SUPPLEMENTARY MATERIAL

Implementing a Quality Intervention to Improve Confidence in Outpatient Venous Thromboembolism Management

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Supplementary Methods

A simple (uncontrolled) interrupted time series (ITS) cannot exclude time-varying confounders that do not form part of the underlying trend, such as other interventions or events occurring around the time that may also affect the outcome (history bias) [1].

To address this limitation, a controlled ITS (CITS) analysis was performed in addition to the simple ITS. This involved incorporating a control series that was not exposed to the intervention to the simple ITS design. In a CITS, if an effect is detected in the intervention group but not in a well-chosen control group, it suggests that the effect is more likely attributable to the intervention [1]. For our study, patients with chronic obstructive pulmonary disease (COPD) exacerbations were used as an internal control group. Per Friedman et al [2], “an internal control arm would allow us to check that nothing else in the clinical environment is changing during the pre and post period.” Analyzing the discharge rate of patients with COPD provided us with an internal patient outcome that would reflect the general care of ED patients. Providing an educational initiative on VTE should not have affected the COPD measure, at least not directly.

Both the simple and controlled ITS models were developed based on the simple and segmented regression with difference-in-difference models outlined in the article by Mascha et al [3]. These models included indicator variables for the intervention or control series as interaction terms. The ITS analyses used the same time periods, as described in the study timeline (**Figure 1**). However, as the outcome was analyzed monthly and the interventions did not precisely take place at the beginning of a month, date ranges for the analyses were matched as closely as possible to account for a full month of data.

1. Lopez Bernal J, Cummins S, Gasparrini A. The use of controls in interrupted time series studies of public health interventions. *Int J Epidemiol*. Dec 01 2018;47(6):2082-2093. doi:10.1093/ije/dyy135

2. Friedman C. *Evaluation Methods in Biomedical and Health Informatics*. https://link.springer.com/book/10.1007/978-3-030-86453-8 Accessed Jan 31, 2024

3. Mascha EJ, Sessler DI. Segmented Regression and Difference-in-Difference Methods: Assessing the Impact of Systemic Changes in Health Care. *Anesth Analg*. Aug 2019;129(2):618-633. doi:10.1213/ANE.0000000000004153

Supplementary Tables

Supplementary Table 1. Provider barrier impact score

Barrier, n (%)	Not a barrier		Somewhat of a barrier		Significant barrier	
	Pre-quality intervention (n=25)	Post-quality intervention (n=23)	Pre-quality intervention (n=25)	Post-quality intervention (n=23)	Pre-quality intervention (n=25)	Post-quality intervention (n=23)
Access to DOAC	2 (8%)	6 (26%)	6 (24%)	10 (43%)	17 (68%)	7 (30%)
Bleeding concern/lack of laboratory monitoring	1 (4%)	3 (13%)	12 (48%)	9 (39%)	12 (48%)	11 (48%)
Lack of a dedicated appointment post-discharge with a clinician	1 (4%)	2 (9%)	6 (24%)	10 (43%)	18 (72%)	11 (48%)
Differing recommendations from providers	9 (36%)	11 (48%)	12 (48%)	10 (43%)	4 (16%)	2 (9%)
Converting a patient from warfarin to a DOAC	3 (12%)	4 (17%)	13 (52%)	17 (74%)	9 (36%)	2 (9%)
Concern for patient adherence	0 (0%)	0 (0%)	11 (44%)	14 (61%)	14 (56%)	9 (39%)
Concern about a medical malpractice lawsuit	11 (44%)	12 (52%)	10 (40%)	10 (43%)	4 (16%)	1 (4%)
Discharge paperwork burden	17 (68%)	15 (65%)	6 (24%)	7 (30%)	2 (8%)	1 (4%)
Lack of patient education regarding treatment of condition	1 (4%)	5 (22%)	17 (68%)	10 (43%)	7 (28%)	8 (35%)

DOAC, direct oral anticoagulant.

Supplementary Table 2. Provider demographics

Variable	Providers (n=25)
Resident, n (%)	21 (84%)
Post-graduate year 1	9 (42.86%)
Post-graduate year 2	5 (23.81%)
Post-graduate year 3	7 (33.33%)
Attending, n (%)	4 (16%)
Years of experience, n (%)	
0-5	0
6-10	2 (50%)
>10	2 (50%)
VTE education naïve, n (%)	15 (60%)

VTE, venous thromboembolism.

Supplementary Table 3. Social determinants of health impact score

Social determinant of health factors	Not difficult at all	Somewhat difficult	Very difficult
Lack of support (e.g., family, friends) (n=25)	2 (8%)	12 (48%)	11 (44%)
Socioeconomic barriers (e.g., low income, unemployment, etc.) (n=25)	0	6 (24%)	19 (76%)
Low health literacy (n=25)	0	9 (39%)	16 (64%)
English as a second language (n=25)	0	16 (64%)	9 (39%)
Difficulty attaining transportation for follow up care (n=25)	0	11 (44%)	14 (61%)
Housing instability (n=24)	1 (4%)	7 (29%)	16 (67%)

Supplementary Table 4. Discharge rates for patients diagnosed with acute VTE in the ED

Pilot

Variable	Pre-pilot	Post-pilot	*P*-value[a]
Patients diagnosed with acute PE in the ED, n	204	177	
Disposition, n (%)			
Discharge	10 (4.9%)	22 (12.4%)	0.01
Observation to discharge	23 (11.3%)	38 (21.5%)	
Observation to admission	6 (2.9%)	4 (2.3%)	
Admission	165 (80.9%)	113 (63.8%)	
Patients diagnosed with acute DVT in the ED, n	152	157	
Disposition, n (%)			
Discharge	81 (53.3%)	70 (44.6%)	0.16
Observation to discharge	23 (15.1%)	30 (19.1%)	
Observation to admission	3 (2.0%)	0	
Admission	45 (29.6%)	57 (36.3%)	
Total PE and DVT discharges, n (%)	91 (25.6%)	92 (27.5%)	0.61

Quality intervention

Variable	Pre-quality intervention	Post-quality intervention	*P* value[a]
Patients diagnosed with acute PE in the ED, n	101	96	
Disposition, n (%)			
Discharge	10 (9.9%)	8 (8.3%)	0.89
Observation to discharge	12 (11.9%)	7 (7.3%)	
Observation to admission	1 (1.0%)	0	
Admission	78 (77.2%)	81 (84.4%)	
Patients diagnosed with acute DVT in the ED, n	71	88	
Disposition, n (%)			
Discharge	39 (54.9%)	47 (53.4%)	0.98
Observation to discharge	10 (14.1%)	16 (18.2%)	
Observation to admission	0	1 (1.1%)	
Admission	22 (31.0%)	24 (27.3%)	
Total PE and DVT discharges, n (%)	49 (28.5%)	55 (29.9%)	0.86

DVT, deep vein thrombosis; ED, emergency department; PE, pulmonary embolism.

[a] *P*-values for two-proportion *z*-tests were only assessed for the “Discharge” disposition.

Supplementary Table 5. Segmented linear regression analysis of monthly discharge rates for the pilot (simple uncontrolled interrupted time series model)

Variable	Parameter	95% CI	Standard error	*P* value
Constant	B_0, 0.363	0.299 to 0.428	0.030	<0.001
Baseline trend/slope	B_1, −0.024	−0.034 to −0.013	0.005	<0.001
Change in level immediately post-pilot	B_2, 0.162	−0.009 to 0.333	0.081	0.061
Change in trend/slope: comparison of pre-pilot slope to post-pilot slope	B_3, 0.014	−0.007 to 0.035	0.010	0.176

Supplementary Table 6. Segmented linear regression analysis of monthly discharge rates for the quality intervention (simple uncontrolled interrupted time series model)

Variable	Parameter	95% CI	Standard error	*P* value
Constant	B_0, 0.328	0.241 to 0.415	0.036	<0.001
Baseline trend/slope	B_1, −0.018	−0.047 to 0.011	0.012	0.173
Change in level immediately post-quality intervention	B_2, 0.096	−0.028 to 0.221	0.051	0.106
Change in trend/slope: comparison of pre-quality intervention slope to post-quality intervention slope	B_3, 0.000	−0.032 to 0.032	0.013	0.996

Supplementary Table 7. Segmented linear regression analysis of monthly discharge rates for the pilot (controlled interrupted time series model)

Variable	Parameter	95% CI	Standard error	*P* value
Constant	B_0, 0.320	0.196 to 0.443	0.061	<0.001
Baseline trend/slope of discharge rate before pilot intervention for COPD	B_1, 0.022	−0.001 to 0.044	0.011	0.058
Change in level of discharge rate immediately post-pilot intervention for COPD	B_2, −0.132	−0.275 to 0.010	0.070	0.068
Difference in the trend/slopes of discharge rate for COPD between prepilot and postpilot intervention	B_3,−0.028	−0.054 to −0.002	0.013	0.039
Difference between VTE vs COPD in level at beginning of study	B_4, 0.044	−0.094 to 0.182	0.068	0.523
Difference between VTE vs COPD in slope for prepilot intervention	B_5,−0.045	−0.070 to −0.021	0.012	0.001
Difference between VTE vs COPD in the change in level of discharge rate immediately post-pilot intervention	B_6, 0.294	0.077 to 0.512	0.107	0.010

Difference between VTE vs COPD in change in slope for post-pilot intervention	B_7, 0.042	0.009 to 0.075	0.016	0.015

COPD, chronic obstructive pulmonary disease; VTE, venous thromboembolism.

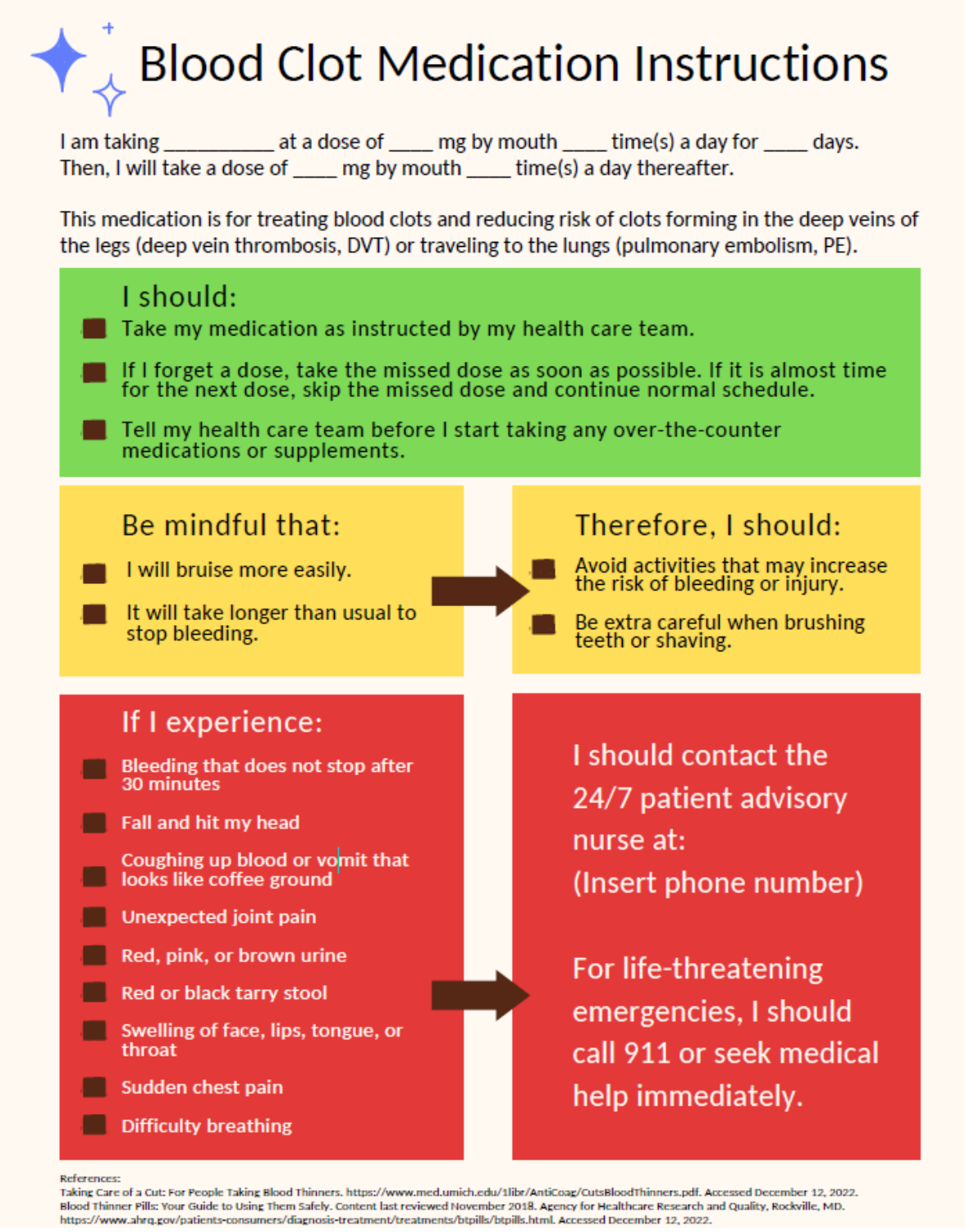
Supplementary Table 8. Segmented linear regression analysis of monthly discharge rates for the quality intervention (controlled interrupted time series model)

Variable	Parameter	95% CI	Standard error	*P* value
Constant	B_0, 0.300	0.187 to 0.413	0.052	<0.001
Baseline trend/slope of discharge rate before pilot intervention for COPD	B_1, 0.043	0.005 to 0.081	0.017	0.029
Change in level of discharge rate immediately post-pilot intervention for COPD	B_2,−0.051	−0.196 to 0.094	0.067	0.460
Difference in the trend/slopes of discharge rate for COPD between pre-quality and post-quality intervention	B_3,−0.059	−0.100 to −0.018	0.019	0.009
Difference between VTE vs COPD in level at beginning of study	B_4, 0.028	−0.109 to 0.165	0.063	0.665
Difference between VTE vs COPD in slope pre-quality intervention	B_5,−0.061	−0.107 to −0.015	0.021	0.013
Difference between VTE vs COPD in the change in level immediately of discharge rate post-quality intervention	B_6, 0.147	−0.035 to 0.330	0.084	0.104
Difference between VTE vs COPD in change in slope post-quality intervention	B_7, 0.059	0.008 to 0.109	0.023	0.026

COPD, chronic obstructive pulmonary disease; VTE, venous thromboembolism.

Supplementary Figures

Supplementary Figure 1. Patient infographic in English and Spanish



Guía para el medicamento para los coágulos de sangre

Estoy tomando _____ a una dosis de _____ mg por vía oral _____ vez(ces) al día por _____ días. Luego, cambio a una dosis de _____ mg por vía oral _____ vez(ces) al día.

Este medicamento se utiliza para tratar coágulos sanguíneos y reducir el riesgo de formación de un coágulo sanguíneo en las piernas (trombosis venosa profunda, DVT) o en los pulmones (embolia pulmonar, PE).

Debo:

- Tomar mi medicamento según las instrucciones de mi equipo de atención médica.
- Si se me olvida tomar una dosis, debo tomar la pastilla olvidada tan pronto como sea posible. Si ya casi es la hora para la próxima dosis, debo omitir la dosis olvidada.
- Informarle al doctor antes de tomar cualquier nuevo medicamento de venta libre o suplemento.

Es posible que:

- Me puedan salir moretones con mayor facilidad.
- Me tome más tiempo detener un sangrado.

Por eso, debo:

- Evitar actividades que puedan aumentar el riesgo de sangrado.
- Tener mucho cuidado al cepillarme los dientes o afeitarme.

Si experimento algunos de estos síntomas:

- Sangrado que dura más de 30 minutos
- Me caigo y me golpeo la cabeza
- Toser o vomitar sangre o material que se ve como café molido
- Dolor en las articulaciones
- Orina de color rojo, rosa, o café
- Deposiciones rojas o negras
- Inflamación del rostro, labios, lengua, o de la garganta
- Dolor o presión de pecho
- Dificultad para respirar

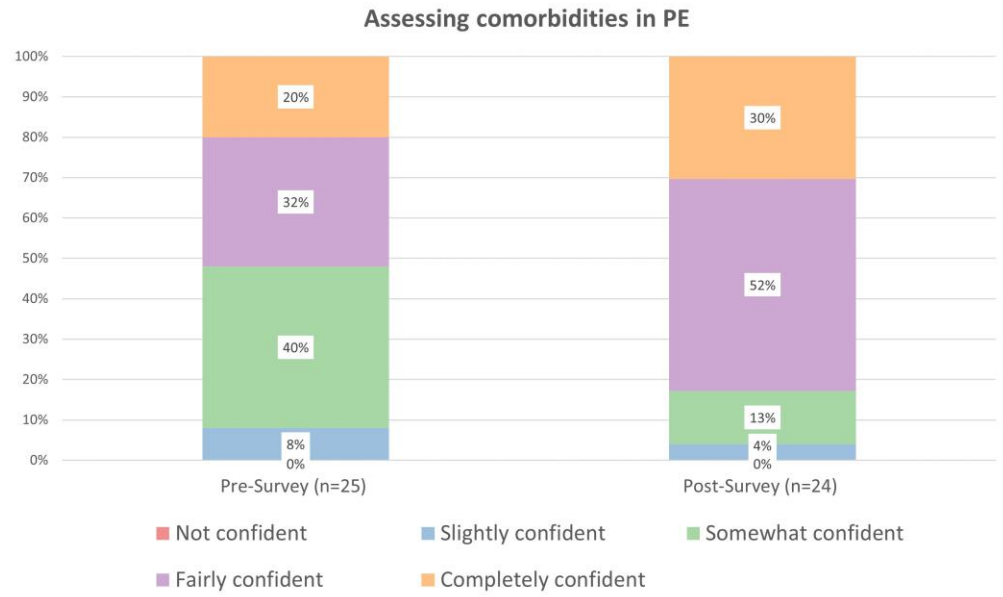
Debo llamar a la línea de enfermería 24-Horas Nurseline al:
(número de teléfono)

En caso de una emergencia que ponga en riesgo la vida, debo llamar al 911 o buscar ayuda inmediatamente.

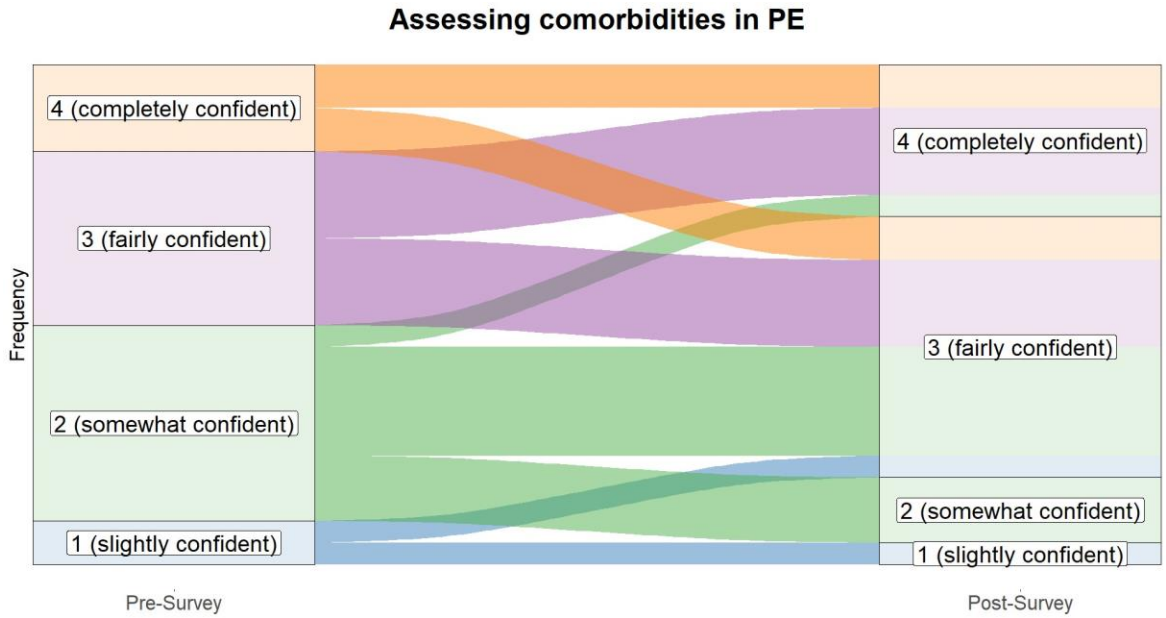
Referencias:
Taking Care of a Cut: For People Taking Blood Thinners. https://www.med.umich.edu/1libr/AntiCoag/CutsBloodThinners.pdf. Accessed December 12, 2022.
Blood Thinner Pills: Your Guide to Using Them Safely. Content last reviewed November 2018. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/patients-consumers/diagnosis-treatment/treatments/btpills/btpills.html. Accessed December 12, 2022.

Supplementary Figure 2. Assessing confidence: assessing comorbidities in requiring surgical or medical admission for patients with PE. (A) Proportion of providers by response and (B) progression of responses pre- to post-intervention. PE, pulmonary embolism.

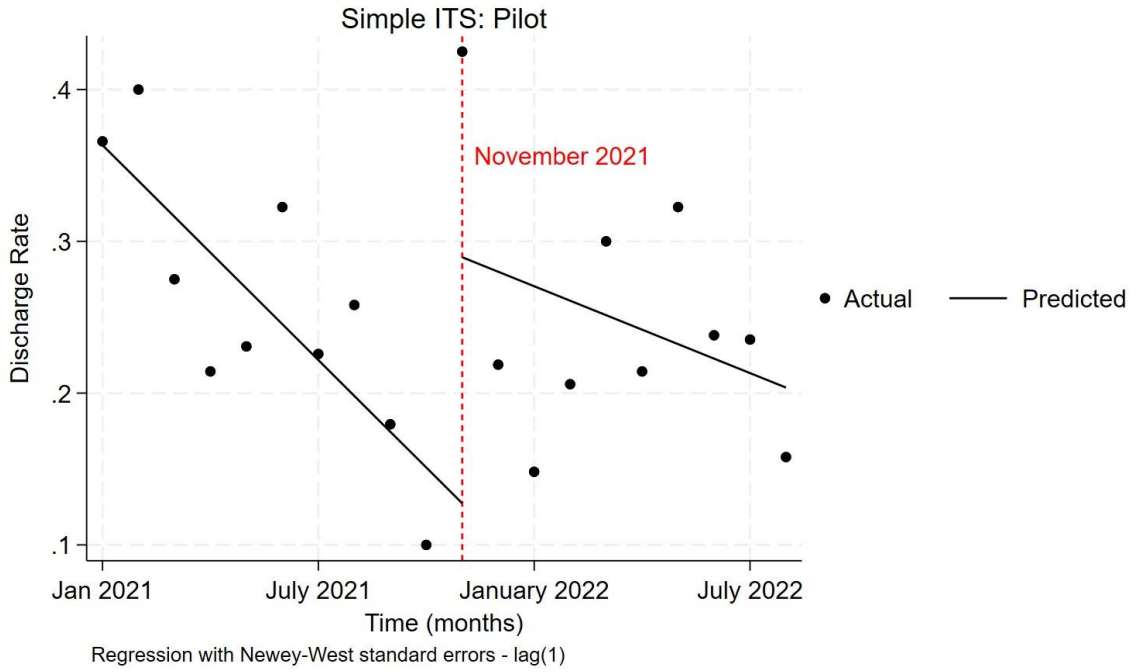
A



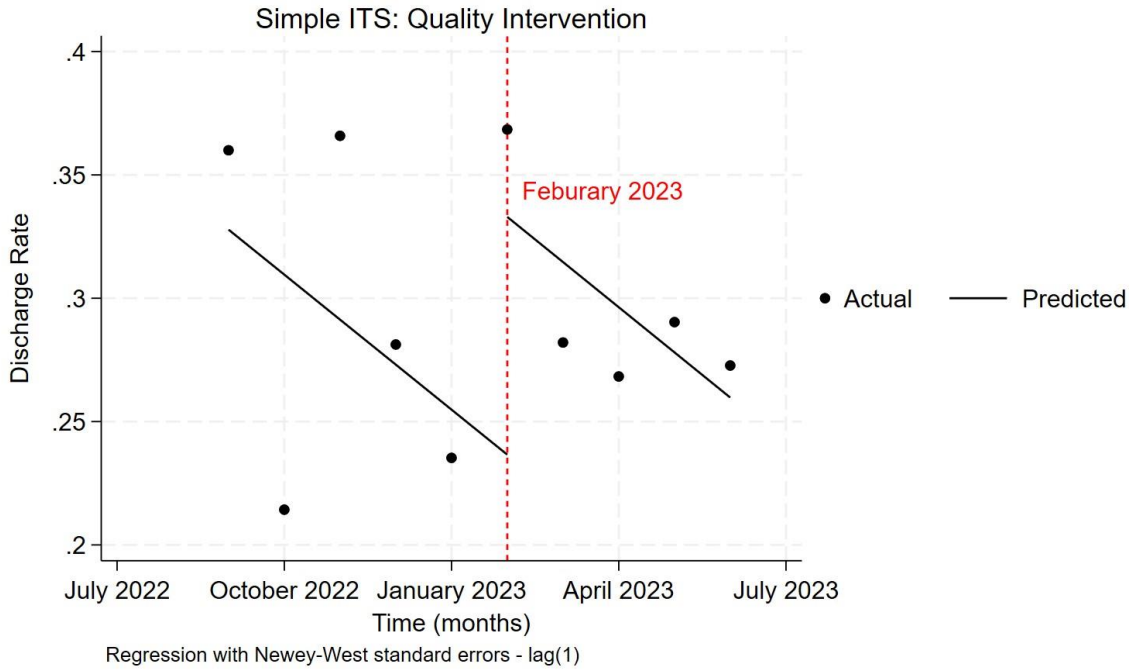
B



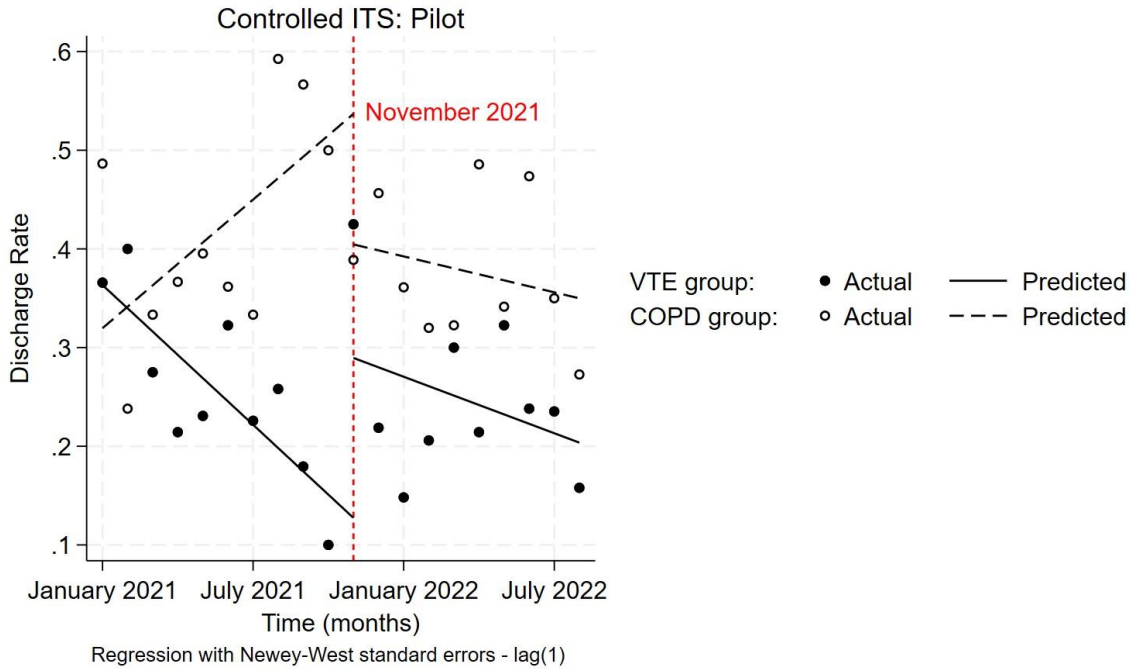
Supplementary Figure 3. Simple ITS for pre- and post-pilot intervention. ITS, interrupted time series.



Supplementary Figure 4. Simple ITS for pre- and post-quality intervention. ITS, interrupted time series.



Supplementary Figure 5. Controlled ITS for pre- and post-pilot intervention. ITS, interrupted time series.



Supplementary Figure 6. Controlled ITS for pre- and post-quality intervention. ITS, interrupted time series.