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 disease1. AD is a complex disorder that encompasses genetics, barrier function, immunity, and environmental factors that all play key roles2. 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 control3-6. 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
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 | Dermatology residents | Patients with AD and their families       | 10~15          | Individual training on the proper selection of moisturizers and proper application methods |
| Emollient education | Dermatology residents | Patients with AD and their families       | 15             | Individual education to correct lifestyle modification based on the results of a skin prick test |
| Skin prick test  | Dermatology residents | Patients with AD and their families       | 15             | Group lecture to help better understanding on the various and complex causes of AD |
| 2. Group education | 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 causes | 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 |
| Lecture on AD diagnosis | Dermatology professors | Caregivers of pediatric AD patients and adult AD patients | 20~30          | Entertaining program for young AD patients who are hard to get an education |
| Lecture on AD care | Dermatology professors | Caregivers of pediatric AD patients and adult AD patients | 20~30          | Entertaining program for young AD patients who are hard to get an education |
| 3. Fun activity | 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 | Entertaining program for young AD patients who are hard to get an education |
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

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**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

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

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 estimate  |
|                         | Standardized estimate SE | Standardized estimate SE |
| Overall satisfaction     |                          |                          |
| Individual education     | 0.148                    | 0.164                    |
|                         | 0.148                    | 0.164                    |
| Group education          | 0.712                    | 0.139                    |
|                         | 0.712                    | 0.139                    |
| Fun activity             | 0.088                    | 0.223                    |
|                         | 0.088                    | 0.223                    |

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 | 0.144 | 0.870 | 0.688 |
| Group education                              | 0.079 | 0.116 | 0.177 | 0.961 |
| Fun activity                                 | 0.143 | 0.223 | 0.243 | 0.772 |

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\textsuperscript{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\textsuperscript{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
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          | 0.498 | 0.054       | 0.167 | 0.598          |
| Group education by           |                |     |              |     |                |           |
| adcause                      | 1.000          | 0.379 | 0.029       | 0.058 | 0.714          |
| addiag                       | 1.015          | 0.385 | 0.029       | 0.081 | 0.648          |
| adcare                       | 1.057          | 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          | 0.455 | 0.042       | 0.117 | 0.639          |
| Overall satisfaction         | 1.082          | 0.455 | 0.042       | 0.117 | 0.639          |

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.

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.

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.

ACKNOWLEDGMENT

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2018R1D1A3A03000686), and a grant of the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea (grant number: HI18C0308).

CONFLICTS OF INTEREST

The authors have nothing to disclose.

FUNDING SOURCE

AD School in Daegu-Gyeongbuk was supported by The Korean Atopic Dermatitis Association and The Association of Daegyeong Dermatologists. The funder(s) had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

DATA SHARING STATEMENT

Research data are not shared.

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