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## Marijuana Use and Heart Disease: Potential Effects of Public Exposure to Smoke

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As California anticipates the potential legalization of recreational marijuana, it is important to recognize the possible negative impacts of widespread use on public health and safety so that effective regulatory policies can be written. Because the mental impairment caused by the drug tetrahydrocannabinol (THC) is well known, it will be non-controversial to legislate against “driving while stoned” and the use of marijuana on the job. However, secondhand smoke presents another way for increased marijuana use to harm public health that may be less obvious to policy makers, due to rarity of studies that have explored these effects. Until recently, the rare studies of marijuana secondhand smoke primarily explored whether exposure causes false positives on drug tests.<sup>1,2</sup> This brief report summarizes our current understanding of the cardiovascular health effects of inhalation of marijuana smoke, with an emphasis on public exposure to secondhand smoke.

In addition to the drug THC, marijuana smoke consists of dried plant combustion products that include many of the thousands of chemicals in tobacco smoke,<sup>3</sup> as well as fine inhalable particles that can trigger heart attacks.<sup>4-6</sup> Tobacco secondhand smoke is responsible for about 50,000 deaths in the U.S. each year; about 80% of these are from cardiovascular disease.<sup>7,8</sup> Making workplaces and public places smokefree (and thus a reduction in secondhand smoke) is almost immediately followed by a reduction in hospital admissions for heart attacks.<sup>9</sup> ***Because of their similar chemical composition, marijuana secondhand smoke and tobacco secondhand smoke are likely to have similar harmful effects on public health.***

- *Blood vessels.* Normal arteries get larger and smaller on a minute-to-minute basis in order to accommodate the body’s need to move blood. Cigarette smoking and exposure to secondhand smoke reduce the ability of arteries to expand (grow in diameter) when they need to pass more blood to the heart and limbs during exertion.<sup>10,11</sup> Reducing this function of arteries increases the risk of atherosclerosis (partially blocked arteries), heart attack, and stroke. Research reported at the annual American Heart Association Scientific Sessions in November 2014\* demonstrated that exposure to marijuana secondhand smoke for 30 minutes (with most of the exposure occurring during the first 10 minutes) reduced this function of arteries in rats similarly to the reduction caused by similar concentrations of tobacco secondhand smoke.<sup>12</sup> The functional impairment occurred even when the marijuana

\* <http://newsroom.heart.org/news/secondhand-marijuana-smoke-may-damage-blood-vessels-as-much-as-tobacco-smoke>

lacked the drug THC, confirming that it was caused by one or more of the other thousands of chemicals in the smoke.

- *Heart*. A study in 2001 indicated that smoking marijuana increased the risk of experiencing a heart attack within the next hour.<sup>13</sup> Because THC has direct effects on heart rate and blood pressure, the authors focused on the potential link between the elevated heart attack risk and the THC. However, it is difficult to exclude the possibility that the increased heart attack risk was actually caused by the effects of smoke chemicals on the blood vessels, as described in the previous paragraph. Enough evidence has emerged to suggest consequences to the heart from THC itself that at least two groups of cardiologists have recommended that marijuana smoking be considered a potential heart attack risk factor.<sup>14,15</sup>

Legalization of marijuana makes an understanding of the consequences of public exposure to marijuana secondhand smoke more important than ever before. The similarity of the chemical composition of secondhand smoke from tobacco and marijuana, along with our observation that both kinds of smoke can impair blood vessel function, indicate that ***marijuana secondhand smoke is not harmless and that legal limitations on public exposure to secondhand smoke should apply to both tobacco and marijuana.***

#### References:

1. Law, B., Mason, P.A., Moffat, A.C., King, L.J., and Marks, V. (1984). Passive inhalation of cannabis smoke. *J Pharm Pharmacol* 36: 578-81.
2. Hayden, J.W. (1991). Passive inhalation of marijuana smoke: a critical review. *J Subst Abuse* 3: 85-90.
3. Moir, D., Rickert, W.S., Levasseur, G., Larose, Y., Maertens, R., White, P., and Desjardins, S. (2008). A comparison of mainstream and sidestream marijuana and tobacco cigarette smoke produced under two machine smoking conditions. *Chem Res Toxicol* 21: 494-502.
4. O'Toole, T.E., Hellmann, J., Wheat, L., Haberzettl, P., Lee, J., Conklin, D.J., Bhatnagar, A., and Pope, C.A., 3rd (2010). Episodic exposure to fine particulate air pollution decreases circulating levels of endothelial progenitor cells. *Circ Res* 107: 200-3.
5. Brook, R.D., Rajagopalan, S., Pope, C.A., 3rd, Brook, J.R., Bhatnagar, A., Diez-Roux, A.V., Holguin, F., Hong, Y., Luepker, R.V., Mittleman, M.A., Peters, A., Siscovick, D., Smith, S.C., Jr., Whitsel, L., and Kaufman, J.D. (2010). Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association. *Circulation* 121: 2331-78.
6. Pope, C.A., 3rd, Burnett, R.T., Krewski, D., Jerrett, M., Shi, Y., Calle, E.E., and Thun, M.J. (2009). Cardiovascular mortality and exposure to airborne fine particulate matter and cigarette smoke: shape of the exposure-response relationship. *Circulation* 120: 941-8.
7. California Environmental Protection Agency (2005). Proposed Identification of Environmental Tobacco Smoke as a Toxic Air Contaminant. Part B: Health Effects.
8. Barnoya, J. and Glantz, S.A. (2005). Cardiovascular effects of secondhand smoke: nearly as large as smoking. *Circulation* 111: 2684-98.
9. Lightwood, J.M. and Glantz, S.A. (2009). Declines in acute myocardial infarction after smoke-free laws and individual risk attributable to secondhand smoke. *Circulation* 120: 1373-9.
10. Celermajer, D.S., Adams, M.R., Clarkson, P., Robinson, J., McCredie, R., Donald, A., and Deanfield, J.E. (1996). Passive smoking and impaired endothelium-dependent arterial dilatation in healthy young adults. *N Engl J Med* 334: 150-4.
11. Celermajer, D.S., Sorensen, K.E., Georgakopoulos, D., Bull, C., Thomas, O., Robinson, J., and Deanfield, J.E. (1993). Cigarette smoking is associated with dose-related and potentially reversible impairment of endothelium-dependent dilation in healthy young adults. *Circulation* 88: 2149-55.
12. Wang, X., Derakhshandeh, R., Narayan, S., Luu, E., Le, S., Danforth, O.M., Rodriguez, H.J., Sievers, R.E., Schick, S.F., Glantz, S.A., and Springer, M.L. (2014). Brief exposure to marijuana secondhand smoke impairs vascular endothelial function (conference abstract). *Circulation* 130: A19538.
13. Mittleman, M.A., Lewis, R.A., Maclure, M., Sherwood, J.B., and Muller, J.E. (2001). Triggering myocardial infarction by marijuana. *Circulation* 103: 2805-9.
14. Jouanjus, E., Lapeyre-Mestre, M., and Micallef, J. (2014). Cannabis use: signal of increasing risk of serious cardiovascular disorders. *Journal of the American Heart Association* 3: e000638.
15. Thomas, G., Kloner, R.A., and Rezkalla, S. (2014). Adverse cardiovascular, cerebrovascular, and peripheral vascular effects of marijuana inhalation: what cardiologists need to know. *Am J Cardiol* 113: 187-90.