The Health Impact of Chronic Recurrent Rhinosinusitis in Children

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Objectives: To report and quantify the health-related quality of life of children who require surgical intervention for chronic recurrent rhinosinusitis and to assess the perspective of the child vs that of the parent.

Design: Prospective, observational.

Patients and Intervention: Twenty-one of a consecutive sample of 35 children undergoing endoscopic sinus surgery for infectious indications completed, along with their parents, the Child Health Questionnaire. The Child Health Questionnaire measures in parallel both child and parent perceptions of health by means of separate parent proxy report (Child Health Questionnaire-Parent Form 50) and child self-report (Child Health Questionnaire-Child Form 87) questionnaires concerning physical and psychosocial functioning.

Main Outcome Measures: Tabulated scores from both the Child Health Questionnaire-Parent Form 50 and Child Health Questionnaire-Child Form 87 were compared with published data from age-matched normative populations and several pediatric chronic disease groups.

Results: Significant decrements in the general health of children with chronic recurrent rhinosinusitis compared with a normative sample were observed for both child- and parent-reported data, particularly in the physical domains. Children with rhinosinusitis were perceived by their parents to have significantly more bodily pain (P < .001) and to be more limited in their physical activities (P < .05) than children with asthma, juvenile rheumatoid arthritis, and other chronic disorders. Parent-child perceptions did vary, with parents reporting more pain and general behavioral effects relative to their children’s reports in these areas.

Conclusion: The health impact of chronic recurrent rhinosinusitis as reported by the subjective evaluations of pediatric patients and their parents is severe.


RHINOSINUSITIS has become the most prevalent chronic illness in the United States afflicting almost 31 million people according to National Center for Disease statistics; approximately 1 in 8 adults suffers from sinusitis at some time during the course of his or her life.1 Although the comparative frequency of rhinosinusitis in the pediatric population is less well established, its recognition is on the rise as both parents and physicians have been better educated about signs and symptoms of this disease and its associated morbidity in children.2 Whereas notable decrements in the general health of adults with chronic sinusitis have been demonstrated comparatively with the population at large, to our knowledge, the impact of chronic recurrent rhinosinusitis on the general health and well-being of children has not yet been quantified or reported.

Chronic diseases in the pediatric population have, until recently, been principally evaluated by morbidity and mortality statistics. This is owing in part to the inherent difficulties involved in deriving quality of life data from children, as well as the fact that most adult health assessment instruments are inappropriate for application to pediatric populations. The items on adult instruments often ignore health issues of importance to children such as physical and emotional development, self-esteem, and family relationships. The clinical manifestations of chronic recurrent rhinosinusitis have also clearly been shown to be different in children in comparison to adults.

Various child health assessment instruments have been developed over the past decade. These include the Child Health and Illness Profile, the Dartmouth Primary Care Cooperative Information Project, the Functional Status II(R), the RAND Health Insurance Experiment, the National Health Interview Survey, the Ontario Child Health Study, and The Health Institute Child Health Questionnaire (CHQ). Two of these instruments, the Ontario Child Health Study and the CHQ, are uniquely designed to measure in parallel both parent and child perceptions of health by means of separate parent proxy (CHQ-Parent Form 50 [CHQ-PF50]) and child
PATIENTS, MATERIALS, AND METHODS

Approval for this study was obtained from the Human Subjects Committee of the Massachusetts Eye and Ear Infirmary, Boston. Over a 4-year enrollment period, the CHQ was administered to all patients between the ages of 4 and 18 years undergoing endoscopic sinus surgery by one of us (M.J.C.) for the indications of chronic and/or recurrent rhinosinusitis. Rhinosinusitis in this patient series was defined by the following signs and symptoms—nasal congestion, rhinorrhea, facial pain and/or headache, irritability and/or behavior change, day and night cough, postnasal discharge, halitosis, and occasional fever—in various clinical combinations of variable comparative severity. Chronic rhinosinusitis was the operative diagnosis when the symptom complex persisted for longer than 12 weeks. Recurrent rhinosinusitis was the operative diagnosis when 4 or more annual symptomatic episodes occurred with complete resolution of signs and symptoms for 6 to 8 weeks between infections. Acute infectious exacerbations frequently occurred in children with persistent low-grade signs and symptoms; hence, the inclusive operative diagnosis of chronic recurrent rhinosinusitis.

All children had computed tomographic scan documentation of rhinosinusitis. All computed tomographic scans were reviewed and staged as follows: stage 1, solely unilateral disease; stage 2, bilateral disease limited to the ethmoid or maxillary sinuses; stage 3, bilateral disease with involvement of at least 1 sphenoid or frontal sinus; or stage 4, pansinusitis (which in children without frontal sinus involvement at least 1 sphenoid or frontal sinus; or stage 4, pansinusitis). 

Results

Of the 35 patients enrolled, 21 patients and parents (60%) both returned completed CHQ-CF87 and CHQ-PF50 questionnaires. These 21 children and parents constitute the final study group. The mean (±SD) age of these children is 10.2±3.5 years with a range of 4 to 18 years; 6 children are younger than 8 years. The study population is equally divided between boys (n=11; 52%) and girls (n=10; 48%).

The CHQ offers a 50-item parent proxy report form known as the CHQ-PF50 and an 87-item child self-report form known as the CHQ-CF87.13 The CHQ-PF50 is typically self-administered but can be given by interview. It consists of 14 concepts ordered according to the degree to which they measure physical vs psychosocial aspects of general health (Table 1). These scales include Physical Functioning, Role/Social—Physical, General Health, Bodily Pain, Family Activities, Role/Social—Emotional, Role/Social—Behavioral, Parental Impact—Time, Parental Impact—Emotional, Self Esteem, Mental Health, General Behavior, Family Cohesion, and Change in Health. These 14 concepts can be summarized into 2 summary component scales representative of Physical and Psychosocial health. The simultaneous employment of the CHQ-CF87 and CHQ-PF50 allows for such a comparison.

This study uses a general health assessment instrument, the CHQ, to evaluate the impact of chronic recurrent rhinosinusitis on the health status of afflicted pediatric patients. Akin to what has been performed in adult populations, this study provides cross-sectional data on the burden of rhinosinusitis relative to healthy pediatric populations as well as in comparison with other chronic childhood diseases and conditions. Additionally, this study uniquely compares data obtained from parallel parent proxy reports (CHQ-PF50) and child self-reports (CHQ-CF87) of general health concepts.

STUDY GROUP DEMOGRAPHICS

Of the 35 patients enrolled, 21 patients and parents (60%) both returned completed CHQ-CF87 and CHQ-PF50 questionnaires. These 21 children and parents constitute the final study group. The mean (±SD) age of these children is 10.2±3.5 years with a range of 4 to 18 years; 6 children are younger than 8 years. The study population is equally divided between boys (n=11; 52%) and girls (n=10; 48%).
CHQ-CF87 is analogous to the CHQ-PF50 in that it is self-administered or given by interview depending on the age of the child. Its 12 components are identical to those of the CHQ-PF50 with the exceptions that there are no Parental Impact—Time and Parental Impact—Emotional scales and there are no available Physical and Psychosocial summary scales (Table 1).

The CHQ-PF50 has been administered to the parents of a representative sample of US children and to the parents of children with asthma, attention-deficit/hyperactivity disorder, cystic fibrosis, epilepsy, juvenile rheumatoid arthritis, and psychiatric problems.13,14 The CHQ-CF87 has been applied in a middle school sample of predominantly African American children as well as in selected pediatric populations with end-stage renal disease, attention-deficit/hyperactivity disorder, and cystic fibrosis.13,14,20 Both the CHQ-PF50 and the CHQ-CF87 have demonstrated strong internal consistency and validity across these diverse clinical groups.

Permission to use the CHQ-PF50 and the CHQ-CF87 was obtained from one of us (J.M.L.). A health conditions checklist for their child was additionally included with the CHQ-PF50.

All data were scored in a raw-form relational database. Both the CHQ-PF50 scale scores and summary measures (Physical and Psychosocial) and the CHQ-CF87 scale scores were calculated according to published algorithms.13 Individual scale scores were normalized to a range from 0 (worst) to 100 (best); scoring each of the scales provides a profile of health status. Physical and Psychosocial summary measures are calculated using a method known as linear T-score transformation method.13 This method uses data from a representative US population sample to transform the average score achievable for the CHQ as 50 with an SD of 10. Thus 10 points in either direction (60 or 40, respectively) represent scores that are significantly above or below the expected norm.

Means were compared by t test with 2-tailed P values. Comparisons were made to normative data from a general US population and to data previously collected from other childhood chronic diseases.13 For statistical analysis of these comparisons, population means and SDs were calculated for all CHQ-PF50 and CHQ-CF87 scores. In comparing means with normative data, a statistically significant difference exists if the 95% confidence limit for one sample fails to overlap the mean of the other sample.

Reliability refers to the proportion of measured variance that is due to actual variability between subjects as opposed to variability within subjects. Internal consistency reliability for all CHQ-PF50 and CHQ-CF87 scale scores was estimated by calculating the Cronbach α coefficient. A reliability coefficient for a multi-item scale is a measure of internal consistency, a function of both the average degree of association among items and the number of items in each scale. A Cronbach α coefficient of 0.70 has conventionally been accepted as the minimum standard for group level analysis. Median internal consistency reliability coefficients for CHQ-PF50 scale scores have ranged from 0.69 to 0.89, with a reported median value of 0.84 when the CHQ-PF50 has been applied to a normative sample of US children.13 Internal consistency reliability coefficients for CHQ-CF87 scales across different clinical groups have similarly ranged from 0.62 to 0.91.14 For the children of this study with chronic recurrent rhinosinusitis, internal consistency reliability coefficients for the CHQ-PF50 scales ranged from 0.53 to 0.97 with a median value of 0.77, and for the CHQ-CF87 scales ranged from 0.68 to 0.91 with a median value of 0.82. Scores from the CHQ-PF50 parent reports and from the corresponding CHQ-CF87 patient self-reports were compared by t test with 2-tailed P values.

Thirteen children (62%) had undergone prior adenoidectomy; this is true of 4 of the 6 children younger than 8 years. The patient distribution of sinus computed tomographic scans according to stage is as follows: stage 1, 7 patients (33.3%); stage 2, 9 patients (42.9%); stage 3, 3 patients (14.3%); and stage 4, 2 patients (9.5%).

Parents were asked to report on the prevalence of comorbid chronic conditions in their children. Chronic allergies, anxiety, asthma, and chronic respiratory, lung, and/or breathing trouble were more prevalent in the children with chronic recurrent rhinosinusitis than in the general population.13 A greater number of parents reported asthma as a comorbid chronic condition through the CHQ-PF50 (38%) than was determined through medical record review (29%).

**CHQ-PF50 SCORES FOR PATIENTS WITH CHRONIC RECURRENT RHINOSINUSITIS vs NORMATIVE DATA**

Tabulated mean CHQ-PF50 scores for the 12 scales of general health and the 2 summary measures are given (Table 2) in comparison to normative data from a representative sample of US children.13 The age range of the normative population (5-18 years) closely matches that of the study population, eliminating the need for any age adjustment. In comparison with parental reports in the normative US sample, lower scores were reported across several health scales by the parents of the pediatric patients with chronic recurrent rhinosinusitis. The most significant decrements were observed for the General Health, Bodily Pain, and Parental Impact—Emotional scales (P<.001), followed by the Physical Functioning and Role/Social—Physical scales (P<.01), and the Role/Social—Emotional and Behavioral, Parental Impact—Time and Mental Health scales (P<.05). No significant differences were observed for the Self Esteem and General Behavior scales. Summarizing the data, differences between the groups were more pronounced for the physical components of health than for the psychosocial components. This is demonstrated by the significant difference (P<.001) in the Physical summary scale scores between the 2 groups; whereas, there was no statistically significant difference in the corresponding Psychosocial summary scale scores.

**CHQ-PF50 SCORES FOR CHRONIC RECURRENT RHINOSINUSITIS vs OTHER PEDIATRIC CHRONIC DISEASES**

To estimate the relative burden of chronic recurrent rhinosinusitis compared with other pediatric chronic diseases, the chronic recurrent rhinosinusitis CHQ-PF50

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**Table 2**

<table>
<thead>
<tr>
<th>Scale</th>
<th>CHQ-PF50 Mean</th>
<th>Normative Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodily Pain</td>
<td>62.6</td>
<td>80</td>
</tr>
<tr>
<td>Physical Functioning</td>
<td>57.3</td>
<td>67</td>
</tr>
<tr>
<td>Role/Social—Physical</td>
<td>55.7</td>
<td>60</td>
</tr>
<tr>
<td>Role/Social—Emotional</td>
<td>62.0</td>
<td>70</td>
</tr>
<tr>
<td>Parental Impact—Emotional</td>
<td>46.0</td>
<td>50</td>
</tr>
<tr>
<td>Parental Impact—Time</td>
<td>68.0</td>
<td>70</td>
</tr>
<tr>
<td>General Health</td>
<td>58.0</td>
<td>65</td>
</tr>
<tr>
<td>Emotional and Behavioral</td>
<td>60.0</td>
<td>65</td>
</tr>
<tr>
<td>Social—Physical</td>
<td>66.0</td>
<td>65</td>
</tr>
<tr>
<td>Social—Emotional</td>
<td>70.0</td>
<td>70</td>
</tr>
<tr>
<td>Self Esteem</td>
<td>69.0</td>
<td>70</td>
</tr>
<tr>
<td>Total Health</td>
<td>554.0</td>
<td>600</td>
</tr>
</tbody>
</table>

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1365
scale scores were compared with similar published data for children with attention-deficit/hyperactivity disorder, psychiatric disorders, juvenile rheumatoid arthritis, epilepsy, and asthma.13 Children with chronic recurrent rhinosinusitis were reported by their parents to have significantly more bodily pain (Figure B) than children in any of the other chronic disease groups (P<.001), even those with juvenile rheumatoid arthritis (P<.01).

### CHQ-CF87 SCORES FOR PEDIATRIC PATIENTS WITH CHRONIC RECURRENT RHINOSINUSITIS vs HEALTHY CHILDREN

Nine CHQ-CF87 scales are presented from our study population in comparison data from a sample population of children from a predominantly African American community middle school (Table 3).14 The age range of the school sample was 10 to 15 years, less broad than the population with rhinosinusitis. Again the Role/Social—Physical (P<.05) and Bodily Pain (P<.001) scale scores are significantly lower for the children with chronic recurrent rhinosinusitis.

### COMPARISON OF PARENT PROXY REPORT CHQ-PF50 AND CHILD SELF-REPORT CHQ-CF87 SCALE SCORES

Seven scales were common to both the parent proxy report CHQ-PF50 and the child self-report CHQ-CF87. In general, parents reported lower scores. Differences between parent and child were statistically significant (P<.05) for 3 scales—the General Health, Bodily Pain, and General Behavior scales—as given in Table 4.
The findings of this study do underscore that children with rhinosinusitis warranting surgical therapy have a significant chronic illness. The parent proxy CHQ-PF50 results reveal the relative burden of chronic recurrent rhinosinusitis on the general health of children to be severe in the physical domain. According to the parents’ perceptions, children with chronic recurrent rhinosinusitis demonstrate significant decrements in the Physical Functioning, Role/Social—Physical, General Health, Bodily Pain, Role/Social—Emotional and Behavioral, Parental Impact—Time and Parental Impact—Emotional scales as well as in the Physical Summary scale score in comparison with normative data from a representative sample of US children. The child self-report results reveal children with chronic recurrent rhinosinusitis to have significantly lower scores for the Role/Social—Physical and Bodily Pain scales when compared with a middle school sample of predominantly African American children. When compared with other chronic pediatric illnesses such as asthma, epilepsy, attention-deficit/hyperactivity disorder, and juvenile rheumatoid arthritis, children with chronic recurrent rhinosinusitis also demonstrate significantly poorer results in such concepts as Role/Social—Physical and Bodily Pain.

Through concurrent application of the CHQ-PF50 and CHQ-CF87, differences between parent and child perceptions of health were also investigated. Parents reported significantly poorer General Health and Bodily Pain scale scores than their children, suggesting that parent and child perceptions of bodily pain do differ. The physician’s interpretation of the clinical presentation of the disease may likewise be different depending on whether...
the parent or child is primarily interviewed. Parents also reported significantly poorer General Behavior scale scores than their children. Previous literature has suggested that children at least 8 years of age can accurately report on such subjective concepts as self-esteem and behavior. Since 29% of the study children were younger than 8 years, it is probable that some of the children were unable to accurately report on concepts involving such psychosocial issues. None of the self-report CHQ-CF87 scale scores for these concepts were significantly lower in the children with chronic recurrent rhinosinusitis than in the comparative healthy middle school sample.

This study has several limitations. First, solely children whose chronic recurrent rhinosinusitis was severe enough to warrant surgical intervention were enrolled. This restriction was purposeful to more precisely define the disease process. Extrapolation of the results, however, to pediatric patients with rhinosinusitis whose disease is successfully medically managed is questionable. Second, no true normative population has completed the child self-report CHQ-CF87. The predominantly African American middle school sample to which the pediatric patients with rhinosinusitis have been compared is not absolutely representative of the general US pediatric population. Third, for the self-report CHQ-CF87, the children are not age matched with their comparison groups; the age of the children of the middle school sample and other disease cohorts ranged from 10 to 15 years, whereas the age of the children with chronic recurrent rhinosinusitis is 4 to 18 years. The children with rhinosinusitis are correctly age matched to both the normative population and the comparative disease groups for the parent proxy report CHQ-PF50 portion of the study. Fourth, the sample size is small, although similar to some of the comparative chronic pediatric disease groups. Finally, data from our chronic recurrent rhinosinusitis sample of children was compared with reported mean data from other studies. Statistical comparisons were therefore based on estimated confidence intervals and multiple t tests. When multiple t tests are performed, there is an increased risk of a cumulative type I error or probability of falsely identifying a significant difference. This probability is related to the number of t tests performed and is unavoidable with multiple t tests.

More robust statistical methods would have required original data from other investigators. Therefore, there is the possibility that not all of the comparisons designated as significant are truly so.

Despite such limitations, the information obtained is of value in several aspects. Quality of life data can be used in conjunction with objective parameters like symptom persistence and computed tomographic findings to determine criteria for medical or surgical treatment. The sequential application of the CHQ at specific posttreatment intervals may be useful in judging the outcome of such therapeutic interventions. Finally, by highlighting the severity of rhinosinusitis in comparison with other chronic pediatric disorders, a substantial argument can be made to direct a greater proportion of clinical health care and research funds to the successful prevention and management of this common childhood disease.

The results of this study demonstrate significant decrements in the health-related quality of life of children who undergo surgical treatment for chronic recurrent rhinosinusitis compared both with normative populations and other pediatric chronic illness groups. These results underscore the severity of this chronic recurrent disease process. Applicable differences between parent and child reporting of general health concepts were also revealed through simultaneous application of both general health assessment instruments, highlighting the importance of acquiring both perspectives on pediatric illness.

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REFERENCES