

Minor Restorations Decreased after Implementation of Sugar Sweetened Beverage Tax

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Sugar-Sweetened Beverage (SSB) Taxes and Caries Rates

- SSB taxes have been implemented in several countries in an attempt to improve population oral and overall health (*Bridge et al., 2020; Haque et al., 2020; Hajishafiee et al., 2023*)
- Most studies of SSB taxes on oral health to date have been simulation-based (*Schwendicke et al., 2016; Jevdjevic et al., 2019; Alhareky, 2021; Shakiba et al., 2022*)
- One study found a decrease in SSB consumption after tax, but did not assess caries incidence (*Alhareky et al., 2021*)
- In the United Kingdom, hospital admissions for caries-related extractions decreased by 12.1% in children aged 0-18 living where a SSB tax was implemented compared to where no tax was implemented (*Rogers et al., 2023*)

Sugar-Sweetened Beverage (SSB) Taxes and Caries Rates

- Philadelphia, Pennsylvania (USA) implemented a 1.5-cent-per-fluid-ounce tax on sweetened caloric and non-caloric (i.e., diet) beverages (*Cawley et al., 2019*)
 - Went into effect January 1, 2017
- Boulder, Colorado (USA) implemented a 2-cent-per-fluid-ounce tax on SSBs with ≥ 5 grams of caloric sweetener per 12 fluid ounce (*Daly et al., 2023*)
 - Went into effect July 1, 2017
- This study examined rates of minor restorations before and after the implementation of an SSB tax in Philadelphia and Boulder (treatment) and outside of Philadelphia and Boulder (control) in January 2016 – January 2020

Methods

- Merative Dental claims data from 2016-2020 were analyzed
 - Pennsylvania residents in the Philadelphia area and outside Philadelphia^a
 - Colorado residents in the Boulder area and outside Boulder^b
- Individuals received minor restorative care during the study period
- Difference-in-difference analyses of the number of 2- and 3- surface restorations completed between the two regions before and after the tax was implemented

Philadelphia & Outside Philadelphia Sample

	Philadelphia	Outside Philadelphia ^a
Sample size	202,377 (11.7%)	1,523,189 (88.3%)
Mean age (std. dev.)	40.5 (21.1)	40.8 (22.1)
Gender		
Female	106,119 (52.4%)	786,238 (51.6%)
Male	96,258 (47.6%)	736,951 (48.4%)

^aOutside Philadelphia = Allentown-Bethlehem-Easton; Altoona; Bloomsburg-Berwick; Chambersburg-Waynesboro; East Stroudsburg; Erie; Gettysburg; Harrisburg-Carlisle; Johnstown; Lancaster; Lebanon; Montgomery County-Bucks County-Chester County; Newark; Non-Metropolitan Statistical Area (MSA); Pittsburgh; Reading; Scranton-Wilkes-Barre-Hazleton; State College; Williamsport; York-Hanover; Youngstown-Warren-Boardman

Race/Ethnicity data are not available for Merative data

Boulder & Outside Boulder Sample

	Boulder	Outside Boulder ^b
Sample size	389,770 (11.5%)	2,990,550 (88.5%)
Mean age (std. dev.)	40.2 (21.3)	36.9 (20.3)
Gender		
Female	77,902 (51.2%)	595,833 (52.6%)
Male	74,245 (48.8%)	536,526 (47.4%)

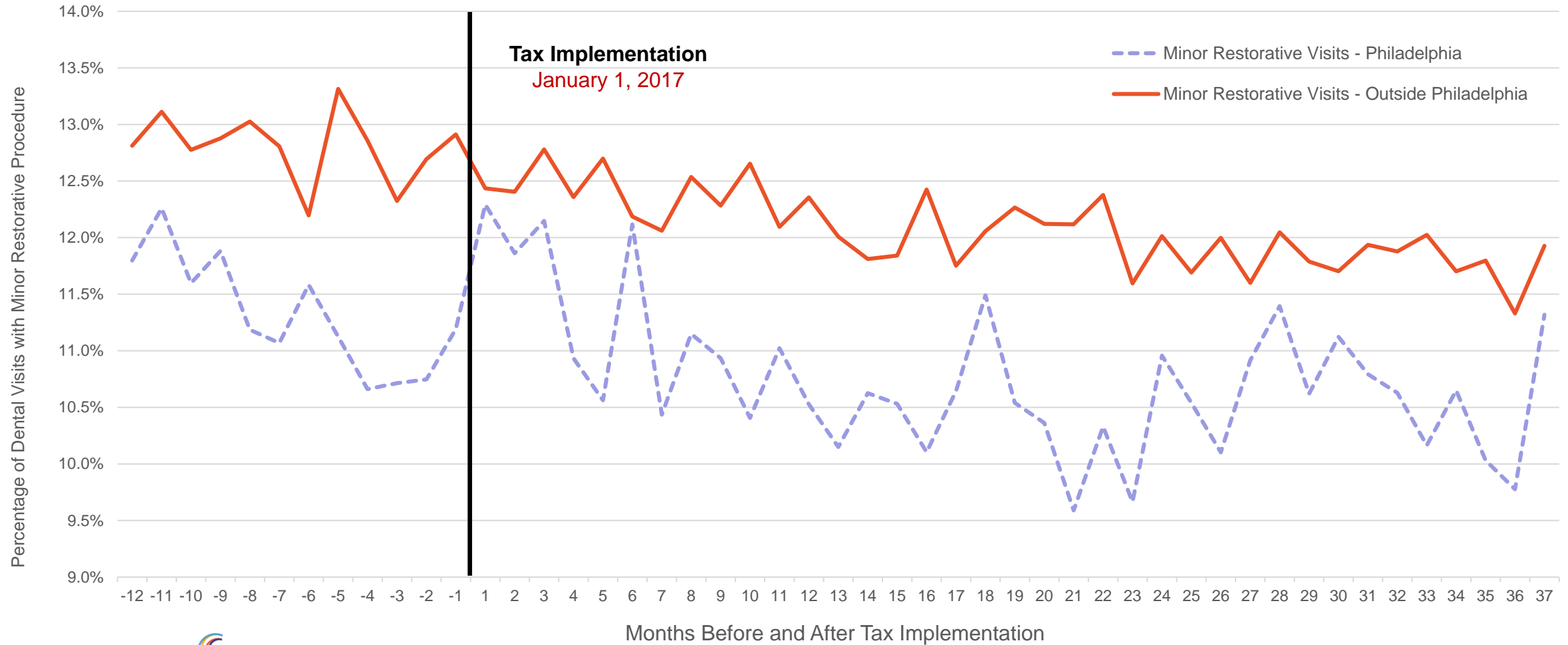
^bOutside Boulder = Aurora; Colorado Springs; Denver; Fort Collins; Grand Junction; Greeley; Lakewood; Non-Metropolitan Statistical Area (MSA); Pueblo

Race/Ethnicity data are not available for Merative data

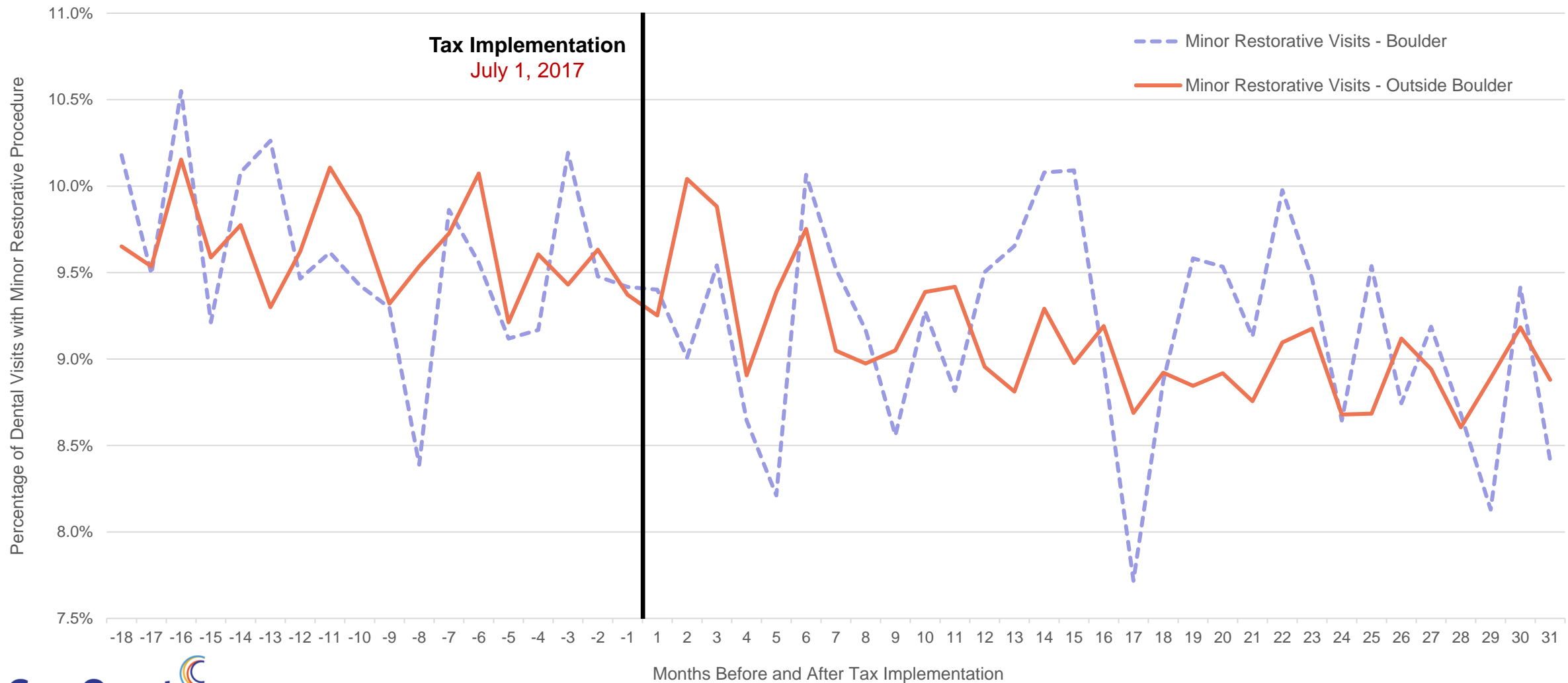
Results

- Number of total dental visits and visits with minor restorative care remained relatively stable before and after tax implementation in both regions
- Percentage of dental visits involving a minor restorative procedure decreased slightly from the start to end of the study period (January 2016-January 2020)
 - **Philadelphia:** from **11.8%** to **11.3%**
 - **Outside Philadelphia:** from **12.8%** to **11.9%**
 - **Boulder:** from **10.2%** to **8.4%**
 - **Outside Boulder:** from **9.7%** to **8.9%**

Percentage of Dental Visits Involving a Minor Restorative Procedure by Location – Philadelphia



Percentage of Dental Visits Involving a Minor Restorative Procedure by Location - Boulder



Difference-in-Difference Results – Philadelphia

Two-Surface Restorations:

- There was a significant **increase** in 2-surface restorations from pre-tax to post-tax for those in Philadelphia compared to outside Philadelphia ($\beta=0.43$, 95% CI=0.27; 0.59; $p<0.001$)

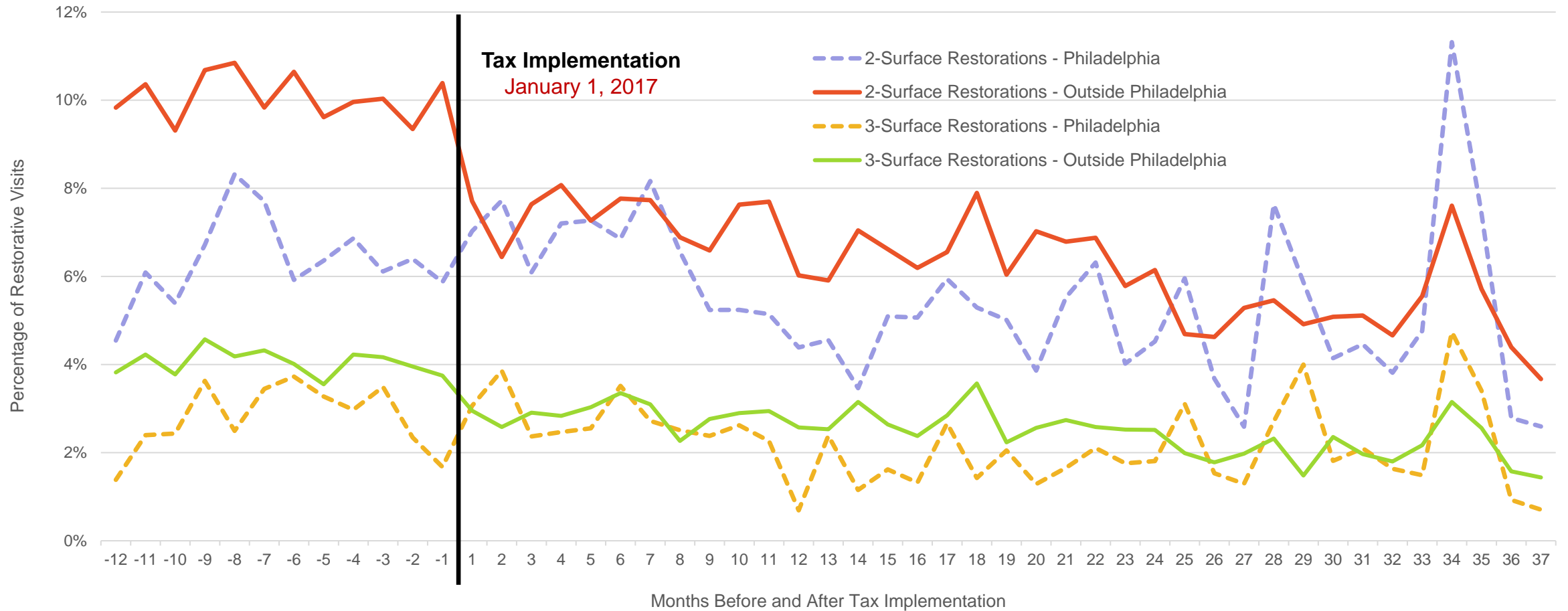
Three-Surface Restorations:

- There was a significant **increase** in 3-surface restorations from pre-tax to post-tax for those in Philadelphia compared to outside Philadelphia ($\beta=0.16$, 95% CI=0.09; 0.24; $p<0.001$)

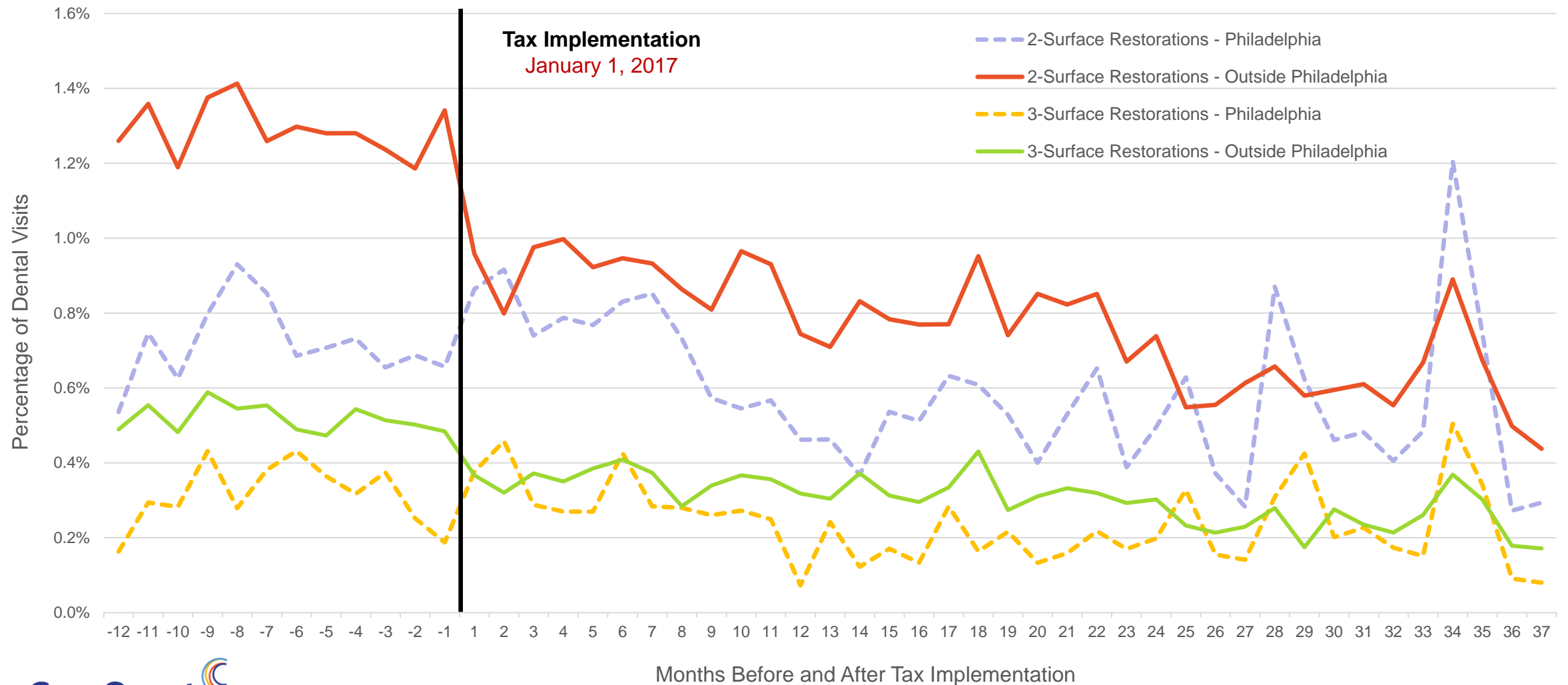
Difference-in-Difference Analysis - Philadelphia

	Variable	Coefficient	95% CI	P value
2-Surface Restorations	Intercept	1.29	1.19; 1.38	<0.001
	Treatment	-0.57	-0.71; -0.43	<0.001
	Time	-0.52	-0.64; -0.41	<0.001
	Difference-in-Difference	0.43	0.27; 0.59	<0.001
3-Surface Restorations	Intercept	0.53	0.48; 0.57	<0.001
	Treatment	-0.21	-0.28; -0.15	<0.001
	Time	-0.22	-0.27; -0.17	<0.001
	Difference-in-Difference	0.16	0.09; 0.24	<0.001

Percentage of Restorative Visits by Number of Surfaces and Location - Philadelphia



Percentage of Dental Visits by Number of Restored Surfaces and Location - Philadelphia



Difference-in-Difference Results – Boulder

Two-Surface Restorations:

- There was a significant **decrease** in 2-surface restorations from pre-tax to post-tax for those in Boulder compared to outside Boulder
($\beta = -0.71$, 95% CI = 0.91; -0.51; $p < 0.001$)

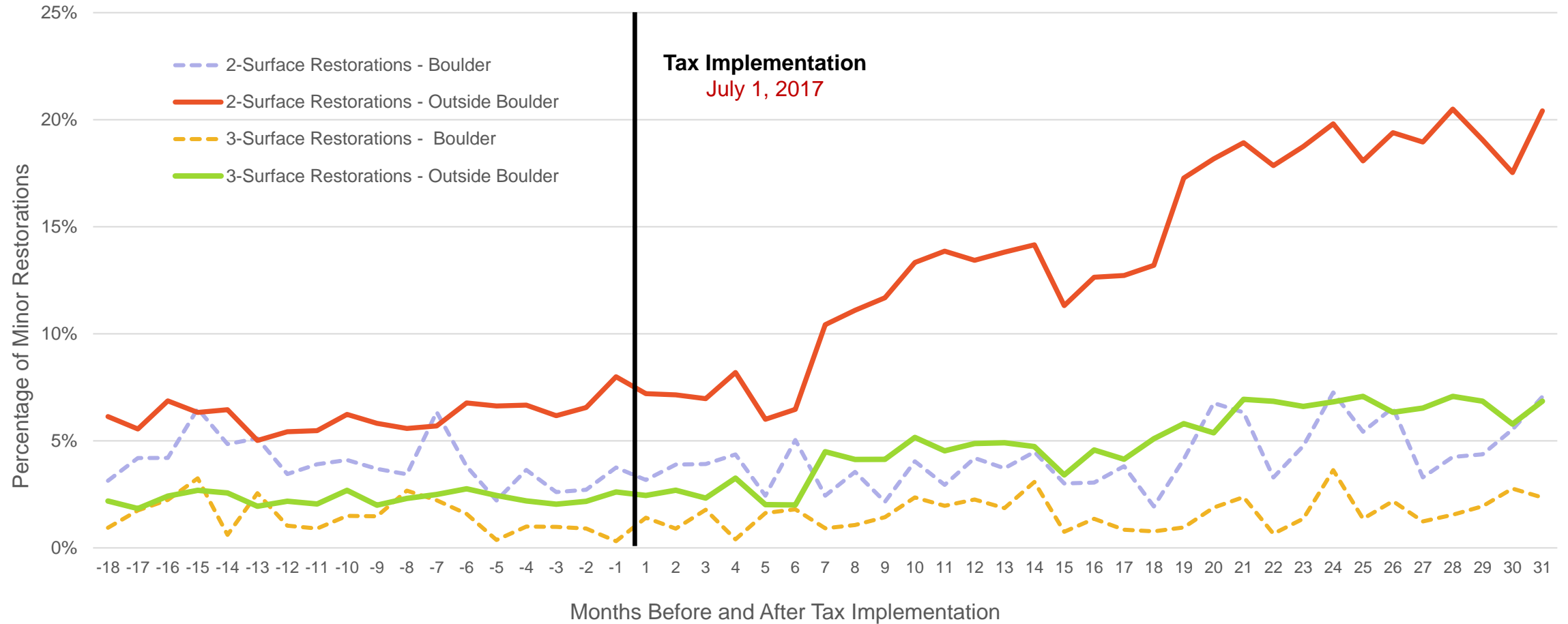
Three-Surface Restorations:

- There was a significant **decrease** in 3-surface restorations from pre-tax to post-tax for those in Boulder compared to outside Boulder
($\beta = -0.23$, 95% CI = -0.31; -0.15; $p < 0.001$)

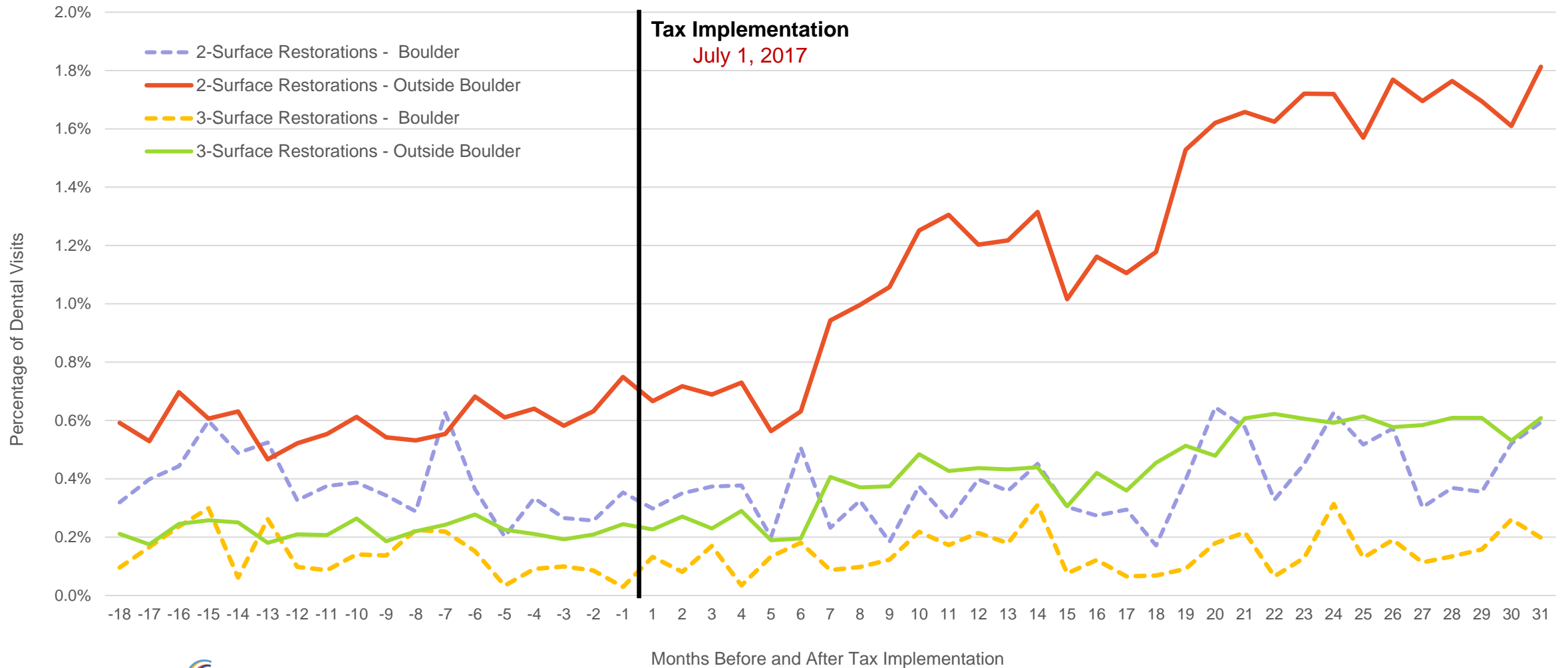
Difference-in-Difference Analysis - Boulder

	Variable	Coefficient	95% CI	P value
2-Surface Restorations	Intercept	0.61	0.50; 0.72	<0.001
	Treatment	-0.21	-0.36; -0.05	<0.05
	Time	0.69	0.55; 0.83	<0.001
	Difference-in-Difference	-0.71	-0.91; -0.51	<0.001
3-Surface Restorations	Intercept	0.21	0.17; 0.26	<0.001
	Treatment	-0.07	-0.13; -0.00	<0.05
	Time	0.23	0.17; 0.28	<0.001
	Difference-in-Difference	-0.23	-0.31; -0.15	<0.001

Percentage of Restorative Visits by Number of Surfaces and Location - Boulder



Percentage of Dental Visits by Number of Restored Surfaces and Location - Boulder



Conclusions

- While dental visits remained consistent across time in both regions, the percentage of dental visits involving minor restorative procedures decreased slightly over time across all locations
- The difference-in-difference analysis of 2- and 3-surface minor restorations within the metro Philadelphia area **increased** after SSB tax implementation compared to areas outside Philadelphia, suggesting the tax did not have oral health benefits
- The difference-in-difference analysis of 2- and 3-surface minor restorations within the metro Boulder area **decreased** after SSB tax implementation compared to areas outside Boulder, suggesting the tax had oral health benefits
- Results suggest that a SSB tax alone does not account for changes in restorative rates, and future research should examine factors related to interactions between such taxes, demographics, and social determinants of health in changes in restoration rates

Thank you for your attention!

Questions?



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