

ETS and Conception Smoking Out a Mechanism of Action

Numerous studies have shown that women who smoke have a harder time getting pregnant and a greater risk of spontaneous abortion and having low-birth-weight babies. Smoking also has long been associated with menstrual disturbances and possibly other antiestrogen effects. But findings on reproductive outcomes have been less straightforward when it comes to the harmful effects of women's exposure to environmental tobacco smoke (ETS). Now a team of U.S. and Chinese researchers report a link between ETS exposure and significantly lower urinary levels of estrone conju-



Conception smokescreen. A study of Chinese women trying to conceive adds to the body of evidence that ETS exposure—not just active smoking—may hamper reproduction.

gates (E_1C ; the main metabolite of estrogen) [*EHP* 113:412–417]. The findings suggest that ETS exposure, like active smoking, may affect reproduction in part through antiestrogen effects.

The study was part of a large, prospective reproductive health study conducted from 1997 to 2000 among women working full-time at the Anqing Textile Mill in southeast China's Anhui Province. In an earlier study of the same cohort, the investigators reported a dose–response relationship between ETS exposure and risk of early pregnancy loss.

This study included 371 newly married women aged 20–34 who had stopped contraception and intended to conceive. None had borne children. All were nonsmoking, all had the same occupation, and all were of the same socioeconomic background. ETS exposure in this homogeneous group was very high because of the high prevalence of smoking among Chinese men. In China, it is estimated that 63% of men are smokers (compared to only 3.8% of women).

For up to a year, or until pregnancy, the women kept daily diaries recording exposure to ETS at both home and work. They

also collected first-morning urine specimens each day. The researchers calculated the percentage of days in each menstrual cycle that included ETS exposure, then analyzed the independent association between ETS exposure and profiles of pregnanediol-3-glucuronide (PdG) and E_1C in the women's menstrual cycles. PdG and E_1C are urinary metabolites of hormones that regulate reproductive function.

Because individual women's hormone levels vary significantly during their menstrual cycles, it was critical to accurately determine the day of ovulation in order to compare hormone levels among the study subjects. The researchers used the estimated day of ovulation to align the individual menstrual cycles for comparison.

Of the 673 cycles included in the study, 344 (51%) were non-conceptive and 329 (49%) resulted in conception. Only 76 cycles did not include ETS exposure; of these, 42% resulted in conception. During nonconception cycles, ETS-exposed women had a consistently lower daily urinary E_1C level compared to nonexposed women. During conception cycles, the association was not significant; the investigators write that their study may not have had the power to detect a relatively small effect of ETS exposure in these cycles. They also reported no significant difference in PdG levels between women who were exposed to ETS and those who weren't, regardless of conception status.

These findings suggest that ETS exposure, like active smoking, may affect estrogen levels. Estrogen affects the timing of ovulation during the menstrual cycle, thus potentially affecting the ability to become pregnant. In shedding new light on the biological mechanisms by which ETS exposure may affect reproduction, the study adds to the body of knowledge on the harmful impact of smoking upon smokers and nonsmokers alike. —**Laura Alderson**

The Heart of Toxicity Details of Cardiovascular Damage Uncovered

In recent years, researchers have found that air pollutants can adversely affect the human cardiovascular system. But little has been uncovered about exactly how that damage occurs. German and U.S. researchers working together have now helped fill that gap, identifying for the first time several key components of heart function that are affected by air pollution [*EHP* 113:440–446].

Cardiac arrhythmia, or a change in heart rhythm, is a major cause of death around the world. Three main factors, known as the “cardiac death triangle,” are major contributors to arrhythmias. One of these, impaired autonomic nervous system function, has been linked in numerous ways with air pollutants. This study sheds new light on links between air pollutants and the other two factors—damage to the myocardium (heart muscle) and increases in the vulnerability of the myocardium to functional alterations. The latter includes changes in the normal ebb and flow of the electrical charge around cell membranes, a phenomenon known as depolarization and repolarization.

To gather clinical data about these two factors, the team evaluated 56 East German men for the effects of selected air pollutants. The average age of the men was 66 years, and the average body mass index was 28, which is considered overweight. All of the men had stable coronary artery disease.

Using electrocardiograms (ECGs) taken every two weeks during late 2000 and early 2001, the team analyzed four key indicators of heart function and condition: QT interval duration (the total time from ventricular depolarization to complete repolarization) and T-wave amplitude, complexity, and variability of complexity (all indicators of normal ventricular repolarization). QT interval duration has been used extensively in the past to quantify

repolarization, whereas T-wave data have received more acceptance only in the past few years as researchers discover their importance in elucidating nuances of heart function.

These indicators were assessed in conjunction with pollution readings taken from two outdoor monitoring stations in numerous short time intervals before the ECG readings. The pollutants studied included fine and ultrafine particulates of various compositions, nitrogen oxides, elemental and organic carbon, carbon monoxide, and sulfur dioxide. The monitoring stations were located fairly centrally to both the study center where the ECG readings were taken and the homes of the subjects, scattered around the city.

The results showed that each indicator was rapidly impacted by at least one pollutant; the significance of the impact was based on effects assessed as pollutant concentrations rose from the first to the third quartile. Particles of various sizes and makeups induced the widest-ranging effects, but nitrogen oxides, carbon monoxide, and sulfur dioxide also had an effect on certain indicators. For the three pollutants that have both German and U.S. standards—nitrogen dioxide, carbon monoxide, and sulfur dioxide—all the concentrations studied were much lower than the standard. For certain fine particulates ($PM_{2.5}$), the third quartile was higher than the U.S. annual standard, and the maximum was higher than the U.S. annual and 24-hour standards. There are no applicable standards for the other substances evaluated.

This is the first clinical evidence of specific repolarization pathways affected by air pollutants, the authors say, and it fits observed epidemiologic patterns and speculation on biological pathways. However, the data must be viewed in light of the fact that they were derived from a high-risk group of older, overweight men with a previous history of heart disease, during a cool and humid time of year in one European setting. In addition, the pollution measurements likely didn't fully capture the subjects' indoor and outdoor exposures. Additional research should be able to readily address these limitations and expand on the findings. —**Bob Weinhold**

A Precautionary Tale

Mental Health and Risk Communication

Many agencies and organizations have, over the years, assumed that a substance should be assumed benign until proven harmful, and that caution is needed only in limited cases. Advocates of the precautionary principle, on the other hand, assume that it is better to be cautious in the face of scientific uncertainty about a potential threat—such as electromagnetic fields (EMFs) from cellular phones and cell phone towers—which should be presumed to be harmful until proven otherwise. However, one important component of overall health, mental health, might not benefit from following the precautionary principle, according to a small European study [*EHP* 113:402–405].

To observe how following the precautionary principle affects certain facets of mental health, researchers at the Research Centre Jülich, a German organization funded primarily by the country's federal government, surveyed students and employees at Austria's University of Innsbruck and evaluated their responses to precautionary statements. The surveys focused on the issue of EMFs (which the researchers called "electrosmog") from wireless communications.

In two separate experiments in 2003 and 2004, the researchers presented respondents with various sets of statements about the electrosmog controversy and risk management responses. All the participants saw a base statement noting that there is widespread debate about the potential risks related to electrosmog, although the International Commission on Non-Ionizing Radiation Protection says that current exposure limits adequately protect the public. Some of the participants also saw various additional statements describing measures taken to protect against the potential electrosmog threat, such as "Following a precautionary approach, Switzerland has tightened exposure limits by a factor of 10 in areas where people are exposed for long periods of time." Statements in the first experiment focused on health-related measures such as stricter exposure limits, while the single additional statement used in the second experiment focused on enhancing public participation in deciding where to build cell phone towers.

After reading the statements, subjects were asked for their perception of the extent of the risk and the quality of the scientific knowledge about electrosmog. In the first experiment respondents who read any of the health precautionary statements felt significantly more threatened than those who read only the base statement. The researchers write that these results support the idea that "precautionary measures will be considered a cue that risk might be real and increase perceived risk."

This effect was not found in the second experiment, which used a public participation measure. However, respondents who read about public participation had less trust in public health protection.

The team concludes that policy makers should be aware of this downside to taking a precautionary approach, even though enacting such an approach may lead to reduced exposures and improved physical health. However, they acknowledge that more study needs to be done to confirm their results before drawing any practical conclusions for policy making. —**Bob Weinhold**



Is ignorance bliss? The precautionary principle, which espouses caution in the face of scientific uncertainty, may cause unintended alarm among the public.