Original Article

An international multicenter study on quality of life and family quality of life in children with atopic dermatitis

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Background: Atopic dermatitis (AD) has severe impact on the quality of life (QoL) of children suffering from the disease and their families. The infant's dermatitis quality of life index (IDQoL) and the dermatitis family impact questionnaire (DFI) were designed to study this impact. **Aims:** To compare the impact of AD on children and their families in different countries. **Methods:** 419 children with AD from six countries representing three continents under the age of 4 years were included into the study. English, Ukrainian, Czech, Portuguese, and Korean versions of the IDQoL and the DFI and Dutch version of the IDQoL questionnaires were used. **Results:** The highest scored items for the IDQoL and the DFI were rather similar. The IDQoL and the DFI results were well correlated with parental assessment of disease severity and between each other in all countries. Some differences mostly in the IDQoL assessment were found. **Conclusion:** Despite some reported peculiarities, parents in different counties assessed QoL and family QoL of their AD children in a similar way. The IDQoL and the DFI may be reliable initial measures for international studies. International study on the influence of the same treatment methods on the IDQoL and the DFI assessments is important.

Key words: Atopic dermatitis, children, quality of life

INTRODUCTION

Atopic dermatitis (AD) is a common chronic inflammatory skin condition that often begins in infancy or early childhood, with 90% of cases appearing in the first 5 years of life.[1,2] Prevalence of AD in different regions may vary. Thus, reported prevalence of AD in preschool children in UK is 21.0%, meanwhile in China only 3.07%.[3,4] Severe negative impact of AD on the quality of life (QoL) of children and their families was well documented in previous studies.[5-8]

Questionnaire is the most common method to measure QoL. In small children, outsider or proxy-ratings (questions posed to persons close to the patient or to a patient's therapist, if the patient cannot

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give information by him/herself) can be used. Parent proxy-report should only be the primary outcome measure when the child is too young or ill or otherwise unable to self-report.[9]

The infant's dermatitis quality of life index (IDQoL) questionnaire was designed 10 years ago for use in children with AD below the age of 4 years. It is self-explanatory and should be completed by the child's parents or regular carer. The higher the score the more the QoL is impaired. The severity of eczema is scored separately by the child's parents or regular carer.[10]

Following interviews of families in which one child had AD, the dermatitis family impact (DFI) questionnaire was described covering "secondary" effect of skin disease.[11]

QoL questionnaires are increasingly being used by clinicians and researches as outcome measures for assessing the impact of AD. Moreover, their use in conjunction with clinical measures in clinical trials has been recommended by the National Institute for Health and Clinical Excellence (UK).[12]

The IDQoL and the DFI were translated into different languages and several national versions of these questionnaires are available.[13-17] However, few authors provided exact numeric data on IDQoL and DFI items assessment in their articles and therefore it is difficult to understand how much the results of different studies vary.

Results of a comparative study on QoL of AD children from Ukraine and Czech Republic showed minimal differences in the IDQoL results.[18]

The aims of our study were first to make a comparison of the assessment of the impact of AD on young children and their families in different countries and continents and second, to investigate the reliability of the IDQoL and the DFI questionnaires as initial measure for international multicenter studies.

METHODS

Study population

The authors who published a study on the IDQoL and the DFI assessments in children with AD were found by means of PubMed and contacted to obtain the data set. Data on 419 children with AD from six countries (Ukraine, Czech Republic, Singapore, the Netherlands, Brazil, and South Korea) representing three continents from 0 to 4 years old who had no other manifest diseases were used for the study. The diagnosis of AD was made using Hanifin and Rajka or Williams' criteria.[19,20] Patients from South Korea, Brazil, Singapore, and the Netherlands were selected from participants of local studies.[14,17,21,22] Children who had diagnosed AD and were less than 4 years old at the moment of completing the questionnaires by their parents were selected for the study. Part of patients from Ukraine and Czech Republic participated in comparative study on the IDQoL.[18] All patients visited dermatologists except those from the Netherlands who visited the general practitioner. Ethical permission for the study was granted by the local ethic research committees.

QoL assessment

Original (English), Ukrainian, Czech, Portuguese, and Korean versions of the IDQoL and the DFI questionnaires and a Dutch version of the IDQoL questionnaire were used. Permission to use the IDQoL and the DFI questionnaires were granted by its authors and copyright owners, Professor Andrew Y. Finlay and Dr. M.S. Lewis-Jones.

The IDQoL consists of 10 questions scored 0-3. The IDQoL is calculated by summing the score of each question resulting in a maximum of 30 and a minimum of 0. The IDQoL also contains a single initial question on parental assessment of global clinical severity which is scored separately from the QoL, graded 0-4, from none to extremely severe.[10] The DFI also consists of 10 questions scored 0-3 and a maximum score of 30.[11] The higher the score the more the QoL is impaired in both questionnaires.

In most cases, the parent who filled in the questionnaires was mother. However, it was previously shown that gender of parent who should fill in the IDQoL[23,24] and the DFI[24] cannot significantly influence the results of clinical studies.

Statistical analysis

Values are expressed as mean±standard deviation (SD). Tukey-Kramer Multiple Comparisons Test, Kruskal-Wallis Test (Nonparametric ANOVA), and Spearman nonparametric correlation were used. The results were considered significant if $P<0.05$.

Demographic and economical parameters

To check demographic and economical inequivalence between countries, total fertility rate, infant mortality rate, literacy rate, and gross domestic product per capita in all participated countries were checked by means of internet resources (http://www.indexmundi.com and data for the year 2010 from the International Monetary Fund; http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita).

RESULTS

Mean IDQoL, DFI, and parental assessment of disease severity scores are presented in Table 1. Korean parents assessed severity of AD in their children significantly higher than Ukrainian, Dutch, Czech, and Brazilian ($P<0.05$). Mean IDQoL results in children from Korea were higher than in patients from Ukraine, Czech Republic, and Singapore ($P<0.05$). In contrast, Dutch children had lower mean IDQoL than Ukrainian, Czech, Singapore, Brazilian, and Korean ($P<0.05$).

The items with highest score for the IDQoL and the DFI were rather similar for all countries [Table 2]. The IDQoL and the DFI results were well correlated with parental assessment of disease severity and between each other in all countries [Table 3]. The DFI results did not correlate with patients' age. Meanwhile, only in Ukrainians parental assessment of disease severity and the IDQoL negatively correlated with the age of children with AD (r=–0.27, $P<0.01$ and r=–0.23, $P<0.05$, respectively).

Some differences in 8 of 10 separate IDQoL items were

Table 1: Mean infant's dermatitis quality of life index, dermatitis family impact, and parental assessment of disease severity scores per country

Country	Parental assessment of AD severity	Mean IDQoL results	Mean DFI results
Ukraine (*n*=103)	1.86±0.80	7.50±4.50	9.44±5.69
Czech Republic (*n*=126)	2.11±0.88	7.65±5.63	7.43±5.86
Singapore (*n*=44)	2.07±1.25	8.16±5.68	8.45±6.97
The Netherlands (*n*=49)	1.90±0.96	4.69±3.77	N.A.
Brazil (*n*=43)	1.98±0.94	9.35±5.00	8.37±4.43
South Korea (*n*=54)	2.56±0.88	11.30±6.20	10.04±7.57

IDQoL: Infant's dermatitis quality of life, DFI: Dermatitis family impact, AD: Atopic dermatitis, N.A.: Not available

Table 2: The three highest scored infant's dermatitis quality of life index items and dermatitis family impact items per country

Country	Highest scored IDQoL items			Highest scored DFI items		
	1st	2nd	3rd	1st	2nd	3rd
Ukraine	Symptoms	Time to get to sleep	Mood	Tiredness/ exhaustion	Expenditure	Emotional distress
Czech Republic	Symptoms	Problems at bathtime	Time to get to sleep	Expenditure	Tiredness/ exhaustion	Emotional distress
Singapore	Symptoms	Time to get to sleep	Total time disturbed	Expenditure	Tiredness/ exhaustion	Emotional distress
The Netherlands	Symptoms	Time to get to sleep	Mood	-	-	-
Brazil	Symptoms	Problems at bathtime	Mood, treatment	Expenditure	Time spent on shopping	Sleep of others in family
South Korea	Symptoms	Mood	Problems at bathtime	Treatment	Expenditure	Emotional distress

IDQoL: Infant's dermatitis quality of life, DFI: Dermatitis family impact

Table 3: Correlations of the infant's dermatitis quality of life index, the dermatitis family impact, and parental assessment of disease severity (Spearman r)

	IDQoL-DFI		IDQOL - Parental assessment of disease severity		DFI - Parental assessment of disease severity	
Ukraine	r=0.58	*P*<0.0001	r=0.43	*P*<0.0001	r=0.41	*P*<0.0001
Czech Republic	r=0.68	*P*<0.0001	r=0.51	*P*<0.0001	r=0.37	*P*<0.0001
Singapore	r=0.72	*P*<0.0001	r=0.75	*P*<0.0001	r=0.55	*P*<0.0001
The Netherlands	N.A.	N.A.	r=0.52	*P*<0.0001	N.A.	N.A.
Brazil	r=0.77	*P*<0.0001	r=0.82	*P*<0.0001	r=0.70	*P*<0.0001
South Korea	r=0.67	*P*<0.0001	r=0.77	*P*<0.0001	r=0.60	*P*<0.0001

IDQoL: Infant's dermatitis quality of life, DFI: Dermatitis family impact, N.A.: Not available

found. Thus, symptoms were assessed less severe in Ukrainians in comparison with Koreans (1.22±0.78 and 1.67±0.97, $P<0.05$). Mood changes were higher in Brazilian and Korean children than in Dutch children (0.51±0.65, 1.07±0.70, and 1.02±0.90, respectively, $P<0.05$). Impact of AD on playing and swimming was less severe for Dutch than for Czech and Brazilians (0.29±0.58, 0.79±0.96, and 0.84±0.65, respectively, $P<0.01$). Items concerning impact on family activity and mealtimes were also assessed significantly lower by Dutch parents than by Ukrainian, Czech, Brazilian, and Korean parents (0.29±0.58, 1.03±0.88, 0.73±0.88, 0.72±0.70, and 0.55±0.72 for family activity and 0.12±0.33, 0.75±0.77, 0.56±0.81, 0.84±0.65, and 0.74±0.76 for mealtimes, respectively, $P<0.05$). Brazilian children had significantly higher impact of their treatment on QoL than Ukrainians, Czech, Singapore, and Dutch children (1.07±0.67, 0.64±0.70, 0.38±0.68, 0.39±0.69, and 0.31±0.51, respectively, $P<0.01$). Problems with dressing had higher impact on Brazilians than on Ukrainians, Singaporeans, and Dutch (1.02±0.80, 0.61±0.75, 0.18±0.39, and 0.39±0.67, respectively, $P<0.01$). Meanwhile, Singaporeans had less concern on dressing than Ukrainian and Czech children (0.18±0.39, 0.61±0.75, and 0.81±0.93, respectively, $P<0.05$) and Dutch less concern than Czech (0.39±0.67 and 0.81±0.93, $P<0.05$). Problems at bathtime had more severe impact on Brazilians than on Ukrainians, Singaporeans, and Dutch (1.02±0.80, 0.63±0.77, 0.45±0.76, and 0.49±0.68, respectively, $P<0.01$).

Mean DFI results did not differ significantly in patients from different countries. Some differences were found only in four separate DFI items. Ukrainians and Koreans had higher impact on family food preparation and feeding than Czech and Brazilian families (1.09±0.89 and 1.15±0.95 versus 0.71±0.84 and 0.42±0.70, respectively, $P<0.05$) and higher impact on housework than Czech families (0.85±0.88, 1.02±0.91, and 0.47±0.76, respectively, $P<0.01$). Brazilians had more time to spend on shopping than Ukrainians, Czech, Singapore, and Koreans (1.23±0.61, 0.62±0.81, 0.46±0.75, 0.55±0.85, and 0.55±0.72, respectively, $P<0.01$). Meanwhile, Korean parents had more problems with child's treatment than Ukrainian, Czech, Singaporean, and Brazilian (1.44±0.92, 1.03±0.88, 0.73±0.88, 0.82±0.92, and 0.72±0.70, respectively, $P<0.05$).

Separate IDQoL and DFI items were well correlated with parental assessment of disease severity in almost all cases [Tables 4 and 5]. However, only in Ukrainians, four IDQoL items negatively and one item positively correlated with the age of patients ("symptoms" r=–0.21, $P<0.05$; "mood" r=0.21, $P<0.05$; "time to get to sleep" r=–0.22, $P<0.05$; "total time disturbed" r=–0.45, $P<0.001$; "dressing uncomfortable" r=–0.31, $P<0.01$) and IDQoL item on symptoms correlated with the age in Czech and Dutch children (r=0.30 and r=0.42, $P<0.01$, respectively). Only one separate DFI item in Ukrainian parents ("sleep of others in family" r=–0.26, $P<0.05$) and two DFI items in Korean parents ("food preparation and feeding" r=–0.30,

Table 4: Correlations of separate infant's dermatitis quality of life index items with parental assessment of disease severity (Spearman r)

AD severity assessed by the parents	IDQoL questions									
	Symptoms	Mood	Time to get to sleep	Total time disturbed	Playing or swimming	Enjoying family activity	Mealtimes	Problems from treatment	Dressing uncomfortable	Problems at bathtime
Ukraine	r=0.51 *P*<0.0001	r=0.07 *P*=0.49	r=0.16 *P*=0.11	r=0.24 *P*<0.05	r=0.34 *P*<0.001	r=0.29 *P*<0.01	r=0.32 *P*<0.01	r=0.26 *P*<0.01	r=0.30 *P*<0.01	r=0.26 *P*<0.05
Czech Republic	r=0.35 *P*<0.0001	r=0.33 *P*<0.0001	r=0.19 *P*<0.05	r=0.17 *P*=0.06	r=0.50 *P*<0.0001	r=0.49 *P*<0.0001	r=0.22 *P*<0.05	r=0.33 *P*<0.001	r=0.28 *P*<0.01	r=0.46 *P*<0.0001
Singapore	r=0.70 *P*<0.0001	r=0.56 *P*<0.0001	r=0.39 *P*<0.01	r=0.30 *P*<0.05	r=0.33 *P*<0.05	r=0.28 *P*=0.07	r=0.31 *P*<0.05	r=0.35 *P*<0.05	r=0.46 *P*<0.01	r=0.31 *P*<0.05
The Netherlands	r=0.49 *P*<0.001	r=0.28 *P*<0.05	r=0.20 *P*=0.18	r=0.29 *P*<0.05	r=0.22 *P*=0.14	r=0.27 *P*=0.05	r=0.11 *P*=0.44	r=0.18 *P*=0.21	r=0.49 *P*<0.001	r=0.25 *P*=0.09
Brazil	r=0.56 *P*<0.0001	r=0.47 *P*<0.01	r=0.69 *P*<0.0001	r=0.62 *P*<0.0001	r=0.65 *P*<0.0001	r=0.40 *P*<0.01	r=0.59 *P*<0.0001	r=0.67 *P*<0.0001	r=0.71 *P*<0.0001	r=0.65 *P*<0.0001
South Korea	r=0.65 *P*<0.0001	r=0.60 *P*<0.0001	r=0.60 *P*<0.0001	r=0.45 *P*<0.001	r=0.17 *P*=0.22	r=0.37 *P*<0.01	r=0.42 *P*<0.01	r=0.50 *P*<0.001	r=0.38 *P*<0.01	r=0.36 *P*<0.01

IDQoL: Infant's dermatitis quality of life, AD: Atopic dermatitis

Table 5: Correlations of separate dermatitis family impact items with parental assessment of disease severity (Spearman r)

AD severity assessed by the parents	DFI questions									
	Housework	Food preparation and feeding	Sleep of others in family	Family leisure activity	Time on shopping	Expenditure	Tiredness/ exhaustion	Emotional distress	Relationships	Treatment
Ukraine	r=0.30 *P*<0.01	r=0.25 *P*<0.05	r=0.41 *P*<0.0001	r=0.14 *P*=0.19	r=0.35 *P*<0.01	r=0.24 *P*<0.05	r=0.25 *P*<0.05	r=0.29 *P*<0.01	r=0.18 *P*=0.10	r=0.24 *P*<0.05
Czech Republic	r=0.29 *P*<0.001	r=0.15 *P*=0.10	r=0.31 *P*<0.001	r=0.29 *P*<0.01	r=0.34 *P*<0.0001	r=0.37 *P*<0.0001	r=0.25 *P*<0.01	r=0.26 *P*<0.01	r=0.22 *P*<0.01	r=0.19 *P*<0.05
Singapore	r=0.54 *P*<0.0001	r=0.47 *P*<0.01	r=0.51 *P*<0.001	r=0.42 *P*<0.01	r=0.43 *P*<0.01	r=0.24 *P*=0.11	r=0.38 *P*=0.01	r=0.38 *P*=0.01	r=0.30 *P*=0.05	r=0.37 *P*=0.01
Brazil	r=0.13 *P*=0.40	r=0.07 *P*=0.63	r=0.57 *P*<0.0001	r=0.57 *P*<0.0001	r=0.67 *P*<0.0001	r=0.55 *P*=0.0001	r=0.62 *P*<0.0001	r=0.60 *P*<0.0001	r=0.57 *P*<0.0001	r=0.42 *P*<0.05
South Korea	r=0.40 *P*<0.01	r=0.45 *P*<0.001	r=0.60 *P*<0.0001	r=0.49 *P*<0.001	r=0.45 *P*<0.001	r=0.45 *P*<0.001	r=0.62 *P*<0.0001	r=0.46 *P*<0.001	r=0.55 *P*<0.0001	r=0.52 *P*<0.0001

AD: Atopic dermatitis, DFI: Dermatitis family impact

P<0.05 and "helping with treatment" r=–0.28, *P*<0.05) significantly correlated with the age of their children with AD.

DISCUSSION

Our results showed common tendencies in the assessment of QoL and family QoL in nonrandomized AD children from different countries. High level of correlation between parental assessment of disease severity with the IDQoL and the DFI confirms common tendencies in the assessment of QoL and family QoL by parents of AD children from different countries despite cultural, climatic, and economic peculiarities. Authors of previously published studies on the IDQoL and the DFI were eager to show only the three highest scored items of the questionnaires.[13,15,17] The value of this approach is controversial because the difference between highest scored items and subsequent highly scored items may often be insignificant. However, three highest scored items of the IDQoL and the DFI in counties we studied were quite common. Despite rather low impact of AD on expenditures in UK study,[11] our study demonstrated high impact of this DFI item for all studied countries. We studied economical parameters in participating countries and did not find any difference in the assessment of the economical impact of AD on families from countries with different economical situations. Meanwhile, Camfferman *et al.*[25] recently reported that low socioeconomic status is associated with a higher frequency of disturbed sleep due to eczema in children. In our study, Brazilian families were from one of the poorest regions of the country and only they reported sleep of others in the family as one of the top scored items.

We also checked total fertility rate, infant mortality rate, and literacy in all participated countries [Table 6]. It seems that only combination of higher fertility rate with high infant mortality rate may play some role in the attitude of Brazilians parents to their own QoL and QoL of their children. They did not assess emotional distress as top scored DFI item but reported high impact of AD on time spends on shopping, on the mood of their children and high impact of AD treatment on their children.

AD had sufficient impact on child's mood in all studied countries. According to Ricci *et al.*,[15] parents perceive their child's mood with great sensitivity and attention and are able to sense small alterations and changes in his mood and everyday activities. However, feelings of exhaustion and depression in parents can sometimes alter this perception and lead to a slight overrating in their assessment. Meanwhile in our study, Brazilian and Korean parents who reported highest impact of AD on their child's mood did not assess emotional distress or tiredness and exhaustion higher than others.

Emotional distress was reported as a serious problem for all parents except Brazilian. Moderate to severe childhood eczema should be regarded as a significant illness in which maternal stress is equivalent to that associated with the care of children with severe developmental and physical problems.[26] Despite the fact that parenting distress is associated with severe atopic eczema in early childhood, Daud and colleagues[27] reported that atopic eczema does not lead to insecurity of the mother-child attachment. However, our results indicate the necessity of inclusion of measures focused on a decrease of parental distress caused by AD in their child into all educational

Table 6: Demographic and economical parameters

Country	Total fertility rate (children born/ woman)	Infant mortality rate (deaths/1000 live births)	Literacy (%)	Gross domestic product per capita* (USD)
Ukraine	1.28	8.54	99.4	6698
Czech Republic	1.26	3.73	99	24950
Singapore	1.11	2.32	92.5	56694
The Netherlands	1.66	4.59	99	40973
Brazil	2.18	21.17	88.6	11273
South Korea	1.23	4.16	97.9	29997

*Data for the year 2010 from the International Monetary Fund. Source: Adopted from http://www.indexmundi.com and http://en.wikipedia.org/wiki/list_of_countries_by_gdp_(ppp)_per_capita

activities for this group of patients and their families.

Significant correlation of itch and sleeplessness is well documented in large studies.[28] However, only Brazilians assessed sleeplessness of the parents higher than tiredness and exhaustion or emotional distress. Therefore, it is possible to consider that parental exhaustion and emotional distress are more complicated problems than simple consequences of sleeplessness.

The fact that impact of AD on relation in the family was not a highly assessed item in our study is optimistic because it was previously reported that divorce/separation is associated with a significantly increased incidence of AD in children.[29] Meanwhile, in all countries except Ukraine, impact of AD on relation in the family was higher in children with higher parental assessment of disease severity.

Parent-caregiver's assessment of severity of AD was previously found to be the single strongest predictor of family impact.[30] In our study, Korean parents assessed disease severity of their children highly. However, Korean parents had more problems with child's treatment only. Korea has its unique culture and parents of AD children usually depend on other sources of medical care such as oriental medicine or herbal medicine for their children's treatment. Therefore, they spend extra money for lots of medications which are not evidence based. This tendency may affect parents and increase the impact of AD. Meanwhile, negative correlation of this DFI item with age in Korean parents suggests that this is mostly a problem of initial relapses of AD and deficit of experience in parents.

Lower IDQoL results in Dutch patients may be partially explained by absence of severe cases of AD in this group. Recommendations of the general practitioner that treated Dutch patients contain less limitations and restrictions and may also be the reason of better QoL assessment results.

Patients from Singapore have low impact of AD on their dressing. Singapore is near to equator and there is no winter there. Hence, children wear minimal clothes at home and this may result low assessment of this IDQoL item. Despite the fact that Brazil is also located near equator, Brazilians assessed the impact of AD on their child's dressing much higher. However, they did not use any special clothes. This peculiarity may be addressed to intercultural differences.

Problems at bathtime and impact of AD treatment in Brazilians may be considered as other intercultural differences. Most of Brazilians reported two baths a day and no problems with water quality or costs. Despite the absence of severe cases of AD in studied patients from Brazil, their parents consider high impact of treatment on children's QoL. Brazilians spend more time for shopping may be attributed to objective factors.

Another intercultural difference is that Ukrainian parents begin to consider clinical manifestations of their children AD less severe and Czech and Dutch parents more severe with age of children. According to literature data, AD may resolve completely in half of the children by the age of two, but in others persists in a mild form or periodically recurs.[31] Thus, Ukrainian parents assess their child's symptoms with higher objectivism. Meanwhile, Czech and Dutch parents consider condition more severe in older group of children. The reason for that can be hidden in more serious self-consciousness and stress connected with psychological and physical limitations caused by AD in older children.

We have shown some difference in QoL and family QoL assessments caused by cultural peculiarities in different countries. However, these differences concern few separate items of the DFI and IDQoL questionnaires. Correlations between both questionnaires and parental assessment of disease severity were common in all countries. Thus, our results showed that parents in different countries assessed QoL and family QoL of their children with AD in similar way. It makes possible to recommend the IDQoL and the DFI questionnaires for international

studies as reliable initial measure tool to assess impact and efficacy of treatment. The next important step to confirm this statement should be an international study on the influence of same treatment methods on the IDQoL and DFI results.

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