

Identifying High-risk Asthma With Utilization Data: A Revised HEDIS Definition

Antonia V. Bennett, MA; Paula Lozano, MD; Laura P. Richardson, MD; Elizabeth McCauley, PhD;
and Wayne J. Katon, MD

Objective: To develop a definition of high-risk asthma that more precisely identifies patients needing case management than the 2006 Healthcare Effectiveness Data and Information Set (HEDIS) definition.

Study Design: Two-year claims-based study, with cross-sectional phone survey data, for a sample of 769 youths (age 11-17 years) with asthma.

Methods: The 2006 HEDIS measure defines high-risk asthma as meeting any of the following criteria: ≥ 1 emergency department (ED) visits, ≥ 1 hospitalizations for asthma, ≥ 4 asthma medication prescriptions, or ≥ 4 ambulatory visits for asthma with ≥ 2 prescriptions for asthma medication in 1 year. We created a revised definition (≥ 1 ED visits or ≥ 1 hospitalizations for asthma or ≥ 1 oral steroid prescriptions for asthma) and identified patients with high-risk asthma in year 1 according to each definition. We compared the 2 groups on demographic and clinical characteristics, and healthcare utilization and costs in years 1 and 2.

Results: The revised definition identified 29% of the sample as having high-risk asthma, whereas the 2006 definition identified 67%. Compared with the 2006 definition, the revised definition identified patients with significantly greater asthma-related physical health problems and higher medical costs in year 1. In year 2, youths classified as high risk by the revised definition made more ED visits and were more likely to use oral steroids than those classified as high risk by the 2006 definition.

Conclusion: The revised high-risk asthma definition identifies half as many individuals and is better able to identify patients with poorly controlled asthma in the subsequent year.

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Asthma is the most common chronic illness of childhood and adolescence. In many individuals, it persists into adulthood, causing functional impairment and resulting in considerable use of health services.¹⁻⁴ Randomized controlled trials have shown asthma disease management programs to be effective,⁵⁻⁸ and some organized healthcare systems have integrated disease management systems into their process of care. The resources directed toward disease management can be optimized by targeting youths with the highest risk of adverse consequences. A method for identifying these youths based solely on administrative data would be valuable for health plans.^{9,10}

The Healthcare Effectiveness Data and Information Set (HEDIS) definition of high-risk asthma is one method used to identify patients through administrative data. The **Figure** shows the 2006 HEDIS definition and the revised definition proposed in this study. There is evidence to suggest the 2006 HEDIS definition resulted in high levels of misclassification.^{11,12} A prior study found the definition to be overly broad because 2 criteria (“4 or more prescriptions for asthma medication” and “4 or more ambulatory visits for asthma plus 2 or more prescriptions for asthma medication”) resulted in including large numbers of young people and may represent patients adhering to and doing well with care.¹²

The HEDIS definition of high-risk asthma was amended in 2007 to reduce the amount of misclassification. The 2007 definition requires patients to meet at least 1 of the utilization criteria in a 12-month period for 2 consecutive 12-month periods and the criteria met in each period do not need to be the same ones. Although the extended time period increases the fidelity of the HEDIS definition, the 24-month period limits the definition’s utility as a case-finding tool. A definition of high-risk asthma that requires only 12 months of utilization data, instead of 24 months, would enable health plans to identify patients needing disease management in a time frame that would be amenable to preventive interventions.

In this article we describe development of a revised definition that identifies patients with asthma who are at risk for adverse outcomes, using 12 months of utilization data. The revised definition we proposed is similar to the 2006 definition in that only 12 months of utilization data are required, but the criteria are different. We removed 2 above-mentioned criteria (“4 or more prescriptions for asthma medication” and “4 or more ambulatory visits for asthma plus 2 or more prescriptions for asthma medication”),

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hypothesizing that youths who met only these criteria were not as a group at high risk for adverse outcomes. The criterion of 1 or more oral steroid prescriptions for asthma was added to capture youths requiring treatment for significant exacerbations. In this study we tested the revised definition against the 2006 HEDIS definition to determine whether one is more suitable than the other for identifying high-risk patients. Compared with the 2006 HEDIS definition, we hypothesized the revised definition would capture fewer of the youths with well-controlled persistent asthma and fewer of the youths with intermittent asthma.

METHODS

Study Population

The data for this study were collected as part of the Stress and Asthma Research (STAR) study, a cross-sectional survey study of depression and anxiety among youths with asthma.¹³ Potential subjects for the STAR study were youths (age 11-17 years) with asthma who were enrolled in a Group Health Cooperative (GHC) insurance plan for at least 6 months. GHC is a nonprofit HMO with 25 primary care clinics in Washington State owned by GHC as well as 75 contracted clinics. Youths with asthma were identified through the GHC automated cost and utilization database system by at least 1 of the following types of utilization:

- At least 1 hospitalization in the past year with an asthma diagnosis and at least 1 asthma prescription during that year.
- At least 1 emergency department (ED) or urgent care visit in the past year with an asthma diagnosis and at least 1 asthma prescription during that year.
- At least 2 office visits in the past year with an asthma diagnosis and at least 1 asthma prescription during that year.
- At least 1 visit in the past year with an asthma diagnosis and another in the past 18 months, and at least 1 asthma prescription.
- Only 1 asthma visit in the past year but at least 2 asthma prescriptions filled on different days in that year.
- At least 4 prescriptions for asthma medication in the past year.

These criteria were developed to identify youths with active asthma and screen out patients with very mild asthma (such as mild exercise-induced asthma) and youths with

spurious asthma diagnoses (ie, wheezing secondary to acute respiratory infection). All youths meeting inclusion criteria were invited to participate in the STAR study. Participants in the STAR study with cost and utilization data were included in this analysis. All participants gave informed consent. The study protocols were reviewed and approved by the institutional review board of GHC.

Data Collection

Following receipt of a letter inviting participation in the STAR study, subjects were screened by telephone interview, which included a 10- to 15-minute parent interview and a 45- to 75-minute youth interview. The parent interview included confirmation that their child had been diagnosed with asthma, the number of years since diagnosis with asthma, and demographic questions.

Demographic Information. Child age and sex were determined from administrative data and confirmed during parent interview. The family's address and zip code were linked to census data to determine the median household income of their census block group. Enrollment in Medicaid or the Washington State Basic Health Plan was identified through administrative data.

Asthma Experience and Health Status Indicators. Asthma symptom days, or the number of days with asthma symptoms in the prior 2 weeks, was used as a proxy for asthma severity.¹⁴ Based on the National Asthma Education and Prevention Program guidelines, 0 to 4 symptom days is considered to be equivalent to intermittent to mild persistent asthma and 5 to 14 symptom days is considered persistent asthma.¹⁵ The youth's experience with asthma was identified in the phone interview using the Child Health Survey–Asthma (CHS-A). The CHS-A is a functional status measure with high reliability and validity in capturing a broad range of asthma experiences. Three of the instrument subscales are included in this analysis (physical health,

■ **Figure.** 2006 HEDIS and Revised Definitions of High-risk Asthma^a

2006 HEDIS Definition	Revised Definition
≥1 ED visits for asthma	≥1 ED visits for asthma
or ≥1 hospitalizations for asthma	or ≥1 hospitalizations for asthma
or ≥4 prescriptions for asthma	or ≥1 oral steroid prescriptions for asthma
or ≥4 ambulatory visits for asthma and ≥2 prescriptions for asthma	

ED indicates emergency department; HEDIS, Healthcare Effectiveness Data and Information Set.

^aEach definition is based on utilization in a 12-month period.

■ **Table 1.** Patient Characteristics and Asthma-related Function of Total Sample and Risk Groups

Characteristic	Total	2006 HEDIS Definition		Revised Definition		PValues for Comparison of High-risk Groups
		High Risk	Low Risk	High Risk	Low Risk	
No. (%)	769	518 (67)	251 (33)	223 (29)	546 (71)	—
Mean age, y	14.05	13.98	14.17	14.25 ^a	13.96	<.05
Female, %	47	46	48	50	46	NS
Parental education: at least some college, %	84	84	85	80 ^a	86	NS
Parent report of child's race, %						NS
White	79	79	79	78	79	—
Black	6	6	7	8	5	—
Asian, Hawaiian, Pacific Islander	3	4	2	4	3	—
Native American	7	7	6	6	7	—
Other	3	3	4	4	3	—
Hispanic	5	4	6	6	4	NS
Basic health plan enrollee, %	5	5	5	4	6	NS
Medicaid enrollee, %	15	17	13	16	15	NS
Median income of census tract	\$50,303	\$49,721	\$51,527	\$48,817	\$50,929	NS
Pediatric Chronic Disease Score	648	694 ^a	552	830 ^b	573	NS
Years since asthma diagnosis	7.21	7.57 ^c	6.45	7.82 ^a	6.95	NS
Days with asthma symptoms in prior 2 weeks	3.88	4.12 ^b	3.40	4.42 ^a	3.65	NS
Intermittent asthma (0-4 days out of 14), %	68	66	71	65	68	NS
CHS-A score: physical health	73.40	73.17	73.87	70.34 ^b	74.64	<.05
CHS-A score: activity limitations	83.45	83.09	84.20	82.07	84.02	NS
CHS-A score: emotional health	83.70	82.84 ^b	85.47	82.15 ^a	84.32	NS

CHS-A indicates Child Health Survey–Asthma; HEDIS, Healthcare Effectiveness Data and Information Set; NS, not significant.
^a*P* < .05.
^b*P* < .01.
^c*P* < .001.

activity limitations, and emotional health), which are scored from 0 to 100, with higher scores indicating better outcomes.¹⁶ The Pediatric Chronic Disease Score (PCDS) is an algorithm drawing on claims data for prescription fills that classifies children into chronic disease categories.¹⁷ The modified version of the PCDS used in the STAR study did not include medications used primarily for asthma, anxiety, or depression. Higher scores on the modified PCDS indicate greater non-asthma-related medical morbidity.

Cost and Utilization. Cost and utilization data were taken from the GHC computerized cost and utilization database system for the 12-month period preceding baseline (year 1) and the 12-month period following baseline (year 2). This system uses general ledger costs to calculate actual budget-based cost (not charges) for

all services provided or purchased by GHC. Total health services costs include costs for all conditions including asthma.

Analysis

High-risk status according to the 2006 HEDIS and revised definitions was determined based on individual utilization in year 1 according to the criteria shown in the Figure. We examined the number of youths identified by individual criteria in order to compare the relative contributions of each criterion. Descriptive statistics were used to evaluate the revised definition of high-risk asthma, first by comparing the characteristics of high-risk youths with those of low-risk youths identified by each definition, and second by comparing the characteristics of the high-risk youths identified by each definition.

Differences between the high-risk and low-risk groups within each definition were evaluated by *t* tests for groups with unequal variance and Pearson χ^2 tests. Differences between the high-risk groups identified by each definition also were compared by *t* tests for groups with unequal variance and Pearson χ^2 tests. For all tests a *P* value of less than .05 was considered significant. The characteristics examined were youth and parent demographics, health characteristics including asthma symptom days, and health service costs and utilization in year 1 and year 2. The analysis was conducted using Stata version 8.0.¹⁸

RESULTS

Of the 1458 youths and parents in the initial sample, 170 were ineligible, leaving a sample of 1288. Reasons for ineligibility included the following: child did not have asthma (*n* = 63), disenrollment from GHC (*n* = 84), language ineligibility (*n* = 11), parent too ill (*n* = 6), and other (*n* = 6). Of the eligible sample, 833 parents gave consent and permission for the study to contact their child with asthma. From these 833, the study obtained child consent and completed 781 interviews for a final recruitment rate of 60.6%. This analysis was based on a final sample of 769 youths (12 youths or their parents did not give permission for the use of cost and utilization data). Full details about the sample are published elsewhere.¹⁹

Sample Characteristics

The demographic and health characteristics of the total sample are described in **Table 1**. The 2006 HEDIS definition classified 518 youths (67%) as high risk, whereas the revised definition classified only 223 youths (29%) as high risk. All youths classified as high risk by the revised definition also were classified as high risk by the 2006 HEDIS definition.

Criterion and Stepwise Comparison of High-risk Definitions

Table 2 reports the number of youths identified by each individual criterion. The definitions also were examined in a stepwise manner, and the cumulative number of youths identified with

Table 2. Number of Youths Captured by High-risk Definition Criteria (N = 769)

Criterion ^a	Number (%) of Youths Meeting Individual Criterion
HEDIS definition	
Inpatient	9 (1.2)
ED	60 (7.8)
Rx	496 (64.5)
Visits + Rx	44 (5.7)
Revised definition	
OS	195 (25.4)
Criteria added successively to form HEDIS definition	
Inpatient	9 (1.2) ^b
Inpatient or ED	65 (8.5) ^b
Inpatient or ED or Rx	514 (66.8) ^b
Inpatient or ED or Rx or Visits + Rx	518 (67.4) ^b
Criteria added successively to form revised definition	
Inpatient	9 (1.2) ^b
Inpatient or ED	65 (8.5) ^b
Inpatient or ED or OS	223 (29.0) ^b

ED indicates emergency department; HEDIS, Healthcare Effectiveness Data and Information Set; OS, oral steroid; Rx, prescription.
^aED signifies ≥ 1 ED visits for asthma; Inpatient, ≥ 1 inpatient hospitalizations for asthma; OS, ≥ 1 oral steroid prescriptions for asthma; Rx, ≥ 4 prescriptions for asthma medication; Visits + Rx: ≥ 4 ambulatory visits for asthma and ≥ 2 prescriptions for asthma medication.
^bCumulative number of youths meeting criteria.

each additional criterion are reported for each definition. Nine youths (1.2%) had inpatient hospitalizations, and 65 youths (8.5%) had inpatient hospitalizations or ED visits. The addition of the revised definition criterion “1 or more prescriptions for oral steroids” identified a total of 223 youths (29.0%). In contrast, the addition of the HEDIS criterion “4 or more prescriptions for asthma” identified 514 youths (66.8%), and the fourth HEDIS criterion “4 or more ambulatory visits and 2 or more prescriptions for asthma” captured an additional 4 youths, for a total of 518 (67.4%). The 2006 HEDIS definition identified 295 youths as high risk that the revised definition did not identify; these 295 youths had no asthma-related hospitalizations, ED visits, or prescriptions for oral steroids.

Demographic and Health Characteristics by Risk Group

The 2006 HEDIS definition identified a high-risk group that was very similar to the 2006 HEDIS definition low-risk group in demographic and health plan characteristics (Table 1). In contrast, the revised definition identified a high-

■ **Table 3.** Healthcare Costs and Utilization for Total Sample and Risk Groups

Cost/Utilization	Total	2006 HEDIS Definition		Revised Definition		PValues for Comparison of High-risk Groups
		High Risk	Low Risk	High Risk	Low Risk	
No. (%)	769	518 (67)	251 (33)	223 (29)	546 (71)	—
Year 1: identification of risk						
Mean cost and utilization per patient						
Total health service cost	\$2759	\$2985	\$2294	\$4536 ^a	\$2034	<.05
ED visits for asthma	0.09	0.14 ^a	0	0.31 ^a	0	<.001
Inpatient hospitalizations for asthma	0.03	0.05 ^b	0	0.11 ^b	0	NS
Outpatient visits for asthma	1.12	1.21 ^a	0.94	1.72 ^a	0.87	<.001
Prescriptions for asthma medication	6.46	8.61 ^a	2.02	9.11 ^a	5.38	NS
Prescriptions for oral steroids	0.41	0.54 ^a	0.14	1.42 ^a	0	<.001
Asthma medication profile, %						
No medication	4	1 ^a	8	0 ^a	3	<.05
Reliever only	25	15 ^a	45	4 ^a	33	<.001
Controller without oral steroid	46	53 ^a	32	8 ^a	62	<.001
Any oral steroid use	25	31 ^a	13	87 ^a	0	<.001
Year 2: follow-up						
Mean cost and utilization per patient						
Total health service cost	\$2503	\$2883 ^a	\$1717	\$3499 ^c	\$2095	NS
ED visits for asthma	0.07	0.09 ^a	0.02	0.16 ^a	0.03	<.05
Inpatient hospitalizations for asthma	0.02	0.03 ^b	0	0.04	0.01	NS
Outpatient visits for asthma	0.78	0.90 ^a	0.51	1.04 ^a	0.69	NS
Prescriptions for asthma medication	4.65	5.98 ^a	1.91	6.17 ^a	4.03	NS
Prescriptions for oral steroids	0.24	0.30 ^a	0.10	0.49 ^a	0.13	<.01
Asthma medication profile, %						
No medications	21	14 ^a	35	18	21	NS
Reliever only	26	24 ^b	32	18 ^a	30	<.05
Controller without oral steroid	46	42 ^a	22	33	37	<.05
Any oral steroid use	16	20 ^a	9	30 ^a	11	<.01

ED indicates emergency department; HEDIS, Healthcare Effectiveness Data and Information Set; NS, not significant.

^a*P* < .001.

^b*P* < .01.

^c*P* < .05.

risk group that was older and had lower parental educational attainment than the low-risk group. Both definitions identified high-risk groups with greater morbidity compared with the low-risk groups. The high-risk group for *either* definition had higher mean PCDSs, had been diagnosed with asthma approximately 1 year earlier, had more days of asthma symptoms in the prior

2 weeks, and had slightly lower CHS-A emotional health scores than the low-risk group. There were no differences between groups in the CHS-A activity limitation scores.

The only statistically significant difference between the 2 high-risk groups was in self-reported asthma-related physical limitations, as indicated by the CHS-A physical health

score. These symptoms were worse for the revised definition high-risk group than for the 2006 HEDIS definition high-risk group. The revised definition high-risk group reported more symptom days than the HEDIS definition high-risk group, but this difference was not statistically significant.

Cost and Utilization of Health Services by Risk Group

Cost and utilization of health services for each group in years 1 and 2 are presented in **Table 3** and described below. For the total sample (N = 769) total health-care costs were \$2759 in year 1 and \$2503 in year 2.

2006 HEDIS Definition of High-risk Versus Low-risk Youths. There was no difference in year 1 total health service costs between the 2006 HEDIS high-risk and low-risk groups; however, year 2 total health service costs were higher for the high-risk group than for the low-risk group. Utilization of all types (inpatient hospitalizations for asthma, ED and ambulatory visits for asthma, and for prescriptions for asthma medication) in both year 1 and year 2 was higher for the 2006 HEDIS definition high-risk group than for the low-risk group.

Revised Definition of High-risk Versus Low-risk Youths. Total health service costs in both year 1 and year 2 were higher for the revised definition high-risk group compared with the low-risk group. Compared with the low-risk group, the high-risk group had higher utilization of all types in year 1 and higher utilization of all types except inpatient hospitalizations in year 2.

Comparison of High-risk Youths According to the 2 Definitions. The revised definition high-risk group had higher year 1 total health service costs than the 2006 HEDIS high-risk group. Year 2 total health service costs were \$600 higher for the revised definition high-risk group compared with the 2006 HEDIS definition high-risk group, but were not statistically different. Compared with the 2006 HEDIS definition high-risk group, youths in the revised definition high-risk group made more ED visits and outpatient visits, and were more likely to have used any oral steroids for asthma in year 1. In year 2, youths in the revised definition high-risk group made more ED visits and were more likely to have used any oral steroids for asthma than the 2006 HEDIS definition high-risk group.

DISCUSSION

In this article we propose a more efficient model for identifying youths for asthma case management. This new definition is more precise: it identifies about half as many youths as

Take-away Points

This study developed and tested a definition of high-risk asthma based on a single year of patient utilization data that, compared with the 2006 HEDIS definition, more precisely identified patients needing case management.

- The 2006 HEDIS definition categorized 67% of youths with asthma as high risk, whereas the revised definition categorized just 29% of youths as high risk.
- Compared with the 2006 HEDIS definition, the revised definition identified youths with significantly greater asthma-related physical health problems and higher medical costs in the first year, and youths who made more emergency department visits and were more likely to use oral steroids in the second year.

the 2006 HEDIS definition for high-risk asthma, and unlike the 2007 definition, requires only 1 year rather than 2 years of health plan data. The youths identified as high risk by the revised definition had significantly more asthma-related physical limitations, and higher costs in year 1 compared with youths identified by the 2006 HEDIS definition. Furthermore, compared with youths identified as high risk by the 2006 HEDIS definition, youths identified as high risk by the revised definition had greater asthma morbidity in the subsequent year, including a higher number of ED visits, a higher percentage treated with oral steroids, and a trend toward higher medical costs. We did not use the newer HEDIS definition for high-risk asthma, which was based on 24 months of utilization data, because we were seeking to develop a tool that could be used to identify candidates for preventive interventions. Managed care organizations seeking to allocate limited resources may find the revised definition more useful, given its ability to identify a smaller, more high-risk population.

A limitation of this analysis is that the data were collected from 1 large HMO in 1 geographic region of the United States. Our proposed high-risk definition should be tested in other clinical settings and populations. One strength of this study is the inclusion of structured youth and parent interviews, including measures of asthma symptoms and asthma-related functioning, as well as automated data on physician diagnosis and asthma-related treatment in a large sample of youths with asthma. Another strength is the depth of data regarding costs and utilization. The analysis of the 2006 HEDIS and revised definitions in this study did not include tests of sensitivity and specificity, because of the lack of a gold standard; however, the administrative and survey data available to this analysis provided a unique opportunity to link the high- and low-risk groups with reports of functional status and health service costs.

CONCLUSION

The revised definition for high-risk asthma proposed here is an easily applied tool for health plans wanting to identify

a subset of youths with asthma who are likely to benefit from care management based on their risk of poor medical and cost outcomes.

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Author Affiliations: From the Department of Health Services (AVB), the Department of Pediatrics (PL, LPR), and the Department of Psychiatry & Behavioral Sciences (EM, WJK), University of Washington, Seattle; the Center for Health Studies, Group Health Cooperative (PL), Seattle; and the Children's Hospital and Regional Medical Center (LPR, EM), Seattle.

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Address correspondence to: Antonia V. Bennett, MA, Department of Health Services, University of Washington, Box 357660, Seattle, WA 98195-7660. E-mail: abenn@u.washington.edu.

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