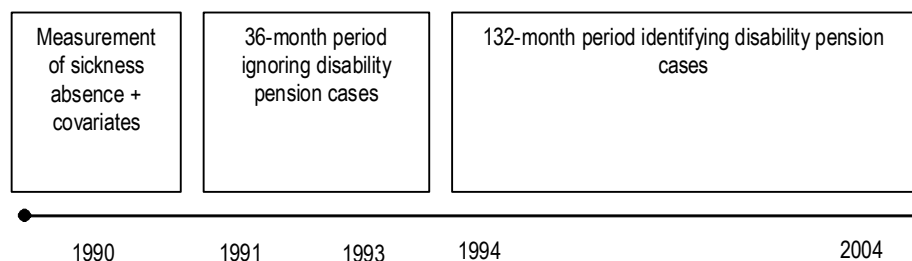
Growing numbers of younger disability pension recipients are a particular problem as they may be beneficiaries for decades: An upper cut-off point of 45 years of ages was chosen to ensure a study population considerably younger than the official retirement age, and to ensure a maximum age of 59 during follow-up: Alternative labour market exit options in terms of voluntary early retirement is available from age 60 on the Danish labour market. A total of 4177 respondents were between 18 and 45 years of age. They were followed for 168 months in DREAM, which contains information on all social transfer payments for all citizens in Denmark since mid 1991, including granted disability pension. The type of social transfer payment

is reported per week for each person. DREAM includes approximately 3.4 million people and is updated every three months. The weekly information on transfer payments is registered if a person has received any kind of transfer payment for more than one day. It is possible to register only one type of transfer payments in any given week, and if more are obtained, the system will in those cases overwrite the codes when the information is updated. Disability pension though, always has the higher priority.

In the present study we have analysed the determinants measured using the baseline DWECS questionnaire and disability pension data derived from DREAM among the 4177 persons categorized as 18-45 year old employees at baseline.

## Outcome

A disability pension case was defined from onset of receiving disability pension according to DREAM. During the three-year wash-out period from 1991 through 1993, a total of 3 persons where either disability pensioned, emigrated or died. They were excluded from the study, as they were no longer under risk of disability pension in the follow-up period from 1994 through 2004. This left a total of 4174 employees aged 18-45 in 1990 to be under risk for disability pension from 1994 to 2004. These 4174 employees constitute the basis of analysis in this study. To eliminate confounding attributable to sickness absence periods immediately prior to disability pension, the follow-up period for disability pension started 36 months after the assessment period of sickness absence. Hence disability pension cases were identified from 1 January 1994 to 31 December 2004. The 168-month follow-up thus consists of a 36-month wash-out period and a 132-month follow-up of disability pension cases. The study design is shown in Figure 1.



**Figure 1.** Self-reported sickness absence and future disability pension 1990-2004. Study design.

### Self-reported sickness absence

Sickness absence was measured using one question: 'How many workdays in total have you been sickness absent within the last 12 months?' The variable was divided into quartiles Q1 to Q4. As 35% of the study population reported 0 days of sickness absence per annum, it was not possible to create quar-

tiles of equal size: Q1 included the part of the population with least (0) absence (35% of the population), Q2 included 17% of the population, Q3 23%, and Q4 consisted of the 25% with most absence (see Table 1).

### Potential confounders

Age, gender and socioeconomic position

The study includes data on gender and baseline

age of the individual employee. Based on employment grade, job title, and education respondents were classified into five socio economic position groups; I: executive managers and/or academics, II: middle managers and/or 3-4 years of further education, III: other white collar workers, IV: skilled blue-collar workers, and V: semi-skilled or unskilled workers.

#### Health behaviour

Smoking status was divided into three categories: current smokers, previous smokers and never-smokers.

Body Mass Index (BMI) was calculated by dividing weight in kilograms with squared height in meters and categorized according to the standardized classification of the National Institutes of Health using four categories: underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), and obesity (>30).

#### Work environment exposures

Physical exposures at work were measured by 4 questions on how much of the time the respondent had physically strenuous work; worked with arms lifted above the shoulders; lifted burdens heavier than 20 kilograms; or worked in a standing or squatting position. The six response options ranged from 'never' to 'almost all the time'. In the analyses the 4 items were dichotomised with 'never' and 'almost never' as one answer category and the remaining four options as the second answer category.

Psychosocial exposures at work were measured by using 18 items combined into five scales: skill discretion, decision authority, social support, job demands and conflict at work. The five scales were dichotomized around the 75% quartiles. Scale characteristics are described elsewhere [15].

#### Analysis

Logistic regression methods were used to analyse the associations between the risk factors and the outcome variable. The analysis was performed in three stages: initially, analysis was performed to establish the association between days of sickness absence in 1990 and disability pension during follow-up. This first step was controlled for age, gender and socioeconomic position. The second step included the variables measuring health behaviour. The third and final step introduced the psychosocial and physical work environment variables. The Cochran-Armitage trend test was performed in order to test if a gradual increase in sickness absence was associated with increase in risk of disability pension. The SAS procedure PROC GENMOD (SAS version 9.1) was used to perform the logistic regression analyses.

### 3. Results

During follow-up, a total of 140 persons (3.4%) received disability pension. Of these, 82 (58.6%) were women, 58 (41.4%) were men. There was an excess risk of future disability pension for the quartile of the population with most absence (more than 6 days per annum) compared to those with no absence, when taking into account gender, age and socioeconomic position. There was no significant effect of gender, whereas there was a significant increase in risk with increasing age. People in socioeconomic positions III, IV and V all had significantly higher risk of future disability pension than those in socioeconomic position (table 1, model I).

The introduction of health behaviour variables into the model did not alter the results of model I. The OR for more than 6 days of absence per annum decreased from 2.77 to 2.68, and remained significant. There was an increased risk of disability pension for people who were smokers at baseline, whereas there was no effect of BMI (table 1, model II).

Introducing the work environment variables explained part of the gradient in disability pension risk between socioeconomic positions. Risk in socioeconomic position V decreased from OR 3.74 to OR 2.76, and the excess risk in socioeconomic position IV was no longer significant. After adjusting for age, gender, socioeconomic position, and physical and psychosocial work environment exposures, the quartile of the employees reporting most absence from work, more than 6 days per annum, had a significantly increased risk of future disability pension (OR = 2.51). Age, socioeconomic position, smoking and high physical demands in work remained significant independent predictors of future disability pension (table 1, model III).

More women than men had sickness absence exceeding 6 days per annum, and more women than men received disability pension during follow-up. The association between <6 days of sickness absence per annum and disability pension was significant for both genders, but was stronger among men (OR=3.13) than among women (OR=2.19) (Table 2).

Additional analysis treating days of sickness absence during 1990 as a continuous variable showed a clear trend of increase in disability pension risk with increase in absence days/yr. A 10-day increase in absence days per annum (scale score ranging from 0-220 days/yr) yielded an increase in disability pension risk of approximately 35% (Cochran-Armitage trend test  $p < 0.0001$ ), also when taking into account various confounders (Table 3).

**Table 1** Odds ratios and 95% CI's for determinants in 1990 for disability pension in 1994-2004 among 4174 employees

Risk factor	Level	N	Cases	Model I			Model II			Model III			
				OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	
Days of absence/yr	Q4	>6	1026	58	<b>2.77</b>	<b>1.77-4.33</b>	<b>0.00</b>	<b>2.68</b>	<b>1.70-4.24</b>	<b>0.00</b>	<b>2.51</b>	<b>1.58-3.99</b>	<b>0.00</b>
	Q3	3-6	980	33	1.58	0.96-2.61	0.07	1.58	0.95-2.63	0.08	1.49	0.89-2.49	0.12
	Q2	1-2	719	15	1.10	0.59-2.05	0.77	1.14	0.61-2.14	0.68	1.13	0.60-2.14	0.70
	Q1	0	1449	34	1.00			1.00			1.00		
Gender	Female	2003	82	1.35	0.92-1.98	0.12	1.42	0.95-2.13	0.09	1.48	0.98-2.24	0.06	
	Male	2171	58	1.00			1.00			1.00			
Age	40-45	1024	64	<b>4.88</b>	<b>3.02-7.88</b>	<b>0.00</b>	<b>5.05</b>	<b>3.09-8.24</b>	<b>0.00</b>	<b>5.41</b>	<b>3.30-8.86</b>	<b>0.00</b>	
	30-39	1596	50	<b>2.10</b>	<b>1.28-3.45</b>	<b>0.00</b>	<b>2.13</b>	<b>1.29-3.51</b>	<b>0.00</b>	<b>2.17</b>	<b>1.31-3.59</b>	<b>0.00</b>	
	18-29	1554	26	1.00			1.00			1.00			
Socioeconomic position	V	940	41	<b>4.13</b>	<b>1.72-9.93</b>	<b>0.00</b>	<b>3.74</b>	<b>1.54-9.08</b>	<b>0.00</b>	<b>2.76</b>	<b>1.09-6.98</b>	<b>0.03</b>	
	IV	439	13	<b>3.24</b>	<b>1.20-8.73</b>	<b>0.02</b>	<b>3.13</b>	<b>1.16-8.47</b>	<b>0.02</b>	2.31	0.82-6.50	0.11	
	III	1472	56	<b>3.08</b>	<b>1.30-7.30</b>	<b>0.01</b>	<b>2.95</b>	<b>1.24-7.03</b>	<b>0.01</b>	<b>2.41</b>	<b>1.00-5.83</b>	<b>0.05</b>	
	II	789	21	1.93	0.76-4.90	0.17	1.74	0.68-4.47	0.25	1.52	0.59-3.91	0.39	
Smoking	I	492	6	1.00			1.00			1.00			
	Yes	1925	89				<b>1.66</b>	<b>1.10-2.49</b>	<b>0.02</b>	<b>1.61</b>	<b>1.07-2.43</b>	<b>0.02</b>	
	Former	686	14				0.71	0.38-1.35	0.30	0.71	0.38-1.34	0.29	
BMI	Never	1563	37				1.00			1.00			
	<18.5	151	6				1.15	0.49-2.74	0.75	1.17	0.49-2.79	0.73	
Decision authority	>30	159	4				0.54	0.19-1.51	0.24	0.58	0.21-1.63	0.30	
	25-30	838	30				1.03	0.66-1.61	0.90	1.02	0.65-1.60	0.93	
	18.5-25	3007	98				1.00			1.00			
Skill decision	Low	1040	45							1.14	0.77-1.71	0.51	
	High	3134	95							1.00			
Social support	Low	1003	45							1.24	0.82-1.86	0.30	
	High	3171	95							1.00			
Conflicts at work	Low	1034	33							0.73	0.48-1.12	0.15	
	High	3140	107							1.00			
Psychological demands	High	860	34							1.20	0.78-1.84	0.41	
	Low	3314	106							1.00			
Physical demands	High	1029	33							0.90	0.59-1.38	0.62	
	Low	3145	107							1.00			
Work with arms lifted	High	655	41							<b>1.88</b>	<b>1.20-2.95</b>	<b>0.01</b>	
	Low	3518	99							1.00			
Work standing/squatting	Yes	651	29							0.96	0.60-1.54	0.87	
	no	3518	111							1.00			
Lift > 20 kg	Yes	756	38							1.29	0.81-2.04	0.28	
	No	3413	102							1.00			
Lift > 20 kg	Yes	701	36							1.08	0.67-1.73	0.76	
	No	3470	104							1.00			

**Table 2** Odds ratios and 95% CI's for levels of sickness absence in 1990 for disability pension in 1994-2004 among 2003 female and 2171 male employees. Adjusted for age, socioeconomic position, health behaviour and work environment.

Risk factor	Level	N	Cases	Model III, women				Model III, men				
				OR	95% CI	P	N	Cases	OR	95% CI	P	
Days of absence/yr	Q4	>6	579	35	<b>2.19</b>	<b>1.19-4.03</b>	<b>0.01</b>	447	23	<b>3.13</b>	<b>1.51-6.51</b>	<b>0.00</b>
	Q3	3-6	472	17	1.24	0.62-2.48	0.54	508	16	1.96	0.90-4.29	0.09
	Q2	1-2	332	10	1.19	0.53-2.65	0.68	387	5	1.14	0.39-3.29	0.81
	Q1	0	620	20	1.00			829	14	1.00		

**Table 3** Odds ratios and 95% CI's per 10-day increase in days of sickness absence in 1990 for disability pension in 1994-2004 among 4174 employees. Model I adjusted for age, gender, socioeconomic position. Model II further adjusted for health behaviour. Model III further adjusted for work environment.

Risk factor	Model I			Model II			Model III		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
10-day increase in absence/yr	<b>1.35</b>	<b>1.18-1.54</b>	<b>0.00</b>	<b>1.34</b>	<b>1.18-1.54</b>	<b>0.00</b>	<b>1.34</b>	<b>1.16-1.54</b>	<b>0.00</b>

#### 4. Discussion

We found that the quartile of the employees reporting most sickness absence (more than 6 days per

annum) to have a risk of future disability pension 2.51 times higher than those reporting no sickness absence, taking into account the effects of age, gender, socioeconomic position, health behaviour, physical and

psychosocial work environment.

### Comparison with other studies

Sickness absence can be viewed as an integrated measure of physical, psychosocial, and social function and wellbeing [5-7]. As such, sickness absence levels can reflect an increased risk of developing poor physical, psychosocial, or social health, which over time can lead to permanent work disability. In the few studies on sickness absence and future disability, most study populations are relatively homogeneous with regards to jobs and occupations: The Finnish 10-town study was performed among municipal employees [9], another among blue collar workers in Poland [11], and thus more homogeneous also with regard to work environment exposures than the working population in general. This will reduce exposure contrast and reduce the generalizability of the results, and the findings may therefore not apply to the general population.

The present study and the study by Gjesdal and Bratberg [10] are to our knowledge the only two studies on a random sample of the working population.

Disability pensions are rare events, therefore sample size in some previous studies may be too small or a detailed analysis of the association between sickness absence and pension risk. For example, in Borg et al. the study population consisted of 213 individuals. Also due to the low incidence of disability pensioning, the follow-up period is of importance [13]. In the present study the availability of prospective data covering a 14-year period provided sufficient disability pension information for these analyses.

### Methodological issues

The DWECS/DREAM study provides data from a large representative sample of the Danish working population. Further, selection bias is minimized from the sampling procedure, due to a 90% response rate. However, a source of error could be that non-responders may have had a different work environment or health from those who replied: If we assume non-responders to have poorer health and more sickness absence than responders, this would underestimate the strength of the association between sickness absence and disability pension found in this study. The design utilizes a 36 month wash-out period, thereby avoiding that the disability pension period began immediately after the sickness absence assessment period. Thereby sickness absence does not run directly into a disability pension, which could otherwise seriously inflate observed associations.

Reforms of the Danish disability pension schemes have been performed during the study period in order to restrict access to permanent disability pension. This could imply that the strength of the association between absence and disability pension could vary during the follow-up period: Sickness absence would probably be stronger associated with a disability pension case occurring in the latter part of the follow-up period, than would be the case for a disability pension case occurring in the beginning of the follow-up period.

Most previous studies on disability were based on information on sickness absence from either company- or administratively collected absence data. We used self-reported data on sickness absence which, in contrast to company- or administrative data, is not based on a workplace- or community based infrastructure

Only a few studies have been conducted on the quality of sickness absence measurements used in occupational research [16-22], and based on these studies it seems that self-reported sickness absence data and employer recordings are equally useful when the recall period is under two months. By using employer records, the problem of recall bias is eliminated. Nevertheless, any systematic recording of non-illness related absence as well as sickness absence in the lower occupational grade, or under-recording in the higher occupational grades may introduce another source of bias.

In relation to our study the basic retrospective measure of frequency was used 'How many workdays in total have you been sickness absent within the last 12 months?' According to the majority of the found studies, the recall period is too long, and the possibility of a systematic over- or underestimation of sickness absence is present, most probably a systematic underestimation [18]. However, the question of recall time is an issue when assessing "true" levels of sickness absence. It does not affect the predictive abilities of the self-reported item on sickness absence as a marker of future disability pensioning.

### 5. Conclusion

The findings of in the present study indicate that the number of self-reported sickness absence days can be used as a risk marker of future disability pension, and may provide useful information for policy makers, case managing authorities, employers, and physicians responsible for interventions aiming at reducing permanent work disability.

### Conflict of interest

The authors have declared that no conflict of interest exists.

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