

Supplementary Tables: Secondhand Smoke and Smoking Restrictions in Casinos: A Review of the Evidence

SUPPLEMENTARY TABLE 1: Impact of SHS on Casino Air Quality in Casinos

Author Year Published	Study Site(s)	Smokefree Policies	Air Quality		Conclusions
			Smoking-Permitted Venues	Smokefree Venues or Other Comparison	
Achutan (2011) ¹⁶	Nevada 3 casinos	Smoking is permitted in casino gaming areas with exception of a poker room in one of the casinos.	<p>PBZs: geometric means: Nicotine 5.32 $\mu\text{g}/\text{m}^3$ RSP 42.1 $\mu\text{g}/\text{m}^3$.</p> <p>Solanesol 0.226 $\mu\text{g}/\text{m}^3$.</p> <p>Casino floor area geometric means: Nicotine 6.69 $\mu\text{g}/\text{m}^3$ RSP 41.4 $\mu\text{g}/\text{m}^3$.</p> <p>Solanesol 0.242 $\mu\text{g}/\text{m}^3$.</p> <p>Of 16 PAHs measured in PBZs and area air samples, only naphthalene was found in both.</p> <p>Area nicotine levels similar to PBZ nicotine levels, indicating that area levels are representative.</p>	NA	A number of SHS components, including nicotine, RSP, solanesol, benzene, naphthalene, and formaldehyde, were detected in the air of 3 casinos where smoking was allowed.

			PBZ and area nicotine levels and area RSP levels similar to those reported by Trout (1998).		
Jiang (2011)¹⁵	36 California tribal casinos 8 Reno, Nevada casinos	2006 Nevada Clean Indoor Air Act bans smoking in restaurants.	Mean PM _{2.5} levels: CA smoking-permitted casinos: –Smoking-permitted gaming areas: 63 µg/m ³ . –Nonsmoking gaming areas: 22 µg/m ³ (43 µg/m ³ for areas with no separation from smoking gaming areas, 20 µg/m ³ for areas with semi-separation, and 7.9 µg/m ³ for areas with complete separation). –Nonsmoking restaurants: 29 µg/m ³ . Reno smoking-permitted casinos: –Smoking-permitted gaming areas: 37 µg/m ³ . –Nonsmoking restaurants: 17 µg/m ³ .	Mean PM _{2.5} levels: Outdoors CA smoking-permitted casinos: 7 µg/m ³ . Outdoors Reno smoking-permitted casinos: 1.2 µg/m ³ . Smokefree CA casino: 5.4 µg/m ³ Outdoors CA smokefree casino: 5.5 µg/m ³ . Reno smokefree casino: 0.6 µg/m ³ . Outdoors Reno smokefree casino: 1.2 µg/m ³ .	Mean PM _{2.5} levels in smoking-permitted casinos are substantially higher than outdoor levels, even in many nonsmoking areas. Incremental PM _{2.5} levels were positively correlated with area smoker density. These results indicate that SHS is the predominant cause of the elevated PM _{2.5} levels. For 90% of casino visits, mean concentrations in smoking areas averaged over 0.5-1 hour exceeded 35 µg/m ³ .
Larsson (2008)¹⁷	Sweden 15 casino workers 22 bingo hall workers 54 bar and restaurant	Sweden National smokefree law extended to hospitality workplaces in 2005.	Pre-law: Median airborne nicotine level = 11.0 µg/m ³ . % of casino and bingo hall workers with levels ≥ 0.5 µg/m ³ = 100%	One year after law: Median airborne nicotine level = 0.22 µg/m ³ . % of casino and bingo hall workers with levels ≥ 0.5	The national smokefree law was associated with a substantial reduction in SHS exposure, as measured objectively by airborne nicotine levels. No notable change was observed in lung function, as measured by

	workers		(based on PBZ sampling for nonsmokers and area sampling for smokers).	$\mu\text{g}/\text{m}^3 = 22\%$ (based on PBZ sampling for nonsmokers and area sampling for smokers).	spirometry.
Repace (2004)¹²	Delaware 1 casino	Wilmington, Delaware Clean Indoor Air Act 2002	Before state smokefree law took effect: Average RSP = $205 \mu\text{g}/\text{m}^3$. Average PPAH = $163 \text{ ng}/\text{m}^3$.	After state smokefree law took effect: Average RSP = $9.4 \mu\text{g}/\text{m}^3$. Average PPAH = $3.7 \text{ ng}/\text{m}^3$.	RSP level after law took effect was 4.6% of baseline RSP level. PPAH level after law took effect was 2.3% of baseline PPAH level.
Repace (2009)¹⁴	Pennsylvania 3 casinos	One casino had a nonsmoking section.	Mean RSP: –Casino smoking areas: $106 \mu\text{g}/\text{m}^3$ (range: $84 \mu\text{g}/\text{m}^3 - 133 \mu\text{g}/\text{m}^3$) –Casino nonsmoking area (1 casino): $36 \mu\text{g}/\text{m}^3$ Mean PPAH: –Casino smoking areas: $20 \text{ ng}/\text{m}^3$ (range: $14 \text{ ng}/\text{m}^3 - 29 \text{ ng}/\text{m}^3$).	Mean RSP outdoors: $18 \mu\text{g}/\text{m}^3$ (range: $11 \mu\text{g}/\text{m}^3 - 28 \mu\text{g}/\text{m}^3$). Mean PPAH outdoors: $5 \text{ ng}/\text{m}^3$ PPAH (range: $3 \text{ ng}/\text{m}^3 - 6 \text{ ng}/\text{m}^3$).	Despite high ventilation rates, the average RSP level in casino smoking areas was 6 times the average outdoor level. The average PPAH level in casino smoking areas was 4 times the average outdoor level. In the only casino with a separate nonsmoking floor, considerable amounts of RSPs and PPAHs infiltrated this floor. Based on cotinine-derived RSP levels, SHS exposure in Pennsylvania casinos is estimated to produce an excess mortality of approximately 6 deaths per year per 10,000 workers at risk.
Repace (2011)¹³	66 casinos in California, Delaware, Nevada, New Jersey, and Pennsylvania that	NA	Geometric mean, $\text{PM}_{2.5}$: –66 smoking-permitted casinos: $53.8 \mu\text{g}/\text{m}^3$ (range:	Geometric mean, $\text{PM}_{2.5}$: –3 smokefree casinos: $3.1 \mu\text{g}/\text{m}^3$ (range:	Across all 66 casinos, $\text{PM}_{2.5}$ levels averaged 10 times outdoor levels, while $\text{PM}_{2.5}$ levels in smokefree casinos were slightly less than

	<p>allowed smoking.</p> <p>Three smokefree casinos</p>	<p>18.5 $\mu\text{g}/\text{m}^3$–205 $\mu\text{g}/\text{m}^3$). –Subset of 21 Reno and Las Vegas smoking-permitted casinos: Gaming areas: 45.2 $\mu\text{g}/\text{m}^3$ (95% CI: 37.7 $\mu\text{g}/\text{m}^3$–52.7 $\mu\text{g}/\text{m}^3$) –Adjacent nonsmoking casino restaurants: 27.2 $\mu\text{g}/\text{m}^3$ (95% CI: 17.5 $\mu\text{g}/\text{m}^3$–36.9 $\mu\text{g}/\text{m}^3$)</p> <p>Geometric mean, PPAH: –4 Reno smoking-permitted casinos: 17 ng/m^3 (SD: 11 ng/m^3). –Nonsmoking casino restaurants: 3.5 ng/m^3 (SD: 1.8 ng/m^3).</p>	<p>0.6 $\mu\text{g}/\text{m}^3$–9 $\mu\text{g}/\text{m}^3$. –Outside casinos: 4.3 $\mu\text{g}/\text{m}^3$ (range: 0.26 $\mu\text{g}/\text{m}^3$–29.7 $\mu\text{g}/\text{m}^3$). –Outside subset of 21 Reno and Las Vegas casinos: 3.9 $\mu\text{g}/\text{m}^3$ (95% CI: 2.5 $\mu\text{g}/\text{m}^3$–5.3 $\mu\text{g}/\text{m}^3$).</p> <p>Geometric mean, PPAH: –Reno nonsmoking casino: 2.3 ng/m^3 (SD: 1.5 ng/m^3). –Nonsmoking casino’s restaurant: 2.2 ng/m^3 (SD: 1.4 ng/m^3). –Outside 4 Reno smoking casinos: 4.6 ng/m^3 (SD: 0.5 ng/m^3). –Outside nonsmoking casino: 2.2 ng/m^3 (SD: 0.5 ng/m^3).</p>	<p>outdoor levels.</p> <p>PPAH levels in 8 smoking casinos in 3 states averaged 4 times outdoors PPAH levels.</p> <p>Ventilation and air cleaning failed to control $\text{PM}_{2.5}$, with drifting $\text{PM}_{2.5}$ infiltrating unseparated nonsmoking areas. Eliminating smoking inside casinos reduces $\text{PM}_{2.5}$ by about 90%, bringing indoor $\text{PM}_{2.5}$ levels down to outdoor levels, and reduces PPAH levels by at least 80%.</p>
<p>Trout (1998)⁹</p>	<p>New Jersey</p>	<p>Casino data based on 18 PBZ samples for nicotine and 10 area samples for nicotine vapor PBZ nicotine levels, expressed as time-weighted averages.</p>	<p>Outside air 275-300ppm RSP</p>	<p>Elevated levels of airborne nicotine consistent with SHS exposure found in PBZ samples; elevated levels of airborne nicotine and respirable dust consistent with SHS exposure found in area samples.</p>

			<p>First evening, geometric mean: 8 $\mu\text{g}/\text{m}^3$ range: 6 $\mu\text{g}/\text{m}^3$ – 12 $\mu\text{g}/\text{m}^3$.</p> <p>Second evening, geometric mean: 10 $\mu\text{g}/\text{m}^3$ range: 4 $\mu\text{g}/\text{m}^3$ – 15 $\mu\text{g}/\text{m}^3$.</p> <p>Air nicotine levels, expressed as time- weighted averages. –First evening, geometric mean: 8 $\mu\text{g}/\text{m}^3$ range: 6 $\mu\text{g}/\text{m}^3$ – 12 $\mu\text{g}/\text{m}^3$.</p> <p>–Second evening, geometric mean: 11 $\mu\text{g}/\text{m}^3$ range: 8 $\mu\text{g}/\text{m}^3$ – 16 $\mu\text{g}/\text{m}^3$.</p>		
York (2010)¹⁸	Nevada	2006 Nevada Clean Indoor Air Act	<p>Mean PM_{2.5} levels: Gaming areas; 48 $\mu\text{g}/\text{m}^3$ (range: 20 $\mu\text{g}/\text{m}^3$ – 73 $\mu\text{g}/\text{m}^3$).</p> <p>Restaurants: 31 $\mu\text{g}/\text{m}^3$ (range: 5 $\mu\text{g}/\text{m}^3$ – 101 $\mu\text{g}/\text{m}^3$).</p>	Outside air 5 $\mu\text{g}/\text{m}^3$	<p>Employees and patrons are exposed to dangerously high levels of PM_{2.5} in Nevada casinos due to SHS.</p> <p>Unhealthy levels of PM_{2.5} were also found in many nonsmoking restaurants in Nevada casinos.</p> <p>PM_{2.5} levels in most casino gaming areas and restaurants exceeded</p>

	16/16 gaming areas and 12/16 restaurants exceeded the then-EPA annual outdoor air quality standard of 15 µg/m ³ . (Note: The EPA has since revised this standard to 12 µg/m ³ .)	annual EPA standards.
	13/16 gaming areas and 5/16 restaurants exceeded EPA 24-hour standard of 35 µg/m ³ .	

Abbreviations: PBZ = personal breathing zone; PM_{2.5} = particulate matter < 2.5 mm in diameter; PAH = polynuclear aromatic hydrocarbons; PPAH = particulate polycyclic aromatic hydrocarbons; RSP = respirable suspended particulates.

SUPPLEMENTARY TABLE 2: SHS Exposure and Health Outcomes of Smoking in Casinos

Author Year Published	Study Site and Participants	Smokefree Policy	SHS Exposure (Biomarkers) and Health Outcomes		Conclusions
			Smoking Casinos	Smokefree Casinos	
Achutan (2011)¹⁶	Nevada 3 casinos 124 nonsmoking dealers	Smoking is permitted in casino gaming areas with exception of a poker room in one of the casinos.	Dealer exposure (all 3 casinos): Urinary cotinine and NNAL levels unadjusted for creatinine increased significantly during an 8-hour shift (<i>p</i> < 0.01). Urinary NNAL levels adjusted for creatinine increased significantly over an 8-hour shift		Study documents an increase in urinary levels of NNAL over a work shift in casino dealers, which provides evidence that the increase is due to workplace SHS exposure. These findings are consistent with studies that have shown an increase in NNAL levels in bar and restaurant

			<p>($p = 0.03$). However, this was not the case for urinary cotinine levels adjusted for creatinine.</p> <p>Pre-shift unadjusted urinary cotinine levels were positively correlated with pre-shift urinary NNAL levels ($r = 0.53, p < 0.01$) and post-shift urinary cotinine levels were positively correlated with post-shift urinary NNAL levels ($r = 0.53, p < 0.01$).</p>		<p>workers who are exposed to SHS over a work shift and in casino patrons exposed over a 4-hour casino visit.</p>
<p>Anderson (2003)¹⁹</p>	<p>Casino in Midwest region, U.S.</p> <p>18 nonsmoking patrons</p>	<p>Casino allows smoking.</p>	<p>Exposure:</p> <p>Cotinine levels in urine samples showed a statistically significant mean increase of 0.044 nmol/mg (95% CI: 0.028 nmol/mg, 0.061 nmol/mg), or 456%, from a single spot check collected before 4-hour casino visits compared to samples collected for 24 hours after these visits.</p> <p>Total NNAL levels in urine samples showed a statistically significant mean increase of 0.018 pmol/mg (95% CI: 0.010 pmol/mg, 0.025 pmol/mg), or 112%, from before to after the visits.</p>	<p>NA</p>	<p>SHS exposure among nonsmokers in a casino results in uptake of a tobacco-specific lung carcinogen.</p> <p>Cotinine and NNAL levels in this study are consistent with levels reported in other studies of SHS exposure.</p> <p>Results suggest that carcinogen levels in nonsmoking casino employees would increase as a result of SHS exposure at work.</p>

Larsson (2008) ¹⁷	Sweden	National smokefree law extended to hospitality workplaces in 2005.	Exposure pre-law: 65% (59 of 91) of respondents reported being exposed to SHS at work for 75% or more of the time; 37% (16 of 43) of nontobacco users had urinary cotinine levels under the limit of detection.	Exposure one year after law: 1% (1 of 71) of respondents reported being exposed to SHS at work for ≥ 75% of the time; 67% (29 of 43) of nontobacco users had urinary cotinine levels below the limit of detection.	The national smokefree law was associated with substantial reductions in self-reported and objectively measured SHS exposure and with a substantial reduction in respiratory and sensory symptoms among nonsmoking gaming workers.
	15 casino workers				
	22 bingo hall workers				
	54 bar and restaurant workers			Health: Frequency of self-reported respiratory and sensory symptoms was approximately halved among nonsmoking gaming and hospitality workers.	
Pilkington (2007) ²⁴	London, England	Smoking allowed in casinos	Exposure: 83% of respondents	NA	In multivariate analysis, the most important determinant of reporting

	25 casinos		reported being nearly always exposed to SHS at work; 74% rated their intensity of exposure as "heavy"; 71% reported that they were nearly always exposed to heavy SHS levels.		sensory or respiratory symptoms was workplace SHS exposure. The presence of respiratory symptoms was also associated with the number of hours worked per week.
	559 respondents among 1,568 unionized casino workers who received a postal survey				
	22% of respondents were current smokers; 39% were never smokers		Health: 91% of respondents reported at least one sensory irritation symptom in the past 4 weeks. 84% of respondents reported at least one respiratory irritation symptom in the past 4 weeks.		
Repace (2009)¹⁴	Pennsylvania 3 casinos 8 volunteer patrons	Smoking allowed in casinos	Exposure: Average increase in urine cotinine following roughly 4-hour casino visits: 1.9 ng/mL.	NA	Cotinine levels were converted into RSP levels using a formula developed by the author; these RSP levels were in turn used to estimate that SHS exposure in Pennsylvania casinos produces an excess mortality of 6 deaths per year per 10,000 workers.
Trout (1998)⁹	New Jersey casino 18 dealers 11 supervisors		Smoking allowed in casino		Dealer exposure: Serum cotinine geometric means, overall: Pre- shift = Both pre- and post-shift serum cotinine geometric means exceed 0.65 ng/mL geometric mean for NHANES III respondents who reported SHS

1.34 ng/mL
(GSD: 1.9)
Post-shift =
1.85 ng/mL
(GSD: 1.4)

Dealers at smoking-
permitted tables:
Pre-shift =
1.22 ng/mL
Post-shift =
1.77 ng/mL

Dealers at
nonsmoking tables:
Pre-shift =
2.30 ng/mL
Post-shift =
2.41 ng/mL

Urine cotinine
geometric means:
Pre-shift =
23.0 ng/mL
(GSD: 2.2)
Post-shift =
33.3 ng/mL
(GSD: 2.0)

exposure at work.

Designating nonsmoking
tables was not effective in
reducing exposure.

A sample of employees
working in a casino
gaming area were
exposed to ETS at levels
greater than those
observed in a
representative sample of
the U.S. population, and
that both serum and urine
cotinine levels of these
employees increased
during their work shifts.

Wakefield (2005) ²⁰	Victoria, Australia 91 nonsmoking workers from casinos (44), clubs (24), and offices (23)	Casinos and clubs have partial or no smoking restrictions; offices are 100% smokefree.	Exposure: Casino mean before-after shift saliva cotinine level per hour worked: 0.18 ng/mL/hr worked. Health: Casino employees were more likely than office employees to report sore eyes and sore throats. Odds ratios for other symptoms were in the predicted direction, but did not reach statistical significance.	Exposure: Office mean before-after shift in saliva cotinine level per hour worked: 0.03 ng/mL/hr worked	Compared with office workers, casino workers had significantly higher levels of mean before-after shift saliva cotinine per hour worked and were more likely to report sore eyes and sore throats. The authors conclude that SHS exposure is associated with increased risk of respiratory symptoms, and that air-conditioning reduces, but fails to eliminate, worker SHS exposure.
Woo (2000) ²⁵	Macau, China 20 nonsmoking, asymptomatic casino workers who had been exposed to SHS for > 8 hrs/day, 6 days/week, for at least 2 years; 20 matched controls London, England 25 casinos	Smoking allowed in casinos	Health: Casino workers: mean flow-mediated dilation 6.6 +/- 3.4%	Health: Controls: mean flow-mediated dilation 10.6 +/- 2.3%	Flow-mediated dilation, an indicator of arterial endothelial function, was significantly lower in the casino workers than in the controls ($p < 0.0001$). In multivariate analysis, SHS exposure was found to be the strongest predictor of impaired flow-mediated dilation.
Pilkington (2006) ⁵²	559 respondents among 1,568 unionized casino workers who received a postal survey	94% of respondents report that customers can smoke in most or all areas of their casinos where staff work	83% of respondents reported being		The majority of casino workers surveyed

22% of respondents were current smokers;
39% were never smokers

nearly always
exposed to SHS at
work;
78% stated that they
minded if people
smoke near them at
work;
57% believed they
had suffered health
problems as a result
of SHS exposure at
work;
65% supported
banning smoking in
all casino customer/
working areas

reported being bothered
by SHS, being concerned
about the effects that SHS
was having on their
health, and supporting
banning smoking in all
customer/working areas
of the casino.

Abbreviations: GSD = Geometric standard deviation; NNAL = (4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol)-a tobacco-specific lung carcinogen.

SUPPLEMENTARY TABLE 3: Smoking Prevalence among Casino Patrons

Author Year Published	Study Site and Participants	Smoking Prevalence		Conclusions
		Casino Patrons	Comparison Group	
Jiang (2011) ¹⁵	36 California tribal casinos 8 Reno, Nevada casinos Casino patrons	<p>Active smoking prevalence (defined as total number of active smokers divided by total number of patrons x 100%):</p> <p>California tribal casinos: 11% (range: 5%–25%) 16% in small casinos (casinos with < 500 slot machines) vs. 10% in medium and large casinos (casinos with 500–1,400 and > 1,400 slot machines, respectively) (<i>p</i> < 0.05).</p> <p>Adult smoking prevalence: 33%, calculated by multiplying the observed prevalence x 3, on the rationale that one third of smokers are smoking cigarettes at any given time.</p> <p>Reno casinos: 10% (range: 7%–12%) Adult smoking prevalence: 30%</p> <p>Casino overall smoking prevalence 33%</p>	California adult overall prevalence = 13%	The adult smoking prevalence in California smoking-permitted casinos appears to be much higher than California’s overall adult smoking prevalence of 13%.
Levens (2005) ²⁸	Pennsylvania Primary care patients aged ≥ 65	<p>Recreational gamblers (persons who reported at least one gambling activity in the last year but who did not report either at-risk gambling behaviors described below): 8.8%</p> <p>At-risk gamblers (persons who reported gambling more than \$100 on a single bet and/or betting more than they could afford to lose in the last year): 10%</p>	<p>All respondents: 8.2%</p> <p>Non-gamblers (persons who reported no gambling activity in the last year): 6.3%</p>	At-risk and recreational gambling were not significantly associated with smoking in this survey of older adult primary care patients.

Pritsos (2008) ²⁷	Nevada 14,052 gamblers at 18 casinos, including 8 in Las Vegas, 7 in Reno/Sparks, and 3 on the South Shore of Lake Tahoe.	Overall, 947 of 14,052 gamblers observed were smoking, which, multiplied by 3 on the rationale that one third of smokers are smoking cigarettes at any given time, yields a prevalence of 20.2% (95% CI: 0.7%), This prevalence did not significantly differ from the U.S. adult smoking prevalence of 20.9% (95% CI:0.6%) ($p < 0.0001$)	U.S.: 20.9% (same year as casino prevalence)	The percentage of gamblers who smoke in Nevada casinos is not significantly different from the 2005 U.S. adult smoking prevalence.
		Overall, smoking prevalence was higher among gamblers at slot machines (771/10,830 x 3 = 21.3%) than among gamblers at table games (176/3,222 x 3 = 16.4%).		
Repac (2004) ¹²	Wilmington, Delaware 1 casino NA	Casino central salon: 25.5%, calculated by multiplying the observed prevalence by 3, on the rationale that one third of smokers are smoking cigarettes at any given time.	Delaware adults: 23% (2002)	The smoking prevalence among casino patrons was slightly higher than the state adult smoking prevalence.
Repac (2009) ¹⁴	Pennsylvania 3 casinos NA	Casino patrons: Estimated average smoking prevalence: 20.1% (range: 13.8%–29.1%), calculated by multiplying the observed prevalence of 6.7% (range: 4.6%–9.7%) by 3, on the rationale that one third of smokers are smoking cigarettes at any given time.	State adult smoking prevalence: 25% (range: 23%–29%) (2007)	The smoking prevalence among casino patrons was lower than the state adult smoking prevalence.

SUPPLEMENTARY TABLE 4. Smoking Prevalence among Problem/Pathological Gamblers*

Study Year Published	Study Site and Population	Smoking Prevalence		Conclusions
		Problem/Pathological Gamblers	Comparison Group	
Potenza (2004) ³⁰	Connecticut 601 callers to state helpline for problem gambling.	Problem gamblers: Of 601 callers for whom tobacco use status was available, 259 (43.1%) were current daily tobacco users. 43 (7.1%) were past daily tobacco users, suggesting low quit rates in this population. and 299 (49.7%) were never daily tobacco users. Almost 91% of current smokers reported onset of smoking before onset of gambling, and 82.48% reported onset of daily smoking before onset of gambling.	U.S. 23% (2000)	A high proportion of problem gamblers calling a state gambling hotline reported daily smoking. In these gamblers, smoking was associated with a number of other problems, including mental health and substance abuse problems. The findings highlight the need for the identification and implementation of effective smoking cessation interventions for problem gamblers.
Fong (2011) ³¹	Southern California casino 176 casino patrons. Problem gamblers = a score of 3 or 4 on the 17-item NORC DSM-IV Screen for	Probable pathological gamblers: smoked ≥ 20 cigarettes/day: 18.5%. nonsmokers: 57.4%. Pathological gamblers reported smoking more cigarettes per day relative to other groups (Kruskal–Wallis test, $p = 0.02$). Self-identified smokers had significantly higher mean	Non-problem gamblers: smoked ≥ 20 cigarettes/day: 5.7% nonsmokers: 81.1%	Pathological gamblers smoked more cigarettes per day than non-pathological gamblers. Smokers had higher scores than nonsmokers on a screen assessing gambling pathology. Interventions for smoking cessation are needed for casino patrons with gambling problems.

	Gambling Problems; pathological gamblers = a score of 5 or higher.	scores (3.9, SD: 3.5) on the NORC DSM-IV Screen for Gambling Problems than patrons who reported not smoking (2.5, SD: 3.0); $p < 0.05$].		
Rodda (2004)³³	Victoria, Australia 81 electronic gaming machine players, 29 (35, 8%) of whom scored above the SOGS cut-off for problem gambling.	Problem gamblers: 82.8% (24/29) (C.L.: 68.2%, 97.4%). SOGS scores predicted both smoking status and tobacco dependence scores (calculated using a 10-item Tobacco Dependence Scale). Anxiety scores were positively correlated with smoking status, SOGS scores, and tobacco dependence scores.	Non-problem gamblers: 46.2% (24/52) (C.L.: 32.1, 60.2) The difference in smoking prevalence between problem and non-problem gamblers was significant (likelihood-ratio chi-square = 11.05, $p < 0.001$). Victoria smoking prevalence: 25%.	Found a high smoking rate in a sample of untreated problem gamblers. Significant linear relationships existed between problem gambling, measured by SOGS, the likelihood of participants reporting smoking, and nicotine dependence scores. The authors speculate that smoking cessation treatments, smokefree policies, and efforts to address the underlying issue of negative affect/anxiety in gambling venues might help reduce high smoking rates among problem gamblers.
Mason (2007)³²	New Zealand 12,529 respondents aged ≥ 15 years to the 2002/03 New Zealand Health Survey. Problem gamblers were identified using a 10-question screen that was specially	Problem gamblers: Prevalence of daily smoking: 58.3% (95% CI: 46.5%-70.0%)	Non-problem gamblers: Prevalence of daily smoking: 22.5% (95% CI: 21.3%–23.6%) OR: 2.96 (95% CI: 1.68–5.21). This association remained statistically significant when controlling for other variables (including sex, age, ethnicity, deprivation,	Problem gambling was significantly associated with daily smoking. The authors speculate that laws making gambling venues smokefree could affect both smokers' gambling behavior and the amount that they smoke, and call for studies on the impact of such laws on the prevalence of problem gambling.

			developed for this survey.	household size, education, and employment status) with regression analysis.	
				Problem gamblers were also more likely to increase the amount smoked while gambling (61.2%) compared to non-problem gamblers (32.4%).	
Weis (2007)³⁷	Virginia	Pathological gamblers: 5/8	584 naval psychiatric outpatients Prevalence of pathological gambling (SOGS score \geq 5): 1.4% (n = 8). Prevalence of problem gambling (SOGS score \geq 3): 2.7% (n = 16).	All study participants: 201/584 (34.5%).	Smokers had 3.2 times greater odds of problem gambling compared with nonsmokers, but these results were not statistically significant ($p = 0.094$). Smokers had statistically significantly higher mean SOGS scores (0.42 vs. 0.21). Smoking is a risk factor for gambling problems.
Petry (2002)²⁹	Connecticut	Breakdown of initial 345 subjects: 62% current daily smokers 6% former daily smokers 32% never daily smokers (Thus, only 9% of gamblers who were ever daily smokers had quit, a very low rate.) Breakdown of 317 subjects	345 persons starting treatment for gambling; 317 persons included in final analysis	Connecticut smoking prevalence (1998): 22%	Smoking rates among treatment-seeking gamblers appear to be substantially higher than rates of smoking in the general population. This study suggests that treatment-seeking gamblers who smoke daily may differ from treatment-seeking gamblers who do not smoke daily on a number

		<p>included in final analysis: 66.2% daily smokers; 33.8% never daily smokers</p> <p>Although life-time SOGS scores did not differ between daily smokers and never daily smokers, past-month SOGS scores were significantly higher in the daily smokers ($p < 0.001$).</p> <p>At treatment entry, daily smokers reported greater cravings for gambling and lower perceived ability to control their gambling compared to never daily smokers ($F_{1,278} = 7.00$ and 9.94, $p < 0.01$).</p> <p>Compared to never daily smokers, daily smokers also gambled more days ($F_{1,304} = 10.54$, $p < 0.001$) and spent greater amounts of money gambling ($F_{1,304} = 13.17$, $p < 0.001$) in the past month.</p>		<p>of dimensions, including having more severe current gambling problems.</p> <p>The association between daily smoking and increased gambling problems could result from nicotine enhancing gambling experiences, gambling reinforcing nicotine's effects, or each behavior serving as a cue for the other.</p> <p>Efforts to treat gambling disorders may benefit from considering the role played by nicotine dependence.</p> <p>Research should explore whether smoking adversely affects gambling treatment or outcomes.</p>
Grant (2008)³⁴	<p>A Midwest public university hospital and an East coast private university hospital</p> <p>465 adult</p>	<p>44.9% of the subjects were current daily smokers Subjects who were daily smokers had more severe gambling symptoms based on several indicators, including SOGS and DSM-IV criteria.</p>	<p>General U.S. population: 16.7% to 22.4%</p>	<p>Daily smoking is more common in pathological gamblers than in the general population. Pathological gamblers who are daily smokers tend to have more severe gambling symptoms than pathological gamblers who are not daily smokers. Daily smoking is common in pathological gamblers and has important</p>

	outpatients seeking treatment for pathological gambling			clinical implications.
Grant (2005)³⁵	225 adults recruited for pharmacological treatment for pathological gambling	48.9% of the subjects were current daily smokers; 21.8% of the subjects were prior daily smokers Current and prior daily smokers had stronger urges to gamble, based on several measures of gambling severity.	NA	Daily smoking is common in treatment-seeking pathological gamblers, and is associated with more severe urges to gamble.
McGrath (2009)³⁶	Literature review of articles published in English between 1980 and 2008 based on search of MEDLINE, PsychINFO, Web of Science, Science Direct, and Proquest focused on empirical studies of the comorbidity of smoking and gambling.	NA	NA	A number of studies suggest that the rate of tobacco dependence is higher among problem gamblers than in the general population. Tobacco addiction and problem gambling may be mediated by similar neurobiological, genetic, and environmental mechanisms.

Abbreviations: CI = confidence interval; OR = odds ratio; SOGS = South Oaks Gambling Screen.

*As defined here, a person is diagnosed as a pathological gambler if they meet standardized diagnostic criteria related to “persistent” or “maladaptive” gambling behavior.

SUPPLEMENTARY TABLE 5: Economic Impact of Smokefree Policies on Casinos

Study Year Published	Study Site and Timeframe	Smokefree Policy	Economic Impact	Conclusions
Lal (2008) ³⁸	Victoria, Australia 1998–2005	Victoria Smoke-Free Policy of 2002	<p>The study examined the ratio of monthly electronic gaming machine (EGM) expenditure for the Australian state of Victoria to monthly EGM expenditure for the Australian state of South Australia from July 1998 to December 2005.</p> <p>Victoria implemented a law making most areas of gaming venues smokefree in September 2002. South Australia had minimal smoking restrictions for gaming venues during the study period.</p> <p>The study found that the ratio decreased by 0.73 and the mean monthly expenditure level decreased by 13.8% following implementation of the Victoria law.</p>	<p>The study finds that the Victoria law resulted in an abrupt, long-term decrease in EGM expenditure.</p> <p>Separate measures to reduce problem gambling and limit gamblers' losses were implemented in January 2003.</p> <p>The study suggests that, in addition to protecting gaming workers and patrons from SHS, Victoria's smokefree law may have helped to reduce problem gambling.</p>
Harper (2003) ³⁹	Victoria, Australia 2001-2003		The commentary notes early reports that the Victoria smoke-free law may have resulted in reduced gambling revenue and speculates on potential explanations.	The commentary speculates that smokers who interrupt their gambling to go outside to smoke may emerge from the "trance" induced by gambling, take stock of their losses, and break off gambling earlier than they would have done otherwise.
Mandel (2005) ⁴²	Delaware 1996–2004	Delaware Indoor Air Law of 2002	Linear regression controlling for underlying economic conditions and seasonal effects found that the Delaware smokefree law was associated with no significant effect on total gaming revenue or average revenue per video lottery terminal.	A state law making casinos smokefree had no detectable effect on total gaming revenue or average gaming revenue per video lottery terminal.
Pakko (2006) ⁴³	Delaware 1996–2004	Delaware Indoor Air Law of 2002	A re-analysis of Mandel's data using alternative approaches to control for differences in the variance of error terms across observations yielded a different result from that study. The new analysis found that both total gaming revenues and revenues per video lottery terminal fell significantly after the	The study concludes that Delaware's smokefree law had a statistically significant negative effect on gaming revenue. The study estimates that these losses could amount to about \$6.5 million per month in inflation

			implementation of Delaware's smokefree law.	adjusted 2004 dollars, representing a revenue loss of nearly 13% compared to the year preceding the implementation of the law.
Pakko (2008)⁴⁴	Delaware 1997-2005	Delaware Indoor Air Law of 2002	Pakko revisits his 2006 analysis and arrives at similar findings. In addition, he finds that the revenue losses were greater at racinos facing competition from smoking-permitted gambling facilities in neighboring states.	The study arrives at the same finding as Pakko's 2006 analysis, namely that the Delaware smoke-free law negatively impacted racino revenues.
Thalheimer (2008)⁴⁶	Delaware 1996-2004	Delaware Indoor Air Law of 2002	Using equations to estimate the demand for slot machines, the study finds that the Delaware law had a negative impact on this demand in the state's three racinos, reducing this demand (handle) by 15.9%, and that this impact did not vary across the racinos	The study finds that the Delaware smoke-free law reduced the demand for video lottery terminal wagering at the state's racinos.
