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Abstract

Background. The comprehensive consequences of atopic dermatitis (AD) include a negative influence on work-life. However, data regarding use of social benefits in patients with AD is sparse.

Objective. To examine the association between AD and use of social benefits, with a specific focus on paid sick leave and disability pension.

Methods. The study cohort comprises citizens born in the period 1964 – 1999 with a diagnosis of AD registered in the Danish National Patient Registry (DNPR) and a 20-fold match control group from the background population. Cross-linkage of data from 1964 up to 2015 by four national registers (The DNPR; the Central Person Register; the Register of Medicinal Product Statistics; and the Danish Register for Evaluation of Marginalisation) enabled the comparison of AD patients and controls with respect to social benefits. Prescription of systemic medication served as a proxy for AD severity. Social benefits were analysed as a function of AD status using cox regression.

Results. A total of 28,156 AD-patients were registered in the DNPR, and the control group comprised 473,836 individuals not registered with AD in the DNPR. AD was found to be associated with increased risk of receiving social benefits, paid sick leave in particular and most pronounced for younger patients with severe AD (OR = 1.37, 95% CI 1.25-1.52). The use of disability pension was increased for all groups of AD patients compared to controls, most pronounced for older patients with severe AD (HR 1.67 (95% CI 1.45-1.93)).

Conclusions. Our data emphasizes that AD significantly impact work-life negatively for the patients and is a financial burden for the society.

Introduction

Though the prevalence of atopic dermatitis (AD) is highest in childhood (1, 2), the chronic nature of the disease imposes a burden to the patient and society also in adulthood. Recent studies report a prevalence of 6-10%, in adults, which is higher than previously reported (3-9). Furthermore, a Danish study found persistent AD in 50% of an adult population diagnosed with AD in school age (9). Considering the high prevalence, chronicity and clinical manifestations of AD, the multidimensional consequences of the disease are substantial (10-16).

The individual and public health burden due to AD includes the impact on work-life.

Particularly, increased sick leave (17-19), decreased work productivity (20, 21), influence on educational or occupational choice (22, 23) and job change (17) in AD patients have been described, and these effects of the disease constitute also a financial burden to the society.

Previous studies estimated the medical costs of AD incurred by the payer in the United States to be 0.9 to 3.8 billion totally in 1997 (24), and based on data from 2005 Fowler et al. found the total indirect work-loss costs of disability and sick leave to be significantly increased in workers with AD (25). An increase was reported in disability pension granted due to AD over the last decades in Denmark (26), however with no comparison to other patient groups.

Knowledge on social benefits, including long term paid sick leave and granted disability pensions in patients with AD is sparse (23, 26, 27), and needs to be further expanded. The aim of this study was to examine the association between AD and social benefits with a specific focus on paid sick leave and disability pensions in the Danish population. Our hypotheses were

that adults with AD, particularly severe AD, are burdened in their work-life leading to (a) an increased risk of receiving social benefits from the government, (b) having longer periods with paid sick leave and, ultimately, (c) having a higher risk of disability pension compared to the background population.

Materials and Methods

Study population and design

The study cohort comprises patients born between 1st of January 1964 and 31st of December 1999, and recorded with AD in the Danish National Patient Registry (DNPR) before December 31st, 2015 (28). Since the DNPR, which was founded in 1977, recorded inpatients only until 1995, and hereafter also outpatients, the AD study population was divided into two groups. Group 1 was born 1964-1976 and group 2 was born 1977-1999. Thus, patients in group 1 had a minimum age of 13 years for a recorded inpatient AD diagnosis, and a minimum age of 30 years for a recorded outpatient AD diagnosis, while in group 2 the minimum age was 0 and 17 years for a recorded inpatient and outpatient AD diagnosis, respectively.

Each AD patient was individually matched on gender, year of birth and place of birth by municipality with a 20-fold match control group (no history of hospital registered AD) in the general population. According to the matching criteria an exact matching of 1:20 was not possible. An overview of the selection, as well as inclusion and exclusion criteria for both AD patients and controls are given in Fig. 1 and 2, respectively. The final analyses comprised 28,156 AD patients and 473,836 controls.

Registries

The Central Personal Register (CPR) comprises a unique and permanent personal identification number assigned to all Danish citizens at birth or upon immigration. This number is unambiguous and links administrative and health registers. The identification number is used in Danish registers whenever a person is in contact with a public or governmental institution, enabling cross-linkage of different registers on an individual level.

The Danish National Patient Registry (DNPR) records patients attending hospitals (inpatients and outpatients) with a Danish version of the International Classification of Diseases (ICD 8 or ICD10). For details see Suppl. Table 1. AD-patients not referred to hospital are not registered in the DNPR. Patients with asthma and/or allergic rhinitis attending hospitals were likewise recorded in the DNPR defined by ICD8 and ICD10 codes (Suppl. Table 1). Register data with AD diagnosis has previously been validated in children (29) as well as in adults (30).

The Register of Medicinal Product Statistics (RMPS) (31) records all pharmacy dispensed prescriptions. Medication of relevance was topical medication for AD, comprising topical corticosteroids, pimecrolimus and tacrolimus, and systemic medication for AD, comprising orally administered ciclosporin, azathioprine, methotrexate, prednisolone and mycophenolate mofetil. These data were used as a proxy to separate mild/moderate cases of AD, i.e. users of topical medication, from severe AD, i.e. users of systemic medication.

The Danish Register for Evaluation of Marginalization (DREAM) (32) records information on each Danish citizen's receipt of public transfer income and unemployment registrations since 1991. A social benefit, for example paid sick leave, disability pension, mandatory work placement, educational grant and maternity pay is recorded each for all citizens on a weekly basis. When we use the term "all benefits combined" we exclude maternity pay and educational grant.

Socio-economic status (SES) was based on data from DRP and DREAM provided by Statistics Denmark. SES was divided into categories according to skill level and source of income as follows: 1) Academic master's and top executives; 2) professional bachelor's degrees and self-employed; 3) skilled labor; 4) unskilled labor; 5) paid sick leave; 6) disability pension and 7) students and unemployment (table 1) . For more details regarding data from DREAM see Suppl. Table 2.

Ethics

The study was approved by the Danish Data Protection Board (no. BFH-2017-097, I-suite no. 05899). Register-based studies do not require informed consent from those registered, nor from the ethics committees in Denmark. The study was approved by The Danish National Prescription Registry (DNPR) administered by Statistics Denmark (no. FSEID-00003185).

Statistics

Cox regression was used to examine the use of all benefits combined, paid sick leave or disability pension, respectively, for AD patients compared with the control group from August 5th, 1991 until December 31st, 2015. The outcome date was the first registration of either 1) any benefit, 2) paid sick leave or 3) disability pension during follow-up. The end date was date of death, first date of emigration or receiving any benefit, paid sick leave or

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disability pension, which ever came first. A zero-inflated Poisson regression model was used to calculate the odds ratio of all long-term sick leave and the ratio of average number of weeks per year of all long-term sick leave. Models were adjusted by a fixed set of covariates (asthma, allergic rhinitis and SES). All analyses were carried out using SAS 9.3 software (SAS Institute Inc., Cary, NC, US).

Results

Baseline characteristics of the AD and control groups born 1964-1976 (group 1) and 1977-1999 (group 2) are shown in Table 1. In group 1, approximately 60% are women, while group 2 is equally divided with respect to gender. Asthma and allergic rhinitis occurred more frequently in the AD groups. Systemic treatment prescribed to AD patients and controls in group 1 and 2 were 25.9% and 8.98%, and 13.8% and 4.41%, respectively.

Benefits from the government

Table 2 and 3 show the AD patients' use of any kind of social benefits from the government in group 1 and 2 respectively, compared to the corresponding control groups. After adjustments for asthma, allergic rhinitis and SES the hazard ratios (HR) were significantly increased for severe AD patients compared to controls in both group 1 and 2 (HR 1.07, 95% CI: 1.02-1.13 and HR 1.16, 95% CI: 1.11-1.22, respectively). Additionally, patients with mild/moderate AD in group 2 had an increased use of any kind of benefits (HR 1.03, 95% CI: 1.01-1.06), Table 3.

Paid long term sick leave

The average number of weeks with paid long term sick leave per year and OR are given in table 4 and 5. Paid sick leave was significantly higher for patients with severe AD in both group 1 and 2 compared to the corresponding control group (OR 1.32, 95% CI: 1.13-1.54 and OR 1.37, 95% CI: 1.25-1.52, respectively), and in the mild/moderate AD patients in group 2 (OR 1.22, 95% CI: 1.16-1.30).

Disability pension

Data regarding disability pension in AD patients compared to controls is shown in Table 6 and 7. The adjusted HR for severe AD-patients in group 1 and 2 compared to the control group was 1.67 (95% CI: 1.45-1.93) and 1.40 (95% CI: 1.14-1.72), respectively. Patients with mild/moderate AD in group 2 had a higher risk of receiving disability pension compared to the controls (adjusted HR 1.19, 95% CI: 1.07-1.33), while this was not significant for group 1 (adjusted HR 1.03, 95% CI: 0.92-1.15). Asthma and SES were independent risk factors for receiving disability pension, while allergic rhinitis was protective. The average age for receiving disability pension in the group 1 for mild/moderate AD, severe AD and controls was 33.0, 34.6 and 33.6 years, respectively, and in group 2 the average age was 21.9, 24.0 and 22.9 years, respectively.

Discussion

Results from this population-based registry-study clearly illustrate the negative impact on work-life in adult AD patients, and the financial burden for the society, through increased use of social benefits, including paid sick leave and disability pension, as compared to the background population

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During the entire study period the risk of receiving any kinds of benefits from the government was significantly higher for severe AD patients compared to the controls. While paid sick leave was more long-lasting *and* more prevalent for patients with both mild/moderate and severe AD compared to controls in the younger group of patients, this was only the case for severe AD patients in the older population. Similar rather consistent results on increased sick leave and lost work productivity among AD patients compared to individuals without AD have previously been reported. However, designs of these studies unable direct comparison (17-21, 23, 25, 33, 34). In contrast to the present study, sick leave and severity of disease were self-reported in all previous studies. Previous studies focusing on the financial aspect of AD found indirect and direct costs of sick leave to be high in patients with AD (25, 33). Although the present study did not calculate specific costs, these results are comparable.

To our knowledge, no previous studies have compared the risk of receiving disability pension in AD patients to any reference group. This issue is highly relevant considering that reduced work productivity (20, 21), work absenteeism (35) and impaired quality of life in AD patients have been acknowledged for years (36-38). Interestingly, supporting our hypothesis, the risk of receiving disability pension was significantly higher in patients with AD, and the risk increased with severity of disease. The proportion of disability pension awarded to patients with AD and controls, respectively, was smaller in group 2, the population born 1977-1999, compared to the group 1, the population born 1964-1976. The currently younger age in group 2 improved treatment strategies, political restrictions in granting disability pensions and labor market conditions are possible explanations for this observation. A recent Danish study by Heede et al. documented a history of AD to be strongly associated with a higher risk of disability pension among 496 hand eczema patients (36). In the present study hand eczema was not recorded, and data are therefore not directly comparable.

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Recently, a higher prevalence of AD in adults than previously recognized has been documented (8), suggesting that social benefits due to AD would increase subsequently. Though relatively fewer AD patients in group 2 are granted a disability pension in the present study, no conclusion is possible since this group is also younger. A characteristic of the individuals awarded with disability pension would be interesting. Independently of AD, predictors of disability pension such as low SES (39), prior sick absence (40), unemployment (41) and low self-rated health (42) have previously been identified. Furthermore, the risk of disability pensions differ between occupations(43). Information regarding these parameters was not available in the present study.

The relatively high number of awarded disability pensions in both AD groups compared to the controls is important as the consequences of each disability pension granted are considerable, personally as well as socio-economically. Notably, disability pension was granted at a remarkably young age in all groups, contributing to the magnitude of the costs associated with AD. Regulations concerning permanent disability differ greatly between countries. However, these results from Denmark indicate the chronicity and seriousness of disease, which can be transferable to similar industrialized countries.

Strengths of this study are the large population-based cohort, comprising the entire Danish population of patients with AD diagnosed in hospital matched with multiple controls, and furthermore the linkage of four different national registers. Since the DREAM register provides objective measures on benefits awarded no bias is induced regarding the number of weeks on paid sick leave or granted disability pensions. However, different start dates for the four registers required assumptions and arguments to enable comparison. In 1977 DNPR records began, which means that all patients hospitalized with AD only as children were not identified prior to this. Furthermore, patients treated for AD by their General Practitioners or

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a private dermatologist were unregistered in the DNPR. Both issues may have caused misclassification of mild/moderate AD patients as controls, and thereby induce a possible underestimation of the results. In addition, this would most obviously explain the doubled proportion of AD patients receiving systemic treatment in the older compared to the younger population. By splitting the population into two groups, based on date of birth before and after 1977, we were able to analyze the two groups separately, confirming and strengthening the almost identical results in the two groups. Danish registers are generally of high standard but changing variables from year to year and missing data due to lack of reporting from e.g. hospitals are well-known limitations in register-based studies. Register-based data unable evaluation of the potentially causal relationship between AD and the social benefits. Instead of AD, the reason for paid sick leave or granted disability pension *could* be another independent disease or comorbidity associated to AD such as hand eczema, depression, asthma and cardiovascular disease (27, 44-46). In line with previous studies, our baseline characteristics of the study population confirmed asthma and allergic rhinitis as frequent comorbidities to AD (6, 12, 47), and adjustments for these factors were performed. Though systemic treatment was used as a proxy for severe AD, the medications used for systemic treatment of AD are not exclusive of AD treatment. Information for which disease the medicine was prescribed was not available, and therefore the AD patient could have another concomitant disease for which the medicine was used. Another limitation was that medication delivered directly from the hospital to the patients without use of prescriptions was not included, inducing a risk of underestimation of use of systemic medication.

This study confirms that a diagnosis of AD in childhood or as an adult is associated with social benefits later in life, which contributes to the understanding of the considerable costs of AD. Continued focus of the seriousness of AD as a disease complicating life and work life is

important. To minimize sick leave, to maintain employment and to avoid the ultimate occupational end stage, disability pension, the need for improved treatment strategies, educational and occupational counseling and attention to comorbidities of AD are emphasized by our results. Preferably, future studies should focus on causality of AD and social benefits.

Conclusion

In this large-scale registry-study the socioeconomic burden of AD comprises an increased risk of paid sick leave and disability pension. Compared with non-AD controls, an increased risk of receiving any kinds of benefits from the government, including paid sick leave and granted disability pension was associated to a diagnosis of AD, particularly severe AD.

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Figure 1. Flow chart of the selection of AD patients and a random sample of controls matched on gender, date of birth and municipality

Figure 2. Flow chart for selection of AD patients and control population

Figure 3. Overview of the four registers used

Table 1. Baseline data for mild/moderate and severe atopic dermatitis (AD) patients and control population born before and after 1977. Data on gender, death, permanent immigration, asthma, systemic treatment, socio-economic status (SES) divided into categories according to skill level and source of income are given for each group.

	Born between 1964 - Dec. 31 st 1976 (group 1)			Born between Jan. 1 st 1977 - 1999 (group 2)		
	Mild/moderate AD patients	Severe AD patients	Controls	Mild/moderate AD patients	Severe AD patients	Controls
	n = 5,361 (%)	n = 1,878 (%)	n = 132,878 (%)	n = 18,040 (%)	n = 2,877 (%)	n = 340,958 (%)
Men	2,108 (39.32)	724 (38.55)	53,417 (40.20)	9,219 (51.10)	1,195 (41.54)	168,912 (49.54)
Women	3,253 (60.68)	1,154 (61.45)	79,461 (59.80)	8,821 (48.90)	1,682 (58.46)	172,046 (50.46)
Deceased	104 (1.94)	46 (2.45)	2,130 (1.60)	80 (0.44)	20 (0.70)	1,294 (0.38)
Permanent emigration	34 (0.63)	32 (1.70)	3,882 (2.92)	349 (1.93)	162 (5.63)	6,736 (1.98)
Asthma	1,395 (26.02)	828 (44.09)	5,572 (4.19)	6,705 (37.17)	1,574 (54.71)	22,933 (6.73)
Allergic rhinitis	757 (14.12)	557 (29.66)	2,774 (2.09)	3021 (16.75)	1,098 (38.16)	6,020 (1.77)
Systemic treatment	0 (0)	*1,878 (100)	11,939 (8.98)	0 (0)	**2,877 (100)	15,036 (4.41)
SES #: 1) Academic master's and top executives	2,010 (37.49)	603 (32.11)	41,416 (31.17)	4,855 (26.91)	648 (22.52)	87,941 (25.79)
SES #: 2) Professional bachelor's degrees and self employed	1,848 (34.47)	672 (35.78)	46,272 (34.82)	5,493 (30.45)	888 (30.87)	100,525 (29.48)
SES #: 3) Skilled labor	762 (14.21)	273 (14.54)	20,445 (15.39)	4,896 (27.14)	902 (31.35)	99,591 (29.21)
SES #: 4) Unskilled labor	561 (10.46)	266 (14.16)	18,789 (14.14)	1,390 (7.71)	221 (7.68)	25,839 (7.58)
SES #: 5) Paid sick leave***	0 (0)	0 (0)	0 (0)	56 (0.31)	16 (0.56)	1,195 (0.35)
SES #:	50	23	1,428	277	58	5,145

6) Disability pension	(0.93)	(1.22)	(1.07)	(1.54)	(2.02)	(1.51)
SES #:	130	41	4,528	1073	144	20,722
7) Others****	(2.42)	(2.18)	(3.41)	(5.95)	(5.01)	(6.08)
* 25.94% of the total AD population received systemic treatment (n = 7,239). According to our definition that systemic treatment was defined as severe AD. ** 13.75% of the total AD population received systemic treatment (n = 20,917) # Socio-economic status of parents at age 16 of the AD patients/controls. *** it was not separately calculated before 1977, but part of disability pension **** ongoing education and unemployment						

Table 2. Use Risk of all benefits combined, except maternity pay and educational grant, in mild/moderate AD patients (n = 5,361) and severe AD patients (n = 1,878) compared to controls (n = 132,878) born between 1964-1976 (group 1).

	N (%)	Person-years at risk for first benefit	Incidence rate/person- years	HR crude (95% CI)	HR adjusted*
Mild/moderate AD patients	5,037 (93.96)	15,072,505	33.42/100,000	1.01 (0.99-1.04)	1.01 (0.98-1.04)
Severe AD patients#	1813 (96.54)	4,785,332	37.87/100,000	1.14 (1.09-1.20)	1.07 (1.02-1.13)
Controls	123,788 (93.16)	377,703,057	32.77/100,000	1.00 -	1.00 -
# has received systemic treatment for AD					
*Adjusted for asthma, allergic rhinitis and socio-economic status (defined in table 1).					

Table 3. Risk of all benefits combined, except maternity pay and educational grant, in mild/moderate AD patients (n = 18,040) and severe AD patients (n = 2,877) compared to controls (n = 340,958) born between 1977-1999 (group 2)					
	N (%)	Person-years at risk for first benefit	Incidence rate/person- years	HR crude (95% CI)	HR adjusted*
Mild/moderate AD patients	9544 (52.90)	40,649,352	23.48/100,000	1.05 (1.03-1.07)	1.03 (1.01-1.06)
Severe AD patients#	2042 (70.98)	7,152,339	28.52/100,000	1.23 (1.18-1.29)	1.16 (1.11-1.22)
Controls	185,528 (54.41)	809,301,318	22.92/100,000	1.00 -	1.00 -
# has received systemic treatment for AD.					
*Adjusted for asthma, allergic rhinitis and socio-economic status (defined in table 1).					

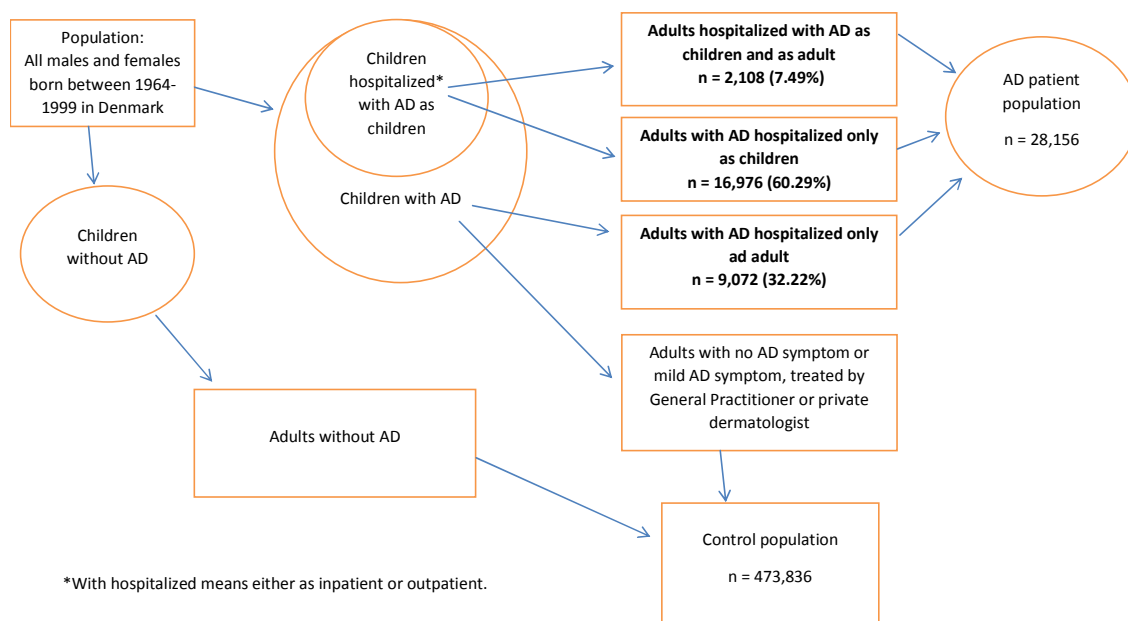
Table 4. Paid sick leave in mild/moderate AD patients (n = 5,361) and severe AD patients (n = 1,878) compared to controls (n = 132,878) born between 1964-1976				
	N (%)	Average number of weeks per year of all long-term sick leave	Odds ratio of all long- term sick leave	Ratio of average number of weeks per year of all long-term sick leave
Mild/moderate AD patient	3771 (70.34%)	2.03 Std dev 2.75 Min-max 0.04-38.69	0.94 95% CI 0.79-1.13 ChiSq <0.51	1.04 95% CI 1.01- 1.07 ChiSq < 0.007
Severe AD patient	1470 (78.27%)	2.99 Std dev 6.00 Min-max 0.04-193.61	1.32 95% CI 1.13-1.54 ChiSq <0.0004	1.80 95% CI 1.75-1.88 ChiSq < 0.0001
Controls	91231 (68.66%)	1.98 Std dev 2.86 Min max 0.04-250.95	1.00	1.00

Table 5. Paid sick leave pay in mild/moderate AD patients (n = 18,040) and severe AD patients (n = 2,877) compared to controls (n = 340,958) born between 1977-1999				
	N (%)	Average number of weeks per year of all long-term sick leave	Odds ratio of all long- term sick leave	Ratio of average number of weeks per year of all long-term sick leave
Mild/moderate AD patient	5369 (29.76%)	1.69 Std dev 2.62 Min-max 0.04-42.43	1.22 95% CI 1.16-1.30 ChiSq <0.0001	1.12 95% CI 1.08- 1.15 ChiSq <0.0001
Severe AD patient	1344 (46.72%)	2.12 Std dev 2.76 Min-max 0.04-20.93	1.37 95% CI 1.25- 1.52 ChiSq <0.0001	1.70 95% CI 1.61-1.77 ChiSq <0.0001
Controls	106870 (31.34%)	1.60 Std dev 2.30 Min-max 0.04-71.31	1.00	1.00

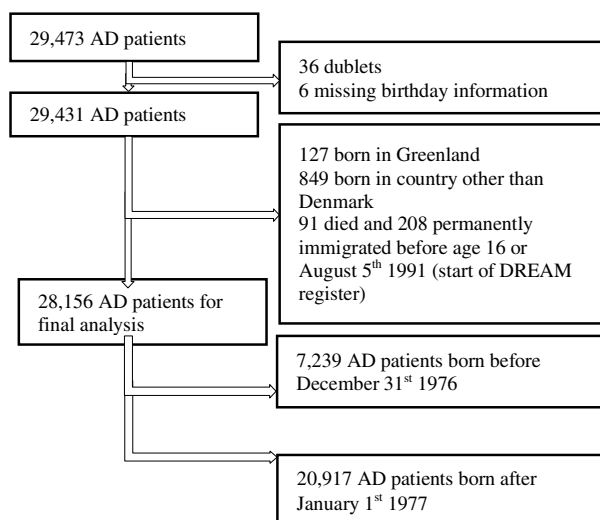
Table 6. Risk of disability pension in mild/moderate AD patients (n = 5,361) and severe AD patients (n = 1,878) compared to controls (n = 132,878) born between 1964-1976 (group 1)						
	N (%)	Average age for receiving disability pension (years)	Person-years at risk	Incidence rate/person- years	HR crude (95% CI)	HR adjusted* (95% CI)
Mild/moderate AD patients	349 (6.51)	33.02 Std dev 7.95 Min max 16.34- 50.87	44,961,474	0.78/100.000	1.11 (1.00- 1.24)	1.03 (0.92- 1.15)
Severe AD patients #	226 (12.04)	34.57 Std dev 7.44 min max 19.18- 49.77	15,509,820	1.46/100.000	2.09 (1.83- 2.38)	1.67 (1.45- 1.93)
Controls	7852 (5.91)	33.60 Std dev 8.01 Min max 16.00- 51.90	1,122,282,273	0.70/100.000	1.00 -	1.00 -
# has received systemic treatment for AD						
*Adjusted for asthma, allergic rhinitis and socio-economic status (defined in table 1).						

Table 7. Risk of disability pension in mild/moderate AD patients (n = 18,040) and severe AD patients (n = 2,877) compared to controls (n = 340,958) born between 1977-1999 (group 2)

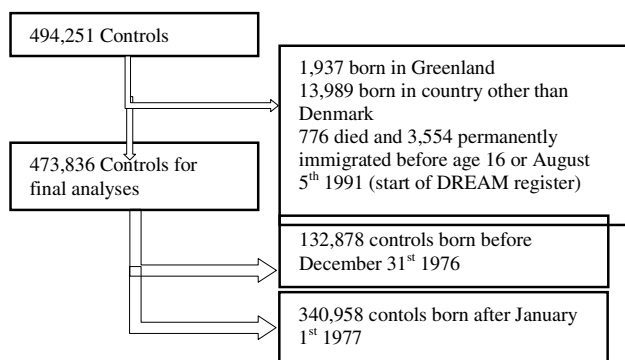
	N (%)	Average age for receiving disability pension (years)	Person-years at risk	Incidence rate/person- years	HR crude (95% CI)	HR adjusted* (95% CI)
Mild/moderate AD patients	384 (2.13)	21.93 Std dev 4.57 Min max 16.00- 35.71	63,460,480	0.61/100,000	1.27 (1.15- 1.41)	1.19 (1.07- 1.33)
Severe AD patients#	101 (3.51)	24.04 Std dev 5.06 Min max 16.00- 35.65	12,904,035	0.78/100,000	1.66 (1.37- 2.03)	1.40 (1.14- 1.72)
Controls	6043 (1.77)	22.87 Std dev 5.05 Min max 16.00 – 38.93	1,275,537,516	0.47/100,000	1.00 -	1.00 -
# has received systemic tablet treatment for AD						
*Adjusted for asthma, allergic rhinitis and socio-economic status (defined in table 1).						



AD population



Control population



**Danish National Patient
Registry (DNPR)**

Records including diagnosis.
Inpatients since 1977 and
outpatient since 1995

Central Person Register (CPR)

Birthday, sex, parents, death,
socio economic status ect.
Recorded since 1964

**Register of Medicinal Product
Statistics (RMPS)**

All pharmacy dispensed
prescriptions.
Recorded since 1994

**Danish Register for Evaluation of
Marginalization (DREAM)**

Information about all benefits
received.
Recorded since august 1991

Suppl. Table 1.

ICD8 and ICD10 codes of atopic dermatitis, asthma and allergic rhinitis.

	Atopic dermatitis	Asthma	Allergic rhinitis
ICD8	69100 69108 69109	49300 49301 49302 49308 49309	50703 50708 50709
ICD10	DL20 DL200 DL200A DL208 DL208A-D DL209	DJ45 DJ45.0 DJ45.1 DJ45.8 DJ45.9 DJ46.0 DJ46.9	DJ30 DJ30.0 DJ30.0A DJ30.1 DJ30.1A-C DJ31 DJ31.0 DJ30.2-DJ30.4 DJ31.0

Supplementary file
Methods.

Data from The Danish Register for Evaluation of Marginalization (DREAM)

For each individual the total number of days receiving benefits was recorded, as well as each person's "weeks at risk", which is the number of weeks it is possible to be in recorded in DREAM registrations. The start date was either the 16th birthday, the start of the DREAM register (3rd of August 1991) or immigration, which ever came first. The end date was calculated according to the different social benefits. For "all benefits combined" the end date was either first benefits received, 31st of December 2015, death or permanent emigration which ever came first.

Only long term paid sick leave is recorded in DREAM, since the employer is compensated for long term sick leave only by the state. The definition of long-term sick leave has changed over time. The employer paid period of sick leave before compensation by the government depends on the category of employment. Only private companies were compensated before year 2000. Large private companies, small private companies without insurance and self-employed were compensated after 35 days of sick leave between 1991 and 1992, and from 1993 to 2000 after 14 days. After 2000 also public employers were compensated and for the periods 2000 - March 2007, April 2007 - June 2008, July 2008 - 2011 and 2012 - 2015 it was after 14 days, 15 days, 21 days and 30 days of sick leave, respectively. Chronically ill patients with a contract with the state, newly employed (first three months), insured self-employed (or in a smaller private company) were compensated after 1 to 3 days of sick leave, respectively.

The end date for paid sick leave was either 31st of December 2015, death or permanent emigration which ever came first. If emigration was only for a shorter time and if there were social benefits both before and after emigration, then emigration was not considered. If emigration information was ambiguous, the end date was the first date for leaving the country.

Disability pension is granted by the state if the work ability is insignificant, and before 2003 social problems could also be a cause. For disability pensions, the end date was calculated as for paid sick leave.