control. Khuriman et al[1] describe a prevalence of 14% overall in population-based prevalence studies, but of 20% after 5 years and 40% after 15 years (defined as decreased pinprick sensation—a coarse, subjective, and imprecise measure of neuropathy). With the advent of vibrometry, a much more sensitive indicator, this prevalence may indeed prove much higher. No unbiased population-based studies exist to our knowledge in this country.

More importantly, "neuropathies" may not all occur through the same mechanism.[2] Mononeuritis may be primarily vascular in origin, whereas diffuse peripheral neuropathies may be metabolic, especially as they seem to improve with better control. As discussed in the introduction, diabetes-induced hearing loss may occur on the basis of metabolic derangements, in which case the eighth nerve might be more sensitive to noise than if the mechanism were vascular damage, where no such interaction might be expected. If an interaction were seen, actively working well-controlled diabetic patients could be expected to develop more noise-induced hearing loss even at "acceptable" noise exposure levels than nondiabetic persons. Noise has been associated with such diffuse interaction in solvent-induced neuropathy.[3] Diabetic patients should then wear hearing protection earlier than prescribed by the current hearing conservation standard. The purpose of the paper was to document that, in working diabetic patients, there is no gross evidence of excess dysfunction, although one of the authors had discovered such an excess in a separate small group, diabetic geologists in hazardous waste sites. On balance, current evidence does not warrant general restriction of diabetic patients from noisy jobs. Diabetic patients are certainly not immune to the effects of noise and deserve all the hearing protection they can get.

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Indoor Air Quality

To the Editor: The contribution Dr Kirkbride makes[1] to the recent discussion on the impact of environmental tobacco smoke (ETS) on air quality in modern office buildings[2–4] sharply highlights the obstacle to the serious application of much-needed industrial hygiene and occupational health measures to modern office buildings.

Yes, Dr. Kirkbride is correct on all counts:

(1.) He is correct in finding that 68% of *sick buildings* in Canada suffer from inadequate ventilation and that another 10% suffer from re-entry of building or motor vehicle exhaust. (A review by the National Institute for Occupational Safety and Health of their buildings investigations reports the same results.)

(2.)He is correct, also, in maintaining that many of his colleagues believe environmental tobacco smoke "is the most important single pollutant in the air of office buildings."

That the result of many field studies contradicts Dr Kirkbride's conviction appears to be besides the point.

The number of Canadian municipalities with by-laws regulating smoking in public places is rapidly increasing. The federal government has announced its intentions to ban smoking in all public service workplaces by January 1, 1989. Yet, it is remarkable that not one of these municipal by-laws or the contemplated federal standard address needed regulations of indoor air quality.

What our original paper and subsequent discussions point to is the desperate need for indoor air quality standards. Rules for regulation of smoking should be part of such standards. A model for setting an air quality standard with provisions for smoking regulations is the *Indoor Air Quality Standard* being drafted by the state of New Jersey.[5] In the meantime, it may have unpleasant consequences for the serious investigator, but nevertheless it is necessary to put the contribution of environmental tobacco smoke relative to the indoor environment and to health and comfort levels in that environment into proper perspective.

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Standardization of Spirometry—1987 ATS Update

To the Editor: The American Thoracic Society (ATS) has recently updated its recommendations on the standardization of spirometry.[1] Spirometry has become the most common and useful test of pulmonary function in the occupational setting because it is simple to administer, inexpensive, safe, and quite sensitive and specific.[2]

Highlights of the standardization document which influence occupational spirometric testing are:

Equipment Selection and Testing—Selection of adequate equipment is critical to the acquisition of accurate spirometric data. The new ATS document outlines recommendations for accuracy of spirometers and gives test methods for validating spirometer performance. Recently, 53 contemporary spirometers were evaluated to determine whether they met the new ATS criteria.[3] Unfortunately, only 27 (51%) of the devices met the new recommendations. Although there is a widespread demand for a simple, small, inexpensive, and accurate spirometer, sometimes manufacturers and users translate this to mean that accuracy can be exchanged for lower cost. Users must be cautioned against such an exchange. Before buying a spirometer, the manufacturer should be asked to provide data comparing the performance of their spirometer to the ATS recommendations. Based on testing performed by an independent laboratory, the manufacturer should be able to provide quantitative evidence of the accuracy and validity of their spirometer and associated computer software.

Equipment Quality Control—Preventive maintenance, calibration checks, verification, and quality control are especially important in the occupational

setting to assure accurate spirometric results. The new ATS document outlines such procedures to be used in all settings, including occupational testing. For example, during industrial surveys or other field studies, the equipment should be calibrated prior to testing daily if in regular use and then every four hours during use. The four-hour interval is recommended to prevent invalidation of data from a large number of maneuvers. Similarly, periodic leak testing is an important quality assurance test for volume type spirometers.

Forced Vital Capacity Maneuver Performance—Recommendations are made for instructing and demonstrating the maneuver to test subjects. A minimum of three acceptable maneuvers are required, and if there is large variability between maneuvers, then up to eight maneuvers may be necessary. Criteria for determination of the end of test are now more stringent, to correct for deficiencies noted in the earlier ATS recommendations. In addition, a minimum exhalation time of 6 seconds is recommended. However, care must be exercised in excluding a subject's test result from a study or further consideration solely based on the reproducibility of the test result. The "back extrapolation" method for determining beginning of test has been refined, as have the methods for assessing the subject's quality of test performance.

Measurement Procedures—Since spirometry is an effort-dependent test, visual inspection of the recorded tracing is necessary to determine adequacy of testing results. An important addition to the new ATS recommendations is a more extensive description of the graphic recorders or visual displays needed for technicians to assess the quality of the spirogram. Accuracy of diagnostic and computer displays as well as other display features are recommended. Appendix materials in the new ATS document provide information for both manufacturers and users to help improve the quality of computerized systems.

Acceptability and Reproducibility—Before spirometric measurements are used for any purpose, they should be checked first for acceptability and then for reproducibility. Since the forced expiratory maneuver is effort-dependent, proper and enthusiastic "coaching" of the subject cannot be overemphasized. Although the use of data with poor reproducibility is left to the discretion of the interpreter, every attempt should be made to obtain at least three acceptable spirograms.

Recommendations are contained in the new ATS document, which will assist users in obtaining better data from spirometry. As the quality of spirometry improves through improved instrumentation, software, and technician performance, the comparability of results will likewise improve.

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Book Reviews

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Books for review should be sent to David H. Garabrant, MD, University of Southern California School of Medicine, 1420 San Pablo St, Los Angeles, CA 90033.

Office Spirometry—A Practical Guide to the Selection and Use of Spirometers. Paul L. Enright and Robert E. Hyatt, 253 pp, $18.95, 1987. Lea & Febiger, 600 Washington Square, Philadelphia, PA 19106-4198.

This well-written book will be of great value to any physician who is considering the purchase of an office spirometer or who currently must interpret spirometric data. It can be easily and quickly read by a physician or technician staff and provides information not found elsewhere.

The first two chapters acquaint the reader with the need for spirometric testing in general practice. Clinical indications for spirometry are discussed with particular attention to chronic obstructive lung disease. Some of the information presented will seem rather basic to physician readers but should be of interest to others. The discussion of the economics of office spirometry will be useful to physicians who are considering purchasing equipment. The interpretation of spirometric data, although presented primarily for the nonphysician, is accompanied by informative sections on volume-time and flow-volume curves with examples to illustrate common patterns. In chapter 4 there is an excellent discussion of the various types of spirometers with clear diagrams of the inner workings of both manual and automated machines.

In chapter 5 is presented a "consumers' guide" to the purchase of spirometers with detailed evaluations of 21 different spirometers. This chapter would be extremely useful to those who anticipate purchasing equipment. The techniques involved in testing subjects are presented in detail with emphasis on reproducibility and recognition of unacceptable expiratory maneuvers. This chapter contains essential information for the physician who must review spirograms and supervise technicians. The authors present 12 spirograms to illustrate common problems. The techniques for calibration of equipment and for doing manual calculations are accompanied by a discussion of predicted values for various ethnic and racial groups. Chapter 9 presents a detailed discussion of postbronchodilator testing which includes indications, choice of bronchodilator, and method of administration. Chapter 10 describes how to do other nonroutine tests in the office such as maximum voluntary ventilation, slow vital capacity, chest x-ray planimetry, and methacholine challenges.

This book is a valuable introductory text suitable for physicians who wish to review practical spirometry as well as for other medical professionals who need a reference text for use in setting up and running a spirometry program.

—Robert Leonard Goldberg, MD