Smoking Cessation
Leadership Center

UCSF

University of California
San Francisco

Adverse effects of marijuana smoke exposure on the heart

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April 18, 2023

Moderator

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University of California, San Francisco

A National Center of Excellence for Tobacco-Free Recovery

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Disclosures

This UCSF CME activity was planned and developed to uphold academic standards to ensure balance, independence, objectivity, and scientific rigor; adhere to requirements to protect health information under the Health Insurance Portability and Accountability Act of 1996 (HIPAA); and include a mechanism to inform learners when unapproved or unlabeled uses of therapeutic products or agents are discussed or referenced.

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- For our California residents, SCLC offers regional trainings, online education opportunities, and technical assistance for behavioral health agencies, providers, and the clients they serve throughout the state of California.
- For technical assistance please contact (877) 509-3786 or Jessica.Safier@ucsf.edu.

- CDC Tips Campaign 2023
- Find resources at:

  https://www.cdc.gov/tobacco/campaign/tips/index.html

Littered cigarette butts release toxic chemicals such as nicotine and arsenic into the environment.

In California, cigarette butts make up 34% of total litter collected, and California public agencies spend an excess of $41 million annually on litter cleanup.

Earth Day 2023

This Saturday, April 22

Today's Presenter

Matthew L. Springer, Ph.D.

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University of California, San Francisco

Adverse Effects of Marijuana Smoke Exposure on the Heart

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4/18/2023

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Adverse Effects of Marijuana Smoke Exposure on the Heart and Blood Vessels

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NHLBI, NIDA, CA Tobacco-Related Disease Research Program, CA Dept. of Cannabis Control, Elfenworks Foundation, Roy E. Thomas Medical Foundation, AHA, Flight Attendant Medical Research Institute

"Smokewar" by Rui Zheng, 2013

The Bad Ol' Days

The Bad Ol' Days

Typical day in 2023

Well OK, I Guess I Should Include SOME Stats...

- Smoking causes over 140,000 cardiovascular deaths in the US per year
- Secondhand smoke is estimated to cause ~50,000 US deaths/year, mostly from cardiovascular disease
- Smoking bans in public places lead to reduction in frequency of heart attacks

Matt

SFGATE NEWS SPORTS BUSINESS A&E FOOD LIVING TRAVEL REAL ESTATE CARS

Back to the Future? (Denver, 2014)

Photo: Brennan Linsley / Associated Press

"Partygoers dance and smoke pot April 19, the first of two days of the annual 4/20 marijuana festival in Denver. The 4/20 event was the first one since Colorado legalized recreational marijuana in January."


1/2 mile from UCSF!
0
0.5
1 mile
Show


0
0.5
1 mile
1/2 mile from UCSF!
4/20/2017
Show


0
0.5
1 mile
1/2 mile from UCSF!
4/20/2017
4/20/2018
Show

SF, 2017... REALLY!!!
(the return of a familiar problem)

"NOW SERVING CANNABIS FOR BRUNCH
In S.F., gourmet fare infused with artisanal weed offers medicated spreads to new connoisseurs"
– SF Chronicle 1/22/17

SF, 2017... REALLY!!!

(the return of a familiar problem)

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– SF Chronicle 1/22/17

Problem: General public avoids tobacco SHS but many think marijuana SHS is ok

"There's no nicotine"

"It's natural"

"It's medicinal"

"<u>No one said it ISN'T ok</u>"

Cannabis is not just a drug, it’s a smoke

Marijuana = THC & CBD

Marijuana ≠ THC & CBD

Marijuana = THC & CBD &

Table 4. Various Analytes Including Tobacco-Specific Compounds and Heavy Metals Determined in Sidestream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

	ISO		extreme	
	tobacco	marijuana	tobacco	marijuana
tar (mg/cig)	24.3 ± 1.8	49.7 ± 2.5*	17.2 ± 1.8	30.8 ± 1.6*
NO (μg/cig)	1101 ± 47	2087 ± 152*	1419 ± 124	2631 ± 241*
NOx (μg/cig)	1172 ± 44	2284 ± 229*	1521 ± 153	2880 ± 323*
CO (mg/cig)	61.7 ± 2.0	54.0 ± 3.7*	61.6 ± 2.9	50.6 ± 3.9*
nicotine (mg/cig)	4.77 ± 0.26	0.065 ± 0.018*	3.11 ± 0.23	0.074 ± 0.029*
ammonia (μg/cig)	5568 ± 322	14270 ± 472*	3919 ± 327	10743 ± 675*
HCN (μg/cig)	83.8 ± 7.8	685 ± 29*	103 ± 10	678 ± 72*
NNN	41 ± 4.8	<0.634*	28 ± 2.0	0.634−2.0*
NAT	17.4 ± 1.4	<2.34*	10.2 ± 1.1	<2.34*
NAB	2.71 ± 0.52	<0.793*	0.79−2.5	<0.793
NNK	92 ± 11.7	<4.65*	61 ± 5.1	<4.65*
mercury	8.32 ± 0.57	<4.40*	6.31 ± 0.61	<4.40*
cadmium	478 ± 19	4.0−13.4*	360 ± 20	4.0−13.4*
lead	34.5−115	<34.5	34.5−115	<34.5
chromium	31.0−103	31.0−103	<31.0	31.0−103
nickel	35.5−118	35.5−118	<35.5	<35.5
arsenic	<11.3	<11.3	<11.3	<11.3
selenium	<17.5	<17.5	<17.5	<17.5

[a] Values are provided ± standard deviations. For tar, nicotine, and CO, $n = 20$. For all others, $n = 7$. Units are ng/cigarette unless noted differently. *$P < 0.05$ vs tobacco. Values shown with "<" were below the limit of detection; values shown as a range were above the limit of detection but below the limit of quantitation.

Table 5. Miscellaneous Organics Determined in Mainstream and Sidestream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

	ISO		extreme	
	tobacco	marijuana	tobacco	marijuana
		mainstream		
pyridine	31.1 ± 1.7	34.6 ± 4.3	59 ± 4.9	93.0 ± 8.9*
quinoline	1.31 ± 0.08	1.06 ± 0.26*	2.22 ± 0.22	2.68 ± 0.34*
1,3-butadiene	64.8 ± 2.2	79.5 ± 7.4*	124 ± 7	138 ± 17
isoprene	286 ± 15	74.0 ± 6.5*	540 ± 18	132 ± 19*
acrylonitrile	13 ± 1.2	36.6 ± 4.3*	24 ± 0.9	66.9 ± 9.5*
benzene	62.2 ± 3.5	58.3 ± 5.9	94.6 ± 2.6	84.4 ± 8.9*
toluene	103 ± 6	124 ± 15*	169 ± 3	199 ± 25*
styrene	15 ± 0.6	17.2 ± 2.3*	28.6 ± 2.0	44.7 ± 4.2*
		sidestream		
pyridine	265 ± 11	307 ± 14*	225 ± 9	278 ± 22*
quinoline	9.94 ± 0.92	11.3 ± 0.7*	8.53 ± 0.54	9.82 ± 1.10*
1,3-butadiene	372 ± 12	412 ± 27*	269 ± 13	420 ± 22*
isoprene	1459 ± 82	656 ± 40*	1153 ± 51	614 ± 31*
acrylonitrile	102 ± 4	295 ± 21*	73.8 ± 4.7	273 ± 17*
benzene	290 ± 11	341 ± 12*	203 ± 11	328 ± 18*
toluene	516 ± 20	704 ± 29*	393 ± 32	729 ± 28*
styrene	105 ± 10	162 ± 10*	85.2 ± 10.6	175 ± 9*

[a] Values are provided ± standard deviations; $n = 7$. Units are μg/cigarette. *$P < 0.05$ vs tobacco.

marijuana was ammonia. In marijuana smoke, ammonia was found at levels about 20-fold those in tobacco in mainstream smoke (Table 3) and about 3-fold greater in sidestream smoke (Table 4), although the absolute values were very much greater in sidestream smoke. The amount of ammonia produced during combustion of tobacco has been related to the amount of nitrate fertilizer applied during growth (*30*). The simplest explanation for the very high levels of ammonia found in marijuana smoke may be that the marijuana used for this study contained more nitrate than the tobacco sample. The marijuana plants were grown on soil-less growth medium. All fertilizers were commercially available and consisted of water-soluble hydroponic vegetable fertilizers used for horticulture and contained nitrogen

Table 6. Aromatic Amines Determined in Mainstream and Sidestream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

	ISO		extreme	
	tobacco	marijuana	tobacco	marijuana
		mainstream		
1-aminonaphthalene	24.9 ± 2.6	84.4 ± 13.2*	35.1 ± 5.7	178 ± 17*
2-aminonaphthalene	9.38 ± 0.62	33.6 ± 3.5*	12.9 ± 1.2	66.3 ± 6.8*
3-aminobiphenyl	2.22 ± 0.18	9.15 ± 0.63*	3.68 ± 0.44	18.8 ± 1.8*
4-aminobiphenyl	1.56 ± 0.13	6.17 ± 0.44*	2.54 ± 0.17	13.5 ± 1.5*
		sidestream		
1-aminonaphthalene	195 ± 16	305 ± 21*	144 ± 8	266 ± 23*
2-aminonaphthalene	136 ± 7	177 ± 19*	79.4 ± 7.4	139 ± 12*
3-aminobiphenyl	33 ± 2.1	50.4 ± 3.7*	19.7 ± 1.6	40.6 ± 2.4*
4-aminobiphenyl	23.2 ± 1.8	31.2 ± 2.8*	13.9 ± 1.3	27.3 ± 2.2

[a] Values are provided ± standard deviations; $n = 7$. Units are ng/cigarette. *$P < 0.05$ vs tobacco.

Table 7. Selected Carbonyl Compounds Determined in Mainstream and Sidestream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

	ISO		extreme	
	tobacco	marijuana	tobacco	marijuana
		mainstream		
formaldehyde	200 ± 28	25.1 ± 2.7*	543 ± 91	66.5 ± 11.8*
acetaldehyde	872 ± 101	448 ± 44*	1555 ± 222	1021 ± 99*
acetone	454 ± 44	237 ± 23*	826 ± 93	514 ± 32*
acrolein	125 ± 13	54.3 ± 4.5*	251 ± 32	148 ± 13*
propionaldehyde	72.1 ± 8.1	32.3 ± 3.2*	97.8 ± 14.4	74.0 ± 6.4*
crotonaldehyde	62.9 ± 7.3	23.1 ± 1.5*	127 ± 17	56.7 ± 7.7*
methyl ethyl ketone	135 ± 16	62.4 ± 5.5*	265 ± 27	140 ± 7*
butyraldehyde	47.1 ± 5.7	46.5 ± 3.8	77.1 ± 10.0	110 ± 8*
		sidestream		
formaldehyde	886 ± 47	383 ± 27*	662 ± 29	202 ± 34*
acetaldehyde	1587 ± 45	1170 ± 69*	1383 ± 37	896 ± 112*
acetone	828 ± 22	566 ± 34*	720 ± 22	405 ± 54*
acrolein	437 ± 10	304 ± 20*	316 ± 12	179 ± 24*
propionaldehyde	121 ± 6	120 ± 6	116 ± 5	93.4 ± 11.7*
crotonaldehyde	106 ± 3	49.9 ± 3.8*	97.5 ± 8.7	42.9 ± 4.7*
methyl ethyl ketone	222 ± 9	160 ± 11*	202 ± 17	116 ± 13*
butyraldehyde	67.1 ± 2.7	173 ± 12*	60.2 ± 1.7	139 ± 13*

[a] Values are provided ± standard deviations; $n = 7$. Units are μg/cigarette. *$P < 0.05$ vs tobacco.

in the form of both nitrate and ammoniacal nitrogen. However, it is not known to what extent the differences in the growing conditions between the marijuana and the tobacco, including the types of fertilizers used, influenced the levels of nitrates in the plants. The temperature of combustion can also influence the production of ammonia. Burning tobacco results in a reduction of nitrate to ammonia, which is released to a greater extent during sidestream smoke formation (*31*), suggesting that lower combustion temperatures favor the production of ammonia. Combustion temperature differences between marijuana and tobacco may have also contributed to the differences in ammonia yield, but this was not verified.

Tobacco-specific nitrosamines were not found in the marijuana smoke (Tables 3 and 4). This result was expected, given that these compounds are derived from nicotine. Arsenic and lead were also noticeably absent from the marijuana smoke, which is consistent with the certificate of analysis provided with the plant material (data not shown). Again, this could be a function of the relatively controlled growth conditions.

NO and NO_x were significantly elevated in the marijuana smoke under both smoking regimes and in mainstream (Table 3) and sidestream smoke (Table 4). A logical explanation would be that these are arising from the nitrate present in the fertilizer and would be consistent with the very high ammonia yields.

Table 9. PAHs and Aza-arenes Determined in Mainstream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

		ISO		extreme	
no.		tobacco	marijuana	tobacco	marijuana
1	naphthalene	2907 ± 159	2070 ± 290*	4908 ± 456	4459 ± 646
2	1-methylnaphthalene	2789 ± 176	2057 ± 302*	4888 ± 491	4409 ± 604
3	2-methylnaphthalene	2093 ± 137	1292 ± 189*	3666 ± 374	2917 ± 477*
4	acenaphthylene	385 ± 22	235 ± 31*	711 ± 51	459 ± 60*
5	acenaphthene	172 ± 10	91.2 ± 10.2*	309 ± 22	213 ± 48*
6	fluorene	769 ± 42	366 ± 37*	1369 ± 100	659 ± 64*
7	phenanthrene	293 ± 14	273 ± 23	515 ± 32	476 ± 45
8	anthracene	91.8 ± 5.4	70.9 ± 6.7*	162 ± 13	136 ± 9*
9	fluoranthene	96.8 ± 3.7	65.6 ± 6.5*	171 ± 11	117 ± 12*
10	pyrene	88.8 ± 4.3	45.6 ± 4.4*	154 ± 12	82.3 ± 11.2*
11	benzo(a)anthracene	30.5 ± 2.5	26.2 ± 3.4*	52 ± 5.8	43.1 ± 7.9*
12	chrysene	38.8 ± 2.3	26.2 ± 1.4*	61.7 ± 7.4	56.3 ± 7.9
13	benzo(b)fluoranthene	10.8 ± 0.6	7.18 ± 1.12*	21.9 ± 3.1	16.2 ± 3.6*
14	benzo(k)fluoranthene	3.42 ± 0.32	1.52 ± 0.26*	7.45 ± 1.47	4.54 ± 0.96*
15	benzo(e)pyrene	11 ± 0.6	6.15 ± 0.37*	19.2 ± 1.3	12.6 ± 2.7*
16	benzo(a)pyrene	14.3 ± 1.2	8.67 ± 1.12*	25.1 ± 2.5	15.5 ± 2.9*
17	perylene	3.9 ± 0.46	3.72 ± 0.79	10.8 ± 2.3	6.10 ± 0.82*
18	indeno(1,2,3,-cd)pyrene	4.58 ± 0.89	3.60 ± 0.48*	10.1 ± 0.9	8.65 ± 3.11
19	dibenz(a,h)anthracene	1.15 ± 0.21	1.41 ± 0.19*	4.84 ± 1.05	2.83 ± 0.59*
20	benzo(g,h,i)perylene	3.77 ± 0.66	2.56 ± 0.36*	7.17 ± 1.02	6.03 ± 2.34
21	5-methylchrysene	<0.035	<0.035	<0.071	<0.071
22	benzo(b)fluoranthene	11.5 ± 1.4	6.47 ± 0.86*	19.1 ± 1.7	17.6 ± 1.4
23	benzo(j)fluoranthene	5.81 ± 0.44	4.27 ± 0.83*	13.3 ± 1.8	12.2 ± 2.1
24	dibenz(a,h)acridine	<0.314	<0.314	<0.628	<0.628
25	dibenz(a,j)acridine	<0.260	<0.260	<0.519	<0.519
26	7*H*-dibenzo(c,g)carbazole	<0.139	<0.139	<0.278	<0.278
27	dibenz(a,l)pyrene	<0.317	<0.317	<0.634	<0.634
28	dibenz(a,e)pyrene	0.531 ± 0.198	0.156−0.522	<0.313	<0.313
29	dibenz(a,i)pyrene	0.987 ± 0.145	0.164−0.548*	2.55 ± 0.60	<0.329*
30	dibenz(a,h)pyrene	0.177−0.589	<0.177	<0.354	<0.354

[a] Values are provided ± standard deviations; $n = 7$. Units are ng/cigarette. *$P < 0.05$ vs tobacco. Values shown with "<" were below the limit of detection; values shown as a range were above the limit of detection but below the limit of quantitation.

Table 10. PAHs and Aza-arenes Determined in Sidestream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

		ISO		extreme	
no.		tobacco	marijuana	tobacco	marijuana
1	naphthalene	6861 ± 419	16748 ± 2396*	10111 ± 758	14398 ± 2614*
2	1-methylnaphthalene	6265 ± 365	14812 ± 1511*	7115 ± 787	11016 ± 2954*
3	2-methylnaphthalene	6513 ± 306	11832 ± 1078*	7137 ± 778	9030 ± 2236
4	acenaphthylene	2684 ± 184	4056 ± 452*	2171 ± 123	2876 ± 571*
5	acenaphthene	960 ± 31	1345 ± 101*	791 ± 51	873 ± 163
6	fluorene	1429 ± 71	1073 ± 72*	1242 ± 56	873 ± 67*
7	phenanthrene	2818 ± 112	4932 ± 306*	2117 ± 98	3113 ± 477*
8	anthracene	755 ± 38	1135 ± 75*	542 ± 26	693 ± 111*
9	fluoranthene	699 ± 26	952 ± 61*	520 ± 24	619 ± 78*
10	pyrene	528 ± 35	609 ± 60*	377 ± 25	398 ± 38
11	benzo(a)anthracene	159 ± 8	245 ± 16*	113 ± 7	170 ± 21*
12	chrysene	401 ± 21	488 ± 28*	291 ± 18	331 ± 27*
13	benzo(b)fluoranthene	98.4 ± 8.4	114 ± 7*	79.8 ± 4.3	80.3 ± 8.0
14	benzo(k)fluoranthene	25.8 ± 4.1	27.3 ± 2.8	19.3 ± 3.1	19.7 ± 2.2
15	benzo(e)pyrene	94.9 ± 6.9	87.9 ± 7.5	72.9 ± 3.8	63.1 ± 6.2*
16	benzo(a)pyrene	91.7 ± 7.1	101 ± 9*	62.7 ± 4.2	69.7 ± 6.3*
17	perylene	23.6 ± 2.9	26.4 ± 4.7	16.4 ± 1.7	19.9 ± 2.7*
18	indeno(1,2,3,-cd)pyrene	41.7 ± 5.7	45.9 ± 6.8	32.8 ± 6.6	27.4 ± 3.3
19	dibenz(a,h)anthracene	13.8 ± 3.1	15.6 ± 3.2	13.9 ± 2.8	10.8 ± 1.2*
20	benzo(g,h,i)perylene	44.7 ± 8.0	41.8 ± 9.6	32.8 ± 7.2	30 ± 5.0
21	5-methylchrysene	<0.354	<0.354	<0.354	<0.354
22	benzo(b)fluoranthene	118 ± 9	102 ± 11*	90.4 ± 5.6	86.7 ± 12.5
23	benzo(j)fluoranthene	102 ± 7	120 ± 16*	72.3 ± 6.2	124 ± 14*
24	dibenz(a,h)acridine	<3.138	<3.138	<3.138	<3.138
25	dibenz(a,j)acridine	<2.597	<2.597	<2.597	<2.597
26	7*H*-dibenzo(c,g)carbazole	<1.389	<1.389	<1.389	<1.389
27	dibenz(a,l)pyrene	<3.172	<3.172	<3.172	<3.172
28	dibenz(a,e)pyrene	<1.565	<1.565	<1.565	<1.565
29	dibenz(a,i)pyrene	<1.644	<1.644	<1.644	<1.644
30	dibenz(a,h)pyrene	<1.768	<1.768	<1.768	<1.768

[a] Values are provided ± standard deviations; $n = 7$. Units are ng/cigarette. *$P < 0.05$ vs tobacco. Values shown with "<" were below the limit of detection.

Dried plant smoke: similar chemicals in varied proportions

Sample comparisons of components of tobacco and marijuana secondhand smoke

	tobacco	marijuana
tar (mg/cig)	24.3 ± 1.8	49.7 ± 2.5*
NO (µg/cig)	1101 ± 47	2087 ± 152*
CO (mg/cig)	61.7 ± 2.0	54.0 ± 3.7*
nicotine (mg/cig)	4.77 ± 0.26	0.065 ± 0.018*
ammonia (µg/cig)	5568 ± 322	14270 ± 472*
HCN (µg/cig)	83.8 ± 7.8	685 ± 29*
pyridine (µg/cig)	265 ± 11	307 ± 14*
benzene (µg/cig)	290 ± 11	341 ± 12*
toluene (µg/cig)	516 ± 20	704 ± 29*
styrene (µg/cig)	105 ± 10	162 ± 10*

	tobacco	marijuana
naphthalene (ng/cig)	6861 ± 419	16748 ± 2396*
formaldehyde (µg/cig)	888 ± 47	383 ± 27*
acetaldehyde (µg/cig)	1587 ± 45	1170 ± 69*
acrolein (µg/cig)	437 ± 10	304 ± 20*
methyl ethyl ketone (µg/cig)	222 ± 9	160 ± 11*
phenol (µg/cig)	264 ± 13	260 ± 11
m + *p*-cresols (µg/cig)	64.6 ± 2.5	104 ± 6*
pyrene (ng/cig)	528 ± 35	609 ± 60*
benzo(e)pyrene (ng/cig)	94.9 ± 6.9	87.9 ± 7.5
anthracene (ng/cig)	755 ± 38	1135 ± 75*

From Moir *et al.*, 2008. Subset of 65 components analyzed under standard tobacco smoking conditions

Inhaling a whole chemistry lab...

Acute and long-term cardiovascular risk is unclear

Risk of MI goes up ~5-fold in the hour after marijuana use (Mittleman, 2001)

Mortality from MI may or may not increase in marijuana users (Mukamal, 2008; Frost, 2013)

No clear correlation between long-term marijuana use and cardiovascular disease later in life (e.g., Reis, 2017 CARDIA study)

…but, increased MI, heart failure, stroke reported for marijuana users relative to non-users (e.g., Kalla et al., Chami et al., 2017 ACC conference)

Public Release

Health Effects of Cannabis and Cannabinoids

Current State of Evidence and Recommendations for Research

This report will be available to download as a free pdf: **Nationalacademies.org/CannabisHealthEffects**

The National Academies of
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Acute and long-term cardiovascular risk of active cannabis use in humans?

NASEM report 2017: inconclusive evidence of harmful human cardiovascular effects, but then…

AHA Scientific Statement (Page et al., 2020) reported 18 "seminal human studies" in or after 2016, 11 of which showed adverse effects including increased:

- cardiac death rates
- systolic blood pressure
- vascular calcification
- prediabetes
- myocardial infarction
- stroke/TIA
- heart failure
- (higher MI incidence, lower mortality rate 🤔)

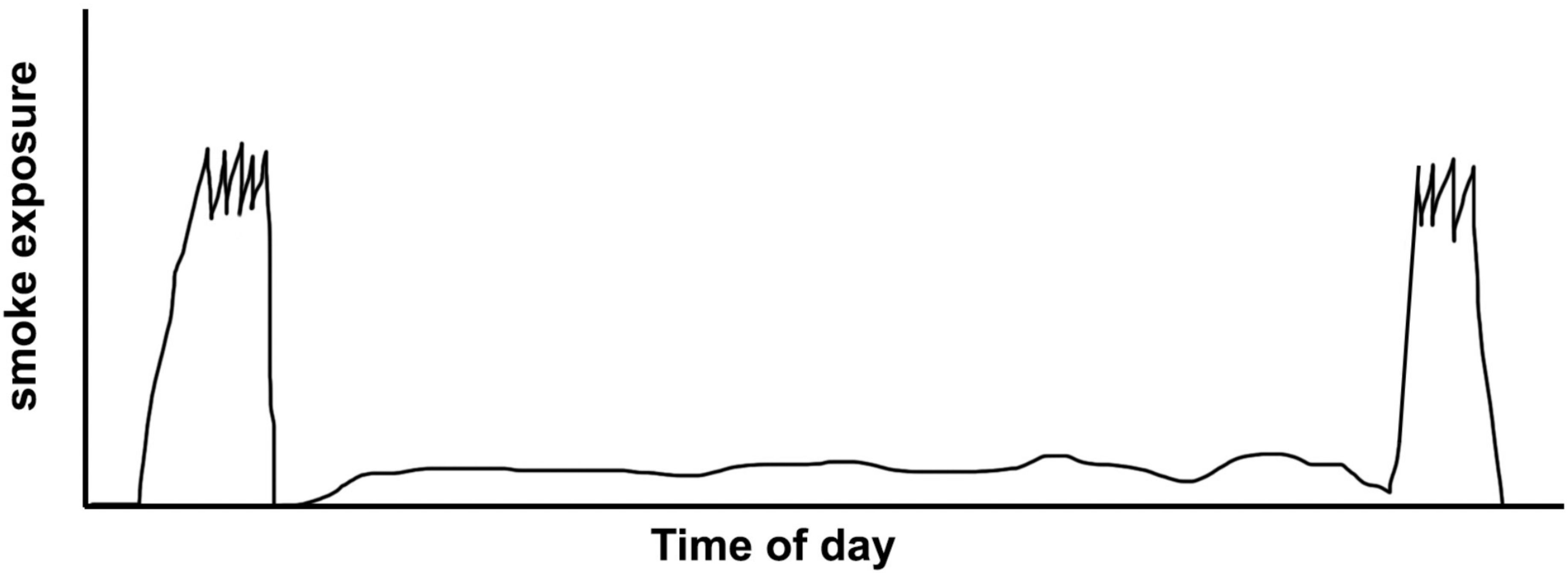
Is secondhand smoke from marijuana really an issue?

Wilson et al., Pediatrics, 2018:

~Half of children of parents in a Colorado smoking cessation study showed evidence of marijuana exposure, correlating with parental smoking of marijuana in the home

For cardiovascular effects, exposure duration may be more important than cumulative exposure level

"Our employees are all smokers, so it doesn't matter if they get exposed to secondhand smoke, right?"



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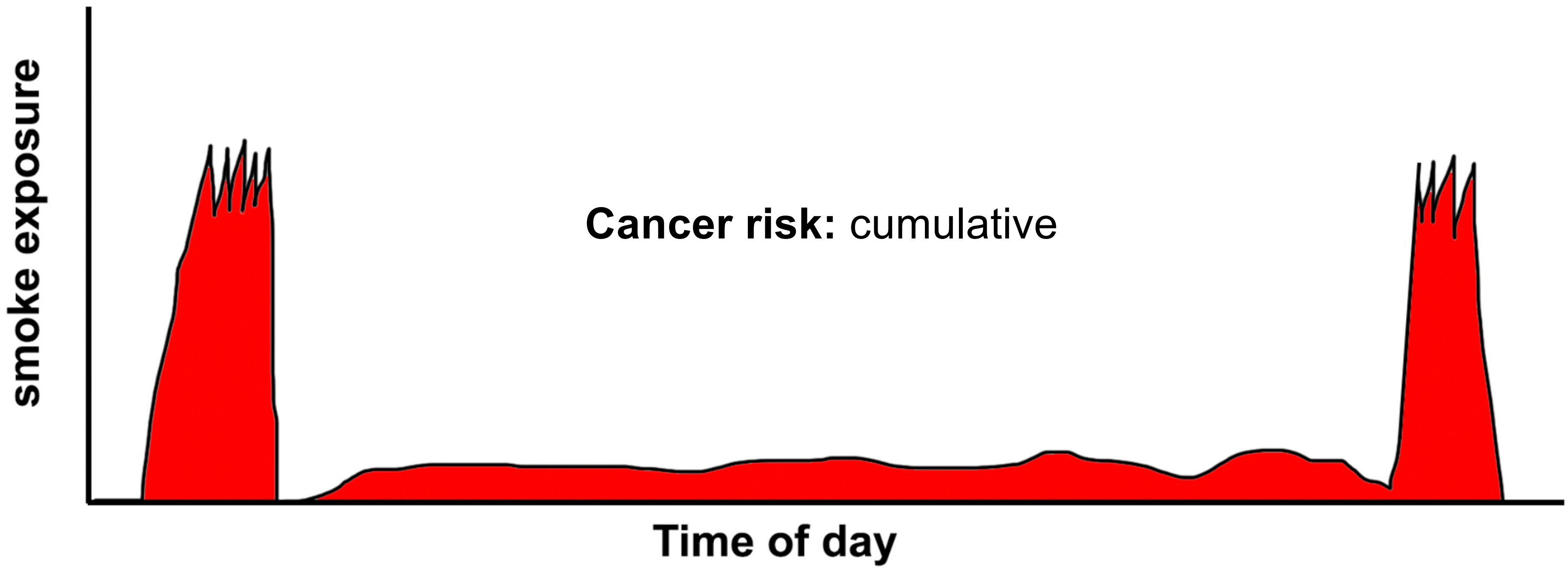

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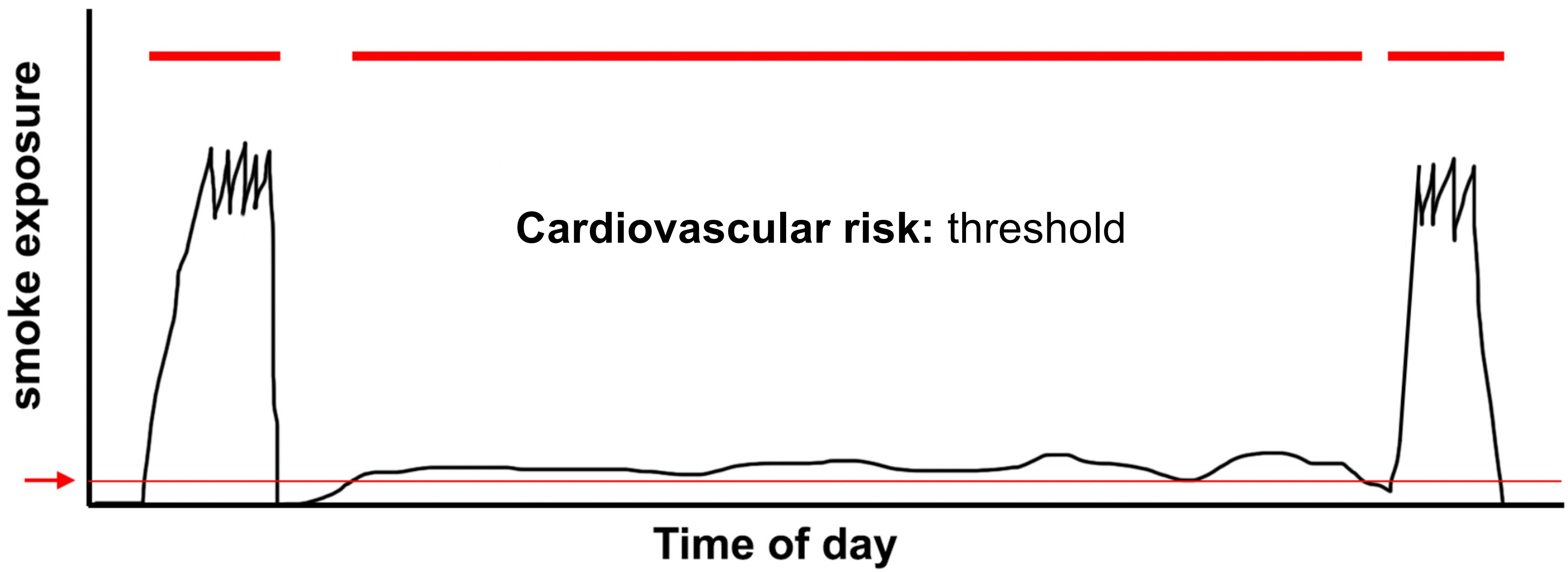


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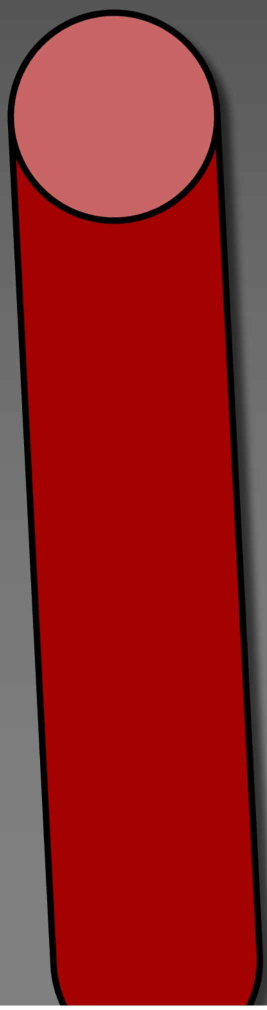
Tobacco smoking and secondhand smoke exposure impairs ability of arteries to *vasodilate* when they need to pass more blood

Vasodilation: Arteries grow in diameter when necessary

"Flow-Mediated Dilation" (FMD) of the artery



Brachial artery FMD gets lower with increasing cardiovascular risk factors

Dilation of coronary arteries in response to increased coronary blood flow gets lower with increasing cardiovascular risk factors
(Nabel, Selwyn, and Ganz, 1990)

Improves FMD:
Dark chocolate, green tea, red wine, *etc*.

Impairs FMD:
Age, smoking, secondhand smoke, *etc*.

Cigarette smoking is associated with dose-related and potentially reversible impairment of endothelium-dependent dilation in healthy young adults

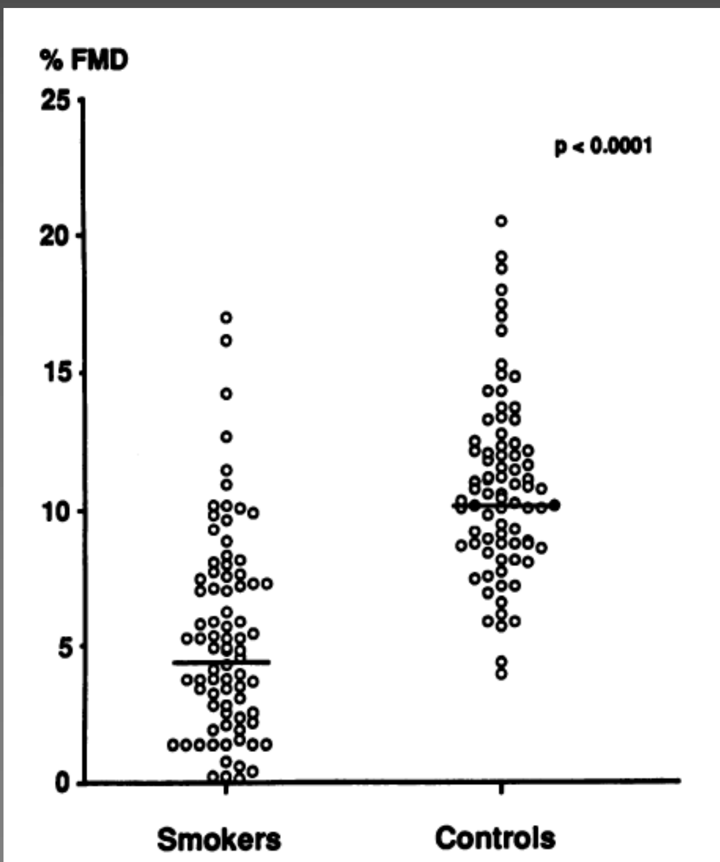
DS Celermajer, KE Sorensen, D Georgakopoulos, C Bull, O Thomas, J Robinson and JE Deanfield

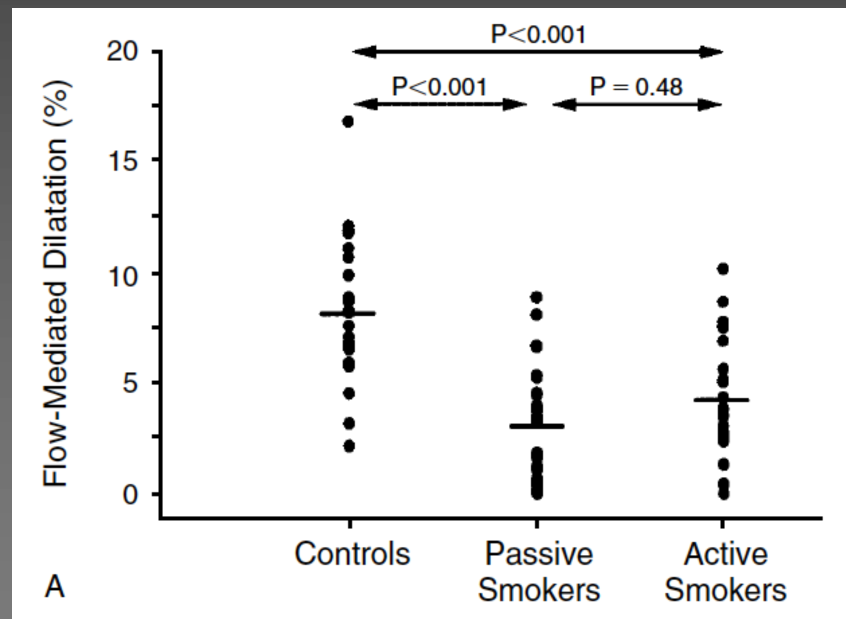
Circulation 1993;88;2149-2155

150 THE NEW ENGLAND JOURNAL OF MEDICINE Jan. 18, 1996

PASSIVE SMOKING AND IMPAIRED ENDOTHELIUM-DEPENDENT ARTERIAL DILATATION IN HEALTHY YOUNG ADULTS

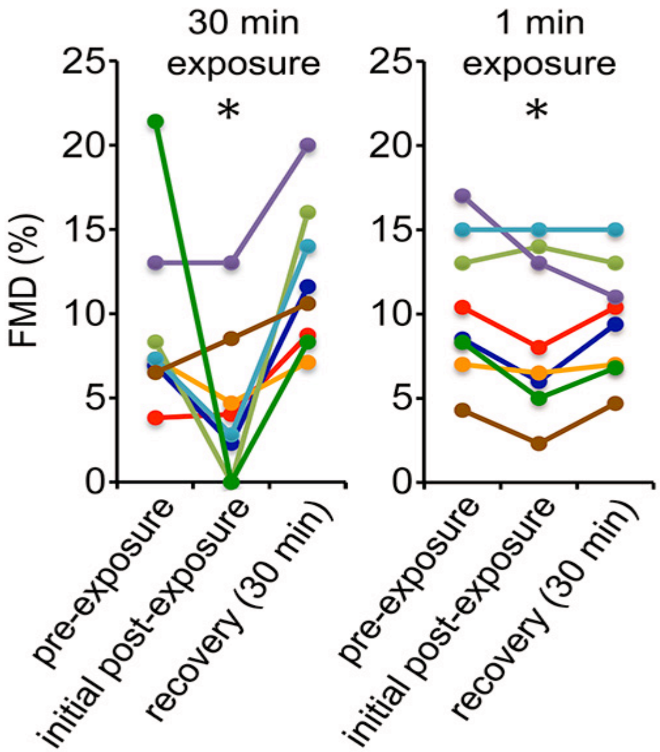
DAVID S. CELERMAJER, PH.D., MARK R. ADAMS, M.B., B.S., PETER CLARKSON, M.B., B.S., JACQUI ROBINSON, R.N., ROBYN MCCREDIE, B.SC., ANN DONALD, AND JOHN E. DEANFIELD, M.B., CH.B.





Several years of secondhand smoke exposure impairs FMD

1 minute of SHS exposure was enough to impair vascular endothelial function



n=8 for all groups

*P<.01 impairment vs. mean of pre-exposure and recovery

Pinnamaneni et al., 2014, Nicotine Tob. Res. 16:584-590

DEA Registration Form 225A: Schedules

https www.deadiversion.usdoj.gov/webforms/feeExemptionDetail.do

Matt Khach-22 Lab Quake talks Blog CNN KCBS BigCharts Weather Pandora UCSF UCSF directory HBS N-Judah UC Maps

DEA Registration Form 225A: Schedules

U.S. Department of Justice Drug Enforcement Administration

Office of Diversion Control

HELP

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General Instructions.

2. Business Activity/Schedules

Your business activity is: RESEARCHER (I)

Please make any requested changes to your registered schedules below, and select Next to continue.

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☐ **Check here if you require order forms to only purchase Schedule I and II from suppliers.**

Fields with a (*) are required.

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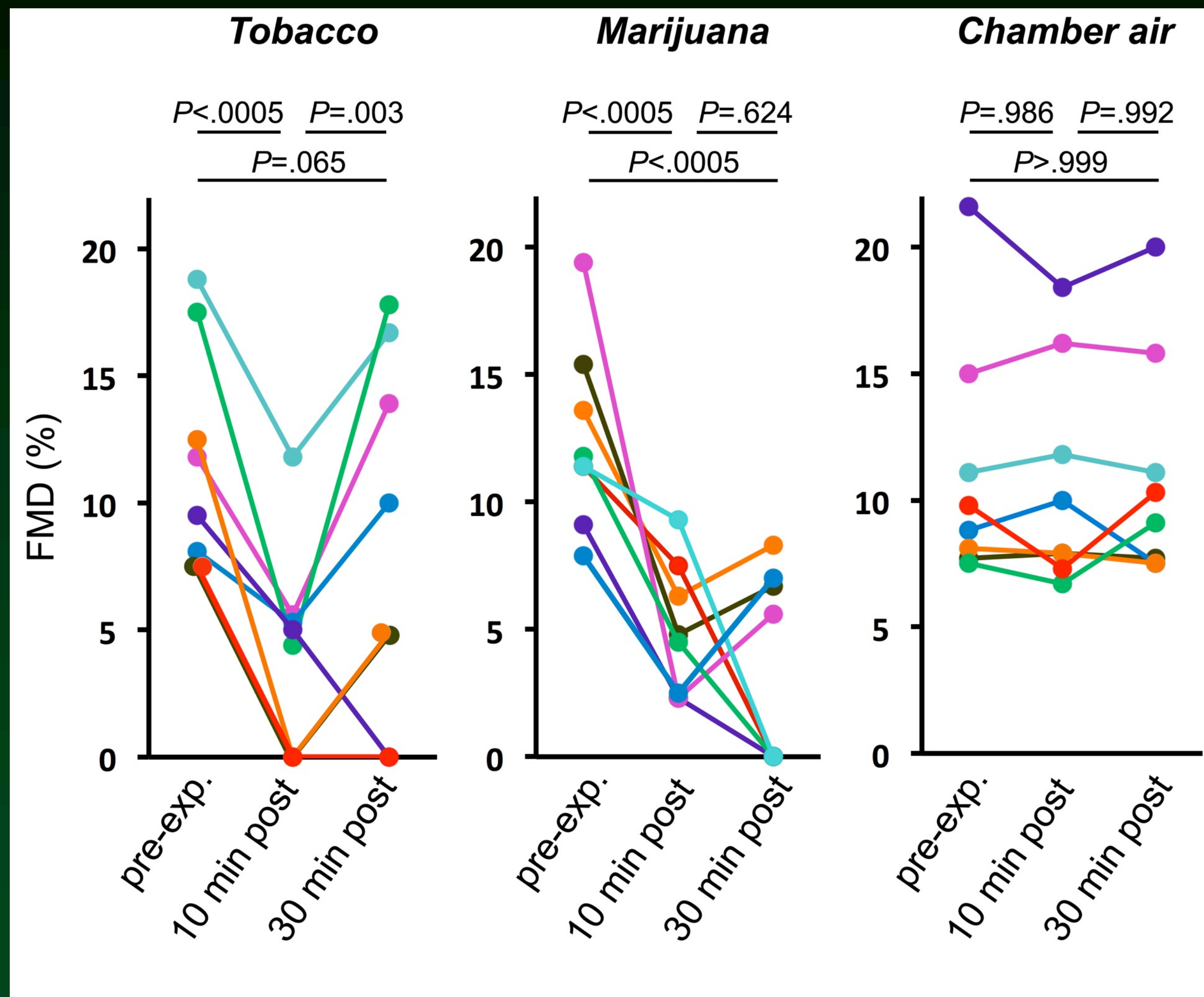
Impairment from <u>one minute</u> of marijuana SHS persists longer than impairment from tobacco SHS



~670 μg/m³ particles (PM2.5)

Wang et al., 2016, J Am Heart Assoc 5:e003858

Marijuana SHS for one minute substantially impairs vascular endothelial function in rats.

Neither THC nor paper smoke are required for marijuana SHS to impair vascular function.

...nicotine is not required for impairment of vascular function by smoke.

One minute of marijuana SHS exposure impairs vascular function for at least 90 minutes, longer than impairment from tobacco SHS.

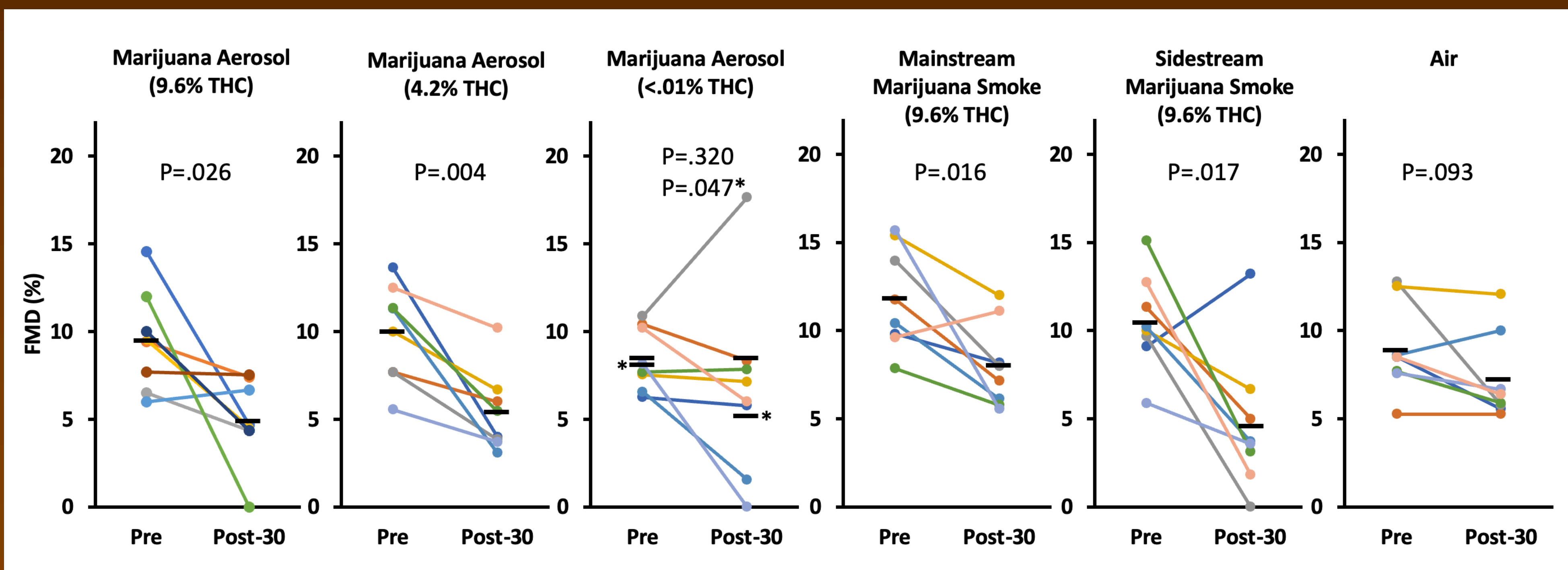
Public exposure to secondhand smoke should be avoided whether the source is tobacco or marijuana.

Is FMD impaired by *Volcano* vaporizer cannabis aerosol?

FMD is impaired by *Volcano* marijuana leaf vaporizer aerosol

(presented at AHA 2019; paper in prep)

Pulsatile exposure:
5s 1x/min for 5 min



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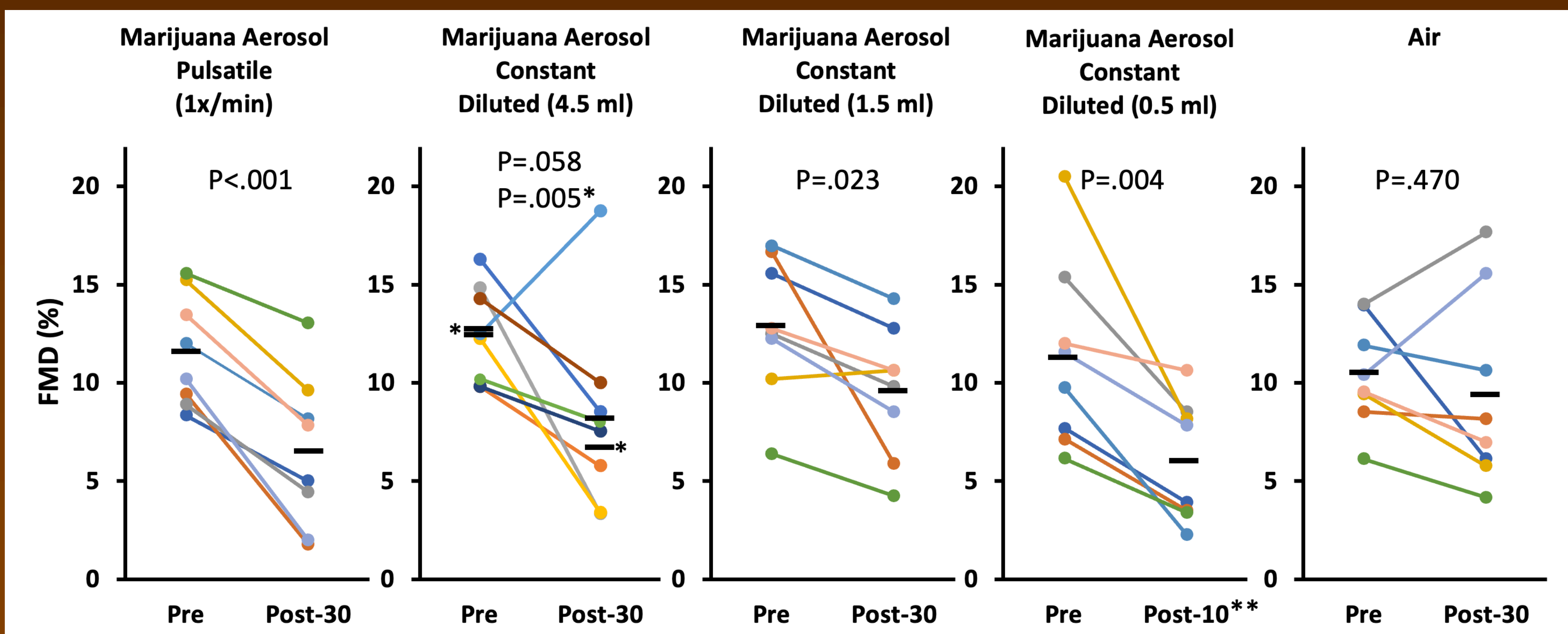
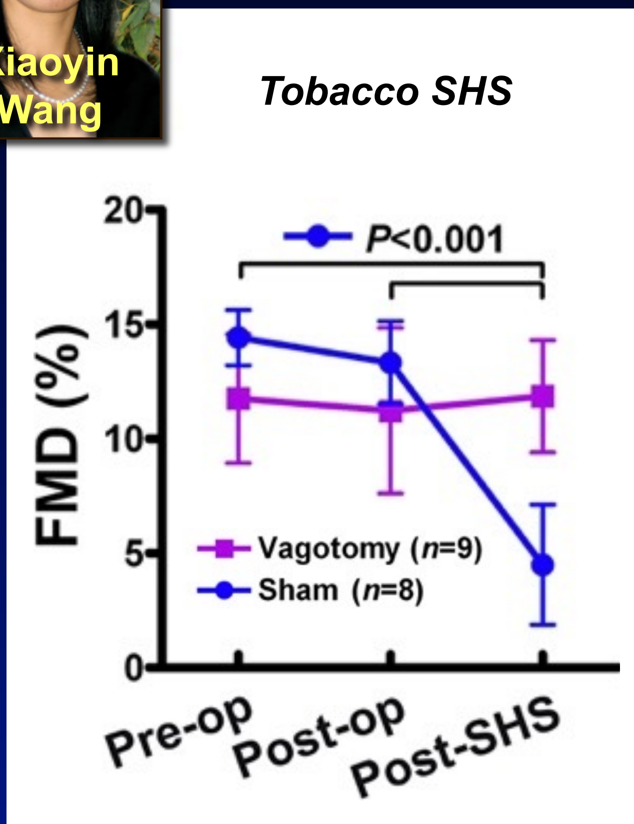


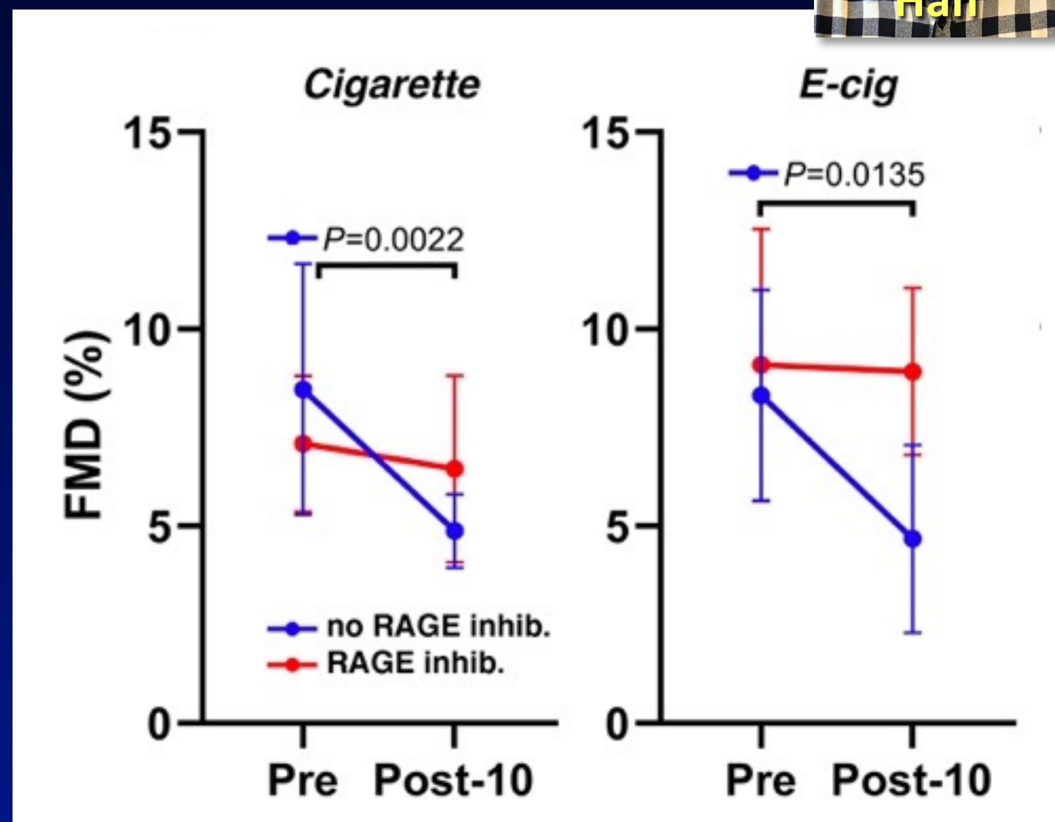
What impairs FMD?

Tobacco smoke (cigarette)	yes
Tobacco smoke (cigar)	yes
Marijuana smoke	yes
Tobacco leaf vaporizer (IQOS) aerosol	yes
Marijuana leaf vaporizer aerosol	yes
E-cig aerosol (PG/VG + freebase nicotine)	yes
E-cig aerosol (JUUL: PG/VG + nicotine salts)	yes
E-cig aerosol (PG/VG no nicotine)	yes
Acrolein or acetaldehyde gas	yes
Inert carbon particles	yes
Water vapor	no
Air	no

Impairment of endothelial function involves the vagus nerve and the RAGE pathway

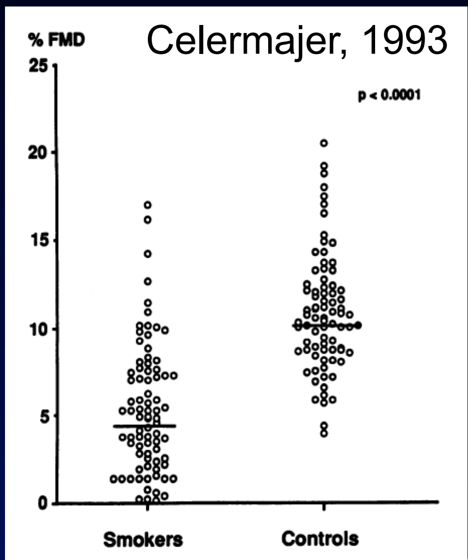


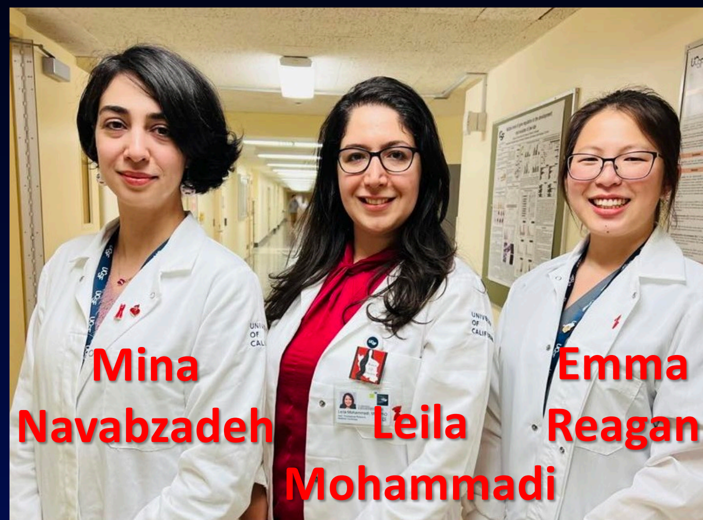
in Nabavizadeh et al., 2022, *ATVB 42:1324-1332*



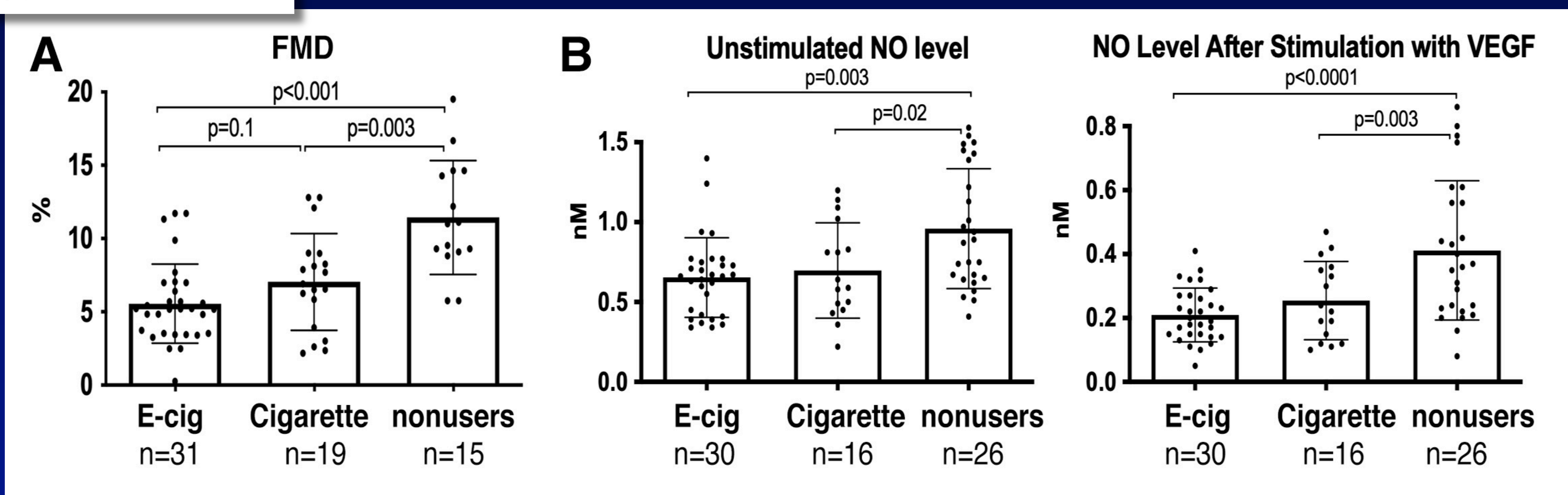
Han et al., submitted

Impairment of endothelial function from chronic smoking or vaping in humans

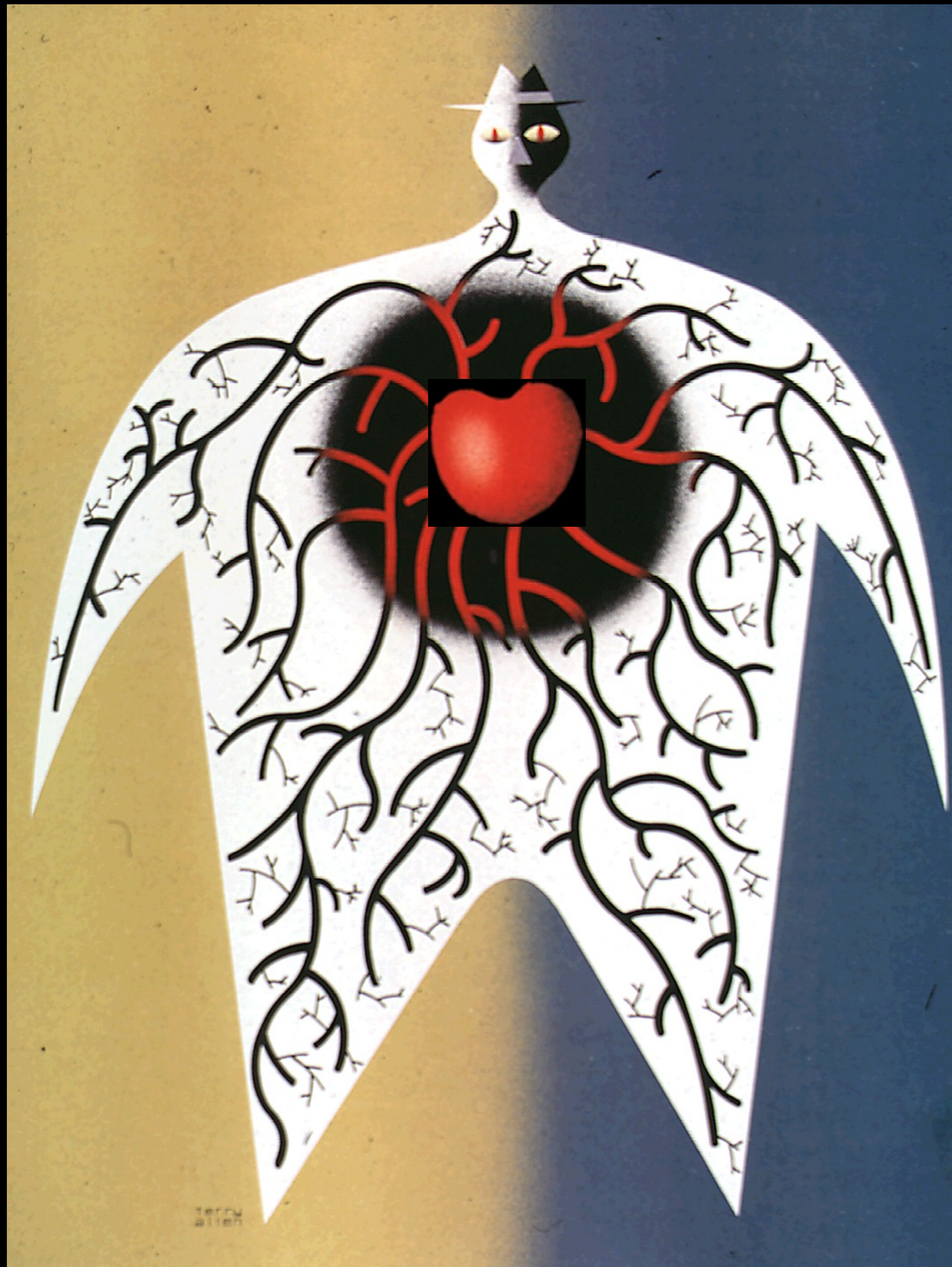




Ok, and how about marijuana???... 😉



Mohammadi et al., 2022, ATVB 42:1333-1350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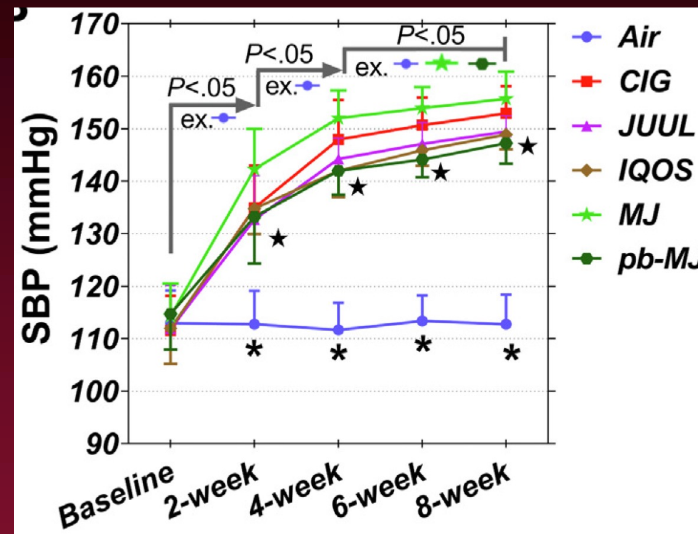
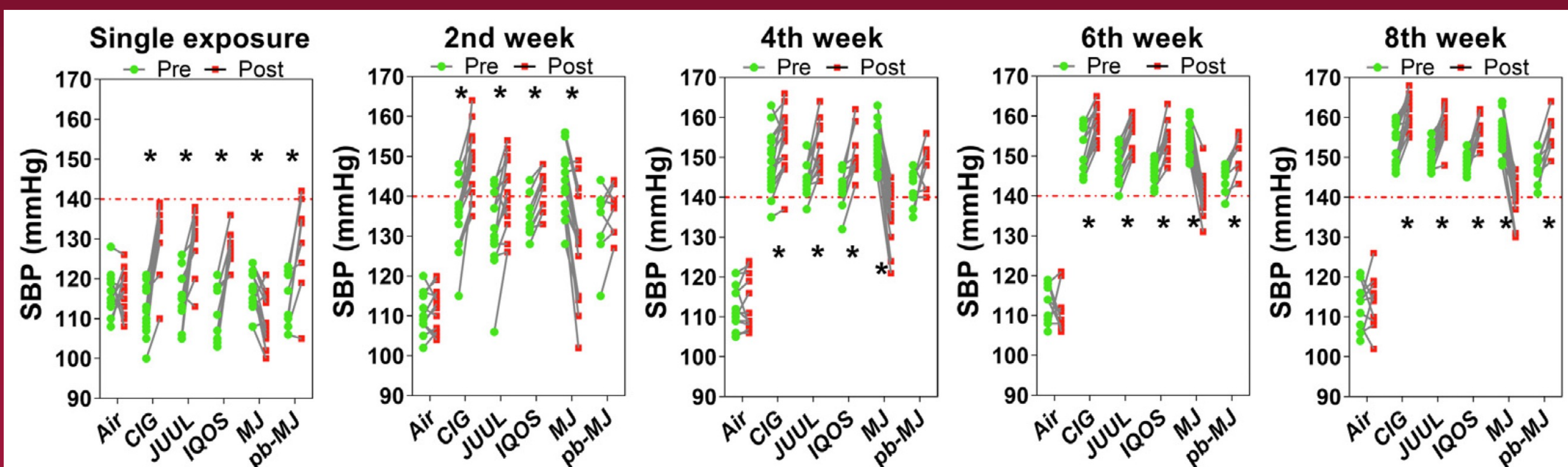
Adverse Effects of Tobacco Products and Marijuana on Blood Pressure and the Heart

(Qiu et al., 2023, Heart Rhythm, 20:76-86)

Pulsatile exposure:
2s 1s/min for 5 min,
5 days/week, 8 weeks





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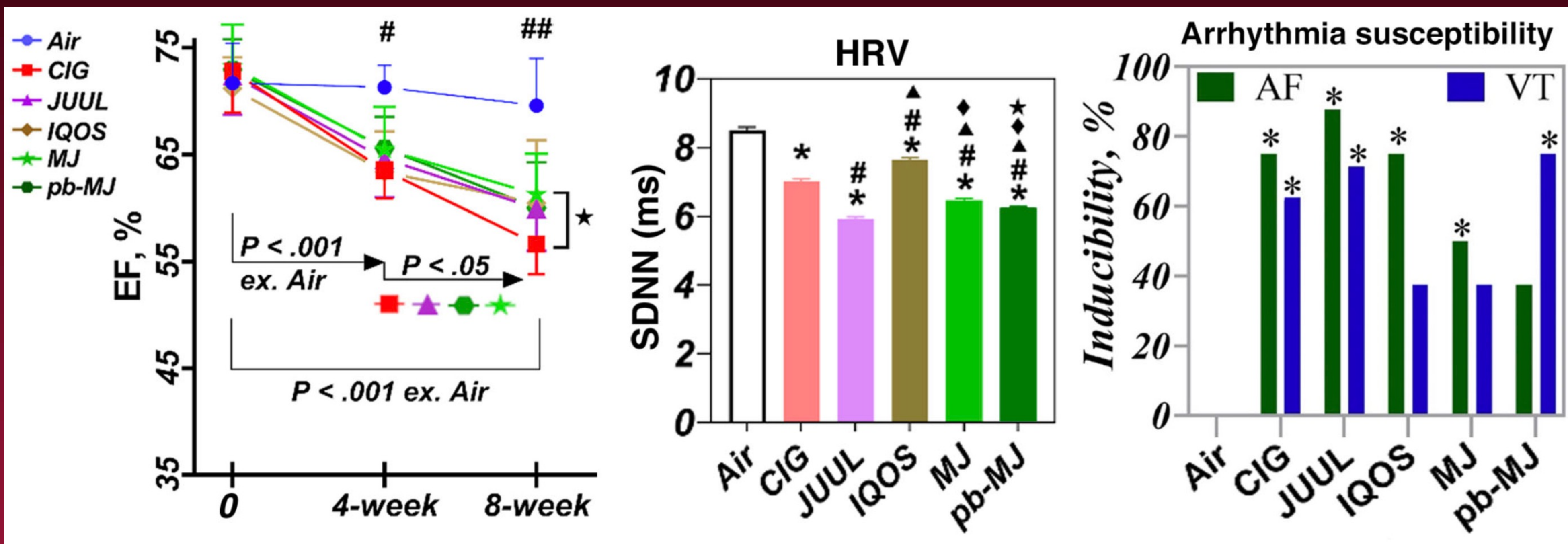

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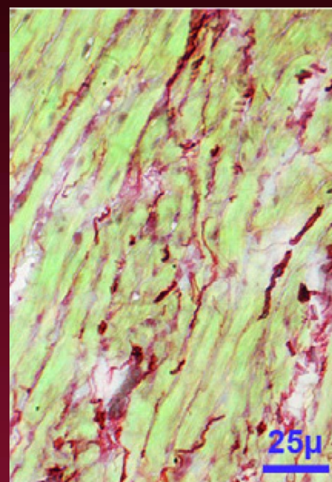

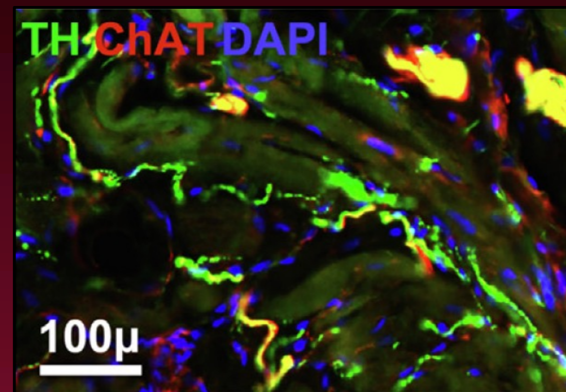

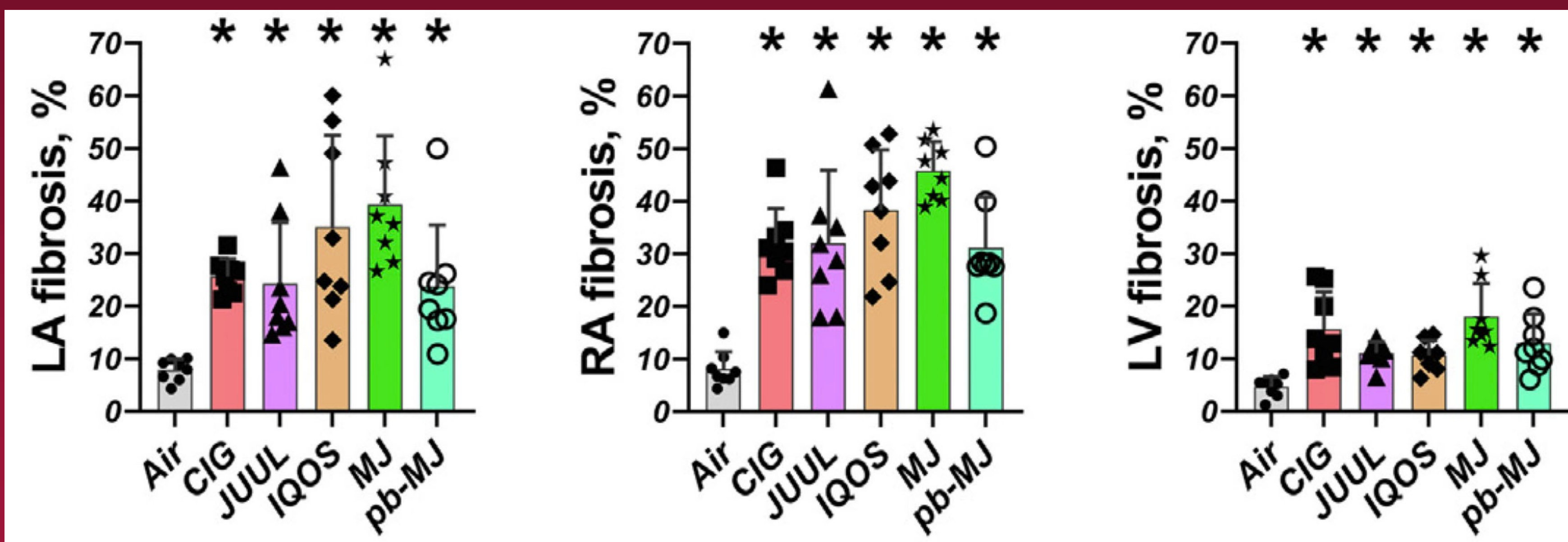

Summary

Marijuana is not just a drug, it’s a source of smoke

FMD in rats is impaired by tobacco smoke, e-cig aerosol, marijuana smoke, and marijuana vaporizer aerosol

FMD in humans is impaired by tobacco smoke, e-cig aerosol, and... (stay tuned)

Tobacco SHS impairs FMD in humans and rats; marijuana SHS and secondhand vaporizer aerosol impairs FMD in rats

FMD impairment from smoke is not dependent on a specific chemical

8 weeks of 1x daily tobacco or cannabis smoking/vaping in rats decreased cardiac function and heart rate variability; and increased BP, fibrosis, and susceptibility to arrhythmia

Submit questions via the **‘Q & A’ box**

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For technical assistance please contact (877) 509-3786 or Jessica.Safier@ucsf.edu.

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  - ✓ Other resources as needed

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SCLC next live webinar will be co-hosted with NBHN on ***Peer Support in Tobacco Cessation and Recovery*** on

- **Monday, May 22, 2023**
- **3:00 pm – 4:00 pm EDT**

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