The relationship between obesity and asthma severity and control in adults

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Background: The association of obesity with asthma outcomes is not well understood.

Objective: The objective of this study was to examine the association of obesity, as represented by a body mass index (BMI) of greater than 30 kg/m^2, with quality-of-life scores, asthma control problems, and asthma-related hospitalizations.

Methods: The study followed a cross-sectional design. Questionnaires were completed at home by a random sample of 1113 members of a large integrated health care organization who were 35 years of age or older with health care use suggestive of active asthma. Outcomes included the mini-Asthma Quality of Life Questionnaire, the Asthma Therapy Assessment Questionnaire, and self-reported asthma-related hospitalization. Several other factors known to influence asthma outcomes also were collected: demographics, smoking status, oral corticosteroid use in the past month, evidence of gastroesophageal reflux disease, and inhaled corticosteroid use in the past month. Multiple logistic regression models were used to measure the association of BMI status with outcomes.

Results: Even after adjusting for demographics, smoking status, oral corticosteroid use, evidence of gastroesophageal reflux disease, and inhaled corticosteroid use, obese adults were more likely than those with normal BMIs (<25 kg/m^2) to report poor asthma-specific quality of life (odds ratio [OR], 2.8; 95% CI, 1.6-4.9), poor asthma control (OR, 2.7; 95% CI, 1.7-4.3), and a history of asthma-related hospitalizations (OR, 4.6; 95% CI, 1.4-14.4).

Conclusions: Our findings suggest that obesity is associated with worse asthma outcomes, especially an increased risk of asthma-related hospitalizations. (J Allergy Clin Immunol 2008; 122:507-11.)

Asthma and obesity are important public health problems.[1-3] Over the past 30 years, asthma prevalence has more than tripled.[4] The prevalence of obesity also has increased dramatically over the past 30 years. In the late 1990s, Camargo et al[5] reported the first prospective data linking obesity with risk of adult-onset asthma. Since then, many groups around the world, using a variety of study designs, have confirmed the positive association between body mass index (BMI) and asthma.[6] Data from uncontrolled observational studies suggest that medical or surgical[7-9] weight loss interventions in obese asthmatic patients improve asthma control, and 2 small randomized trials from Finland provide additional support for the causal nature of the obesity–asthma association.[10,11]

In recent years, investigators have begun to more seriously explore the possibility that asthma is not a single disease but rather a constellation of different diseases or asthma phenotypes.[12] Thus obesity might be associated with a different type of asthma, such as one that is of greater severity or that is more difficult to control. Previous research has found, for example, that obese women with asthma were twice as likely to report hospital admission as their nonobese asthmatic counterparts.[5] To date, 2 studies have examined the relation of obesity to asthma severity or asthma control.[13,14] The first is a *post hoc* analysis of 3000 subjects with moderate asthma enrolled in a randomized controlled trial.[13] The authors found that BMI can influence the natural history of asthma control and might influence response to asthma treatment medications. The second study was an observational study of 400 asthmatic subjects receiving care in 4 university-based French outpatient clinics[14] in which the investigators found that overweight individuals were less likely to transition from unacceptable levels of asthma control to acceptable levels.

Although the association of asthma with obesity is becoming increasingly established, it is not known whether other factors (eg, demographics, smoking status, comorbid gastroesophageal reflux disease [GERD], and medication use) might explain the observed differences in asthma severity and control between obese and nonobese populations.

With this background in mind, our objective was to examine the association of obesity with a comprehensive set of outcome measures, including asthma-specific quality of life, level of asthma control, and asthma-related hospitalizations. We examined these associations with and without adjustment for selected demographic variables, smoking status, use of oral corticosteroids in the past month, current evidence of comorbid

Abbreviations used
AQLQ: Juniper mini-Asthma Quality of Life Questionnaire
ATAQ: Asthma Therapy Assessment Questionnaire
BMI: Body mass index
GERD: Gastroesophageal reflux disease
ICS: Inhaled corticosteroid
OR: Odds ratio

GERD, and regular inhaled corticosteroid (ICS) use in the past month.

METHODS
Study subjects

Study participants were members of the Colorado and Northwest regions of Kaiser Permanente, a large managed care organization centered in Denver, Colorado, and Portland, Oregon, respectively. Health plan members were eligible for the study if they were at least 35 years of age and had, in the 2-year period preceding the survey, at least 1 documented asthma-related medical encounter and at least a 6-month supply of asthma medication dispensed. These criteria were used to identify a population with persistent asthma and have been reported elsewhere.[15,16] A search of more than 1,000,000 electronic medical records identified 9420 individuals who met these criteria, and we mailed surveys to a randomly selected subset of 1600 in the fall of 2002, 800 in each region. Of the 1317 (82%) persons who completed the questionnaire, 204 denied having doctor-diagnosed asthma and were excluded from further analysis. Completion of the questionnaires was assumed to indicate consent to participate in the study. The study was approved by both the Kaiser Permanente Colorado and Northwest Regional Institutional Review Boards. Some results from this survey have been reported elsewhere.[15,16]

Survey

The primary independent variable was BMI, which was calculated from self-reported height and weight. The primary dependent variables were as follows:

1. the 15-question Juniper mini-Asthma Quality of Life Questionnaire (AQLQ),[17] a validated instrument from which one can generate an overall score and 4 domain scores (symptoms, emotions, activity, and environment), each ranging from 1 to 7, with higher scores indicating better quality of life in the last 2 weeks;
2. the 4-question Asthma Therapy Assessment Questionnaire (ATAQ),[18,19] a validated asthma control tool with scores ranging from 0 to 4, reflecting the number of asthma control problems present in the last month; and
3. self-report of an asthma-related hospitalization in the previous year.

Secondary predictor variables included the following:

1. age, sex, race/ethnicity, highest grade in school completed (less than high school, high school, technical school, college, postgraduate, or professional), and annual family household income (<$20,000, $20,000-$34,000, $35,000-$49,900, $50,000-$74,999, and ≥$75,000);
2. smoking status, with never smoking defined as less than 20 packs of cigarettes OR less than 12 oz of tobacco in lifetime OR less than 1 cigarette a day for a year; current smoking defined as smoking cigarettes within the past month; and former smoking defined as ever smokers who have not smoked in the past month;
3. current evidence of GERD, which was defined as a positive response to the question "In addition to asthma, has a doctor ever told you that you have any of the following health conditions" (one of the conditions to which the patient could check "Yes" (vs "No") was "Gastroesophageal Reflux Disease (GERD)");

4. any use of oral steroids in the past month to help manage asthma symptoms; and
5. regular use of ICSs within the past month, defined as use "every day, whether or not I had asthma symptoms."

TABLE I. Characteristics of the population with persistent asthma enrolled in a group model health maintenance organization (n = 1113)

Characteristic	Descriptive statistics
Mean age (y) ± SD	56.8 ± 12.2
Age <65 y (%)	72.6
Male sex (%)	48.6
Race/ethnicity (%)	
White (non-Hispanic)	86.1
Black (non-Hispanic)	3.6
Hispanic	4.8
Other	4.0
Information not available	1.5
Education: highest grade completed (%)	
Less than high school	4.2
High school/GED	40.4
Technical school	12.0
College graduate	29.1
Postgraduate/professional	20.1
Information not available	1.2
Income (%)	
<$20,000	13.5
$20,000-$34,999	17.7
$35,000-$49,999	17.1
$50,000-$74,999	19.7
≥$75,000	22.0
Information not available	10.0
BMI (%)	
<25 kg/m^2	26.1
25-29.9 kg/m^2	36.9
≥30 kg/m^2	37.0
Smoking (%)	
Never	45.8
Former	44.1
Current	8.0
Information not available	2.1
Oral corticosteroid use (%)	
Use in past month	14.1
Information not available	2.8
GERD status (%)	
History of GERD	39.4
Information not available	8.9
ICS use (%)	
Use in past month	61.4
Information not available	9.5
Mini-AQLQ	
Mean ± SD	4.98 ± 1.24
Total score <3.9 (%)	20.8
Symptoms domain <3.9 (%)	22.8
Emotions domain <3.9 (%)	25.6
Activity domain <3.9 (%)	15.5
Environment domain <3.9 (%)	36.8
Information not available (%)	0.0
ATAQ	
Mean ± SD	0.89 ± 1.04
Score >1 (%)	27.8
Information not available (%)	1.2
Asthma-related hospitalization	
Hospitalization in past year	5.6
Information not available (%)	1.2