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Secondhand Smoke In Casinos: Nonsmokers' Exposure, Dose, And Risk

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Abstract: I assessed area secondhand smoke (SHS) exposures in 5 casinos, using respirable particle (RSP) concentrations (PM2.5) and particle-bound polycyclic aromatic hydrocarbons (PPAH), and personal SHS exposures using a biomarker, to estimate SHS air pollution, odor, and irritation for patrons and workers, and mortality risk to casino workers. I deployed real-time area monitors for RSP and PPAH indoors and outside of 3 casinos. I measured smoking prevalence, smoker density, and carbon dioxide levels to generalize results. I employed urine cotinine to estimate personal RSP exposure in 7 volunteers visiting 3 casinos before and after casino visits via pharmacokinetic modeling. Air pollution levels were compared to the color-coded U.S. air quality index (AQI) for PM2.5 and to contemporaneous measurements from the State's real-time PM2.5 outdoor network. Risks to casino workers were assessed by dose-response risk models. The Pennsylvania casinos: Mohegan Sun, Philadelphia Park, and Harrah's (RSP & PPAH) and The Meadows, Philadelphia Park, and Presque Isle Downs (cotinine). RSP in all casino smoking areas ranged from 2.5 to 11 times outdoors, while PPAH ranged from 2.5 to 6 times outdoors. Nonsmokers gambling for ~5 hours had 10 to 20 fold increases in urine cotinine. Smoking prevalence ranged from 15% (weekday) to 30% (holiday weekend), compared to Pennsylvania's smoking prevalence of 25% (23% to 29%). This occurred despite the fact that ventilation rates per occupant in all cases exceeded ASHRAE Standard 2001, the last standard to recommend ventilation rates for casinos with smoking. Personal RSP exposures averaged 160 ug/m3 (SD 81) [cotinine 1.77 (SD 0.83) ng/ml], outdoor levels averaged 13.6 ug/m3, while measured area RSP levels averaged 106 ug/m3 (SD 25) compared to measured outdoor RSP levels averaging 18 ug/m3 (SD 9). PPAH indoors averaged 4 times higher [20 ng/m3 (SD 8)] inside casinos than outdoors [5 ng/m3 (SD 3)]. Casino air quality ranged from Unhealthy (Code Red) to Hazardous levels (Code Maroon) of RSP due to SHS. SHS-RSP irritation thresholds were exceeded by factors of 10 to 100 in all smoking areas, and by 99.9% of the levels measured on the nonsmoking floor of one casino, while adverse SHS odor thresholds were exceeded by factors ranging from 10- to 1000-fold in the smoking areas and from 3- to 200-fold in the nonsmoking areas. Nonsmoking casino patrons who visited the casinos in the early evening during weekdays, experienced personal RSP exposures (calculated from cotinine using a pharmacokinetic model) ranging from Very Hazardous to Unhealthy levels of air pollution, and averaging Very Unhealthy (Code Violet), according to the AQI. Contemporaneous RSP as measured by Pennsylvania's outdoor air quality monitoring network was Good (Code Green). Risk assessment based on cotinine dosimetry for the 12,364 casino workers ultimately expected for Pennsylvania's gaming industry, yields an estimated 8 deaths from SHS-lung cancer and heart disease per year. Risk from SHS for the average casino worker exceeds OSHA's Significant Risk level by an estimated 27 fold. Air pollution from RSP and PPAH from smoking in casinos is a significant threat to both public and worker health.

Categories (Complete): Science Theme: Air Quality - Exposure Characterization and Health Effects Type of Research: Exposure Assessment - field Type of Research Other : Dose Assessment - field Exposure: Tobacco Effect: Other Effect Other : Air Quality and Risk assessment

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