to an evaluation of whether those who sought medical help fared any differently from those who did not.

In our view, scientific evaluation of the usefulness of detecting high-risk individuals is the next step, an evaluation which is no less a "therapeutic trial" than the large-scale trials of drugs today that are conducted with the precision which comes from good experimental design and careful attention to the characterization of "cases" and "controls." When a number of such trials (carried out in different communities) all indicate that early detection by screening can indeed lead to the institution of measures to improve an individual's subsequent health and happiness, then and only then, in our view, should mass screening be advocated.

Thus, although we welcome the study, we do not share the opinions of Hudgel et al about the desirability at present of screening for obvious disease. Our reasons are the following: (1) we do not know if we can beneficially alter the natural history of the disease at this stage; (2) even if an appropriate intervention were available, we do not know how compliant the high-risk individual would be; and (3) we do not know if the quality of life of an individual who was informed that he was at high risk would improve or decline as a result of this information. As Hiatt has stated with eloquence, in an era when resources are not limitless and the medical commons are rapidly being used up, we believe that before advocating a mass screening program, we must be able to offer the evidence that it "works."

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REFERENCES

Pulmonary Function Testing and the Prevention of Pulmonary Disease

This editorial comment is based on the concluding chapter of a forthcoming monograph edited by Peter T. Macklem, M.D., and me entitled The Lung in the Transition Between Health and Disease. The article by Hudgel et al (see page 619) is so much in keeping with the conclusions that were reached by Macklem and me that I have decided to make my editorial comments here largely a verbatim quote from sections of the concluding chapter.

In considering the simplicity of determination of the forced expiratory volume in one second (FEV1) and its potential use in detecting individuals who are headed toward serious trouble at a time when intervention might prevent a disastrous outcome, it is interesting to explore the reasons why the spirometer has not achieved a position comparable to the clinical thermometer, the sphygmomanometer, the ophthalmoscope, the chest x-ray film, and the electrocardiogram in the frequency of use. In part, the reason is a lack of knowledge by the health profession in general of chronic limitation of airflow, its importance in terms of mortality and morbidity, its natural history, the simplicity of its detection, and the possibility of altering its course before serious symptoms occur.

Perhaps even greater responsibility for the near absence of the use of pulmonary function in the prevention of chronic limitation of airflow must be borne by the expert in pulmonary medicine, especially in his relation to the nonspecialist. If evaluation of pulmonary function is to play a significant role in the prevention of chronic limitation of airflow, it is the pulmonary specialist who is in the best position to educate the rest of the health professions; yet the pulmonary specialist is no more likely to use pulmonary function tests for prevention than the nonpulmonary specialist.

The expert in pulmonary medicine knows the value of tests of pulmonary function in determining the significance of chronic limitation of airflow as a possible cause of symptoms and the patient's ability to withstand surgical procedures; however, he has not emphasized the importance of pulmonary function in the patient with no respiratory symptoms who is being examined by a physician. Even the expert in pulmonary medicine is not likely to carry out simple spirometric studies in a young patient referred to him for evaluation of a finding on the chest x-ray film which later proved inconsequential, yet it would be unlikely for the patient not to have his temperature measured, his blood pressure deter-
tributed

mined, and his blood and urine examined. While there would be only a small chance that the information from spirometric studies would have contributed to solving the problem for which the patient sought medical attention (but no less than the multiplicity of other tests), the information could prove of great use in the prevention of chronic limitation of airflow.

Let us suppose that the FEV\textsubscript{1} of this patient were at a lower level than nine out of ten subjects of his age. If this patient were a heavy cigarette smoker, would knowledge of his abnormal FEV\textsubscript{1} be of value? All current information would suggest that the patient would achieve considerable benefit from cessation of smoking. Do we have any reason to doubt that the imparting of information about the abnormality of FEV\textsubscript{1} from the physician to the patient could have contributed to the cessation of smoking in that specific patient? Without compelling evidence to the contrary, it seems absolutely irresponsible to assume that we could not do better in modifying behavior constructively in specific patients with more information on the part of the physician and patient.

To conclude that the physician could be just as effective by imparting the general information concerning smoking with no knowledge of the patient's FEV\textsubscript{1} is pure sophistry. In addition to the possible additional benefit of specific knowledge of pulmonary function in leading to a cessation of cigarette smoking, the exploration of other risk factors could possibly be of value in preventing progressive limitation of airflow; for example, knowledge of the patient's abnormal FEV\textsubscript{1} could have led to further exploration of his occupational history, Pi phenotype, and allergies. While the effectiveness of the modification and control of the environment of a subject presumptively at high risk is unknown at this time, no information available places limits on the possible gains from environmental control. We must admit that we just do not know how effective a program of prevention of chronic limitation of airflow based on serial measurements of pulmonary function measurements could be.

It seems likely that the recording of repeated measurements of pulmonary function in the medical records of individual patients would be of great value in much the same way that previously obtained x-ray films or measurements of blood pressure are useful. Clearly, serial measurements suggesting an abnormal rate of deterioration would be more significant than a single abnormal measurement. Whatever the benefit to an individual patient of having data on pulmonary function nearly always present on his medical records (rather than nearly always absent), the availability of such information would be an immense step forward toward better understanding of the natural history, risk factors, and effectiveness of prevention of chronic limitation of airflow.

There is growing recognition of the role of the medical profession in the prevention of morbidity and mortality before the occurrence of overt symptoms. A number of physicians and other health professionals have formed a new specialty, "prospective medicine."\textsuperscript{1,3} Significant risk factors in relation to the health of the individual patient are evaluated, information is shared with the patient, and an attempt is made to modify the overall risk of morbidity and mortality. Regardless of the effectiveness of such an approach, we find it ironic that essentially no use is being made of simple spirometric measurements in spite of the proven effectiveness of FEV\textsubscript{1}, not only in chronic limitation of airflow, but as a predictor of longevity.

To this point, we have discussed only the use of simple measurements of pulmonary function in patient-initiated contact with physicians. Entirely different considerations arise when the health professional initiates the contact for purposes of screening. The special technical and ethical problems of screening a large population for abnormalities of pulmonary function are complex. While the potential benefits toward prevention of chronic limitation of airflow are even greater than through an increased use of pulmonary function tests in a more conventional patient-physician setting, the risks are also greater. Leaving aside the problem of cost effectiveness, a nontrivial problem, there is a major risk of imparting uselessly distressing, and perhaps falsely distressing, information to a large number of people who were not seeking help from the health professions. While it is an awesome responsibility for a physician to tell a patient who has sought his help that he has an abnormal FEV\textsubscript{1} or Pi phenotype and ought to change his lifestyle, perhaps even his occupation, physician-patient relations in general are characterized by hard decisions having to be made with an insufficient amount of information. What a thoughtful physician should tell a young asymptomatic miner who has an MZ phenotype with an abnormal FEV\textsubscript{1} (in the statistical sense) is far from certain, but it is our strong conviction that a better decision is more likely to be made with knowledge of the FEV\textsubscript{1} than without it. The beneficial use of data on pulmonary function from screening is less certain. We have great concern for the risk in having nonexperts, working with perhaps questionable equipment, imparting information about pulmonary function to a subject who did not seek medical
attention. Indeed, the consensus among experts in pulmonary medicine, pulmonary physiology, and epidemiology a few years ago was that we were not ready to screen populations for abnormalities of pulmonary function, yet all available current information suggests that the screening for abnormalities of FEV\(_1\) could prove to be an outstandingly effective means of preventing the serious consequences of chronic limitation of airflow in a large number of subjects. We do not know whether this is true; but even more important, we do not know that it is not true! The message seems clear: We must encourage the use of the spirometer as part of the routine examination of nearly all adult patients, and we must encourage the development of controlled studies in populations to determine the effectiveness of evaluation of pulmonary function as a means of preventing the serious consequences of chronic limitation of airflow.

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### Screening for Early Obstruction of the Airways

A 1978 Reappraisal

Ten years ago, Hogg and his associates made an important observation that the principal site of increased resistance in chronic airflow obstruction occurred in the peripheral airways of the lung and not in the more proximal bronchi, as had been believed. These same studies suggested that resistance to airflow in the peripheral airways of normal lungs was negligible. A novel concept concerning the natural history of chronic airflow obstruction evolved from these observations. It was suggested that the peripheral airways were functionally a "quiet zone," such that extensive disease might exist at these sites and yet not be detected by the usual tests of pulmonary function, particularly the forced expiratory volume in one second (FEV\(_1\))\(^2\). It was further suggested that more sophisticated tests of ventilatory function, which were sensitive to disease in the small airways, might allow chronic airflow obstruction to be diagnosed at an earlier and more reversible stage. Because of the dismal experience in attempting to arrest the progression of clinically overt chronic airflow obstruction, this idea had enormous appeal to pulmonary physicians. Subsequently, considerable effort has been expended in developing and evaluating so-called tests of "disease of the small airways," which might be suitable for purposes of screening.

In 1973, the Division of Lung Diseases of the National Heart, Lung, and Blood Institute and the American Thoracic Society sponsored a workshop on early diagnosis of obstruction of the airways in relation to mass screening programs. This conference concluded that mass screening for early chronic airflow obstruction should not be undertaken until two major questions were answered: (1) Do the proposed tests of early chronic airflow obstruction predict the development of frank obstruction at a later time? (2) If detected at an early stage, can the subsequent course of chronic airflow obstruction be modified by treatment or removal of risk factors? In the five years since that conference, a fairly definite answer to the second question and a tentative answer to the first question have emerged.

The usefulness of different tests of pulmonary function in diagnosing the early stages of chronic airflow obstruction can be determined only by prospective studies which allow sufficient time for disabling airflow obstruction to develop. This particular type of study has not yet been completed, but other types of studies have raised questions about the original premises which indicated the need for more sophisticated testing methods. Early studies purporting to demonstrate the greater sensitivity of the newer tests (such as the closing volume [CV]) to detect early chronic airflow obstruction proceeded on the assumption that an abnormal FEV\(_1\)\(0.9\) was evidence of advanced disease, and individuals to be studied were selected on the basis of a normal or nearly normal FEV\(_1\)\(0.9\). Studies of this type are interesting because they demonstrate that physiologic abnormalities can occur in the face of a normal FEV\(_1\)\(0.9\), but these studies provide no basis for stating that any test is more sensitive than the FEV\(_1\)\(0.9\).

An independent judgment as to the presence of early chronic airflow obstruction (by clinical assess-