

Table 1

Parent-completed Screen for Child Anxiety Related Emotional Disorders Questionnaire Scores for EoE Vs Anxiety, Allergy, and GP Groups

	EoE	GP group ^a	GP vs EoE group	Allergy group ^a	Allergy vs EoE group	Anxiety group ^a	Anxiety vs EoE group
Total subjects, n	20	43	—	40	—	37	—
Total anxiety	7 (35.0)	4 (12.5)	.007	6 (18.8)	.191	22 (68.8)	.003
Panic disorder	5 (25.0)	1 (6.7)	.003	2 (13.3)	.370	12 (80)	<.001
GAD	6 (30.0)	5 (16.1)	.272	6 (19.4)	.692	20 (64.5)	.004
Separation anxiety	3 (15.0)	7 (28.0)	.586	5 (20.0)	1.000	13 (52.0)	.003
Social anxiety	5 (25.0)	4 (18.2)	1.000	6 (27.3)	1.000	12 (54.5)	.024
School avoidance	5 (25.0)	2 (8.7)	.029	3 (13.0)	.332	18 (78.3)	<.001

Abbreviations: EoE, eosinophilic esophagitis; GAD, generalized anxiety disorder; GP, general pediatric.

^aData retrieved from Petrovic-Dovat et al.⁸

there was higher rate of all anxiety disorders in the anxiety group compared with the EoE group. There was no difference between the EoE and FA groups for any of the anxiety disorders. However, there was a statistically significant higher rate of parent-reported total anxiety ($P = .007$), panic disorder ($P = .003$), and school avoidance ($P = .029$) in the EoE group vs the GP group.

Our pilot study shows that parents of children with EoE report more symptoms of anxiety disorder and its subtypes of panic disorder and school avoidance compared with parents of children from the general population with no chronic illness. However, there are some limitations. Our study was cross-sectional and had a limited sample size; the children who met the inclusion criteria were in various stages of severity and medical treatment for EoE. Our demographic data for mean age and race were similar to the published article, which helped solidify the comparisons. In addition, the study populations being compared were from a similar geographic area and cared for under the same medical institution. Atopy, which is common in EoE, such as eczema, asthma, FA, and allergic rhinitis, was not considered in this study. Nevertheless, parental perception of quality of life in children with EOE was significantly affected compared with children without chronic illness.

It has been reported that overall adjustment and emotional responses to symptoms and treatment for children are greatly influenced by chronic illness.⁷ Therefore, dietary restriction, which is a major element of EoE management and treatment, should be carefully evaluated and implemented because eating can be a deeply emotional and social experience. Although the consequences of eating the offending food might not be as obvious or immediate for the EoE group as for the FA group, dietary restrictions and fluctuations in disease manifestation can have a profound effect on children's quality of life.^{7,10} Therefore, the use of a validated anxiety screening tool, such as the SCARED, in patients with EoE could be very useful in screening for anxiety symptoms in children with EoE. Mental health services should be considered for those with higher scores and could be added to the multidisciplinary team (pediatrician, allergist, gastroenterologist, and nutritionist) already treating these patients.

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Comparison of fractional exhaled nitric oxide levels measured using the NIOX VERO and NOA 280i



Fractional exhaled nitric oxide (FeNO) is a type 2 biomarker of eosinophilic airway inflammation and predicts the likelihood of

corticosteroid responsiveness in patients with eosinophilic asthma.^{1,2} Several devices are available to measure FeNO levels for research purposes or in clinical practice worldwide, including the Sievers Nitric Oxide Analyzer (NOA 280i; GE Analytical Instruments, Boulder, Colorado), a stationary chemiluminescence

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analyzer, and the NIOX VERO (Aerocrine AB, Solna, Sweden), a portable electrochemical analyzer. The NIOX VERO is a new FeNO measurement device that is intended to replace the NIOX MINO, a previous portable electrochemical analyzer from the same manufacturer.³ Some reports have compared the NOA 280i with the NIOX MINO.^{4,5} However, potential differences between the NOA 280i and NIOX VERO remain unclear. In this cross-sectional study, we compared FeNO levels measured using the NOA 280i and NIOX VERO.

Subjects included 107 adult patients with bronchial asthma (51 men and 56 women; 59 nonsmokers, 46 ex-smokers, and 2 current smokers; 75 with and 32 without atopy; mean age 60 years, mean body mass index 24.0 kg/m², and mean predicted percentage of forced expiratory volume in 1 second 82.6%) who attended outpatient clinics at the Shizuoka General Hospital (Shizuoka, Japan) for routine checkups from October through December 2015. All patients satisfied the definition of asthma according to the Global Initiative for Asthma⁶ and were receiving inhaled corticosteroids with or without other medications, including long-acting β_2 -agonists, leukotriene receptor antagonists, or sustained-release theophylline, for at least 6 months. Patients were excluded from the study if they had any acute viral infections within the past month before the study. This study was approved by the institutional review board of the Shizuoka General Hospital (SGHIRB 2015051) and written informed consent was obtained from all subjects before the study. On examination day, FeNO levels were measured using the NOA 280i and NIOX VERO in a random order among patients. Measurement of FeNO using the NOA 280i was performed with an online method at a flow rate of 50 mL/s according to the American Thoracic Society and European Respiratory Society recommendations.⁷ Measurement of FeNO using the NIOX VERO was performed according to the manufacturer's instructions. To avoid any influence of forced expiration, spirometry was performed after FeNO measurement. Each measurement was repeated 3 times by 2 authors (Y.E. and T.A.) who were blinded to the clinical information and the FeNO levels measured with the other NO analyzer, and then the average levels were calculated. Correlations between variables were performed using the Pearson correlation coefficient and the Bland-Altman plot was used to assess the level of agreement between values measured by the 2 devices. EZR 1.27 (Saitama Medical Center, Jichi Medical University, Saitama, Japan) was used for statistical analyses. A *P* value less than .05 was considered significant.

The mean coefficients of variation from triplicate measurements were significantly lower for the NIOX VERO than for the NOA 280i (total range 4.1% vs 6.4%; 50- to 100-ppb range 3.9% vs 6.9%, respectively). However, there was no difference in the coefficient of variation between the 2 devices in other ranges (10–50 or >100 ppb) or in any ranges in each device. FeNO levels measured using the NIOX VERO (mean $\pm$ SD 53.4 $\pm$ 38.9 ppb) were significantly higher than those using the NOA 280i (mean $\pm$ SD 41.7 $\pm$ 33.2 ppb; *P* < .0001). However, there was a significant correlation between NIOX VERO- and NOA 280i-measured FeNO levels (*r* = 0.946, *P* < .0001; Fig 1). The following correction equation was obtained to relate the 2 measurements: FeNO (NIOX VERO) = FeNO (NOA 280i) $\times$ 1.096 + 7.741. The Bland-Altman plot showed a moderate degree of agreement between the 2 devices; the mean inter-device difference was 11.7 ppb (95% limits of agreement –13.5 and 37.0 ppb). A sub-analysis of FeNO lower than 100 ppb prompted the following correction equation: FeNO (NIOX VERO) = FeNO (NOA 280i) $\times$ 1.035 + 8.188; the Bland-Altman plot showed a mean inter-device difference of 9.4 ppb (95% limits of

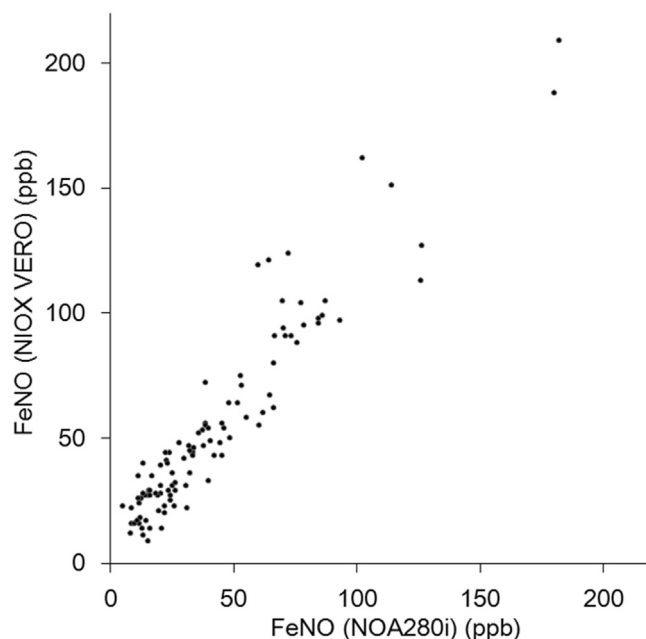


Figure 1. Correlation between NIOX VERO- and NOA 280i-measured fractional exhaled nitric oxide (FeNO) levels.

agreement –7.1 and 25.8 ppb). Another analysis that excluded 4 outlier values (inter-device difference range 51.6–59.5 ppb) prompted the following correction equation: FeNO (NIOX VERO) = FeNO (NOA 280i) $\times$ 1.045 + 8.192; the Bland-Altman plot showed a mean inter-device difference of 10.0 ppb (95% limits of agreement –8.7 and 28.7 ppb).

There is a difference in the method of nitric oxide measurement between the NIOX VERO and NOA 280i, which has been described in detail elsewhere.^{1,7} In this study, we found a significant correlation and moderate agreement between FeNO levels measured using the NIOX VERO and NOA 280i. The correction equations will enable researchers and clinicians to compare FeNO levels measured using the 2 devices. We also found that FeNO levels measured by the NIOX VERO were significantly higher than those measured by the NOA 280i. This is the first study to compare the NIOX VERO, a recent hand-held and portable electrochemical analyzer, with the NOA 280i, a stationary, chemiluminescence analyzer, in adult patients with asthma. A previous study reported a significant correlation (*r* = 0.876) and moderate agreement (Bland-Altman plot: mean inter-device difference 3.3 ppb, 95% limits of agreement –7.0 and 13.6 ppb) between FeNO levels measured with the NIOX MINO and those measured with the NOA 280i.⁴ However, NIOX MINO-measured FeNO levels were significantly lower than NOA 280i-measured levels, suggesting differences between FeNO levels measured using the NIOX MINO and NIOX VERO. The National Institute for Health and Care Excellence guidelines state that the manufacturers of the NIOX MINO and NIOX VERO have provided details of a study (commercial and confidential) that compared the technical performance and accuracy of the 2 devices.³ Currently, the information regarding differences between the 2 devices is unavailable for general users. The NIOX VERO might replace the NIOX MINO worldwide. Hence, the comparison between FeNO levels measured using these 2 devices requires attention.

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An analysis of insurance and other factors associated with asthma-related emergency department visits, 2009–2014



Asthma is a common chronic airway disorder characterized by periods of reversible airflow obstruction known as asthma attacks. Although no cure for asthma is known, control of the frequency and intensity of exacerbations and associated functional limitations is desirable. Uncontrolled asthma has a significant cost to families and society, including costs associated with work and school absenteeism, emergency department (ED) visits, and hospitalizations. Costs associated with asthma, including costs of children and adults missing school or work after an asthma attack, continue to increase.¹ Asthma prevalence is also increasing disproportionately across historically vulnerable populations that are likely to have barriers to routine asthma care.^{2,3}

Since the passing of the Patients Protection and Affordable Care Act (ACA) in 2010, insurance status has been at the forefront of the health care discussion along with ways to decrease costs. ED visits related to asthma are often characterized as unwarranted and even abusive in some cases.⁴ The goal of existing asthma guidelines is to prevent asthma attacks, reducing the need for ED visits and hospitalizations. However, in recent years, although health care visits for asthma have decreased in primary care settings, ED visits and hospitalization rates for asthma were stable.³ This study sought to examine whether asthma-related ED visits and insurance status are associated (while accounting for other sociodemographic variables of interest) by using the most recently available National Hospital Ambulatory Medical Care Survey–Emergency Department (NHAMCS-ED) data.

This study was a retrospective, cross-sectional, observational analysis of data collected by the Centers for Disease Control and Prevention (and available to the public) in the NHAMCS-ED during the years 2009 through 2014.⁵ Children younger than 2 years and patients with an obstructive lung disease (including all the following *International Classification of Diseases, Ninth Revision* [ICD-9] codes 490xx, 4901x, 4911x, 49120, 49121, 49122, 4918x, 4919x, 4920x, 4928x, 4940x, and 4941x) were excluded.

The survey data were analyzed using the sampled visit weight, which is the product of the corresponding sampling fractions at each stage in the sample design. The sampling weights have been adjusted by the National Center for Health Statistics for survey nonresponse as appropriate, yielding unbiased national estimates of visit occurrences, percentages, and characteristics.⁵ The sampling weights were divided by the number of survey years included

in this study (2009–2014) to arrive at mean annual estimates. The analysis of the survey, as designed, allows the generation of national mean annual ED visit totals by extrapolation of the survey sample ($n = 166,795$). Because of the complex sample design, the appropriate SAS (version 9.3, SAS Institute Inc, Cary, North Carolina) procedures/options to address missing data and utilize domains to determine accurate variance estimates were implemented in the analyses as recommended by the National Center for Health Statistics.⁶ The study was submitted to the Campbell University Institutional Review Board and received an exemption.

The outcome variable of interest was a diagnosis of asthma with an ICD-9 code of 493xx (yes vs no), where the denominator was the number of cases that met the inclusion and exclusion criteria. Although an asthma diagnosis at an ED visit included in this survey may be an initial diagnosis of the condition, it more likely is a recording of a known, preexisting condition. The choice of independent variables was made based on factors determined to be relevant to an asthma diagnosis recorded at the survey visit but was limited by the data available in the NHAMCS-ED surveys.

A multivariable logistic regression model was constructed for the diagnosis of asthma recorded at the time of ED visit to evaluate the predictive value of each independent variable, adjusting for covariates of interest. Weighted, adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs) for each level of each variable included in the model (compared with each variable's reference group) were reported.

An unweighted total of 166,795 visits were identified for patients who met the study inclusion and exclusion criteria in the NHAMCS-ED between the years of 2009 and 2014. From this survey total, the national mean annual asthma-related ED visit totals were estimated (Table 1).

On the basis of the weighted multivariable logistic regression model, after adjusting for factors of interest, patients were significantly less likely to have an asthma diagnosis noted during an ED visit if they had workers' compensation or other insurance as compared with private insurance (OR, 0.57; 95% CI, 0.37–0.88). Work-related asthma is a common, yet underdiagnosed condition, with a median prevalence estimate of 18% among working adults; however, only a small percentage of workers' compensation claims are attributable to respiratory disorders, such as asthma.^{7–9} Therefore, although patients who qualify for workers' compensation could have presented to the ED with asthma, they likely used their private insurance because it was easier than filing a claim.