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ORIGINAL ARTICLE

Participants' Satisfaction with the Atopic Dermatitis Education Program: Assessing the Impact of Each Content Using Structural Equation Modeling

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Background: Only a few studies have tried to assess factors relevant to the satisfaction of the participants in atopic dermatitis (AD) educational programs. More systematic modeling of this issue is needed. **Objective:** To examine the benefit of a conjoint educational program for AD on patients and caregivers in a clinical setting. **Methods:** In a half-day educational program called "AD school", 831 people (493 patients and 338 family members) participated for 8 years. Various educational and entertaining programs were provided. The on-site survey was administered to measure participants' satisfaction and perception of the benefit. We applied structural equation modeling to identify the relations among satisfaction and perception. **Results:** A total of 209 family survey data was obtained and analyzed. The survey items were grouped into four categories. The categories were classified as individual education, group education, fun activity, and overall satisfaction (fun, benefit, intention to re-join and recommend to others). According to the model that we built, comprehensive group education was demonstrated to be the most relevant factor affecting overall satisfaction. **Conclusion:** Our holistic approach would allow dermatologists to improve the efficacy of the conjoint educational program for AD. **(Ann Dermatol 33(3) 237～244, 2021)**

-Keywords-
Atopic dermatitis, Education, Satisfaction

INTRODUCTION

Atopic dermatitis (AD) is known as an important chronic and relapsing inflammatory skin disease[1]. AD is a complex disorder that encompasses genetics, barrier function, immunity, and environmental factors that all play key roles[2]. Because of the tendency to proceed chronically, patient education for AD is essential in the care of the patient with AD. Previous research has shown that patient education adds value to AD management and that specific interventions aimed at improving patient knowledge can improve AD control[3-6]. However, there is a dearth of research into which programs can be directly related to patient and caregiver satisfaction, and there is still a lack of systematic and standardized educational programs for AD. Education for patients with AD is conducted in a wide variety of ways. Although it is difficult to figure out what

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type of education program is most relevant to satisfaction, it remains an intrinsically worthy goal due to several important benefits such as using it as a basic resource for developing more effective educational programs for AD. Nevertheless, few studies utilizing satisfaction and its relevant variables have been conducted because the literature investigating patient satisfaction suffered from finding a valid methodological approach. That is why a qualitative approach and simple statistical regression analysis were preferred to highlight a single factor of relevance to improve patient satisfaction. Structural equation modeling is one of the powerful multivariate analysis methods. It can provide a very effective structural framework in identifying the complex relationship between multiple variables that researchers can use empirical models to test the validity of theories. Because it analyzes multiple variables at the same time, it has an advantage over other correlation methods such as regression, and latent factors reduce measurement errors[7].

Since 2005, we have offered an annual half-day, a family-engaged educational program entitled "AD School in Daegu-Gyeongbuk, South Korea". Our AD school includes a variety of programs for patients and caregivers. Upon the completion of the AD school, participants and their family members were asked to evaluate factors that may be directly related to satisfaction of the educational programs. In the previous study, we simply measured and described the satisfaction level of each program, to understand patients' satisfaction[8]. Through this follow-up study, we tried to create an integrated framework for assessing the satisfaction level of the AD education program by applying structural equation modeling. Specifically, in this study, we aim to answer what are the strongest predictors for the overall satisfaction of AD educational programs and their associations. This information enriches the theoretical insights and practices of the AD education program.

MATERIALS AND METHODS

Participants

Since the previous study (2005～2011)[8], 493 AD patients (44.4% male; mean age, 9.0±7.7 years) and 338 caregivers participated in our AD school for 8 years from 2012 to 2019. AD was diagnosed by a dermatologist according to Hanifin and Rajka's diagnostic criteria and participants were recruited jointly from five university hospitals in the same province of South Korea. This study was approved by the Institutional Review Board of Kyungpook National University Hospital (IRB no. KNUH 2020-01-008).

AD school: a conjoint educational program for AD patients

AD school was conducted once a year on Saturday as a half-day program for patients with AD and their families (Table 1). After enrollment, patients and families participated in training that focused on the importance of moisturizers and how to apply them properly. Education on moisturizers was conducted individually for each family

Table 1. Structure and content of the atopic dermatitis (AD) school aimed at children with atopic dermatitis and their parents

Session	Educator	Target group	Duration (min)	Topic
1. Individual education				
Emollient education	Dermatology residents	Patients with AD and their families	10～15	Individual training on the proper selection of moisturizers and proper application methods
Skin prick test	Dermatology residents	Patients with AD and their families	15	Individual education to correct lifestyle modification based on the results of a skin prick test
2. Group education				
Lecture on AD causes	Dermatology professors	Caregivers of pediatric AD patients and adult AD patients	20～30	Group lecture to help better understanding on the various and complex causes of AD
Lecture on AD diagnosis	Dermatology professors	Caregivers of pediatric AD patients and adult AD patients	20～30	Group lecture on various clinical features included in the AD diagnosis criteria
Lecture on AD care	Dermatology professors	Caregivers of pediatric AD patients and adult AD patients	20～30	Group lecture on AD management and treatment according to the severity of symptoms
3. Fun activity				
Drawing contest	Art teacher	Pediatric AD patients	60	Entertaining program for young AD patients who are hard to get an education
Recreation (magic show)	Magician	All participants	30	

for 10 to 15 minutes by dermatology residents. If agreed, dermatology residents performed a skin prick test and informed the results to the patient and caregivers. An emergency kit was ready, but no emergency occurred since the AD school was firstly offered. Then the caregivers of pediatric AD patients and adult AD patients participated in the educational lectures. The lecture was conducted by dermatology professors for 20 to 30 minutes each on the cause, diagnosis, treatment, and management of AD. Thus, the total group education lasted 60 to 90 minutes. In addition, although it was slightly different from year to year, some of AD schools included additional lectures on emotional stability and nutritional management of AD patients by specialists. The pediatric AD patients participated in a drawing contest or watched a movie in another room during an educational lecture. After the lecture ended, the patients and caregivers took part in recreational activities such as magic shows.

On-site surveys

The on-site survey was conducted for 209 families who agreed to participate in the survey. Each family was required to submit a survey and the members of the family answered the questions carefully after they discussed programs of the AD school. Satisfaction with each program and the individual lecture was surveyed on a 4-point Likert scale ("Very unsatisfied", "Unsatisfied", "Satisfied", "Very satisfied"). In addition, fun, benefit, intention to rejoin AD school and willingness to recommend AD school to others were collected and utilized in this study.

Modeling for satisfactions of AD school

AD school purports to improve patients' and their family members' AD management and control, which eventually alleviate AD symptoms or treat the AD via their own care strategy. On the other hand, it is not well studied what kind of programs in the AD school contribute satisfaction to the AD school improving the AD management and control. Based on the programs that we implemented in the AD school, this study (1) explored constructs defined based on participants' responses and (2) examine a priori specified hypothesis that the overall satisfaction of the AD

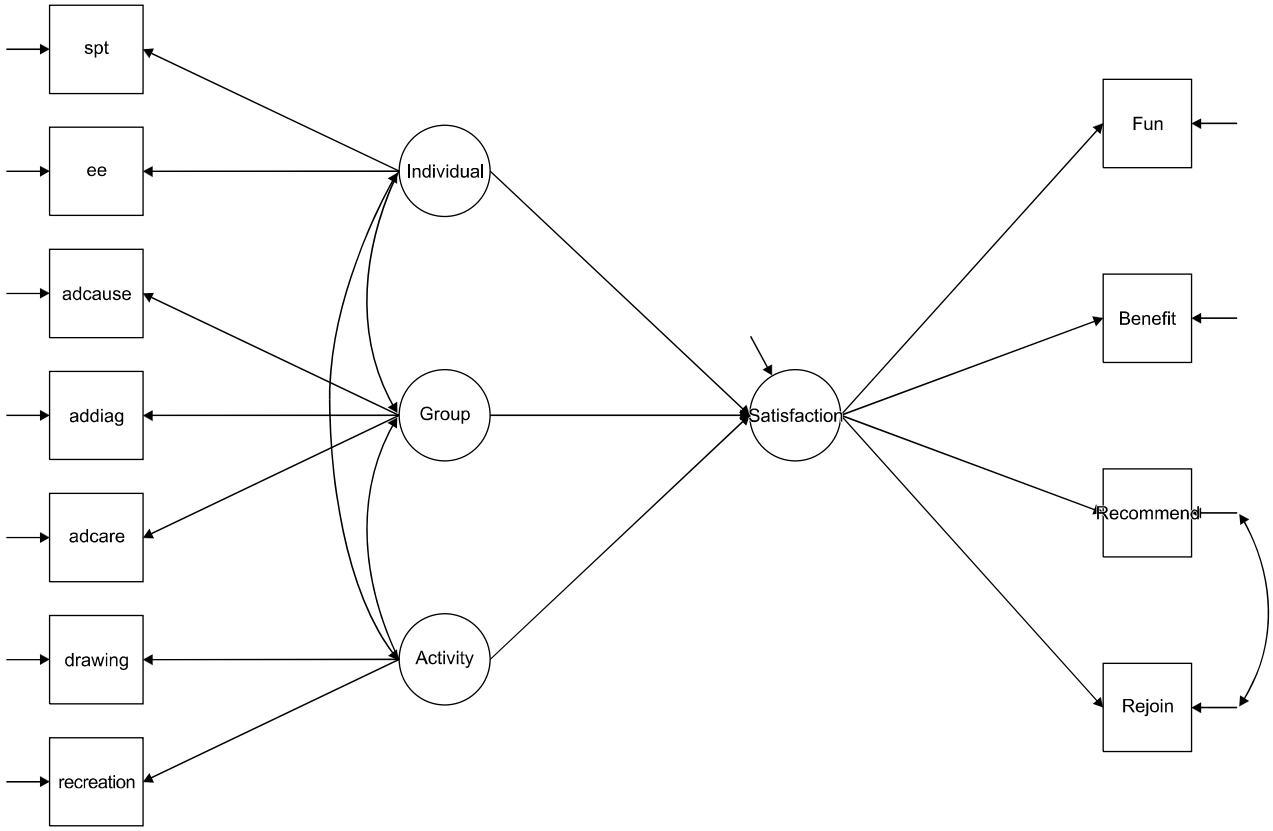

Fig. 1. A priori specified hypothesis of the overall satisfaction of the atopic dermatitis (AD) school with educational program. spt: stands for skin prick test, ee: emollient education, adcause: lecture on AD causes, addiag: lecture on AD diagnosis, adcare: lecture on AD care and treatment, drawing: drawing contest, recreation: magic show, Individual: individual education, Group: group education, Activity: fun activities.

program is predicted by the constructs associated with the programs in the AD school. The priori specified hypothesis is depicted in Fig. 1.

Statistical analysis: a structural equation modeling approach

To be utilized within a single level modeling for 209 families collected over multiple years, it should be examined if there is a clustering effect with regard to year. The intraclass correlation coefficient (ICC) was examined to identify possible clustering effects. ICC is defined by

$$\text{ICC} = \frac{Var(Year)}{Var(Year) + Var(Residual)}$$

which would explain any clustering effect for each indicator. All ICC values measured between 0.007 and 0.148, corresponding to a small ICC, except two variables, skin prick test and recommend, not producing ICCs due to no variability for a certain year. Thus, it was not considered necessary to fit multilevel modeling dealing with the clustering effect in this study.

The hypothesized model depicted in Fig. 1 consist of (1) a structural model describing the association among four constructs: individual education (emollient education and skin prick test), group education (lecture on causes, diagnosis, and care of AD), fun activity (drawing contest and magic show), and overall satisfaction of the AD school (fun, benefit, intention to re-join and recommend to others) and (2) a measurement model including four-factor models for the four constructs. Based on the variance-covariance matrix constructed to model the overall satisfaction, the data were examined to test whether the hypothesized model was a good fit for the data using the full maximum likelihood estimation (FMLE) in Mplus 8.4 (Los Angeles, CA, USA)[9].

The variance-covariance matrix also indicated that the skewnesses and kurtoses for ordinal variables were nearly all between 2 and −2 (except the kurtosis of SPtest, 2.85), which represented an acceptable normal distribution[10]. When fitting structural equation modeling into the data, the MLR estimation option in Mplus was applied, which serves as a maximum likelihood estimator producing the correct asymptotic covariance matrix of the estimates that is not dependent on the assumption of normality. This also yields a robust chi-square test of model fit[9,11].

To check for any possible influential cases, the Cook's distances and Studentized residuals were obtained, indicating no severe influential cases based on cut-offs of 1.0 and ± 3.0, respectively. The variance inflation factor for each variable used was between 1.582 and 7.921 (<10), indicating that there was no severe multicollinearity issue. Multivariate outliers and multicollinearity were examined using IBM SPSS ver. 26[12].

To test the model fit of the data, three model fit indices and a chi-square test result were recorded. Root mean square estimate of approximation (RMSEA), comparative fit index (CFI), and standardized root mean square of residual (SRMR) were applied using the following criteria for a good fit: RMSEA <0.05, CFI >0.95, and SRMR <0.08[13].

RESULTS

This study aims are twofold: (1) defining four constructs based on participants' responses and (2) confirming the priori specified hypothesis depicted in Fig. 1. The former can be done by examining the reliabilities of four constructs, the associations between constructs, and their indicators within the measurement model. The latter can be done by evaluating the hypothesized model including the structural model by using the data of 209 responses.

Composite reliabilities

Applying factor rho coefficient formula[14,15], we found the four composite reliabilities as 0.688 for individual education factor, 0.870 for group education factor, 0.772 for fun activity factor, and 0.961 for overall satisfaction factor in

Table 2. Parameter estimates of structural model in the hypothesized model

Structural model	Unstandardized estimate	Unstandardized SE	Standardized estimate	Standardized SE
Overall satisfaction on				
Individual education	0.148	0.164	0.164	0.184
Group education	0.712	0.139	0.701	0.119
Fun activity	0.088	0.223	0.096	0.243

SE: standard error.

Table 3. Parameter estimates of factor structure and factor reliabilities in the hypothesized model

Factor correlation	Individual	Group	Activity	Composite reliability
Individual education	0.183			0.688
Group education	0.079	0.144		0.870
Fun activity	0.143	0.116	0.177	0.772
Overall satisfaction				0.961

Diagonal entities for the first 3 factors are factor variances and the last column is composite reliability.

Table 2 and 3. Those values indicate the internal consistency of factors. Reliabilities for all of four factors are greater than 0.6 including one less than 0.7 and one greater than 0.9, which is acceptable to confirm that the survey questionnaire measures four factors well.

Model evaluation

Fit indices evaluating the model fit were 0.070 in RMSEA, 0.964 in CFI, and 0.042 in SRMR, which tells that the hypothesized model was supported well by the data. R squared for the overall satisfaction was 0.762 meaning that 76.2% of the variance of the overall satisfaction was explained by this model. Therefore, we can say that the model was explained well by the data. We found a statistically significant path from group education to overall satisfaction ($\beta = 0.712$ and $p < 0.001$), which means that participants learned more in the group education were more positively satisfied with the whole AD education program. Although correlations among the three factors, individual education, group education, and fun activity, were significant ($p < 0.001$) and are positively associated with the overall satisfaction in Table 2 and 3, the two paths from individual education and fun activity were not statistically significant predictors of the overall satisfaction. The fitted model with parameters estimates were depicted in Fig. 2 and listed in Table 4.

In sum, to compare and analyze the AD patient's satisfaction for various programs of Daegu-Gyeongbuk AD school, the programs were classified into individual education, group education, and fun activity, and a hypothesized model describing the associations between the programs and the AD patient's satisfaction were examined. The hypothesized model was supported by 209 responses via the structural equation modeling, which informs that the group education of the three groups was most relevant to the participants' overall satisfaction.

DISCUSSION

Patient education is an important aspect of patient care in AD[16]. Various aspects of education including comprehension of the disease and long-term lifestyle modification are significantly needed and is an important aspect for both pediatric AD patients and their family members[17,18]. Successful AD education increases participants' satisfaction and contributes to the prevention of the chronicity and severe deterioration of AD, including the development of allergy marches.

Most previous reports on AD educational programs have overlooked educational satisfaction. Moreover, the reports

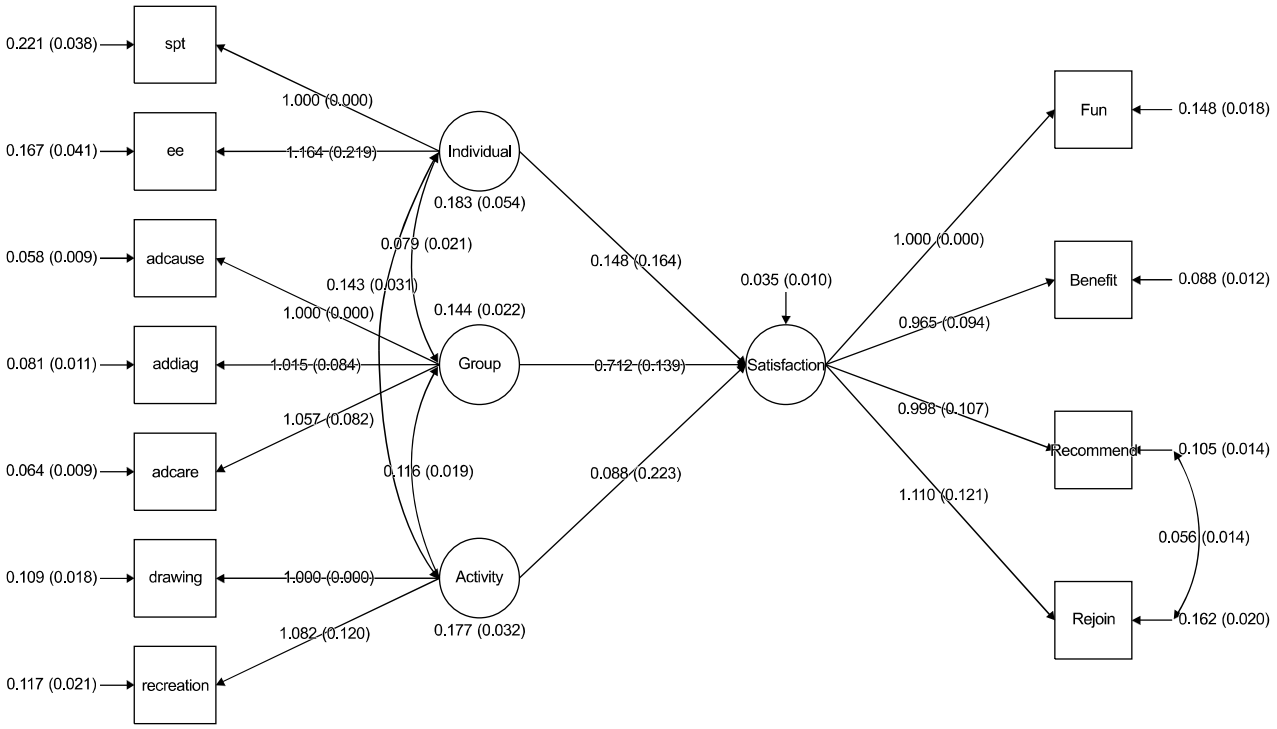

Fig. 2. Fitted model of the priori hypothesized model with parameters estimates. spt: stands for skin prick test, ee: emollient education, adcause: lecture on AD causes, addiag: lecture on AD diagnosis, adcare: lecture on AD care and treatment, drawing: drawing contest, recreation: magic show, Individual: individual education, Group: group education, Activity: fun activities.

Table 4. Parameter estimates of measurement model in the hypothesized model

Measurement model	Unstandardized	SE	Standardized	SE	Error variance	R squared
Individual education by						
spt	1.000		0.428	0.063	0.221	0.453
ee	1.164	0.219	0.498	0.054	0.167	0.598
Group education by						
adcause	1.000		0.379	0.029	0.058	0.714
addiag	1.015	0.084	0.385	0.029	0.081	0.648
adcare	1.057	0.082	0.401	0.028	0.064	0.714
Fun activity by						
drawing	1.000		0.420	0.038	0.109	0.618
recreation	1.082	0.120	0.455	0.042	0.117	0.639
Overall satisfaction						0.762

SE: standard error, spt: skin prick test, ee: emollient education, adcause: lecture on atopic dermatitis (AD) causes, addiag: lecture on AD diagnosis, adcare: lecture on AD care and treatment, drawing: drawing contest, recreation: magic show.

did not include a detailed satisfaction level of the intervention itself, including the specific programs utilized. This may cause the ambiguity of the concept of satisfaction. In the current study, we have subdivided the concept of satisfaction into four components: fun, benefit, intention to re-join, and recommendation of the program to others. In addition, each specific educational content was grouped into relatively short time individual (face-to-face) education (education on moisturizers and skin prick test by dermatology residents), long time group education (educational lectures on AD cause, diagnosis, treatment, and management), and fun entertaining activities (drawing contest, watching a movie, and magic show). Structural equation modeling was applied to integrate the detailed satisfaction items and investigate what types of education can contribute to overall educational satisfaction[19,20]. We have found that all three types of program sessions (individual education, group education, and fun activity) can contribute to overall satisfaction from the on-site survey conducted over the past seven years. Among the contributions, we should highlight that group education on various aspects of AD itself by dermatology professors was most relevant to the overall satisfaction.

AD has a very complex pathogenesis and shows a high degree of heterogeneity of the clinical phenotype[21]. In addition, treatment options are very diverse and often difficult to be determined due to dependency on the patient[22]. In the hospital setting, it is often difficult to deliver such vast amounts of information to patients in a short time. In this respect, patients or their families have unmet needs for information on what AD is, how to diagnose, or how to treat it. For this reason, the participants very likely expressed the greatest satisfaction with group education. This may also be a reason that long term group education covers many different cases that fit to each patient's need. In addition, participants may have expressed more satisfaction with education by professional clinicians or professors when compared to residents. We believe that group education by experts is traditional but, in reality, it is still useful because it effectively delivers a large amount of information about AD. There is also some evidence that group educational programs are more cost-effective and better in supporting lifestyle changes in other medical conditions such as diabetes[23].

In relation to the AD education program, there exist some limitations to our study. First, it was not confirmed whether satisfaction with education led to the improvement of AD symptoms of patients. Our group is trying to periodically follow-up on the patients who participated in the AD school and investigate subjective symptom improvement of AD through patient's self-reported disease severity such as itch numeric rating scale. This approach can also be extended to the patient's relationship with family members and/or caregivers. Information on the effectiveness and satisfaction of the education will be analyzed through the structural equation modeling method used in this study and this result would be used to build a better evaluation model for educational programs. Second, we obtained results via structural equation modeling with a patient's survey for a limited number of education programs. In the future study, it would be necessary to develop and evaluate the satisfaction of various education programs through a multidisciplinary approach that includes aspects of field experts such as dermatologists, allergists, dieticians, psychologists, educators, and nursing staff. Third, participants were mainly pediatric atopic patients and their families. Thus, satisfaction was recorded in consultation within the family, which would be a bias because the response would mainly reflect the opinions of adult family members. Fourth, the educational cycle, once a year, may be too long and

may need to be supplemented through easy and sustainable self-directed methods such as cognitive-behavior therapy, interpersonal psychotherapy via video modules.
In conclusion, patients or caregivers' satisfaction with educational programs has been known as one of the main predictors of AD-related outcomes. Determining which programs affect participants' engagement and satisfaction based on our structural equation model can help guide dermatologists in selecting appropriate strategies to promote the active engagement of patients and families and overall satisfaction. Although our study indicates that group-based education by AD experts is most closely related to participants' satisfaction, further studies are needed with broader ranges of patients and diverse programs, to tailor more targeted programs for AD patients.

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CONFLICTS OF INTEREST

The authors have nothing to disclose.

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DATA SHARING STATEMENT

Research data are not shared.

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