CORRESPONDENCE

Air Quality, Stroke, and Coronary Events—Results of the Heinz Nixdorf Recall Study From the Ruhr Region

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Pathogenicity Underestimated

Surprisingly, there is little public awareness of the issue of particulate matter exposure in urban centers. All the more so as the pathogenicity and epidemiological relevance are backed by robust scientific evidence (1). Similarly, the medical community seems to be lacking the necessary determination and consistency to do what clearly needs to be done. Here, similarities with the hesitant acceptance of the risks of smoking in the 1950s spring to mind.

Given the risks associated with traffic-related particulate matter emissions, some thoughts on automotive engineering and emission standards from a “medical” perspective seems to be worthwhile.

It is a paradox: Vehicles with up-to-date gasoline direct-injection engines emit more particulate matter than older gasoline-powered vehicles with controlled catalytic converters (2). The transitional provisions to the Euro 6 emission standard allow this to happen until 2017, as the proper number of emitted particles is not effectively limited.

This is a tragic development: Efforts to achieve emission goals are thwarted by higher powered engines, increasing numbers of SUVs on the road and dubious consumption measurement practices, while much-trumpeted alternative electrical or gas-powered vehicles struggle to gain any relevant market share and particulate matter emissions from the popular gasoline direct-injection engines continue to increase. As the reduction of particulate matter emissions is easily achieved with filters (3), automotive manufacturers are not made aware of their responsibilities to the extent necessary.

Presently, the limit values for particle pollution are only exceeded at urban monitoring sites, for example in Berlin and Stuttgart. Recently, however, the limit value for smallest-size particles (PM 2.5) has been lowered by the US Environmental Protection Agency to about half of the European limit value. Based on the available evidence, this step should be considered imperative here in Europe as well. The relationship between particulate matter exposure and preventable disease should prompt the medical community to play a more active role when it comes to setting and enforcing limit values—and also to critically reflect on one’s own choice of a vehicle.

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Conflict of interest statement

The author declares that no conflict of interest exists.

Real Exposure Significantly Lower

Between 1985 and 1990, we conducted extensive environmental epidemiological studies at the Erfurt District Institute of Hygiene, using the instruments available at that time. Our aim was to identify a correlation between the exposure to sulfur dioxide and sedimentation dust (in these years the air pollution in the City of Erfurt was extremely high) on the one hand and the incidence of acute bronchopulmonary and cardiac events on the other. In addition, the incidences of these types of disease, including pseudocroup in children, in Erfurt were compared with those in rural areas with low levels of pollution. Unfortunately, we were not allowed to publish our data at that time.

Interestingly, we could not demonstrate any relationship and thus concluded from our data that in situations with acute exposure to high levels of air pollutants, such as episodes of smog, residents tend to avoid spending time outdoors; thus, their actual exposure was significantly lower than it would have been expected from the pollutant levels measured in outdoor air.

According to the literature, people these days spend 80% of their time in indoor spaces. Therefore, we thought that indoor factors play a more significant role than outdoor ones because people, except for a few professions, spend most of their working hours and leisure time in an indoor environment. Consequently, the exposure levels measured in atmospheric outdoor air do not accurately reflect the actual exposure of people living in the area.

In this otherwise very comprehensive publication I would have wished for a discussion of this issue as apparently conclusions about a causal relationship were

drawn from the particulate matter exposure at the place of residence, i.e. from outdoor air data.

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In Reply:

We like to briefly address two special aspects: the legislative measures to limit the health impact of particulate matter exposure and the issue of indoor exposure.

It is true that the EU limit values for particulate air pollutants—currently in force in Germany too—are criticized by large parts of the scientific community. A comprehensive compilation of the currently available data has shown that a significant negative impact on the health of the population occurs already below the EU limit value of 25 µg/m³ for long-term concentrations of PM_{2.5} (1). Therefore, the WHO recommends using a limit value of 10 µg/m³ for PM_{2.5} and the US Environmental Protection Agency lowered the US limit value from 15 to 12 µg/m³ in 2013. In contrast, the consultations within the EU in 2014 did not lead to improvements in health protection and ended with no significant changes to the existing limit values. To achieve a sustained improvement of this situation, it is necessary that the medical community, among others, exerts pressure at the EU level.

However, focusing entirely on the particle mass of the PM_{2.5} or also PM₁₀ particulate matter fractions will fall short of the mark, especially since the larger dust particles, which significantly contribute to this mass, have been very effectively held back by filters put into use over the last decades. PM_{2.5} measuring does not adequately detect so-called ultrafine particles (UFP). Ultrafine particles (particles with a diameter of less than 10 nm) are by-products of any combustion process and emitted in large quantities by cars with modern direct-injection engines in close proximity to where people live and work. Since the

statutory monitoring network is not yet equipped to detect ultrafine particles, we have no data on the degree of exposure of the population to these pollutants and cannot provide any robust information about the health effects of these tiny particles either. Laboratory studies have shown that particulate matter of this size can reach the central nervous system where it may trigger inflammatory reactions (2). Therefore, the first step should be to collect more data on the UFP exposure of the population and investigate potential health effects.

Dr. Schulze addresses the issue of indoor exposure to air pollutants. This can be significant, both at home and at the workplace, and may have considerable health implications. Key determinants of exposure in the home environment are the concentrations of pollutants in the outdoor air, as those tend to penetrate comparatively unhindered into the indoor spaces even in modern homes, and specific indoor factors, such as smoking and other combustion processes (e. g. stoves and fireplaces, gas cookers), and biological material where there is mold. The study's specific design allowed us to take into account smoking and passive smoking as confounding factors. In addition, it can be assumed that further indoor sources of pollutants are independent of outdoor air pollution concentrations. This introduces a degree of uncertainty in estimating the effects which is reflected in the confidence intervals.

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