The Effects of Drug Injury Advertising on Public Health

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Drug Injury Advertising

- Mass Torts: Plaintiffs file claims against a common defendant, seeking compensation for (*alleged*) injuries caused by common actions or products.
- Law firms use advertising to recruit potential plaintiffs to join a mass tort.


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• Gastrointestinal Bleeding
• Kidney Bleeding
• Strokes
• Or Even Death
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Research Questions

1. Do drug injury (DI) ads affect prescriptions of targeted drugs?
   - Adversarial content and intent: DI ads emphasize the risks from the drug.
   - DI ads may influence drug utilization of injured and non-injured patients.

2. Are there measurable effects on public health from shifts in drug utilization driven by drug injury ads?

- Public Health Policy: Connect ads to health outcomes. Regulatory
- oversight of ad content.

Study in the context of anticoagulants (ACs), which reduce the risk of stroke.

Mass Tort Lawsuits

- Lawsuits claim that firms failed to *adequately* inform the public of risks ('failure to warn' cases).
- Lawsuits are not necessarily connected to changes in FDA recommendations.
- Law firms are compensated on a contingency fee basis: high financial gains from representing many clients.

Drug Injury Advertising

Law firms advertise to reach potential plaintiffs:

- Ads respond to new information on:
  - Previously undisclosed adverse effects: e.g., changes in labeling.
  - High financial rewards: e.g., lawsuit settlements or favorable verdicts.
- Emphasize serious adverse events.
- Presented as “Medical Alert,” “FDA Alert.”

These ads could be considered misleading under state ethics rules (Tippett (2015)).

The Case of Anticoagulants

- ACs are used to reduce the risk of clots, stroke, and embolism.
- Primarily prescribed to elderly patients (appropriate to use Medicare data).
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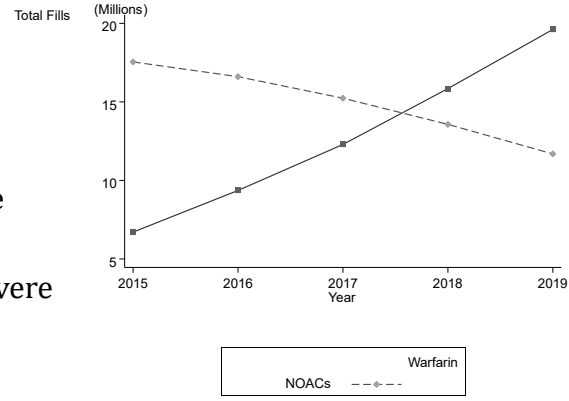
Types of Anticoagulants:

Warfarin: introduced in the 1950s.

NOACs: Pradaxa, Xarelto, Eliquis entering in 2010-12.

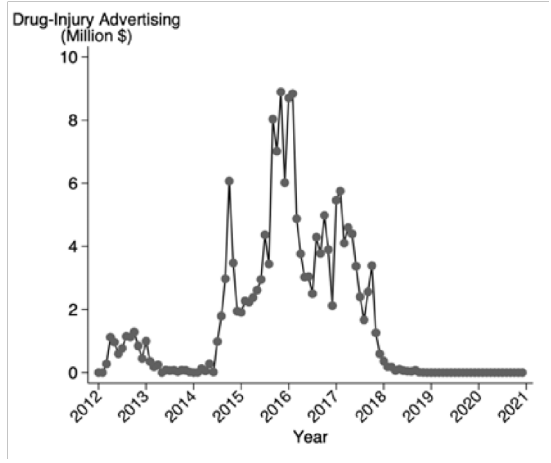
- Clinical studies show that NOACs are more effective and safer.
- Main side effect for **all ACs**: risk of severe bleeding.



Drug Injury Ads Targeting NOACs

The lawsuits alleged that NOACs didn't *adequately* disclose the risks of bleeding.

- 2012: Initial wave of ads and lawsuits targeting Pradaxa.
- 2014: Pradaxa settles for $650 mill. (despite winning in court).
- **2014-2018:** Second wave of DI ads against Pradaxa and Xarelto.
- No ads or lawsuits target Warfarin (well-understood side effects).



Data

1. Mass tort ad spending from X Ante (2015-2020)
   - Observed at the level of a **DMA-month**.
2. Prescription data from Medicare Part D Prescriber Public Use Files (2015-2019)
   - Observed at the level of a **physician-year-drug**.

3. Inpatient visits of Medicare patients to 3,000 hospitals (2015-2019)

Summary Statistics Observed at the level of a **hospital-year-diagnosis**.

Empirical Approach: Prescription Analyses

$$\underset{\text{Prescriptions}}{pres_{dit}} = \beta \underset{\text{Per Capita Ad Spending}}{DIads_{mt}} + \underset{\text{Physician FE}}{\gamma_i} + \underset{\text{Time FE}}{\mu_t} + \epsilon_{dit}, \quad (1)$$

Endogeneity Concerns

- Firms advertise more to viewers who are more likely to file a lawsuit:
  - locations with increasing number of side effects, or
  - locations with growing use and popularity of NOACs.
-

Empirical Approach: Prescription Analyses

Bias may lead to either under- or over-estimation of the true impact.

$$\underbrace{\text{pres}_{dbit}}_{\text{Prescriptions}} = \beta \underbrace{\text{DIads}_{mt}}_{\substack{\text{Per Capita} \\ \text{Ad Spending}}} + \underbrace{\gamma_i}_{\text{Physician FE}} + \underbrace{\eta_{bt}}_{\textbf{Border-Time FE}} + \epsilon_{dbit}, \quad (2)$$

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Empirical Approach: Prescription Analyses

Approach

- Leverage quasi-random variation in ads across DMA borders (Shapiro 2018).
- Viewers and physicians on opposite sides of a border have similar demand due to geographic proximity.
- Viewers and physicians on opposite sides of a border are exposed to different levels of advertising due to market dynamics within their respective DMAs.

$$\underbrace{\text{pres}_{dbit}}_{} = \beta \underbrace{\text{DIads}_{mt}}_{} + \underbrace{\gamma_i}_{} + \eta_{bt} + \epsilon_{dbit}, \quad (2)$$

Empirical Approach: Prescription Analyses

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Prescriptions | Per Capita Spending | Physician FE | **Border-Time FE** Ad

Implementation

- Use data from physicians located in counties on the border of a DMA.
- Control for time-varying unobservables with border-specific time fixed effects.
- Analyzed outcomes: prescriptions fills for NOACs, Warfarin, Total AC.

Empirical Approach: Prescription Analyses

Placebo: Ad spending does not affect prescriptions for unrelated drugs.

Prescription Analyses

Table 1: Drug Injury Ads on Prescriptions

Borders	NOAC	Warfarin	Total AC	Placebo
Drug Injury Ads	–9.737	1.829	–7.907	0.823
	(4.258)	(5.294)	(6.417)	(27.124)
Mean DV	72.16	96.63	168.79	1104.42
N	346,382	346,382	346,382	337,047
Elasticity	–0.03	0.00	–0.01	0.00

physician	yes	yes	yes	yes
border-year	yes	yes	yes	yes

Notes: The unit of observation is at the physician-by-year level over the sample of 2015-2019. The dependent variable is the number of filled prescriptions of NOACs, Warfarin, all anticoagulants, and placebo drugs. The advertising variable is measured as drug injury ad spending per capita. Standard errors are clustered two-way at the physician and the DMA-by-year levels and reported under each coefficient.

Interpretation

DI ads change patient (or physician) beliefs about the risks/benefits of NOACs.

- Estimated elasticity of -0.03 (Shapiro (2022): 0.03)
- Increasing ad spending by \$0.19 per capita ⇒ a 2.6% decrease in NOAC fills.
- Corresponds to 325,000 fewer fills, with a 95% CI of [–660,000,–50,000].

Changes in prescriptions cannot inform welfare when ads may be misleading.

A meta analysis of clinical studies (Ruff et al. (2014)) shows that:

- NOACs reduce stroke by 19% relative to Warfarin.
- NOACs have fewer bleeding events than Warfarin.

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RQ2: Are there measurable effects on public health from shifts in drug utilization driven by drug injury ads?

Empirical Approach

Analyze inpatient hospital visits for diagnoses related to ACs.

$$\underbrace{\text{hosp}_{bct}}_{\text{Per Capita Inpatient Hospital Visits}} = \alpha + \underbrace{\text{pres}_{bct}}_{\text{Per Capita NOAC Scripts}} + \underbrace{\gamma_c}_{\text{County FE}} + \underbrace{\eta_{bt}}_{\text{Border-Time FE}} + \epsilon_{bct}, \quad (3)$$

Endogeneity Concerns

- Patients taking anticoagulants are inherently at higher risk of stroke.

Analyze inpatient hospital visits for diagnoses related to ACs.

Empirical Approach

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Empirical Approach

Approach

- Instrument for prescriptions using drug injury advertising.
- Relevance: ads affect prescriptions.
- Exclusion restriction: health responds to DI through changes in prescriptions.
- Exogeneity: quasi-random variation in ad exposure across DMA borders.
- LATE: causal impact of NOAC fills on patients influenced by DI ads.

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Empirical Approach

Implementation

- Analyzed outcomes:
  - Relevant: stroke, embolism, afib.
  - Side effects: hemorrhaging.
  - Placebo: hip and femur procedures.

Table 2: The Effect of Anticoagulants on Inpatient Hospital Visits

	Relevant Diagnoses		Side Effects	
	OLS	IV	OLS	IV
NOAC Pres.	−0.0018	−0.0110	0.0008	−0.0097
	(0.0011)	(0.0051)	(0.0009)	(0.0052)
Mean DV	1.06	1.06	0.73	0.73
N	3,048	3,048	3,048	3,048
Cragg-Donald Wald F		41.53		41.53

county	yes	yes	yes	yes
border-year	yes	yes	yes	yes

Notes: The unit of obs is at the county-by-year level for the subset of border counties. DV is the per capita number of inpatient visits (in 1,000s) separately for relevant diagnoses and for side effects. Columns (2) and (4) instrument for prescriptions using DI ads interacted with county demographics. Prescriptions track the per capita annual NOAC fill (also in 1,000s). Standard errors are two-way clustered at the county and at the DMA-border-year levels and reported under each coefficient estimate.

Summary of Estimated Effects and Implications

Increasing ad spending by $0.19 (IQR):

- Estimated decrease in NOAC fills is 2.6%, with a 95% CI of [−4.9%; −0.4%]
- Estimated increase in hospital visits is 1.37%, CI of [0.13%, 2.62%].
  - Extrapolating from clinical trials: predict a 0.46% increase in hospitalizations, if the drop in NOACs was substituted with Warfarin.
- Corresponds to a 1,100 increase in hospitalizations, with a CI of [110, 3,425].
- No detectable effect of DI ads on diagnoses related to hemorrhaging.

DIresult

Conclusion

Findings

- Ads shift patients' beliefs about the risks/benefits of targeted drugs.
- Negative effects on public health: First study to quantify the causal effects of drug injury ads on prescriptions and health outcomes.

Policy Implications

- Debate on oversight of drug injury ads:
  - The FDA regulates DTCA to ensure accurate information.
  - Little oversight for DI ads (the FTC and state bars).
  - Results support increased scrutiny of the ads' content to ensure accuracy.
- Public Health:
  - Information campaigns educating patients and/or physicians.

Thank you!

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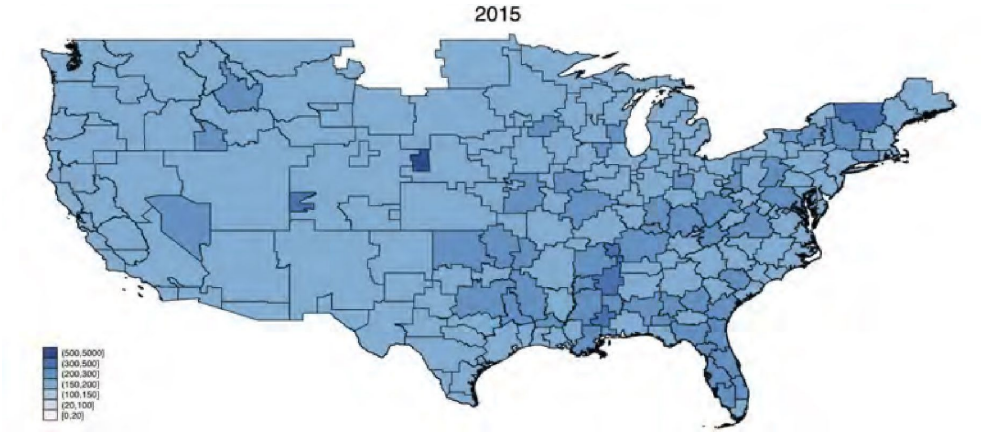
Table 3: Summary Statistics

	Mean	St. Dev.	5th %tile	95th %tile
Prescriptions				
NOAC Prescriptions	71.19	157.43	0.00	338.00
Warfarin Prescriptions	83.27	152.36	0.00	327.10
Total AC Prescriptions	154.46	261.53	0.00	624.00
Placebo Prescriptions	1033.69	992.84	49.80	2929.10
Inpatient Visits				
Relevant Diagnoses (per capita*1,000)	1.17	1.27	0.00	3.08

Side Effect Diagnoses (per capita*1,000)	1.63	1.85	0.00	4.21
Placebo Diagnoses (per capita*1,000)	0.60	0.70	0.00	1.72
Advertising				
Drug Injury Ads (per capita)	0.18	0.19	0.00	0.39

Notes: Prescriptions track annual fills by physician and type of drug. Total AC prescriptions are the sum of Warfarin and NOACs. Placebo prescriptions track the 30-day fills of gabapentin, hydrocodone-acetaminophen, metformin hcl, omeprazole, pantoprazole sodium, tamsulosin hcl. Hospital visits reflect the county-level annual visits per capita for each type of diagnosis (scaled by 1000 for readability). Drug injury ads reflect per capita spending at the DMA-year level.

Figure 1: Variation across DMAs and Years



data estimation

Table 4: The Effect of Anticoagulants on Placebo Hospital Visits

Placebo	OLS	IV
NOAC Pres.	−0.0005	0.0008
	(0.0006)	(0.0033)
Mean DV	0.50	0.50
N	3,048	3,048
Cragg-Donald Wald F		41.53
county	yes	yes
border-year	yes	yes

Notes: The unit of obs is at the county-by-year level for the subset of border counties. DV is the per capita number of inpatient visits (in 1,000s) for placebo diabnoses: hip and femur procedures. Column (2) instruments for prescriptions using DI ads. Prescriptions track the per capita annual NOAC fill (also in 1,000s). Standard errors are two-way clustered at the county and at the DMA-border-year levels and reported under each coefficient estimate.

Results regressing health outcomes on drug injury ads:

$$\underbrace{\text{hosp}_{bct}}_{\text{Per Capita Inpatient Hospital Visits}} = \beta \underbrace{\text{Drugs}_{mt}}_{\text{Per Capita Ad Spending}} + \underbrace{\gamma_c}_{\text{County FE}} + \underbrace{\eta_{bt}}_{\text{Border-Time FE}} + \epsilon_{bct}, \qquad (4)$$

	Relevant Diagnoses		Placebo Diagnoses		Side Effects Diagnoses	
	(1)	(2)	(3)	(4)	(5)	(6)

Drug Injury Ads	0.158	0.251	−0.001	−0.021	−0.010	0.091
	(0.053)	(0.209)	(0.036)	(0.126)	(0.044)	(0.149)
Mean DV	1.15	1.06	0.58	0.50	0.81	0.73
N	5,904	3,048	5,904	3,048	5,904	3,048
border-year	no	yes	no	yes	no	yes

Notes: The unit of observation is at the county-by-year level over the sample of 2015-2019. The dependent variable is the per capita number of inpatient visits across 3 sets of diagnoses. All regressions include county and year fixed effects. The results in columns (2), (4), and (6) use the border strategy so they only rely on data from border counties and include border-by-year fixed effects.
Standard errors are two-way clustered at the hospital and at the DMA-by-year levels and reported under each coefficient estimate.