directly to the U.S. context. We also note the requirement by the Centers for Medicare and Medicaid for a separate shared decision-making session before the screening intervention in the United States. However, evidence suggests that the behavioral components of LSUT's strategy (healthcare professional endorsement and proactively inviting and arranging appointments) are the "active ingredients" that could be implemented in different ways in the U.S. context.

We also share Wilson's interest in broadening LSUT's "Lung Health Check" approach to screening to include other aspects of lung and heart health in the future. Framing lung cancer screening as one optional test within a "Lung Health Check" was intended to improve engagement by minimizing fear (that could lead to information avoidance and uninformed nonparticipation) and to provide an in-person supportive environment where shared decision-making about the screening offer could be achieved. Through this we found potential for other lung and heart health interventions—the key focus of Wilson and colleagues' point. This includes parallels with the PLuSS (Pittsburgh Lung Cancer Screening Study) (3), which found that the prevalence of emphysema and airway obstruction increased with individual lung cancer risk. For example, work led by Ruparel and colleagues (4) found a significant proportion of undiagnosed chronic obstructive pulmonary disease and untreated coronary artery calcification (5) within our LSUT cohort, suggesting opportunities for early diagnosis of chronic obstructive pulmonary disease, instigating cardiovascular risk assessment and primary prevention. The UK taxpayer's universal healthcare system may in the future fund low-dose computed tomography screening scans, and so we would not have the financial disincentives that the United States has in this respect. However, the United Kingdom does have limited resources for subsequent healthcare provision for incidental findings. This makes the feasibility of delivering a holistic health assessment challenging and policy decision-makers would (rightly) first require evidence for the public health benefit and cost-effectiveness of such an approach. ■

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Airway Disease Presenting as Restrictive Impairment

To the Editor:

Eddy and coworkers (1) have earned the appreciation of pulmonary clinicians and physiologists for providing both a physiologic and an

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anatomic basis for observations by a number of researchers in a variety of respiratory disorders, including World Trade Center (WTC) lung disease (2), asthma/reactive airway dysfunction syndrome (3), and coal workers' lung disease (4). These observations have been characterized as restrictive (2) in the presence of decreased FVC often described as parallel to a decrease in FEV_1 (4) and resultant normal FEV_1/FVC ratio. In nonobstructive chronic bronchitis, follow-up spirometry showed parallel decreases in FVC and FEV_1 and a "restrictive pattern" in 14% (5). Similar findings have been described as "GOLD (Global Initiative for Chronic Obstructive Lung Disease)-unclassified," "PRISm" (preserved ratio impaired spirometry), "nonspecific," or simply "low FVC." Findings include characteristic airway symptoms (cough, sputum, and wheezing); flow rates at low lung volumes may be decreased but are often not reported, and oscillometry is consistent with small airway dysfunction. Unlike the iconic restrictive impairment caused by interstitial lung disease or chest bellows deficit, this "restrictive dysfunction" worsens with bronchoprovocation and improves with bronchodilatation. Unlike classic airway obstruction in chronic obstructive pulmonary disease and most cases of asthma, the FEV_1/FVC ratio is maintained, and FRC or residual volume is not or is minimally increased.

Eddy and associates demonstrated loss of subsegmental airways seen on computed tomography (1). This correlated with increased bronchial wall thickness, decreased luminal area, and ventilatory defects on hyperpolarized 3-He magnetic resonance imaging in patients with severe asthma (FEV_1 64–65% of predicted, FEV_1/FVC 0.58–0.64) compared with less severe disease (FEV_1 88% predicted, FEV_1/FVC 0.74). Eddy and colleagues' Figure 1 showing the difference in airway count in patients with severe asthma vividly illustrates the anatomic deficit. Recently, the Mount Sinai WTC group reported increased bronchial wall area on quantitative computed tomography in 167 exposed workers and volunteers with the "Low FVC Spirometric Pattern," confirming Eddy and colleagues' report (6).

Restrictive impairment attributable to asthma was described in 32 of 413 (8%) patients with asthma seen in a small inner-city hospital over 2 years (3). No patients had evidence of another disorder causing restrictive impairment. Plethysmographic FRC was normal or decreased in 22 of 25 patients in whom it was measured. Restriction as opposed to obstruction was attributed to airway closure rather than narrowing, an explanation consonant with Eddy and colleagues' demonstration of airway loss. Restrictive impairment in asthma was not generally recognized before this publication despite two illustrative reports almost a half-century ago cited in this article; Colp and Williams described in 1973 a "restrictive pattern of ventilatory impairment" in two patients with asthma. One patient had mucus plugging of main and lobar bronchi and resultant massive atelectasis clearly explaining her restriction. The other had "diffuse small airway involvement" on pathologic examination, which would cause the loss of airways described by Eddy and colleagues. Three years later, Hudgel and colleagues reported "reversible restrictive lung disease" in a young patient with asthma whose TLC decreased from 5.3 to 2.6 L during an acute episode.

Loss of airways similarly helps explain the characteristic findings of low FVC, normal FEV_1/FVC, and small airway obstruction on oscillometry reported in first responders and area residents with "WTC Lung Disease" (2) and the accelerated "parallel decline" in FVC and FEV_1 reported in 11 coal miners in the absence of radiographic fibrosis (4). ■

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Reply to Miller *et al.*

From the Authors:

We appreciate the thought-provoking comments of Dr. Miller and colleagues in response to our report on "missing" airways in participants with asthma and, in particular, severe asthma (1).

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