Letters

RESEARCH LETTER

Trends in Pulmonary Function Testing Before Noncardiothoracic Surgery

Preoperative pulmonary function tests (PFTs) assess the severity of known pulmonary disease, diagnose causes of respiratory symptoms, and may help identify patients who are at risk for postoperative pulmonary complications. While useful in selected patients, unnecessary testing is costly. Few guidelines for the appropriate use of preoperative PFTs exist, with the most recent being the April 2006 American College of Physicians guidelines on risk assessment and prevention of postoperative pulmonary complications. We conducted a population-based study in Ontario, Canada, to describe temporal trends in preoperative PFTs and to assess whether the guidelines influenced these trends.

Methods | Following research ethics approval from Sunnybrook Health Sciences Centre, we conducted a retrospective cohort study using deidentified data from linked population-based administrative databases. The cohort included individuals who were 40 years or older who underwent elective abdominal aortic aneurysm repair, carotid endarterectomy, peripheral arterial bypass, knee replacement, hip replacement, large-bowel resection, partial liver resection, pancreateoduodenectomy, gastrectomy, esophagectomy, abdominal hysterectomy, radical prostatectomy, nephrectomy, or cystectomy from April 1, 2003, through March 31, 2013.

The outcome of interest was preoperative PFT, defined as physician claims for simple spirometry, flow-volume loop, lung compliance, carbon monoxide diffusion capacity, or bronchial provocative studies within 60 days before surgery. For comparison, we identified nonoperative PFTs, defined as tests conducted from 181 through 365 days before surgery.

After dividing the study into 3-month intervals, rates of preoperative and nonoperative PFTs were measured for each interval. Temporal trends in PFT rates were plotted and visually inspected to assess for time points when they changed substantially. We tested for the effect of guidelines on trends using segmented linear regression models. These analyses were then repeated within subgroups that were stratified by perioperative pulmonary risk based on the presence or absence of asthma or chronic obstructive pulmonary disease.

Results | Of 511,625 individuals in the cohort, 3.6% underwent preoperative PFTs while 3.3% had nonoperative PFTs. Among high-risk individuals with asthma or chronic obstructive pulmonary disease, the proportions who underwent preoperative and nonoperative testing were similar at 8.3%. Conversely, among individuals without these conditions, 2.0% had preoperative testing while 1.6% had nonoperative testing.

Plotted trends showed that preoperative PFT rates decreased during the study while nonoperative rates remained stable (Figure 1). Trends in preoperative PFT rates appeared to decrease following the American College of Physicians guidelines.

![Figure 1. Trends in PFTs Before Elective Noncardiothoracic Surgery From April 1, 2003, Through March 31, 2013](image-url)
lines; this trend was confirmed using segmented regression modeling ($P = .006$). Qualitatively similar patterns were observed in subgroups with and without risk factors for postoperative pulmonary complications (Figure 2).

**Discussion** | Preoperative PFT rates in Ontario, Canada, were low, decreasing from 1 of 23 procedures in 2003 to 1 of 38 procedures in 2013. These trends were qualitatively similar in subgroups stratified by risk for postoperative pulmonary complications. Notably, these decreasing preoperative PFT rates contrast starkly with concurrent increases in rates of other perioperative interventions, such as preoperative anesthesia consultations and stress testing. While the April 2006 publication of the updated American College of Physicians guidelines was followed by substantial decreases in preoperative PFT rates, these guidelines were unlikely to have been the sole reason for this trend. Specifically, they were not associated with any large-scale promotion projects or changes in provincial health insurance payment schedules. The decline in preoperative PFT rates may, in part, be explained by increased use of bedside spirometry and other alternative pulmonary tests, which are not captured by provincial administrative databases. While less costly and possibly more accessible at some hospitals, these alternative tests have limitations, such as measurement error.

Given the low overall rate of preoperative PFTs, large-scale efforts to reduce this testing are likely unnecessary. By 2013, preoperative PFTs were performed in less than 8% of Ontario patients with risk factors for pulmonary complications while preoperative testing rates among individuals without known respiratory disease had approached rates seen in the nonoperative setting. These findings indicate the need for more research to identify which surgical patients most benefit from preoperative PFTs.

Overweight and obesity are associated with various chronic conditions. These conditions are considerable health care and societal burdens, yet could potentially be averted by preventing weight gain and obesity. In a prior analysis, now almost 20 years old, Must et al² used a nationally representative data set from 1988 through 1994 and reported the US chronic disease burden associated with body mass index (BMI), thus informing clinical practice and the priorities for cost-effective prevention strategies. Using the most recent data in the National Health and Nutrition Examination Survey (NHANES, 2007-2012), we updated the prevalence of overweight and obesity by sex, age, and race/ethnicity and compared the values with those of the earlier study.²

Methods | The NHANES was designed to provide cross-sectional estimates of the prevalence of major diseases, nutritional disorders, and potential risk factors among the US population.³ We aggregated data from 2007-2008, 2009-2010, and 2011-2012 and included only adults who were 25 years or older (n = 15 208), excluding those who were pregnant at the time of examination (n = 125) or provided insufficient data regarding weight and height (n = 827). The NHANES obtained approval from the National Center for Health Statistics Research Ethics Review Board and participants provided written consent.

Weight and height were measured during the physical examination using standard procedures. Patients’ BMIs (calculated as weight in kilograms divided by height in meters squared) were classified according to the following categories: underweight (<18.5), normal weight (18.5-24.9), overweight (25.0-29.9), obesity class 1 (30.0-34.9), obesity class 2 (35.0-39.9), and obesity class 3 (>40).³

Data regarding patients’ age, sex, and race/ethnicity were collected. Age was classified as 25 to 54 years or 55 or more years. Self-reported race/ethnicity were categorized as Mexican American, non-Hispanic black, non-Hispanic white, or other.

We stratified the analyses by sex and calculated the weighted proportion estimates in each BMI category by race or ethnic group and age group. All statistical analyses were conducted in Stata, version 12.0 (StataCorp LP), using survey analysis procedures to account for the complex sampling design.

Results | Of the sample population, 39.96% (weighted n = 36 325 297) of men and 29.74% (weighted n = 28 894 630) of women were overweight and 35.04% (weighted n = 31 847 198) of men and 36.84% (weighted n = 35 792 733) of women were obese. The weight status distribution was similar for both sexes across racial groups (Table), except for the proportion of non-Hispanic white women, which was higher in the normal-weight than the overweight category. Compared with 20 years ago, the greatest increase in the proportion of patients in the obesity class 3 category was among non-Hispanic black women.

Discussion | Compared with 1988-1994,² the distribution of the population’s weight status has increased in the past 20 years. The rising trends in overweight and obesity warrant timely attention from health-policy and health care-system decision makers. Clinical practice for the prevention and treatment of chronic conditions has mainly focused on screening high-risk populations. As a result, people in higher-weight categories are more likely to be diagnosed with the chronic diseases associated with excess weight³ because of more frequent measurements, compared with people in the normal-weight category. This approach may ignore individuals with normal weight and their weight gain, which puts them at risk.

Population-based strategies helping to reduce modifiable risk factors such as physical environment interventions, enhancing primary care efforts to prevent and treat obesity, and altering societal norms of behavior are required.⁴ In 2012, the Institute of Medicine identified population-based obesity-prevention strategies that target physical activity, healthy diet,