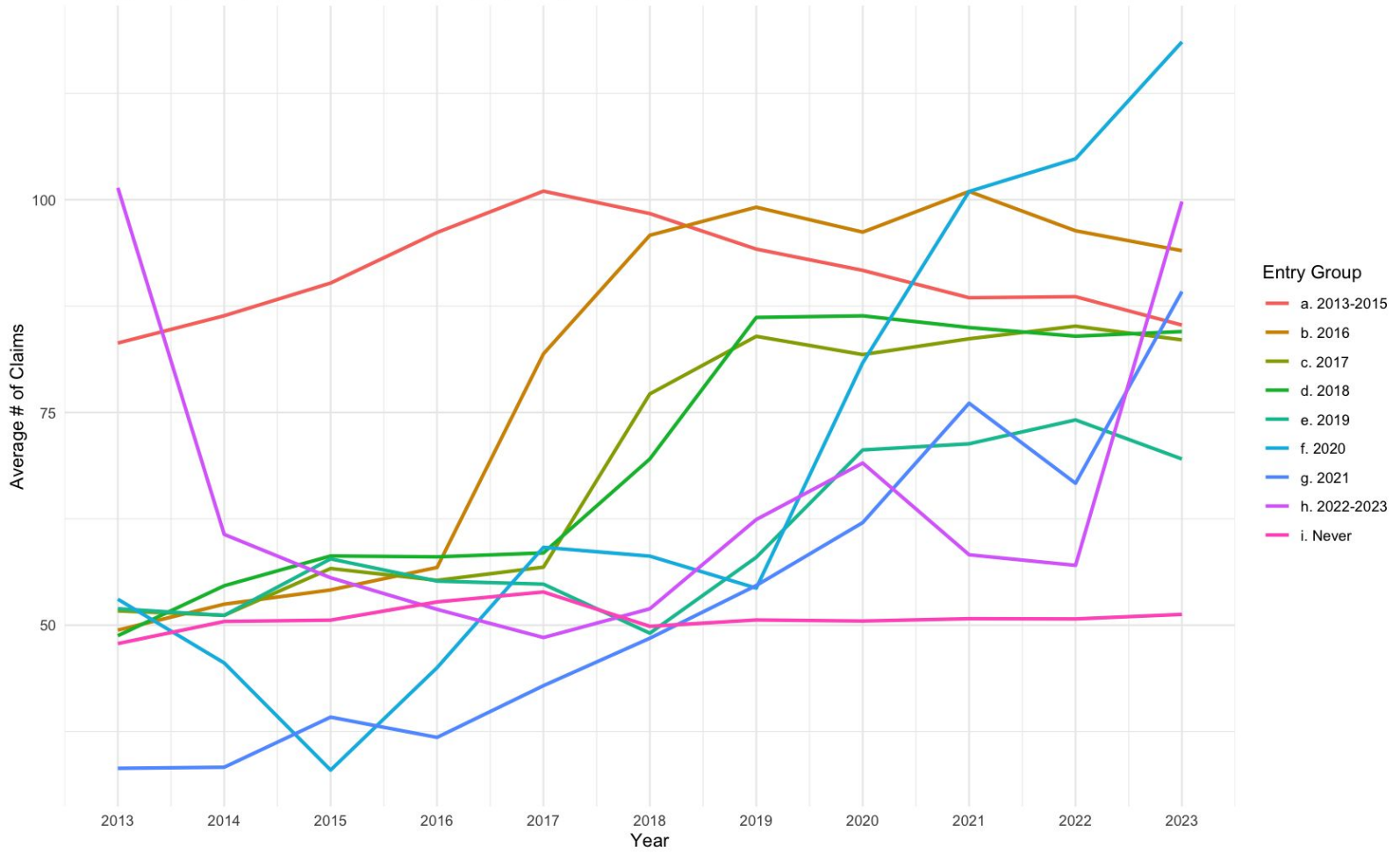


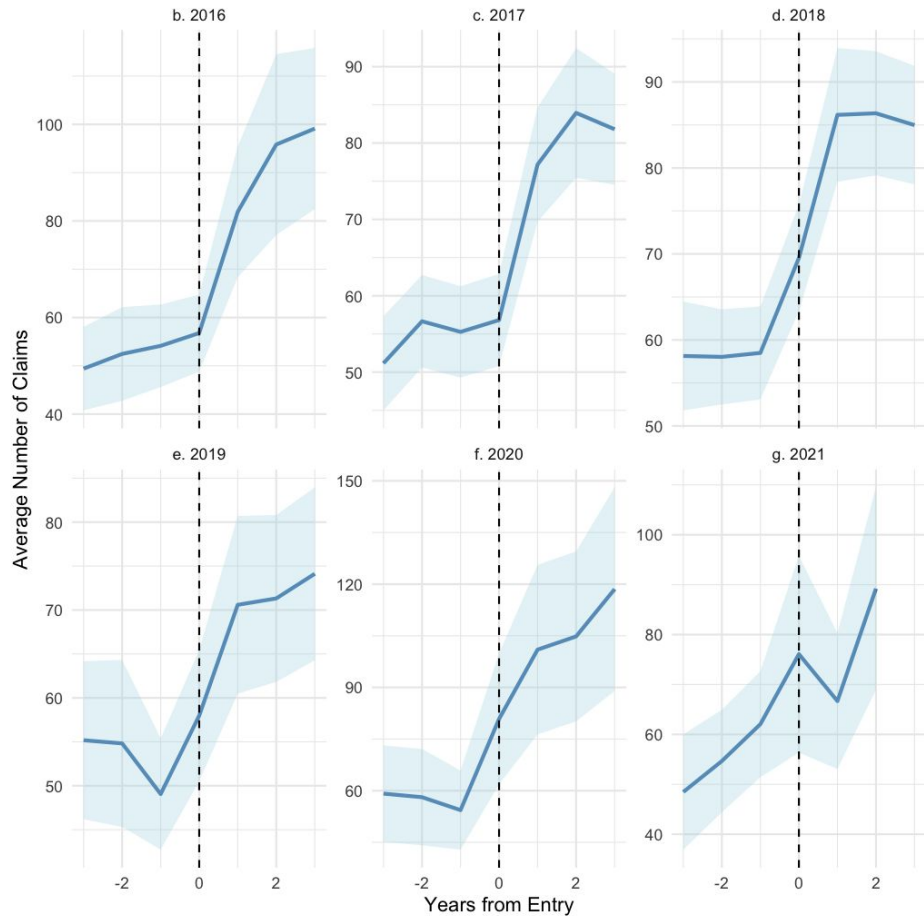
# Buprenorphine Claims (Medicare Part D drug-level files)

```
> print(entry_group_counts)
# A tibble: 9 × 2
  entry_group N_counties
  <chr>      <int>
1 a. 2013-2015      535
2 b. 2016           43
3 c. 2017           59
4 d. 2018          100
5 e. 2019           35
6 f. 2020           24
7 g. 2021           14
8 h. 2022-2023        5
9 i. Never        1559
```

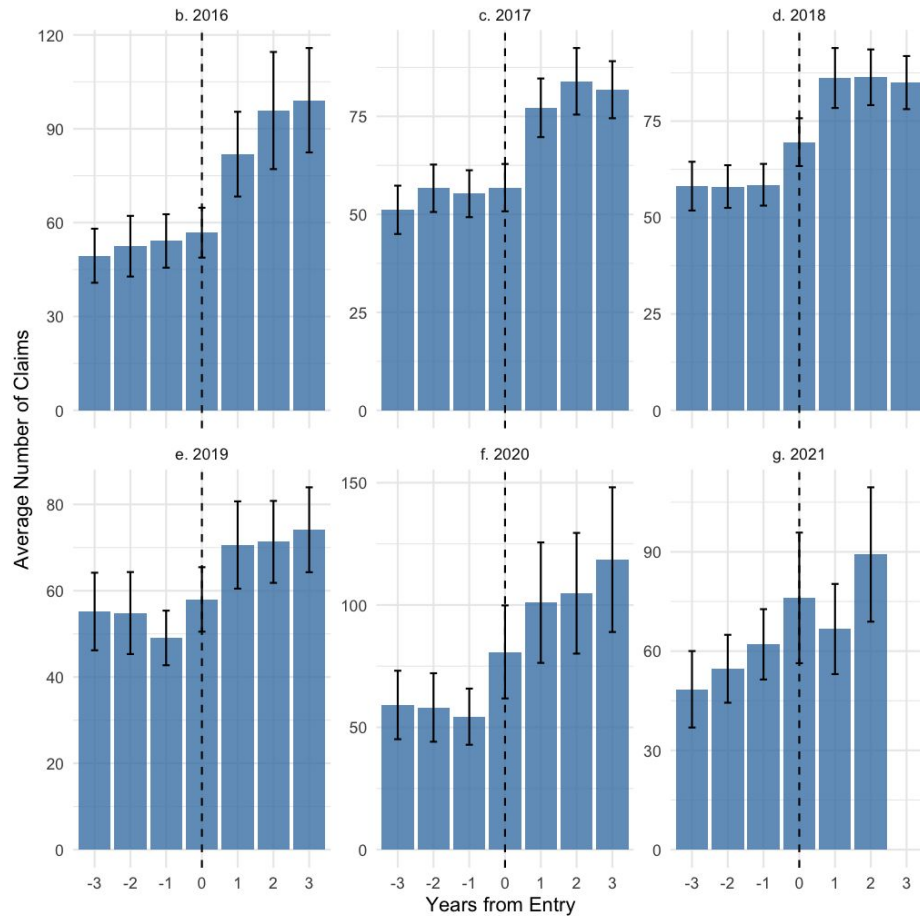
Average Buprenorphine Claims per County by Entry Group



Buprenorphine Claims by Years from Entry of Top 5% Prescriber



Buprenorphine Claims by Years from Entry of Top 5% Prescriber



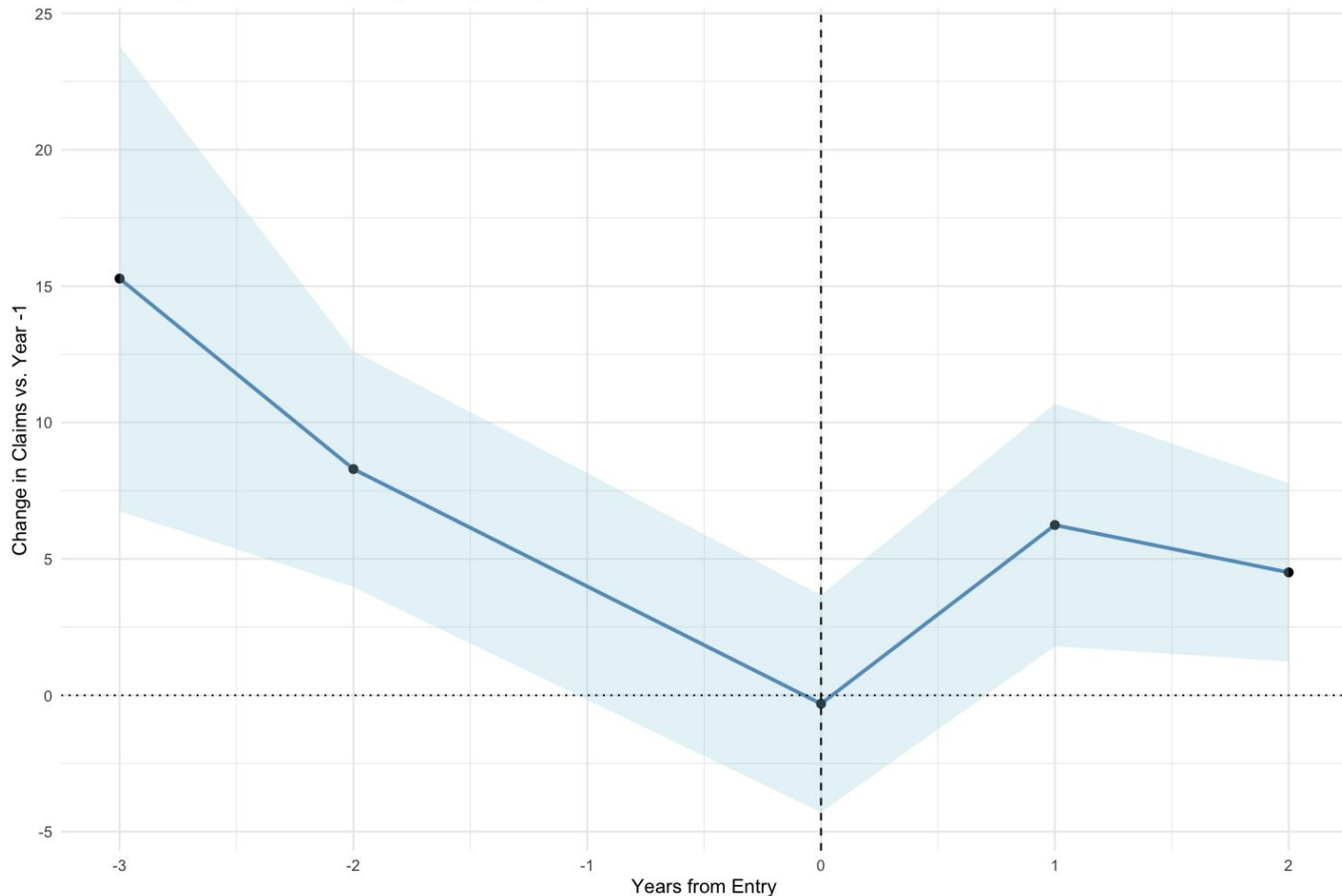
event_time	estimate	lower	upper
<dbl>	<dbl>	<dbl>	<dbl>
1	-3	15.3	6.75 23.8
2	-2	8.29	3.97 12.6
3	0	-0.31	-4.29 3.67
4	1	6.24	1.8 10.7
5	2	4.5	1.24 7.77

Average treatment effect (ATE) from years 0 to +2: 3.48 (95% CI, -0.42 to 7.37). Year +3 dropped due to collinearity

feols(Tot\_Clms ~  
i(event\_time, ref = -1) | fips  
+ year, data = df)

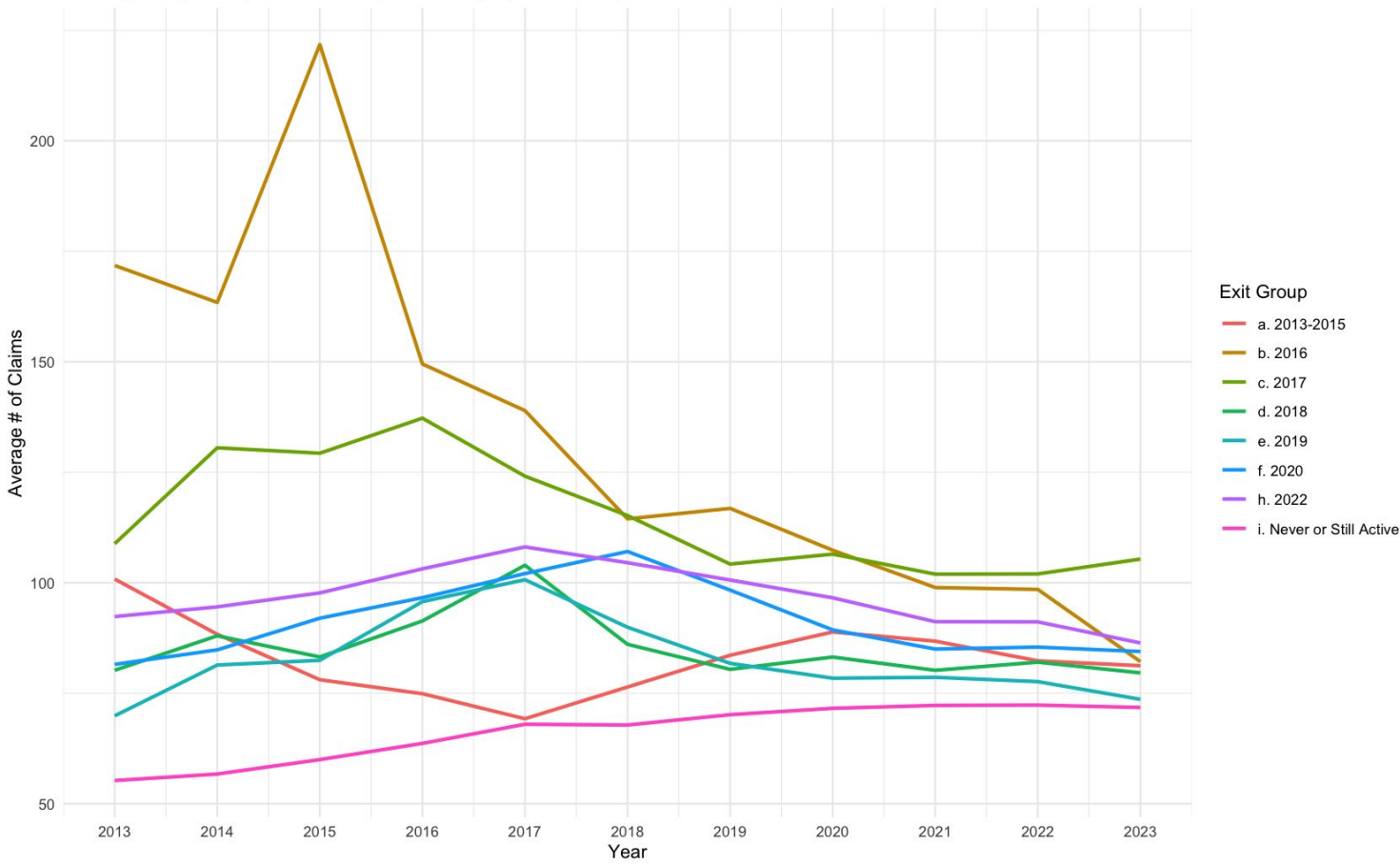
- Fixed-effects OLS estimation regression
- Annual buprenorphine claims (relative to year -1)
- Two-way fixed effects by county "fips" and "year"

Effect of Top 5% Prescriber Entry on Buprenorphine Claims

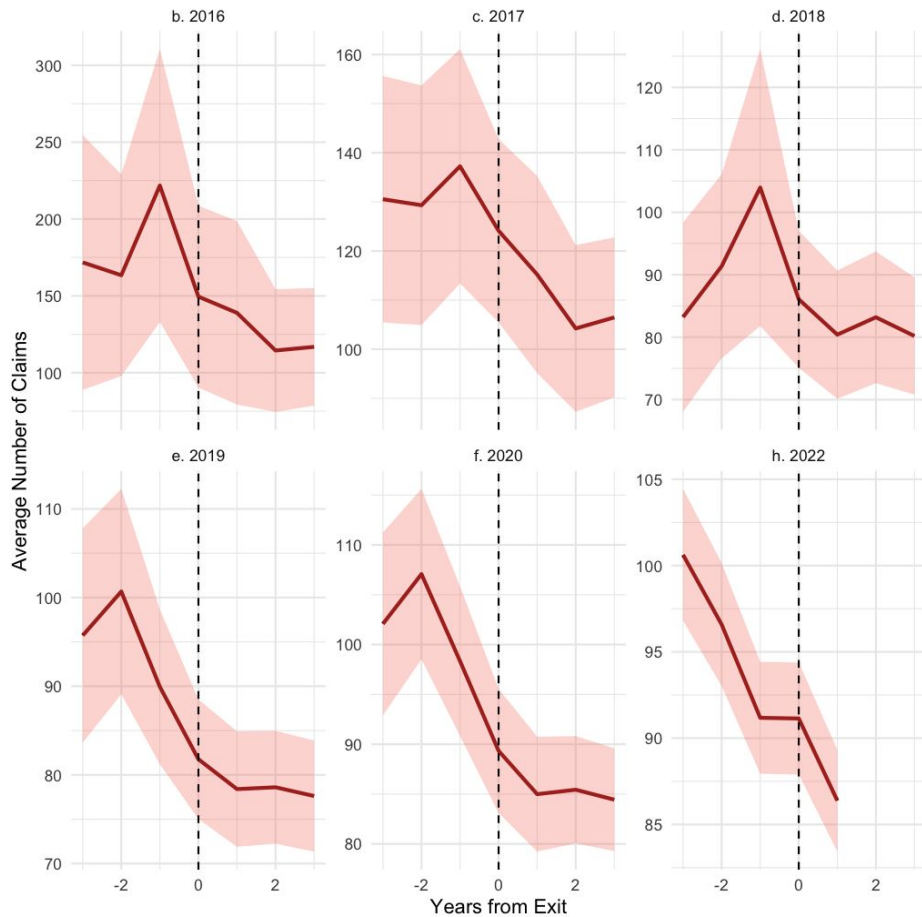


```
>
> print(exit_group_counts)
# A tibble: 8 × 2
  exit_group N_counties
  <chr>      <int>
1 a. 2013-2015      10
2 b. 2016           7
3 c. 2017          36
4 d. 2018          21
5 e. 2019          38
6 f. 2020          73
7 h. 2022         146
8 i. Never or Still Active 2043
```

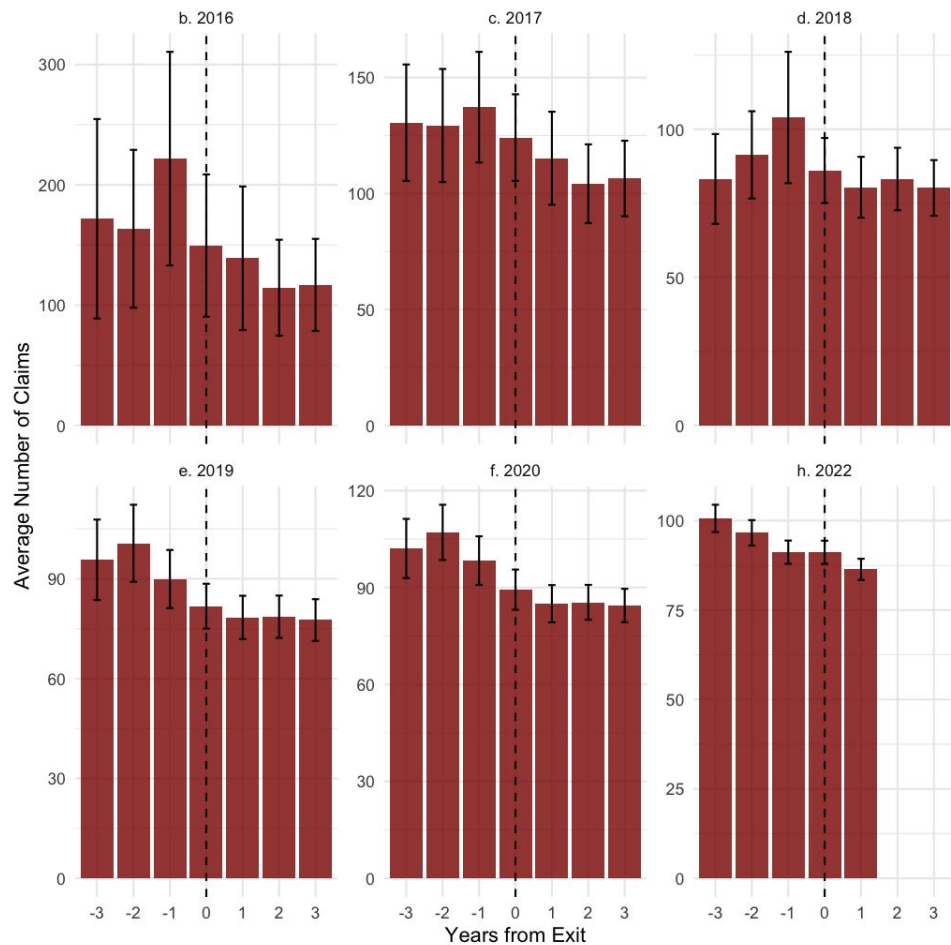
Average Buprenorphine Claims per County by Exit Group



Buprenorphine Claims by Years from Exit of Top 5% Prescriber



Buprenorphine Claims by Years from Exit of Top 5% Prescriber

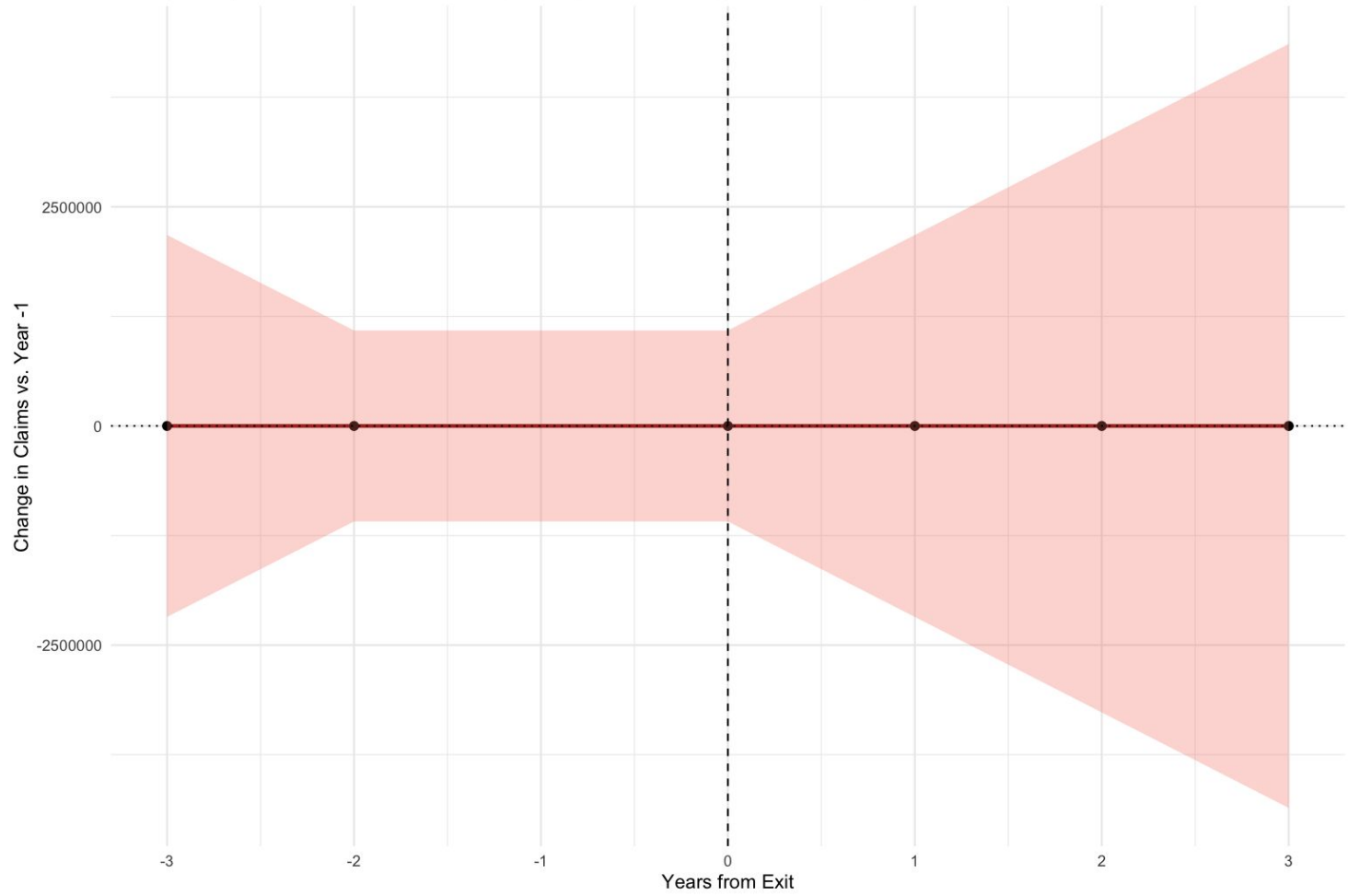


	event_time	estimate	lower	upper
	<dbl>	<dbl>	<dbl>	<dbl>
1	-3	-2.25	-2178950.	2178946.
2	-2	1.58	-1089473.	1089476.
3	0	-2.29	-1089477.	1089473.
4	1	-1.79	-2178951.	2178948.
5	2	-0.97	-3268425.	3268423.
6	3	1.46	-4357897.	4357900.

ATE -1.68 (95% CI,  
-2178951 to 2178948)

Unreliable?

Effect of Top 5% Prescriber Exit on Buprenorphine Claims (Cleaned Data)



## \*\*No prescriber exits in 2021

```
> df %>%  
+   count(lastyear) %>%  
+   arrange(lastyear)  
# A tibble: 10 × 2  
  lastyear      n  
  <dbl> <int>  
1    2013    592  
2    2014   1187  
3    2015   1612  
4    2016   2403  
5    2017   6036  
6    2018   5298  
7    2019   7818  
8    2020  11036  
9    2022  21395  
10   2023 134653
```

Number of all bup  
prescribers

```
> df %>%  
+   filter(top5_flag == 1) %>%  
+   count(lastyear) %>%  
+   arrange(lastyear)  
# A tibble: 10 × 2  
  lastyear      n  
  <dbl> <int>  
1    2013      5  
2    2014     26  
3    2015     37  
4    2016     55  
5    2017    294  
6    2018    145  
7    2019    213  
8    2020    356  
9    2022    474  
10   2023   8012
```

Number of top 5%  
bup prescribers

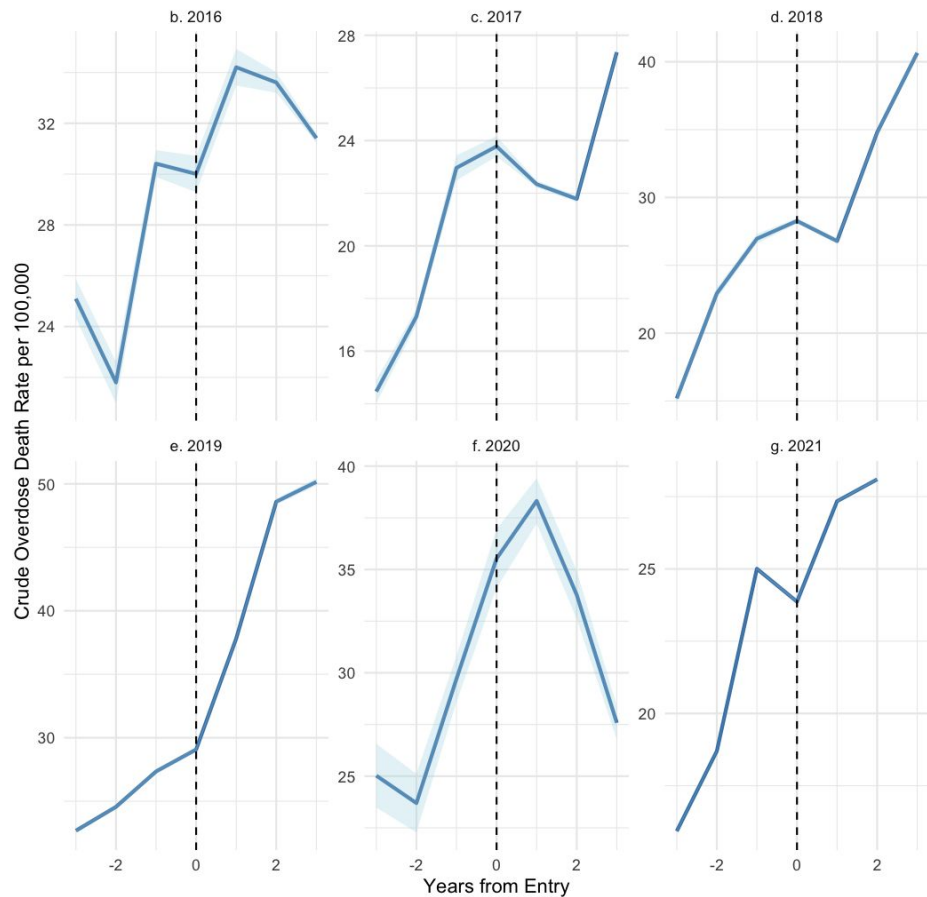
```
> exit_group_counts <- exit_years %>%  
+   count(exit_group, name = "N_counties") %>%  
+   arrange(exit_group)  
>  
> print(exit_group_counts)  
# A tibble: 8 × 2  
  exit_group      N_counties  
  <chr>          <int>  
1 a. 2013-2015           26  
2 b. 2016                14  
3 c. 2017                87  
4 d. 2018                53  
5 e. 2019                78  
6 f. 2020             137  
7 h. 2022             195  
8 i. Never or Still Active 9902
```

Number of counties with exit of  
a top 5% bup prescriber

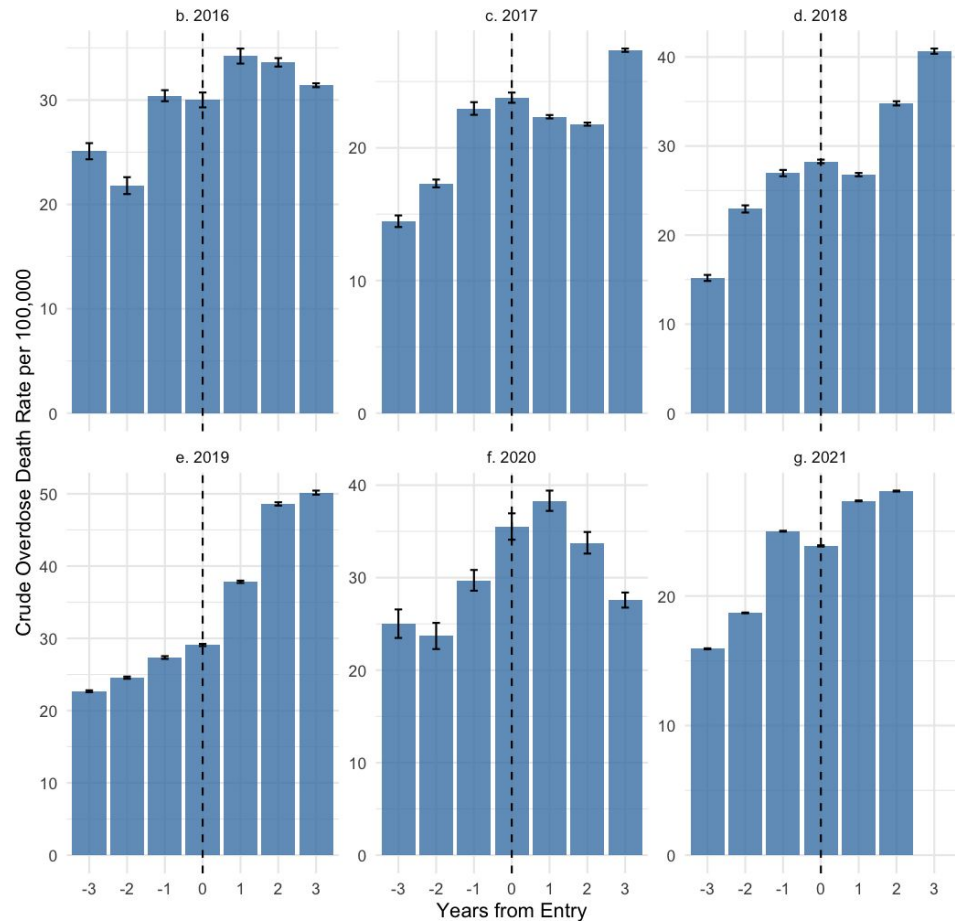


Crude overdose mortality rates per 100,000  
(CDC WONDER public access files)

Overdose Death Rates by Years from Entry of Top 5% Prescriber

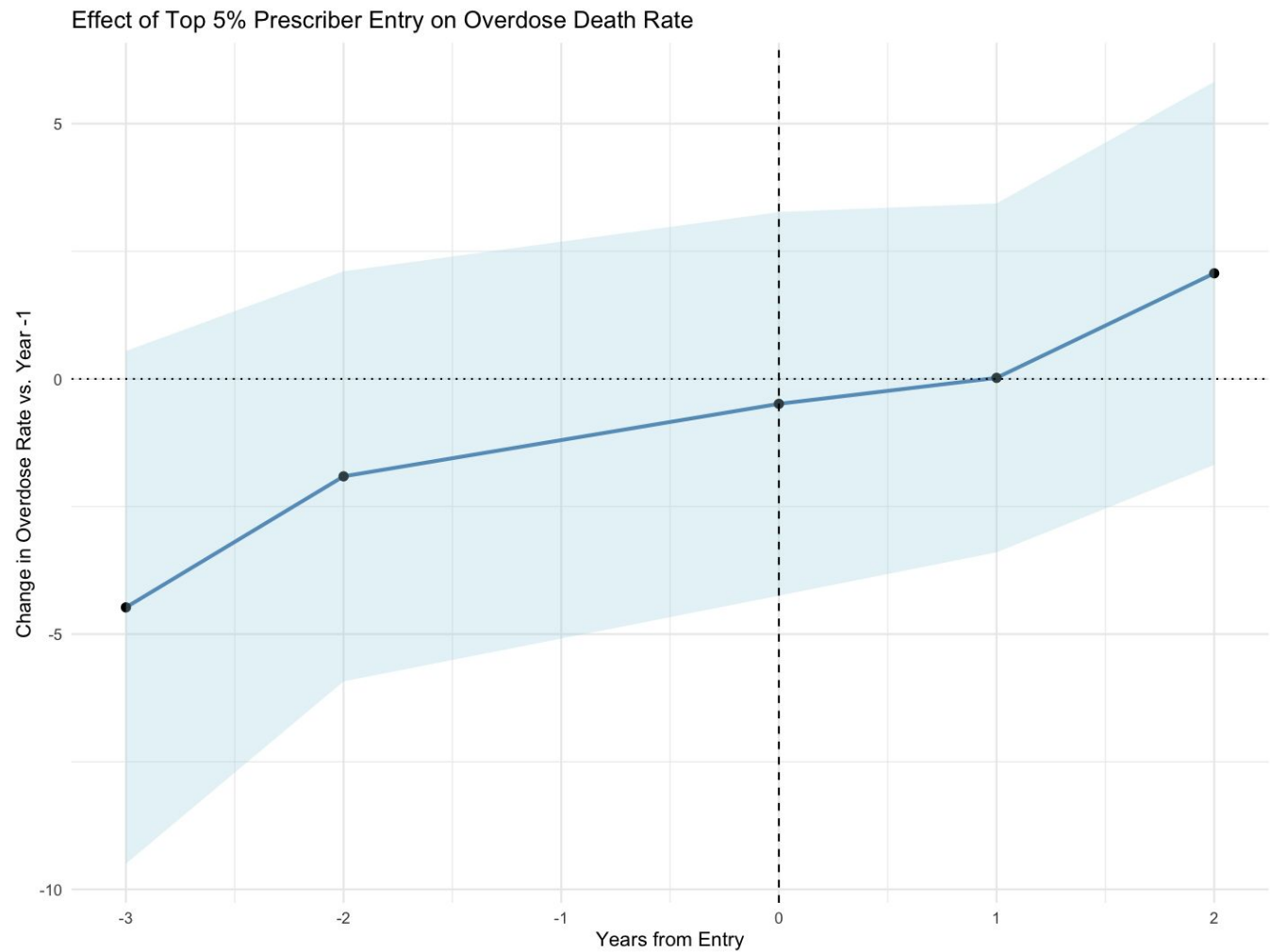


Overdose Death Rates by Years from Entry of Top 5% Prescriber

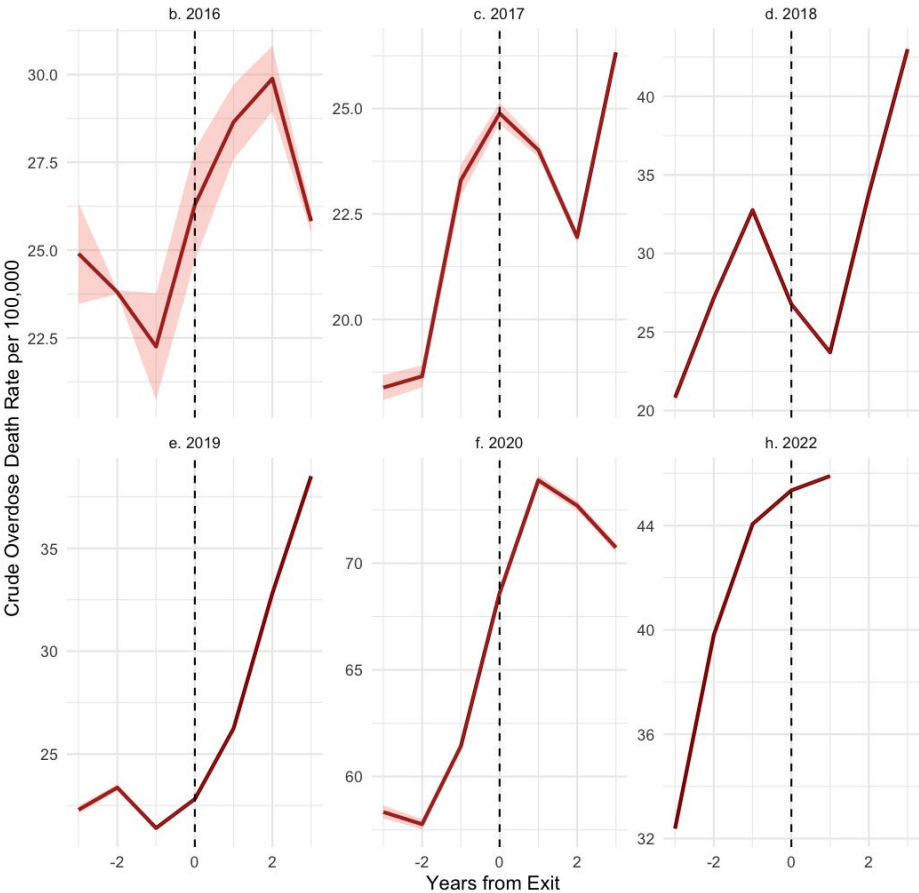


event_time	estimate	lower	upper
	<dbl>	<dbl>	<dbl>
1	-3	1.19	-3.15 5.53
2	-2	1.94	-1.11 4.98
3	0	0.48	-2.89 3.85
4	1	-0.19	-2.48 2.1
5	2	-2.27	-6.36 1.83

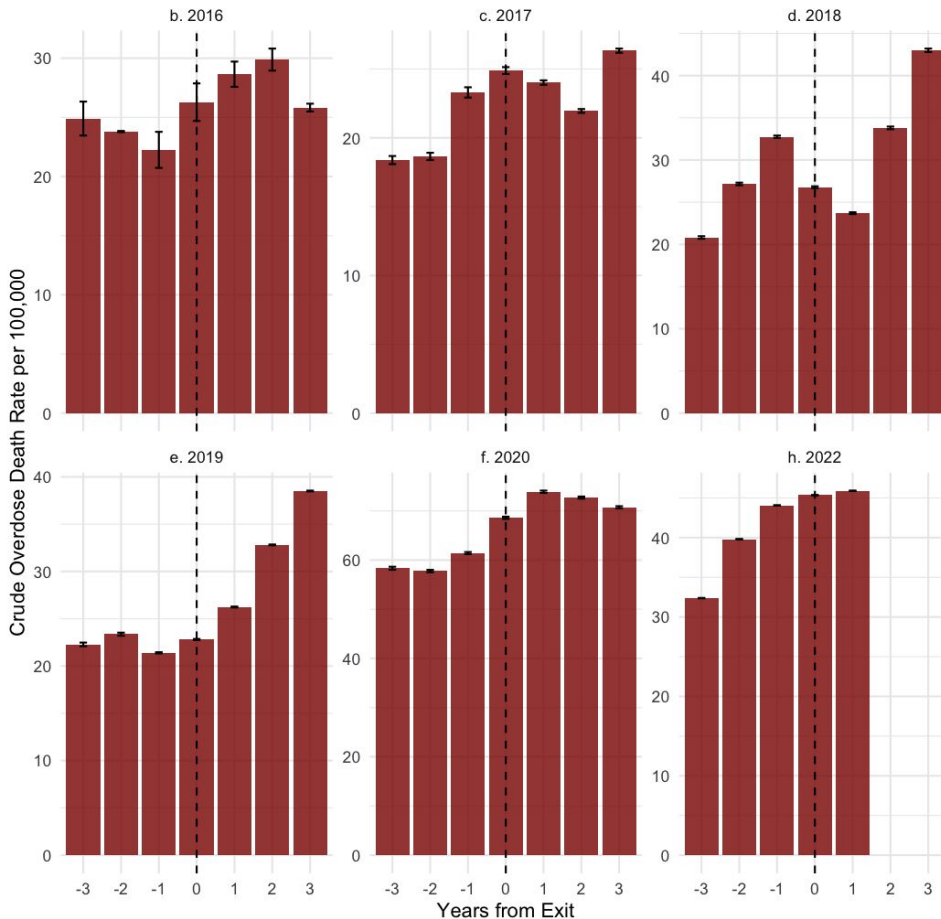
ATE: 0.53 (95% CI, -3.11 to 4.18)



Overdose Death Rates by Years from Exit of Top 5% Prescriber

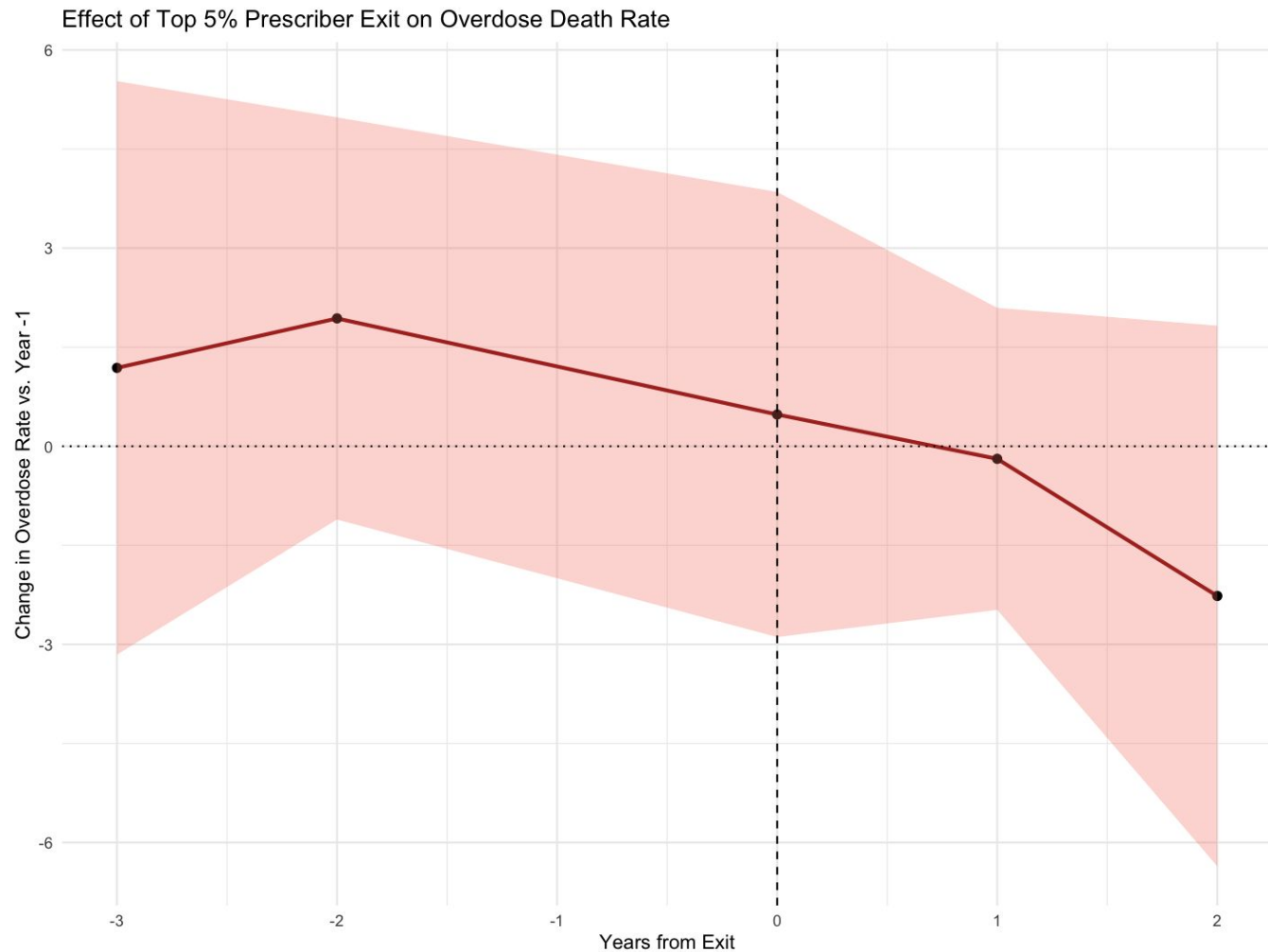


Overdose Death Rates by Years from Exit of Top 5% Prescriber



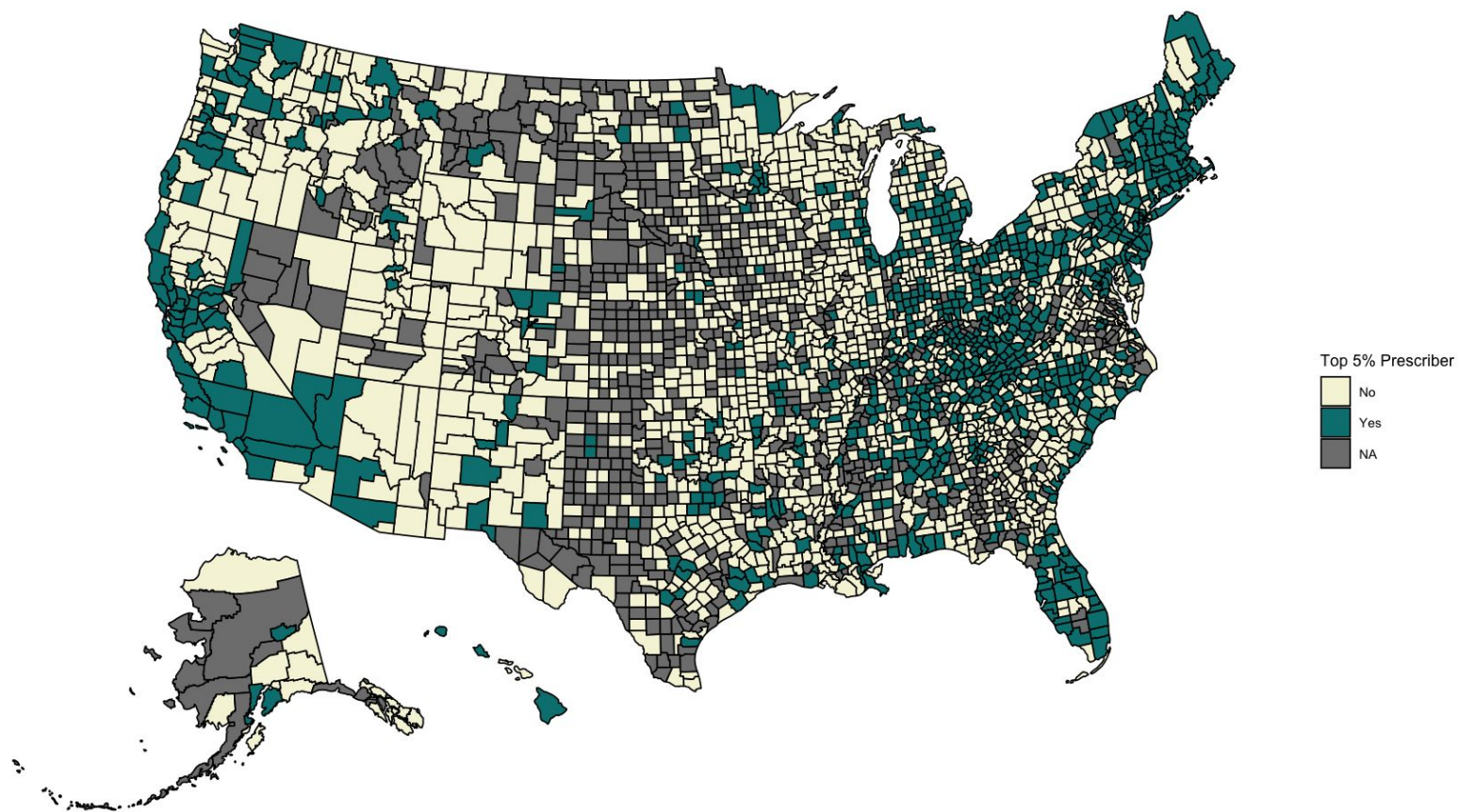
event_time	estimate	lower	upper
	<dbl>	<dbl>	<dbl>
1	-3	1.19	-3.15
2	-2	1.94	-1.11
3	0	0.48	-2.89
4	1	-0.19	-2.48
5	2	-2.27	-6.36

ATE: -0.66 (95% CI, -3.91 to 2.59)



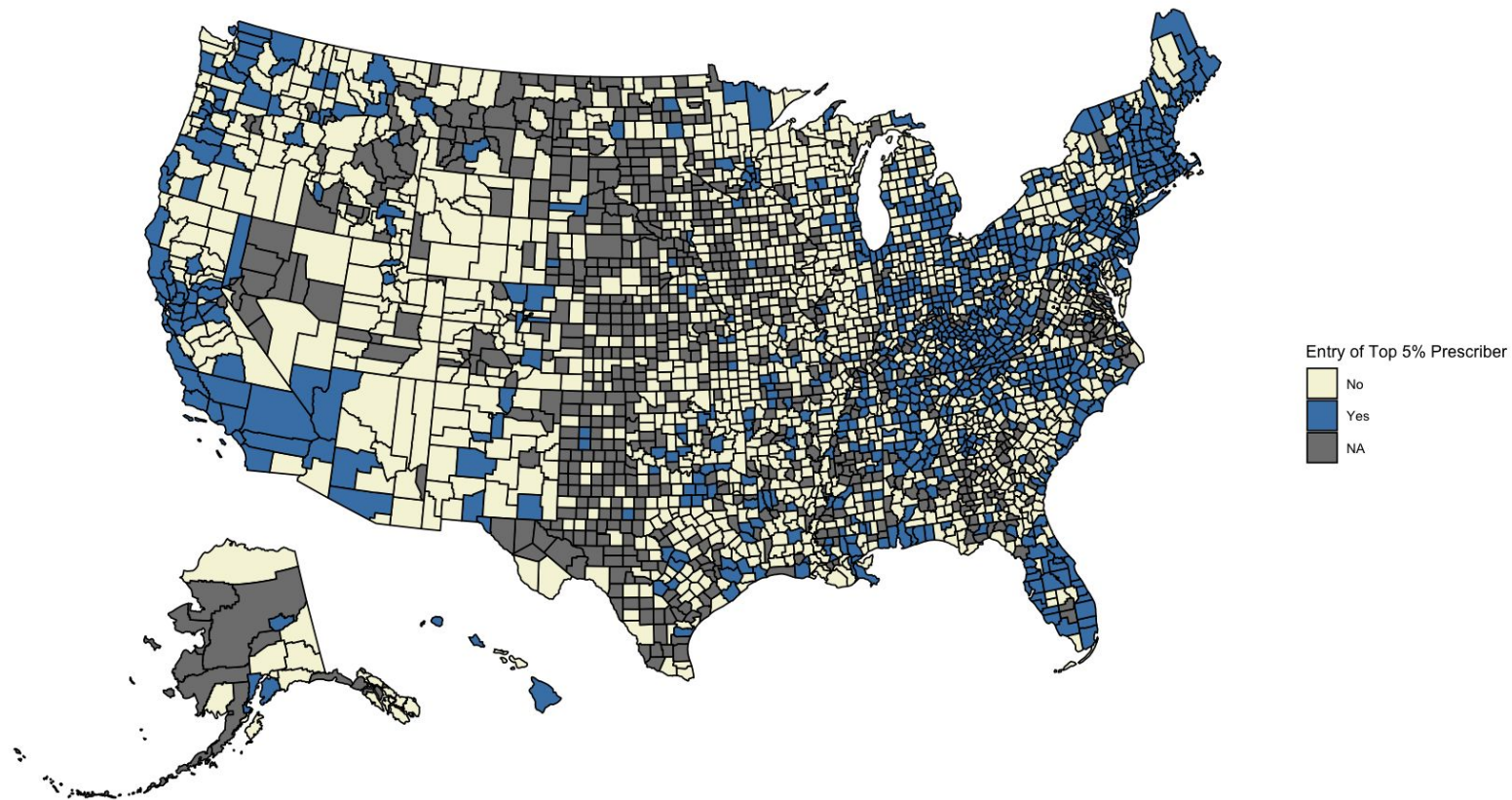
County-level distribution of top 5% prescribers

Counties Top 5% Buprenorphine Prescriber in Any Year



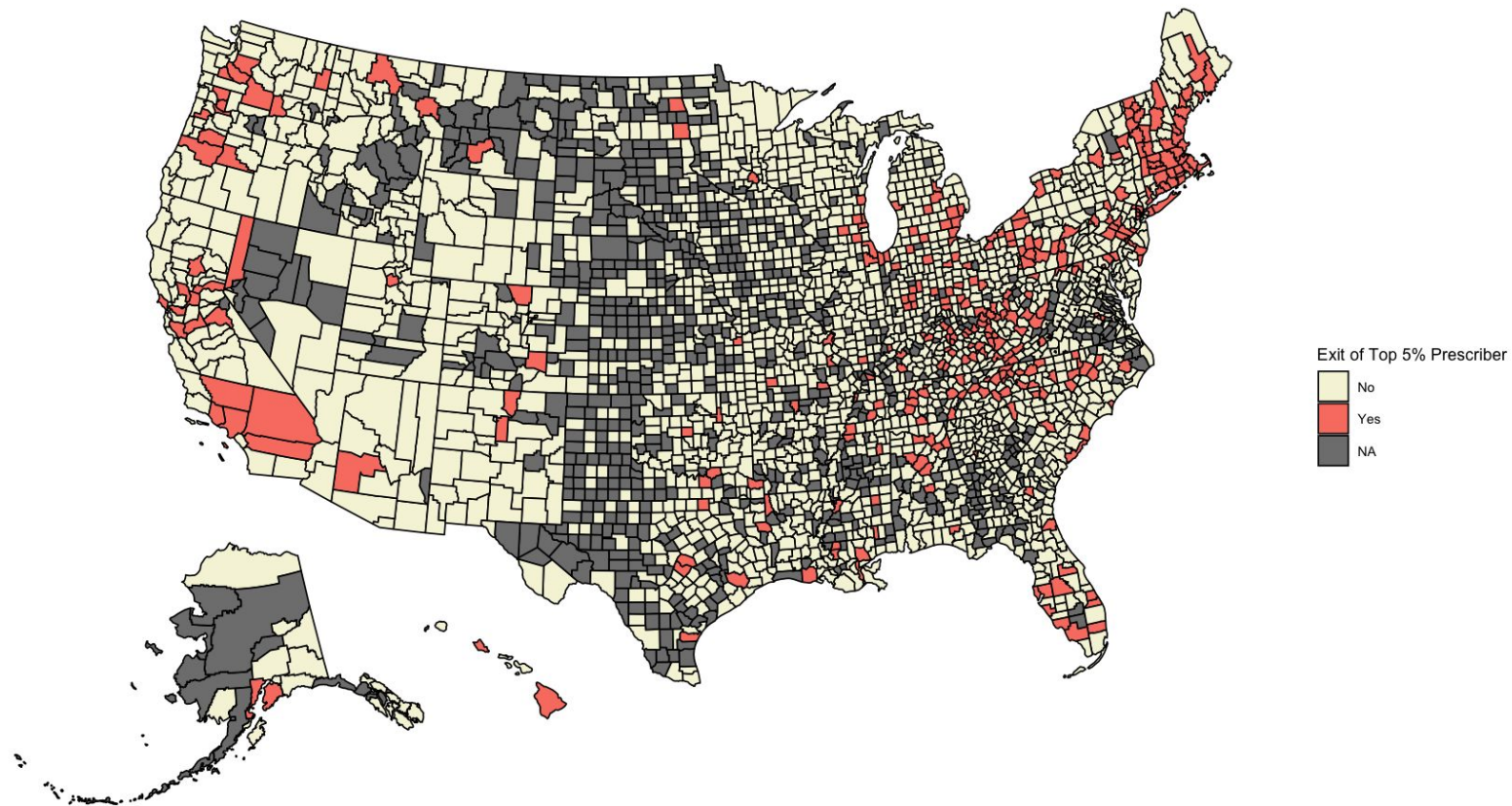


Counties with Entry of Top 5% Buprenorphine Prescriber





Counties with Exit of Top 5% Buprenorphine Prescriber



2020 AHRQ county-level SDOH database

AHRQ:

- Sex
- Race
- Ethnicity
- Education
- Disability (y/n)
- Employment
- Public assistance
- Income (categorical, median, and mean)
- Insurance

CDC WONDER:

- Drug overdose deaths (raw counts and crude rates per 100,000)

```
> glimpse(final_df)
Rows: 210,588
Columns: 50
$ Prscrbr_NPI
$ fips
$ year
$ Tot_Clms
$ top5_flag
$ firstyear
$ lastyear
$ sex_male
$ sex_female
$ race_white
$ race_black
$ race_aian
$ race_asian
$ race_nhpi
$ race_other
$ ethnicity_hispanic
$ ethnicity_nonhispanic
$ educ_less_9th
$ educ_9_12_nodegree
$ educ_highschool
$ educ_some_college
$ educ_associates
$ educ_bachelors
$ educ_grad_prof
$ has_disability
$ employed
$ unemployed
$ unemployment_rate
$ retirement_income
$ social_security_income
$ public_assistance_income
$ food_stamps
$ income_lt_10k
$ income_10k_14k
$ income_15k_24k
$ income_25k_34k
$ income_35k_49k
$ income_50k_74k
$ income_75k_99k
$ income_100k_149k
$ income_150k_199k
$ income_200k_plus
$ median_income
$ mean_income
$ insurance_any
$ insurance_private
$ insurance_public
$ insurance_none
$ `Drug overdose deaths`
$ `Crude drug overdose death rates per 100,000`

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