Patients Undergoing Interventions for Intermittent Claudication in States that Increased Cigarette Tax Are Less Likely to Actively Smoke

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OBJECTIVES

- Active smoking in patients undergoing interventions for intermittent claudication (IC) is associated with poor outcomes
- Therefore, according to Society for Vascular Surgery guidelines, interventions for IC should only be offered after patients quit smoking

Recommendations: Medical treatment for intermittent claudication (IC)

		Grade	Level of evidence
4.1.	We recommend multidisciplinary comprehensive smoking cessation interventions for patients with IC (repeatedly until tobacco use has stopped).	1	A

- However, the prevalence of active smoking at the time of interventions remains high

Figure. Prevalence of Active Smoking at Time of IC Interventions in New England (Levin SR, *J Vasc Surg*, 2019)

Prior/Never smoking 58%
Active smoking 42%
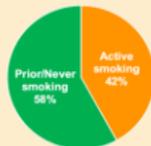
- In the general U.S. population, state cigarette taxes and to a more variable extent state smoke-free air laws, e.g. workplace smoking bans, have had promising effects on smoking prevalence
- However, impact of these population-level strategies on smoking prevalence in patients with IC is unknown
- **Study Aim:** Determine whether state cigarette tax and smoke-free legislation reduce active smoking among patients undergoing interventions for IC

METHODS

Study Design:
- Quasi-experimental study

Database:
- Vascular Quality Initiative (VQI) 2011-2019
- State-level IC intervention data from >600 academic/non-academic medical centers

METHODS

State/Patient Selection:
- Patients undergoing open or endovascular interventions for IC
- As per VQI policy, included patients in states with ≥ 3 participating medical centers

59,847 patients undergoing open surgical bypass or endovascular interventions for IC in 25 states

Exposures:
- State cigarette taxes identified in Centers for Disease Control Tax Burden on Tobacco database (adjusted for inflation using the National Consumer Price Index)
- Implementation of smoke-free workplace state legislation (identified in American Nonsmokers' Rights Foundation database)
  - Policies linked to patients based on the state and month/year in which they underwent interventions

Outcome:
- Active perioperative smoking
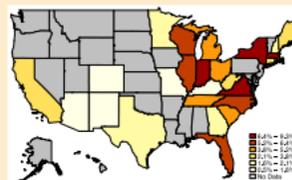 - Dichotomous measure based on patient self-report

Statistical Analysis:
- Difference-in-differences (DID)
  - Technique in economics implemented to estimate the causal effects of tobacco policies on active smoking
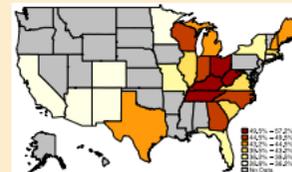
RESULTS

% Total Sample by State
- Most patients in the sample were concentrated on the East coast and Midwest


Mean Active Smoking Prevalence by State
- The active smoking prevalence by state varied from 27% in California to 57% in West Virginia
- Across the study period, active smoking decreased from 48% to 40%

% Tax Change by State Across Study Period
- Eight states increased cigarette taxes by 73% on average adjusted for inflation (ranging from 8% in New Mexico to 182% in California), while the remainder decreased taxes by 13% on average (ranging from -6% in Arizona to -17% in Minnesota)
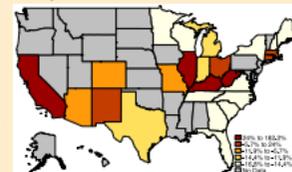
100% Smoke-Free Workplace Legislation Implementation by December 2019
- The number of states implementing smoke-free workplace legislation increased from 9 to 14 states by the end of the study period
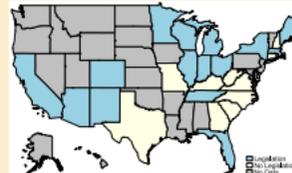
RESULTS

DID Analysis: Change in Active Smoking Associated with State Tobacco Control Policies

	Actively Smoked, %	Model 1[a] Change, Percentage Points[c]	Model 1[a] 95% CI, Percentage Points	P-value	Model 2[b] Change, Percentage Points	Model 2[b] 95% CI, Percentage Points	P-value
All Patients	42.6						
Cigarette tax ($1.00 increase)		-5.9	-10.3 to -1.5	.009	-5.5	-10 to -1	.02
100% smoke-free workplace law implementation		-0.8	-4.3 to 2.8	.7	1.1	-1.7 to 3.8	.5

Variables in bold type are statistically significant (p<.05). Standard errors clustered by state.
CI = Confidence interval.
[a] Adjusted for state and year.
[b] Adjusted for age, gender, race, insurance, COPD, diabetes, and prior year.
[c] Measures the absolute difference in percentages of patients actively smoking before and after the policy.

- Adjusting for state/year (Model 1), every $1.00 cigarette tax increase was associated with a ~6-percentage point decrease in active smoking, representing a 12% relative reduction in the proportion of patients actively smoking compared to a 48% baseline prevalence.
- In contrast, implementation of smoke-free workplace legislation was not significantly associated with a change in active smoking.
- After further adjustment for patient characteristics (Model 2), we observed similar results

DID Analysis: Change in Active Smoking Associated with State Cigarette Tax Interacted with Patient Characteristics

	Actively Smoked, %	Model 4[a] Change, Percentage Points[c]	Model 4[a] 95% CI, Percentage Points	P-value	Model 5[b] Change, Percentage Points	Model 5[b] 95% CI, Percentage Points	P-value
100% smoke-free workplace law		1.1	-1.7 to 3.9	.4	.3	-2 to 7.9	.2
Interaction with cigarette tax ($1.00 increase)							
Age, years				.003[c]			
<40	45.2	-6.5	-15.9 to 3	.2			
40-49	68.2	.1	-6.2 to 6.5	.9			
50-59	64.4	-3.4	-8.3 to 1.5	.2			
60-69	48.7	-7.2	-1.21 to -2.2	.004			
70-79	27.8	-6.2	-10.9 to -1.5	.009			
≥90	11.8	-.3	-6.4 to .5	.09			
Insurance							.82[c]
Medicare	34.2				-6.1	-11 to -1.2	.01
Medicaid	64.9				-4.6	-9.4 to .2	.07
Commercial	43.2				-4.2	-10.3 to 1.9	.2
Other	60.5				-5.4	-11.4 to -7	.08

- Those aged 60-79 were most affected by tax increase (Model 4)
- Among insurance groups, Medicare patients were most affected by tax increases (Model 5)

CONCLUSIONS

- Patients undergoing interventions for IC were less likely to actively smoke after states increased cigarette taxes
- Older patients and Medicare recipients were most price-sensitive
- 100% smoke-free workplace legislation had no impact on active smoking