ORIGINAL REPORT

Quality of Life and Economic Burden in Swedish Adults with Atopic Dermatitis: A Cross-sectional Survey of Patient-reported Outcomes

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Atopic dermatitis (AD) is a chronic skin disease associated with impaired quality of life. Evidence from Sweden on out-of-pocket expenses and productivity losses remains limited. This study assessed the burden of AD among adults in relation to health-related quality of life (HRQoL), work productivity, activity impairment, willingness to pay for symptom relief, economic outcomes, considering comorbid asthma, allergies, depression and anxiety. A cross-sectional survey was conducted between 2024 and 2025 among 220 members of the Swedish Asthma and Allergy Patient Association. Validated instruments included the Dermatology Life Quality Index (DLQI), EuroQol five-dimensions, five-levels instrument (EQ-5D-5L), Patient Benefit Index, and Work Productivity and Activity Impairment questionnaire. Descriptive and regression analyses were performed. Respondents (89.8% female; mean age 43 years) reported moderate HRQoL impairment (mean DLQI 10.1). DLQI and EQ-5D-5L were worse among those with allergic or non-atopic comorbidities but did not differ by asthma status. Mean annual out-of-pocket costs and productivity losses were €900 (95% CI: 401.1–1,758.4) and €1,972 (95% CI: 1,198.7–2,828.0), respectively. Itch intensity and activity impairment were associated with lower HRQoL and higher costs. AD is related to worsened work and activity functioning and high economic burden, suggesting the need for improved support and management strategies for affected adults.

Key words: atopic dermatitis; comorbidities; economic burden health-related quality of life; patient-reported outcomes; work productivity.

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SIGNIFICANCE

Atopic dermatitis affects many aspects of daily life beyond the skin, including sleep, social participation and work. In this survey of Swedish adults, participants reported moderate impairment in health-related quality of life and notable economic consequences associated with activity limitations, symptom intensity and comorbid conditions. Out-of-pocket expenses and productivity losses contributed substantially to the overall burden. These findings illustrate the wide-ranging effects of atopic dermatitis on patients' well-being and finances, supporting the need for comprehensive management that addresses both the medical and practical aspects of living with the disease.

Atopic dermatitis (AD) is a chronic inflammatory skin disorder that commonly begins in childhood, with a prevalence of up to 30% in Western children and 5–10% among adults (1, 2). Characterized by persistent itch and eczematous lesions, AD significantly impairs health-related quality of life (HRQoL) across physical, psychological and social aspects (3–6). It represents the skin disease with the highest global disability burden (5). Despite multiple treatment options, many adults continue to experience substantial symptom burden and unmet therapeutic needs (6), underscoring the need to further explore the relationship between AD, its management and overall burden.

COMORBID CONDITIONS AND DISEASE BURDEN

AD is commonly associated with other atopic conditions, particularly asthma (7–9). While daily treatment and flare management in AD reduce patients' QoL, it remains unclear whether comorbid asthma further amplifies impairment and overall disease burden (8, 9). Understanding these interactions is important for targeted management and resource allocation.

Economic burden

The socioeconomic impact of AD is considerable. Across Europe, moderate-to-severe AD is estimated to impose an annual societal cost exceeding €30 billion, driven mainly by productivity losses, healthcare use and personal expenditures (10–15). Patients face high rates of absenteeism and presenteeism, substantial activity limitations and notable out-of-pocket expenses for non-reimbursed treatments and supportive care (13–15). In a large multi-country study, Zink et al. (15) reported mean out-of-pocket expenses of €927 per patient annually, higher than for psoriasis or arthritis, illustrating AD's significant financial impact.

Knowledge gaps. Despite accumulating evidence, important gaps remain. Patient-reported data on out-of-pocket costs, productivity losses and indirect economic impacts, such as short-term sick leave, time spent on care or preventive measures, remain underexplored, particularly in relation to comorbid conditions. Intangible costs related to reduced HRQoL, emotional distress and social limitations are often overlooked in economic analyses (16, 17). Willingness to pay (WTP) for symptom relief serves as a proxy for these intangible costs and reflects patients' perceived need for effective therapies (16, 17). However, few recent studies have examined WTP in AD, particularly in adults with comorbid conditions (17, 18). Additionally, impaired QoL may be related to comorbid asthma and allergic conditions in individuals with AD (19), highlighting the need to assess differences between patients with and without asthma, for understanding disease heterogeneity and guiding targeted care.

Evidence from Sweden and study rationale. In Sweden, registry-based studies confirm that AD reduces HRQoL and increases healthcare use, sick leave and productivity losses (4, 20–25). Comorbid conditions, especially allergic and mental health disorders, are major cost drivers (24, 25). Yet, these findings are largely based on administrative data, while patient-reported evidence on work impairment, out-of-pocket expenses and perceived treatment value remains scarce. Earlier Swedish studies also indicated undertreatment in moderate-to-severe disease (22, 23, 25), suggesting potential unmet needs.

A clearer understanding of self-reported burden is essential for patient-centred care and decision-making in publicly funded healthcare, where indirect and intangible costs are often overlooked. Estimating WTP offers insight into disease impact and treatment preferences relevant to reimbursement and priority setting. Few Swedish studies have jointly examined these aspects from the patient perspective. This study, therefore, provides new patient-reported evidence integrating these domains to inform both clinical practice and health policy.

Aim of the study

This study aims to assess the burden of AD among adults in Sweden by examining its associations with HRQoL, work productivity, daily activities, WTP for symptom relief, out-of-pocket expenses and indirect costs in terms of productivity losses among individuals with and without comorbid asthma. It also considers allergic and non-atopic comorbidities, such as depression, anxiety and ADHD, and explores variations by age, sex and disease severity to identify factors associated with greater economic burden.

MATERIALS AND METHODS

Study design and population

A cross-sectional, online survey was conducted from January 2024 to January 2025 among adult members of the Swedish Asthma and Allergy Patient Association. This 12-month period was chosen to capture potential seasonal variation in AD activity and related costs; respondents completed the questionnaire once, reporting for the previous month. Inclusion criteria were (*i*) age ≥18 years, (*ii*) residence in Sweden and (*iii*) self-reported current or previous AD. Exclusion criteria were incomplete consent or missing key demographic or AD-related data. AD status and severity were self-reported.

Primary variables were AD severity, HRQoL, work productivity (absenteeism, presenteeism and total productivity loss), activity impairment, out-of-pocket costs, WTP for symptom relief, perceived treatment benefit and healthcare utilization.

Survey development and data collection

The questionnaire was designed collaboratively by physicians, health economics researchers and patients using a Delphi process (26). Clinical experts ensured content validity, methodologists refined question structure and recall windows, and patients reviewed relevance and wording.

The survey collected data about the following information:

- demographics (age, sex),
- age at AD diagnosis,
- self-rated AD severity during the past month,
- atopic comorbidities (asthma, allergic rhinitis, food allergy) and non-atopic comorbidities (depression, anxiety, ADHD, eating disorders, other chronic conditions),
- HRQoL,
- work productivity and reasons for absenteeism (e.g. physician visits),
- daily activity limitations,

- healthcare contacts and treatments used,
- perceived treatment benefit and
- monthly out-of-pocket expenses for treatment, travel and skin-care products.

Intangible burden was assessed using an adapted WTP approach following established methods (17, 18, 22). Participants indicated how much they would pay per month for complete symptom relief as (*i*) an exact amount, (*ii*) a predefined monetary interval and (*iii*) a percentage of income (Full questions are shown in Appendix S3).

Measures and variable definitions

Validated instruments were used to measure disease severity, HRQoL, work impairment, treatment benefit and costs (**Table I**). Details on instruments, AD severity and definition of allergy are provided in Appendix S1. The recall window for most self-reported measures was 1 month. Work productivity and activity impairment (WPAI) was measured using 1-week recall period.

Procedure

The survey was distributed by email through the Patient Association. Data were collected via the SurveyMonkey® platform. Participants provided electronic informed consent before accessing the questionnaire and could contact the research team for clarification. Each record represented one individual's experience over 1-month recall period. Responses were pseudonymized before analysis. Each participant could respond once during the year. Participation was voluntary and non-remunerated.

Sample size

A sample size of approximately 200 participants was estimated to provide 80% power to detect a 3-point difference in the DLQI outcome between patients with and without asthma, assuming a 2:1 ratio of individuals without and with asthma. The calculation incorporated an alpha level of 5% and anticipated a 30–50% response rate.

Statistical analysis

Descriptive and inferential analyses. Descriptive statistics summarized the frequency and severity of AD symptoms (itch, pain), comorbid conditions and time spent on treatment. HRQoL scores were reported as means with standard deviations (SDs).

Normality was examined with the Shapiro–Wilk test to guide the choice of parametric or non-parametric statistics. Continuous variables were summarized as mean (SD) or median (IQR) if not normally distributed; categorical variables as counts (*n*) and percentages (%). Independent samples *t*-tests were used for continuous variables, and one-way ANOVA, Mann–Whitney *U* or Kruskal–Wallis tests for comparisons between continuous and categorical variables, as appropriate. Categorical associations were analysed using χ^2 or Fisher's exact test. Spearman's rank correlation (r_s) assessed the strength and direction of associations.

A two-sided $p<0.05$ was considered statistically significant.

Cost analysis. Cost differences by AD severity and comorbidities were assessed using bootstrap *t*-tests and one-way bootstrap ANOVA with Bonferroni correction. Due to right-skewed cost distributions, 1,000 bootstrap replications with 95% confidence intervals (CIs) were applied. Median and range (min–max) values were reported for sensitivity analysis.

Productivity losses were valued using the human capital approach based on Swedish (2024) average gross wages (29), including social benefits. Annual cost estimates were extrapolated from weekly/monthly data using severity-specific symptomatic-week assumptions (2–8 per year) informed by literature (7, 19) and expert consensus (full scenario assumptions are provided in Appendix S4). Uncertainty estimates were quantified using 1,000 bootstrap replications to derive bias-corrected and accelerated 95% CI. Costs were converted to euros using the 2024 annual-average exchange rate (1 SEK=0.0875 €) from the Swedish Riksbank (30).

Regression models

A log-linear regression model was applied, due to skewed data, to investigate the relationship between patients' key demographic and clinical characteristics, and the HRQoL measured by the disease-specific instrument (DLQI), and to determine factors that might be independently associated with HRQoL. Multivariate generalized linear models (GLM) were used, exploring main effects, with gamma distribution and a log-link function applied in order to examine the relationship between the costs and various variables, including age, sex, disease severity, symptom intensity, presence of comorbid conditions and activity impairment. All regression coefficients were exponentiated to enable interpretation.

Missing data

Analyses were conducted using complete-case data as the primary approach, assuming missingness at random and excluding cases with incomplete key variables. This strategy was chosen to maintain interpretability of self-reported cost and HRQoL

Table I. Overview of instruments used in the study

Instrument	Domain measured	Format/Items	Score range/Interpretation	References
Patient Global Assessment (PGA)	Patient-reported AD severity	One item, self-rated (numerical or categorical scale)	0 (no symptoms) to 10 (worst imaginable), or none to very severe	Vakharia et al. (32) Silverberg et al. (19)
Dermatology Life Quality Index (DLQI)	Dermatology-specific HRQoL	Ten items scored 0–3	0–30; higher scores=greater HRQoL impairment	Finlay & Khan (27) HOME 2024 (33)
EuroQoL-5Dimensions-5Levels (EQ-5D-5L)	General health-related HRQoL	Five domains 5 levels each (1–5)+EuroQol visual analogue scale (VAS)	Health states are represented as five-digit codes ((e.g.) 13425), 1=no problems, 5=extreme problem and converted into index scores using (21) value set tariffs (39) VAS: 0 (worst) to 100 (best)	EuroQol group (34) Sun et al. (35)
Numerical Rating Scales (NRS)	Itching and pain	Two separate scales	0 (none) to 10 (worst imaginable)	Adapted from (36)
Work Productivity and Activity Impairment (WPAI)	Work productivity and daily activity	Six items	Scores range 0–100%; higher=more impairment	Reilly et al 1993 (37)
Patient Benefit Index (PBI)	Perceived treatment benefit	PNQ (Patient-Reported Need for Quality-of-Life Improvement) and PBQ (Patient-Reported Benefit from Treatment) items scored 0–4	Global score 0 (no benefit) to 4 (maximum benefit), weighted by importance (The PNQ used here from Wintermann et al. (39))	Augustin et al. (38) https://www.patient-benefit-index.com/ (28)
Institute for Medical Technology Assessment (iMTA) Questionnaires for the measurement of costs in economic evaluations	Out-of-pocket costs and medical consumptions	Itemized format	Not scored; used for economic evaluation	https://www.imta.nl/questionnaires/(40)

data. As a sensitivity analysis, multiple imputation by chained equations (MICE) with 20 imputations was performed.

Analyses were performed in Excel (EQ-5D-5L scoring) and SPSS v21.

Ethical considerations

The study was approved by the Swedish Ethics Review Authority (Uppsala; Dnr 2019–03720; amendment 11 August 2024). All participants provided written electronic informed consent. Data were processed in accordance with the Swedish Data Protection Act and the ethical principles of the Declaration of Helsinki (31).

RESULTS

Descriptive characteristics

Of 220 individuals aged ≥18 years who consented, valid responses varied across outcomes (range=106–147) because of incomplete questionnaires. Percentages are based on available responses and may not sum to 100%. The sample was predominantly female (89.8%) and middle-aged (mean=43 years, SD 14). Fifteen per cent were <30 years, 48% were 31–50 years, 23% were 51–60 years and 13% were >60 years. At the time of the survey, 72% were employed. Fifty-five per cent reported mild-to-moderate disease and 9% severe AD. Most (72%) reported onset before age 2 years (**Table II**).

HRQoL and symptoms

Mean DLQI was 10.1 (SD 6.3; n=112), indicating moderate impairment. The median EQ-5D-5L index was 0.92 (IQR 0.13; n=112) and the mean EQ-VAS 62.1 (SD 20.4; n=144). DLQI and EQ-5D-5L correlated inversely (r_s=−0.64, p<0.001). Mean itch intensity was 5.1 (SD 2.6; n=111) and pain 3.3 (SD 2.6; n=106) on a 0–10 scale. Both symptoms correlated with HRQoL (itch-DLQI r_s=0.59, p<0.001; pain-DLQI r_s=0.57, p<0.001; itch-EQ-5D-5L r_s=−0.37, p<0.001; pain-EQ-5D-5L r_s=−0.43, p<0.001) (Fig. S1).

Mean PBI was 2.82 (SD 0.84; n=112). Comorbid atopic diseases were common: 54% reported asthma, 47% allergic rhinitis and 64% food allergies, with many participants reporting multiple allergic conditions. Depression/anxiety occurred in 13%, ADHD in 3% and eating disorders in 1%.

No sex differences were detected (p>0.05; χ^2 test). Participants with asthma were slightly younger than those without (mean difference approximately 6 years; p=0.03; t-test).

Associations of disease severity and comorbidities with HRQoL

HRQoL differed significantly across severity levels (**Fig. 1**): DLQI increased (p<0.001; ANOVA) and EQ-5D-5L decreased (p<0.001; Kruskal–Wallis) with greater severity, indicating reduced HRQoL.

Participants with allergic conditions had poorer HRQoL (DLQI p=0.035; t-test; EQ-5D-5L p=0.008; Mann–Whitney U). ADHD was associated with higher DLQI (p=0.026; t-test) and lower EQ-5D-5L (p=0.028; Mann–Whitney U). EQ-5D-5L indices were also lower among respondents with any non-atopic comorbidity (p=0.006; Mann–Whitney U). Results were consistent in imputed data analyses (Tables SII–SIV).

Healthcare use and treatments

Respondents reported 1.6 (SD 3.1) healthcare contacts per month, with no significant variation by age, sex,

severity or comorbidity (p>0.05; ANOVA or χ^2 tests). Topical treatments (ointments/creams) were used by 83% and systemic therapy by 10% (Appendix S2, Fig. S2).

WTP for symptom relief

About 70% were willing to spend ≤10% of monthly income for effective treatment. WTP as a proportion of income correlated with DLQI (r_s=0.33). A larger share of those with asthma (36%) reported WTP >10% of income than those without (26%; p=0.023; χ^2 test) (Appendix S3).

Work productivity and activity impairment

Mean overall work impairment (WPAI) was 26.6% (SD 28.5; n=85), mainly due to presenteeism (24.6%, SD 25.9; n=86). Absenteeism averaged 4.3% (SD 15.6). Activity impairment was 29.1% (SD 26.0; n=114).

Work and activity impairment increased with greater severity (p=0.006; ANOVA; p<0.001; Kruskal–Wallis). Presenteeism was higher among respondents with depression/anxiety (p=0.040; t-test) and ADHD (p=0.030; t-test). Activity impairment was higher in those with non-atopic comorbidities (p=0.020; Mann–Whitney U), with asthma and other allergic conditions

Table II. Characteristics of the study population[1]

Characteristics	All AD population		AD population with asthma		AD population without asthma		
	Mean (SD)[2] (n[3]=126)		Mean (SD) (n=51)		Mean (SD) (n=49)		p value[+]
Age (years)	43.65 (14.19)		42.49 (13.93)		48.55 (14.94)		0.03[a]
Age (in 5 bands)	n (%) (all[4] n=126)		n (%) (all n=51)		n (%) (all n=49)		
18–30	19 (15.1)		4 (7.8)		11 (22.4)		
31–40	37 (29.4)		10 (19.6)		17 (34.7)		
41–50	24 (19.0)		15 (29.4)		4 (8.2)		
51–60	29 (23.0)		13 (25.5)		13 (26.5)		
>60	17 (13.5)		9 (17.6)		4 (8.2)		0.01[b]
Sex	n (%) (all n=147)		n (%) (all n=68)		n (%) (all n=62)		
Female	132 (89.8)		57 (83.8)		58 (93.5)		
Male	15 (10.2)		11 (16.2)		4 (6.5)		0.08[b]
Employment	n (%) (all n=115)		n (%) (all n=56)		n (%) (all n=51)		
Yes	83 (72.2)		39 (69.6)		38 (74.5)		
No	32 (27.8)		17 (30.4)		13 (25.5)		0.57[b]
Start of disease (year of age)	n (%) (all n=144)		n (%) (all n=68)		n (%) (all n=61)		
Before the age of 2 years	105 (71.9)		52 (76.5)		45 (72.6)		
Before the age of 18 years	32 (21.9)		14 (20.6)		13 (21.0)		
After the age of 18 years	7 (4.8)		2 (2.9)		3 (4.8)		0.69[c]
Disease severity	n (%) (all n=114)		n (%) (all n=55)		n (%) (all n=51)		
Severe	10 (8.8)		4 (7.3)		6 (11.8)		
Moderate	24 (21.1)		14 (25.4)		10 (19.6)		
Mild	39 (34.2)		16 (29.1)		17 (33.3)		
Clear/almost clear	41 (36.0)		21 (38.2)		18 (35.3)		0.78[b]
Comorbid diseases	n (%)		n (%)		n (%)		
Asthma	82 (54)		82 (100)		-		
Allergic conditions	n (%) (all n=276[5])		n (%)		n (%)		
Allergic rhinitis	72 (47)						
Food allergies	98 (64)						
Other allergies	106 (70)		64 (55.2)		52 (44.8)		0.06[b]
Non-atopic conditions	n (%) (all n=105[5])		n (%)		n (%)		
Depression	21 (14)						
Anxiety	35 (23)						
Eating disorders	5 (3)						
ADHD	13 (9)						
Other diseases	31 (20)		43 (64.2)		24 (35.8)		0.27[b]
	N	Mean (SD); [6]median (IQR)	n	Mean (SD); [6]median (IQR)	n	Mean (SD); [6]median (IQR)	
Itch intensity (0–10)	111	5.06 (2.58)	54	5.02 (2.36)	50	4.96 (2.91)	0.90[a]
Pain intensity (0–10)	106	3.27 (2.61)	51	3.27 (2.56)	48	3.35 (2.78)	0.97[a]
*DLQI score (0–30)	112	10.14 (6.26); [6]9.00 (9.00)	55	10.21 (6.50); [6]8.00 (7.00)	51	10.25 (6.17); [6]9.00 (10.00)	0.86[a]
*EQ-5D-5L index score (-0.314–1)	112	0.86 (0.16); [6]0.92 (0.13)	55	0.84 (0.19); [6]0.91 (0.93)	50	0.87 (0.16); [6]0.94 (0.14)	0.27[d]
*EQ VAS score (0–100)	144	62.10 (20.41)	56	61.07 (19.07)	50	65.34 (22.86)	0.17[a]
*PBI score (0–4)	112	2.82 (0.84)	50	2.88 (0.76)	40	2.73 (0.93)	0.64[a]
*Wpai							
% Overall work impairment	85	26.59% (28.47); 20.00% (47.00)	40	27.21% (27.72); 20.05% (41.00)	38	27.42% (29.19); 20.00% (50.00)	0.69[d]
% Presenteeism	86	24.59% (25.89); 20.00% (43.00)	40	24.88% (23.78); 20.00% (35.00)	38	26.05% (27.46); 20.00% (50.0)	0.92[d]
% Absenteeism	85	4.33% (15.15); 0.00% (0.00)	40	4.63% (18.17); 0.00% (0.00)	38	4.81% (13.01); 3.33% (1.00)	0.30[d]
% Activity impairment	114	29.06% (26.03); 30.00% (40.00)	55	36.91% (26.65); 30.00% (30.00)	50	31.40% (28.35); 20.00% (40.00)	0.20[d]

Notes: [1]does not sum up to study sample – those who consented due to missing responses; [2]SD=standard deviation; [3]n=number of participants; [4]all n=total of all categories; [5]responses, percentages are based on available responses for each item; participants may report multiple comorbidities and response rates vary; [6]Median (IQR=interquartile range): reported in case of non-normality; + Statistically significant results with bold; Statistical tests: [a]Independent samples t-test, [b]χ^2 Test, [c]Fisher's Exact test (expected count in a cell <5), [d]Mann–Whitney U test.
DLQI:Dermatology Life Quality Index; EQ-5D-5L:EuroQol 5-Dimension 5-Level; EQ-VAS:EuroQol Visual Analogue Scale; PBI:Patient Benefit Index; WPAI:Work Productivity and Activity Impairment.

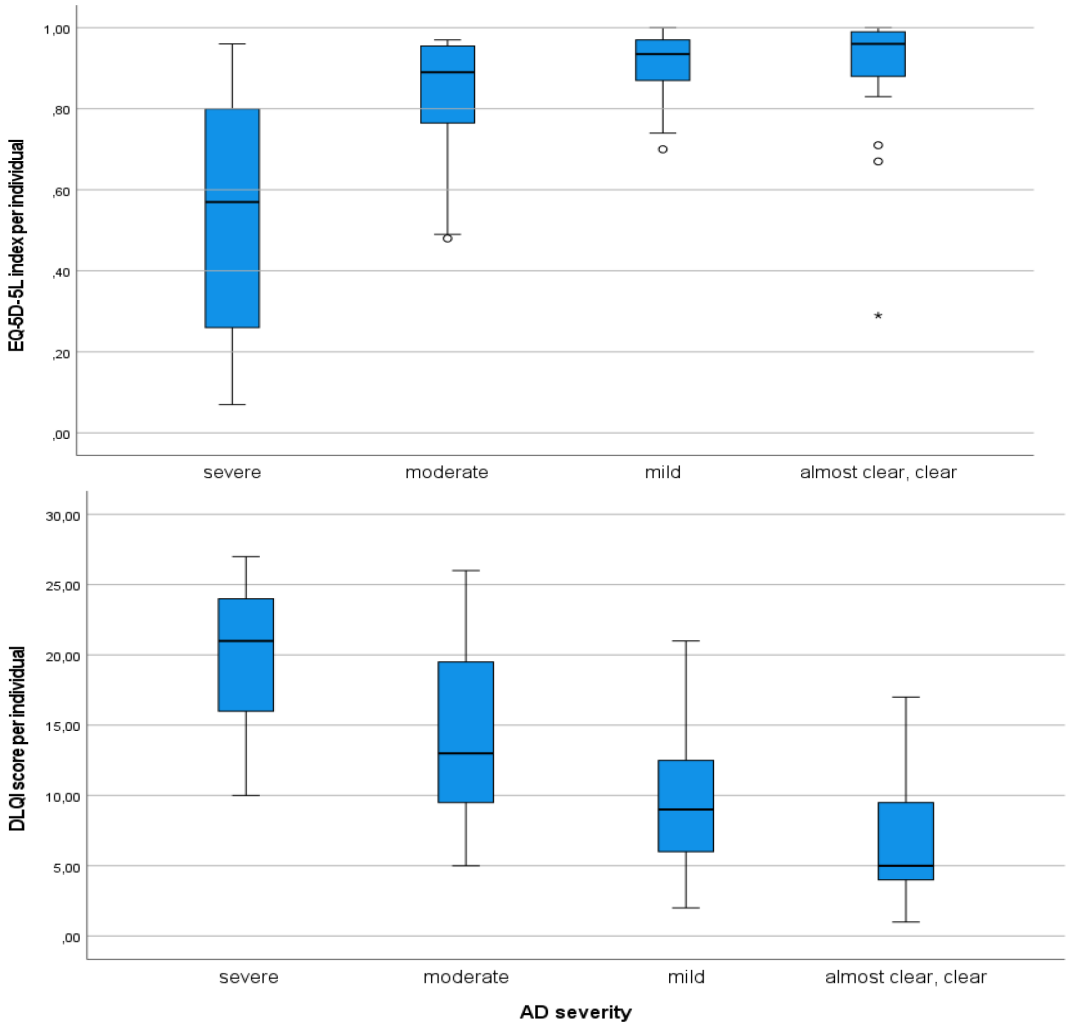

Fig. 1. Health-related quality of life measured with DLQI and EQ-5D-5L outcomes by disease severity.

(p=0.006; Mann–Whitney U), and in those reporting allergies only (p<0.001; Kruskal–Wallis) (Table SII and Fig. S3).

Productivity losses and out-of-pocket costs

Mean total productivity loss (absenteeism +presenteeism) was €384.8 per week (95% CI: 279.5–505.9) and €1 972 per year (95% CI: 1,198.7–2,828.0). No significant differences appeared across age groups (p=0.260; ANOVA), sex (p=0.430; t-test) or asthma status (p=0.980; t-test). Losses were higher among participants with non-atopic comorbidities (p=0.042; t-test), particularly those with ADHD (p=0.026; t-test) and other allergic conditions (p=0.043; t-test). Productivity losses correlated with disease severity and DLQI (rs=0.45–0.50, p<0.001).

Mean monthly out-of-pocket costs were €189.4 (95% CI: 111.8–312.6) and annual €900.3 (95% CI: 401.1–1,758.4). Costs were higher in individuals with allergic conditions (p=0.032; Mann–Whitney U) and tended to rise from mild to moderate disease (mild €89.2, moderate €311.5, p=0.05; Kruskal–Wallis). Most expenses were for treatment (48%, 29% prescription, 19% over-the-counter), special nutrition (24%) and healthcare visits (14%) (**Table III**, **Fig. 2**).

Annual estimates apply symptom-active periods only. Additional results and graphs, including overview of correlations (Fig. S1), are provided in the supplementary material (Fig. S2, Tables SIII–SV, Appendices S4–S7).

Regression analyses

DLQI-Dermatology-specific HRQoL. Higher activity impairment (B=1.27, p<0.001) and greater itch intensity (B=0.10, p<0.001) were independently associated with higher (worse) DLQI scores. Age, sex, age at disease onset and comorbidities showed no significant associations with DLQI (p>0.05). The overall regression model was statistically significant (F(13,69)=8.56, p<0.001) and explained approximately 55% (adjusted

Table III. Out-of-pocket costs and work productivity losses per individual (Euros)

			95% CI[a]	
		€ Costs	Lower	Upper
Out-of-pocket costs per month	Mean	189.4	111.8	312.6
	Median	78.7	52.5	131.2
	Minimum	0.0		
	Maximum	2,825.4		
Out-of-pocket costs per year	Mean	900.3	401.1	1,758.4
	Median	315.8	171.9	487.8
	Minimum	0.0		
	Maximum	22,602.9		
Lost productivity per week – absenteeism	Mean	66.5	21.3	121.3
	Median	0.0	0.0	0.0
	Minimum	0.0		
	Maximum	1,149.2		
Lost productivity per week – presenteeism	Mean	318.3	229.4	412.0
	Median	252.8	126.4	316.0
	Minimum	0.0		
	Maximum	1,264.1		
Total productivity losses per week (presenteeism and absenteeism)	Mean	384.8	279.5	505.9
	Median	252.8	126.4	379.2
	Minimum	0.0		
	Maximum	1,471.0		
Total productivity losses per year (presenteeism and absenteeism)	Mean	1,972.3	1,198.7	2,828.0
	Median	594.1	252.8	1,603.1
	Minimum	0.0		
	Maximum	13,238.9		

[a]Bootstrap results are based on 1,000 bootstrap samples.
CI:Confidence interval.

R^2=0.545) of the variation in DLQI scores, indicating that the included variables together had a substantial influence on dermatology-specific HRQoL (Appendix S5).

Out-of-pocket costs. Patients reporting greater activity impairment and higher perceived treatment benefit (PBI) incurred significantly higher out-of-pocket costs. Activity impairment was associated with a 3.7-fold increase in out-of-pocket expenditure (Exp(B)=3.69, p=0.043), while each unit increase in PBI corresponded to a 1.7-fold increase (Exp(B)=1.68, p=0.004). The model demonstrated satisfactory fit (deviance/df=1.02; Pearson χ^2/df=0.81; overall p<0.001) (Appendix S6).

Productivity losses. Activity impairment and itch intensity were associated with higher productivity losses. Specifically, patients with greater activity impairment had nearly a 6-fold increase in productivity losses (Exp(B)=5.85, p=0.003), and each unit increase in itch intensity corresponded to a 14% higher loss (Exp(B)=1.14, p=0.013). Age, severity, pain, EQ-5D-5L index and healthcare contact frequency were not associated with productivity losses (p>0.05) (Appendix S7).

Coefficients and 95% CIs are reported in **Table IV** and additional information in (Appendix S5–7).

DISCUSSION

Main results

This study examined the clinical, functional, and economic burden of AD among Swedish adults using patient-reported data. By combining validated HRQoL, productivity and cost instruments (32–39), it provides an integrated view of how AD affects daily life. The findings indicate that AD affects well-being, work productivity and personal finances, complementing recent European research (10–15, 19–24, 40).

In this Swedish sample, AD was associated with reduced HRQoL, work and activity impairment, healthcare utilization and personal expenses. Outcomes were similar for respondents with and without comorbid asthma. Although the median EQ-5D-5L index (0.92) indicated relatively good health, the mean DLQI (10.1) reflected dermatology-specific limitations suggesting that generic HRQoL measures may not fully capture the everyday burden of AD. The moderate PBI (2.8) and the finding that roughly 70% of respondents were willing

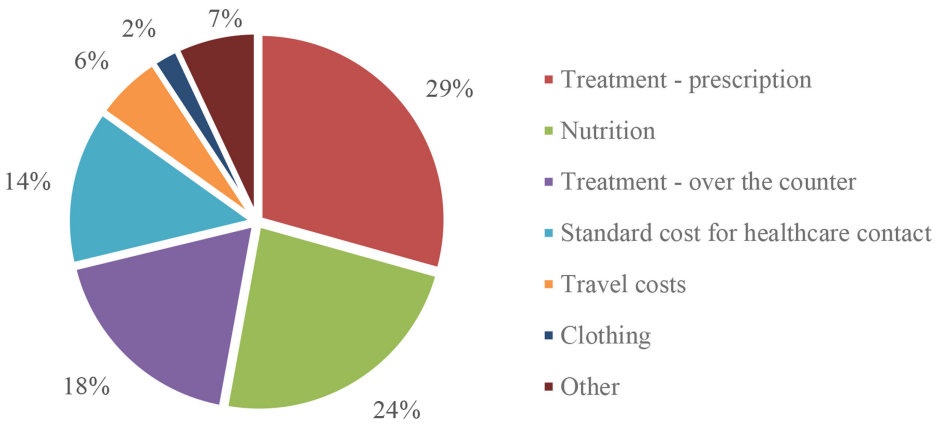

Fig. 2. Distribution of out-of-pocket costs per various expense category relevant to the disease.

Table IV. Statistically significant results across regression models

Variable	Outcome	B	Exp(B)	95% CI for Exp(B)	*p*-value
% Activity impairment	Productivity losses	1.767	5.851	(1.800, 19.022)	0.003
	Out-of-pocket cost	1.305	3.688	(1.041, 13.065)	0.043
	DLQI score	1.268	–	–	<0.001
Itch severity	Productivity losses	0.130	1.139	(1.028, 1.261)	0.013
	DLQI score	0.095	–	–	<0.
Perceived benefit index	Out-of-pocket cost	0.518	1.679	(1.179, 2.393)	0.004
Sex (male)	Productivity losses	-0.385	0.681	(0.478, 0.969)	0.033

B=unstandardized regression coefficient; *Exp(B)*=exponentiated coefficient (odds ratio); productivity losses and out-of-pocket cost were analysed using generalized linear models with a gamma distribution and log-link function, whereas DLQI score was analysed using log-linear regression. Dashes (-) indicate that Exp(B) and CI are not applicable for linear models. All results shown are statistically significant *at* $p<0.05$.
CI:confidence interval; DLQI:Dermatology Life Quality Index.

to allocate up to 10% of their monthly income for effective treatment underscore the importance of symptom control. Despite potential anchoring effects in income-based preference questions, these responses suggest that treatment affordability and access remain critical considerations in Swedish AD care, particularly regarding biologic therapies and health-technology assessment.

Comorbid allergic and non-atopic conditions were frequent and associated with lower HRQoL. Presenteeism and activity impairment were major contributors to the economic burden, with mean annual productivity and out-of-pocket costs of approximately €1,970 and €900 per person. Regression analyses linked greater activity limitation and itch intensity to poorer dermatology-specific HRQoL and higher out-of-pocket spending. Productivity losses were chiefly driven by itch and activity limitation. Male respondents reported somewhat lower productivity losses, though interpretation is limited by the small male subsample. Stratification by allergic or psychiatric comorbidity did not materially alter these associations.

Comparison with other studies

The degree of HRQoL impairment (DLQI between 9 and 13) and pruritus severity (5) aligns with recent European findings (11–14), as do the broad effects on work and daily functioning, which intensify with disease severity (13–17).

Systemic therapy use (approximately 10%) was lower than in international studies (21, 22, 24), supporting previous reports of undertreatment in Sweden. Nonetheless, participants reported moderate perceived benefit and strong WTP, reflecting active engagement in self-management despite limited systemic use (17, 18, 22).

Annual out-of-pocket estimate (approximately €900) aligns with Zink et al. (€927) and exceeds Beretzky et al. (€747) (11, 15), possibly reflecting national reimbursement structures, climate and self-care practices. Additional spending on nutrition and healthcare visits, rarely reported elsewhere, adds nuance to understanding patient expenses (17).

Productivity losses were somewhat smaller than in other European or Asian reports (13, 14) but followed similar associations with severity and HRQoL (15–17, 40). Observed differences are likely to reflect variation in disease mix and costing assumptions. Comparable Swedish registry studies also note higher costs in individuals with allergic or neuropsychiatric comorbidities (23, 24), supporting the direction of our results.

Strengths and limitations

This study provides a comprehensive assessment of the burden of AD among Swedish adults, integrating validated patient-reported instruments for symptoms, HRQoL, work productivity and economic costs, a combination rarely addressed together in national studies. The combination of dermatology-specific, generic and functional measures offers a multidimensional perspective rarely captured within one dataset. Standardized methodology and appropriate statistical approaches, including bootstrapping and multiple imputation, strengthen internal validity.

The predominance of female participants and recruitment via a patient association may limit generalizability. However, the sex distribution is broadly consistent with population data showing that adult women are more affected by AD and tend to report higher burden, particularly in terms of HRQoL and healthcare use (20). Moreover, individuals engaged in patient organizations often represent those most impacted by the disease, making the findings informative for understanding unmet needs among active healthcare users.

The cross-sectional, self-reported design precludes causal inference and may introduce recall or selection bias but captures patients' direct perceptions of symptom impact and financial strain, dimensions not available in registry-based research. Although the sample was modest and missing data reduced statistical power in some subgroup analyses, multiple imputation showed minimal deviation from complete-case results, supporting data stability. Observed patterns and effect directions were consistent with previous European evidence, indicating external coherence. Annual cost estimates were extrapolated using severity-specific assumptions for symptomatic

weeks; residual uncertainty remains due to variable flare frequency. Finally, while a non-AD comparator group was not included, within-sample contrasts by severity and comorbidity provide clinically meaningful differentiation of disease burden.

Clinical and practical importance

These findings highlight the multifaceted burden of AD in Sweden and the need to address both dermatological symptoms and functional impairments. Clinicians should prioritize pruritus control and incorporate regular monitoring of itch and functional outcomes (e.g. WPAI) to optimize long-term management. Attention to mental health and daily functioning remains essential in routine care, to enhance outcomes and guide treatment optimization.

For policymakers, the results highlight possible areas for concern, such as productivity losses, healthcare utilization and indirect economic costs associated with AD. Strategic resource allocation towards early intervention, multidisciplinary care and equitable coverage for effective therapies (e.g. biologics) could mitigate long-term societal costs. Preventive measures in high-risk occupations and employer-supported initiatives such as workplace health programmes and flexible work arrangements may further reduce the broader economic impact of chronic AD.

Conclusions

This study demonstrates that adults with AD have reduced work productivity, substantial economic burden and impaired HRQoL, with worse HRQoL among those with severe disease. Patients with AD had relatively low HRQoL, independently of comorbid asthma, although the role of comorbidities warrants further investigation. Participants reported notable personal expenses and activity limitations and were willing to pay considerably for symptom relief, underscoring the high perceived value of effective treatment. These findings highlight the need to integrate broader outcome measures, such as HRQoL, WPAI and PBI, to more comprehensively capture the personal and societal burden of AD. Patient management should address both the medical and practical aspects of living with the disease.

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Conflict of interest: AMe, LR, SM, AMo, ÅS have no conflicts of interest to declare. Lvk has been a consultant or speaker for Pfizer, Sanofi, Leo Pharma and Eli Lilly.

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