



# Impairment of Quality of Life and Mental Health Status in Adult-Onset Atopic Dermatitis

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**Background:** Patients with atopic dermatitis (AD) have an impaired quality of life (QoL). To our knowledge, impairments in mental health status and health-related QoL (HRQoL) have not yet been evaluated in adult-onset and child-onset AD in a large-scale study.

**Objective:** This study compared the mental health status and HRQoL (using the EuroQoL [EQ] five-dimensional [5D] questionnaire) in child-onset AD and adult-onset AD to those in normal controls.

**Methods:** We used nationwide, population-based, cross-sectional data from the Korean National Health and Nutrition Examination Survey conducted from 2008 to 2013. We performed multiple logistic regression analyses with adjustments for age, sex, body mass index, income, education level, drinking status, current smoking, regular exercise, diabetes mellitus, hypertension, and dyslipidemia, and analyzed odds ratios (OR) for factors associated with impaired QoL.

**Results:** The OR for strong psychological stress, depressed mood, and suicidal ideation were significantly increased in adult-onset AD patients compared to in normal controls. In addition, the OR (95% confidence interval [CI]) values for the EQ-5D questionnaire responses (for physical activity, self-control, daily activities, pain/discomfort, and anxiety/depression) were significantly high in adult-onset AD compared to in normal controls after adjustments for covariates. However, patients with child-onset AD showed a significantly increased OR (95% CI) only for problems in pain/discomfort in the EQ-5D questionnaire.

**Conclusion:** Adult-onset AD patients suffer from impaired HRQoL and significant mental problems compared to normal controls. Dermatologists should focus not only on the clinical phenotype but also patients' psychological health status to ensure a better treatment outcome.

**Keywords:** Atopic dermatitis, Epidemiologic studies, Mental health, Psychological stress, Quality of life

## INTRODUCTION

Atopic dermatitis (AD) is a common pruritic, chronic, inflammatory skin disease. It is well known to occur in childhood, and it persists after puberty in more than half of AD patients<sup>1</sup>. The prevalence of adult AD is estimated to be 3% to 7% in the United States, Germany, and Japan<sup>2-4</sup>. A

recent Korean study revealed that the prevalence of AD has significantly increased in the elderly population in the last 10 years, whereas it significantly decreased in infants and preschool-aged children<sup>5</sup>.

Adult-onset AD refers to when symptoms of AD appear first in adult life. Bannister and Freeman<sup>6</sup> recognized it as a subgroup of AD. Approximately one in four adult AD pa-



tients report adult-onset AD<sup>7</sup>. However, diagnosing adult-onset AD can be challenging for dermatologists because patients who report having adult-onset AD actually have adult-recurrent AD and are unaware they had had childhood AD. It is difficult to differentiate between adult-onset AD and child-onset AD. The lack of a diagnostic laboratory marker for AD leads dermatologists to diagnose AD mainly by assessing clinical manifestations. The diagnosis of AD can be made based on clinical findings of characteristic morphology, age-dependent distribution, and associated clinical signs. The Hanifin and Rajka criteria of AD<sup>8</sup>, which are commonly used for the diagnosis of AD worldwide, consists of four major and 23 minor items. Although itching and a chronic/relapsing course are the predominant features, AD has a wide range of manifestations with variable presentations, distributions, and severity levels<sup>9</sup>.

Recently, Silverberg et al.<sup>10</sup> reported that adult-onset AD has a distinct clinical phenotype compared to child-onset AD. Eczema in adult-onset AD involves flexural areas less and presents with a greater predilection for areas such as the head and neck and/or hands and feet. Some studies have suggested that 50% of AD cases begin in the first year of life, while 85% begin within the first five years<sup>11-13</sup>. Nevertheless, adult-onset AD is a distinct subset from persistent child-onset AD<sup>14</sup>. A recent systematic review and meta-analysis study revealed that AD is found considerably in lower proportions early in life and conversely in higher proportions as an adult-onset disease<sup>7</sup>. A recent meta-analysis of 17 studies found that the proportion of adult-onset AD was 26.1%<sup>7</sup>.

The clinical course, health-related quality of life (HRQoL), and disease burden are considered different between adult-onset AD and child-onset AD. There is a need for the development of tailored and precise strategies to treat and care for child-onset AD and adult-onset AD, focusing on quality of life and mental health problems.

To our knowledge, impairments in mental health status and HRQoL have not yet been evaluated in adult-onset and child-onset AD in a large-scale study. Therefore, this study aimed to examine the mental health status and HRQoL in adult-onset and child-onset AD patients in South Korea using survey data obtained from the Korean National Health and Nutrition Examination Survey (KNHANES) conducted from 2008 to 2013.

## MATERIALS AND METHODS

### Study population and data collection

This study employed a nationwide, population-based, cross-sectional study design and secondary data analysis approach using information from KNHANES (2008~2013). The Korea Disease Control and Prevention Agency (KDCA) conducts the KNHANES annually. This survey adopted a multi-staged, stratified, clustered-sampling method based on age, sex, and geographical area of residence according to household registries<sup>15</sup>. It consisted of a health interview, health behavior survey, health examination, and nutrition survey. The first three components were performed in a vehicle-based examination center, and the nutrition survey was conducted during scheduled household visits. Physicians or trained interviewers collected all questionnaires in person at the participants' homes. All participants who agreed to take part in the survey provided written informed consent before the study began and had the right to refuse to participate at any time. The KDCA complies with the Personal Information Protection Act and Statistics Act and only provides de-identified data to researchers to maintain participants' anonymity; these data can be downloaded from the KNHANES website (<https://knhanes.kdca.go.kr/>) and used for academic research purposes. The study design followed the tenets of the Declaration of Helsinki for biomedical research. The KNHANES was carried out following approval from the institutional review board of the KDCA (approval no. 2008-04EXP-01-C, 2009-01CON-03-2C, 2010-02CON-21-C, 2011-02CON-06-C, 2012-01EXP-01-2C, and 2013-07CON-03-4C).

### Definition of atopic dermatitis

The presence of a medical history of AD was based on participants' responses to the questionnaires. The participants who answered "yes" to "Have you ever been diagnosed with AD by a physician" were placed in the AD group, which was divided further into two subgroups according to the timing of the disease onset of AD. Patients who answered that AD symptoms occurred after the age of 20 years fell under the adult-onset AD group, while those answered that AD symptoms developed before the age of 20 years fell under the child-onset AD group.

### Sociodemographic characteristics, health behaviors, and comorbid chronic diseases

The collected data included age, sex, smoking and drinking status, physical activity, and household income as gathered from self-reported questionnaires. Participants were considered drinkers if they drank more than once per month during the past year. Smoking status was divided into current smokers and non-smokers. Subjects were considered regular exercisers if they performed moderate exercise more than five times per week for at least 30 minutes per session or if they performed vigorous exercise more than three times per week for at least 20 minutes per session. The lowest income level was defined as the 25th percentile among all subjects. The education level was divided into two groups, those without a high school diploma and those with a university diploma, respectively. Occupation status was divided into yes (currently employed) or no (not currently employed). Medical history information of diabetes, hypertension, and dyslipidemia was obtained by questionnaires.

### Measurements

Trained staff measured the height (cm) and weight (kg) of each subject to the nearest 0.1 cm and 0.1 kg, respectively, with subjects wearing light clothing and no shoes. Each subject's body mass index (BMI) was calculated by dividing their weight (kg) by the square of their height ( $m^2$ ).

### Psychological health status and HRQoL

Psychological stress was evaluated from the subjects' responses to the following question: "How much stress do you feel in your everyday life?" Subjects who answered they "very strongly" or "strongly" feel stress were categorized as having psychological stress. The proportions of participants who had been diagnosed with depressive disorder, who experienced a depressed mood for more than two weeks, or who had suicidal ideation were analyzed to discern mental health status.

HRQoL was assessed using the EuroQoL (EQ) five-dimensional (5D) questionnaire. The EQ-5D questionnaire is one of the most widely used preference-based instruments for assessing HRQoL; as such, it has been utilized in various studies to assess and monitor the community's HRQoL. In Korea, the EQ-5D questionnaire has been deployed as part of an annual nationwide health survey—namely, the KNHANES—since 2005<sup>16</sup>. Using the five questions asked for determining the level

of self-reported problems, which focus on mobility (EQ-1), self-control (EQ-2), the performance of usual activities (EQ-3), pain/discomfort (EQ-4), and anxiety/depression (EQ-5), respectively, we analyzed patients with severe problems in mobility (EQ-1), pain/discomfort (EQ-4), and anxiety/depression (EQ-5). Participants selected one of the following three responses for each question: no problems, moderate problems, and severe problems. Subjects who reported moderate to severe problems for each question were classified as "participants with problems."

### Statistical analyses

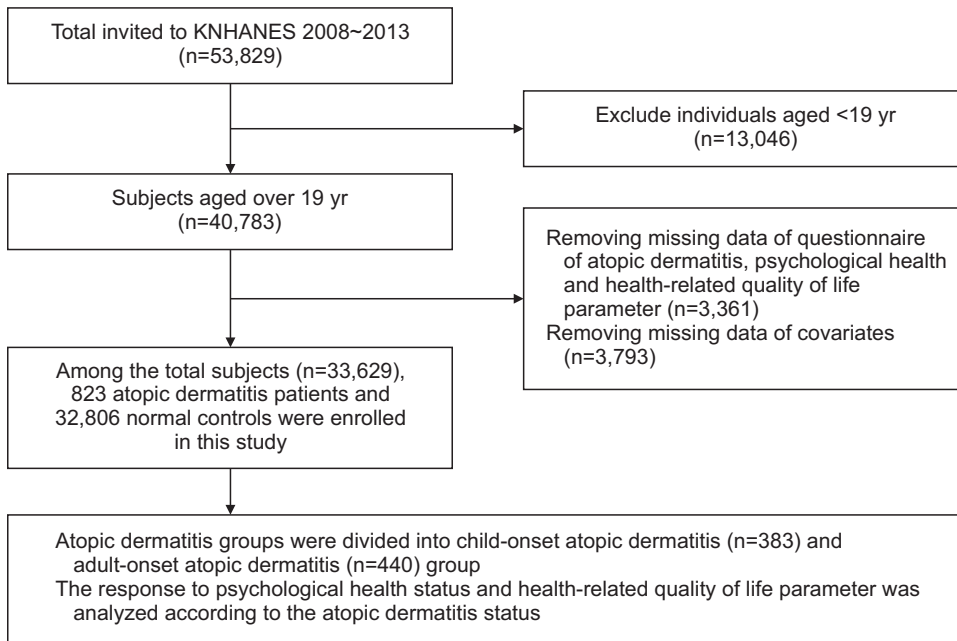
All variables are presented using the mean±standard error (SE) or percentage (SE) values. The chi-squared test and Bonferroni correction for categorical variables or one-way analysis of variance and Scheffe's multiple comparison for continuous variables were used to compare differences in baseline characteristics among three groups. Multiple logistic regression analysis was used to evaluate the risk of mental health status and EQ-5D responses, and odds ratios (ORs) and 95% confidence intervals (CIs) were calculated after adjusting for potential confounders. In model 1, adjustments for age and sex were made. In model 2, adjustments for age, sex, BMI, smoking status, alcohol consumption, regular physical activity, monthly household income, education level, diabetes mellitus, hypertension, and dyslipidemia were made. All analyses were performed using the Statistical Analysis System version 9.3 software program (SAS Institute Inc., Cary, NC, USA). All statistical tests were two-tailed, and statistical significance was set at  $p < 0.05$ .

## RESULTS

### Demographics of atopic dermatitis groups and normal controls

Among 53,829 individuals who participated in KNHANES from 2008 to 2013, those younger than 19 years ( $n=13,046$ ) were excluded. Additionally, 7,154 individuals were eliminated due to missing data. Thus, our final study population included 33,629 participants with complete datasets (Fig. 1). Among 823 participants diagnosed with AD, 383 individuals reported child-onset AD, and 440 subjects reported that AD symptoms appeared after 20 years of age, respectively. Baseline characteristics are presented in Table 1. In our adult AD data, the adult-onset AD was more prevalent than child-onset AD.

The adult-onset AD group was not different from the



**Fig. 1.** Flow diagram of the study participant selection process. KNHANES: Korean National Health and Nutrition Examination Survey.

**Table 1.** Demographic characteristics of the normal and atopic dermatitis (AD) study populations with AD subgrouping according to disease onset

Characteristic	Normal (n=32,806)	AD subgroup		p-value
		Child-onset AD (n=383)	Adult-onset AD (n=440)	
Age (yr)	44.98±0.16	26.57±0.37	43.54±0.82	<0.001* <sup>†</sup>
Sex (male)	49.83 (0.28)	51.61 (2.94)	46.79 (2.98)	0.52
Body mass index (kg/m <sup>2</sup> )	23.69±0.03	23.16±0.23	23.69±0.21	0.08
Lowest income level (Q1)	15.21 (0.37)	8.2 (1.82)	15.97 (2.21)	<0.001* <sup>†</sup>
Occupation (yes)	64.41 (0.39)	56.95 (2.9)	68.1 (2.74)	<0.001* <sup>†</sup>
Education level (≤high school)	32.4 (0.5)	41.22 (2.72)	35.49 (2.65)	0.02*
Current smoking	31.54 (0.34)	29.54 (2.71)	32.27 (2.82)	0.73
Heavy drinking	13.73 (0.26)	11.33 (1.89)	10.76 (1.81)	0.19
Regular exercise	22.06 (0.34)	24.82 (2.57)	21.86 (2.28)	0.47
Comorbidity				
Diabetes mellitus	8.52 (0.19)	0.99 (0.58)	9.91 (1.74)	<0.001* <sup>†</sup>
Hypertension	26.34 (0.36)	9.81 (1.69)	23.18 (2.39)	<0.001* <sup>†</sup>
Dyslipidemia	11.7 (0.21)	4.49 (1.32)	14.23 (2.03)	<0.001* <sup>†</sup>

Values are presented as mean±standard error or percent (standard error). \**p*<0.05, significantly different from Normal and child-onset AD groups. <sup>†</sup>*p*<0.05, significantly different from child AD and adult-onset AD groups.

control group with respect to age, sex; BMI; income level; occupation status; education level; and health behaviors such as smoking, drinking, and exercise (Table 1). However, the child-onset AD group showed differences in demographics compared to the adult-onset AD and control groups. Child-

onset AD patients (26.57±0.37 years) were younger than both the control group (44.98±0.16 years) and the adult-onset AD group (43.54±0.82 years) (*p*<0.001). The proportion of participants with a job was also smaller in the child-onset AD group (56.95%) than in the adult-onset AD (68.1%) and

control (64.41%) groups ( $p < 0.001$ ); however, the percentage of participants in the lowest income level (8.2%) in the child-onset AD group was less than those in the control (15.21%) and adult-onset AD (15.97%) groups ( $p < 0.001$ ). The proportion of participants without a high school diploma was higher in the child-onset AD group (41.22%) than in the control (32.4%) ( $p = 0.02$ ).

The rates of comorbid diabetes mellitus, hypertension, and dyslipidemia were significantly lower in the child-onset AD group than in the adult-onset AD and control groups ( $p < 0.001$ ), but there was no significant difference in the presence of comorbidities between the control and adult-onset AD groups.

### **Analyses of psychological health status and EQ-5D responses among control, adult-onset atopic dermatitis, and child-onset atopic dermatitis groups**

Using the normal control group as a reference, the adult-onset AD group showed significantly high risk levels for all three mental health problems, including strong psychological stress (OR, 1.39; 95% CI, 1.08~1.80), depressed mood (OR, 1.45; 95% CI, 1.08~1.94), and suicidal ideation (OR, 1.71; 95% CI, 1.27~2.29), and moderate to severe problems according to the EQ-5D responses, including physical activity (OR, 1.72; 95% CI, 1.27~2.33), self-control (OR, 2.17; 95% CI, 1.33~3.55), daily activity (OR, 1.91; 95% CI, 1.34~2.73), pain/discomfort (OR, 1.72; 95% CI, 1.36~2.18), and anxiety/depression (OR, 1.65; 95% CI, 1.22~2.22) after adjustment for all covariates (Table 2).

However, using the normal control group as a reference, the OR (95% CI) values for mental health problems (1.18 [0.93~1.5] for severe psychological stress, 1.19 [0.82~1.74] for depressed mood, and 1.29 [0.90~1.86] for suicidal ideation) and those for moderate to severe problems according to the EQ-5D responses (1.43 [0.66~3.09] for physical activity, 1.19 [0.26~5.35] for self-care, 1.22 [0.52~2.84] for daily activities, and 1.39 [0.94~2.05] for anxiety/depression, respectively) in child-onset AD were not statistically significant after adjustment for covariates. Only the OR (95% CI) values of problem in pain/discomfort (1.46 [1.04~2.05]) significantly increased in child-onset AD after adjustment (Table 2).

The risk for having at least one of the three mental health problems was increased significantly in adult-onset AD (OR, 1.50; 95% CI, 1.19~1.87) but not so in child-onset AD (OR, 1.22; 95% CI, 0.95~1.55) relative to in the control group after adjustment for age, sex, BMI, income, education level, drink-

ing status, current smoking, regular exercise, asthma, diabetes mellitus, hypertension, and dyslipidemia. The OR (95% CI) values for having at least one problem according to the EQ-5D responses were significantly higher in both the adult-onset AD (1.58 [1.26~1.98]) and child-onset AD (1.43 [1.07~1.91]) groups after adjustment for covariates (Table 2).

### **Impaired psychological health status and EuroQoL by the presence of atopic dermatitis**

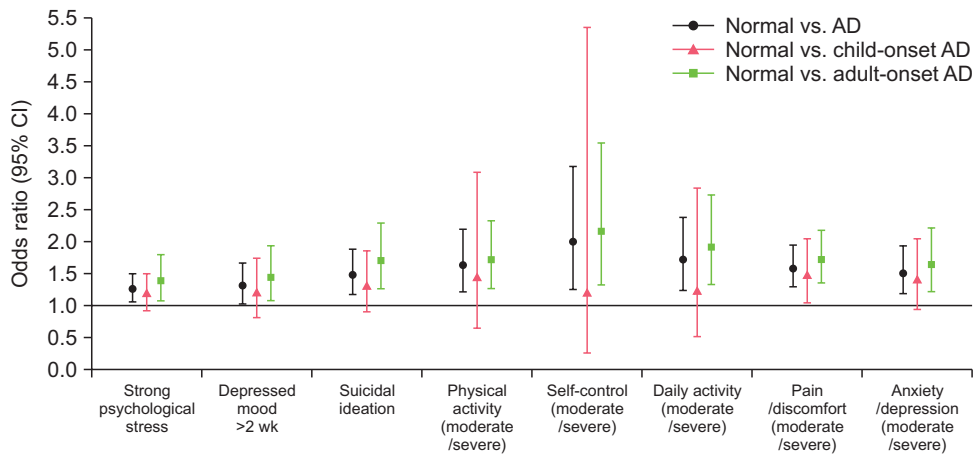
The effect of AD on mental health status and EQ-5D responses of the total AD population ( $n = 823$ ) was evaluated, using the control group as a reference (Supplementary Table 1). It was determined that the presence of AD significantly impairs mental health and increases the risks for experiencing strong psychological stress (OR, 1.27; 95% CI, 1.06~1.51), depressive mood for more than two weeks (OR, 1.31; 95% CI, 1.03~1.67), and having suicidal ideation (OR, 1.49; 95% CI, 1.17~1.89) after adjustment age, sex, BMI, income, education level, drinking status, current smoking, regular exercise, diabetes mellitus, hypertension, and dyslipidemia ( $p < 0.05$ ) (Supplementary Table 1). The OR (95% CI) values for having at least one mental health problem were significantly higher in the AD group than in the control group after adjustment (1.33 [1.13~1.58]) (Supplementary Table 1). The AD groups showed greater impairment than the control group according to the EQ-5D responses. The risks for moderate to severe problems in physical activity (OR, 1.64; 95% CI, 1.23~2.20), self-control (OR, 2.0; 95% CI, 1.25~3.18), daily activity (OR, 1.72; 95% CI, 1.24~2.39), pain/discomfort (OR, 1.59, 95% CI, 1.30~1.95), and anxiety/depression (OR, 1.52; 95% CI, 1.19~1.93) were increased in AD patients compared to the control group after adjustment age, sex, BMI, income, education level, drinking status, current smoking, regular exercise, diabetes mellitus, hypertension, and dyslipidemia (Supplementary Table 1). The OR (95% CI) values for having at least one HRQoL problem (per EQ-5D responses) were significantly higher in the AD groups compared to the control group after adjustment (1.50 [1.25~1.81]) (Supplementary Table 1).

As shown in Fig. 2, the ORs for mental health problems and HRQoL were significantly increased in the total AD group ( $n = 823$ ) and adult-onset AD group ( $n = 440$ ), but not in the child-onset AD group ( $n = 383$ ), when using the normal control group as a reference.

**Table 2.** Psychological health and health-related quality of life (QoL) parameters in comparison with normal, child-onset atopic dermatitis (AD), and adult-onset AD

Outcome	AD status	% (SE)	Model 1		Model 2	
			OR (95% CI)	p-value	OR (95% CI)	p-value
Strong psychological stress	Normal	27.36 (0.3)	1 [Ref.]	0.02	1 [Ref.]	0.02
	Child-onset AD	35.44 (2.71)	1.15 (0.91~1.45)	< .01	1.18 (0.93~1.5)	<0.01
	Adult-onset AD	35.12 (2.93)	1.41 (1.09~1.82)	< .01	1.39 (1.08~1.80)	<0.01
Depressed mood >2 wk	Normal	12.83 (0.23)	1 [Ref.]	0.02	1 [Ref.]	0.03
	Child-onset AD	12.68 (2.07)	1.25 (0.85~1.83)	< .01	1.19 (0.82~1.74)	0.01
	Adult-onset AD	17.57 (2.08)	1.46 (1.09~1.95)	< .01	1.45 (1.08~1.94)	<0.01
Suicidal ideation	Normal	12.69 (0.23)	1 [Ref.]	<0.001	1 [Ref.]	<0.001
	Child-onset AD	12.97 (1.99)	1.36 (0.96~1.94)	< .001	1.29 (0.90~1.86)	<0.001
	Adult-onset AD	19.73 (2.26)	1.72 (1.29~2.29)	< .001	1.71 (1.27~2.29)	<0.001
At least one or more above 3 mental health problems	Normal	36.93 (0.33)	1 [Ref.]	<0.001	1 [Ref.]	<0.001
	Child-onset AD	42.04 (2.84)	1.20 (0.95~1.52)	< .001	1.22 (0.95~1.55)	<0.001
	Adult-onset AD	47.11 (2.87)	1.50 (1.20~1.88)	< .001	1.50 (1.19~1.87)	<0.001
Physical activity (moderate/severe)	Normal	11.63 (0.23)	1 [Ref.]	0.001	1 [Ref.]	<0.01
	Child-onset AD	2.56 (0.93)	1.47 (0.68~3.19)	< .001	1.43 (0.66~3.09)	<0.001
	Adult-onset AD	15.1 (1.81)	1.74 (1.28~2.36)	< .001	1.72 (1.27~2.33)	<0.001
Self-control (moderate/severe)	Normal	3 (0.11)	1 [Ref.]	<0.01	1 [Ref.]	<0.01
	Child-onset AD	0.4 (0.31)	1.18 (0.26~5.38)	< .01	1.19 (0.26~5.35)	<0.01
	Adult-onset AD	5.12 (1.1)	2.23 (1.37~3.65)	< .01	2.17 (1.33~3.55)	<0.01
Daily activity (moderate/severe)	Normal	7.27 (0.18)	1 [Ref.]	<0.001	1 [Ref.]	<0.001
	Child-onset AD	1.63 (0.69)	1.31 (0.56~3.04)	< .001	1.22 (0.52~2.84)	<0.001
	Adult-onset AD	10.91 (1.61)	1.96 (1.37~2.79)	< .001	1.91 (1.34~2.73)	<0.001
Pain/discomfort (moderate/severe)	Normal	20.74 (0.31)	1 [Ref.]	<0.001	1 [Ref.]	<0.001
	Child-onset AD	16.03 (2.2)	1.53 (1.10~2.14)	< .001	1.46 (1.04~2.05)	<0.001
	Adult-onset AD	29.62 (2.37)	1.75 (1.38~2.21)	< .001	1.72 (1.36~2.18)	<0.001
Anxiety/depression (moderate/severe)	Normal	10.47 (0.22)	1 [Ref.]	<0.001	1 [Ref.]	<0.001
	Child-onset AD	9.99 (1.69)	1.48 (1.00~2.17)	< .001	1.39 (0.94~2.05)	<0.001
	Adult-onset AD	15.87 (1.98)	1.66 (1.23~2.25)	< .001	1.65 (1.22~2.22)	<0.001
At least one or more above 5 EuroQoL dimensions	Normal	29.14 (0.36)	1 [Ref.]	<0.0001	1 [Ref.]	<0.001
	Child-onset AD	21.8 (2.35)	1.51 (1.13~2.02)	< .001	1.43 (1.07~1.91)	<0.001
	Adult-onset AD	37.65 (2.5)	1.61 (1.28~2.01)	< .001	1.58 (1.26~1.98)	<0.001

CI: confidence interval, OR: odds ratio, SE: standard error, Model 1: adjusted for age and sex, Model 2: adjusted for age, sex, body mass index, income, education level, drinking status, current smoking, regular exercise, asthma, diabetes mellitus, hypertension, and dyslipidemia.



**Fig. 2.** Odds ratios for psychological health and health-related quality of life parameters according to the presence of AD while using normal controls as a reference. AD: atopic dermatitis, CI: confidence interval.

## DISCUSSION

This study presented that patients with adult-onset AD are at significantly increased risk for mental health problems and worse EuroQoL outcomes compared to normal controls after adjustment for age, sex, BMI, income, education level, drinking status, current smoking, regular exercise, asthma, diabetes mellitus, hypertension, and dyslipidemia, but the same is not true of those with child-onset AD.

We observed some phenotypical differences between patients with adult-onset AD and child-onset AD, respectively<sup>10</sup>. A higher proportion of patients with child-onset AD compared to those with adult-onset AD had a personal or family history of food or medication allergies and adverse reactions<sup>10</sup>. Patients with child-onset AD also more frequently experienced symptoms such as facial dermatitis, conjunctivitis or eyelid dermatitis, cheilitis, pruritus after sweating, xeroderma or xerosis, hand and foot dermatitis, nipple dermatitis, and Dennie–Morgan line<sup>10,17–19</sup>. A higher proportion of patients with child-onset AD had a personal or family history of food or medication allergies and adverse reactions compared to those with adult-onset AD<sup>7</sup>. Inconsistent patterns were observed for AD presentation on the trunk, nummular eczema, and flexural dermatitis among individual studies<sup>7</sup>. Adult-onset AD was associated with higher rates of face and neck symptoms and foot dermatitis but possibly lower rates of flexural lesions and multiple other signs and symptoms of AD<sup>7</sup>. These findings compel us to develop adequate assessments and confirmatory diagnostic testing tools for adult-onset AD. Moreover, it is imperative to elucidate the frequencies and proportions of lesion distribution, morphologic characteris-

tics, associated clinical signs and symptoms, and other clinical characteristics of adult-onset versus child-onset AD. The difference in clinical manifestations between adult-onset and child-onset AD might influence mental health and EQ-5D responses of patients with AD.

The findings of impaired QoL and mental health problems in AD patients have been reported in several studies<sup>20–26</sup>. In general, AD is perceived as insignificant relative to other systemic diseases because it is not life-threatening. However, patients with AD may experience reduced sleep quality, interpersonal difficulties, and poor overall QoL due to skin lesions and associated pruritus. Especially, adult-onset AD leads to visible symptoms on the face and neck, which can have a greater impact on daily life among adults than in children. In AD patients, changes in appearance can result in negative self-image and self-esteem, reducing the QoL. In assessing the QoL of AD patients, dermatologists need to understand not only the disease these individuals are experiencing but also their emotional problems via a holistic approach. Therefore, in treating AD, it is essential to recognize that AD can cause poor QoL and to use appropriate assessment tools.

Until now, the HRQoL and mental health status in AD patients while considering the disease onset has not been explored. Considering our finding of a degraded QoL among adult-onset AD patients, we should focus not only on the clinical phenotype itself but also patients' emotional problems.

This study has several limitations. To begin with, this study used a cross-sectional, population-based study design; therefore, the cause-and-effect relationship could not be determined. Details on the severity of AD, medication history, and the presence of other allergic diseases were not retrieved us-

## REFERENCES

ing the questionnaire survey. The severity and the duration of the disease are two major factors associated with the HRQoL. Yet, they were not included in this analysis. Other factors such as the family history of mental illness, marriage status, occupation, working hours, working environments that may affect the mental health and the HRQoL were not adjusted for analysis in this study. The possibility of recall bias is another limitation. AD patients with symptoms appearing before the age of twenty might have been classified as adult-onset AD if they could not recall the onset of AD symptoms.

Previous studies have documented poor HRQoL in adult AD patients. However, the HRQoL associated with the onset of AD has not been investigated<sup>27,28</sup>. This study has strengths in that it revealed impaired HRQoL and significant mental problems in both adult-onset and child-onset AD patients compared to normal controls using a nationwide, population-based survey database. Dermatologists should be concerned with improving the HRQoL and managing the psychological health status of their adult-onset AD patients to ensure a better treatment outcome.

## SUPPLEMENTARY MATERIALS

Supplementary data can be found via <http://anndermatol.org/src/sm/ad.21.282-s001.pdf>.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

## FUNDING SOURCE

None.

## DATA SHARING STATEMENT

Data are available from the KNHANES website (<https://knhanes.kdca.go.kr/>).

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