Difference in Differences

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JAMA Internal Medicine | Original Investigation | PHYSICIAN WORK ENVIRONMENT AND WELL-BEING

Physician EHR Time and Visit Volume Following Adoption of Team-Based Documentation Support

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IMPORTANCE Physicians spend the plurality of active electronic health record (EHR) time on documentation. Excessive documentation limits time spent with patients and is associated with burnout. Organizations need effective strategies to reduce physician documentation burden; however, evidence on team-based documentation (eg, medical scribes) has been limited to small, single-institution studies lacking rigorous estimates of how documentation support changes EHR time and visit volume.

OBJECTIVES To analyze how EHR documentation time and visit volume change following the adoption of team-based documentation approaches.

DESIGN, SETTING, AND PARTICIPANTS This national longitudinal cohort study analyzed physician-week EHR metadata from September 2020 through April 2021. A 2-way fixed-effects difference-in-differences regression approach was used to analyze changes in the main outcomes after team-based documentation support adoption. Event study regression models were used to examine variation in changes over time and stratified models to analyze the moderating role of support intensity. The sample included US ambulatory physicians using the EHR. Data were analyzed between October 2022 and September 2023.

EXPOSURE Team-based documentation support, defined as new onset and consistent use of coauthored documentation with another clinical team member.

MAIN OUTCOMES AND MEASURES The main outcomes included weekly visit volume, EHR documentation time, total EHR time, and EHR time outside clinic hours.

+ Editorial
+ Related article
+ Supplemental content

Example of Using Diff-in-Diff in clinical study

Hello! I am here to help the doctor

Medical scribes:
a personal assistant to the physician; performing documentation in the Electronic Health Record (EHR)

Excessive documentation limits time spent with patients and is associated with burnout.

PICO

- P:

  Physician in USA using EPIC Electronic Health Record (EHR) program

- I:

  record by medical scribe (adopters)

- C:

  record by physician (non-adopters)

- O:

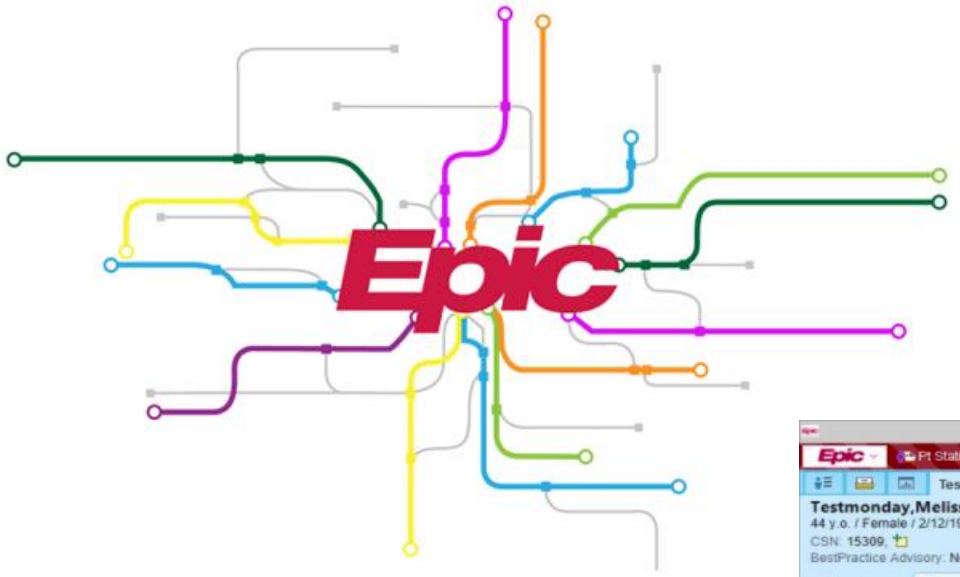
  1. patient visit volume
  2. documentation use

Hypothesis

- Using medical scribe (adopters) would change physician performance
- High support use would change physician performance more than low support use

Why diff-in-diff

- National longitudinal cohort study
- Compare outcome in adopter group (between pre- post- using medical scribe) and to non-adopter group (diff-in-diff)
- Individual data from EPIC EHR database (electronic health record software) from 2020-2021
- Staggered effect: adopt intervention at different time→ Callaway and Sant'Anna estimator (different weighting according to different time)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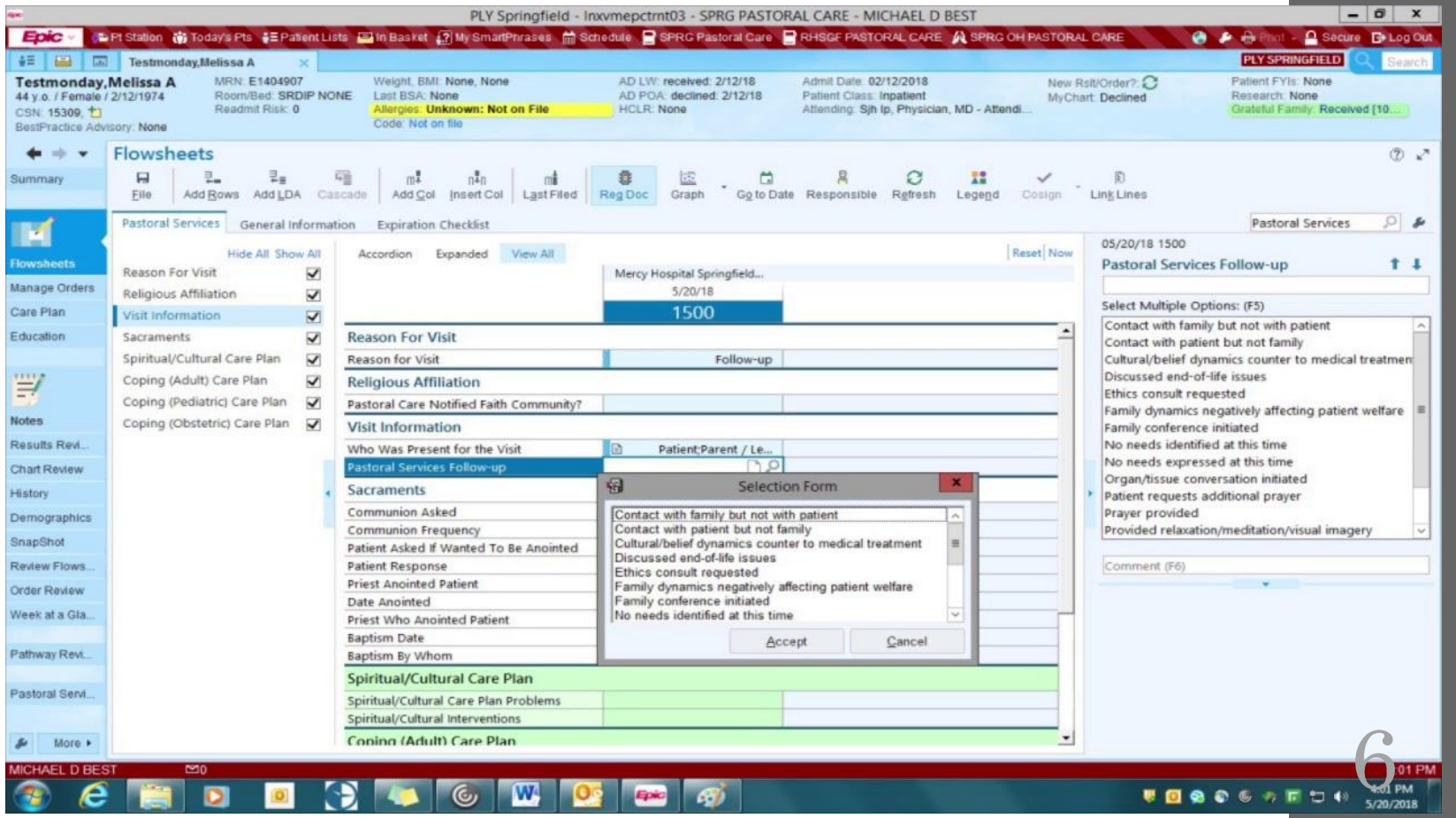

PLY Springfield - lnxvmepctrnt03 - SPRG PASTORAL CARE - MICHAEL D BEST
Testmonday,Melissa A
44 y.o. / Female / 2/12/1974
Flowsheets
Pastoral Services
General Information
Expiration Checklist
Reason For Visit
Religious Affiliation
Visit Information
Sacraments
Spiritual/Cultural Care Plan
Coping (Adult) Care Plan
Coping (Pediatric) Care Plan
Coping (Obstetric) Care Plan
Pastoral Services Follow-up
Select Multiple Options: (F5)
Contact with family but not with patient
Contact with patient but not family
Cultural/belief dynamics counter to medical treatment
Discussed end-of-life issues
Ethics consult requested
Family dynamics negatively affecting patient welfare
Family conference initiated
No needs identified at this time
No needs expressed at this time
Organ/tissue conversation initiated
Patient requests additional prayer
Prayer provided
Provided relaxation/meditation/visual imagery
Selection Form
Accept
Cancel

PICO

- P:

  Physician in USA using EPIC EHR program

- I:

  record by medical scribe (adopters)

- C:

  record by physician (non-adopters)

- O:

  1. visit volume

  2. documentation use

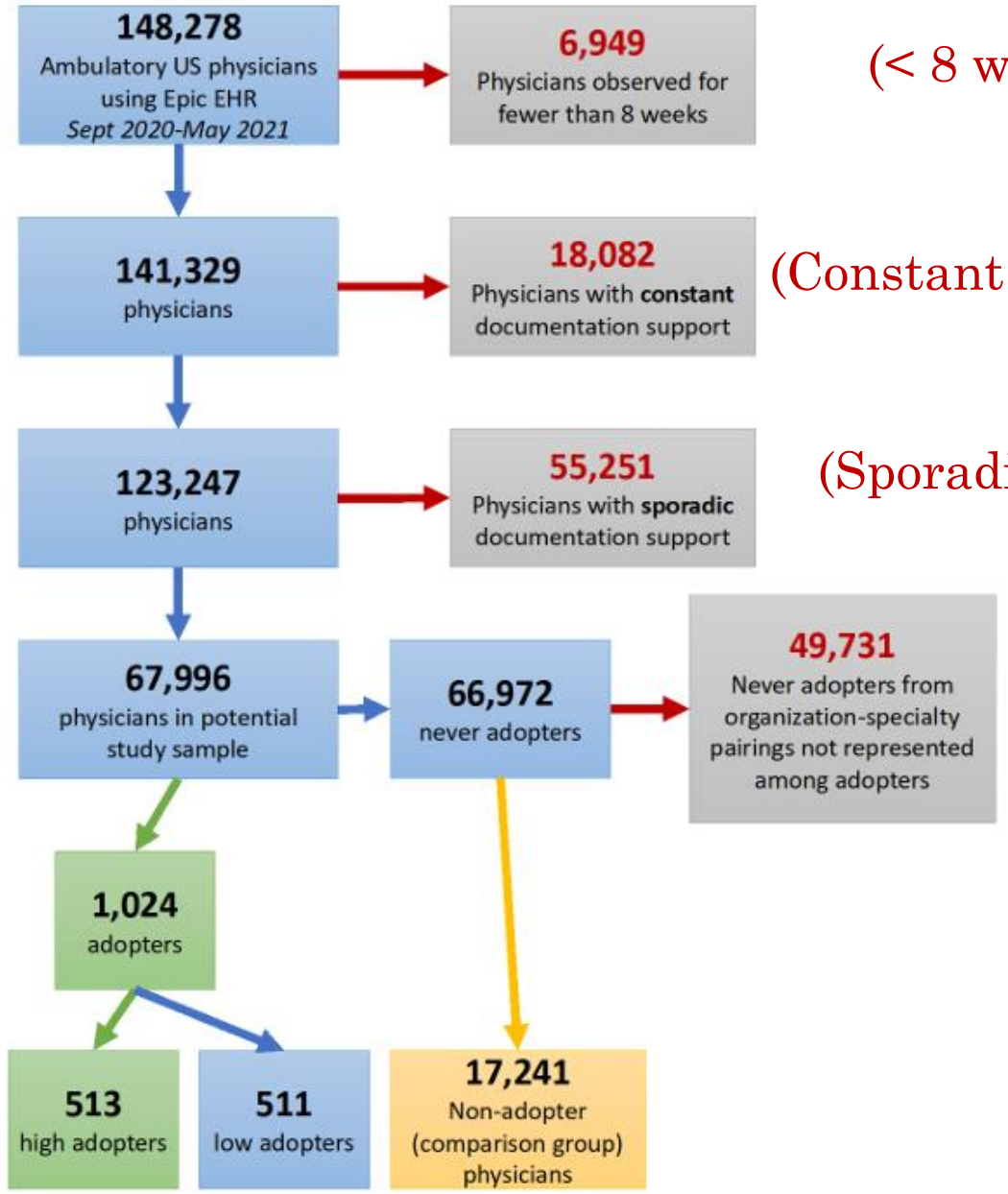
- High support use (> 40% of total record)
- Low support use (≤ 40% of total record)

- Use Medical Scribe continuously for at least 4 weeks+ use at least 4 weeks
- Shift during study period

- Never using Medical Scribe
- All non-adopters in same specialty, same organization

Exclude:
- Constant using medical scribe (before study period)
- Sporadic using medical scribe (not continuously)
- Non adopters who are not match to adopters

eFigure 1. Sampling Diagram



(< 8 weeks → too short duration)

(Constant medical scribe use before study period→ no pre- post- effect)

(Sporadic use→ Not continuously use medical scribe)

(Not same specialties/organization →unmatched)

PICO

- P:

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  record by medical scribe (adopters)

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  record by physician (non-adopters)

- O:

  1. visit volume
  2. documentation use

  Total patient visit → should **increase**
  Time for medical record → should **decrease**
  Time to use medical software (overall) → should **decrease**
  Time to record outside office hour → should **decrease**

Table. Descriptive Statistics of Physician and Organization Study Sample

Characteristic	Overall	Adopters	Preadoption	Postadoption	Nonadopters
No. of physicians	18 265	1024	NA	NA	17 241
Primary outcomes, mean (SD)					
Total visits/wk	41.5 (28.2)		41.5 (27.3)	45.7 (29.0)	41.4 (28.2)
Active time in notes, min/wk	256.7 (206.3)		246.6 (201.6)	230.8 (201.1)	258.0 (206.5)
Active time in EHR, min/wk	707.6 (475.6)		660.4 (448.6)	637.5 (436.8)	711.1 (477.3)
Active time outside scheduled hours, min/wk	127.5 (146.5)		127.7 (148.4)	128.6 (141.7)	127.5 (146.6)
Physician specialty, %					
Primary care	57.2	36.2			58.5
Medical specialty	31.6	49.3			30.5
Surgical specialty	11.2	14.5			11.0
Organizational characteristics, %					
Size					
<25 Physicians	0.4	2.1			0.4
25-50 Physicians	2	6.2			1.8
51-200 Physicians	21.3	32.1			20.7
>200 Physicians	76.2	59.6			77.2

Results

Diff-in-Diff (TWFE)

- Ordinary least square regression model
- 2-way fixed effect: fixed for physician specialties and time-week

↓

Relative effect

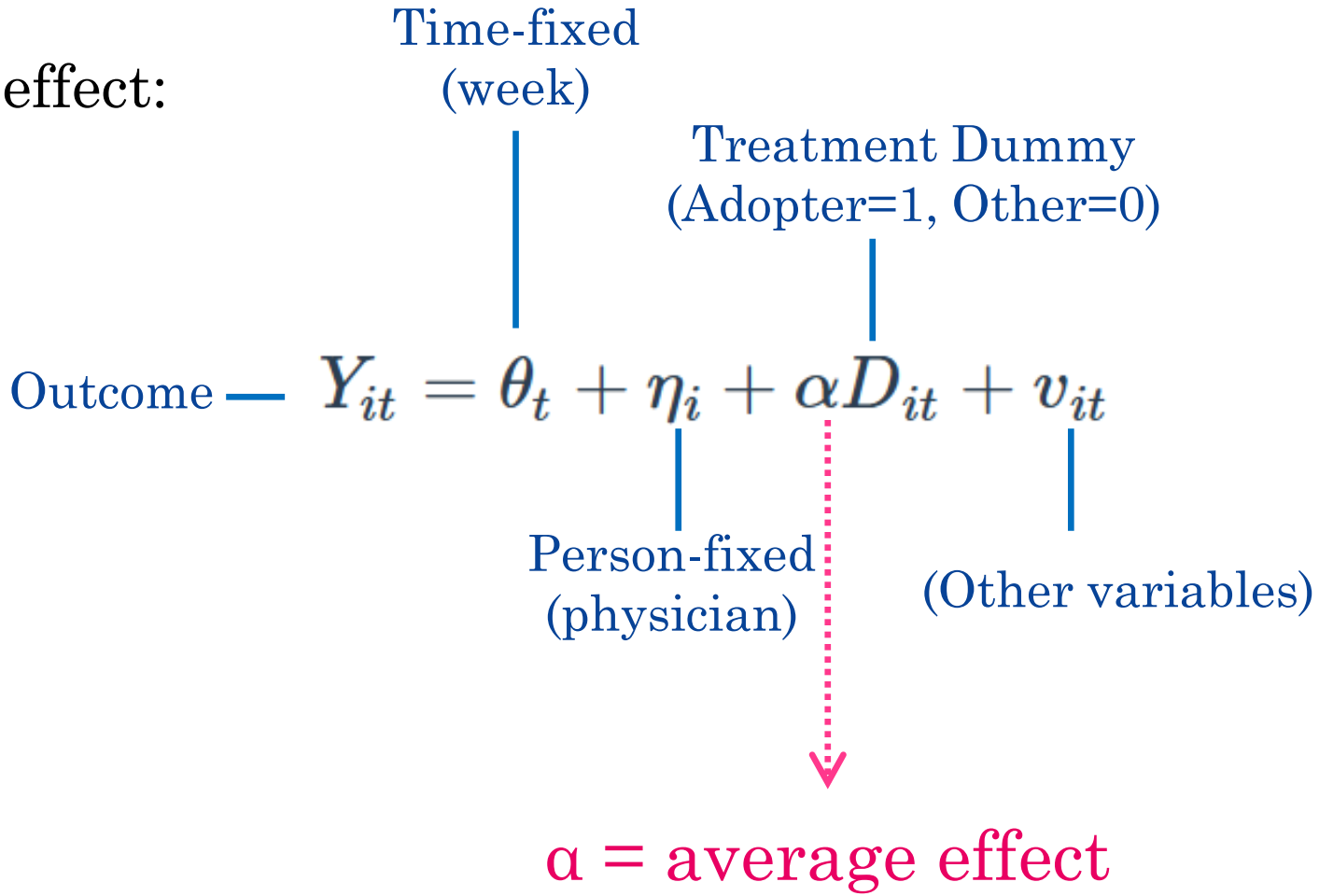
(Relative change)

Average Value in 3 groups

Outcome	Overall	Never Adopter (control group)	Adopter (pre-adoption)	Adopter (post-adoption)	TWFE Difference-in-Differences	Relative Effect
No. of Physicians in Analysis	18,265	17,241	1,024	1,024		
No. of Physician-Weeks in Analysis	669,721	632,179	17,717	19,825	Estimate (95% CI)	
Per Week						
Total Visits	41.5 (28.2)	41.4 (28.2)	41.5 (27.3)	45.7 (29.0)	**2.5 [1.9 to 3]**	**6.0%**
No. Established Patient Visits	23.2 (20.7)	23.2 (20.7)	20.9 (19.5)	23.1 (20.6)	**1.4 [1 to 1.9]**	**6.2%**
No. New Patient Visits	3.3 (5.5)	3.2 (5.4)	4.4 (6.7)	5.3 (7.4)	**0.3 [0.1 to 0.5]**	**9.6%**
No. Level 3 E/M Visits (New + Est.)	10.4 (13.3)	10.4 (13.2)	9.9 (13.8)	10.8 (14.4)	**0.6 [0.2 to 1]**	**5.8%**
No. Level 4 E/M Visits (New + Est.)	13.2 (14.8)	13.2 (14.8)	12.5 (14.2)	14.0 (14.8)	**1 [0.6 to 1.4]**	**7.3%**
No. Level 5 E/M Visits (New + Est.)	1.5 (3.8)	1.4 (3.8)	1.7 (4.6)	2.3 (5.2)	**0.2 [0.1 to 0.3]**	**13.3%**
Total Time in EHR (mins)	707.6 (475.6)	711.1 (477.3)	660.4 (448.6)	637.5 (436.8)	**-28.9 [-38.6 to -19.2]**	**-4.1%**
Time in Notes (mins)	256.7 (206.3)	258.0 (206.5)	246.6 (201.6)	230.8 (201.1)	**-23.3 [-30.3 to -16.2]**	**-9.1%**
Time in Clinical Review (mins)	119.3 (92.2)	119.8 (92.7)	111.1 (84.4)	111.9 (84.9)	**2.5 [0.6 to 4.4]**	**2.1%**
Time in In Basket (mins)	95.9 (87.2)	96.8 (87.7)	80.2 (74.4)	83.3 (79.2)	1.3 [0 to 2.6]	1.4%
Time Outside Scheduled Hours (mins)	127.5 (146.5)	127.5 (146.6)	127.7 (148.4)	128.6 (141.7)	**-6.5 [-10 to -3]**	**-5.1%**
Time on Unscheduled Days (mins)	110.0 (131.3)	109.7 (131.4)	117.8 (134.5)	111.8 (125.5)	-0.4 [-4.6 to 3.7]	-0.4%
Pajama Time (mins)	110.9 (164.9)	110.3 (164.2)	120.0 (180.3)	121.2 (170.0)	-3.9 [-8.1 to 0.4]	-3.5%
Unscheduled Days with EHR Use	2.3 (1.2)	2.3 (1.2)	2.4 (1.2)	2.4 (1.2)	0 [0 to 0.1]	1.5%
% of Visits Closed Same-Day	76.0 (31.3)	76.5 (31.0)	69.7 (33.2)	66.0 (35.0)	**-2.2 [-3.2 to -1.2]**	**-2.9%**
% of Visits Closed within 2 days	87.0 (24.2)	87.3 (24.0)	83.3 (26.4)	81.9 (27.6)	-0.3 [-1.1 to 0.5]	-0.4%
Per Scheduled Day						
Total Visits	11.6 (6.2)	11.6 (6.1)	12.1 (6.3)	13.1 (6.9)	**0.7 [0.6 to 0.8]**	**6.0%**
Total Time in EHR (mins)	204.8 (120.5)	205.6 (120.8)	197.5 (117.9)	184.9 (111.7)	**-9.9 [-12.5 to -7.2]**	**-4.8%**
Time in Notes (mins)	74.1 (54.9)	74.4 (55.1)	73.9 (54.7)	65.6 (50.9)	**-7.8 [-9.8 to -5.8]**	**-10.5%**
Time in Clinical Review (mins)	35.1 (25.9)	35.2 (25.9)	33.9 (26.4)	33.1 (24.4)	0.5 [-0.1 to 1]	1.3%
Time in In Basket (mins)	28.5 (26.7)	28.8 (26.8)	24.9 (23.7)	25.2 (25.4)	0.3 [-0.2 to 0.8]	1.1%
Time Outside Scheduled Hours (mins)	35.0 (36.1)	35.0 (36.2)	35.7 (35.9)	35.2 (34.1)	**-1.4 [-2.2 to -0.5]**	**-3.9%**
Pajama Time (mins)	32.8 (49.2)	32.6 (49.1)	36.3 (53.4)	35.8 (48.6)	**-1.8 [-2.9 to -0.6]**	**-5.4%**
Per Visit						
Total Time in EHR (mins)	22.4 (25.3)	22.6 (25.6)	20.8 (22.2)	17.4 (18.2)	**-1.6 [-2.1 to -1.1]**	**-7.2%**

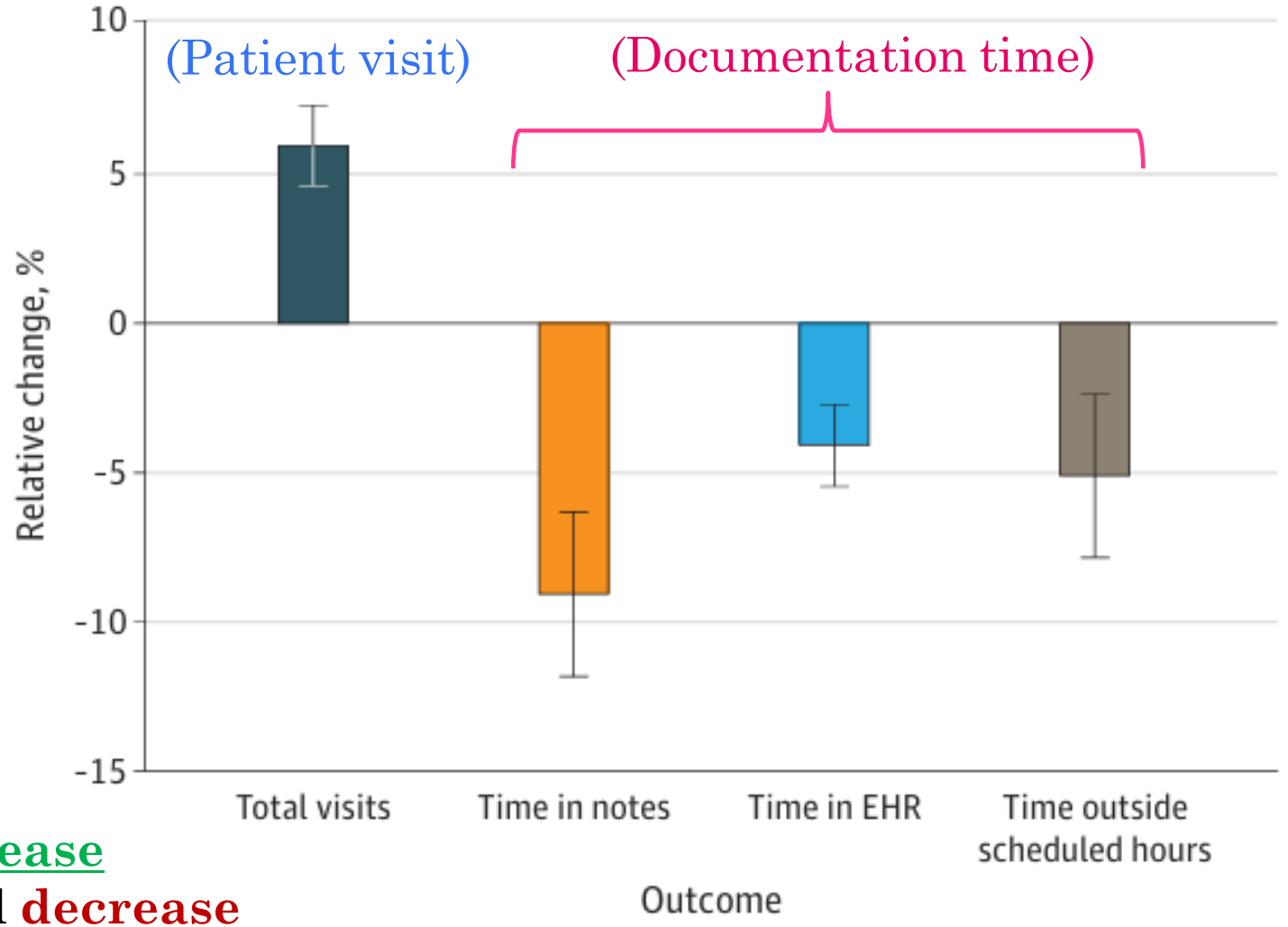
Results

2-way fixed effect:



	TWFE Difference-in-Differences Estimate (95% CI)	Relative Effect
	2.5 [1.9 to 3]	6.0%
	1.4 [1 to 1.9]	6.2%
	0.3 [0.1 to 0.5]	9.6%
	0.6 [0.2 to 1]	5.8%
	1 [0.6 to 1.4]	7.3%
	0.2 [0.1 to 0.3]	13.3%
	-28.9 [-38.6 to -19.2]	-4.1%
	-23.3 [-30.3 to -16.2]	-9.1%
	2.5 [0.6 to 4.4]	2.1%
	1.3 [0 to 2.6]	1.4%
	-6.5 [-10 to -3]	-5.1%
	-0.4 [-4.6 to 3.7]	-0.4%
	-3.9 [-8.1 to 0.4]	-3.5%
	0 [0 to 0.1]	1.5%
	-2.2 [-3.2 to -1.2]	-2.9%
	-0.3 [-1.1 to 0.5]	-0.4%
	0.7 [0.6 to 0.8]	6.0%
	-9.9 [-12.5 to -7.2]	-4.8%
	-7.8 [-9.8 to -5.8]	-10.5%
	0.5 [-0.1 to 1]	1.3%
	0.3 [-0.2 to 0.8]	1.1%
	-1.4 [-2.2 to -0.5]	-3.9%
	-1.8 [-2.9 to -0.6]	-5.4%
	-1.6 [-2.1 to -1.1]	-7.2%

Figure 1. Relative Changes Following Adoption of Team-Based Documentation Support for Primary Outcomes



Hypothesis

Total patient visit → should **increase**

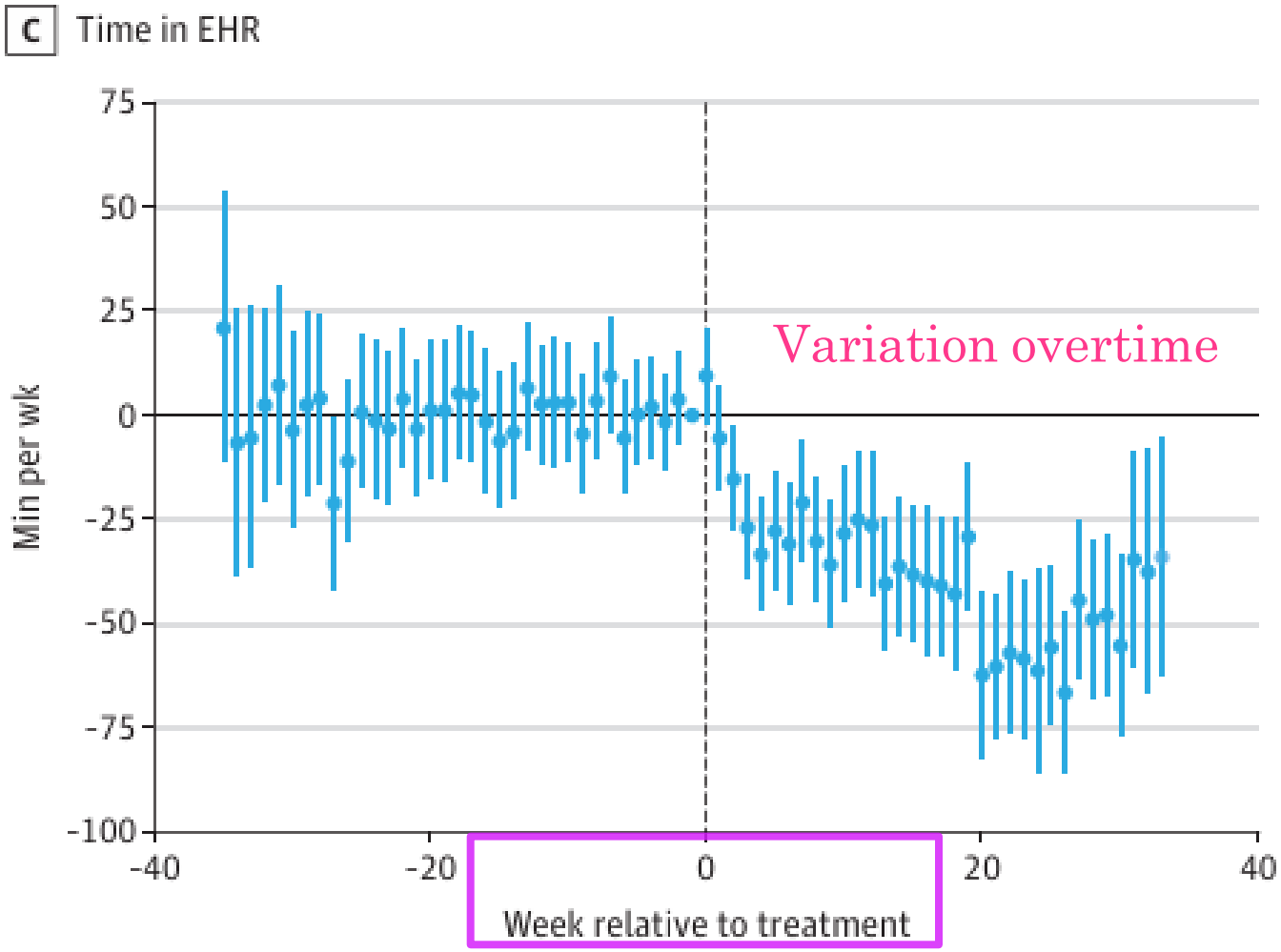
Time for medical record → should **decrease**

Time to use medical software (overall) → should **decrease**

Time to record outside office hour → should **decrease**

Event study

Estimator = 0
→ Parallel trend assumption
(no different between adopters vs non-adopters before intervention)

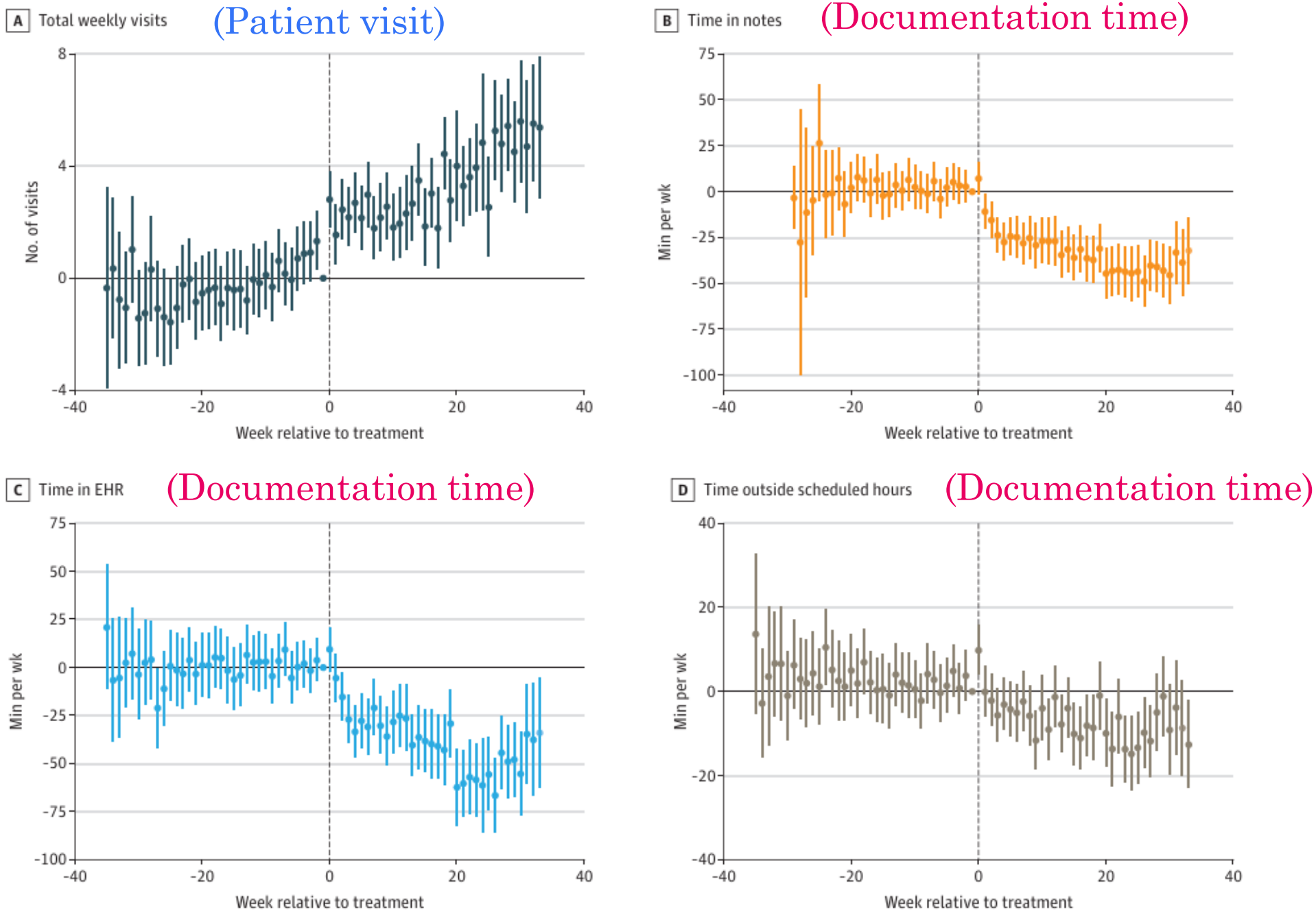


- Estimate: Outcome of adopters - Outcome of non-adopters → report over time (weeks)

  → Parallel trend assumption

  → Show variation of outcome (over time)

Figure 2. Event Study Estimates for Primary Outcomes



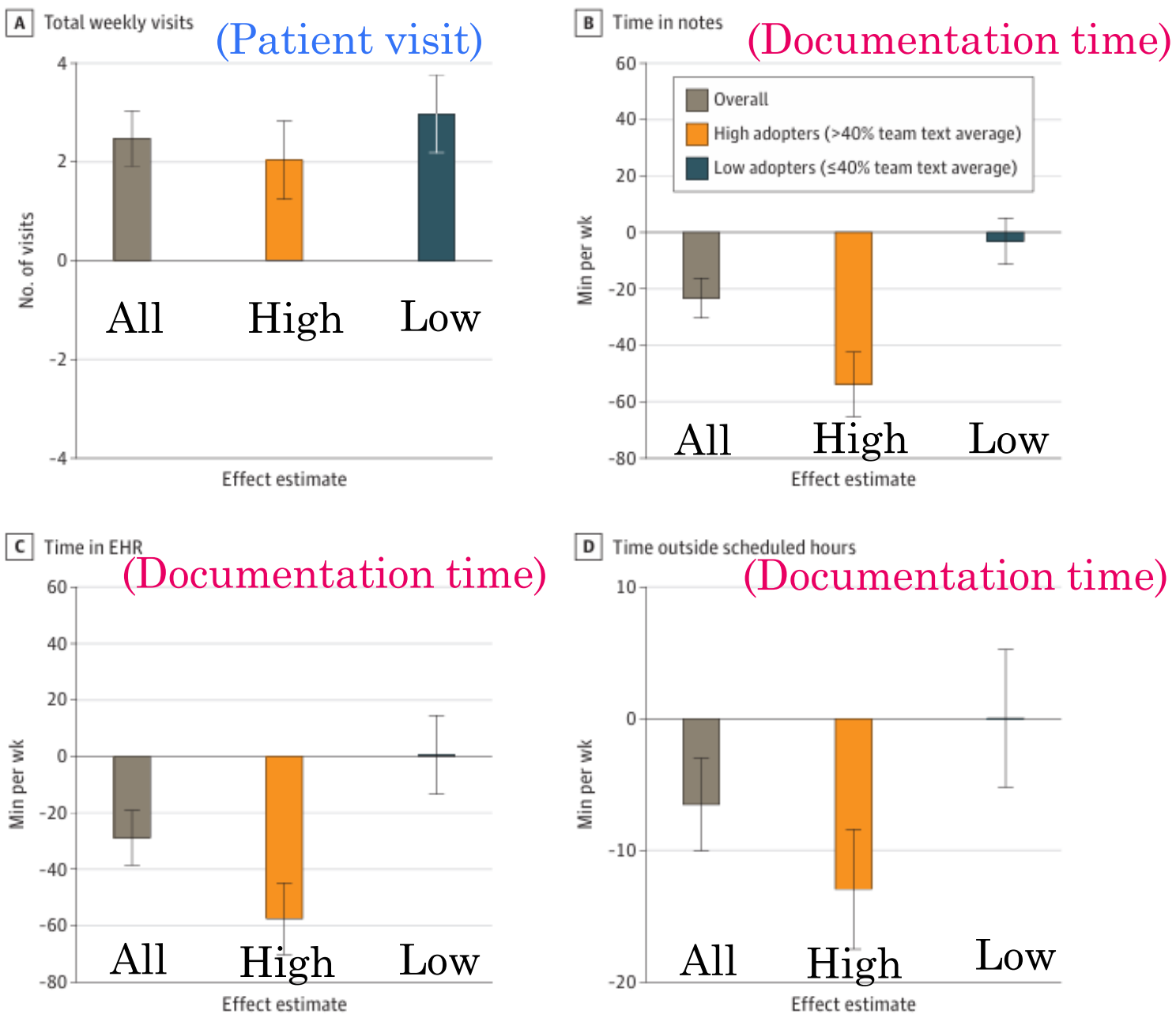
Hypothesis

- 1. Using medical scribe (adopters) would change physician performance
- 2. High support use would change physician performance more than low support use

<u>Stratified</u>
- High support use (> 40% of total record)
- Low support use (≤ 40% of total record)

- Relative change
- Event Study

Figure 3. Comparison of Changes Stratified by Team-Based Documentation Support Intensity for Primary Outcomes



(Patient visit)

(Documentation time)

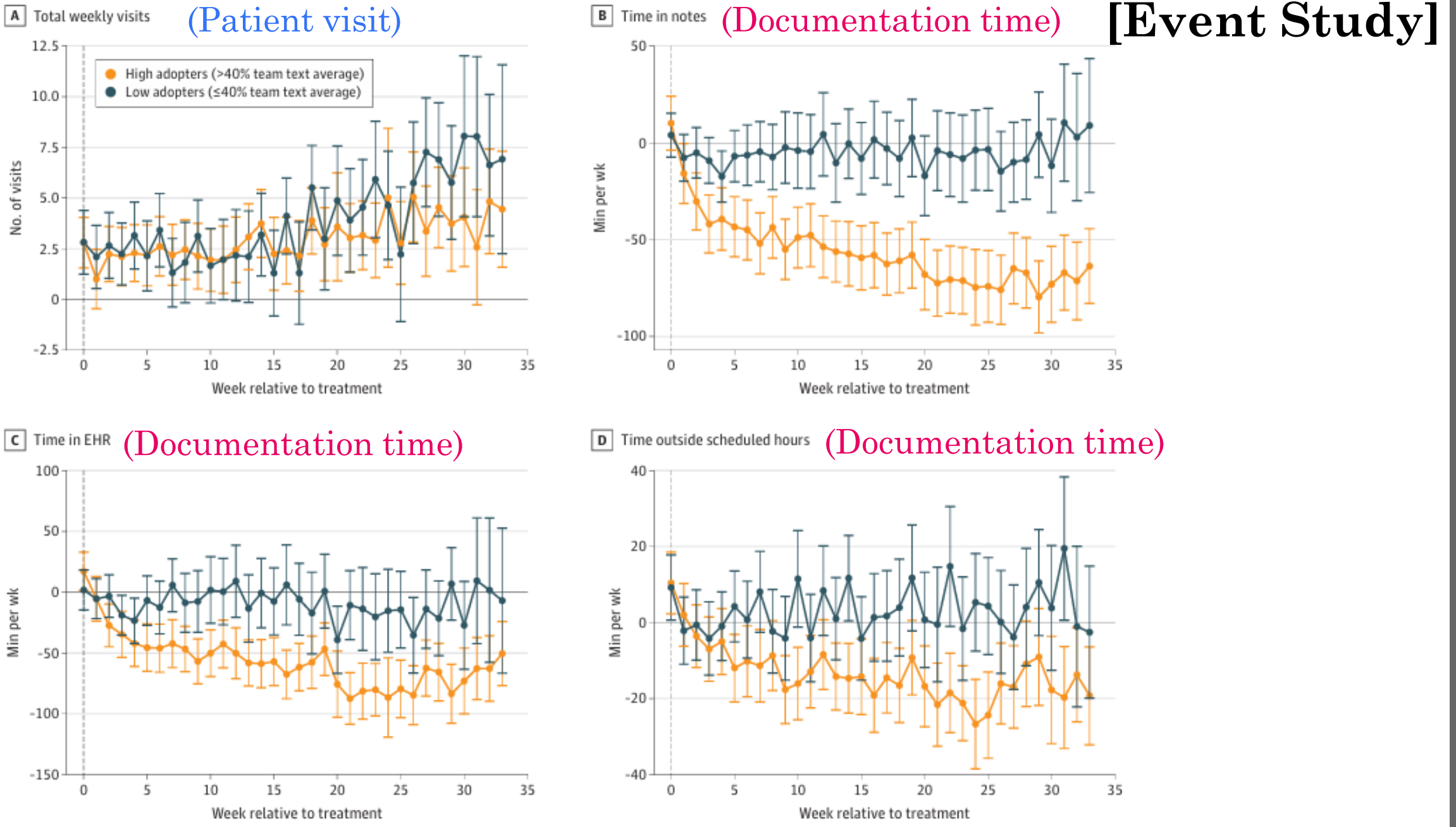
(Documentation time)

(Documentation time)

[Relative change]

High support reduced documentation use but not patient visits

Figure 4. Event Study Estimates Stratified by Team-Based Documentation Support Intensity for Primary Outcomes



[Event Study]

Sensitivity Analysis:

eTable 3. Comparison of TWFE and Callaway & Sant'Anna Estimates, Primary Outcomes

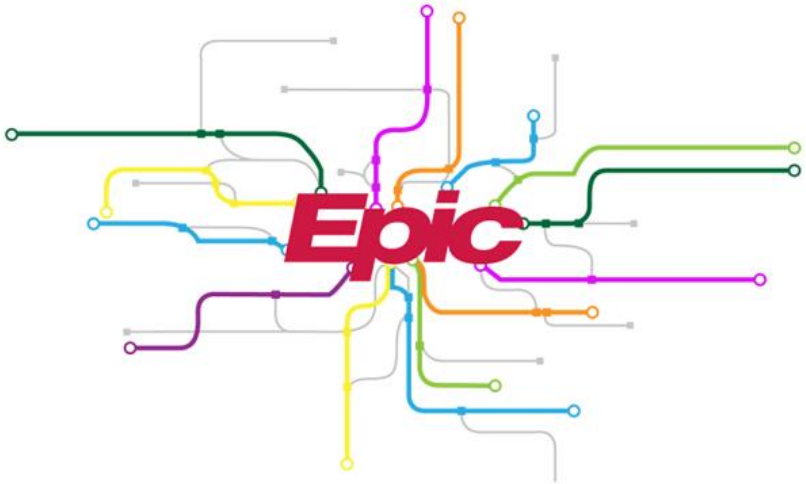
	Overall		High Support (n=513)	
	TWFE Estimate (95% CI)	CS Estimate (95% CI)	TWFE Estimate (95% CI)	CS Estimate (95% CI)
Per Week				
Total Visits	**2.5 [1.9 to 3]**	**2.6 [1.6 to 3.5]**	**2 [1.2 to 2.8]**	**2.4 [0.6 to 4.1]**
Total Time in EHR (mins)	**-28.9 [-38.6 to -19.2]**	-3.9 [-18.6 to 10.7]	**-57.6 [-70.2 to -44.9]**	**-31.3 [-60.2 to -2.5]**
Time in Notes (mins)	**-23.3 [-30.3 to -16.2]**	**-18 [-30.3 to -5.6]**	**-53.9 [-65.3 to -42.4]**	**-47 [-66 to -27.9]**
Time Outside Scheduled Hours (mins)	**-6.5 [-10 to -3]**	0.5 [-5.1 to 6.1]	**-12.9 [-17.5 to -8.4]**	-7 [-18 to 4.1]
Time on Unscheduled Days (mins)	-0.4 [-4.6 to 3.7]	**-7.2 [-14.3 to -0.2]**	-3 [-8.3 to 2.4]	-8.1 [-20.8 to 4.7]
Pajama Time (mins)	-3.9 [-8.1 to 0.4]	-5 [-12.2 to 2.1]	**-10.4 [-15.9 to -4.8]**	-12.2 [-25.7 to 1.2]

Staggered effect (*intervention roll out different time*)

→ Use Callaway & Sant'Anna Estimates *(Cluster weighting according to time)*

Diff-in-Diff: Summary

- Diff-in-Diff can be used in observational study
- Compare pre-post outcome with control group
- Consider definition of intervention & control
- Aware of staggered effect (different time of intervention roll out)
- Report relative change and event study



Thank you