INSTITUTE OF MEDICINE

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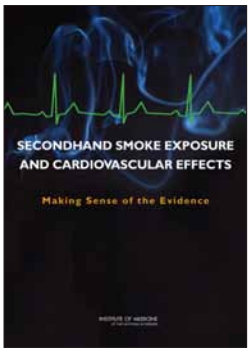
Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence



Heart disease is the leading cause of death in the United States, according to the Centers for Disease Control and Prevention (CDC). An American has a coronary event (heart attack) nearly every 25 seconds, resulting in death about every minute. Smoking is the leading risk factor for heart disease.

Evidence suggests that exposure to secondhand smoke also can result in adverse health effects, including heart disease in nonsmoking adults. Secondhand smoke, also known as environmental tobacco smoke, consists of a mixture of gases and particles including smoke from burning cigarettes, cigars, pipe tobacco, and exhaled mainstream smoke. Smoking bans are making progress at reducing involuntary exposure to secondhand smoke in workplaces, restaurants, and other public places in the United States and abroad. Such legislation also provides the opportunity to study the effects of smoking bans on the health of smoking and nonsmoking adults.

In 2008, the CDC asked the Institute of Medicine to convene a committee to assess the relationship between secondhand-smoke exposure and effects on the heart. The committee evaluated three relationships:

- The association between secondhand-smoke exposure and cardiovascular disease, especially coronary heart disease
- The association between secondhand-smoke exposure and acute coronary events (heart attacks)
- The association between smoking bans and heart attacks

Study results consistently indicate that exposure to secondhand smoke increases the risk of coronary heart disease by 25 to 30 percent.

SECONDHAND-SMOKE EXPOSURE AND CORONARY HEART DISEASE

Cardiovascular disease is a major public health concern. Study results consistently indicate that exposure to secondhand smoke increases the risk of coronary heart disease by 25 to 30 percent. Additional evidence suggests increased risks even at the lowest levels of exposure, and data from cellular experiments and experiments in animals indicate that effects of secondhand smoke on the cardiovascular system are plausible. Therefore, the committee concurs with the current consensus in the 2006 surgeon general's report that "the evidence is sufficient to infer a causal relationship between exposure to secondhand smoke and increased risks of coronary heart disease among both men and women." While the committee found strong evidence of this association, the evidence for determining the precise magnitude of the increased risk—that is, the number of cases of disease that are attributable to secondhand-smoke exposure—is not as strong. The committee therefore did not estimate the size of the effect.

SECONDHAND-SMOKE EXPOSURE AND HEART ATTACKS

The committee reviewed 11 key studies that showed decreased heart attacks after the implementation of smoking bans. Of these, the two studies that analyzed changes in the hospitalization rate for nonsmokers showed a reduced risk of a heart attack in nonsmokers that could be attributed to a decrease in secondhand-smoke exposure following the implementation of smoking bans. Nine other studies examining smoking bans provided indirect evidence of an association between secondhand-smoke exposure and heart attacks. Given the small amount of data for nonsmokers, however, the committee could not determine how much of the positive effect of bans is attributable to nonsmokers as compared to smokers.

Remarkably, all of the publications show a decrease in the rate of heart attacks after a smoking ban was implemented. Those decreases ranged from six percent to 47 percent, depending on the study and form of analysis.

Data from cellular experiments and experiments in animals demonstrate that there are effects of secondhand smoke, its components, or both, on the cardiovascular system, such as inflammation and increased blood clots. In addition, secondhand smoke contains some of the same components as smoke and air pollution, such as particulate matter. Both smoke and air pollution have been associated with heart attacks. An association between secondhand-smoke exposure and heart attacks, therefore, is biologically plausible, providing further confidence that the effects seen in the observational studies are not just random effects.

On the basis of the observational, animal and cellular studies, there is sufficient evidence to infer that a low level of exposure to secondhand smoke induces changes in the body related to cardiovascular disease. However, none of the studies included information on how long or how often individuals were exposed to secondhand smoke before or after implementation of smoking bans. For example, it is not known whether individuals were exposed to high concentrations sporadically for short periods, to low concentrations more consistently, or both. Without this information, the committee could not determine whether acute exposures were triggering heart attacks, chronic exposures were causing chronic damage that eventually resulted in heart attacks, or both.

SMOKING BANS AND HEART ATTACKS

The evidence that exists about smoking bans and heart attacks, including the 11 studies analyzed in this report, support an association between smoking bans and a decrease in the incidence of heart attacks. Remarkably, all of the publications show a decrease in the rate of heart attacks after a smoking ban was implemented. Those decreases ranged from six percent to 47 percent, depending on the study and the form of analysis. Such consistent data confirms for the committee that smoking bans do, in fact, decrease the rate of heart attacks. It is important to note that many contextual factors associated with a ban—including information announcing the ban, education and outreach efforts on the adverse health effects of secondhand smoke, and support for smoking cessation programs—are difficult, if not impossible, to separate from the impact of the ban itself, and could vary from ban to ban. For these reasons, the committee's conclusions regarding the effects of bans refer to the combined effects of different types of legislation and the contextual factors.

In most of the smoking-ban studies, the magnitude, frequency, and duration of exposures that occurred before a ban are not known. However, monitoring studies do show that exposure to secondhand smoke is dramatically reduced in places that are covered by bans. The committee was unable to determine the magnitude of the effect

because of the variability among and uncertainties within the 11 studies analyzed in this report. The distinctive characteristics of smoking bans cause them to vary greatly. For example, these studies varied by the type of venue covered by the bans (such as offices, other workplaces, restaurants, and bars) and compliance with and enforcement of the bans. Other differences included the length of follow-up after implementation, population characteristics (such as underlying rates of heart attacks and prevalence of other risk factors for heart attacks), size, secondhand-smoke exposure levels before and after implementation, preexisting smoking bans or restrictions, smoking rates, and method of statistical analysis. However, based on its review of the available literature, the committee concludes that there is a causal association between smoking bans and decreases in heart attacks.

Data consistently demonstrates that secondhand-smoke exposure increases the risk of coronary heart disease and heart attacks and that smoking bans reduce heart attacks.

FURTHER RESEARCH

The committee recommends additional research on the effect of indoor smoking bans and secondhand-smoke exposure on acute coronary events. Such studies should be designed to examine the time between an intervention and changes in the effect and to measure the magnitude of the effect. Future studies should examine the time from initiation of a ban to observation of an effect and that include follow-up after initiation of enforcement, taking the social aspects into account. They should include direct observations on individuals—including their history of cardiac disease, exposure to other environmental chemicals, and other risk factors for cardiac events—to assess the impact of those factors on study results. Further, studies that examine whether decreases in hospital admissions for acute coronary events are transitory or sustained would be informative. Assessment of smoking status is also needed to distinguish between the effects of secondhand smoke in nonsmokers and the effects of a ban that decreases cigarette consumption or promotes smoking cessation in smokers.

In addition, the committee found only sparse data on the prevalence and incidence of cardiovascular disease and acute coronary events at the national level in general compared with other health end points for which there are central data registries and surveillance of all events, such as the Surveillance, Epidemiology, and End Results (SEER) Program for cancer. A large prospective cohort study could be very helpful in more accurately estimating the magnitude of the risk of cardiovascular disease and acute coronary events posed by secondhand-smoke exposure.

CONCLUSION

Data consistently demonstrates that secondhand-smoke exposure increases the risk of coronary heart disease and heart attacks and that smoking bans reduce heart attacks. Given the prevalence of heart attacks, and the resultant deaths, smoking bans save more than half a million lives each year in the U.S. alone. The savings, as measured in human lives, is undeniable.

FOR MORE INFORMATION . . .

Copies of *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence* are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, www.nap.edu. The full text of this report is available at www.nap.edu.

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