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Articoli/Articles

OUTDOOR AIR POLLUTION AND HEALTH

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SUMMARY

Outdoor air pollution has been recognized as a relevant factor for health. Studies on exposure of both workers and normal population due to accidental contaminations of environment have been performed. Energy production, winter heating, vehicle exhausts and industrial activities can act acutely or chronically. Epidemiological studies should be corrected for disturbing factors, so that the result are useful to suggest new rules about total good quality of environment (outdoor and indoor).

Attention to environmental pollution, its chronic effects and prevention of such effects through systematic interventions, did not begin in Italy before the end of the Second World War: actually, in the basic National Acts on Health of 1904 and 1934, very little can be found about this argument.

Between the two Wars, some interest had only arisen along two lines:

1) studies on exposure of workers to acute and chronic effects of occupational pollutants;

2) studies on the population accidents of acute exposure such as the Mose Valley in Belgium (1930), Donora in Pennsylvania (1948), Poza Rica in Mexico (1950), ending up with the well-known episode of London City (1952).

But it was not until the mid Fifties that the deep air pollution of some Italian towns (Milan at first, then Genoa and Mestre near Venice) was recognized, a pollution caused by energy production, winter heating, vehicle exhausts and industrial activities, in different proportion according to the area and the season.

Key words: Air pollution - Epidemiology - Health

The first occasion of public health discussion about this argument took place in 1954, when the Italian Society of Hygiene, Preventive Medicine and Public Health devoted part of its 17th annual meeting to *Acute respiratory tract diseases, a public health problem* and *Air pollution due to combustion and industrial activity*. Three years later Saint Vincent housed the *First meeting on study methods for atmospheric pollution due to domestic and industrial combustions and to vehicle exhausts*, again organized by that Society. The same winter, Milan faced the same extra-deaths of *London 1952*, in the occasion of a week-long thermal inversion.

Among the different kinds of environmental pollution, air pollution, such as food and drinking water pollution, is considered a real risk, because the gaseous or dusty substances are introduced deeply into the organism.

Air pollution can act both acutely or chronically. *Open* population can be interested by acute or chronic pollution, and the same happens to the workers. But the model of occupational exposure¹⁻² is not easy to adopt for the study of exposure of the open population (i.e. ozone and health³), because the former is composed of relatively few, healthy individuals (involving the so called *healthy workers effect*) and the exposure is usually limited to one or few pollutants, at medium or high concentrations; while the latter is composed of hundreds of thousand or millions subjects, of all ages, including the healthy and the sick, and the exposure is always to several pollutants together, usually at low concentrations, which can interact each other and even potentiate their effects.

It must also be considered that data accumulated through animal tests give little help for estimation of human risk, especially chronic risk. Also experiments in volunteers, though very useful, are limited by increasing ethical boundaries.

Therefore, direct epidemiological studies appear to be very promising, in spite of the difficulties of their design in presence of such disturbing factors as the length of the observation period needed: their purpose is to demonstrate association between presence/levels of pollutants and the incidence of different respiratory diseases, or an extra mortality which cannot be otherwise explained.

Epidemiological studies are made even more complex by the many difficulties in avoiding disturbing factors as, first of all, cigarette smoking (whose health consequences are well known and often similar to those of air pollution), professional exposure, effects of other pollutants (through food and water), the *urban* factor. In addition, air pollution effects can be deeply influenced by atmospheric conditions (absence of wind, thermal inversion).

The suggestion of performing epidemiological studies on children came from the observation that children do not smoke and are all easy to reach in schools. But children are not the best model to study chronic effects⁴.

We can therefore conclude that even the epidemiological studies involve many difficulties, i.e. to generalize data taken from either small or selected groups⁵⁻⁶ or short time observations⁷.

Going into the classification of expected health effects of air pollutants, we can divide such effects into acute and chronic.

Acute effects go from simple disturbances such air duct irritation, to acute respiratory disease (ARD), to the aggravation of acute respiratory infection and even to death (mostly in subjects suffering from chronic respiratory and/or heart diseases).

Chronic effects include chronic bronchitis, asthma and pulmonary cancer. According to the results of the many epidemiological studies conducted so far, we can say that air pollution from heating and thermo-electrical plants is definitely associated with ARD, while this is not yet ascertained for air pollution due to vehicle exhausts. The risk of ARD increases in subjects already affected by chronic bronchitis, asthma and chronic heart diseases.

It is more difficult to associate chronic pollution with chronic health effects. Provided that cigarette smoking is by far the principal risk factor, sufficient evidence has been accumulated to demonstrate that chronic pollution is associated with chronic bronchitis, while the association with lung cancer is still far from having been fully demonstrated. In addition, admitting that such association would finally be proved, cigarette smoking will remain the principal risk factor for lung cancer.

Fifty years after the first scientific meeting on air pollution in Italy, how have things gone on?

Reasonably good legislative interventions have been made, regarding all the causes of pollution: industrial plants, energy production, home heating, vehicle exhausts: Italian legislation has progressively adhered to the European Union (formerly EEC) directives.

Industrial pollution has decreased also because of major changes in the production procedures and because many highly polluting plants have closed, others have moved away from the cities, or have left the country, to be reassembled in some areas of the Third World.

Energy production plants have adopted advanced systems for cleaning emissions.

Home heating has changed the characteristics of fuel, reducing the content of sulphur, adopting fume-washing systems and centralizing the heating plants. Some cities have adopted the so called *tele-heating* (one plant for all the city or sections of it).

The greatest problem left is represented by vehicle exhausts, which has increased in size and has reduced the average speed of vehicles, worsening the pollution, in spite of the improved fuels and engines. We believe that the only significant solution to traffic pollution will come from a change in city design and from better public transportation.

A final consideration: if open air pollution is probably moving to a global solution in the next few years, many problems will arise from another kind of air pollution: indoor air pollution. It is a problem that will be debated in this Meeting by Gianfranco Tarsitani, and I am sure that everybody will be interested in it, because indoor has so many facets and involves every building where humans live and work and play, also where open air pollution never existed, also where it has already been solved!

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