

Research summary

To assess the degree of carcinogen exposure among those individuals working or socializing in smoking environments, scientists at the University of Minnesota conducted two studies, which measured the level of carcinogen uptake in non-smoking casino patrons and in non-smoking bar and restaurant employees both before and after exposure to environmental tobacco smoke (ETS). Both studies demonstrated that nonsmokers' exposure to ETS causes significant increases in uptake of tobacco-specific carcinogens and toxins.

Policy implications

Results of these studies illustrate the importance of instituting smoking bans in workplaces to protect public health.

About umntturcresearchbrief

The UMN TTURC Research Brief presents timely information on emerging tobacco research from the University of Minnesota. The core aims of UMN TTURC are to examine approaches for reducing tobacco toxin exposure, determine the most effective methods for treating smokers who are unable or unwilling to quit smoking, and outline public policy implications for interventions that reduce exposure to tobacco toxins.

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Environmental tobacco smoke and carcinogen exposure

Environmental tobacco smoke poses a health danger for many Americans, especially those who patronize or work in bars, restaurants, and casinos that allow smoking. In 2002, the US Department of Health and Human Services' National Toxicology Program listed environmental tobacco smoke (ETS) exposure as a workplace carcinogen. (1) Bars and restaurant employees, in fact, have been shown to have four to six times higher exposure to ETS than other employees in other workplaces. (2)

To assess the degree of carcinogen exposure among those individuals working or socializing in smoking environments, researchers at the University of Minnesota Transdisciplinary Tobacco Use Research Center measured levels of exposure to cancer-causing chemicals in nonsmoking bar and restaurant employees and in nonsmoking casino patrons both before and after exposure to ETS.

Methods of two studies

The venue chosen for the first study, conducted in 2003, was a casino in the upper Midwest. Researchers asked 18 qualifying nonsmokers to spend 4 hours in the casino. Participants collected a urine sample before the visit and then collected samples for a 24-hour period after

leaving the casino. Researchers then measured the presence of total cotinine (a biomarker for nicotine uptake) and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL) and its glucuronides (NNAL-Glucs) in the samples. Presence of total NNAL (NNAL plus NNAL-Glucs) indicates that a potent carcinogen, NNK, has been absorbed in the body. (NNK has been shown to cause cancer in rats, mice, and hamsters.)

In the second study, the results of which were published this month, researchers recruited nonsmoking individuals who worked a minimum 6-hour shift in a bar or restaurant that permitted smoking. Each of the 20 participants collected urine samples for 24 hours on working and non-working days. (A 48-hour time period was required between the employees' nonwork day and their last work shift; the majority of subjects—17—indicated that they were not exposed to ETS during urine collections other than at their work days at the restaurant or bar. On the basis of measurements of total cotinine and carbon monoxide levels on nonworking days, none of the participants were found to be smoking or using nicotine.) As with the casino study, researchers then analyzed the samples for the presence of total cotinine and total NNAL, as well as total nicotine.

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Findings

For both studies, the analyses showed statistically significant increases in biological measures of exposure to cancer-causing agents and nicotine. In the casino study, the average increase in total NNAL after spending several hours in the casino was 112% (more than 2-fold). Cotinine concentrations increased 456%.

In the hospitality employees study, results showed significant increases in the levels of total NNAL, total nicotine and total cotinine on working days compared with nonworking days. Nonsmoking employees had up to 25 times higher levels of total nicotine in their urine and up to 4.5 times more total NNAL. Increases in toxin levels were seen even when the mean number of patrons smoking in the establishment was not very high. Interestingly, most study participants had total NNAL values that were above the level of nonexposure (typically 0.01 pmol/mL), even on the days when they were not working, which may reflect sustained levels of carcinogens in the body. Exposure to total NNAL increased by 108% on average, and 75% of the participants experienced an average increase of 142% in levels of total NNAL.

Policy implications

The studies discussed in this brief demonstrate that both patrons and employees of hospitality venues that allow smoking are exposed to ETS and show significant increases in levels of potent toxins.

Because ETS has been classified as a carcinogen and has been found to increase the risk of cancer as well as cardiovascular and lung diseases, many workplaces have instituted smoking bans. Studies have shown that smoking bans do reduce toxin exposures. (3,4) Our study results support the importance of instituting smoking bans in workplaces to protect public health. •

References

1. Report on Carcinogens, 10th ed. US Department of health and Human Services, Public Health Service, National Toxicology Program; 2002.
2. Eisner MD, Smith AK, Blanc PD. Bartenders' respiratory health after establishment of smoke-free bars and taverns. *JAMA* 1998;280:1909-14.
3. Lambert WE, Samet JM, Spengler JD. Environmental tobacco smoke concentrations in no-smoking and smoking sections of restaurants. *Am J Public Health* 1993;83:1339-41.
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Findings from the two studies discussed in this brief were published in:

*Anderson KE, Kliris J, Murphy L, et al. Metabolites of a tobacco-specific lung carcinogen in nonsmoking casino patrons. *Cancer Epidemiol Biomarkers Prev* 2003;12(12):1544-6.*

*Tulanay OE, Hecht SS, Carmella SG, et al. Urinary metabolites of a tobacco-specific lung carcinogen in nonsmoking hospitality workers. *Cancer Epidemiol Biomarkers Prev* 2005;14(5):1283-6.*

For more information about this study, please contact Jeanne Mettner, UMN TTURC's communications consultant, at 612.889.8047.

Mean differences in 24-hour amounts of toxins between work and nonwork days*

	# of Subjects	Difference	P value
Nicotine (nmol)	19	81.9	0.0001
Cotinine (nmol)	19	98.7	<0.0001
NNAL (pmol)	18	40.5	0.0013

*Difference equals work minus nonwork values

SOURCE: Tulanay OE et al. *Cancer Epidemiol Biomarkers Prev* 2005;14(5):1283-6.