The Impact of Increased Access to Telemedicine

Dan Zeltzer
Tel Aviv University

joint with

Liran Einav
Stanford and NBER

Joseph Rashba
Clalit Health Services

Ran Balicer
Clalit Health Services and
Ben-Gurion University

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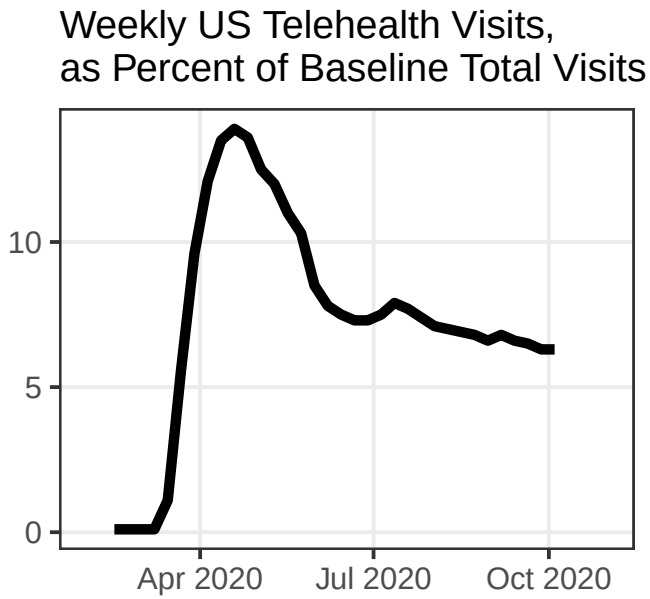
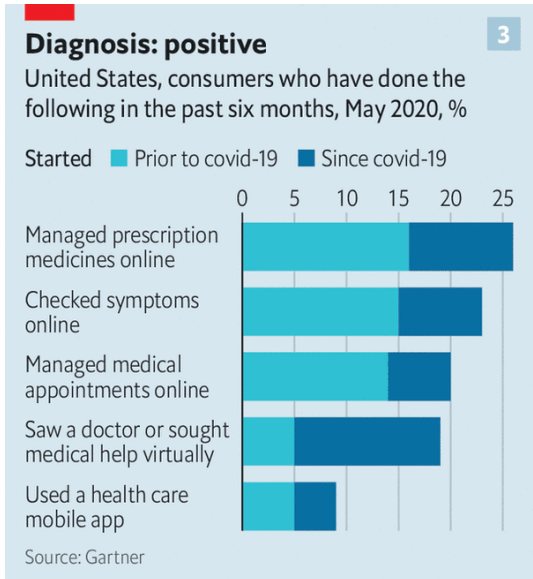
NBER Aging Meeting

Motivation

- For many years, telemedicine remained an unfullfilled promise, hampered by regulation, reimbursement, and licensing restrictions.
- The COVID-19 pandemic precipitated a sharp surge in adoption.



Source: Mehrotra et al. (2020)



The Economist

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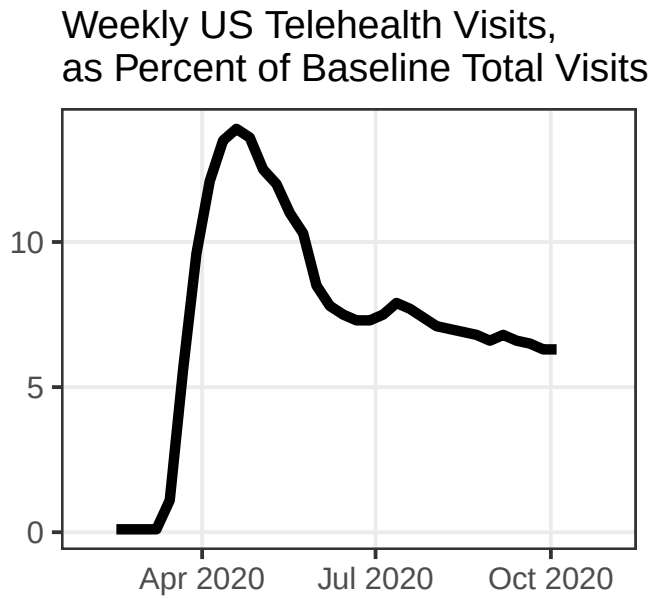

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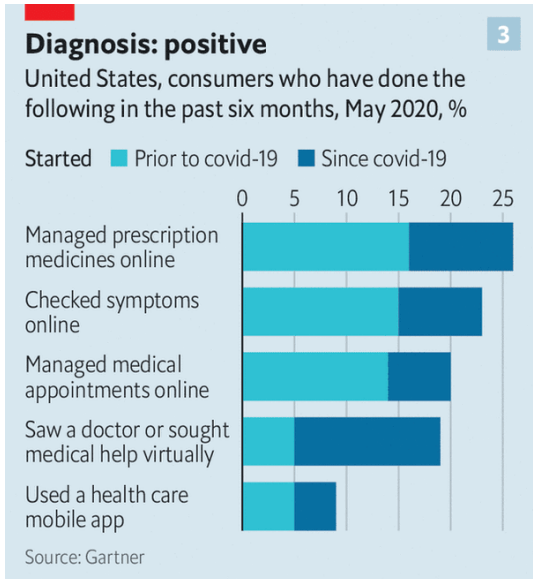

The Economist

- A key question is whether and how telemedicine should be maintained going forward. But little is known about the impact of such a change.
- We aim to start filling this gap and provide evidence on the effects of increased access to telemedicine.

Increased Access to Telemedicine: Pros and Cons

Pros

- convenient
- cheaper

Cons

- overuse?
- lower quality? (misdiagnosis, discontinuity)

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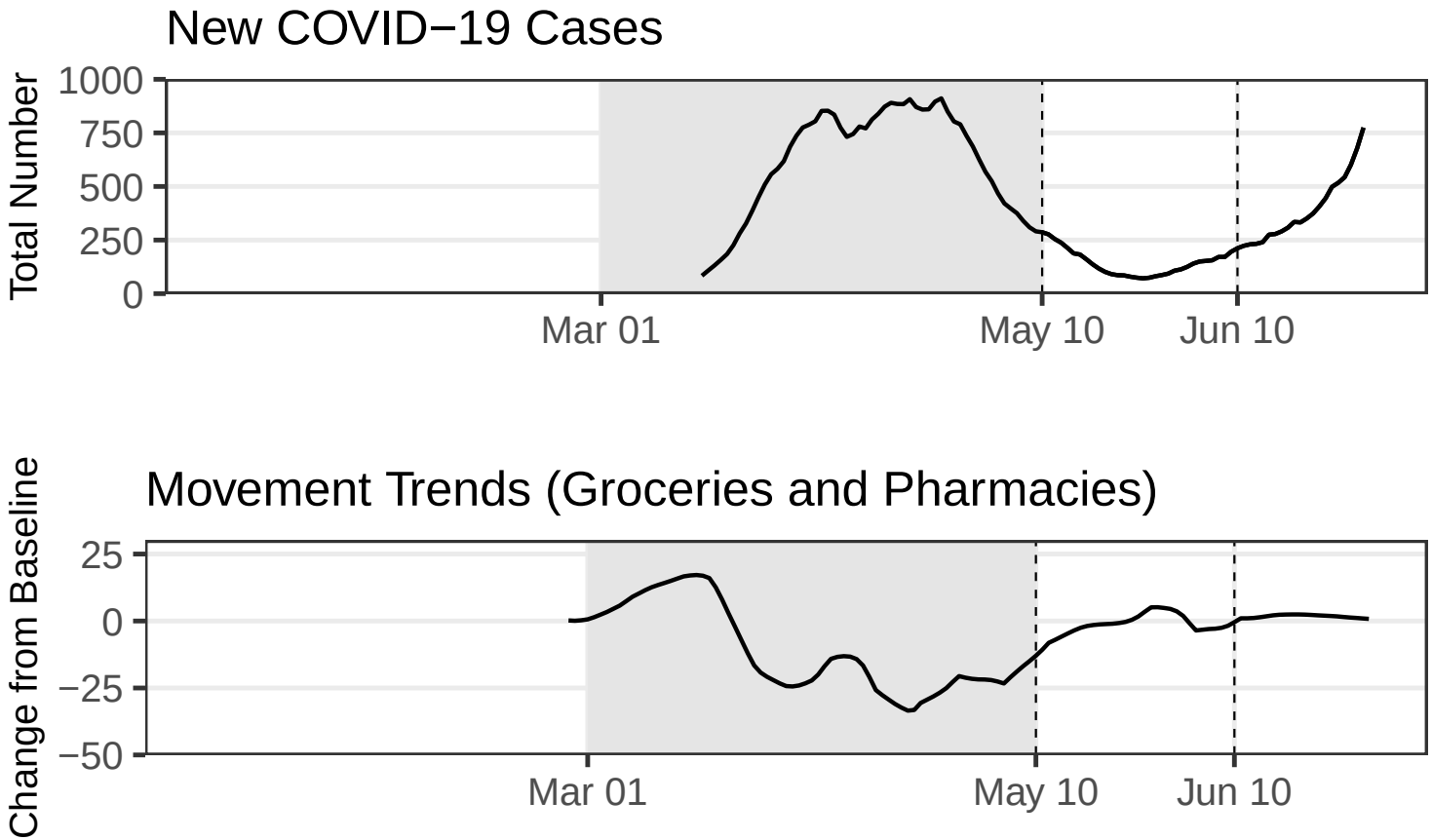
Outline

- Empirical Strategy
- Data
- Main Results: The Impact of Telemed
- Diagnosis of Specific Conditions (if time permits)

First COVID-19 Lockdown in Israel



- The first lockdown involved a full shutdown of commerce, retail, and air traffic; severe mobility restrictions (100m perimeter); and high level of adherence.

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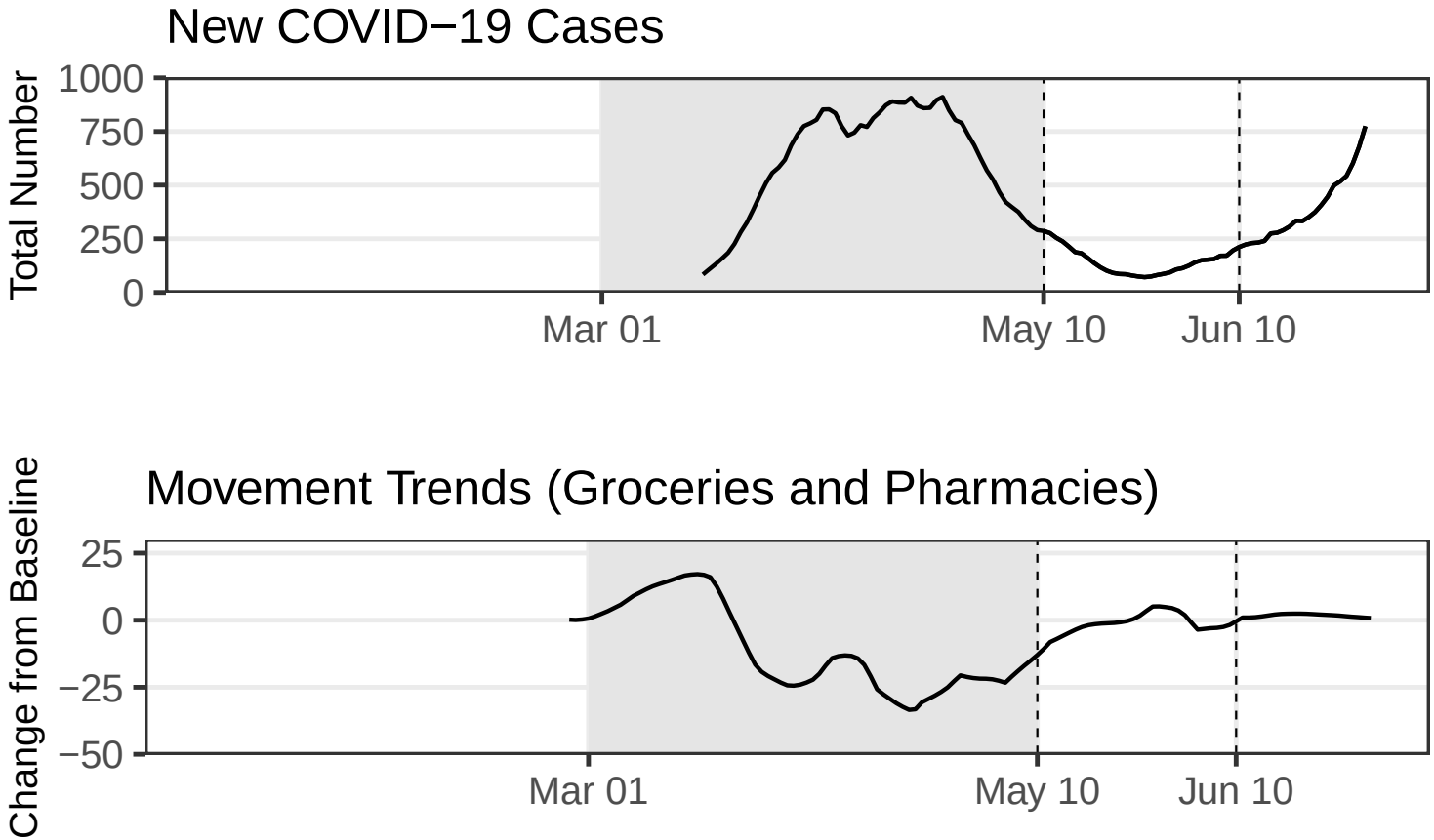
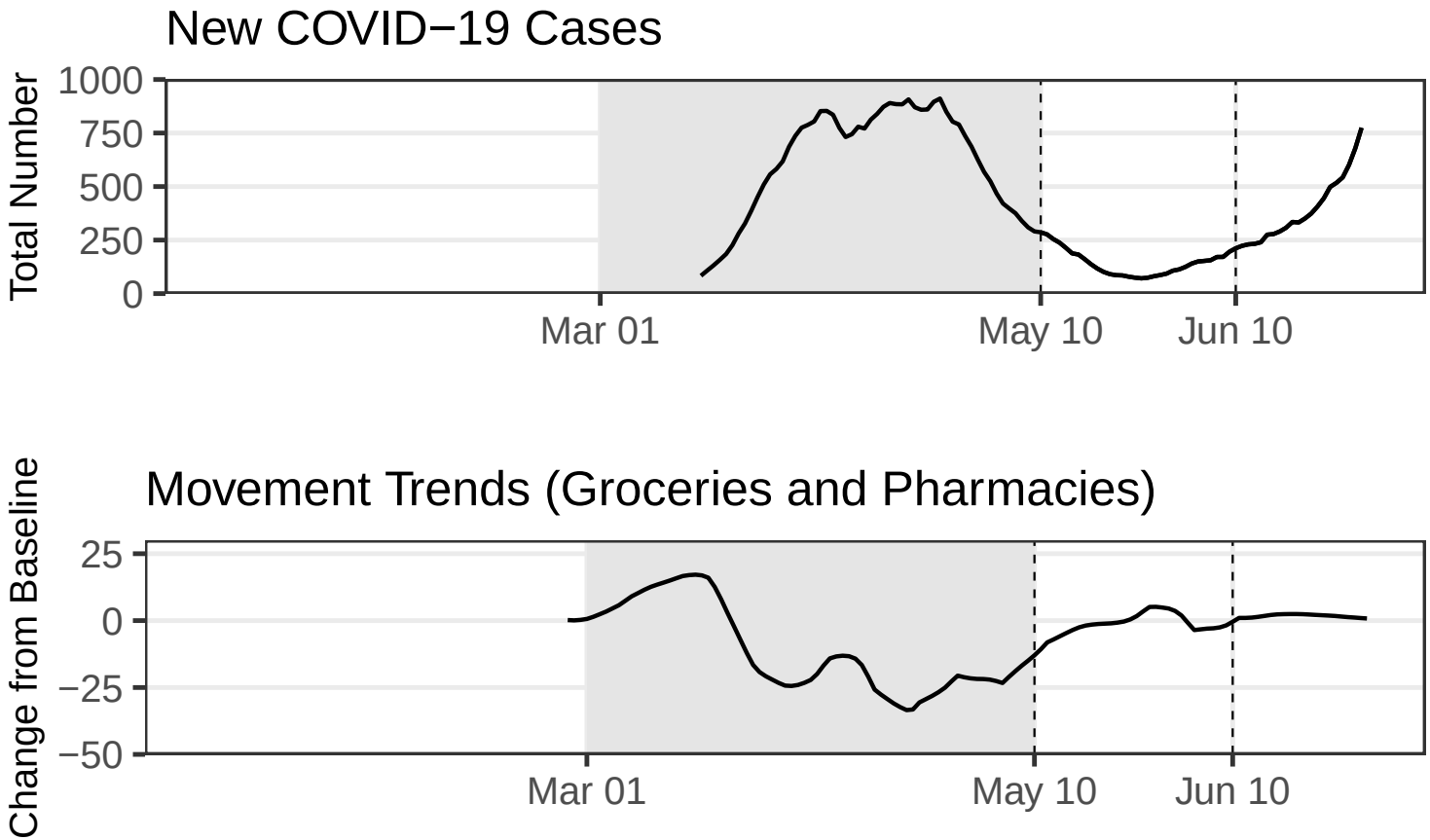


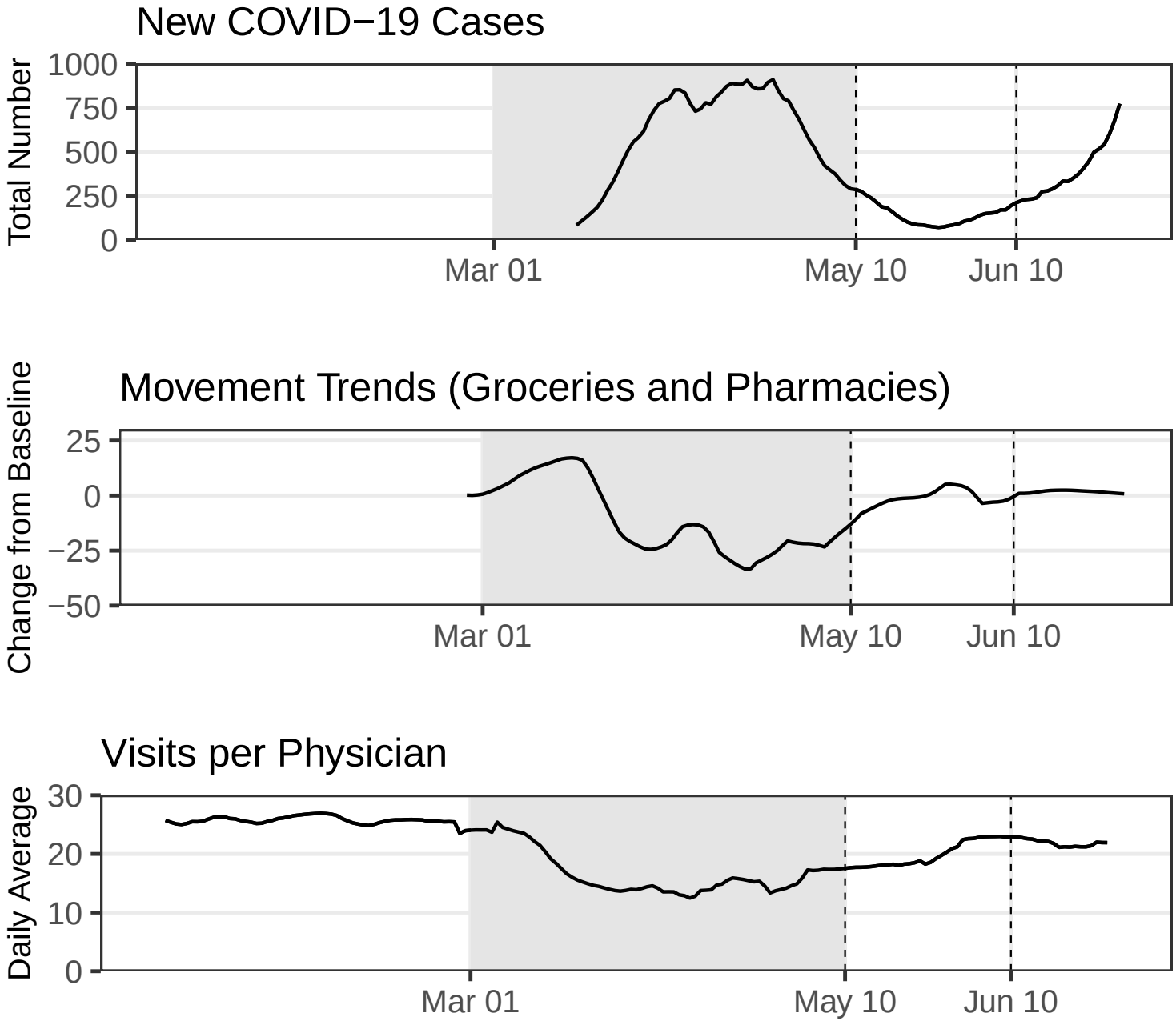
- The lockdown ended with fewer than 200 deaths and a sharp decline in COVID-19 incidence. Test positivity was well below 3%. At the time, it was widely believed that Israel was approaching full suppression.

First COVID-19 Lockdown in Israel



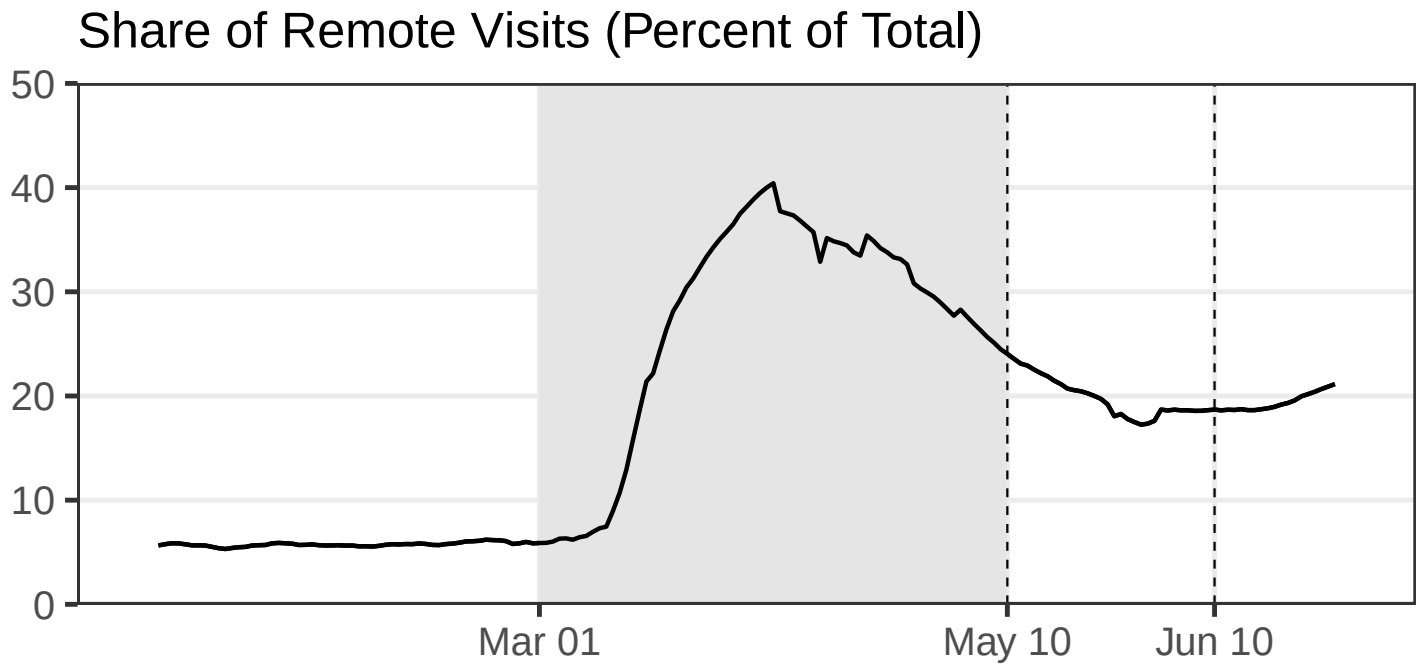
- The bounce back from the first lockdown was characterized by a partial (and temporary) return to normalcy, with malls, restaurants, and schools all opening in early May.

First COVID-19 Lockdown in Israel



Remote Primary Care During and Post Lockdown

(Remote visit = synchronous phone or video encounter)



Like elsewhere, telemedicine use sharply increased;
Post-lockdown levels remained high.

Empirical Approach

Our strategy exploits this post-lockdown "normalcy" to emulate the post-pandemic world:
We compare patients with low and high *access* to remote care in May–June 2020, based on earlier telemed adoption of their regular physician.

Data

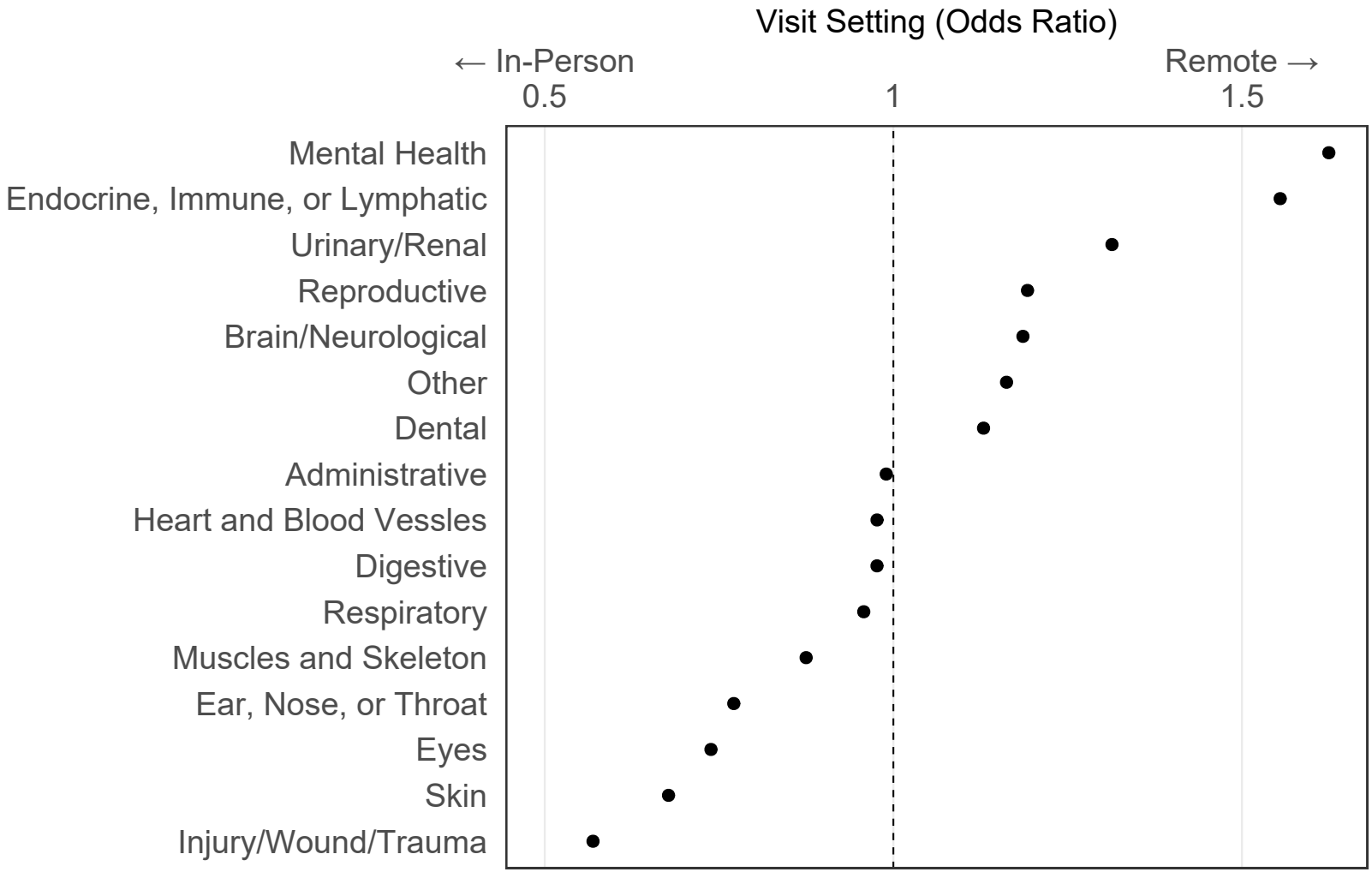
Data Source Clalit Health Services, the largest of four Israeli HMOs. Clalit covers half of the population (with annual switching rate of about 1%).
It operates a large network of physicians, outpatient clinics, and hospitals.

Main Study Sample

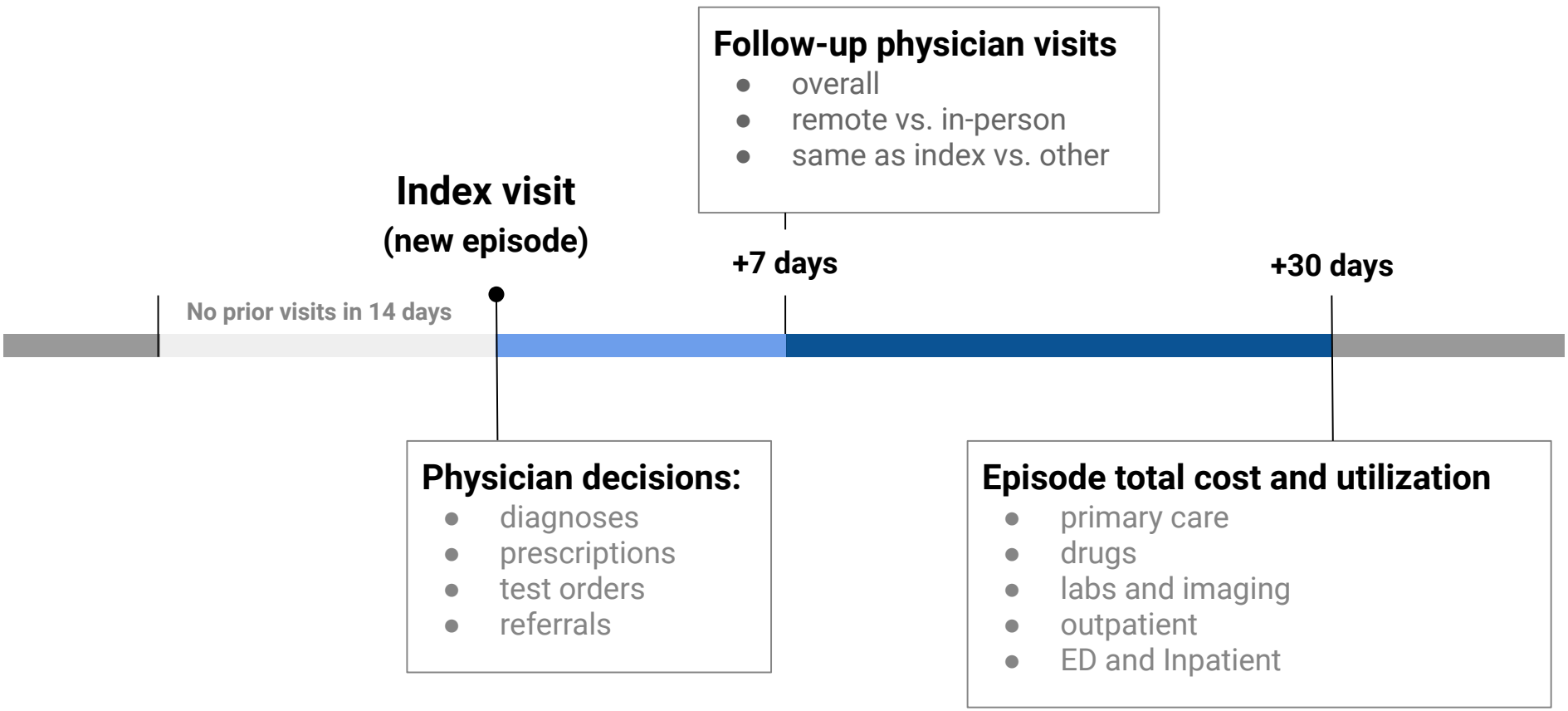
- 10 million visits with active primary care physicians between January 2019 and June 2020.
- We observe rich claims and EMR data covering prior and subsequent utilization.

Remote Medicine Relative Use, by Diagnostic Category

May–June 2020, Non-Followup Primary Care Visits



Unit of Observation: A Care Episode Starting with a Primary Care Visit



Descriptives of Post-Period Visits, by Setting

Non-followup visits in May–June 2020:

	In Person	Remote
	(1)	(2)
Female (Percent)	54.1	58.2
High SES (Percent)	26.5	42.0
Age (Mean)	36.8	40.2
ACG (Mean)	1.3	1.4
Number of CC (Mean)	2.5	3.0
Number of Visits	510,779	112,348

Measuring Physician Adoption of Remote Care

Using data from the lockdown period (March–April 2020), we estimate:

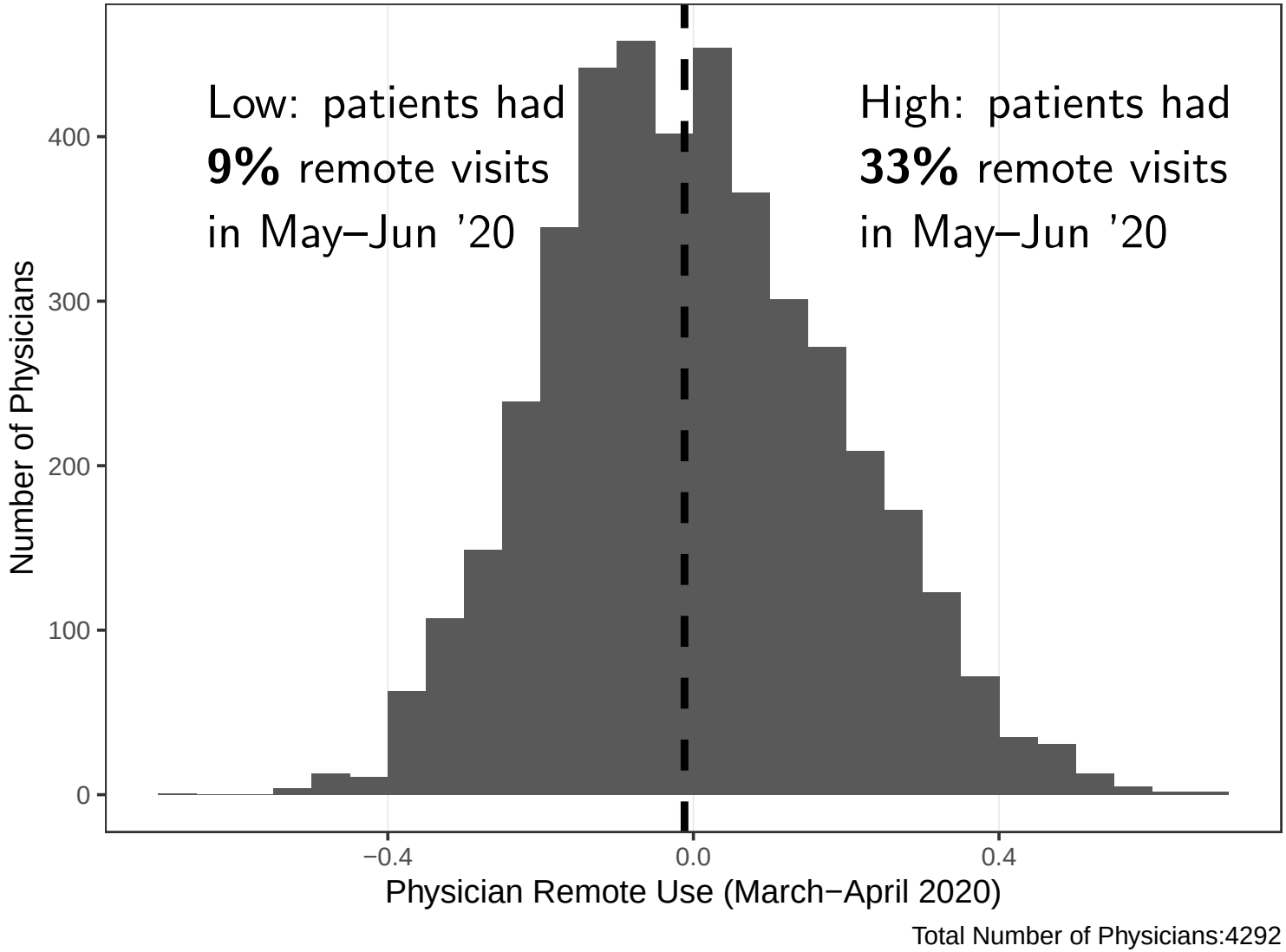
$$\overbrace{\text{Remote}_{ijtl}}^{\text{remote visit}} = \overbrace{\alpha_j}^{\text{physician FE}} + \underbrace{\beta X_{itl}}_{\text{visit controls}} + \underbrace{\gamma_t}_{\text{week FE}} + \underbrace{\eta_l}_{\text{subdistrict FE}} + \varepsilon_{ijtl}$$

visit controls: patient age, gender, ACG score, and number of chronic conditions.

We then split physicians to High and Low adopters at the median:

$$\widehat{\text{High}}_j = \begin{cases} 1 & \text{if } \hat{\alpha}_j > \text{median}\,\hat{\alpha} \\ 0 & \text{otherwise} \end{cases}$$

Distribution of Physician Fixed-Effects



Patients whose PCP adopted telemed during the lockdown were much more likely to use telemed post lockdown. ▸ Raw Adoption Rates

Main Diff in Diff Specification

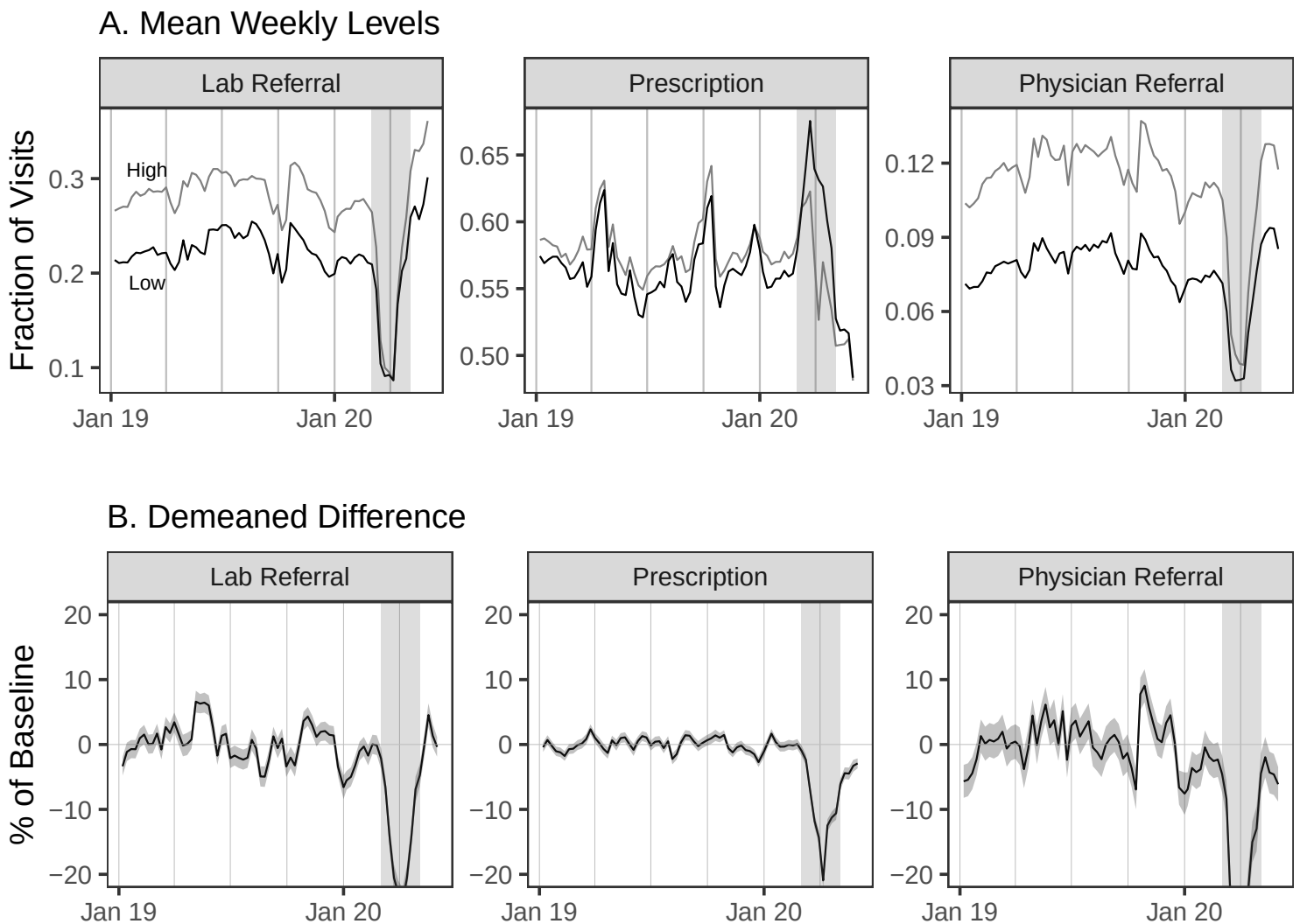
We compare outcomes of patients of high and low telemedicine adopters, pre and post lockdown:

$$\begin{aligned}\text{Outcome}_{itl} =& \beta \widehat{\text{High}}_{k(i)} \times \text{Post}_t + \\ & \alpha \widehat{\text{High}}_{k(i)} + \gamma \text{Post}_t + \underbrace{\delta X_{itl}}_{\text{visit controls}} + \underbrace{\eta_l}_{\text{subdistrict FE}} + \epsilon_{itl}\end{aligned}$$

Notes:

- We do not use the actual (endogenous) visit setting.
- Instead, we use telemed adoption by $k(i)$, patient i's main PCP, the provider that i had seen the most in 2019 (not necessarily the index-visit provider).
- We exclude the March–April peak lockdown period.

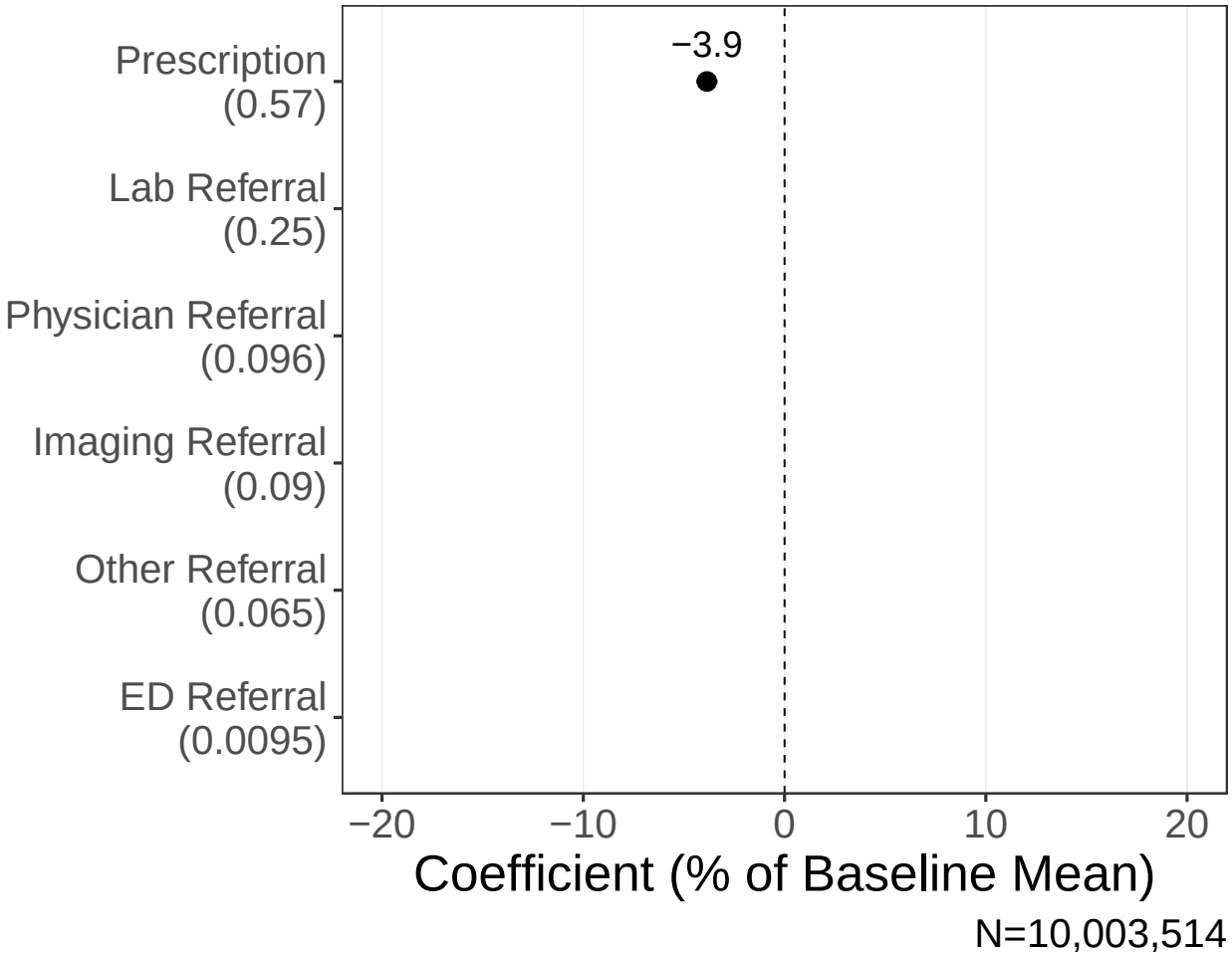
Pretrends



- Pretrends of high and low adopters are highly correlated. ▸ specs
- Placebo analysis also supports the design validity. ▸ placebo

Telemedicine Impact on Visit Outcomes

$$\text{Outcome}_{itl} = \boxed{\beta}\widehat{\text{High}}_{k(i)} \times \text{Post}_t + \alpha\widehat{\text{High}}_{k(i)} + \gamma\text{Post}_t + \delta X_{itl} + \eta_l + \epsilon_{itl}$$



Telemed access is associated with fewer prescriptions

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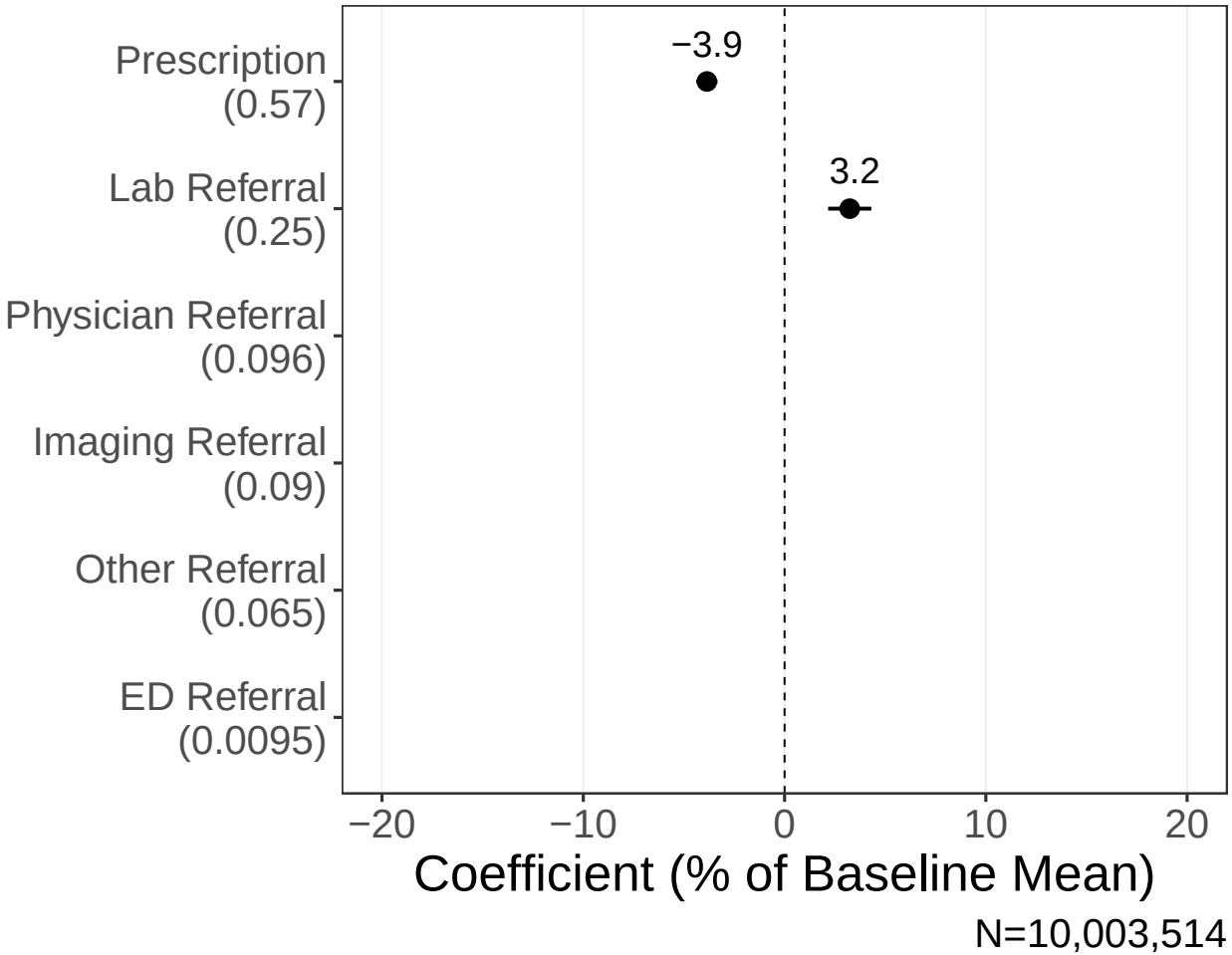

Telemed access is associated with fewer prescriptions and more labs.

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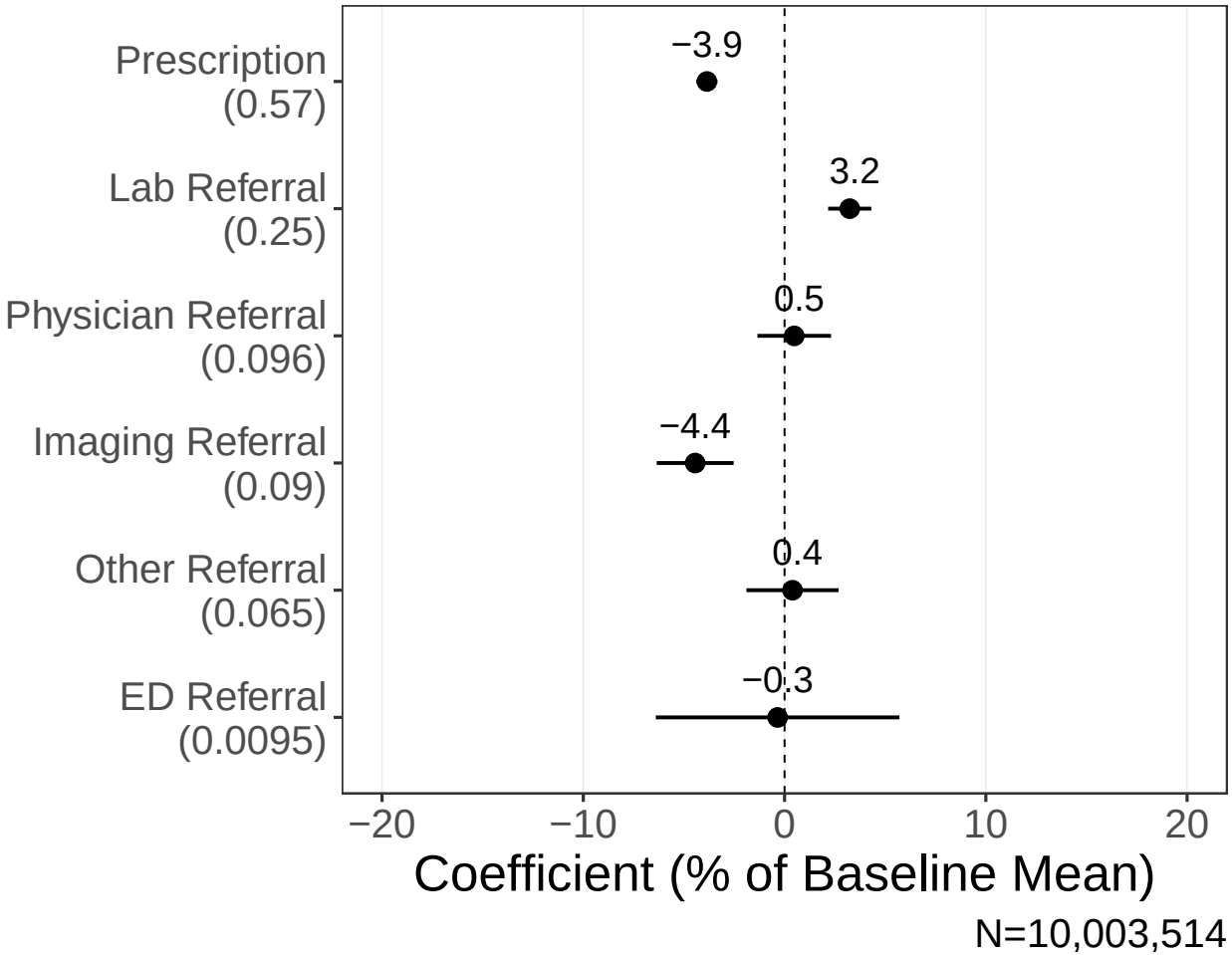

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Telemedicine Impact on 7-Day Followups

Impact on Number of Physician Followups

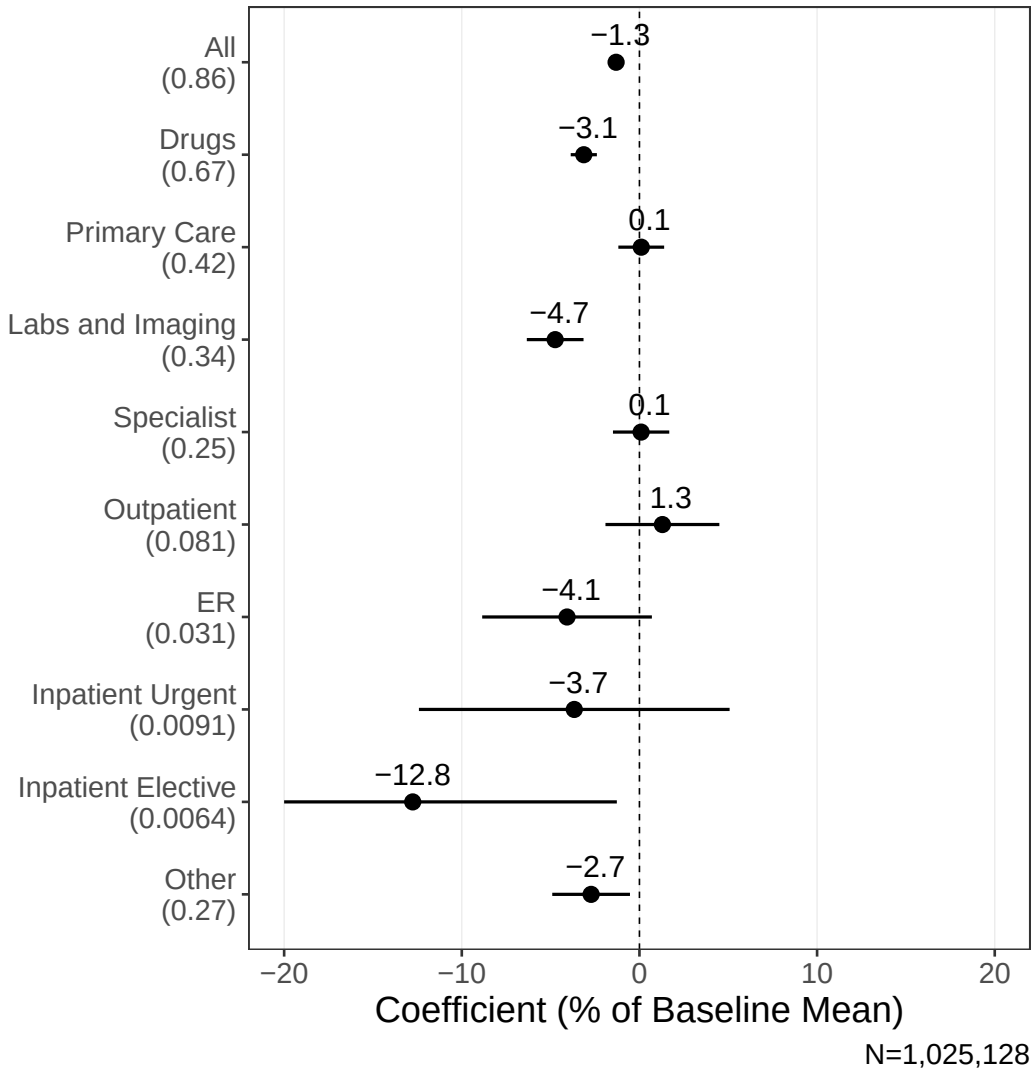
(as Percent of Average Total Number in Baseline Period)

All Followups	With Index Physician	With Others
3.2	3.4	-0.2
(0.6)	(0.4)	(0.5)

	Remote	In-Person
	13.2	-10.0
	(0.2)	(0.6)

Notes: The baseline average is 0.31 followups. N=10,448,838.

Telemedicine Impact on Episode (30-Day) Utilization



Telemedicine access is associated with lower care intensity.
Average episode cost is 8.3% lower. ▸ Details

Interim Summary

Despite some differences, episodes of patients with high and low access to telemedicine appear largely comparable.

Other Margins

1. What about overall demand for care?
2. Might utilization look similar but care quality be lower?

Telemedicine Access and Patient Demand

To estimate effects of telemed access on patient demand,
we sample *all enrollees* (including those with zero visits),
and use the same DD specification:

$$\text{Outcome}_{itl} = \boxed{\beta}\widehat{\text{High}}_{k(i)} \times \text{Post}_t + \alpha\widehat{\text{High}}_{k(i)} + \gamma\text{Post}_t + \delta X_{itl} + \eta_l + \epsilon_{itl},$$

where now the outcome is a dummy for any visit during the period.

Telemedicine Access, Patient Demand, and Total Cost

	Baseline (1)		Estimated Impact (2)	Telemed Access (3)
Episode Cost	NIS 580	×	−8.3%	
Probability of Episode	0.18	×	+5.2%	

Compared with May–June 2019, during May–June 2020 enrollees with high telemed access had more visits but lower total cost.

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Probability of Episode	0.18	$\times$	$+5.2\%$	≈ 0.19

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$\times$			
Probability of Episode	0.18	$+5.2\%$	≈ 0.19
Total Cost per Enrollee	NIS 103		$\approx$ NIS 102

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Diagnosis and Treatment of Specific Conditions

- To evaluate diagnostic quality, we focus on specific medical conditions: urinary tract infection (UTI), acute myocardial infarction (AMI), and bone fractures.

- We selected these conditions because:
  1. They are commonly observed in both remote and in-person visits.
  2. Missed diagnosis during the index visit are likely to show up later.

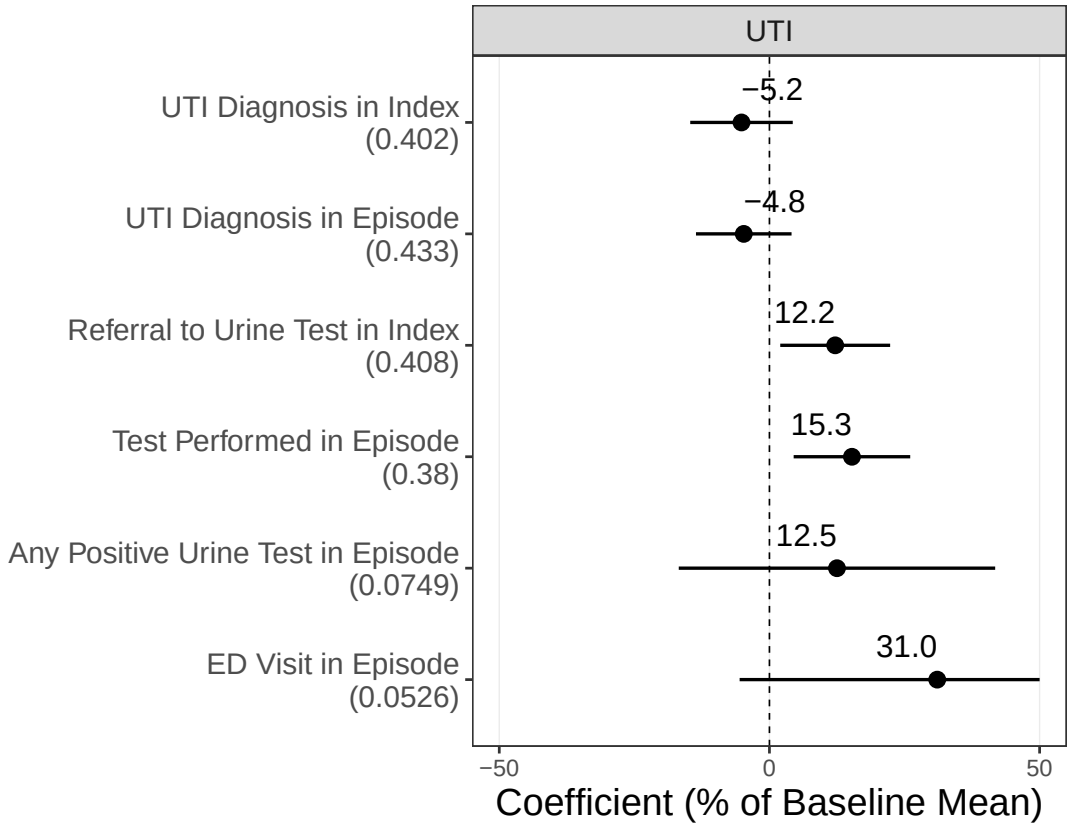
UTI Sample

To account for diagnosis uncertainty, we sample target conditions together with related diagnoses that share similar symptoms:

ICD9 Code	Diagnosis	Number of Visits
A. Target Conditions		
599.0	Urinary Tract Infection	7,758
595.0	Cystitis Acute	248
595	Cystitis	224
590.1	Pyelonephritis Acute	84
B. Differential Diagnoses		
788.1	Dysuria	5,521
788.3	Urinary Incontinence	2,373
788.4	Urinary Frequency	1,474
600.0	Prostatic Enlargement	1,323
788.0	Renal Colic	1,046
616.1	Vaginitis	766
600.9	Prostatic Hyperplasia	543
788.2	Urine Retention	213
597	Urethritis	82
All		21,824

The Impact of Telemed Access on the Diagnosis of UTI

$$\text{Outcome}_{itl} = \boxed{\beta}\widehat{\text{High}}_{k(i)} \times \text{Post}_t + \alpha\widehat{\text{High}}_{k(i)} + \gamma\text{Post}_t + \delta X_{itl} + \eta_l + \epsilon_{itl}$$



- No evidence for increased rate of false negative UTI diagnoses.
- Slightly more urine tests; but positivity rate is consistent with "refer to confirm", rather than lower threshold.

The Impact of Telemed Access: Additional Results

- No impact on diagnosis rates of target conditions during the index visit *or 30-days after*. ▸ UTI ▸ AMI ▸ Fracture
- No change in 7-day physician followup rates. ▸ Details
- No increase in ED visits or total cost. ▸ Details

Summary

Increased access to telemedicine is associated with:

- A (modest) increase in patient utilization of care.
- A (modest) increase in tests and followups—possibly reflecting a prolonged diagnostic process due to lack of physicals.
- No evidence for an increase in missed diagnoses or adverse outcomes.
- More followups are with the same physician—better continuity.
- Total cost of care does not increase.

Design caveats notwithstanding, results are **probably good news**: if telemedicine is comparable to in-person care, it can streamline care, improve access for remote/immobile patients, and save resources.

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Many open questions:

- What is the best mix of remote and in-person visits?
- Could remote sensors improve diagnostic certainty?
- How to reimburse telemedicine so that its benefits are retained?

Thank You!

Estimating Pretrends in Clinical Practice

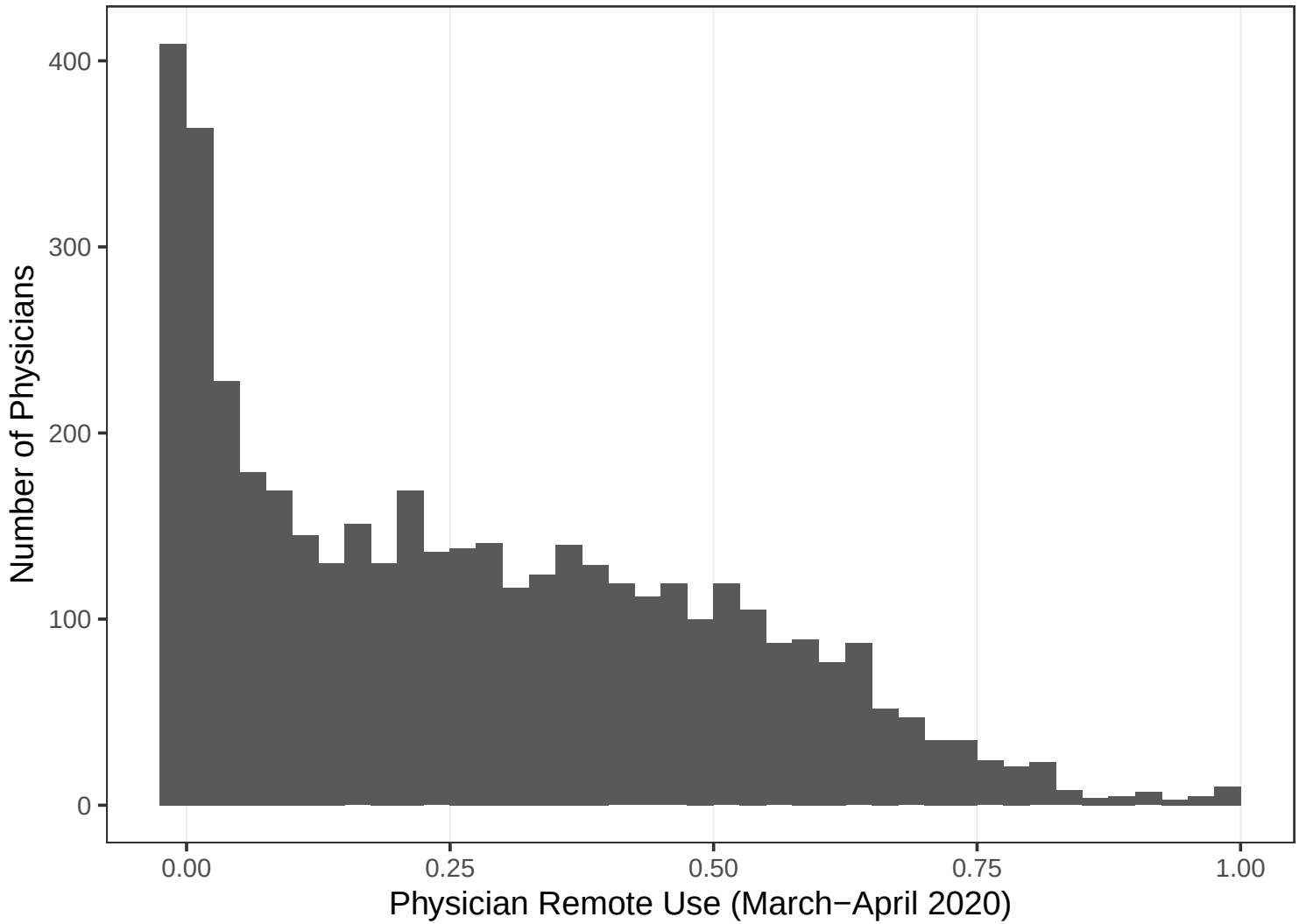
To compare pretrends in practice of High and Low adopters, we estimate flexible time trends in outcomes. Namely:

$$\text{Outcome}_{it} = \sum \overbrace{W_t}^{\text{week}} \left(\gamma_t + \beta_t \widehat{\text{High}}_{k(i)}\right) + \delta_t X_{it} + u_{it}$$

◂ Back

Physicians Use of Telemedicine is Heterogeneous

Distribution of Physicians' Share of Visits Seen Remotely, March–April 2020



Total Number of Physicians:4292

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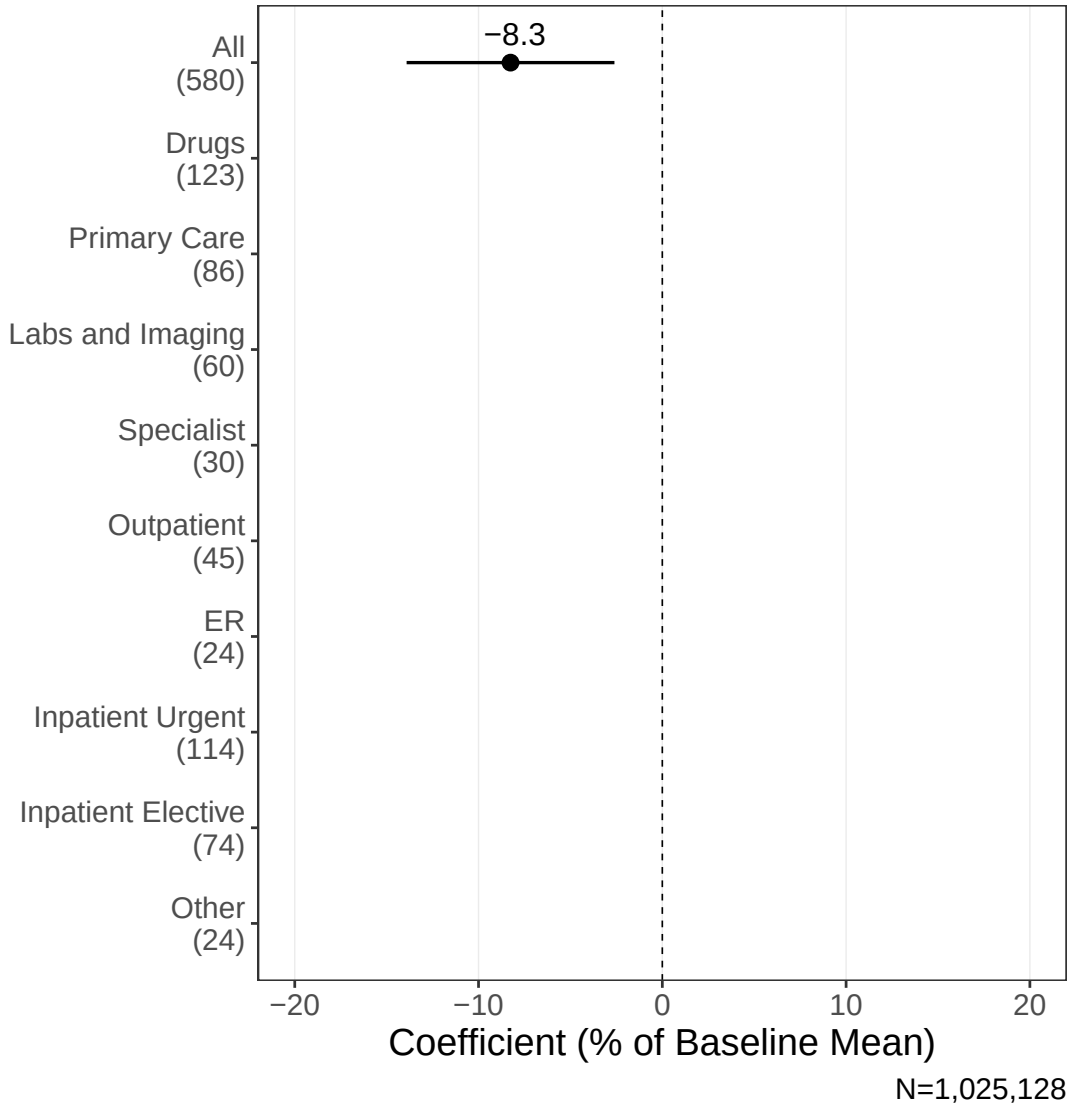
Telemedicine Impact on Episode (30-Day) Cost



Telemed access is associated with neither greater cost

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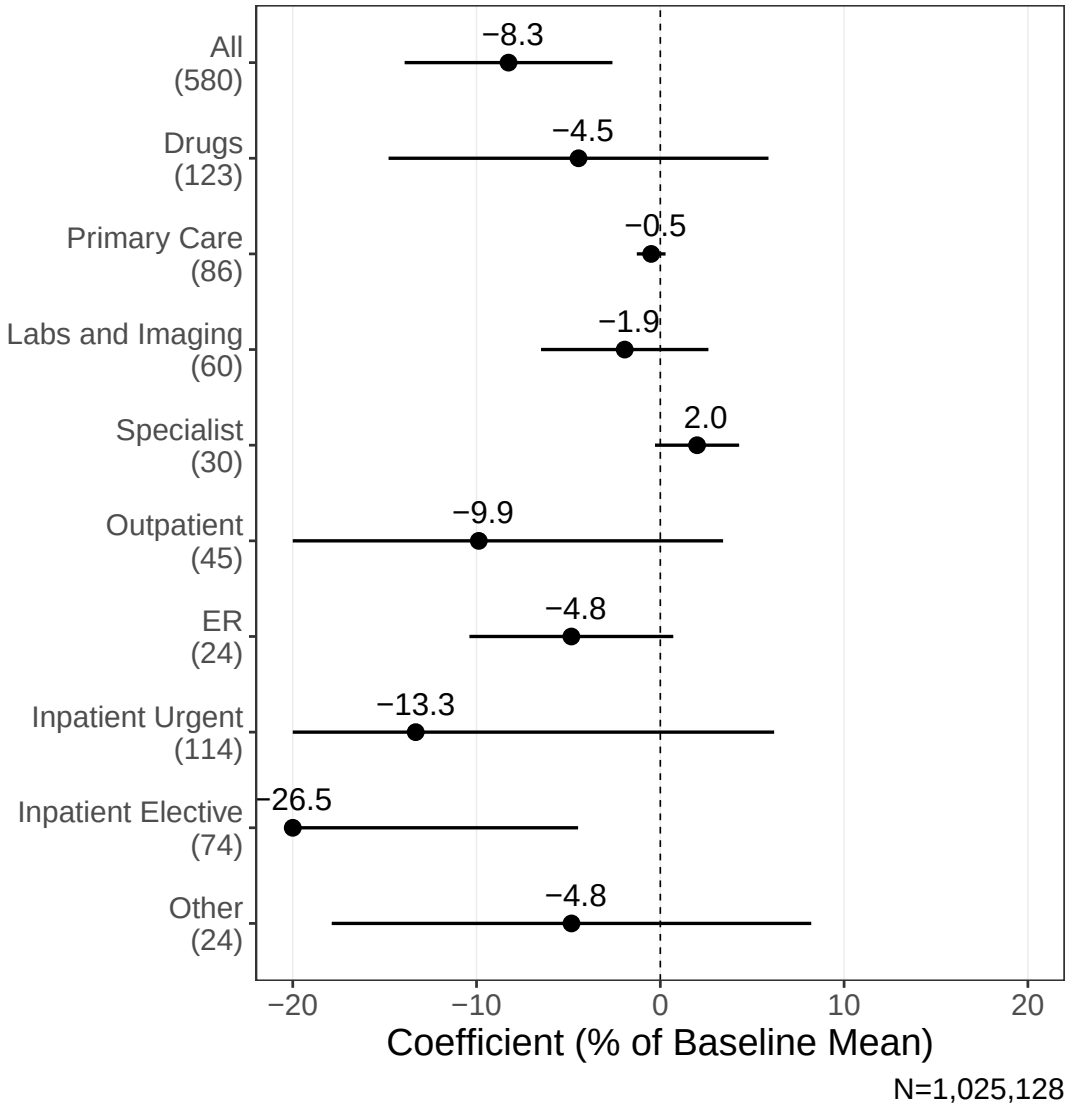
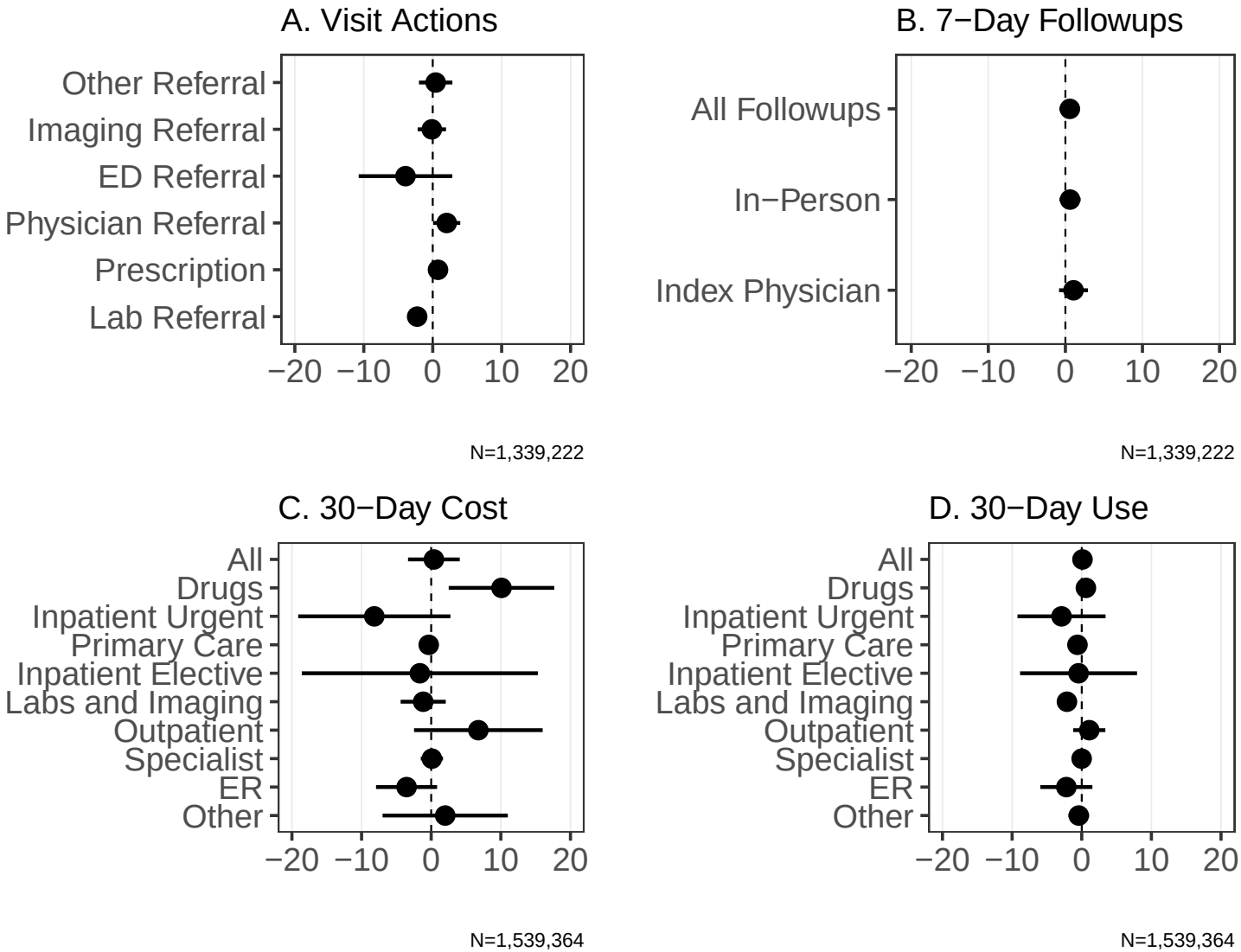


Telemed access is associated with neither greater cost nor greater hospital use.

▸ utilization

Placebo Analysis



Placebo estimates, using Jan–Feb 2019 and Jan–Feb 2020 as the pre and post periods.

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Mammograms as Placebo

To mitigate the concern that patients with high telemedicine access had different utilization trends in the post period, we estimate the impact of access to telemedicine on the probability the patient underwent a Mammogram: an routine screening test unlikely to be affected by telemedicine.

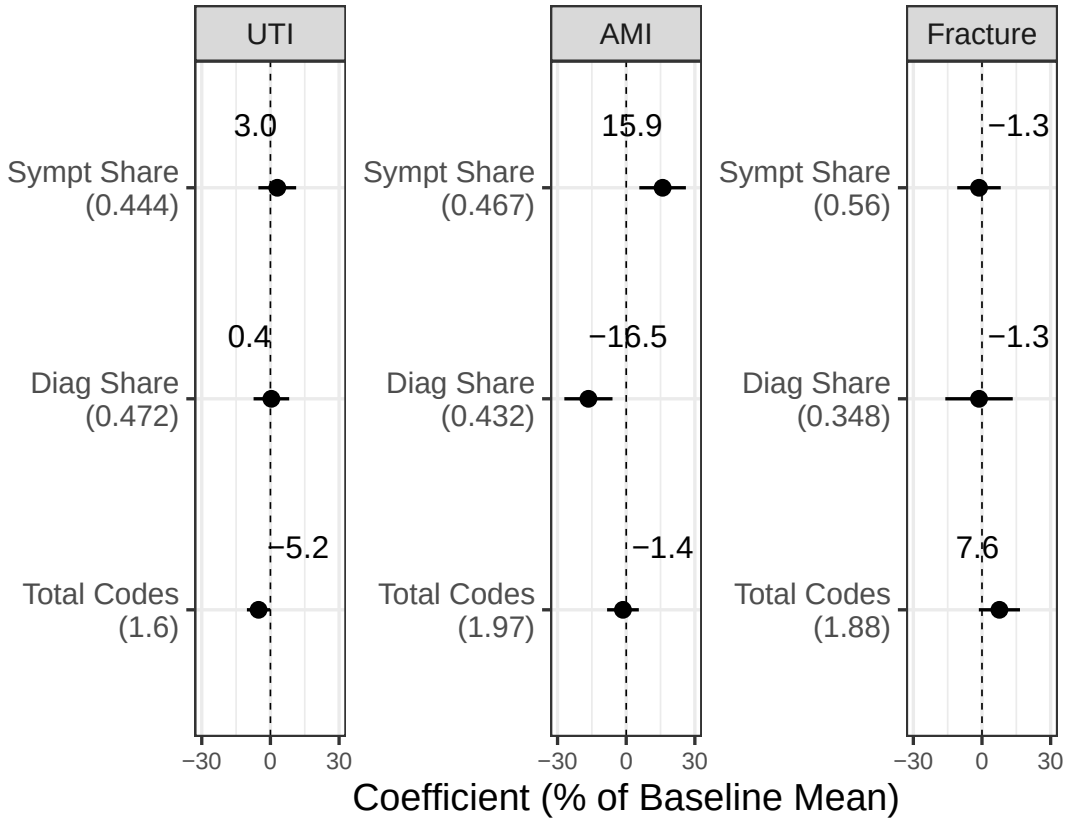
Indeed, we find no significant impact of telemedicine access on Mammogram use: $1.9\% \pm 3.9\%$ of baseline. ◂ Back

Additional Condition-Specific Exhibits

UTI Subsample: Main Diagnoses

ICD9 Code	Diagnosis	Number of Visits
A. Target Conditions		
599.0	URINARY TRACT INFECTION	7,832
595.0	CYSTITIS ACUTE	248
595	CYSTITIS	226
590.1	PYELONEPHRITIS ACUTE	86
B. Differential Diagnoses		
788.1	DYSURIA	5,553
788.3	URINARY INCONTINENCE	2,414
788.4	URINARY FREQUENCY	1,484
600.0	PROSTATIC ENLARGEMENT	1,345
788.0	RENAL COLIC	1,054
616.1	VAGINITIS	771
600.9	PROSTATIC HYPERPLASIA	551
788.2	URINE RETENTION	216
597	URETHRITIS	82
614	PELVIC INFLAMMATORY DISEASE	52
597.8	MEATITIS	26
616.3	BARTHOLINS ABSCESS	19
788.7	URETHRAL DISCHARGE	14
616.2	BARTHOLINS CYST	12
All		22,031

The Impact on Coding of Visit Summaries



- The share of ‘unspecific‘ diagnosis coded (”Chest Pain”) slightly increases.
- The share of specific codes (”Angina Pectoris”) decrease.

Hints to a lower physician certainty in the diagnosis.

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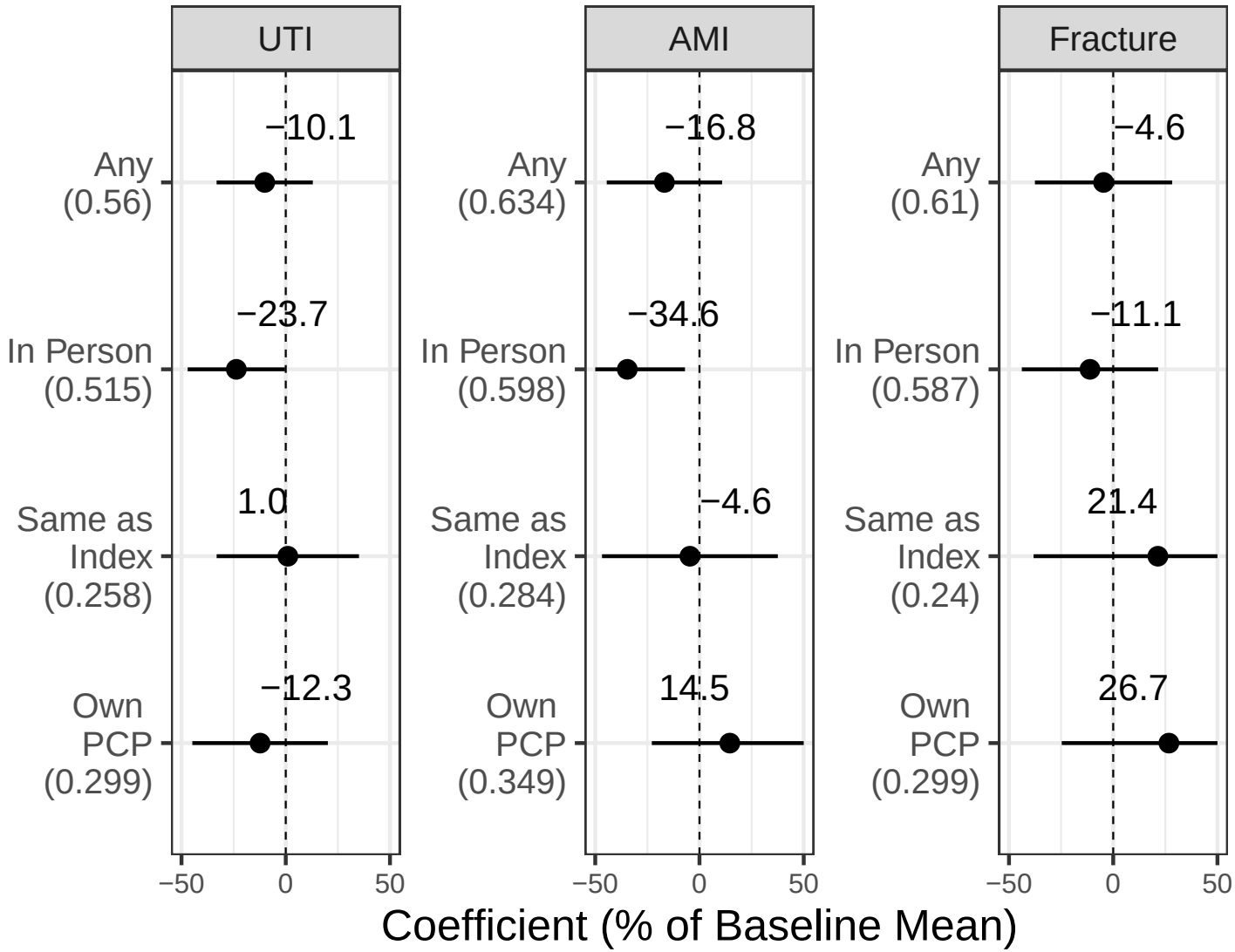
Results: Physician Follup Visits



No evidence for change in overall followup rates.

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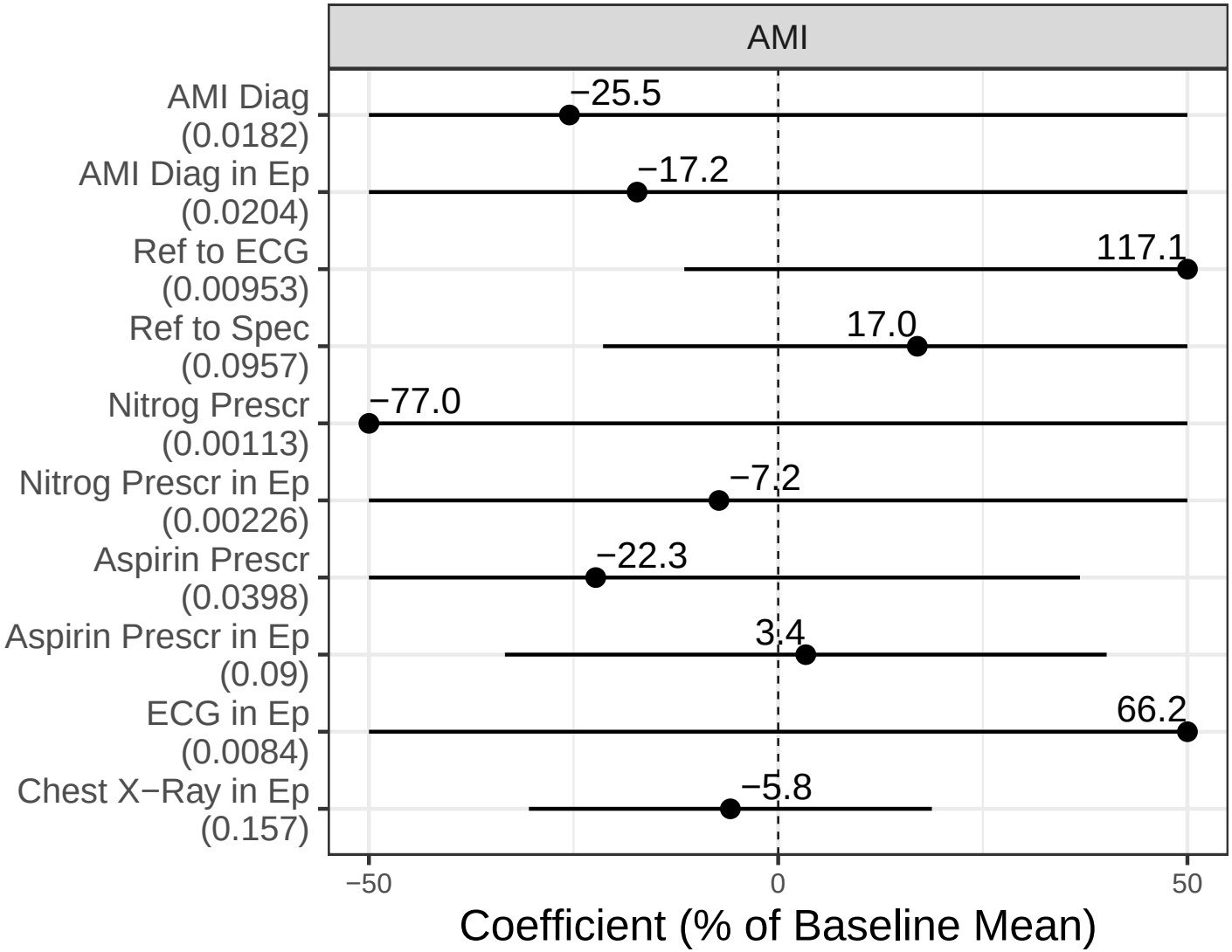
Results: Other AMI Outcomes



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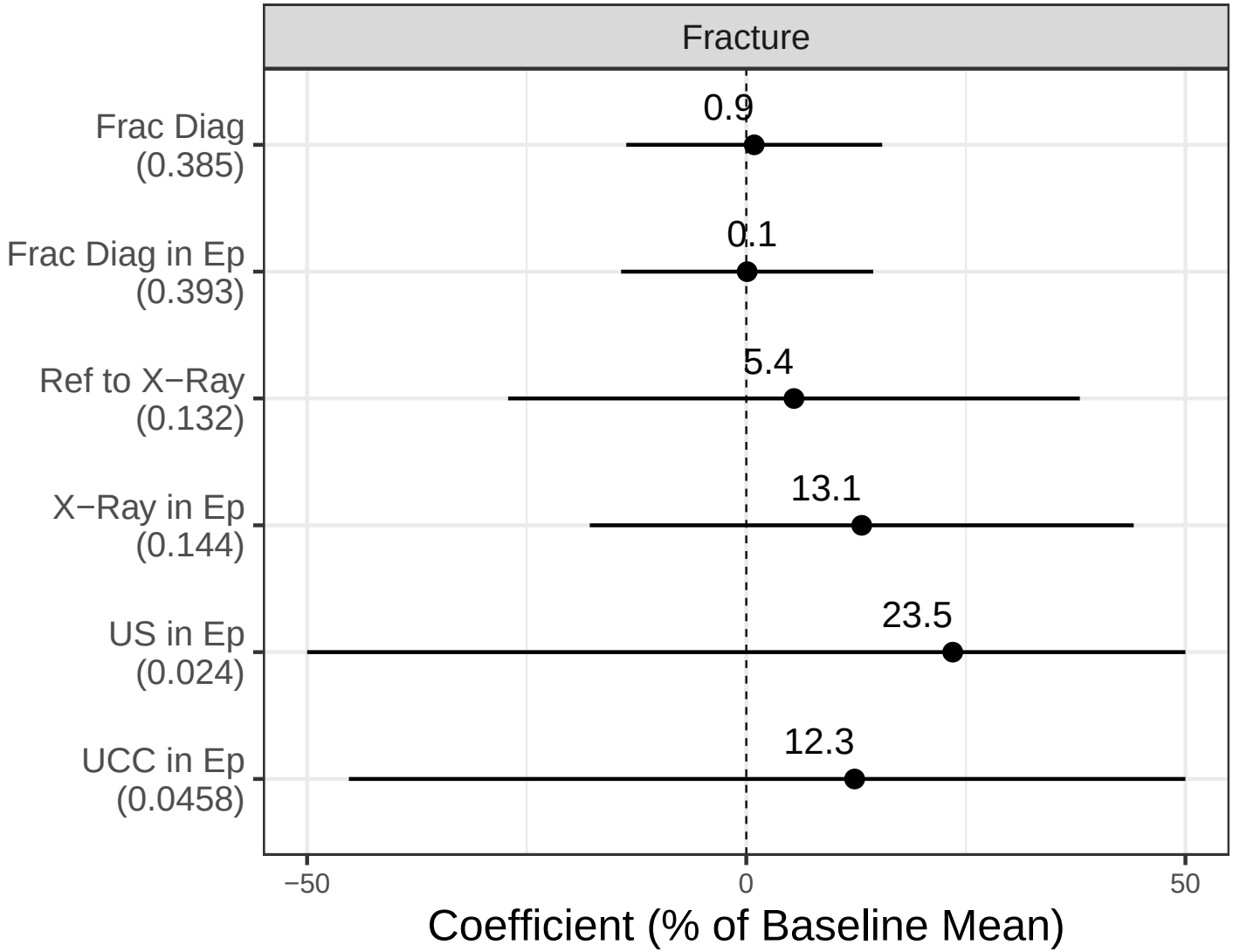
Results: Other Fracture Outcomes



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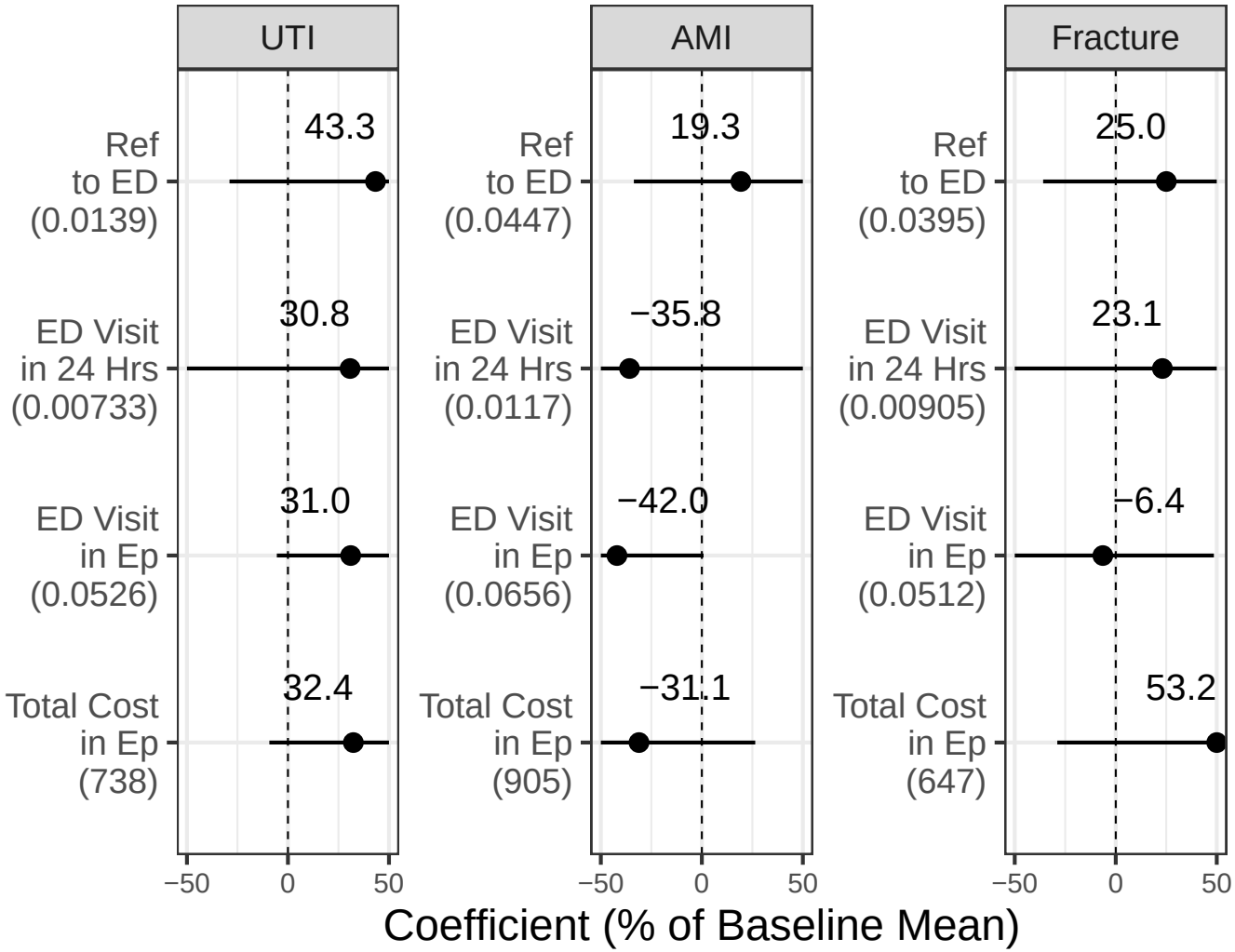
DD Results for ED Referrals, ED Visits, and Total Cost



No evidence for telemedicine affecting ED referrals, ED visits, or episode cost.

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