even when no association has been found between exposure to such air pollution levels and VC and FEV\textsubscript{1}, in a cross-sectional study. Therefore, air pollution standards can be considered safe only if longitudinal studies have proved that no harm has been done by exposure to such levels. At present, there is a tendency in a number of countries to increase the air pollution standards, using the argument that medical investigations have not shown effects so far on the lung function following exposure to moderate levels of air pollution.\textsuperscript{7,8} Based upon the association between exposure to moderate levels of air pollution and an accelerated decline in VC and FEV\textsubscript{1}, our conclusion is that the above-mentioned tendency to increase air pollution standards is dangerous and should not be based on arguments of "lack of evidence" in cross-sectional medical investigations. Again, to prove that certain levels of air pollution are not harmful longitudinal epidemiologic studies of lung function changes must be carried out.

Furthermore, our study confirms the observations of Fletcher et al that an accelerated FEV\textsubscript{1}, decline with age seems to be an important indicator for effects of hazardous environmental conditions such as smoking or air pollution.

**REFERENCES**

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**DISCUSSION**

Dr. Brooks, Cincinnati: The level of air pollution was decreasing over the period of your study. Might there be some other factors such as occupation?

Dr. Van der Lende: We tried to standardize for occupation using history of exposure in the questionnaire, and this did not explain the differences.

Dr. Brain: Is the difference between the two communities in rate of decline of FEV\textsubscript{1}, important?

Dr. Van der Lende: The effect of very heavy smoking is about double the effect of pollution.

**Air Pollution and Health Effects in Children Residing in Akron, Ohio***

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The purpose of this study was to determine the effects of ambient air pollutants on respiratory function, incidence and severity of acute respiratory illness, nature of pulmonary epidemiology, and trace element accumulation, in 4th, 5th and 6th grade children in Akron, Ohio.

**MATERIALS AND METHODS**

Air pollutants were measured at three locations and included sulfur dioxide (SO\textsubscript{2}), nitrogen dioxide (NO\textsubscript{2}), total suspended particulates (TSP), and from the Hi-Vol filters, suspended sulfates (SO\textsubscript{4}{\textsuperscript{2-}}), and suspended nitrates (NO\textsubscript{3}{\textsuperscript{-}}). The filters and bubblers were run on a daily 24 hour schedule and chemical analyses were carried out by Community Health Assessment Monitoring Program (CHAMP) contractors.

All physiologic and epidemiologic data were collected at Seiberling and Betty Jane grade schools, in Akron, Ohio, both of which are located on the eastern edge of the city and adjacent to industrial complexes.

Pulmonary function test (PFT) data were collected using a Collins 9 liter water-filled spirometer and included forced vital capacity (FVC), forced expiratory volume—one second (FEV\textsubscript{1}), and maximal midexpiratory flow (MMF). All of the lung function data were adjusted using the independent variables age, height, and weight. A stepwise linear regression model with forward order of inclusion was used to examine the effects and relative contributions of variation for the three independent variables. Using these selection criteria, the appropriate coefficients were used to adjust the data according to the following equation:

\[
\text{PFT}_{\text{adj}} = \text{PFT} + \beta_{H} (\text{He-He}) + \beta_{W} (\text{We-We}) + \beta_{age} (\text{age-\text{age}})
\]

The questionnaire used was of our design, but was a modification of those used in The Tucson Longitudinal Study.

Daily diaries were filled out each day in home room by the children and included responses to runny nose, sore throat, cold, chest congestion, and eye irritation. These diaries served a two-fold function: 1) to relate individual

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daily symptoms to daily levels of air pollutants, and 2) to act as a surveillance tool for acute respiratory illness (ARI).

The ARIs were detected with the aid of the daily diaries and when a child was detected with an ARI he/she was called to the clinic for direct observation. If it was a true ARI, pulmonary function tests were conducted twice during the symptomatic phase and three times during the asymptomatic phase. In general, the symptomatic phase lasted one week and as a general rule the asymptomatic phase was followed-up for two weeks. All of the ARI data were adjusted as described above and as such each child served as his own control.

Socioeconomic status was characterized between the two schools and there were no differences. Racial distributions were identical between the two schools.

RESULTS AND DISCUSSION

The aerometric results indicate significant differences between the annual means for SO2 and NO2 with the Seiberling school having the higher values.

The questionnaire results indicate that the Seiberling children reported more wheezing in the chest, and shortness of breath than the Betty Jane children. Daily symptoms reported by the students indicate that the Seiberling children reported twice as many incidences of upper respiratory symptoms including rhinitis, cough, and sore throat.

Baseline asymptomatic lung function testing did show that the ratio FEV1/FVC was significantly lower at the Seiberling school. For both schools there was a decrease in lung function during the symptomatic phase of an acute respiratory illness (ARI), and the tests further indicate that the ARIs in the Seiberling school were more severe and/or involved the small airways more so than the ARIs at the Betty Jane school. Recovery from the ARIs were not complete after nine days with the Seiberling children showing slower recovery than the Betty Jane children.

On the basis of available aerometric information it is suggested that SO2 in combination with NO2 is primarily responsible for the reduction in lung function tests and the exacerbations seen in the children at the Seiberling school.

DISCUSSION

Dr. Buist: Did you take into account socioeconomic status, race or family history of smoking, since all of these have been associated with increase of symptoms and decreased lung function?

Dr. Mostardi: The socioeconomic status is about the same in the two schools. There were only one or two blacks. The presence of smokers in the house has not yet been characterized.

Dr. Abraham: Was there any evidence of a relationship to occupation?

Dr. Mostardi: The distribution of occupation was approximately similar in both communities.

Respiratory Effect of Longterm Exposure to Two Mixes of Air Pollutants in Los Angeles County*

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Chronic obstructive respiratory disease and progressive decrement in lung function is probably due to multiple factors acting either together or in sequential patterns. Among these factors may be long-term exposure to pollutants in the ambient air.

METHODS

Four geographically defined study areas located in four communities in Los Angeles County historically exposed to different types and levels of air pollutants were selected for study. Levels of pollutants measured at monitoring stations adjacent to the study areas during the study period, 1972-1977, are given in Table 1.

Our "clean area" in Lancaster was exposed to relatively low levels of most pollutants, although some photochemical oxidants were present. The second area, located in Long Beach, had been exposed to moderately high levels of sulfur dioxide and nitrogen dioxide. Isopleths studies indicated that the Long Beach study area was exposed to high levels of particulates, and the location of the study area downwind from the oil refineries of Torrance, Carson, and Signal Hill suggested high levels of hydrocarbon. The third area located in Burbank had been exposed to moderately high levels of photochemical oxidants, particulates, nitrogen dioxide and hydrocarbons, and our most polluted study area located in Glendora (Azusa monitoring station) had been exposed to very high levels of photochemical oxidants, sulfates, particulates, and secondary pollutants. All residences in the Burbank and Long Beach study areas and the majority of residences in the Lancaster study area were within one mile of a monitoring station of the Southern California Air Quality Management District. All residences in the Glendora study area were within three miles downwind from the Azusa monitoring station which was used to estimate exposures occurring in the Glendora study area.

The four study areas were selected for similarity in demographic characteristics according to the 1970 Census. They contained a majority of white, non-Spanish-surnamed residents. The median income of residents of the four study areas was approximately $11,000-$12,000 in 1970, and the proportion of homeowners ranged from 61% to 72%. To reduce the number of variables that might confound com-

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