

## *Summary of Michigan Cotinine Study\* Results*

### *April 2011*

The purpose of the study was to determine differences in exposure to secondhand smoke and reported respiratory and general health among bar employees in the state of Michigan before and after Michigan’s smoke-free air law went into effect on May 1, 2010.

Forty bar employees from the following Michigan counties participated in the study: Benzie-Leelanau, Berrien, Delta-Menominee, Genesee, Ingham, Marquette, Muskegon, Emmet, Ottawa, St. Clair, and Wayne. Each participant completed the pre- and post-law urine specimen collection for cotinine (nicotine metabolite), creatinine, and 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL) analysis. Each of these chemical compounds are biomarkers for measuring level of exposure to secondhand smoke. Each participant also completed a respiratory and general health questionnaire. The same participants completed a urine collection and the questionnaire approximately four to six weeks before and approximately six to ten weeks after the smoke-free law went into effect.

The results demonstrated a significant decrease in mean cotinine levels among participants working in the same bars before ( $M = 35.92$ ) and after ( $M = 0$ ) the smoke-free law went into effect ( $t = 13.043$ ,  $df = 39$ ,  $p < .001$ ). There was not a significant difference in mean creatinine levels among participants before and after the law went into effect. However, assessment of creatinine levels alone is not as reliable nor as direct a measure of secondhand smoke exposure as cotinine levels, and many other extraneous biological and lifestyle factors can impact creatinine levels, for instance, kidney functioning, and frequency and level of physical activity, especially weight training, or if an individual consumes creatinine supplements. There was also a significant decrease in mean NNAL levels among participants working the same bar before ( $M = .086$ ) and after ( $M = .034$ ) the smoke-free law went into effect ( $t = 4.477$ ,  $df = 35$ ,  $p < .001$ ).

The results also demonstrated a significant improvement in reported general health status on a scale from 1 = “Worst” to 10 = “Best”, before ( $M = 7.20$ ) and after the law went into effect ( $M = 8.23$ ), ( $t = -5.272$ ,  $df = 39$ ,  $p < .001$ ). There was also a significant decrease in six reported respiratory symptoms before and after the smoke-free law went into effect. See table below for mean differences and for significance test results for differences in the means for each reported respiratory symptom before and after the smoke-free went into effect. Each symptom was rated on a scale of 1 (Not Present) to 5 (Severe).

Respiratory Symptom	Pre-law Mean (Not Present = 1, Severe = 5)	Post-law Mean (Not Present = 1, Severe = 5)	Paired-samples t-test results
Allergic symptoms	2.50	1.55	$t = 5.538$ , $df = 39$ , $p < .001$
Wheezing	1.33	1.15	$t = 2.014$ , $df = 39$ , $p = .051$
Shortness of breath	1.69	1.38	$t = 2.226$ , $df = 38$ , $p = .032$
Phlegm production	1.79	1.44	$t = 2.483$ , $df = 38$ , $p = .018$
Day time cough	1.48	1.18	$t = 2.504$ , $df = 39$ , $p = .017$
Morning cough	1.55	1.13	$t = 3.185$ , $df = 39$ , $p = .003$

\*Also referred to as the “Michigan Secondhand Smoke Exposure Study”

*Summary of Cotinine Study\* Results*  
*Ottawa*

The purpose of the study was to determine differences in exposure to secondhand smoke and reported respiratory and general health among bar employees in the state of Michigan before and after Michigan's smoke-free air law went into effect.

Four bar employees, two male and two female between the ages of 23 and 59, from Allendale, Grand Haven, and Spring Lake participated in this study. Two participants were bartenders, and the work positions of the other participants were not reported. The participants completed the pre- and post-law urine specimen collection for cotinine (nicotine metabolite), creatinine, and 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL) analysis. Each of these chemical compounds are biomarkers for measuring level of exposure to secondhand smoke, and NNAL is a carcinogen. Each participant also completed a respiratory and general health questionnaire. The same participants completed a urine collection and the questionnaire approximately four to six weeks before and approximately six to ten weeks after the smoke-free law went into effect.

The results demonstrated a significant reduction in the mean cotinine levels for the participants working in the same bar before and after the smoke-free law went into effect. Before the law went into effect, the mean cotinine level for the participants was 33.25 nanograms (ng)/ml, and the cotinine level was too low to be detected approximately one to one-and-a-half months after the law went into effect. There was an increase in participants' mean creatinine levels before and after the law went into effect. However, assessment of creatinine levels alone is not as reliable nor as direct a measure of secondhand smoke exposure as cotinine levels, and many other extraneous biological and lifestyle factors can impact creatinine levels, for instance, kidney functioning, and frequency and level of physical activity, especially weight training, or if an individual consumes creatinine supplements. There was a reduction in the participants' mean NNAL level (measured in picomoles (pmol)/ml) before ( $M = .113$ ) and after ( $M = .066$ ) the smoke-free law went into effect.

The results demonstrated a marginally significant improvement in mean reported general health status, on a scale from 1 = "Worst" to 10 = "Best", before ( $M = 5.75$ ) and after the law went into effect ( $M = 7.25$ ). Each respiratory symptom was rated on a scale of 1 (Not Present) to 5 (Severe), and there was a reported decrease in severity for morning cough, phlegm production, shortness of breath, and allergic symptoms. There was a reported increase in asthma-like symptoms, specifically whistling or wheezing sound, and no difference in severity was reported for daytime cough. It is important to note that while there were reductions in chemical biomarkers and most of the respiratory symptoms, most of these results were not statistically significant due to the small sample size of four participants. These are different than the state results that included a total sample of 40 participants, and because of the larger sample size, significant reductions were found in both cotinine and NNAL levels, in addition to reported significant improvements in general health and all respiratory symptoms at the state level.

*\*Also referred to as the "Michigan Secondhand Smoke Exposure Study"*