

AMERICAN ACADEMY OF PEDIATRICS
COMMITTEE ON ENVIRONMENTAL HAZARDS
PEDIATRIC ASPECTS OF AIR POLLUTION

PUBLIC concern regarding air pollution has increased rapidly in recent years. Because air pollution may present special problems in the pediatric age group, available information on the effects of various air pollutants on children has been reviewed with the purpose of: (1) defining the potential ill effects of air pollution in this age group, (2) making information regarding these effects readily accessible to pediatricians, and (3) delineating further areas of study which may be necessary to safeguard child health from this environmental hazard.

Three general conclusions became apparent to the Committee after reviewing more than 100 publications from the world literature dealing specifically with the health effects of air pollution on children* The first is that children as a group may serve to delineate more clearly the effect of air pollution on health. They (1) spend most of their lives and attend school in limited geographical areas where air quality and meteorological effects can be measured and school absenteeism may also be ascertained, (2) are more susceptible to most respiratory infections, (3) are not largely affected by smoking because it becomes a factor in only a small subgroup, and (4) are not exposed to the occupational hazards to which many adults are exposed. Another observation is that some aspects of growth and development in children may be affected by certain air pollutants. Finally, our review of studies on air pollution in children has shown that the majority of publications have originated from countries outside the United States; this suggests a relative lack of serious consideration of the problem in this country.

Various procedures have been used to study the effects of air pollutants in children, for example, questionnaires, records of school absenteeism, or hospitalization and

* Reprints and translations were compiled by the National Air Pollution Control Administration, Office of Technical Information and Publications.

clinical evaluations. Some studies have included laboratory measurements, such as pulmonary function tests, hematologic assays, and x-rays. Most studies were done in presumably healthy school children; some have been specifically directed at children with associated illnesses, e.g., asthma.

Because the pediatrician is particularly interested in possible adverse effects of air pollutants prevalent in his community, we have attempted to summarize available information from the reference point of specific sources and pollutants. This is only possible for certain industries which emit one major type of air pollutant. However, in most urban communities and with several industries, pollution results from a variety of combustion processes. For instance, fuel oil produces some particulates and variable amounts of sulfur oxides, coals produce considerable quantities of particulate pollution (fly ash) as well as sulfur oxides, and automotive gasoline produces a small amount of particulate containing lead and large quantities of hydrocarbons. All combustion processes produce nitrogen oxides, carbon monoxide, and carbon dioxide.

Air pollution constituents are of two general classes—reducing compounds and oxidizing compounds. Northern industrial cities have a predominantly reducing type of pollution characterized by particulates and sulfur oxides. Southern and southwestern cities have a pollution pattern more dominated by automobile exhaust components. Many pollutants, especially those which are more reactive chemically, interact with each other and with other substances in the atmosphere; new substances are formed, depending on atmospheric conditions. This is particularly striking in sunny southern cities where profound alterations in the initial hydrocarbon pollution result from ultraviolet radiation in photochemical smog. A complex series of reactions produces considerable quantities of ozone and other oxidants, which result in an oxidizing type of air pollution. Most large cities in this coun-

TABLE I
SUMMARY OF REPORTS ON EFFECTS OF AIR POLLUTANTS ON CHILDREN

<i>Industrial or Other Source of Pollutant</i>	<i>Pollutants Incriminated</i>	<i>Clinical Findings</i>	<i>Laboratory Findings</i>
Individual pollutants:			
Hydroelectric, aluminum, phosphate, fertilizer plants	Fluorine	Teeth mottling; reduced caries	Hemoglobin decrease
Lead processing plants*	Lead	No clinical disease resulting from air exposure	X-ray changes as well as increased urine and blood Pb
Copper mine	Arsenic	No clinical effect	Arsenic detected in hair and urine; hemoglobin decreased
Asbestos plant	Asbestos	Lower respiratory disease and aggravation of pulmonary disease	None reported
Cement plants; abrasive and silicone manufacturing	Silicates	Increased upper respiratory disease	Cytological changes in nasal and ocular mucosae†‡
Solvent factories	Fatty acids	Irritation of upper respiratory tract with increased respiratory illnesses	None reported
Motor vehicles; ferrous, metallurgical, hydroelectric power plants	Carbon monoxide	Anorexia, fatigueability, headache, dizziness, decreased visual threshold	Increased carboxyhemoglobin; increased red blood cell count
Neoprene plant	Chloroprene	None	Increased coproporphyrinuria and 17-ketosteroids in urine†‡
Reducing agents:			
Paper mills, viscose plants	Sulfur dioxide, hydrogen sulfide, carbon bisulfide	Increase in respiratory infections, inflamed eyes, headaches, nausea	Peak expiratory flow decreased
Synthetic alcohol plants	Sulfur dioxide, hydrogen sulfide, hydrocarbons	Headache, anorexia, increased upper respiratory infections	None reported
Steel mills, coal and oil power plants, petroleum refineries	Sulfur dioxide and particles; hydrocarbons	Growth retardation; increased respiratory infections; increased asthma attacks	Anemia, delayed ossification, decreased peak expiratory flow, accentuated lung markings on chest x-rays
Superphosphate, fertilizer producing plants	Sulfur dioxide, sulfuric acid	Increased respiratory infections	None reported
Oxidants:			
Automobile exhaust	Oxidants, largely ozone	Decreased athletic performance	None reported

* Metal reclaiming plants and car exhausts other possible sources but not studied.

† Methodology uncertain.

‡ Effect on 17-ketosteroids possible due to seasonal changes.

try have variable combinations of these two basic types of pollution.

Other sources of pollution are vegetation (pollens, spores, and so forth), various industrial processes, and incineration. Many of these emissions have quite specific characteristics which can be detected over limited areas close to the source. Meteorologic factors are important influences in the degree of pollution, irrespective of the quantity of emissions. Pollution in a local area is

removed horizontally by wind and vertically by the normal rising of heated air. Any decrease in wind velocity or the presence of atmospheric inversion, which prevents the normal rise of ground level air, will increase the level of pollution in a given area.

Table I summarizes available information on the effects on children of: (1) miscellaneous individual pollutants, (2) reducing pollutants, and (3) oxidizing pollutants.

Also listed are the industrial or other sources of the pollutant, the type of pollutants incriminated, and the clinical and/or laboratory findings noted in the studies reviewed.† Findings tabulated should not be regarded as conclusively demonstrated, but only as suggestive of the type of ill effect that may be encountered in children. A major problem inherent in most studies was ascertaining whether air pollutants alone were responsible for ill effects noted rather than other variables such as malnutrition or factors associated with socio-economic status. Another problem defined in only a few studies was consideration of the long-term ill effects which may persist into adult life. No data are available regarding the effects on pregnancy outcome in women living in high air pollution areas. Most studies done specifically in asthmatic children indicate an intensification of respiratory symptoms and that this results from air pollution in general rather than any specific type of air pollutant.

It is apparent that more information is needed regarding this problem. The ill effects in children of certain air pollutants suggested in the reports summarized here, the occasional episodes of increased morbidity and mortality resulting from sudden increases in air pollution, and data on the ill effects of certain air pollutants on experimental animals all point to the need for fur-

† A reference list of the articles reviewed by the Committee may be obtained by writing the American Academy of Pediatrics, 1801 Hinman Avenue, Evanston, Illinois 60204. Copies of translations of foreign language articles can also be obtained on special request to the Academy.

ther research on the magnitude and prevention of this problem. Until further information becomes available, it is recommended that pediatricians become knowledgeable in the types of industries and air pollutants present in their community and be alert to any evidence of ill effects that they may note in their patients. This Committee is actively engaged in stimulating further investigations on the effects of air pollution in children and will provide any assistance it can to pediatricians in matters related to this increasing problem of urban civilization.

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Air Pollution Primer: National Tuberculosis and Respiratory Disease Association, 1740 Broadway, New York, New York 10019.

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