

Exercise-Induced Asthma is Associated with Impaired Quality of Life Among Children with Asthma in Japan

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ABSTRACT

Background: Asthma is the most common chronic diseases in school-aged children in Japan. It is important to consider health-related quality of life (QoL) among children with chronic diseases when treatment decisions are made.

Methods: A school-based survey was conducted in randomly selected public schools in Tokyo by using a KINDL[®] questionnaire for evaluating QoL and the international study of asthma and allergy on childhood (ISAAC) questionnaire, which is designed for comparing the asthma prevalence in various countries, from May to June in 2005. We recruited approximately 10% of the total children 6–7-years-old and 13–14-years-old living in Tokyo for sampling.

Results: Response rate of this questionnaire was 86% (22,645 children) in the 6–7-year-old group and 64% (12,879 children) in the 13–14-year-old group. Comparing asthmatics with non-asthmatics in the same age, QoL of children with asthma was significantly impaired. The severity of QoL of children with asthma was significantly impaired. QoL of children with exercise-induced asthma (EIA) were more significantly impaired than ones without EIA and showed lower scores in the categories of physical functioning, emotional and school activities than those without EIA. Of note, QoL was more impaired in the EIA-positive group among severe asthmatics, suggesting that QoL of children with even severe asthma could be improved when EIA is appropriately controlled.

Conclusions: Existence of EIA among asthmatic children most strongly impairs their QoL. We should be more cautious about the management of EIA.

KEY WORDS

asthma, children, exercise induced asthma, health related QoL, ISAAC

INTRODUCTION

Asthma is the most common chronic diseases in school-aged children in Japan.^{1,2} The treatment of children with asthma extends over a long time. Therefore, it is important to consider the health-related quality of life (QoL) among children when treatment decisions are made in such chronic illnesses during childhood. According to the World

Medical Association Declaration of Ottawa on the Rights of the Child to Health Care, a pediatric patient and her/his parents or legal representatives have a right to actively participate in all decisions involving the child's health care. The wishes of the child should be taken into account.³

In young adults, indeed, asthma symptoms have been reported to be more obviously associated with QoL rather than objective lung function tests.⁴ Thus,

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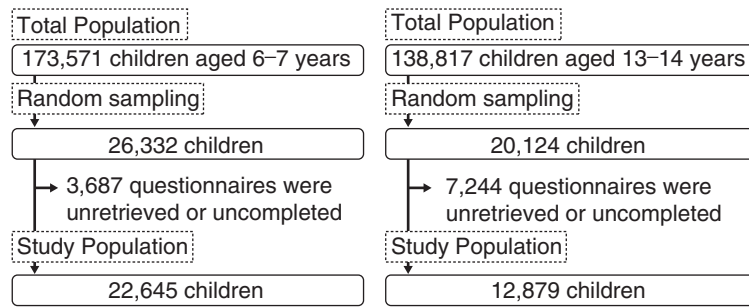


Fig. 1 Study subjects and the study protocol. According to the published list regarding the number of pupils in each grade, approximately 10% of total children of 6–7 years of age ($n = 22,645$) and 13–14 years of age ($n = 12,879$) living in Tokyo from May to June in 2005.

good QoL seems to be an important outcome of successful treatment. However, regarding school-aged children with asthma in comparison with healthy children or with children with other diseases, the number of reports and the information regarding QoL are still limited,⁵⁻⁷ although the children have reportedly impaired QoL, especially the physical dimensions such as general health and bodily pains.

Recently, the QoL Questionnaire for Japanese School-aged Children with Asthma Version 3 (JSCA-QOL v.3) has been developed in Japan and is recognized to be valid and reliable for evaluation among asthmatic children.⁸ Here, we used the KINDL[®] questionnaire to compare the QoL of asthmatic children and that of healthy children. We examined whether QoL is impaired in school-aged children with asthma in comparison with healthy non-asthmatic children of >300,000 total children as has been reported⁵⁻⁷ in other countries, and if so, to what extent and which factors were disturbed in them by assessing a generic QoL scale. We report here that the presence of exercise-induced asthma (EIA) may comprise a major factor impairing the QoL of children with asthma.

METHODS

STUDY SUBJECTS AND THE STUDY PROTOCOL

The study was carried out as a cross-sectional, questionnaire-based survey among 6–7-year-old and 13–14-year-old school children in Tokyo. According to the published list regarding the number of pupils in each grade, the total number of children aged 6–7 years (the first grade) and that of children aged 13–14 years (the eighth grade) were found to be 173,571 and 138,817 in all schools in Tokyo, respectively. Participants were extracted from up to 10% of the target population by selecting schools randomly. Then, some of public schools in Tokyo were randomly selected (Fig. 1). Questionnaires for the students of 6–7 years of age were completed by their parents, and those of the students of 13–14 years of age were com-

pleted by themselves. Then, the questionnaires were answered in an anonymous manner in collaboration with local education departments in Tokyo.

QUESTIONNAIRE

KINDL[®] Questionnaire

The school-based survey was conducted by using the KINDL[®] questionnaire, which was developed in Germany and designed for evaluating health-related QoL in children not specific to asthma symptoms and applicable to the general population with and without any disease,^{9,10} since we aimed to compare QoL of asthmatics with that of non-asthmatics. In addition, the number of question items is only 24 which is a reasonable number to answer and this KINDL[®]QOL has been used worldwide. The Japanese version of Kiddy-KINDL 4–7 year olds (Parents' Version)¹¹ was applied to children of 6 to 7 years of age. The Japanese version of Kiddo KINDL 12–16 years of age (Teenagers' Version)¹² was developed for junior high school students in Japan¹² and applied to students of 13 to 14 years of age in this study.

ISAAC Questionnaire

These QoL-related questions as well as questionnaires for asthma-related symptoms were asked to each child by using the international study of asthma and allergy on childhood (ISAAC)-questionnaire¹³ in order to make a comparison of QoL between the severities and various factors such as the existence of EIA among asthmatics. In this study, those who answered “yes” in the ISAAC question “Have you ever had wheezing or whistling in the chest in the past?” were defined as asthmatics and “In the last 12 months, has your child’s chest sounded wheezy during or after exercise?” were defined as EIA.

STATISTICAL ANALYSIS

Statistical analysis of the data was performed using the SPSS ver.12.0J.

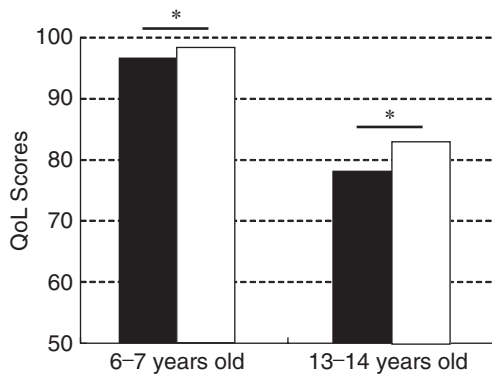


Fig. 2 The mean QoL scores of children with/without asthma. Closed column indicates children with asthma; and open column represents non-asthmatic children. The mean QoL score of asthmatic children ($n = 3,391$ for 6–7 years of age and $n = 1,438$ for 13–14 years of age) was significantly lower than that of non-asthmatics ($n = 17,789$ for 6–7 years of age and $n = 10,740$ for 13–14 years of age) in each age group. $*p < 0.05$.

ETHICS

The study protocol was approved by the ethics committee of the National Center for Child Health and Development.

RESULTS

Response rates to these questionnaires was 86% (22,645 children) in the 6–7-year-old group and 64% (12,879 children) in 13–14-year-old group. Prevalence of current asthma in the 6–7-year-old group was 16.1% (those with complications of allergic rhinoconjunctivitis (ARC) was 3.3%, those with atopic dermatitis (AD) was 2.8%, and those with both ARC and AD was 2.5%), that in the 13–14-year-old group was 11.7% (those with complication of ARC was 2.9%, those with AD was 1.9% and those with both ARC and AD was 1.4%). Comparing asthmatics with non-asthmatics in the same age, QoL of children with asthma was significantly impaired (Fig. 2: younger group: 96.7 vs. 98.6, $p < .001$, elder group: 78.2 vs. 83.0, $p < .001$). In addition, QoL of children was significantly impaired by severity (Fig. 3: severe asthmatics, moderate ones, mild ones and non-asthmatics was 95.1, 95.8, 97.9 and 98.6 respectively in younger children, and 76.2, 78.4, 78.3 and 83.0 respectively in elder ones. $p < .001$).

Given that physical impairment is known to affect the health-related QoL,⁶ we hypothesized that QoL of asthmatic children having exercise-induced asthma (EIA) might be more impaired compared to those who have no EIA. Thus, we found that asthmatic children having EIA had significantly lower scores of QoL (Fig. 4: younger group: 95.7 vs. 97.1, $p < .001$, elder group: 77.2 vs. 81.1, $p < 0.01$). Of note, QoL was more impaired in the EIA-positive group among asth-

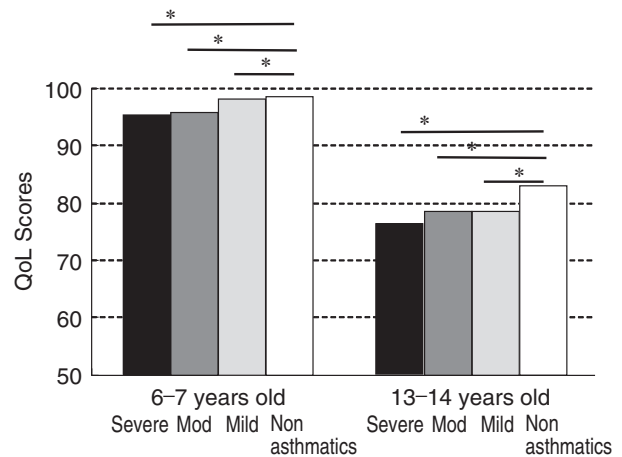


Fig. 3 The mean QoL scores based on the severity of symptoms. Closed column indicates children with severe asthma; dark gray column indicates children with moderate asthma; light gray column indicates children with mild asthma; and open column represents non-asthmatic children. The severer the asthma, the lower the QoL score was in both age groups. Bar and * indicate that the difference was significant at $p < 0.05$ against non-asthmatic children.

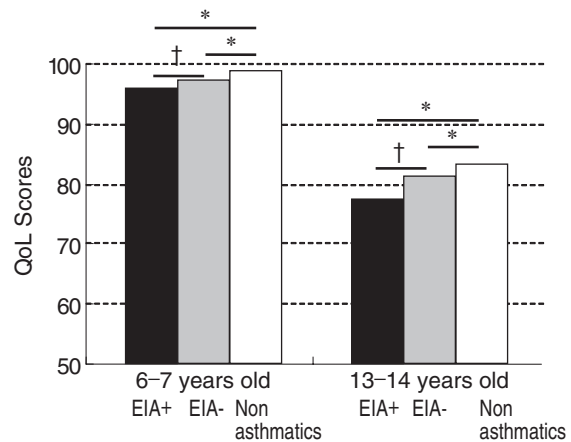


Fig. 4 The mean QoL scores of children with/without EIA. Closed column indicates asthmatic children with EIA; gray column indicates asthmatic children without EIA; and open column represents non-asthmatic children. Asthmatic children with EIA had significantly lower QoL scores than those without EIA. $*p < 0.05$ against non-asthmatic children, † $p < 0.05$ between asthmatics with/without EIA.

matics having the highest severity as well as those having milder symptoms (Fig. 5), suggesting that QoL of children with even severe asthma could be improved when EIA is well controlled. Children with EIA had constantly lower scores of QoL scales regarding the categories of school activities, emotional and physical functioning scales than those without EIA and those without asthma in both age groups

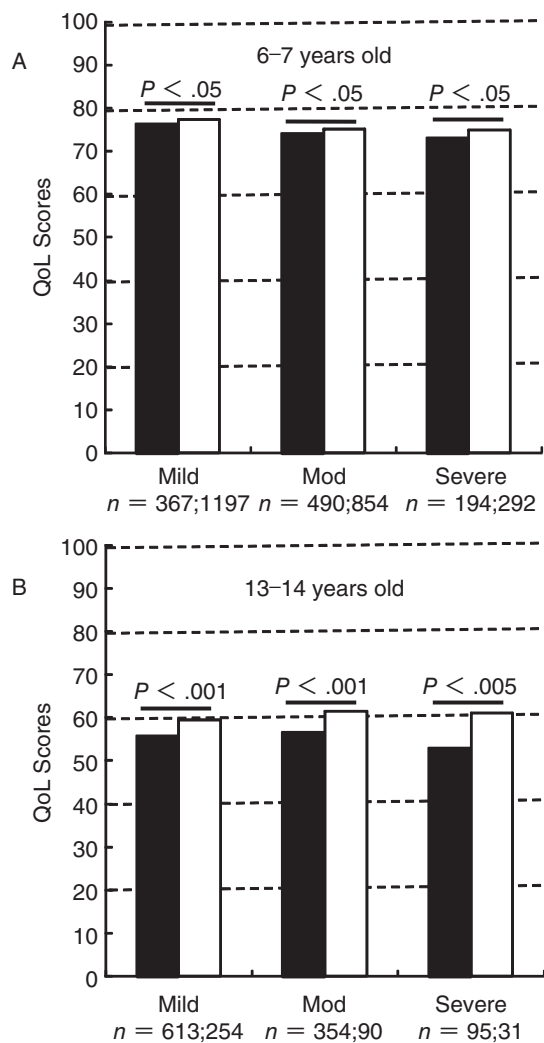


Fig. 5 The mean QoL scores of asthmatic children with/without EIA in each severity group. Closed column indicates asthmatic children with EIA; and open column represents asthmatic children without EIA in children 6-7 years of age (A) and in children 13-14 years of age (B). They were divided into severity groups based on the ISAAC questionnaires. Differences between asthmatic children with/without EIA were all found at significant levels as indicated.

(Fig. 6). Then, we further examined the effect of EIA among asthmatics on each QoL scale when the severity groups and age groups were divided to find which factors are responsible for the impairment of QoL found in children having EIA. The impairment in the physical functioning scale was always found at significant levels in 3 severity groups each in both age groups, while five other QoL subcategorized scales often failed to produce a significant difference when each category was analyzed one by one (Fig. 7).

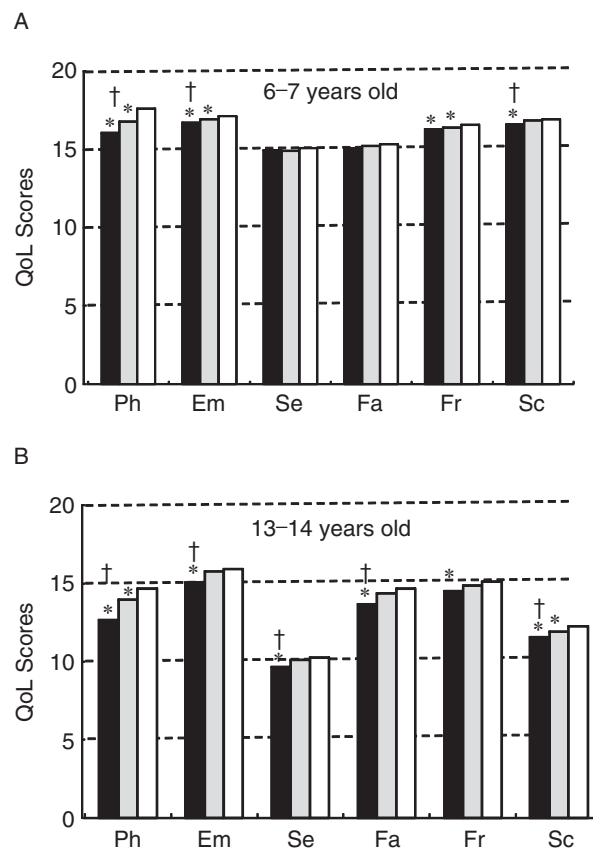


Fig. 6 The mean QoL scores of children with/without EIA in each subcategorized scale. Closed column indicates asthmatic children with EIA; gray column indicates asthmatic children without EIA; and open column represents non-asthmatic children in children 6-7 years of age (A) and in children 13-14 years of age (B). QoL scores were divided into each subcategorized scale, i.e., physical functioning (Ph), emotional (Em), self esteem (Se), family cohesion (Fa), friendship (Fr), and school activities (Sc). * $p < 0.001$ against non-asthmatic children, † $p < 0.001$ between asthmatics with/without EIA.

DISCUSSION

Recently, the QoL Questionnaire for Japanese School-aged Children with Asthma Version 3 (JSCA-QoL v.3) has been developed in Japan and is recognized to be valid and reliable for evaluating asthmatic children mainly for evaluating the effects of a particular treatment or intervention.⁸ However, we used the KINDL[®] questionnaire in the present study to distinguish the problems affecting asthmatic children when compared to healthy children in terms of QoL. We also performed the ISAAC questionnaire together with the KINDL[®] questionnaire to compare the QoL impaired in asthmatics and the severity and symptoms found in asthmatic children.

We were able to find the mean QoL score of asth-

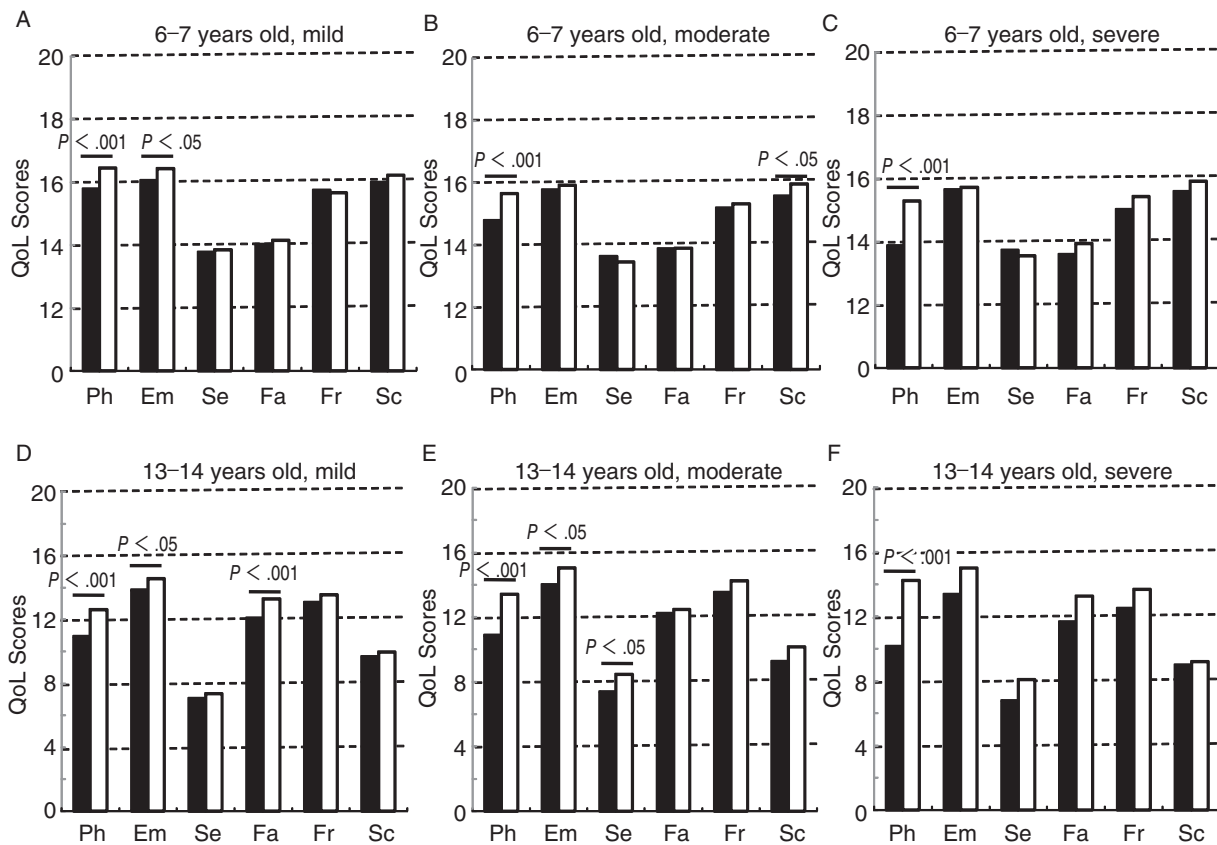


Fig. 7 The mean QoL scores of children with/without EIA in each subcategorized scale in each severity group. Closed column indicates asthmatic children with EIA; and open column represents non-asthmatic children in children 6–7 years of age having mild (A), moderate (B), and severe symptoms (C), respectively and in children 13–14 years of age having mild (D), moderate (E), and severe symptoms (F), respectively. When differences were found between asthmatic children with/without EIA, they were indicated in figures. Unless otherwise specified, they were not significant.

matic children which was shown to be significantly lower than that of non-asthmatics, although the differences were less than 4 points out of 100 total points in each group, probably powered by a large number of subjects. We also found, by performing the ISAAC questionnaire together with the KINDL® questionnaire, that the severer the asthma the lower the QoL score in the age groups at 6–7 and at 13–14 years of age.

Given that physical impairment substantially affects the health-related QoL, we examined whether the QoL of asthmatic children having EIA is more impaired and found that asthmatic children having EIA had significantly lower scores of QoL. Of note, QoL was more impaired in the EIA-positive group even among asthmatics having the highest severity. This suggests that QoL of children with even severe asthma could be improved only when EIA is well controlled. The QoL factorial scores of asthmatics with EIA were lower than those of non asthmatics and asthmatics without EIA in the items of physical functioning, emotional and school activities. Especially, the QoL subcategorized scale of physical functioning

was constantly impaired in any severity group and in any age group.

Nevertheless, we found here that the presence of EIA among asthmatic children strongly impairs their QoL. Although there is no ideal outcome measure for evaluating asthma control in childhood, we should be more cautious about the management of EIA. Cromolyn,¹⁴ cysteinyl leukotriene antagonists and long acting beta 2 agonists (LABA) have been reportedly effective for preventing EIA.¹⁵ Indeed, improvement of the QoL of asthmatics has been shown when such drugs are added to inhaled glucocorticoid monotherapy.^{16,17} Not only pharmacological approaches, but physical training are shown to decrease the chance of EIA among asthmatics.¹⁸ As such, patient-centered measures of asthma control must also be further incorporated into office visits for improved asthma management.

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