Informative ordeals in healthcare: Prior authorization of drugs in Medicaid

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Managing healthcare spending without cost-sharing

- Total spending on drugs has increased but share paid out-of-pocket by patients has fallen from 57% in 1990 to 15% in 2018 (CBO, 2022)
- US federal programs such as Medicaid aim to ensure access to health services for low-income individuals by using minimal cost-sharing
  - Copays for prescription drugs as low as $1 in Massachussets Medicaid (MassHealth)
- An alternative for reducing healthcare spending is prior authorization (PA)
  - Provider must submit a PA form to payer and obtain approval before prescribing a drug
- Stated rationale for PA is to reduce spending by screening out low-value utilization
  - Information: reduce information asymmetry between principal and agent
  - Ordeal: improves targeting if willingness to undergo ordeal correlated with value
  - $\rightarrow$ **But** substantial admin burden associated with paperwork

What is the effect of prior authorization on drug utilization and appropriate use of drugs?

- Does prior authorization in MassHealth **reduce utilization** and **increase likelihood of guideline-concordant use**?
- Use difference-in-differences to compare drug utilization before and after a PA change in MassHealth fee-for-service (treatment group) relative to BCBS MA (control group)

What is the effect of prior authorization on drug utilization and appropriate use of drugs?

- Does prior authorization in MassHealth **reduce utilization** and **increase likelihood of guideline-concordant use**?
- Use difference-in-differences to compare drug utilization before and after a PA change in MassHealth fee-for-service (treatment group) relative to BCBS MA (control group)
- We find:
  - PAs decrease drug utilization of brands and specific dosages, formulations, or routes of administration by 52%-62%
  - PAs encourage substitution to generics or other drugs within the same active ingredient
  - PAs decrease utilization of entire active ingredients by 16%, with little substitution to other similar drugs
  - No differential targeting of guideline-inconsistent uses

Contribution

- Administrative burdens in US health care
  - Prior auth: Brot-Goldberg et al (2023), Eliason et al (2021), Frakt and Kyle (2021); Dillender (2018); Navar et al. (2017), Tseng et al. (2018)
  - General admin costs: Pozen and Cutler (2010); Cutler and Ly (2011); Frakt (2018)
  - Claims review and denials: Gottlieb et al. (2018), Dunn et al (2021); Shi (2021)
- Cost-sharing versus non-price rationing
  - Cost sharing: Sood et al. (2013); Baicker et al. (2015); Brot-Goldberg et al. (2017)
  - Quantity limits (Gandhi and Shi, 2024); wait times (Russo, 2023; Martin and Smith, 1999)
- Ordeals and targeting in social insurance programs
  - Deshpande and Li (2019); Finkelstein and Notowidigdo (2019); Shepard and Wagner (2021); Heinrich (2016); Herd and Moynihan (2018); Homonoff and Somerville, forthcoming

Outline

Setting: Medicaid and prior authorizations

- Medicaid: public health insurance program in the US administered by states
  - Provides health care coverage to eligible low-income adults and children
  - Zero or very low copays
  - Unlike private payers, Medicaid programs must cover almost all new drugs approved by the FDA
- MassHealth: Medicaid program in Massachusetts
  - Eligible individuals have the option to enroll in either MassHealth fee-for-service (FFS) or MassHealth managed care
  - FFS: providers are paid directly by MassHealth for care provided
  - Managed care is a contract between Medicaid and a managed care organization
- Prior authorization (PA): a requirement that a provider obtain approval from the payer to prescribe a treatment or service to ensure it is covered by the insurer
  - In vast majority of cases, a PA form needs to be submitted to the payer for approval
  - Some 'smart PA': algorithm checks past claims data and automatically approves PA if conditions met

MassHealth prior authorization form

MASSACHUSETTS STANDARD FORM FOR MEDICATION PRIOR AUTHORIZATION REQUESTS

E. Compound and Off Label Use

Is Medication a Compound? ☐ Yes ☐ No

If Medication Is a Compound, List Ingredients:

For Compound or Off Label Use, include citation to peer reviewed literature:

F. Patient Clinical Information

Please refer to plan-specific criteria for details related to required information.

Primary Diagnosis Related to Medication Request:

ICD Codes:

Pertinent Comorbidities:

Previous Therapies

Drug Name	Strength	Dosing Schedule	Date Prescribed	Date Stopped	Description of Adverse Reaction or Failure	Check if Sample
						☐
						☐
						☐
						☐
						☐

Are there contraindications to alternative therapies? ☐ Yes ☐ No

If yes, please list details:

Were nonpharmacologic therapies tried? ☐ Yes ☐ No

If yes, provide details:

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Empirical approach

- Difference-in-difference specification:

$$Y_{itd} = \alpha_0 MassHealth_{it} + \sum_{k=-4}^{k=6} \alpha_k \mathbb{1}(t - T_d = k) + \sum_{k=-4}^{k=6} \beta_k \mathbb{1}(t - T_d = k) MassHealth_{it} + \delta_d + \delta_t + X_i + \varepsilon_{itd}$$

- Compare within-drug utilization before and after a PA change in MassHealth fee-for-service (treatment group) relative to BCBS MA (control group)
  - Robustness specification uses matched treated-control units (nearest neighbor matching)
  - Robustness to 'stacked' event study (Cengiz et al, 2009)
- Why BCBS? Why not Medicaid managed care?
  - Use MassHealth FFS and BCBS because can observe full formularies
  - Both have adjudicated claims in data
  - Two largest insurers in MA
- Future: add more control payers and MassHealth managed care using MMIT data

Outline

Data: Massachusetts All-Payer Claims Database (APCD)

- Time period: 2009-2013
  - Future: data from 2016-2020
- Health insurance claims from private and public payers (Medicaid)
- Main source of drug utilization
  - Pharmacy claims: drugs dispensed, days supply, list prices, out-of-pocket costs
    - Observe active ingredient, brand name, formulation/route of administration, dosage
  - Medical claims: health care provider visits, diagnoses, procedures (including physician administered drugs), costs
  - Plan enrollment data: demographics, plan type, dates enrolled, type of coverage (medical, prescription, dental, vision)
- Data does not include rebates, so focus on drug utilization instead of spending
  - Future: out-of-pocket costs

Sample selection: patients enrolled in MassHealth FFS or BCBS only

- In our data: patients ever covered by MassHealth FFS or BCBS MA (medical or rx): almost 45% of all under 65 patients during 2009-2013
- 58% of under-65 MassHealth enrollees were covered by only FFS and not managed care at some point during 2009-2013

	MassHealth FFS (Treated)	BCBS (Control)
Patients with 1+ full quarter of medical and prescription drug coverage in 2009-2013	1,501,885	2,911,939
and only covered by MassHealth FFS or BCBS for 1+ quarter	-244,865	-124,090
and younger than 65 during 2009-2013	-197,983	-264,247
and MA resident	-13,660	-781,624
Number of patients in sample	1,045,377	1,741,978
Number of patient-quarters in sample	9,462,758	17,961,091

FFS = fee-for-service. BCBS = Blue Cross Blue Shield. NDC = National Drug Codes. HCPCS = Healthcare Common Procedure Coding System.

Sample selection: patients enrolled in MassHealth FFS or BCBS only

- MassHealth benes are younger + much more likely to have ER visit or hospitalization

Characteristic	MassHealth FFS (Treated)	BCBS (Control)
Female, %	52.59	49.68
Age	24.20	33.10
Any ER visit, prior 12 months, %	37.93	16.75
Any hospitalization, prior 12 months, %	9.90	3.98
OOP, prior 12 months, $	197	568
OOP pharmacy, prior 12 months, $	85	298
Spending, prior 12 months, $	6,287	4,104
Spending pharmacy, prior 12 months, $	971	962

FFS = fee-for-service. BCBS = Blue Cross Blue Shield

Data: Prior authorization changes

- Collect data on PA changes from MassHealth drug lists for 2009-2013
  - Data includes any PA change and any introduction of a new drug to the formulary (typically new drug approvals)
  - Lowest level for PA: brand-ingredient-dosage-formulation/route level
    - E.g., methylphenidate, brand name Concerta, extended-release formulation, 27mg dosage
  - Can impose PA on any combination of brand, ingredient, dosage, or formulation
  - E.g., methylphenidate, extended-release formulation
- PA changes from the 2023 Blue Cross Blue Shield (BCBS) of Massachusetts formulary
  - Observe whether an active ingredient was subject to PA during 2009-2023
  - Do not observe *when* a PA was added
- Exclude active ingredients ever under PA in BCBS from analysis
  - Future: Address overexclusion of active ingredients using more detailed formulary data (MMIT data)

Active ingredients, indications, diseases, PA changes, and drugs in analysis

	All	Main sample
Active ingredients	298	289
Indications	747	739
Diseases	359	356
PA changes	419	402
Newly approved drugs	194	185
Drugs affected by PA changes	1,058	948
Newly approved drugs	456	407

PA = prior authorization.
Note. Counts exclude drugs that cannot be mapped to NDC or HCPCS codes and associated indications, diseases, PA changes, and active ingredients. Counts also exclude drugs, active ingredients, and PA changes that do not have any claims in the data. In sample means having at least one claim in a patient-quarter observartion meeting our sample selection criteria.

- Treatment unit: drug
  - Defined as a unique combination of active ingredient, brand name, dosage, and formulation/route of administration
- Each PA change can affect multiple drugs: 3 on average

Types of PA status changes

	All	Main sample
PA changes	427	402
Newly approved drugs	197	180
Newly approved drugs → full PA	148	139
Newly approved drugs → partial PA	22	16
Newly approved drugs → no PA	27	25
Events among restricted drugs	37	35
full PA → partial PA	13	11
full PA → no PA	24	24
Events among partially restricted drugs	44	43
partial PA → full PA	17	17
partial PA → partial PA	25	25
partial PA → no PA	2	1
Events among unrestricted drugs	149	144
no PA → partial PA	26	26
no PA → full PA	123	118
Brands only	47	47
Dosage/formulation/route only	39	38
Entire active ingredient	37	33

PA = prior authorization.

- Full PA: any use of the drug requires PA
- Partial PA: some uses require PA
  - Restricts out of the ordinary uses
  - E.g., $\geq$ 60 pills or$\geq$ 1 injection per month, use in specific populations (children only or adults only), use in specific settings (hospital only)

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PA = prior authorization.

- PA added:
  - Includes transitions from no PA to full PA and from partial PA to full PA
  - Examine separately by:
    - Only brand restricted
    - Only specific dosage, formulation, or route of administration restricted
    - Entire active ingredient restricted
- PA removed:
  - Includes transitions from full PA to no PA and partial PA to full PA

Drugs affected by PA changes are common

- 20% of all claims for sample drugs affected by PA changes occur in our sample

(a) PA added

	MassHealth FFS	BCBS
Focal drug claims (N)	1,633,110	1,293,537
Pats w/ focal drug (N)	192,601	327,659
Top drug classes		
Antipsychotics	38 %	7.7%
Antibiotics (tetracyclines)	24.2%	7.5 %
Stimulants (amphetamines)	13.1 %	9.9 %
Opioid agonists	3.4 %	12.2 %
Antidepressants	3.4 %	5.5 %

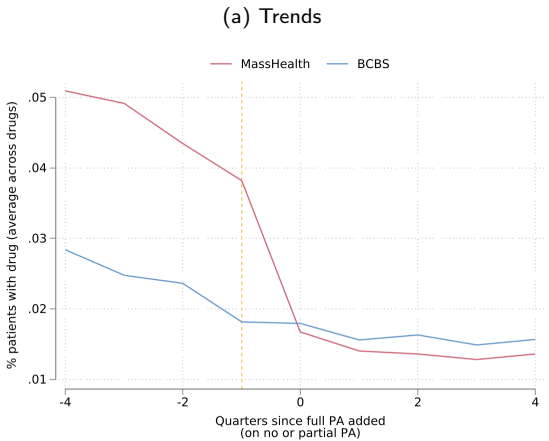
(b) PA removed

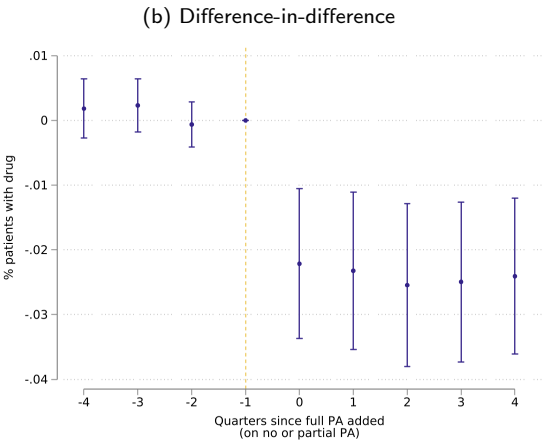
	MassHealth FFS	BCBS
Focal drug claims (N)	1,396,106	2,34,846
Pats w/ focal drug (N)	202,054	399,359
Top drug classes		
Antiinflammatory drugs	44.2 %	45.4%
Antidepressants	33.5%	36.7 %
Misc cardiac drugs	7.0 %	5.6 %
Misc therapeutic agents	4.0 %	3.96 %
Stimulants (amphetamines)	2.5 %	2.9 %

Outline

Outline

Prior authorization reduces % of patients taking drug by over half (54%)



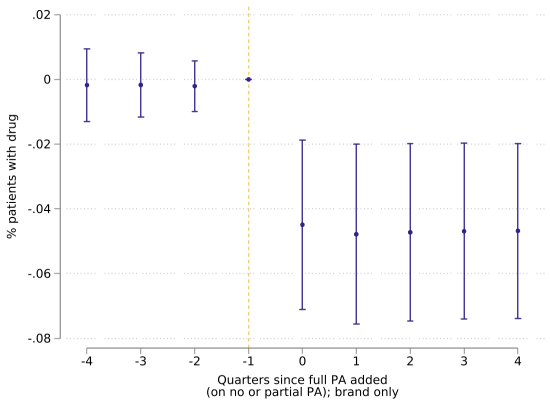


Pre-period control group mean: 0.0458.

No PA → full PA only | Partial PA → full PA only | DiD: Prescriptions | Table

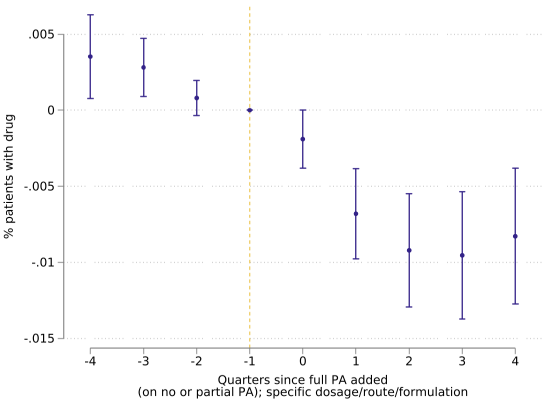
Prior authorization on brands or specific dosages, formulations, or routes reduces drug utilization by 52%-62%

(a) PA added on brand only



Pre-period control group mean: 0.0734.

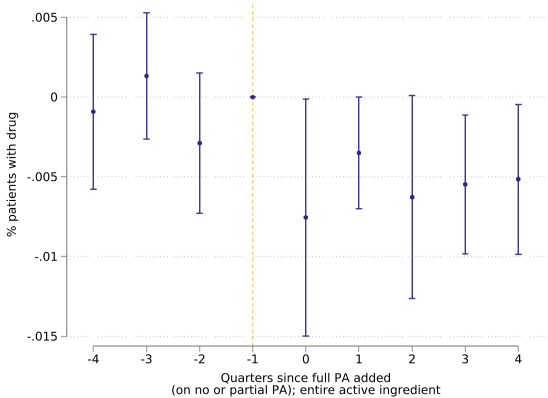
(b) PA added on specific dosage/route/formulation



Pre-period control group mean: 0.0172.

Trends DiD: Prescriptions Table

Utilization decline is smaller when entire active ingredient restricted (16%)



Pre-period control group mean: 0.0312.

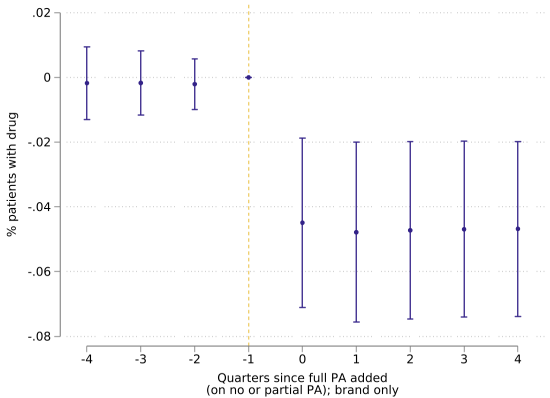
- Statistically significant but much smaller reduction in utilization
- Fewer readily available substitutes?

Trends DiD: Prescriptions Table

Outline

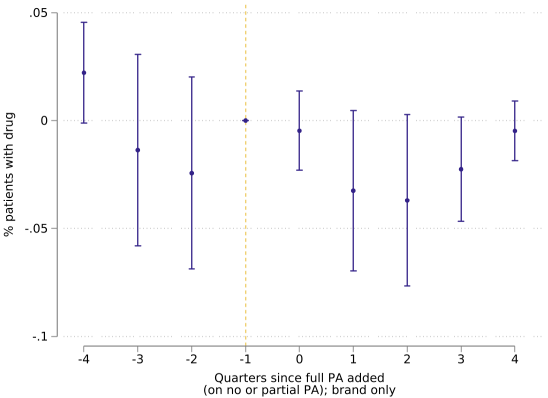
Almost full substitution to generic drugs when brand is restricted (-3%, statistically significant)

(a) Focal drug



Pre-period control group mean: 0.0172.

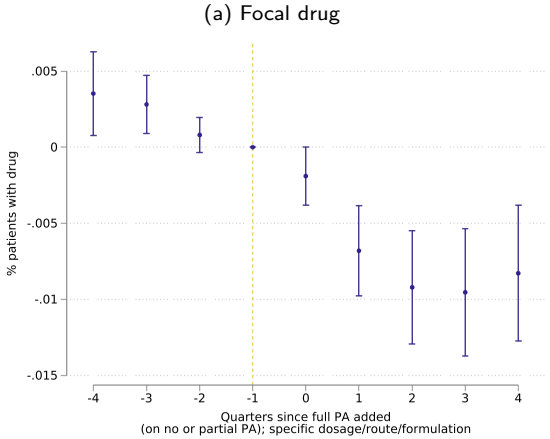
(b) Focal active ingredient



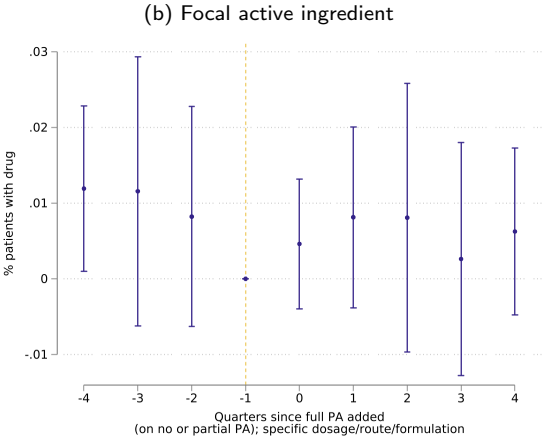
Pre-period control group mean: 0.3417

DiD: Prescriptions Table

Complete substitution when a specific dosage, formulation, or route of administration is restricted (-0.6%, not statistically significant)



Pre-period control group mean: 0.0734.

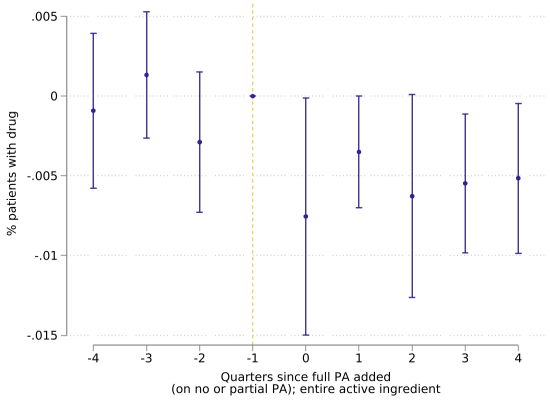


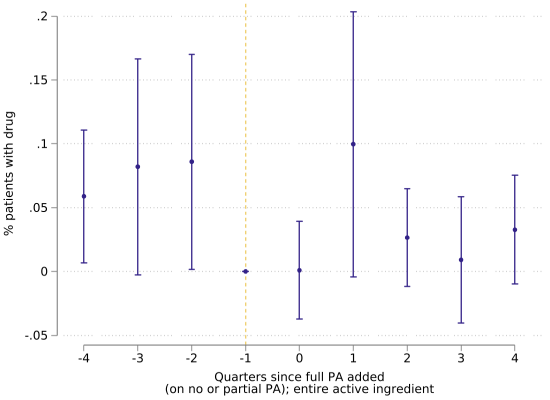
Pre-period control group mean: 0.4475

DiD: Prescriptions Table

Outline

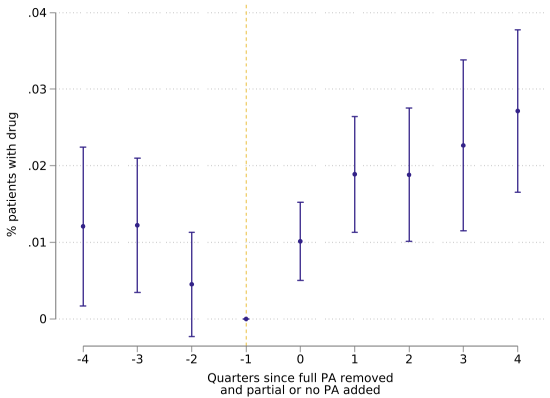
No substitution towards other drugs in same therapeutic class when restricting active ingredient only





Outline

Removing a PA increases drug utilization by 9%



Pre-period control group mean: 0.1393.

- Growing adoption over time
  - Contrast with immediate drop in utilization when PA is added
- Symmetric effect relative to adding a PA
  - Difficult to compare magnitudes since different drugs placed under PA than those for which PA was removed
  - Few drugs have both a PA placed and removed during the study period

Table

Outline

Outline

Guideline-inconsistent use: background and definition

- On-label use: use of a drug approved by the Food and Drug Administration (FDA)
  - i.e., consistent with FDA guidelines
- Off-label use: use of a drug in diseases or populations not approved by the FDA
  - Physicians can freely prescribe drugs off-label
    - Small legal liabilities
  - Pharmacies do not restrict prescribing based on FDA approval status

Guideline-inconsistent use: data

- Identify FDA-approved indications, ages, and dates of approval for each active ingredient affected by PA change
  - Indication: a disease or condition for which a drug is approved by the FDA
  - Drugs@FDA: repository of drug labels listing indications
  - MicroMedex: medical compendium
- Map indications to diseases manually
  - For example, indications: "Bipolar disorder, depressed phase, acute management, monotherapy", "Bipolar disorder, depressed phase, in combination with lithium or valproate; adjunct", "Bipolar I disorder", "Bipolar I disorder, acute manic or mixed episodes" (among others) are all included in disease "bipolar disorder"
- Patient must have an indicated disease and approved age prior to prescription fill date
  - Use ICD-9-CM diagnosis codes in medical claims to identify diseases
- All other uses: off-label (guideline-inconsistent)

Guideline sample and summary statistics

	MassHealth FFS (Treated)	BCBS (Control)
Patients with 1+ full quarter of medical and prescription drug coverage in 2009-2013	1,501,885	2,911,939
and only covered by MassHealth FFS or BCBS for 1+ quarter	-244,865	-124,090
and younger than 65 during 2009-2013	-197,983	-264,247
and MA resident	-13,660	-781,624
and 12+ months of medical coverage prior to 1+ quarter	-241,374	-349,181
Number of patients in sample	804,003	1,392,797
Number of patient-quarters in sample	6,781,702	12,963,535

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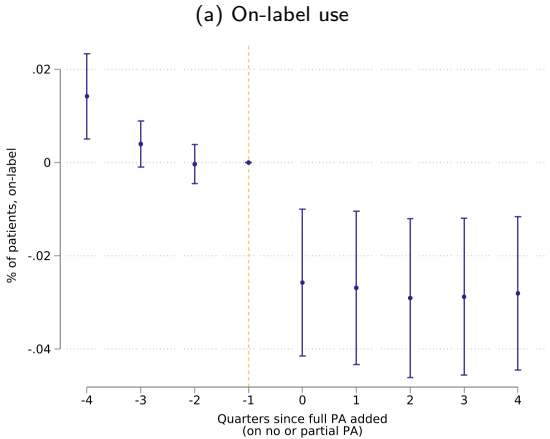
FFS = fee-for-service. BCBS = Blue Cross Blue Shield. NDC = National Drug Codes. HCPCS = Healthcare Common Procedure Coding System.

- For restricted drugs (no PA $\rightarrow$ PA), 1 in 4 prescriptions is off-label
  - 30% off-label in BCBS, 17% in MassHealth
  - For drugs with eased restrictons (PA $\rightarrow$ no PA), 1 in 5 prescriptions is off-label
- Almost all off-label use is for diseases that are not approved by the FDA

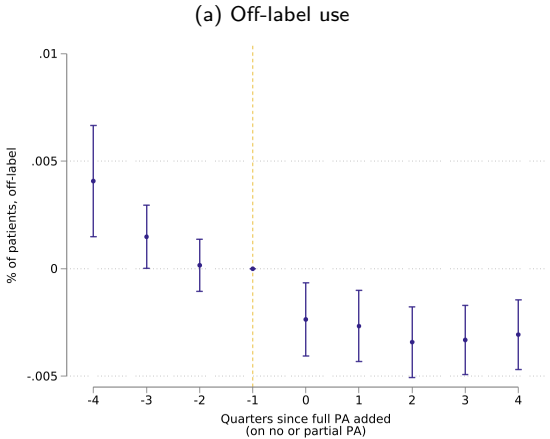
Main results Drug counts

Outline

PA decreases on-label utilization by 63% and off-label utilization by 41%



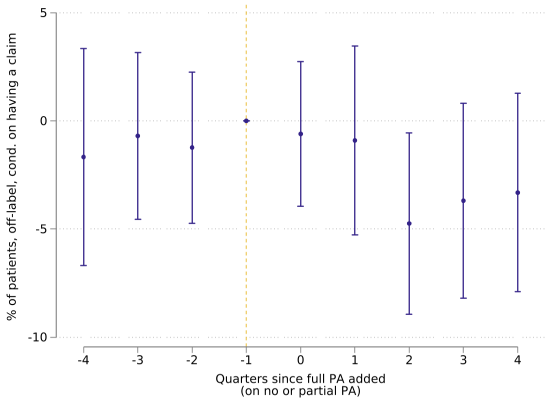
Pre-period control group mean: 0.0496.



Pre-period control group mean: 0.0102

PA removed Table

However, no change in % off-label conditional on having a prescription



Pre-period control group mean: 27.1%.

- Suggests no differential targeting of on- vs. off-label use pre vs. post PA
  - Slight decrease after 6 months implies some off-label uses may be weeded out by PA after grandfathered-in refills expire

PA removed Table

Outline

Conclusion

- Large and persistent effects of PAs on drug utilization in Medicaid
  - PA valuable instrument to divert use to less expensive drugs:
    - Complete substitution within active ingredient when specific dosage, route of administration or formulation is restricted
    - Almost full substitution to generics when brands restricted
  - Much smaller utilization drop when entire active ingredient restricted
- But some patients may not receive needed care
  - Little substitution to similar drugs when entire active ingredient is restricted
  - Both guideline-consistent and guideline-inconsistent uses decrease substantially
- Next steps
  - Exploit introduction of 'smart PA' algorithms with automatic approval. Preserve info content but reduce ordeal
  - Add additional formulary data for MassHealth managed care + exchange plans

Thank you!

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Selection of active ingredients affected by PA changes

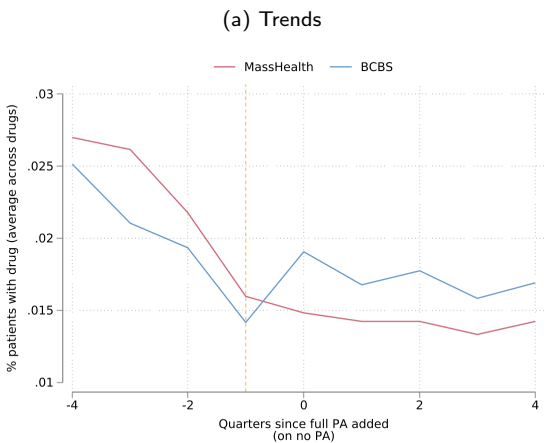
Active ingredients with PA change or introduced as	494
new drug to the MassHealth FFS formulary in 2009-2013	
and have indications that can be mapped to diseases	-51
and are indicated for diseases that have a ICD-9 code	-0
and are indicated for diseases that have at least one diagnosed patient	-0
and are not over-the-counter	-21
and can be identified using NDC or HCPCS codes	-6
and have at least one claim in 2009-2013	-0
Have PA in BCBS	-99
Number of unique active ingredients for analysis	317

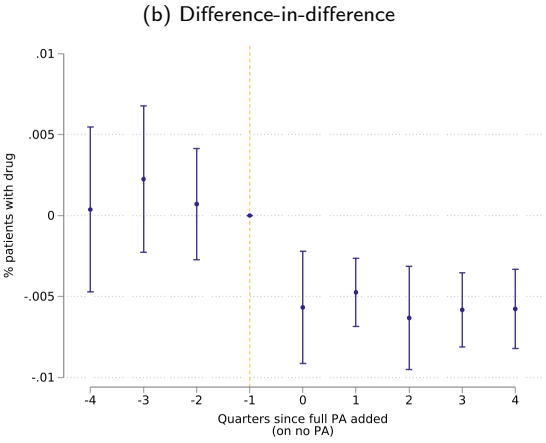
PA = prior authorization.

Note. PA changes do not include deletions from the MassHealth Drug List due to revocation of FDA approval or due to manufacturer discontinuation. Active ingredients with indications that cannot be mapped to diseases include those with unknown indications as well as those with only diagnosis-related, procedure-related, or prophylactic indications (e.g., contraception, imaging, etc.). Codes used to identify drugs in the data include National Drug Codes (NDC) and Healthcare Common Procedure Coding System (HCPCS) codes. Over the counter drugs were identified using the RedBook data and were checked manually.

Back

Effect of PA on % of patients taking drug: no PA → full PA only





Pre-period control group mean: 0.0227.

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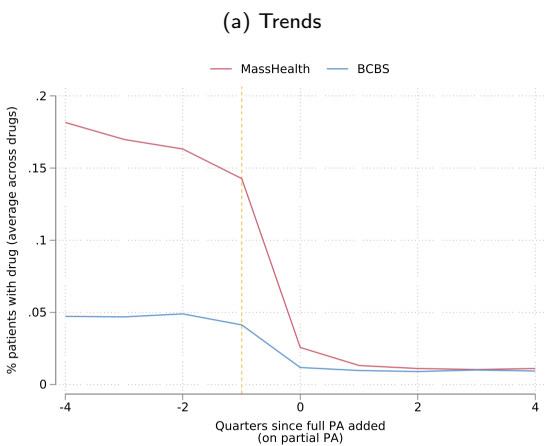
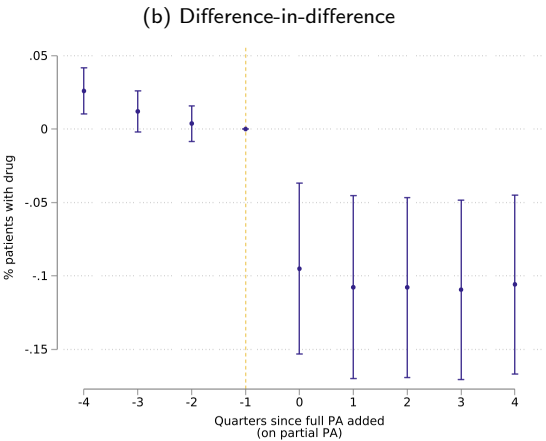
Effect of PA on % of patients taking drug: partial PA → full PA only





Pre-period control group mean: 0.1658.

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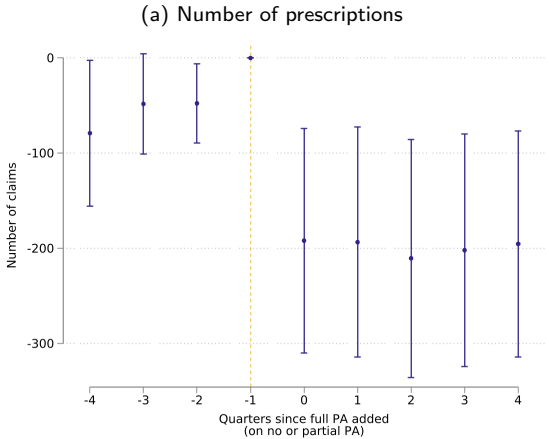
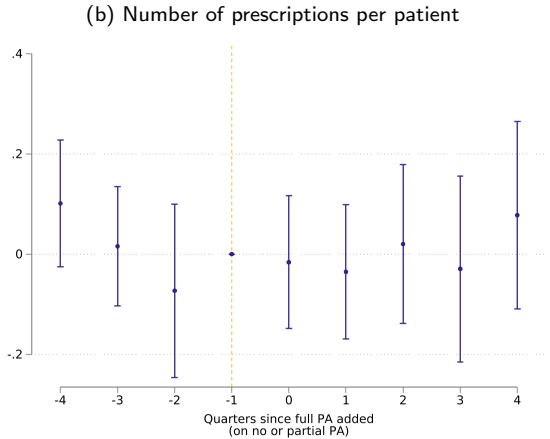
Effect of PA on number of prescriptions



Pre-period control group mean: 392.



Pre-period control group mean: 1.8.

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Effect of PA on % of patients taking drug

	(1) No or partial PA → full PA b/se	(2) No PA → full PA b/se	(3) Partial PA → full PA b/se
Post x MassHealth	-0.024890***	-0.006575***	-0.115347***
	(0.006040)	(0.001830)	(0.030173)
Post	-0.001775	0.004125**	-0.048312***
	(0.002303)	(0.001678)	(0.014076)
MassHealth	0.021321***	0.001473	0.121152***
	(0.006341)	(0.002396)	(0.030908)
Drug x event FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Pre-period control group mean	0.0458	0.0227	0.1658
coef rel to mean	-0.5436	-0.2902	-0.6955

Note. Standard errors are clustered at the drug-event level.

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Effect of PA on number of prescriptions

	(1) No or partial PA → full PA b/se	(2) No PA → full PA b/se	(3) Partial PA → full PA b/se
Post x MassHealth	-1.56e+02***	-5.398395	-8.85e+02***
	(59.722010)	(24.506146)	(3.03e+02)
Post	-5.97e+01**	25.346252	-6.89e+02***
	(29.593334)	(16.431359)	(1.74e+02)
MassHealth	64.666037	-1.00e+02**	8.87e+02***
	(68.524487)	(42.554994)	(3.17e+02)
Drug x event FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Pre-period control group mean	392.6022	163.8888	1579.8332
coef rel to mean	-0.3977	-0.0329	-0.5600

Note. Standard errors are clustered at the drug-event level.

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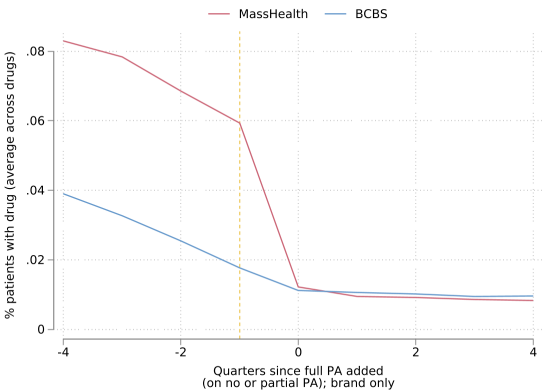
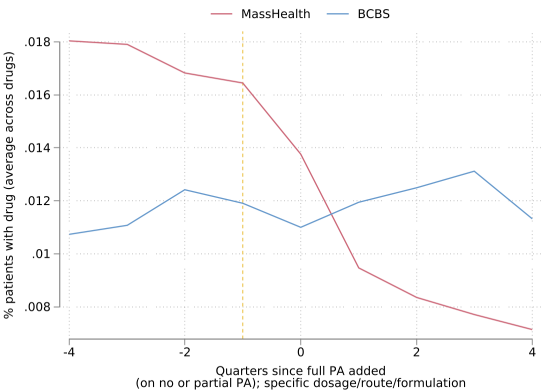
Trends: PA added on brand only or specific dosage, formulation, or route of administration

(a) PA added on brand only



(b) PA added on specific dosage/formulation/route



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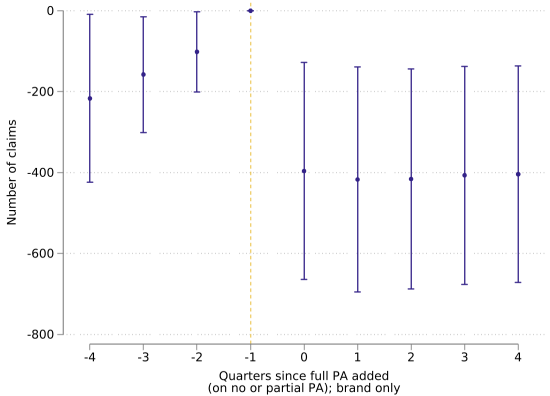
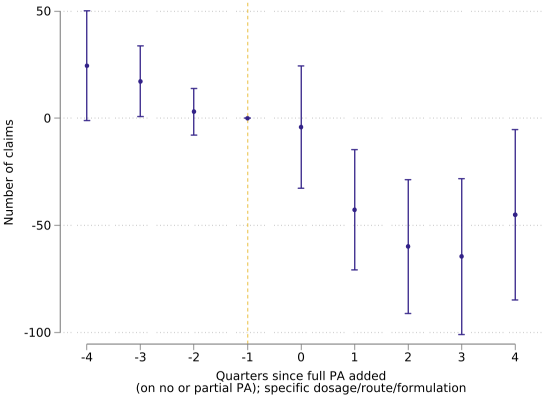
Effect of PA on number of prescriptions

(a) PA added on brand only



Pre-period control group mean: 673.

(b) PA added on specific dosage/formulation/route



Pre-period control group mean: 144.

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Effect of PA on % of patients taking drug

	(1) Brand only b/se	(2) Specific formulation/dosage route b/se	(3) Entire active ingredient b/se
Post x MassHealth	-0.045689***	-0.008865***	-0.004946**
	(0.013042)	(0.001906)	(0.002109)
Post	-0.008273	0.001317	0.003988
	(0.005265)	(0.000847)	(0.002451)
MassHealth	0.046748***	0.005301*	-0.001467
	(0.013760)	(0.002988)	(0.004150)
Drug x event FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Pre-period control group mean	0.0734	0.0172	0.0312
coef rel to mean	-0.6222	-0.5160	-0.1583

Note. Standard errors are clustered at the drug-event level.

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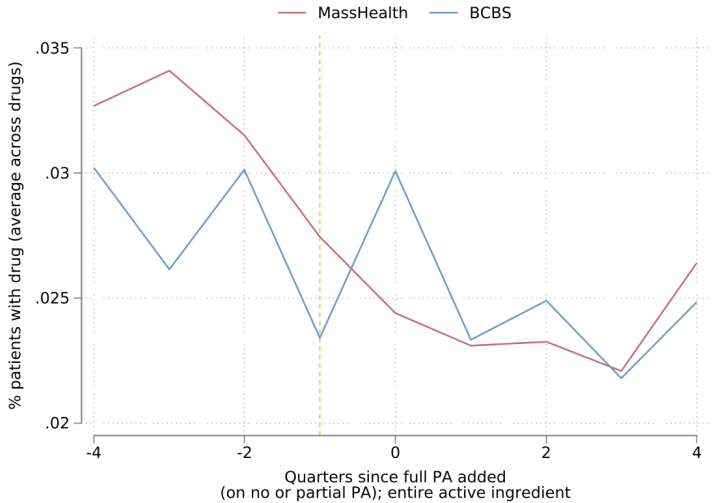
Trends: no or partial PA → full PA, PA added on entire active ingredient



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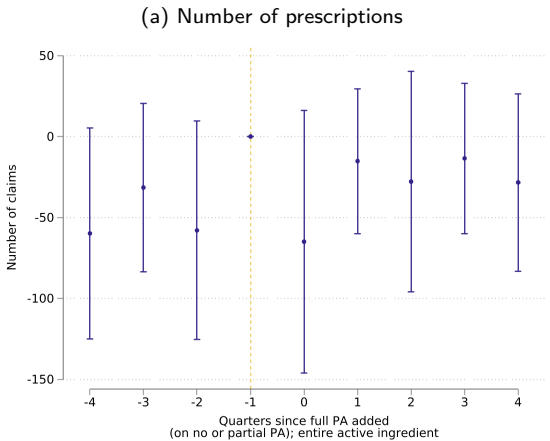
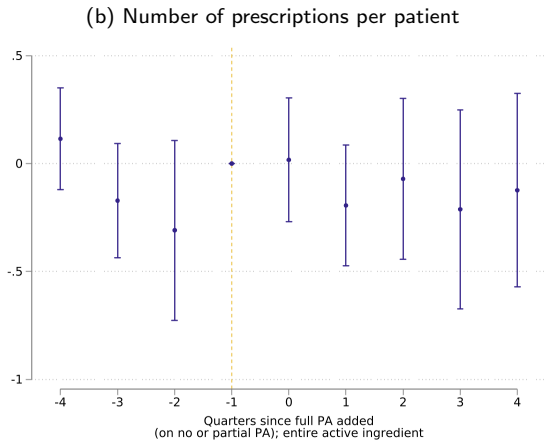
Effect of PA on number of prescriptions, entire active ingredient restricted



Pre-period control group mean: 209.



Pre-period control group mean: 4,305.

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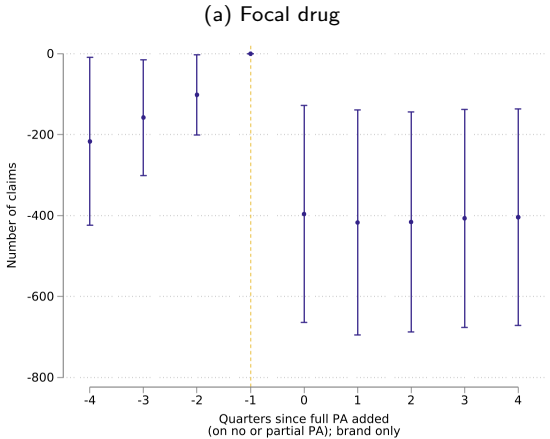
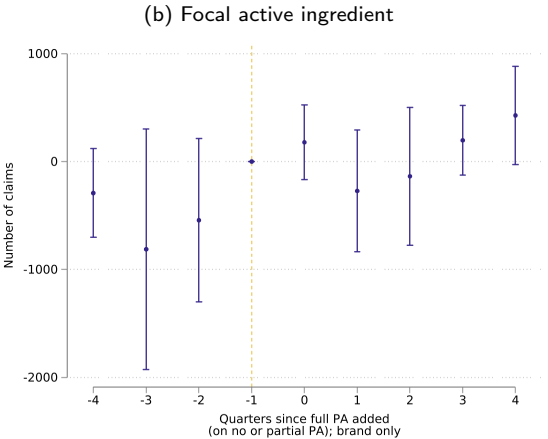
Effect of PA on number of prescriptions, brand only



Pre-period control group mean: 673.



Pre-period control group mean: 4,305.

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Effect of PA on % of patients taking drug, focal active ingredient

	(1) Brand only b/se	(2) Specific formulation/dosage route b/se
Post x MassHealth	-0.016049**	-0.002015
	(0.006810)	(0.006752)
Post	0.006170	-0.003557
	(0.014214)	(0.005408)
MassHealth	0.128074*	0.109570
	(0.075584)	(0.067844)
Drug x event FE	Yes	Yes
State FE	Yes	Yes
Pre-period control group mean	0.4475	0.3417
coef rel to mean	-0.0359	-0.0059

Note. Standard errors are clustered at the active ingredient-event level.

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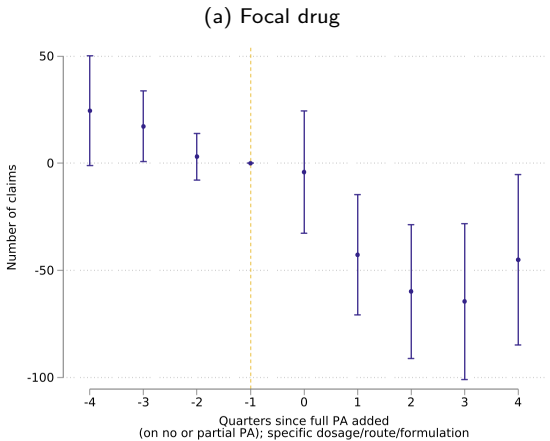
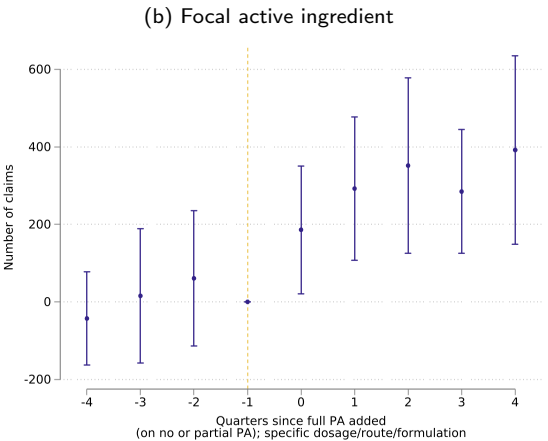
Effect of PA on number of prescriptions, dosage only



Pre-period control group mean: 144.



Pre-period control group mean: 3,058.

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Effect of PA removal on % of patients taking drug

	(1) Full PA → no or partial PA b/se	(2) Full PA → no PA b/se	(3) Full PA → partial PA b/se
Post x MassHealth	0.012493***	0.006484	0.018157***
	(0.004011)	(0.004576)	(0.005198)
Post	0.007694	0.011674**	-0.000643
	(0.004816)	(0.005454)	(0.005276)
MassHealth	-0.007455	-0.017387***	-0.001004
	(0.016501)	(0.005284)	(0.027265)
Drug x event FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Pre-period control group mean	0.1393	0.0231	0.2171
coef rel to mean	0.0897	0.2804	0.0836

Note. Standard errors are clustered at the drug-event level.

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Active ingredients, indications, diseases, PA changes, and drugs used for analysis

	All	Main sample	Guideline sample
Active ingredients	298	289	288
Indications	747	739	733
Diseases	359	356	355
PA changes	419	402	399
Newly approved drugs	194	185	183
Drugs affected by PA changes	1,058	948	928
Newly approved drugs	456	407	402

PA = prior authorization.

Note. Counts exclude drugs that cannot be mapped to NDC or HCPCS codes and associated indications, diseases, PA changes, and active ingredients. Counts also exclude drugs, active ingredients, and PA changes that do not have any claims in the data. In sample means having at least one claim in a patient-quarter observartion meeting our sample selection criteria.

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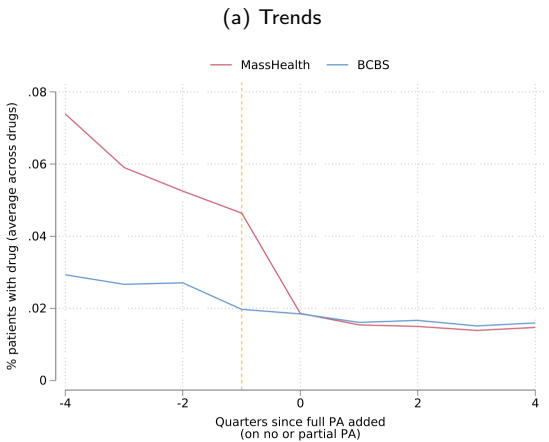
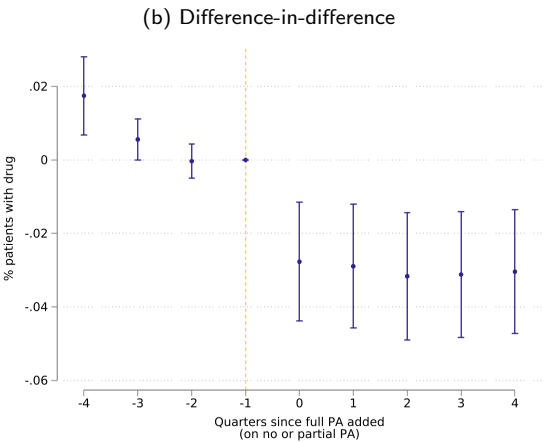
Effect of PA on % of patients taking drug, guideline sample





Pre-period control group mean: 0.0580.

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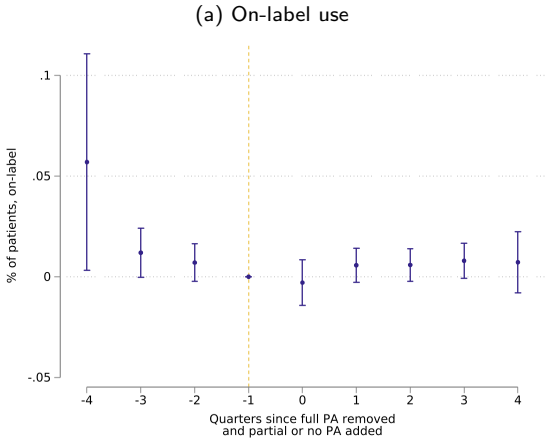
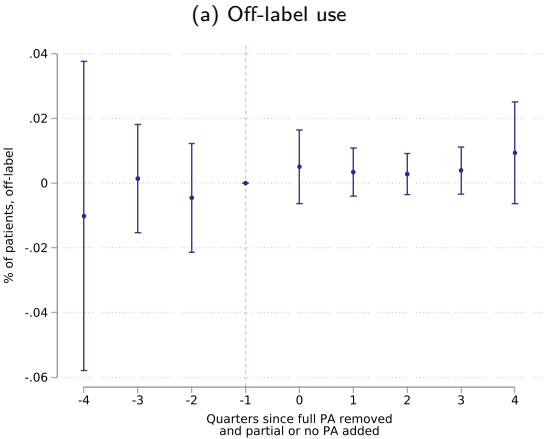
PA removed, % patients taking drug



Pre-period control group mean:



Pre-period control group mean:

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Effect of PA on % of patients taking drug

	(1) On-label b/se	(2) Off-label b/se	(3) Off-label, cond. on any b/se
Post x MassHealth	-0.031392***	-0.004183***	-1.805658
	(0.008740)	(0.001161)	(1.422024)
Post	-0.002321	-0.001468*	0.528511
	(0.001852)	(0.000852)	(1.323775)
MassHealth	0.031283***	0.002244	-4.189415***
	(0.008955)	(0.001369)	(1.502559)
Drug x event FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Pre-period control group mean	0.0496	0.0102	27.1223
coef rel to mean	-0.6325	-0.4104	-0.0666

Note. Standard errors are clustered at the drug-event level.

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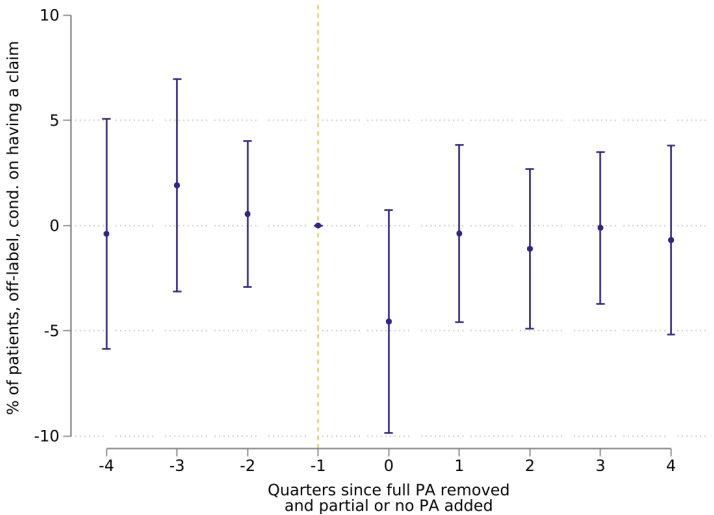
PA removed, % off-label conditonal on prescription



Pre-period control group mean:

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