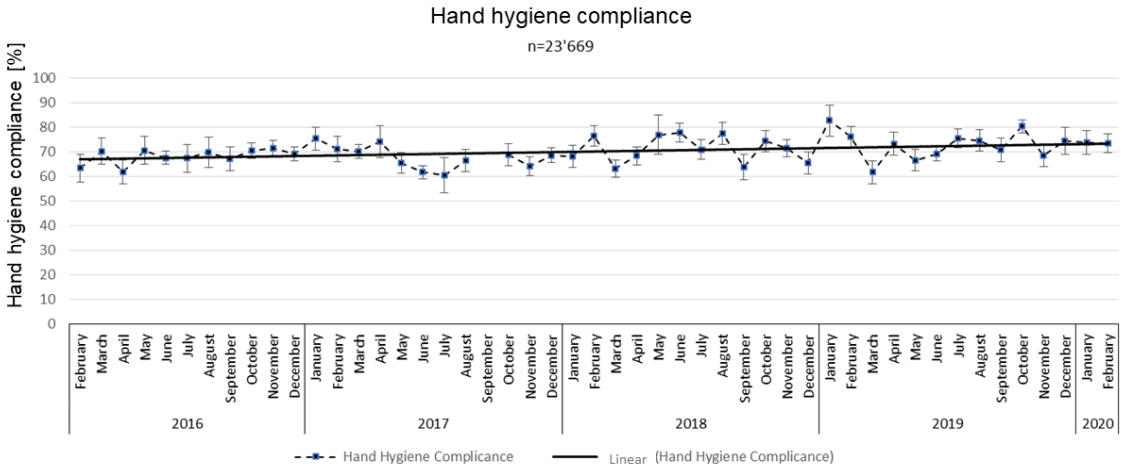
Supplementary Online Content

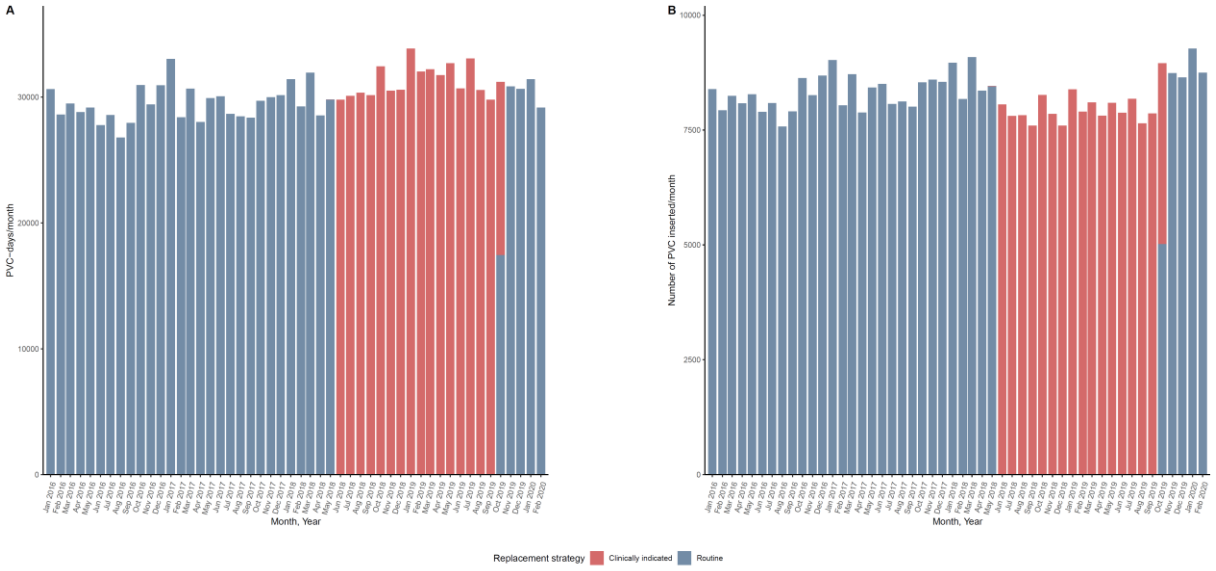
Buetti N, Abbas M, Pittet D, et al. Comparison of routine replacement with clinically indicated replacement of peripheral intravenous catheters. *JAMA Intern Med.* Published online September 17, 2021. doi:10.1001/jamainternmed.2021.5345

This supplementary material has been provided by the authors to give readers additional information about their work.

eFigure 1. Hand hygiene compliance during the study period

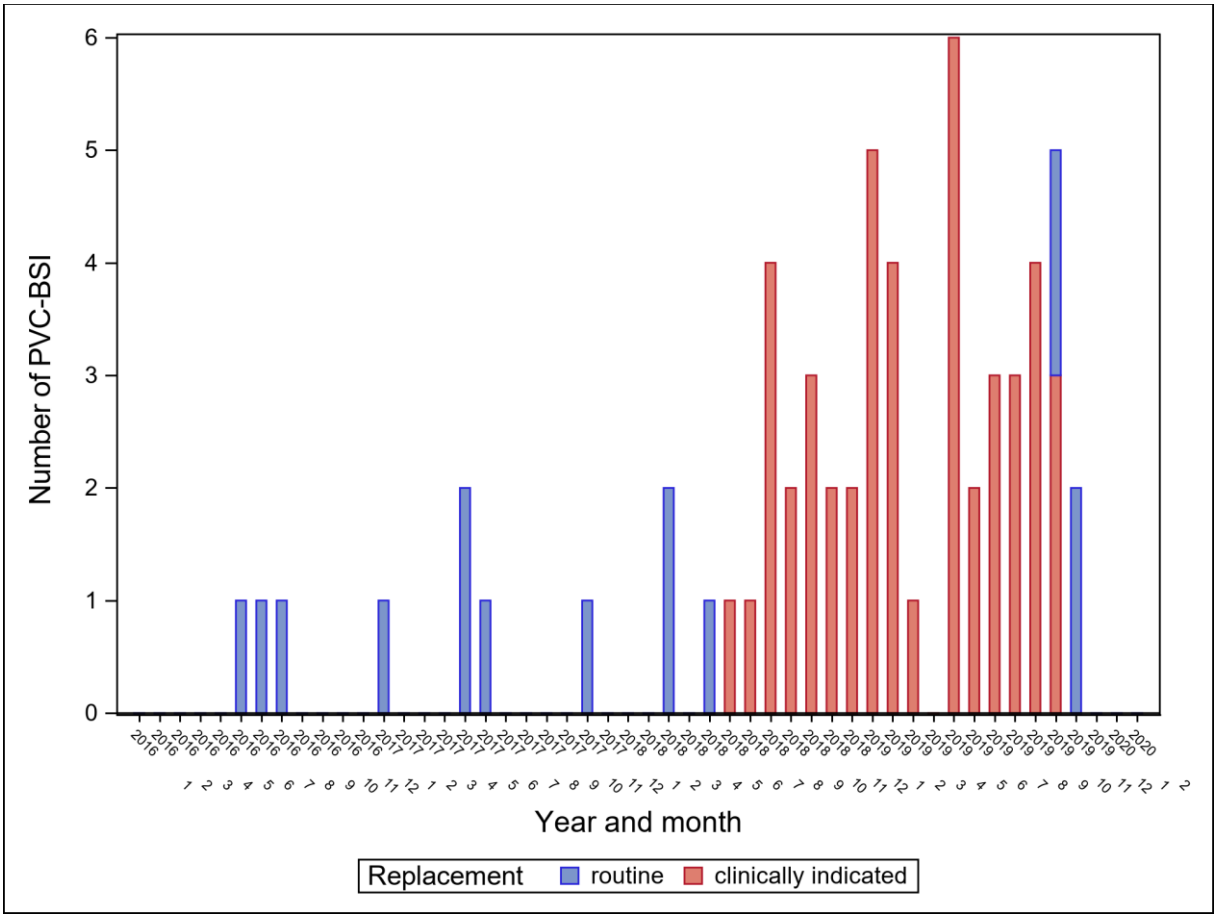


eFigure 2. Number of peripheral venous catheters and catheter-days during the study (January 2016-February 2020)



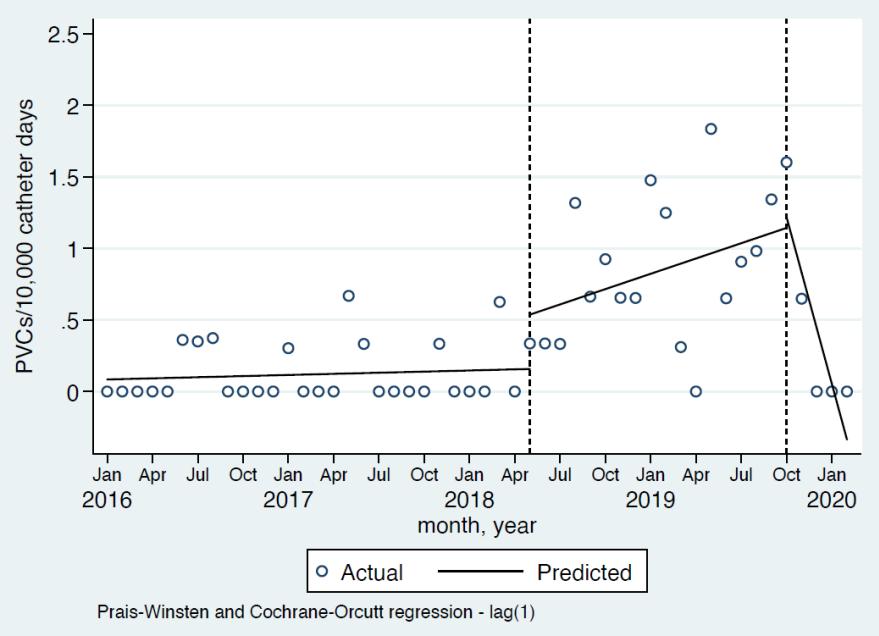
Legend. PVC: Peripheral intravenous catheter. The total number of PVC-days per month and the total number of PVC per month were illustrated in panel A and B, respectively.

eFigure 3. Peripheral venous catheter-associated bloodstream infections during the three study periods (January 2016-February 2020)



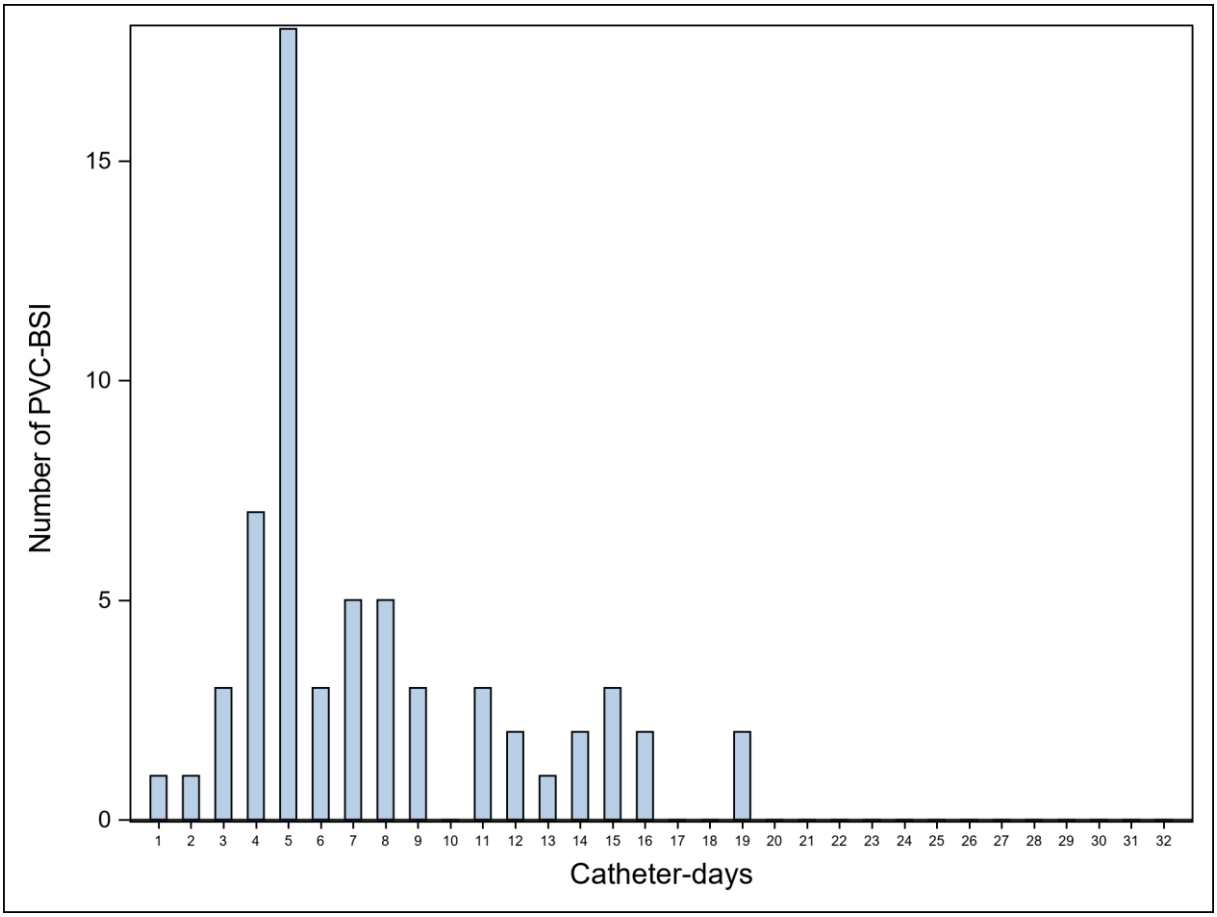
Legend. PVC: Peripheral intravenous catheter. BSI: Bloodstream infection.

eFigure 4. Interrupted time-series analysis



Legend. PVC: Peripheral intravenous catheter bloodstream infection.

eFigure 5. Peripheral venous catheter-associated bloodstream infections by dwell-time (days).



Legend. PVC: Peripheral intravenous catheter. BSI: Bloodstream infection.

eMethods. Interrupted Time-Series Analysis and Missing Data

We conducted an interrupted time-series analysis of monthly rates of PVC per 10,000 catheter-days for all three periods (baseline, intervention, reversion) using a Prais-Winsten regression, which is based on generalized least-squares method accounting for serial auto-correlation. We used the Durbin Watson *d* statistic to evaluate how well the model took into account first-order correlation. Our hypothesis was the absence of an impact on PVC rates between all three periods. This statistical analysis were performed using Stata (StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP), and in particular the itsa command.

Intravascular catheters without information on catheter duration were excluded from the analysis. They accounted for 0.17% (n=674) of all catheters. Included and excluded PVCs are illustrated in the eTable 1.

For the variable “insertion site” we observed 429 catheters without this information: these data were assigned to the category “other”.

For the variables sex and operator, we did not observe missing values with our electronic extraction method. For the variable age, 66 (0.015%) missing values were imputed to the median.

Censoring: Catheter-days data were censored at 30 days.

eTable 1. Included and excluded peripheral venous catheters

		Included PVCs (n=412'631)	Excluded PVCs (n=693)	p-value*
Sex*	Female	73709 (53.8)	135 (36.5)	<.01
Age*, median (IQR)		49 [32 ; 69]	61 [46 ; 72]	0.12
Operator	In-hospital	380363 (92.2)	659 (95.1)	<.01
Catheter-days >4days		86964 (21.1)	0 (0)	<.01

Legend. PVC: Peripheral venous catheter. IQR: Interquartile range. * calculated for patients.

eTable 2. Logistic regression model* adjusting for sex, age and insertion site

		OR	95% CI		p-value
Clinically indicated replacement (versus routine replacement)		6.36	3.60	11.23	<.001
Male		3.360	1.89	5.97	<.001
Age		0.98	0.97	0.99	0.0013
Insertion site	Forearm	0.89	0.45	1.77	0.74
	Arm	0.28	0.093	0.86	0.025
	Elbow	1.89	0.72	4.50	0.20
	Hand	3.02	1.14	7.98	0.026
	Other	3.60	0.22	59.47	0.37

Legend. OR: Odds ratio. CI: Confidence Interval.* Firth method.

eTable 3. Interrupted time-series analysis

PVC-BSI rate (per 10,000 catheter-days)	Coefficient	95% CI	*p*-value
Constant	0.084	-0.145 to 0.31	0.46
Slope before intervention	0.0026	-0.012 to 0.017	0.72
Change in level (baseline-to-intervention)	0.38	-0.005 to 0.76	0.050
Change in slope after intervention	0.033	-0.0011 to 0.067	0.058
Change in level (intervention-to-reversion)	0.075	-0.53 to 0.67	0.80
Change in slope (after reversion)	-0.42	-0.63 to -0.22	<.001
Post-intervention linear trend	0.036	0.0046 to 0.067	0.025
Post-reversion linear trend	-0.39	-0.59 to -0.18	<.001

Legend. PVC: Peripheral venous catheter. BSI: Bloodstream infection. CI:

Confidence Interval.

eTable 4. Description of patients with PVC-BSI during the three different periods

		Period			
		Baseline (n=11)	Intervention (n=46)	Reversion (n=4)	p-value
Sex, n (%)	Female	2 (18.2)	11 (23.9)	1 (25)	0.92
Age, median [IQR]		74 [54 ; 79]	64 [57 ; 76]	67 [60.5 ; 73.5]	0.69
ICU, n (%)		0 (0)	1 (2.2)	0 (0)	0.85
PVC-days, median [IQR]		5 [5 ; 7]	7 [5 ; 12]	4.5 [3.5 ; 7]	0.16
Insertion site, n (%)	Forearm	8 (72.7)	25 (54.3)	2 (50)	0.23
	Arm	0 (0)	4 (8.7)	0 (0)	
	Elbow	0 (0)	5 (10.9)	1 (25)	
	Hand	3 (27.3)	3 (6.5)	0 (0)	
	Wrist	0 (0)	9 (19.6)	1 (25)	

Legend. IQR: Interquartile range. ICU: Intensive care unit. ICU: Intensive care unit.

PVC: Peripheral venous catheter.

eTable 5. Microbiological etiology of peripherally inserted catheter-associated bloodstream infection, stratified by routine and clinically indicated replacement periods

	Routine replacement°	Clinically indicated replacement	p-value*
Achromobacter, n (%)	0 (0)	1 (2.2)	0.64
CoNS or other skin commensals, n (%)	9 (60)	23 (50)	
Enterobacter spp, n (%)	1 (6.7)	3 (6.5)	
Fungi, n (%)	1 (6.7)	1 (2.2)	
Klebsiella spp, n (%)	1 (6.7)	3 (6.5)	
MRSA, n (%)	0 (0)	3 (6.5)	
MSSA, n (%)	1 (6.7)	7 (15.2)	
Pseudomonas aeruginosa, n (%)	0 (0)	3 (6.5)	
Serratia marcescens, n (%)	1 (6.7)	0 (0)	
Sphingomonas paucimobilis, n (%)	0 (0)	1 (2.2)	
Polymicrobial, n (%)	1 (6.7)	1 (2.2)	

Legend. ° Baseline and reversion periods combined. *Fisher's exact test. CoNS: Coagulase-negative staphylococci. MRSA: Methicillin-resistant *Staphylococcus aureus*. MSSA: Methicillin-sensitive *Staphylococcus aureus*.

eResults. Interrupted Time-Series Analysis

Before the intervention, there was almost no monthly change in PVC-BSIs (increase of 0.0026/10,000 catheter-days/month, 95%CI -0.0120 to 0.0172). The intervention was associated with a borderline significant increase in level of PVC-BSI rate by 0.38 PVC-BSIs (95% -0.005 to 0.7605) and a borderline upward change in the slope relative to the pre-intervention period by 0.033, so that the post-intervention linear trend was an increase of PVC-BSIs of 0.0357/10,000 catheter-days/month (95%CI 0.0046 to 0.0667, p=0.0254). The reversion to routine replacement was associated with a statistically significant decrease in level, as well as trend (eTable 3, eFigure 4. The Durbin Watson *d* statistic decreased from 2.17 to 2.05, indicating that the model performed well, with little or no residual autocorrelation.