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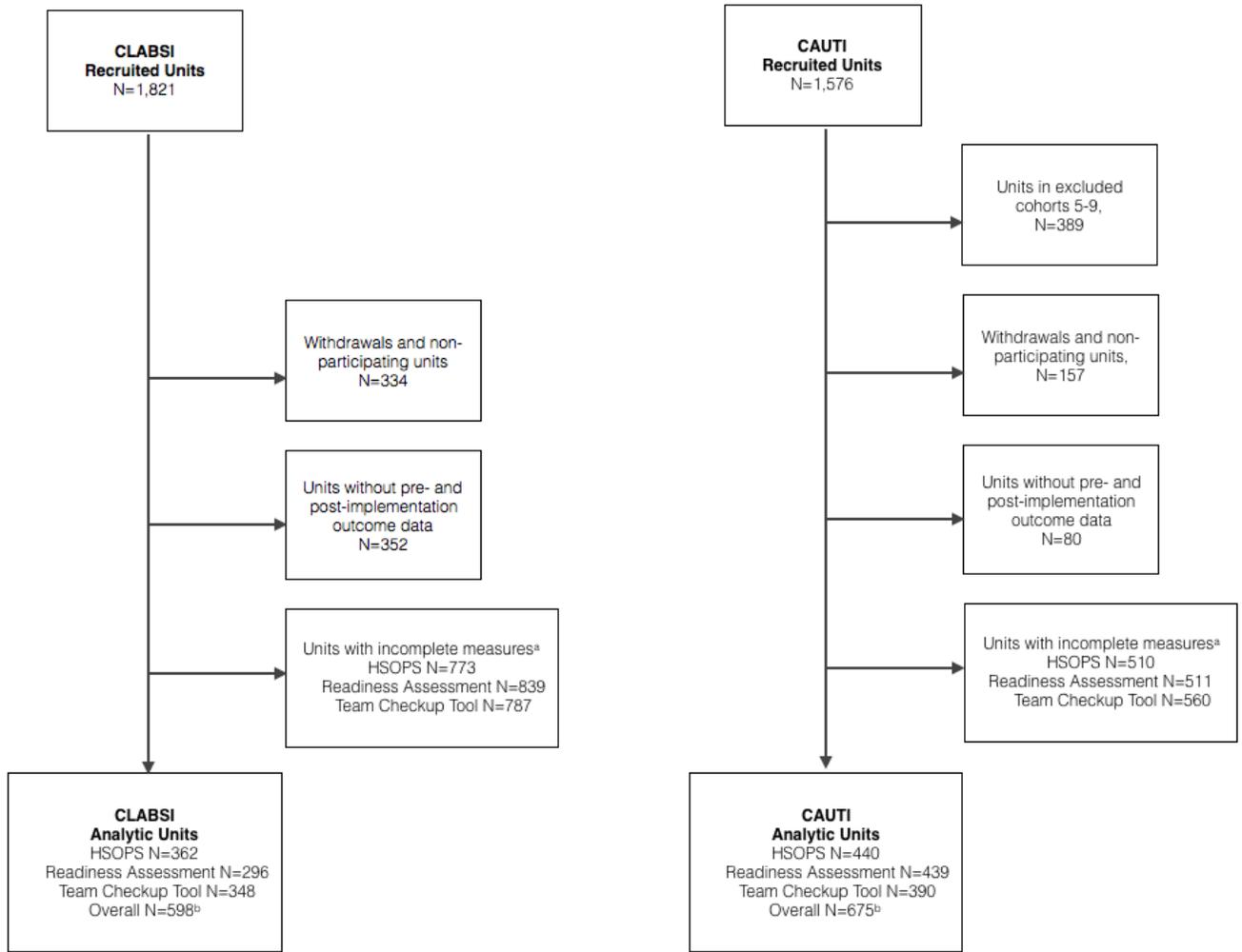
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Appendix 1

Appendix 1 Figure 1. Data Flow Diagram by Collaborative



^a Incomplete measures defined as any missing or invalid response for the measures of interest at baseline (for all 3 tools) or follow-up (for HSOPS and TCT).
^b Unit N by culture survey tool do not add to overall N as some units may have responded to more than one culture survey.

Appendix 1 Text 1. Model Details

The following tables give HSOPS model results for ICUs and non-ICUs for both the CLABSI and CAUTI collaboratives. Columns labeled “IRR” contain the Incident Rate Ratio for the effect. The IRR is the multiplicative effect of the item of interest. An $IRR > 1$ indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an $IRR < 1$ is a negative association, meaning a higher score for the item results in a lower outcome rate. For simplicity we used a significance criteria of $\alpha < 0.01$, hence, 99% confidence intervals (CIs) are reported. Where the confidence interval includes 1, the findings are considered to be not significant at $p < 0.01$. The variable Days was coded as the proportion of time to collaborative completion so that the corresponding coefficient represents the IRR for the entire collaborative period. Interactions with time test the hypothesis that the item affects the change in infection rate; these are labeled in the Variables column with the text “... x Days” .

Appendix 1 Table 1. CLABSI HSOPS Models, ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001
Teaching Hospital	0.94	(0.64,1.37)	0.65	0.93	(0.64,1.36)	0.64	0.94	(0.64,1.36)	0.65	0.94	(0.65,1.38)	0.70
Rural Hospital	1.30	(0.77,2.20)	0.20	1.29	(0.77,2.16)	0.21	1.36	(0.81,2.27)	0.13	1.32	(0.79,2.20)	0.16
Critical Access Hospital	3.45	(0.44,26.99)	0.12	3.46	(0.44,27.08)	0.12	3.44	(0.44,26.73)	0.12	3.54	(0.45,27.57)	0.11
<i>Supervisor expectations & actions promoting safety</i>	1.00	(0.99,1.01)	0.77									
<i>Organizational learning - continuous improvement</i>				1.00	(0.99,1.01)	0.94						
<i>Teamwork within hospital units</i>							0.99	(0.98,1.01)	0.13			
<i>Communication openness</i>										1.00	(0.98,1.01)	0.36

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of "Supervisor expectations & actions promoting safety" on baseline rates, model 2 tested the effect of "Organizational learning - continuous improvement" on baseline rates, model 3 tested the effect of "Teamwork within hospital units" on baseline rates, and model 4 tested the effect of "Communication openness" on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 1. CLABSI HSOPS Models, ICUs at Baseline (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001
Teaching Hospital	0.93	(0.64,1.36)	0.63	0.93	(0.64,1.36)	0.64	0.94	(0.64,1.37)	0.65	0.93	(0.64,1.36)	0.64
Rural Hospital	1.29	(0.77,2.15)	0.20	1.33	(0.80,2.23)	0.15	1.29	(0.77,2.16)	0.20	1.29	(0.77,2.15)	0.21
Critical Access Hospital	3.46	(0.44,27.07)	0.12	3.56	(0.46,27.81)	0.11	3.51	(0.45,27.63)	0.12	3.48	(0.44,27.24)	0.12
<i>Feedback and communication about error</i>	1.00	(0.99,1.01)	0.79									
<i>Nonpunitive response to error</i>				1.00	(0.98,1.01)	0.29						
<i>Staffing</i>							1.00	(0.99,1.01)	0.82			
<i>Management support for patient safety</i>										1.00	(0.99,1.01)	0.90

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of “Feedback and communication about error” on baseline rates, model 6 tested the effect of “Nonpunitive response to error” on baseline rates, model 7 tested the effect of “Staffing” on baseline rates, and model 8 tested the effect of “Management support for patient safety” on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 1. CLABSI HSOPS Models, ICUs at Baseline (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001	1.12	(1.04,1.21)	<0.001
Teaching Hospital	0.94	(0.64,1.38)	0.69	0.93	(0.64,1.36)	0.64	0.95	(0.65,1.39)	0.72	0.93	(0.64,1.36)	0.63
Rural Hospital	1.27	(0.76,2.12)	0.23	1.28	(0.77,2.13)	0.21	1.25	(0.75,2.09)	0.26	1.27	(0.76,2.12)	0.24
Critical Access Hospital	3.30	(0.42,26.19)	0.14	3.45	(0.44,27.12)	0.12	3.35	(0.43,26.31)	0.13	3.41	(0.43,26.75)	0.13
<i>Teamwork across hospital units</i>	1.00	(0.99,1.02)	0.47									
<i>Hospital handoffs & transitions</i>				1.00	(0.99,1.01)	0.97						
<i>Frequency of event reporting</i>							1.00	(0.99,1.01)	0.33			
<i>Overall perceptions of safety</i>										1.00	(0.99,1.01)	0.71

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of “Teamwork across hospital units” on baseline rates, model 10 tested the effect of “Hospital handoffs & transitions” on baseline rates, model 11 tested the effect of “Frequency of event reporting” on baseline rates, and model 12 tested the effect of “Overall perceptions of safety” on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 1. CLABSI HSOPS Models, ICUs at Baseline (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	1.09	(0.98, 1.21)	0.05
Teaching Hospital	0.71	(0.41,1.24)	0.11
Rural Hospital	0.60	(0.24,1.50)	0.15
Critical Access Hospital	n/a	n/a	n/a
<i>Patient safety grade</i>	1.00	(0.99,1.02)	0.64

All models controlled for hospital bed size, teaching status, critical access status (except where noted as n/a) and rurality. Model 13 tested the effect of “Patient safety grade” on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 2. CLABSI HSOPS Models, ICUs over time

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.08	(1.01,1.16)	0.004	1.08	(1.01,1.16)	0.004	1.08	(1.01,1.16)	0.003	1.08	(1.01,1.16)	0.004
Teaching Hospital	0.90	(0.65,1.25)	0.41	0.90	(0.65,1.25)	0.42	0.90	(0.65,1.26)	0.42	0.91	(0.65,1.27)	0.47
Rural Hospital	0.97	(0.62,1.52)	0.88	0.99	(0.64,1.54)	0.95	1.02	(0.66,1.59)	0.91	1.01	(0.65,1.58)	0.94
Critical Access Hospital	1.51	(0.2,11.62)	0.60	1.51	(0.2,11.61)	0.60	1.51	(0.2,11.58)	0.60	1.53	(0.2,11.73)	0.59
Days	0.84	(0.39,1.81)	0.57	0.75	(0.36,1.57)	0.31	0.76	(0.27,2.09)	0.48	0.64	(0.33,1.22)	0.07
<i>Supervisor expectations & actions promoting safety</i>	1.00	(0.99,1.01)	0.63									
<i>Supervisor expectations & actions promoting safety x Days</i>	1.00	(0.99,1.01)	0.42									
<i>Organizational learning - continuous improvement</i>				1.00	(0.99,1.01)	0.88						
<i>Organizational learning - continuous improvement x Days</i>				1.00	(0.99,1.01)	0.69						
<i>Teamwork within hospital units</i>							0.99	(0.98,1)	0.15			
<i>Teamwork within hospital units x Days</i>							1.00	(0.99,1.01)	0.73			
<i>Communication openness</i>										1.00	(0.99,1)	0.14
<i>Communication openness x Days</i>										1.00	(0.99,1.01)	0.87

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of "Supervisor expectations and actions promoting safety" on rates over time, model 2 tested the effect of "Organizational learning – continuous improvement" on rates over time, model 3 tested the effect of "Teamwork within hospital units" on rates over time, and model 4 tested the effect of "Communication openness" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 2. CLABSI HSOPS Models, ICUs over time (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.08	(1.01,1.16)	0.004	1.08	(1.01,1.16)	0.005	1.08	(1.01,1.16)	0.005	1.08	(1.01,1.16)	0.004
Teaching Hospital	0.90	(0.65,1.26)	0.42	0.90	(0.65,1.25)	0.42	0.91	(0.66,1.27)	0.48	0.90	(0.65,1.25)	0.42
Rural Hospital	0.98	(0.63,1.53)	0.92	1.01	(0.65,1.57)	0.96	1.01	(0.65,1.57)	0.95	0.98	(0.63,1.53)	0.93
Critical Access Hospital	1.51	(0.2,11.57)	0.60	1.54	(0.2,11.83)	0.58	1.59	(0.21,12.25)	0.56	1.50	(0.2,11.54)	0.61
Days	0.67	(0.40,1.13)	0.05	0.69	(0.49,0.97)	0.01	0.82	(0.49,1.36)	0.31	0.62	(0.38,1.01)	0.01
<i>Feedback and communication about error</i>	1.00	(0.99,1.01)	0.71									
<i>Feedback and communication about error x Days</i>	1.00	(0.99,1.01)	0.96									
<i>Nonpunitive response to error</i>				1.00	(0.99,1.00)	0.14						
<i>Nonpunitive response to error x Days</i>				1.00	(0.99,1.01)	0.94						
<i>Staffing</i>							1.00	(0.99,1.00)	0.14			
<i>Staffing x Days</i>							1.00	(0.99,1.01)	0.30			
<i>Management support for patient safety</i>										1.00	(0.99,1.01)	0.79
<i>Management support for patient safety x Days</i>										1.00	(0.99,1.01)	0.68

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of "Feedback and communication about error" on rates over time, model 6 tested the effect of "Nonpunitive response to error" on rates over time, model 7 tested the effect of "Staffing" on rates over time, and model 8 tested the effect of "Management support for patient safety" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 2. CLABSI HSOPS Models, ICUs over time (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.08	(1.01,1.16)	0.004	1.08	(1.01,1.16)	0.004	1.08	(1.01,1.16)	0.004	1.08	(1.01,1.16)	0.004
Teaching Hospital	0.90	(0.65,1.26)	0.42	0.90	(0.65,1.25)	0.41	0.91	(0.66,1.27)	0.47	0.90	(0.65,1.25)	0.42
Rural Hospital	0.99	(0.64,1.53)	0.95	0.99	(0.64,1.54)	0.96	0.97	(0.62,1.5)	0.84	0.98	(0.63,1.53)	0.92
Critical Access Hospital	1.52	(0.2,11.65)	0.60	1.54	(0.2,11.81)	0.59	1.48	(0.19,11.31)	0.62	1.50	(0.2,11.52)	0.61
Days	0.58	(0.34,1)	0.01	0.59	(0.36,0.97)	0.01	0.63	(0.38,1.05)	0.02	0.69	(0.42,1.13)	0.05
<i>Teamwork across hospital units</i>	1.00	(0.99,1.01)	0.99									
<i>Teamwork across hospital units x Days</i>	1.00	(0.99,1.01)	0.50									
<i>Hospital handoffs & transitions</i>				1.00	(0.99,1.01)	0.60						
<i>Hospital handoffs & transitions x Days</i>				1.00	(0.99,1.01)	0.52						
<i>Frequency of event reporting</i>							1.00	(1,1.01)	0.14			
<i>Frequency of event reporting x Days</i>							1.00	(0.99,1.01)	0.77			
<i>Overall perceptions of safety</i>										1.00	(0.99,1.01)	0.78
<i>Overall perceptions of safety x Days</i>										1.00	(0.99,1.01)	0.87

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of “Teamwork across hospital units” on rates over time, model 10 tested the effect of “Hospital handoffs & transitions” on rates over time, model 11 tested the effect of “Frequency of event reporting” on rates over time, and model 12 tested the effect of “Overall perceptions of safety” on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 2. CLABSI HSOPS Models, ICUs over time (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	1.08	(1.01, 1.16)	0.004
Teaching Hospital	0.92	(0.66,1.28)	0.50
Rural Hospital	1.01	(0.65,1.58)	0.94
<i>Critical Access Hospital</i>	1.53	(0.19,11.74)	0.59
<i>Days</i>	0.66	(0.41,1.07)	0.03
<i>Patient safety grade</i>	1.00	(0.99,1.00)	0.29
<i>Patient safety grade x Days</i>	1.00	(0.99, 1.01)	0.95

All models controlled for hospital bed size, teaching status, critical access status (except where noted as n/a) and rurality. Model 13 tested the effect of "Patient safety grade" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=304 units from 233 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 3. CLABSI HSOPS Models, non-ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.91	(0.62,1.35)	0.56	0.92	(0.62,1.37)	0.60	0.92	(0.62,1.38)	0.61	0.93	(0.61,1.39)	0.63
Teaching Hospital	1.28	(0.24,6.91)	0.71	1.29	(0.22,7.54)	0.72	1.34	(0.21,8.46)	0.69	1.35	(0.19,9.83)	0.70
Rural Hospital	0.89	(0.19,4.18)	0.85	0.92	(0.18,4.79)	0.89	1.00	(0.20,5.11)	1.00	1.03	(0.20,5.13)	0.97
Critical Access Hospital	1.76	(0.20,15.9)	0.51	1.83	(0.18,18.54)	0.50	1.63	(0.17,15.9)	0.58	1.60	(0.17,15.58)	0.59
<i>Feedback and communication about error</i>	1.02	(0.98,1.05)	0.28									
<i>Nonpunitive response to error</i>				1.01	(0.96,1.06)	0.59						
<i>Staffing</i>							1.00	(0.96,1.04)	0.80			
<i>Management support for patient safety</i>										1.00	(0.96,1.04)	0.89

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of "Supervisor expectations & actions promoting safety" on baseline rates, model 2 tested the effect of "Organizational learning - continuous improvement" on baseline rates, model 3 tested the effect of "Teamwork within hospital units" on baseline rates, and model 4 tested the effect of "Communication openness" on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 3. CLABSI HSOPS Models, non-ICUs at Baseline (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p									
Hospital Beds (100s)	0.90	(0.63,1.29)	0.46	0.92	(0.65,1.31)	0.55	0.92	(0.61,1.39)	0.62	0.93	(0.64,1.37)	0.63
Teaching Hospital	1.55	(0.25,9.57)	0.54	1.06	(0.21,5.24)	0.93	1.40	(0.23,8.55)	0.63	1.23	(0.23,6.46)	0.75
Rural Hospital	0.88	(0.23,3.42)	0.81	0.62	(0.17,2.32)	0.35	1.03	(0.19,5.56)	0.97	0.77	(0.16,3.66)	0.66
Critical Access Hospital	1.67	(0.19,14.78)	0.54	2.37	(0.31,18.21)	0.27	1.59	(0.17,15.18)	0.60	1.84	(0.21,16.01)	0.47
<i>Feedback and communication about error</i>	0.99	(0.95,1.03)	0.44									
<i>Nonpunitive response to error</i>				1.03	(0.99,1.07)	0.04						
<i>Staffing</i>							1.00	(0.96,1.04)	0.94			
<i>Management support for patient safety</i>										1.02	(0.98,1.06)	0.15

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of "Feedback and communication about error" on baseline rates, model 6 tested the effect of "Nonpunitive response to error" on baseline rates, model 7 tested the effect of "Staffing" on baseline rates, and model 8 tested the effect of "Management support for patient safety" on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 3. CLABSI HSOPS Models, non-ICUs at Baseline (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.92	(0.62,1.37)	0.61	0.95	(0.64,1.39)	0.71	0.93	(0.62,1.38)	0.62	0.92	(0.62,1.38)	0.61
Teaching Hospital	1.41	(0.26,7.75)	0.61	1.26	(0.24,6.62)	0.73	1.36	(0.24,7.64)	0.65	1.39	(0.23,8.25)	0.63
Rural Hospital	1.04	(0.22,4.85)	0.95	0.96	(0.21,4.36)	0.94	0.99	(0.20,4.8)	0.98	1.01	(0.18,5.57)	0.99
Critical Access Hospital	1.57	(0.17,14.53)	0.61	1.55	(0.17,14.06)	0.61	1.71	(0.18,16.72)	0.54	1.60	(0.17,15.37)	0.59
<i>Teamwork across hospital units</i>	1.01	(0.97,1.05)	0.69									
<i>Hospital handoffs & transitions</i>				1.02	(0.97,1.07)	0.26						
<i>Frequency of event reporting</i>							1.01	(0.97,1.05)	0.64			
<i>Overall perceptions of safety</i>										1.00	(0.97,1.04)	0.89

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of “Teamwork across hospital units” on baseline rates, model 10 tested the effect of “Hospital handoffs & transitions” on baseline rates, model 11 tested the effect of “Frequency of event reporting” on baseline rates, and model 12 tested the effect of “Overall perceptions of safety” on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 3. CLABSI HSOPS Models, non-ICUs at Baseline (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	0.81	(0.61, 1.06)	0.05
Teaching Hospital	4.28	(1.26,14.51)	0.002
Rural Hospital	1.05	(0.24,4.64)	0.93
Critical Access Hospital	n/a	n/a	n/a
<i>Patient safety grade</i>	1.01	(0.99,1.03)	0.24

All models controlled for hospital bed size, teaching status, critical access status (except where noted as n/a) and rurality. Model 13 tested the effect of “Patient safety grade” on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 4. CLABSI HSOPS Models, non-ICUs over time

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	0.97	(0.82,1.15)	0.65	0.97	(0.82,1.16)	0.67	0.97	(0.82,1.15)	0.63	0.97	(0.81,1.15)	0.63
Teaching Hospital	1.63	(0.71,3.75)	0.13	1.71	(0.72,4.04)	0.11	1.68	(0.71,4.01)	0.12	1.67	(0.68,4.07)	0.14
Rural Hospital	0.65	(0.25,1.69)	0.25	0.69	(0.26,1.86)	0.34	0.69	(0.26,1.82)	0.33	0.70	(0.26,1.84)	0.34
Critical Access Hospital	2.05	(0.61,6.91)	0.13	1.90	(0.54,6.63)	0.19	1.94	(0.57,6.62)	0.17	1.87	(0.55,6.38)	0.19
Days	0.89	(0.10,7.79)	0.89	0.57	(0.05,6.89)	0.56	0.33	(0.05,2.34)	0.15	0.44	(0.09,2.10)	0.18
<i>Supervisor expectations & actions promoting safety</i>	1.01	(0.99,1.03)	0.24									
<i>Supervisor expectations & actions promoting safety x Days</i>	1.00	(0.97,1.03)	0.81									
<i>Organizational learning - continuous improvement</i>				1.00	(0.98,1.03)	0.75						
<i>Organizational learning - continuous improvement x Days</i>				1.00	(0.97,1.04)	0.77						
<i>Teamwork within hospital units</i>							1.00	(0.98,1.02)	0.80			
<i>Teamwork within hospital units x Days</i>							1.01	(0.99,1.04)	0.27			
<i>Communication openness</i>										1.00	(0.98,1.02)	0.68
<i>Communication openness x Days</i>										1.01	(0.98,1.04)	0.37

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of “Supervisor expectations and actions promoting safety” on rates over time, model 2 tested the effect of “Organizational learning – continuous improvement” on rates over time, model 3 tested the effect of “Teamwork within hospital units” on rates over time, and model 4 tested the effect of “Communication openness” on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 4. CLABSI HSOPS Models, non-ICUs over time (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p									
Hospital Beds (100s)	0.97	(0.82,1.16)	0.69	0.97	(0.83,1.15)	0.67	0.98	(0.82,1.16)	0.72	0.97	(0.82,1.15)	0.64
Teaching Hospital	1.83	(0.75,4.49)	0.08	1.62	(0.73,3.62)	0.12	1.68	(0.71,3.98)	0.12	1.66	(0.72,3.83)	0.12
Rural Hospital	0.73	(0.27,1.94)	0.41	0.61	(0.24,1.57)	0.18	0.65	(0.24,1.80)	0.28	0.63	(0.24,1.65)	0.22
Critical Access Hospital	1.78	(0.51,6.28)	0.24	2.06	(0.63,6.78)	0.12	1.92	(0.56,6.54)	0.17	1.97	(0.59,6.61)	0.15
Days	0.31	(0.06,1.47)	0.05	1.47	(0.42,5.15)	0.43	0.73	(0.16,3.28)	0.58	1.38	(0.27,7.17)	0.62
<i>Feedback and communication about error</i>	0.99	(0.97,1.02)	0.50									
<i>Feedback and communication about error x Days</i>	1.01	(0.99,1.04)	0.13									
<i>Nonpunitive response to error</i>				1.02	(1.00,1.04)	0.03						
<i>Nonpunitive response to error x Days</i>				0.98	(0.96,1.01)	0.12						
<i>Staffing</i>							1.00	(0.98,1.03)	0.57			
<i>Staffing x Days</i>							1.00	(0.97,1.03)	0.94			
<i>Management support for patient safety</i>										1.01	(0.99,1.03)	0.25
<i>Management support for patient safety x Days</i>										0.99	(0.97,1.02)	0.34

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of "Feedback and communication about error" on rates over time, model 6 tested the effect of "Nonpunitive response to error" on rates over time, model 7 tested the effect of "Staffing" on rates over time, and model 8 tested the effect of "Management support for patient safety" on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 4. CLABSI HSOPS Models, non-ICUs over time (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.97	(0.82,1.15)	0.64	0.97	(0.83,1.14)	0.66	0.97	(0.82,1.16)	0.69	0.97	(0.82,1.15)	0.63
Teaching Hospital	1.74	(0.76,4.01)	0.09	1.70	(0.76,3.77)	0.09	1.70	(0.71,4.08)	0.12	1.66	(0.72,3.83)	0.12
Rural Hospital	0.71	(0.28,1.85)	0.36	0.66	(0.26,1.67)	0.25	0.68	(0.26,1.79)	0.30	0.64	(0.24,1.73)	0.25
Critical Access Hospital	1.80	(0.54,6.04)	0.21	1.75	(0.53,5.80)	0.23	1.91	(0.55,6.59)	0.18	1.97	(0.59,6.58)	0.15
Days	1.04	(0.17,6.26)	0.96	0.90	(0.21,3.91)	0.85	1.05	(0.22,5.04)	0.93	0.65	(0.16,2.60)	0.42
<i>Teamwork across hospital units</i>	1.01	(0.99,1.04)	0.15									
<i>Teamwork across hospital units x Days</i>	0.99	(0.96,1.03)	0.66									
<i>Hospital handoffs & transitions</i>				1.01	(0.99,1.04)	0.15						
<i>Hospital handoffs & transitions x Days</i>				1.00	(0.96,1.03)	0.75						
<i>Frequency of event reporting</i>							1.00	(0.98,1.03)	0.65			
<i>Frequency of event reporting x Days</i>							0.99	(0.97,1.02)	0.59			
<i>Overall perceptions of safety</i>										1.01	(0.99,1.03)	0.47
<i>Overall perceptions of safety x Days</i>										1.00	(0.98,1.03)	0.74

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of "Teamwork across hospital units" on rates over time, model 10 tested the effect of "Hospital handoffs & transitions" on rates over time, model 11 tested the effect of "Frequency of event reporting" on rates over time, and model 12 tested the effect of "Overall perceptions of safety" on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 4. CLABSI HSOPS Models, non-ICUs over time (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	0.96	(0.80,1.14)	0.51
Teaching Hospital	1.85	(0.77,4.44)	0.07
Rural Hospital	0.89	(0.38,2.05)	0.71
Critical Access Hospital	n/a	n/a	n/a
Days	0.77	(0.21,2.81)	0.60
<i>Patient safety grade</i>	1.00	(0.99,1.02)	0.90
<i>Patient safety grade x Days</i>	1.00	(0.98, 1.02)	0.99

All models controlled for hospital bed size, teaching status, critical access status (except where noted as n/a) and rurality. Model 13 tested the effect of "Patient safety grade" on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=58 units from 43 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 5. CAUTI HSOPS Models, ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.17	(1.04,1.31)	0.001	1.17	(1.04,1.31)	0.001	1.17	(1.04,1.32)	<0.001	1.17	(1.04,1.31)	0.001
Teaching Hospital	1.96	(0.99,3.87)	0.01	1.90	(0.97,3.72)	0.01	1.87	(0.95,3.67)	0.02	1.92	(0.98,3.74)	0.01
Rural Hospital	0.47	(0.17,1.32)	0.06	0.48	(0.17,1.35)	0.07	0.51	(0.18,1.4)	0.08	0.47	(0.17,1.31)	0.06
Critical Access Hospital	9.13	(0.54,153.85)	0.04	9.27	(0.55,156.76)	0.04	9.88	(0.59,164.8)	0.04	8.56	(0.5,145.14)	0.05
<i>Supervisor expectations & actions promoting safety</i>	1.01	(0.99,1.03)	0.20									
<i>Organizational learning - continuous improvement</i>				1.01	(0.99,1.03)	0.46						
<i>Teamwork within hospital units</i>							1.00	(0.97,1.03)	0.90			
<i>Communication openness</i>										1.01	(0.99,1.02)	0.13

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of "Supervisor expectations & actions promoting safety" on baseline rates, model 2 tested the effect of "Organizational learning - continuous improvement" on baseline rates, model 3 tested the effect of "Teamwork within hospital units" on baseline rates, and model 4 tested the effect of "Communication openness" on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 5. CAUTI HSOPS Models, ICUs at Baseline (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.17	(1.04,1.31)	0.001	1.18	(1.07,1.29)	<0.001	1.18	(1.05,1.32)	<0.001	1.17	(1.04,1.32)	<0.001
Teaching Hospital	1.95	(1.00,3.83)	0.01	2.13	(1.20,3.77)	0.001	1.91	(0.98,3.72)	0.01	1.89	(0.96,3.70)	0.02
Rural Hospital	0.48	(0.17,1.32)	0.06	0.47	(0.17,1.32)	0.06	0.49	(0.18,1.36)	0.07	0.50	(0.18,1.38)	0.08
Critical Access Hospital	9.65	(0.58,160.44)	0.04	9.49	(0.59,151.91)	0.04	9.28	(0.55,156.40)	0.04	9.49	(0.56,159.84)	0.04
<i>Feedback and communication about error</i>	1.01	(0.99,1.02)	0.23									
<i>Nonpunitive response to error</i>				1.01	(0.99,1.02)	0.19						
<i>Staffing</i>							1.00	(0.99,1.02)	0.50			
<i>Management support for patient safety</i>										1.00	(0.99,1.02)	0.65

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of "Feedback and communication about error" on baseline rates, model 6 tested the effect of "Nonpunitive response to error" on baseline rates, model 7 tested the effect of "Staffing" on baseline rates, and model 8 tested the effect of "Management support for patient safety" on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 5. CAUTI HSOPS Models, ICUs at Baseline (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.17	(1.04,1.32)	<0.001	1.17	(1.04,1.32)	<0.001	1.17	(1.04,1.32)	0.001	1.16	(1.03,1.31)	0.001
Teaching Hospital	2.00	(1.01,3.98)	0.01	1.85	(0.95,3.60)	0.02	1.91	(0.98,3.73)	0.01	1.98	(1,3.93)	0.01
Rural Hospital	0.48	(0.17,1.33)	0.06	0.51	(0.19,1.42)	0.09	0.47	(0.17,1.30)	0.06	0.46	(0.16,1.3)	0.05
Critical Access Hospital	8.46	(0.5,143.81)	0.05	10.08	(0.6,170.35)	0.04	8.36	(0.49,142.70)	0.05	8.21	(0.48,141.77)	0.06
<i>Teamwork across hospital units</i>	1.01	(0.99,1.03)	0.24									
<i>Hospital handoffs & transitions</i>				1.00	(0.98,1.02)	0.87						
<i>Frequency of event reporting</i>							1.01	(0.99,1.03)	0.21			
<i>Overall perceptions of safety</i>										1.01	(0.99,1.02)	0.20

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of “Teamwork across hospital units” on baseline rates, model 10 tested the effect of “Hospital handoffs & transitions” on baseline rates, model 11 tested the effect of “Frequency of event reporting” on baseline rates, and model 12 tested the effect of “Overall perceptions of safety” on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 5. CAUTI HSOPS Models, ICUs at Baseline (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	1.17	(1.04,1.32)	0.001
Teaching Hospital	1.91	(0.96,3.80)	0.02
Rural Hospital	0.45	(0.15,1.33)	0.06
Critical Access Hospital	n/a	n/a	n/a
<i>Patient safety grade</i>	1.00	(0.99, 1.02)	0.37

All models controlled for hospital bed size, teaching status, critical access status (except where noted n/a) and rurality. Model 13 tested the effect of “Patient safety grade” on baseline rates. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 6. CAUTI HSOPS Models, ICUs over time

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001
Teaching Hospital	1.57	(0.87,2.83)	0.05	1.58	(0.88,2.85)	0.04	1.59	(0.88,2.89)	0.05	1.60	(0.89,2.88)	0.04
Rural Hospital	0.86	(0.47,1.59)	0.53	0.85	(0.46,1.58)	0.51	0.86	(0.47,1.59)	0.53	0.84	(0.45,1.55)	0.46
Critical Access Hospital	1.84	(0.11,30.48)	0.57	1.82	(0.11,30.09)	0.58	1.91	(0.12,31.5)	0.55	1.72	(0.10,28.8)	0.62
Days	2.48	(0.44,14.05)	0.18	1.67	(0.31,8.91)	0.43	0.21	(0.01,5.75)	0.23	1.29	(0.36,4.55)	0.61
<i>Supervisor expectations & actions promoting safety</i>	1.00	(0.99,1.02)										
<i>Supervisor expectations & actions promoting safety x Days</i>	0.99	(0.97,1.01)										
<i>Organizational learning - continuous improvement</i>			0.53	1.00	(0.99,1.02)							
<i>Organizational learning - continuous improvement x Days</i>			0.18	0.99	(0.97,1.02)							
<i>Teamwork within hospital units</i>						0.61	1.00	(0.97,1.02)				
<i>Teamwork within hospital units x Days</i>						0.44	1.02	(0.98,1.06)				
<i>Communication openness</i>									0.74	1.01	(0.99,1.02)	0.26
<i>Communication openness x Days</i>									0.22	1.00	(0.98,1.02)	0.62

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of “Supervisor expectations and actions promoting safety” on rates over time, model 2 tested the effect of “Organizational learning – continuous improvement” on rates over time, model 3 tested the effect of “Teamwork within hospital units” on rates over time, and model 4 tested the effect of “Communication openness” on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 6. CAUTI HSOPS Models, ICUs over time (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.16	(1.04,1.29)	<0.001	1.16	(1.05,1.29)	<0.001	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001
Teaching Hospital	1.60	(0.89,2.88)	0.04	1.60	(0.89,2.88)	0.04	1.58	(0.88,2.84)	0.05	1.58	(0.88,2.84)	0.04
Rural Hospital	0.85	(0.46,1.57)	0.49	0.84	(0.46,1.56)	0.48	0.87	(0.47,1.60)	0.55	0.86	(0.47,1.59)	0.54
Critical Access Hospital	1.82	(0.11,30.00)	0.58	1.79	(0.11,29.53)	0.59	1.85	(0.11,30.73)	0.57	1.85	(0.11,30.71)	0.57
Days	1.38	(0.43,4.42)	0.48	1.03	(0.46,2.30)	0.92	1.30	(0.43,4.00)	0.54	1.33	(0.45,3.95)	0.50
<i>Feedback and communication about error</i>	1.00	(0.99,1.01)	0.42									
<i>Feedback and communication about error x Days</i>	1.00	(0.98,1.01)	0.49									
<i>Nonpunitive response to error</i>				1.00	(0.99,1.02)	0.60						
<i>Nonpunitive response to error x Days</i>				1.00	(0.98,1.02)	0.95						
<i>Staffing</i>							1.00	(0.99,1.01)	0.78			
<i>Staffing x Days</i>							1.00	(0.98,1.02)	0.56			
<i>Management support for patient safety</i>										1.00	(0.99,1.01)	0.77
<i>Management support for patient safety x Days</i>										1.00	(0.98,1.01)	0.51

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of "Feedback and communication about error" on rates over time, model 6 tested the effect of "Nonpunitive response to error" on rates over time, model 7 tested the effect of "Staffing" on rates over time, and model 8 tested the effect of "Management support for patient safety" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 6. CAUTI HSOPS Models, ICUs over time (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001	1.16	(1.04,1.29)	<0.001
Teaching Hospital	1.63	(0.90,2.94)	0.04	1.59	(0.88,2.86)	0.04	1.60	(0.88,2.90)	0.04	1.61	(0.89,2.91)	0.04
Rural Hospital	0.84	(0.46,1.56)	0.48	0.86	(0.46,1.59)	0.52	0.82	(0.44,1.53)	0.42	0.84	(0.45,1.56)	0.47
Critical Access Hospital	1.75	(0.11,29.1)	0.61	1.79	(0.11,29.85)	0.59	1.67	(0.10,28.18)	0.64	1.75	(0.10,29.36)	0.61
Days	1.55	(0.49,4.93)	0.33	0.82	(0.30,2.30)	0.63	1.36	(0.48,3.88)	0.45	1.42	(0.46,4.35)	0.42
<i>Teamwork across hospital units</i>	1.01	(0.99,1.02)	0.34									
<i>Teamwork across hospital units x Days</i>	0.99	(0.97,1.01)	0.33									
<i>Hospital handoffs & transitions</i>				1.00	(0.99,1.01)	0.99						
<i>Hospital handoffs & transitions x Days</i>				1.00	(0.98,1.03)	0.58						
<i>Frequency of event reporting</i>							1.01	(0.99,1.02)	0.22			
<i>Frequency of event reporting x Days</i>							0.99	(0.98,1.01)	0.46			
<i>Overall perceptions of safety</i>										1.00	(0.99,1.02)	0.43
<i>Overall perceptions of safety x Days</i>										0.99	(0.98,1.01)	0.44

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of "Teamwork across hospital units" on rates over time, model 10 tested the effect of "Hospital handoffs & transitions" on rates over time, model 11 tested the effect of "Frequency of event reporting" on rates over time, and model 12 tested the effect of "Overall perceptions of safety" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR < 1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 6. CAUTI HSOPS Models, ICUs over time (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	1.16	(1.05,1.29)	<0.001
Teaching Hospital	1.58	(0.89,2.81)	0.04
Rural Hospital	0.78	(0.41,1.46)	0.30
Critical Access Hospital	n/a	n/a	n/a
Days	1.06	(0.36,3.13)	0.90
<i>Patient safety grade</i>	1.00	(0.99,1.01)	0.71
<i>Patient safety grade x Days</i>	1.00	(0.98, 1.01)	0.91

All models controlled for hospital bed size, teaching status, critical access status (except where noted n/a) and rurality. Model 13 tested the effect of "Patient safety grade" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=164 units from 141 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 7. CAUTI HSOPS Models, non-ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	0.94	(0.78,1.13)	0.37	0.94	(0.79,1.13)	0.42	0.93	(0.78,1.12)	0.34	0.94	(0.78,1.13)	0.37
Teaching Hospital	1.32	(0.38,4.51)	0.57	1.29	(0.38,4.45)	0.59	1.39	(0.4,4.79)	0.49	1.36	(0.4,4.64)	0.52
Rural Hospital	0.84	(0.42,1.67)	0.51	0.81	(0.4,1.64)	0.44	0.85	(0.42,1.7)	0.54	0.83	(0.42,1.67)	0.50
Critical Access Hospital	2.34	(1.06,5.13)	0.01	2.36	(1.07,5.19)	0.01	2.29	(1.04,5.04)	0.01	2.35	(1.07,5.18)	0.01
<i>Supervisor expectations & actions promoting safety</i>	0.99	(0.97,1.01)	0.31									
<i>Organizational learning - continuous improvement</i>				0.99	(0.97,1.01)	0.25						
<i>Teamwork within hospital units</i>							1.00	(0.98,1.02)	0.94			
<i>Communication openness</i>										0.99	(0.98,1.01)	0.47

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of “Teamwork within hospital units” on baseline rates, model 2 tested the effect of “Staffing” on baseline rates, model 3 tested the effect of “Teamwork across hospital units” on baseline rates, and model 4 tested the effect of “Hospital handoffs and transitions” on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 7. CAUTI HSOPS Models, non-ICUs at Baseline (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p									
Hospital Beds (100s)	0.94	(0.79,1.13)	0.42	0.94	(0.78,1.12)	0.35	0.93	(0.78,1.12)	0.34	0.94	(0.78,1.13)	0.36
Teaching Hospital	1.36	(0.40,4.67)	0.52	1.39	(0.41,4.75)	0.49	1.32	(0.38,4.56)	0.56	1.34	(0.39,4.62)	0.55
Rural Hospital	0.84	(0.42,1.67)	0.50	0.85	(0.42,1.70)	0.54	0.85	(0.42,1.70)	0.54	0.83	(0.41,1.67)	0.49
Critical Access Hospital	2.32	(1.06,5.09)	0.01	2.28	(1.03,5.06)	0.01	2.47	(1.08,5.67)	0.01	2.37	(1.07,5.27)	0.01
<i>Feedback and communication about error</i>	0.99	(0.98,1.01)	0.28									
<i>Nonpunitive response to error</i>				1.00	(0.98,1.02)	0.92						
<i>Staffing</i>							0.99	(0.98,1.01)	0.45			
<i>Management support for patient safety</i>										1.00	(0.98,1.01)	0.50

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of “Feedback and communication about error” on baseline rates, model 6 tested the effect of “Nonpunitive response to error” on baseline rates, model 7 tested the effect of “Staffing” on baseline rates, and model 8 tested the effect of “Management support for patient safety” on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 7. CAUTI HSOPS Models, non-ICUs at Baseline (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.94	(0.78,1.12)	0.35	0.94	(0.78,1.12)	0.35	0.93	(0.78,1.12)	0.33	0.94	(0.78,1.13)	0.37
Teaching Hospital	1.40	(0.41,4.81)	0.49	1.35	(0.39,4.64)	0.54	1.44	(0.41,4.99)	0.45	1.34	(0.39,4.62)	0.55
Rural Hospital	0.85	(0.42,1.71)	0.55	0.85	(0.42,1.70)	0.54	0.85	(0.43,1.70)	0.55	0.84	(0.42,1.68)	0.51
Critical Access Hospital	2.27	(1.00,5.12)	0.01	2.46	(1.08,5.60)	0.01	2.26	(1.03,4.98)	0.01	2.42	(1.07,5.45)	0.01
<i>Teamwork across hospital units</i>	1.00	(0.98,1.02)	0.90									
<i>Hospital handoffs & transitions</i>				1.00	(0.98,1.01)	0.46						
<i>Frequency of event reporting</i>							1.00	(0.99,1.02)	0.63			
<i>Overall perceptions of safety</i>										1.00	(0.98,1.01)	0.50

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of “Teamwork across hospital units” on baseline rates, model 10 tested the effect of “Hospital handoffs & transitions” on baseline rates, model 11 tested the effect of “Frequency of event reporting” on baseline rates, and model 12 tested the effect of “Overall perceptions of safety” on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 7. CAUTI HSOPS Models, non-ICUs at Baseline (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	0.93	(0.78,1.11)	0.31
Teaching Hospital	1.24	(0.36,4.27)	0.65
Rural Hospital	0.77	(0.38,1.57)	0.35
Critical Access Hospital	2.80	(1.23,6.39)	0.001
<i>Patient safety grade</i>	0.99	(0.98,1.00)	0.07

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 13 tested the effect of “Patient safety grade” on baseline rates. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 8. CAUTI HSOPS Models, non-ICUs over time

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	0.99	(0.86,1.14)	0.87	1.00	(0.87,1.14)	0.94	0.99	(0.86,1.13)	0.87	0.99	(0.86,1.14)	0.85
Teaching Hospital	1.52	(0.59,3.93)	0.26	1.49	(0.57,3.87)	0.28	1.57	(0.61,4.06)	0.26	1.55	(0.60,4.02)	0.24
Rural Hospital	0.76	(0.44,1.30)	0.19	0.74	(0.43,1.27)	0.15	0.77	(0.45,1.33)	0.19	0.76	(0.44,1.31)	0.19
Critical Access Hospital	2.93	(1.59,5.38)	<0.001	2.96	(1.61,5.46)	<0.001	2.87	(1.56,5.28)	<0.001	2.93	(1.59,5.41)	<0.001
Days	0.24	(0.03,2.11)	0.09	0.18	(0.02,1.83)	0.06	0.10	(0.01,1.26)	0.09	0.19	(0.04,0.93)	0.01
<i>Supervisor expectations & actions promoting safety</i>	0.99	(0.98,1.01)	0.26									
<i>Supervisor expectations & actions promoting safety x Days</i>	1.01	(0.99,1.04)	0.24									
<i>Organizational learning - continuous improvement</i>				0.99	(0.97,1.01)	0.10						
<i>Organizational learning - continuous improvement x Days</i>				1.02	(0.99,1.05)	0.16						
<i>Teamwork within hospital units</i>							1.00	(0.98,1.01)	0.26			
<i>Teamwork within hospital units x Days</i>							1.02	(0.99,1.05)	0.24			
<i>Communication openness</i>										0.99	(0.98,1.01)	0.30
<i>Communication openness x Days</i>										1.02	(0.99,1.05)	0.04

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of “Supervisor expectations and actions promoting safety” on rates over time, model 2 tested the effect of “Organizational learning – continuous improvement” on rates over time, model 3 tested the effect of “Teamwork within hospital units” on rates over time, and model 4 tested the effect of “Communication openness” on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs= non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 8. CAUTI HSOPS Models, non-ICUs over time (continued)

VARIABLES	Model 5			Model 6			Model 7			Model 8		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.00	(0.87,1.15)	0.97	0.99	(0.86,1.14)	0.86	0.99	(0.86,1.14)	0.87	0.99	(0.86,1.14)	0.88
Teaching Hospital	1.54	(0.60,3.98)	0.24	1.55	(0.60,4.02)	0.23	1.55	(0.60,4.03)	0.23	1.52	(0.58,3.95)	0.26
Rural Hospital	0.74	(0.43,1.28)	0.16	0.77	(0.45,1.32)	0.21	0.77	(0.45,1.32)	0.21	0.75	(0.44,1.30)	0.18
Critical Access Hospital	2.94	(1.60,5.38)	<0.001	2.89	(1.56,5.34)	<0.001	2.86	(1.51,5.40)	<0.001	2.98	(1.61,5.54)	<0.001
Days	0.57	(0.13,2.53)	0.33	0.38	(0.13,1.15)	0.02	0.32	(0.08,1.29)	0.04	0.32	(0.06,1.75)	0.09
<i>Feedback and communication about error</i>	0.99	(0.98,1.00)	0.06									
<i>Feedback and communication about error x Days</i>	1.00	(0.98,1.03)	0.85									
<i>Nonpunitive response to error</i>				1.00	(0.98,1.01)	0.69						
<i>Nonpunitive response to error x Days</i>				1.01	(0.99,1.04)	0.21						
<i>Staffing</i>							1.00	(0.98,1.01)	0.74			
<i>Staffing x Days</i>							1.01	(0.99,1.04)	0.20			
<i>Management support for patient safety</i>										0.99	(0.98,1.01)	0.29
<i>Management support for patient safety x Days</i>										1.01	(0.99,1.03)	0.30

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 5 tested the effect of “Feedback and communication about error” on rates over time, model 6 tested the effect of “Nonpunitive response to error” on rates over time, model 7 tested the effect of “Staffing” on rates over time, and model 8 tested the effect of “Management support for patient safety” on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs= non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 8. CAUTI HSOPS Models, non-ICUs over time (continued)

VARIABLES	Model 9			Model 10			Model 11			Model 12		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.99	(0.87,1.14)	0.89	0.99	(0.86,1.14)	0.87	0.99	(0.87,1.14)	0.90	0.99	(0.86,1.14)	0.86
Teaching Hospital	1.57	(0.61,4.05)	0.22	1.56	(0.60,4.03)	0.23	1.53	(0.59,3.97)	0.25	1.54	(0.59,4.01)	0.24
Rural Hospital	0.78	(0.45,1.33)	0.23	0.77	(0.45,1.32)	0.21	0.76	(0.45,1.30)	0.19	0.76	(0.44,1.31)	0.20
Critical Access Hospital	2.83	(1.52,5.27)	<0.001	2.85	(1.52,5.33)	<0.001	2.92	(1.59,5.35)	<0.001	2.95	(1.58,5.51)	<0.001
Days	0.46	(0.10,2.09)	0.19	0.44	(0.13,1.45)	0.08	1.87	(0.36,9.62)	0.32	0.48	(0.11,2.20)	0.22
<i>Teamwork across hospital units</i>	1.00	(0.99,1.02)	0.84									
<i>Teamwork across hospital units x Days</i>	1.01	(0.98,1.03)	0.58									
<i>Hospital handoffs & transitions</i>				1.00	(0.99,1.01)	0.96						
<i>Hospital handoffs & transitions x Days</i>				1.01	(0.98,1.03)	0.41						
<i>Frequency of event reporting</i>							1.00	(0.99,1.02)	0.77			
<i>Frequency of event reporting x Days</i>							0.98	(0.96,1.01)	0.08			
<i>Overall perceptions of safety</i>										1.00	(0.98,1.01)	0.64
<i>Overall perceptions of safety x Days</i>										1.00	(0.98,1.03)	0.65

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 9 tested the effect of "Teamwork across hospital units" on rates over time, model 10 tested the effect of "Hospital handoffs & transitions" on rates over time, model 11 tested the effect of "Frequency of event reporting" on rates over time, and model 12 tested the effect of "Overall perceptions of safety" on rates over time. HSOPS=Hospital Survey on Patient Safety; ICUs= intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 1 Table 8. CAUTI HSOPS Models, non-ICUs over time (continued)

VARIABLES	Model 13		
	IRR*	99% CI	p
Hospital Beds (100s)	1.00	(0.87, 1.14)	0.94
Teaching Hospital	1.48	(0.56,3.88)	0.30
Rural Hospital	0.73	(0.40,1.27)	0.14
Critical Access Hospital	3.12	(1.66,5.86)	<0.001
Days	0.40	(0.12,1.32)	0.05
<i>Patient safety grade</i>	1.00	(0.99,1.01)	0.29
<i>Patient safety grade x Days</i>	1.01	(0.99,1.02)	0.29

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 13 tested the effect of "Patient safety grade" on rates over time. HSOPS=Hospital Survey on Patient Safety; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=276 units from 214 hospitals. *The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2

Appendix 2 Text 1

SUPPLEMENTARY ANALYSES PROVIDED INVOLVING THE READINESS ASSESSMENT

Similar to the analyses performed in the manuscript involving HSOPS measures, we performed additional analyses involving the Readiness Assessment tool, to test the association between results of the Readiness Assessment tool collected as baseline information before implementation of the intervention and hospital units' CLABSI and CAUTI outcomes at baseline and assessed in follow-up over time.

METHODS

Design and Intervention

We performed a secondary analysis of a subset the healthcare worker survey called the Readiness Assessment and patient outcome data collected in the AHRQ CLABSI and CAUTI collaboratives.

Study Participants and Data Sources

Analyses included data from participating adult, acute-care ICU and non-ICU units, including all six cohorts from the CLABSI collaborative with data collected from 2008-2011, and cohorts 1-4 from the CAUTI collaborative with data collected from 2011-2013. CLABSI collaborative cohorts were 30 months in duration; CAUTI collaborative cohorts were 17

months in duration. CAUTI cohorts 5-6 were excluded because of additional interventions implemented in the Emergency Department (ED) and Intensive Care Unit (ICU) settings. To be included in the analyses the unit also had to have: 1) non-missing values for all individual HSOPS measures; 2) hospital characteristic data from American Hospital Association Annual Survey 2010 for CLABSI and 2011 for CAUTI (e.g., teaching status, bed size, rurality, and critical access); 3) at least one valid baseline and one valid post-baseline outcome reported.

Measures

Patient Outcome Measures

The conventional National Healthcare Safety Network (NHSN) infection rate of catheter-associated infections per 1000 catheter days was used for both collaborative projects. Unit-level aggregate infection rates were collected at baseline and monthly post-implementation for CLABSI. Unit-level aggregate infection rates were collected at baseline and quarterly post-implementation for CAUTI. Monthly CLABSI results were aggregated to quarterly numbers for our analyses.

Readiness Assessment

The Readiness Assessment is a 60-item survey performed only at baseline by the unit team leader, with the goal of determining the team's exposure to other interventions and their readiness to collect data using questions in the format of "To what degree has X been implemented?" For this analysis, *a priori* selection of Readiness Assessment measures included two safety activity items common to both the CLABSI and CAUTI collaboratives,

selected in consultation with content and coaching experts from the CLABSI and CAUTI collaboratives: partnership with a unit by a senior executive for patient safety and systematic analysis and proactive learning. Three CLABSI-specific technical strategies were also selected for analysis: stocked independent line cart/kit, inclusion of chlorhexidine in the central line kit, and central line insertion checklist. Four CAUTI-specific technical strategies were selected for analysis, including use of guidelines for appropriate catheter indications, proper catheter insertion technique, proper catheter maintenance technique, and multi-disciplinary urinary catheter “rounds.”

Statistical Analyses

Multilevel negative binomial models were used to adjust for clustering within hospitals and within units over time and also for over-dispersion of the outcome. Hospital characteristics of bed number, teaching status, critical access status, and rurality were adjusted for in the models. Separate models were used for ICUs and non-ICUs and culture items were tested individually because of higher catheter use rates in ICUs, and because the culture of ICUs was anticipated to differ than non-ICUs due to differences in team structure and rounding styles. Models with and without interaction with time were tested individually. Conservative significance testing criteria of $p < 0.01$ was chosen to account for the higher likelihood of random association due to multiple comparisons. Model results for the culture items of interest were depicted using coefficient plots, which plot the coefficient point estimate and the corresponding 99% confidence interval. Analyses were performed using Stata/MP13.1 (StataCorp, College Stations, Texas).

RESULTS

Participant Characteristics and Patient Outcome Measures: These are reported in the main manuscript text and **Table 1**.

Readiness Assessment Measures

The Readiness Assessment response rates were overall low, at 20% for the CLABSI collaborative and 43% for the CAUTI collaborative, calculated as the number of units with Readiness Assessment data divided by the total number of active units. Summary statistics for the Readiness Assessment measures are detailed in **Appendix 2 Table 1** and **Appendix 2 Table 2**. Overall, Readiness Assessment measures were reported at baseline as fully implemented at somewhat higher rates for the CLABSI collaborative (safety activities 47-55%, technical strategies 66-97%) compared to the CAUTI collaborative (safety activities 44-48%, technical strategies 40-79%).

Association between Readiness Assessment Measures and Patient Outcomes

Detailed model results for baseline and longitudinal outcomes for the CLABSI and CAUTI collaboratives are found in **Appendix 2 Text 2** and **Appendix 2 Tables 3-8**, with separate models for ICUs and non-ICUs. In a few cases, model results are not presented due to either lack of variation in the response for the survey item of interest, or too few units responding. Coefficient plots for the Readiness Assessment models for ICUs and non-ICUs are illustrated for CLABSI in **Appendix 2 Figure 1** and for CAUTI in **Appendix 2 Figure 2**. Based on the conservative significance testing criteria of $p < 0.01$, there were no

statistically significant associations found between any of the Readiness Assessment measures selected for testing and the catheter-associated infection outcomes.

Appendix 2 Table 1. CLABSI Readiness Questions and Frequency of Response for Analytic Sample

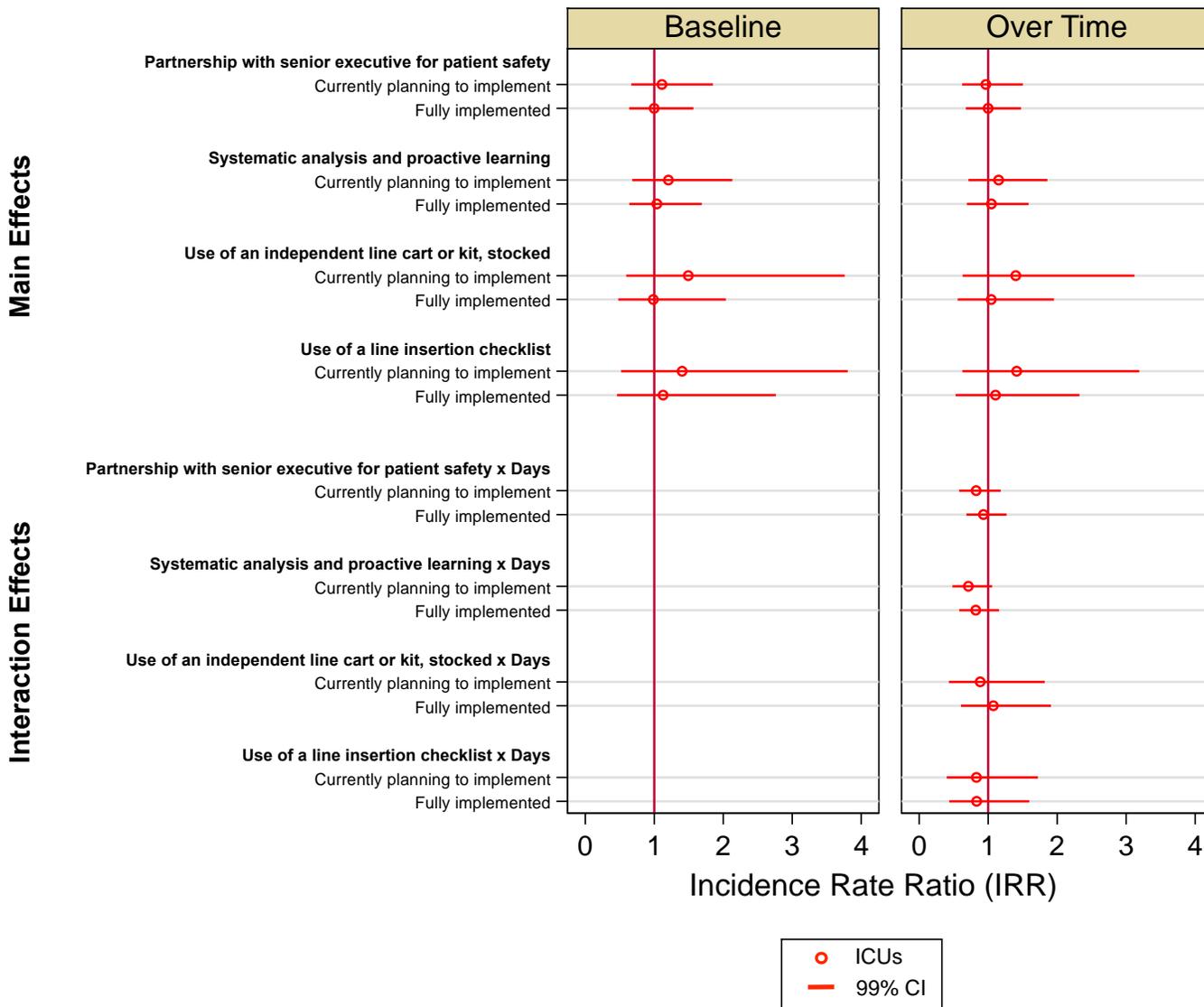
Question	ICU (N=258) N (%)	non-ICU (N=38) N (%)
<i>Safety Activities</i>		
Partnership with Senior Exec for patient safety		
Not Implemented	63 (24)	13 (34)
Currently planning to implement	66 (26)	7 (19)
Fully Implemented	129 (50)	18 (47)
Systematic analysis and proactive learning		
Not Implemented	49 (19)	10 (26)
Currently planning to implement	70 (27)	7 (19)
Fully Implemented	139 (54)	21 (55)
<i>Technical Strategies</i>		
Use of an independent line cart or kit, stocked		
Not Implemented	16 (6)	4 (11)
Currently planning to implement	24 (9)	2 (5)
Fully Implemented	218 (85)	32 (84)
Inclusion of chlorhexadine in central line kit		
Not Implemented	1 (<1)	0 (0)
Currently planning to implement	10 (4)	1 (3)
Fully Implemented	247 (96)	37 (97)
Use of a line insertion checklist		
Not Implemented	12 (5)	6 (16)
Currently planning to implement	32 (12)	7 (18)
Fully Implemented	214 (83)	25 (66)

Appendix 2 Table 2. CAUTI Readiness Questions and Frequency of Response for Analytic Sample

Question	ICU (N=176) N (%)	non-ICU (N=263) N (%)
<i>Safety Activities</i>		
Partnership with Senior Exec for patient safety		
Not Implemented	42 (24)	54 (20)
Currently planning to implement	53 (30)	96 (36)
Fully Implemented	81 (46)	116 (44)
Systematic analysis and proactive learning		
Not Implemented	47 (27)	69 (26)
Currently planning to implement	45 (25)	81 (30)
Fully Implemented	84 (48)	116 (44)
<i>Technical Strategies</i>		
Use of guidelines on appropriate indications for urinary catheter use		
Not Implemented	27 (15)	38 (14)
Currently planning to implement	55 (31)	87 (33)
Fully Implemented	94 (54)	141 (53)
Use of guidelines on proper techniques for urinary catheter insertion		
Not Implemented	11 (6)	11 (4)
Currently planning to implement	26 (15)	67 (25)
Fully Implemented	139 (79)	188 (71)
Use of guidelines on proper techniques for urinary catheter maintenance		
Not Implemented	10 (6)	16 (6)
Currently planning to implement	29 (16)	66 (25)
Fully Implemented	137 (78)	184 (69)
Unit use of multidisciplinary urinary catheter "rounds"		
Yes	70 (40)	196 (74)
No	106 (60)	70 (26)

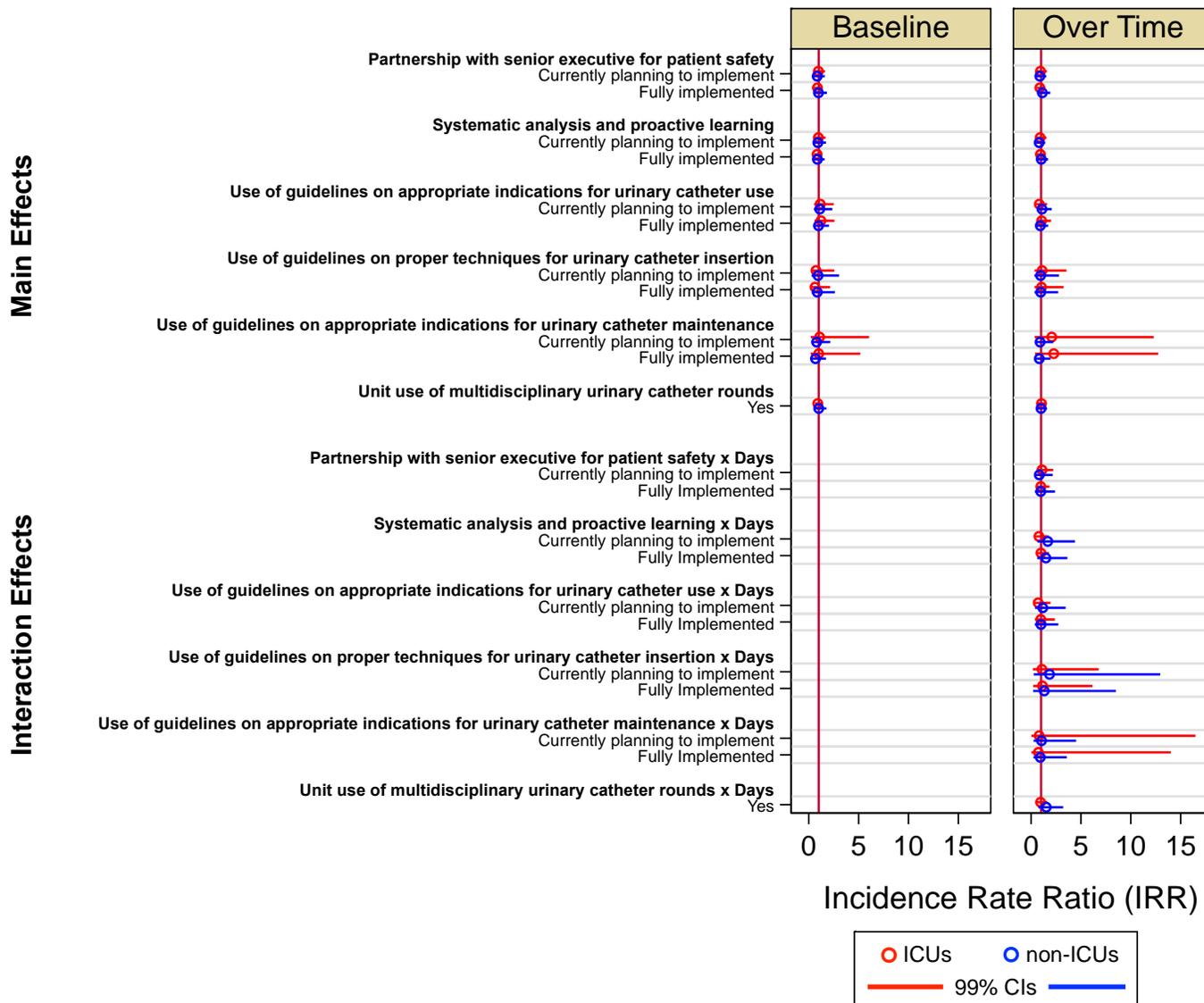
Incidence Rate Ratios (IRRs) and their 99% confidence intervals are given in the following coefficient plots for the Readiness Assessment and Team Check-up Tool (TCT) culture items. Confidence intervals that cross the vertical line at the value of 1 indicate non-significant findings. In addition to the culture predictors of interest shown below, models also adjusted for hospital characteristics including bed size, teaching and critical access hospital status and rurality. For detailed model results, see Supplement 2.

Appendix 2 Figure 1. CLABSI Coefficient Plots, Readiness models



Due to the lack of variation in the response to the item "Inclusion of chlorhexadine in central line kit", in the ICUs, this effect could not be modeled. Due to the small number of non-ICUs meeting inclusion criteria, Readiness culture effects could not be modeled.

Appendix 2 Figure 2. CAUTI Coefficient Plots, Readiness models



Appendix 2 Text 2. Model Details

The following tables give Readiness Assessment model results for ICUs and non-ICUs for both the CLABSI and CAUTI collaboratives. Columns labeled “IRR” contain the Incident Rate Ratio for the effect. The IRR is the multiplicative effect of the item of interest. An $IRR > 1$ indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an $IRR < 1$ is a negative association, meaning a higher score for the item results in a lower outcome rate. For simplicity we used a significance criteria of $\alpha < 0.01$, hence, 99% confidence intervals (CIs) are reported. Where the confidence interval includes 1, the findings are considered to be not significant at $p < 0.01$. The variable Days was coded as the proportion of time to collaborative completion so that the corresponding coefficient represents the IRR for the entire collaborative period. Interactions with time test the hypothesis that the culture item affects the change in infection rate; these are labeled in the Variables column with the text “... x Days” .

Appendix 2 Table 3. CLABSI Readiness Assessment Models, ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.10	(0.99,1.21)	0.02	1.10	(0.99,1.21)	0.02	1.10	(0.99,1.22)	0.01	1.10	(0.99,1.22)	0.01
Teaching Hospital	1.00	(0.64,1.57)	0.98	1.01	(0.65,1.58)	0.95	1.02	(0.65,1.58)	0.92	0.98	(0.63,1.53)	0.92
Rural Hospital	1.24	(0.67,2.31)	0.37	1.21	(0.65,2.27)	0.44	1.27	(0.69,2.34)	0.32	1.24	(0.67,2.30)	0.37
<i>Partnership with Senior Executive for patient safety</i>												
Currently planning to implement	1.11	(0.67,1.85)	0.59									
Fully implemented	1.00	(0.64,1.57)	0.99									
<i>Systematic analysis and proactive learning</i>												
Currently planning to implement				1.21	(0.68,2.13)	0.40						
Fully implemented				1.04	(0.64,1.69)	0.85						
<i>Use of an independent line cart or kit, stocked</i>												
Currently planning to implement							1.49	(0.59,3.76)	0.26			
Fully implemented							0.99	(0.48,2.04)	0.96			
<i>Use of a line insertion checklist</i>												
Currently planning to implement										1.40	(0.52,3.81)	0.38
Fully implemented										1.13	(0.46,2.76)	0.73

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “Partnership with Senior Executive for patient safety” on baseline rates, model 2 tested the effect of “Systematic analysis and proactive learning” on baseline rates, model 3 tested the effect of “Use of an independent line cart or kit, stocked” on baseline rates, model 4 tested the effect of “Use of a line insertion checklist” on baseline rates. ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=258 units from 215 hospitals. Due to the small number of units in Critical Access Hospitals that responded to the Readiness Assessment in the CLABSI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the response to the item “Inclusion of chlorhexadine in central line kit”, in the ICUs, this effect could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR < 1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 4. CLABSI Readiness Assessment Models, ICUs over time

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.09	(1.01,1.19)	0.007	1.09	(1.001,1.19)	0.009	1.10	(1.01,1.19)	0.006	1.10	(1.01,1.19)	0.006
Teaching Hospital	1.01	(0.69,1.47)	0.97	1.03	(0.70,1.49)	0.87	1.03	(0.71,1.49)	0.85	1.01	(0.70,1.46)	0.95
Rural Hospital	0.92	(0.55,1.54)	0.67	0.90	(0.54,1.52)	0.61	0.93	(0.55,1.55)	0.70	0.91	(0.54,1.53)	0.65
Days	0.68	(0.53,0.87)	<.001	0.77	(0.57,1.03)	0.02	0.60	(0.34,1.04)	0.02	0.75	(0.40,1.41)	0.24
<i>Partnership with Senior Executive for patient safety</i>												
Currently planning to implement	0.97	(0.62,1.50)	0.84									
Fully implemented	1.00	(0.68,1.48)	0.99									
Currently planning to implement x Days	0.83	(0.58,1.18)	0.17									
Fully implemented x Days	0.93	(0.69,1.27)	0.55									
<i>Systematic analysis and proactive learning</i>												
Currently planning to implement				1.15	(0.71,1.86)	0.45						
Fully implemented				1.05	(0.69,1.59)	0.78						
Currently planning to implement x Days				0.71	(0.48,1.06)	0.03						
Fully implemented x Days				0.82	(0.58,1.16)	0.14						
<i>Use of an independent line cart or kit, stocked</i>												
Currently planning to implement							1.40	(0.63,3.12)	0.280			
Fully implemented							1.05	(0.56,1.95)	0.857			
Currently planning to implement x Days							0.89	(0.43,1.82)	0.662			
Fully implemented x Days							1.08	(0.61,1.91)	0.747			
<i>Use of a line insertion checklist</i>												
Currently planning to implement										1.41	(0.63,3.19)	0.28
Fully implemented										1.11	(0.53,2.32)	0.73
Currently planning to implement x Days										0.83	(0.40,1.72)	0.51
Fully implemented x Days										0.83	(0.44,1.59)	0.47

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of "Partnership with Senior Executive for patient safety" on rates over time, model 2 tested the effect of "Systematic analysis and proactive learning" on rates over time, model 3 tested the effect of "Use of an independent line cart or kit, stocked" on rates over time, model 4 tested the effect of "Use of a line insertion checklist" on rates over time. ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=258 units from 215 hospitals. Due to the small number of units in Critical Access Hospitals that responded to the Readiness Assessment in the CLABSI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the response to the item "Inclusion of chlorhexadine in central line kit", in the ICUs, this effect could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 5. CAUTI Readiness Assessment Models, ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.03	(0.93,1.14)	0.48	1.03	(0.94,1.14)	0.41	1.03	(0.94,1.14)	0.41
Teaching Hospital	2.46	(1.32,4.58)	<.001	2.41	(1.30,4.45)	<.001	2.33	(1.26,4.31)	<.001
Rural Hospital	0.52	(0.21,1.27)	0.06	0.53	(0.22,1.29)	0.06	0.52	(0.21,1.28)	0.06
<i>Partnership with Senior Executive for patient safety</i>									
Currently planning to implement	0.97	(0.57,1.64)	0.87						
Fully implemented	0.87	(0.55,1.39)	0.45						
<i>Systematic analysis and proactive learning</i>									
Currently planning to implement				0.97	(0.55,1.69)	0.88			
Fully implemented				0.84	(0.55,1.29)	0.30			
<i>Use of guidelines on appropriate indications for urinary catheter use</i>									
Currently planning to implement							1.15	(0.53,2.51)	0.64
Fully implemented							1.23	(0.58,2.58)	0.48

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “Partnership with Senior Executive for patient safety” on baseline rates, model 2 tested the effect of “Systematic analysis and proactive learning” on baseline rates, model 3 tested the effect of “Use of guidelines on appropriate indications for urinary catheter use” on baseline rates. ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=176 units from 148 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 5. CAUTI Readiness Assessment Models, ICUs at Baseline (continued)

VARIABLES	Model 4			Model 5			Model 6		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.03	(0.93,1.14)	0.41	1.03	(0.93,1.14)	0.45	1.03	(0.93,1.13)	0.48
Teaching Hospital	2.33	(1.25,4.36)	<.001	2.38	(1.28,4.40)	<.001	2.40	(1.30,4.41)	<.001
Rural Hospital	0.47	(0.19,1.19)	0.04	0.50	(0.20,1.24)	0.05	0.51	(0.21,1.25)	0.05
<i>Use of guidelines on proper techniques for urinary catheter insertion</i>									
Currently planning to implement	0.73	(0.21,2.56)	0.51						
Fully implemented	0.63	(0.19,2.14)	0.33						
<i>Use of guidelines on proper techniques for urinary catheter maintenance</i>									
Currently planning to implement				1.09	(0.20,6.06)	0.89			
Fully implemented				1.00	(0.19,5.16)	0.99			
<i>Unit use of multidisciplinary urinary catheter "rounds"</i>									
Yes							0.90	(0.62,1.32)	0.47

All models controlled for hospital bed size, teaching status and rurality. Model 4 tested the effect of "Use of guidelines on proper techniques for urinary catheter insertion" on baseline rates, model 5 tested the effect of "Use of guidelines on proper techniques for urinary catheter maintenance" on baseline rates, model 6 tested the effect of "Unit use of multidisciplinary urinary catheter rounds" on baseline rates. ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=176 units from 148 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 6. CAUTI Readiness Assessment Models, ICUs over time

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.05	(0.95,1.16)	0.25	1.05	(0.95,1.16)	0.22	1.05	(0.96,1.16)	0.17
Teaching Hospital	2.33	(1.26,4.32)	<.001	2.26	(1.23,4.15)	<.001	2.24	(1.23,4.09)	<.001
Rural Hospital	0.93	(0.52,1.65)	0.73	0.92	(0.51,1.64)	0.70	0.96	(0.54,1.72)	0.87
Days	0.95	(0.57,1.58)	0.79	1.01	(0.62,1.63)	0.97	1.06	(0.46,2.45)	0.87
<i>Partnership with Senior Executive for patient safety</i>									
Currently planning to implement	0.95	(0.56,1.59)	0.78						
Fully implemented	0.89	(0.56,1.40)	0.51						
Currently planning to implement x Days	1.10	(0.55,2.22)	0.73						
Fully implemented x Days	0.98	(0.52,1.85)	0.94						
<i>Systematic analysis and proactive learning</i>									
Currently planning to implement				0.90	(0.53,1.55)	0.63			
Fully implemented				0.94	(0.61,1.46)	0.71			
Currently planning to implement x Days				0.79	(0.35,1.75)	0.44			
Fully implemented x Days				0.99	(0.55,1.79)	0.97			
<i>Use of guidelines on appropriate indications for urinary catheter use</i>									
Currently planning to implement							0.82	(0.42,1.61)	0.45
Fully implemented							1.07	(0.57,2.01)	0.79
Currently planning to implement x Days							0.72	(0.26,1.96)	0.39
Fully implemented x Days							0.98	(0.40,2.39)	0.94

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “Partnership with Senior Executive for patient safety” on rates over time, model 2 tested the effect of “Systematic analysis and proactive learning” on rates over time, model 3 tested the effect of “Use of guidelines on appropriate indications for urinary catheter use” on rates over time. ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=176 units from 148 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 6. CAUTI Readiness Assessment Models, ICUs over time (continued)

VARIABLES	Model 4			Model 5			Model 6		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.05	(0.95,1.16)	0.24	1.05	(0.95,1.15)	0.25	1.05	(0.95,1.16)	0.22
Teaching Hospital	2.29	(1.24,4.22)	<.001	2.27	(1.23,4.18)	<.001	2.27	(1.23,4.19)	<.001
Rural Hospital	0.93	(0.51,1.69)	0.74	0.96	(0.53,1.73)	0.85	0.92	(0.52,1.65)	0.71
Days	0.85	(0.16,4.52)	0.81	1.28	(0.07,24.16)	0.82	0.98	(0.71,1.36)	0.89
<i>Use of guidelines on proper techniques for urinary catheter insertion</i>									
Currently planning to implement	1.11	(0.35,3.54)	0.82						
Fully implemented	1.06	(0.34,3.26)	0.90						
Currently planning to implement x Days	1.10	(0.18,6.78)	0.90						
Fully implemented x Days	1.14	(0.21,6.16)	0.84						
<i>Use of guidelines on proper techniques for urinary catheter maintenance</i>									
Currently planning to implement				2.08	(0.35,12.30)	0.29			
Fully implemented				2.28	(0.41,12.74)	0.22			
Currently planning to implement x Days				0.82	(0.04,16.48)	0.86			
Fully implemented x Days				0.74	(0.039,14.01)	0.79			
<i>Unit use of multidisciplinary urinary catheter "rounds"</i>									
Yes							1.05	(0.72,1.52)	0.76
Yes x Days							0.95	(0.56,1.62)	0.82

All models controlled for hospital bed size, teaching status and rurality. Model 4 tested the effect of "Use of guidelines on proper techniques for urinary catheter insertion" on rates over time, model 5 tested the effect of "Use of guidelines on proper techniques for urinary catheter maintenance" on rates over time, model 6 tested the effect of "Unit use of multidisciplinary urinary catheter rounds" on rates over time. ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=176 units from 148 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 7. CAUTI Readiness Assessment Models, non-ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.89	(0.76,1.05)	0.08	0.89	(0.76,1.05)	0.08	0.90	(0.76,1.06)	0.09
Teaching Hospital	1.25	(0.39,4.04)	0.63	1.25	(0.39,4.03)	0.63	1.25	(0.38,4.09)	0.62
Rural Hospital	1.20	(0.66,2.16)	0.44	1.18	(0.66,2.14)	0.46	1.17	(0.64,2.14)	0.52
<i>Partnership with Senior Executive for patient safety</i>									
Currently planning to implement	0.85	(0.45,1.60)	0.50						
Fully implemented	0.98	(0.52,1.84)	0.92						
<i>Systematic analysis and proactive learning</i>									
Currently planning to implement				0.92	(0.49,1.73)	0.73			
Fully implemented				0.87	(0.48,1.59)	0.56			
<i>Use of guidelines on appropriate indications for urinary catheter use</i>									
Currently planning to implement							1.11	(0.52,2.36)	0.72
Fully implemented							0.98	(0.48,2.03)	0.95

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “Partnership with Senior Executive for patient safety” on baseline rates. model 2 tested the effect of “Systematic analysis and proactive learning” on baseline rates, model 3 tested the effect of “Use of guidelines on appropriate indications for urinary catheter use” on baseline rates. non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=263 units from 199 hospitals. Due to the small number of non-ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 7. CAUTI Readiness Assessment Models, non-ICUs at Baseline (continued)

VARIABLES	Model 4			Model 5			Model 6		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.90	(0.76,1.06)	0.08	0.90	(0.77,1.06)	0.11	0.90	(0.76,1.05)	0.08
Teaching Hospital	1.27	(0.40,4.10)	0.60	1.31	(0.41,4.21)	0.56	1.27	(0.39,4.07)	0.61
Rural Hospital	1.19	(0.66,2.15)	0.44	1.21	(0.67,2.17)	0.41	1.20	(0.66,2.17)	0.44
<i>Use of guidelines on proper techniques for urinary catheter insertion</i>									
Currently planning to implement	0.94	(0.29,3.04)	0.88						
Fully implemented	0.86	(0.29,2.62)	0.73						
<i>Use of guidelines on proper techniques for urinary catheter maintenance</i>									
Currently planning to implement				0.79	(0.29,2.16)	0.55			
Fully implemented				0.68	(0.27,1.73)	0.28			
<i>Unit use of multidisciplinary urinary catheter "rounds"</i>									
Yes							1.00	(0.57,1.77)	0.99

All models controlled for hospital bed size, teaching status and rurality. Model 4 tested the effect of "Use of guidelines on proper techniques for urinary catheter insertion" on baseline rates, model 5 tested the effect of "Use of guidelines on proper techniques for urinary catheter maintenance" on baseline rates, model 6 tested the effect of "Unit use of multidisciplinary urinary catheter rounds" on baseline rates. non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=263 units from 199 hospitals. Due to the small number of non-ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 8. CAUTI Readiness Assessment Models, non-ICUs over time

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.93	(0.82,1.05)	0.13	0.93	(0.83,1.06)	0.16	0.93	(0.82,1.06)	0.15
Teaching Hospital	1.88	(0.76,4.67)	0.07	1.85	(0.75,4.61)	0.08	1.87	(0.75,4.64)	0.08
Rural Hospital	1.28	(0.80,2.06)	0.18	1.29	(0.80,2.07)	0.17	1.24	(0.76,2.01)	0.26
Days	0.59	(0.28,1.25)	0.07	0.39	(0.19,0.81)	<.001	0.52	(0.21,1.27)	0.06
<i>Partnership with Senior Executive for patient safety</i>									
Currently planning to implement	0.88	(0.51,1.52)	0.56						
Fully implemented	1.14	(0.67,1.93)	0.54						
Currently planning to implement x Days	0.83	(0.31,2.18)	0.61						
Fully implemented x Days	0.98	(0.40,2.40)	0.94						
<i>Systematic analysis and proactive learning</i>									
Currently planning to implement				0.82	(0.47,1.42)	0.35			
Fully implemented				1.02	(0.61,1.7)	0.92			
Currently planning to implement x Days				1.68	(0.64,4.42)	0.17			
Fully implemented x Days				1.49	(0.61,3.64)	0.25			
<i>Use of guidelines on Use of guidelines on appropriate indications for urinary catheter use</i>									
Currently planning to implement							1.10	(0.58,2.08)	0.70
Fully implemented							0.93	(0.50,1.72)	0.76
Currently planning to implement x Days							1.18	(0.40,3.47)	0.70
Fully implemented x Days							1.00	(0.37,2.74)	0.99

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “Partnership with Senior Executive for patient safety” on rates over time, model 2 tested the effect of “Systematic analysis and proactive learning” on rates over time, and model 3 tested the effect of “Use of guidelines on appropriate indications for urinary catheter use” on rates over time. non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=263 units from 199 hospitals. Due to the small number of non-ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR < 1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 2 Table 8. CAUTI Readiness Assessment Models, non-ICUs over time (continued)

VARIABLES	Model 4			Model 5			Model 6		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.93	(0.82,1.05)	0.13	0.93	(0.82,1.06)	0.15	0.93	(0.82,1.05)	0.13
Teaching Hospital	1.89	(0.76,4.68)	0.07	1.93	(0.78,4.78)	0.06	1.87	(0.76,4.63)	0.08
Rural Hospital	1.29	(0.81,2.08)	0.16	1.30	(0.81,2.09)	0.16	1.31	(0.81,2.12)	0.15
Days	0.39	(0.06,2.37)	0.18	0.57	(0.16,2.05)	0.26	0.48	(0.32,0.73)	<.001
<i>Use of guidelines on proper techniques for urinary catheter insertion</i>									
Currently planning to implement	0.96	(0.33,2.80)	0.92						
Fully implemented	0.97	(0.35,2.72)	0.94						
Currently planning to implement x Days	1.85	(0.27,12.95)	0.41						
Fully implemented x Days	1.33	(0.21,8.51)	0.70						
<i>Use of guidelines on proper techniques for urinary catheter maintenance</i>									
Currently planning to implement				0.91	(0.37,2.24)	0.78			
Fully implemented				0.83	(0.35,1.95)	0.57			
Currently planning to implement x Days				1.05	(0.25,4.51)	0.93			
Fully implemented x Days				0.93	(0.24,3.58)	0.89			
<i>Unit use of multidisciplinary urinary catheter "rounds"</i>									
Yes							1.00	(0.63,1.59)	0.99
Yes x Days							1.53	(0.72,3.22)	0.15

All models controlled for hospital bed size, teaching status and rurality. Model 4 tested the effect of “Use of guidelines on proper techniques for urinary catheter insertion” on rates over time, model 5 tested the effect of “Use of guidelines on proper techniques for urinary catheter maintenance” on rates over time, and model 6 tested the effect of “Unit use of multidisciplinary urinary catheter rounds” on rates over time. non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=263 units from 199 hospitals. Due to the small number of non-ICUs in Critical Access Hospitals that responded to the Readiness Assessment on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3

Appendix 3 Text 1

SUPPLEMENTARY ANALYSES PROVIDED INVOLVING THE TEAM CHECK-UP TOOL

Similar to the analyses performed in the manuscript involving HSOPS measures, we performed additional analyses involving the Team Check-up Tool, to test the association between results of the Team Check-up Tool collected as baseline information before implementation of the intervention and hospital units' CLABSI and CAUTI outcomes at baseline and assessed in follow-up over time.

METHODS

Design and Intervention

We performed a secondary analysis of a subset the healthcare worker survey called the Team Check-up Tool and patient outcome data collected in the AHRQ CLABSI and CAUTI collaboratives.

Study Participants and Data Sources

Analyses included data from participating adult, acute-care ICU and non-ICU units, including all six cohorts from the CLABSI collaborative with data collected from 2008-2011, and cohorts 1-4 from the CAUTI collaborative with data collected from 2011-2013. CLABSI collaborative cohorts were 30 months in duration; CAUTI collaborative cohorts were 17 months in duration. CAUTI cohorts 5-6 were excluded because of additional interventions

implemented in the Emergency Department (ED) and Intensive Care Unit (ICU) settings. To be included in the analyses the unit also had to have: 1) non-missing values for all individual HSOPS measures; 2) hospital characteristic data from American Hospital Association Annual Survey 2010 for CLABSI and 2011 for CAUTI (e.g., teaching status, bed size, rurality, and critical access); 3) at least one valid baseline and one valid post-baseline outcome reported.

Measures

Patient Outcome Measures

The conventional National Healthcare Safety Network (NHSN) infection rate of catheter-associated infections per 1000 catheter days was used for both collaborative projects. Unit-level aggregate infection rates were collected at baseline and monthly post-implementation for CLABSI. Unit-level aggregate infection rates were collected at baseline and quarterly post-implementation for CAUTI. Monthly CLABSI results were aggregated to quarterly numbers for our analyses.

Team Check-up Tool

The Team Check-up Tool is an approximately 20-item survey for completion by the initiative team leader using input from the team at baseline and serially in follow-up, with the goal to report progress and barriers in implementation. Similar to the Readiness Assessment, *a priori* selection of Team Check-up Tool measures included three safety activity items common to both the CLABSI and CAUTI collaboratives: senior executive partnership participation in safety rounds, team identification of a patient safety defect to work on, team work through a process to learn from defects. Technical strategies were queried by asking “What portion of the time was X used?” Five CLABSI-specific technical strategies were selected for analysis:

appropriate hand hygiene, chlorhexidine skin prep of patient, full drape of patient, femoral site avoidance in adults, and daily review of catheter necessity. Four CAUTI-specific technical strategies were selected for analysis: catheter appropriateness reviewed before placement, sterile insertion technique, appropriate catheter maintenance steps, and how often the catheter was removed when no longer needed. For CLABSI data using the Team Check-up Tool was collected monthly, while for CAUTI it was collected quarterly.²⁶ Monthly CLABSI Team Check-up Tool reports were aggregated to a quarterly measure for the purpose of comparing the two projects.

Statistical Analyses

Multilevel negative binomial models were used to adjust for clustering within hospitals and within units over time and also for over-dispersion of the outcome. Hospital characteristics of bed number, teaching status, critical access status, and rurality were adjusted for in the models. Separate models were used for ICUs and non-ICUs and culture items were tested individually because of higher catheter use rates in ICUs, and because the culture of ICUs was anticipated to differ than non-ICUs due to differences in team structure and rounding styles. Models with and without interaction with time were tested individually. Conservative significance testing criteria of $p < 0.01$ was chosen to account for the higher likelihood of random association due to multiple comparisons. Model results for the culture items of interest were depicted using coefficient plots, which plot the coefficient point estimate and the corresponding 99% confidence interval. Analyses were performed using Stata/MP13.1 (StataCorp, College Stations, Texas).

RESULTS

Participant Characteristics and Patient Outcome Measures: These are reported in the main manuscript text and **Table 1**.

Team Check-up Tool

The Team Check-up Tool response rates were overall low, at 23% for the CLABSI collaborative and 38% for the CAUTI collaborative, calculated as the number of units with Team Check-up Tool data divided by the total number of active units. Summary statistics for the Team Check-up Tool measures are detailed in **Appendix 3 Table 1** and **Appendix 3 Table 2**. Overall, Team Check-up Tool measures included similar rates (~30%) for monthly senior executive participation for CLABSI and CAUTI, and higher rates (59-75% vs. 49-54%) for teams identifying and working through patient safety defects for the CLABSI collaborative compared to the CAUTI collaborative. Use of technical strategies was reported by the Team Check-up Tool as being used most or all of the time for 70-98% of CLABSI units and 57-97% of CAUTI units.

Association between Team Check-up Tool Measures and Patient Outcomes

Detailed model results for baseline and longitudinal outcomes for the CLABSI and CAUTI collaboratives are found in **Appendix 3 Text 2** and **Appendix 3 Tables 3-8**, with separate models for ICUs and non-ICUs. In a few cases, model results are not presented due to either lack of variation in the response for the survey item of interest, or too few units responding. Coefficient plots for the Team Check-up Tool models for ICUs and non-ICUs are illustrated for CLABSI in **Appendix 3 Figure 1** and for CAUTI in **Appendix 3 Figure 2**. Based on the conservative significance testing criteria of $p < 0.01$, there were no statistically significant

associations found between any of the Team Check-up Tool measures selected for testing and the catheter-associated infection outcomes.

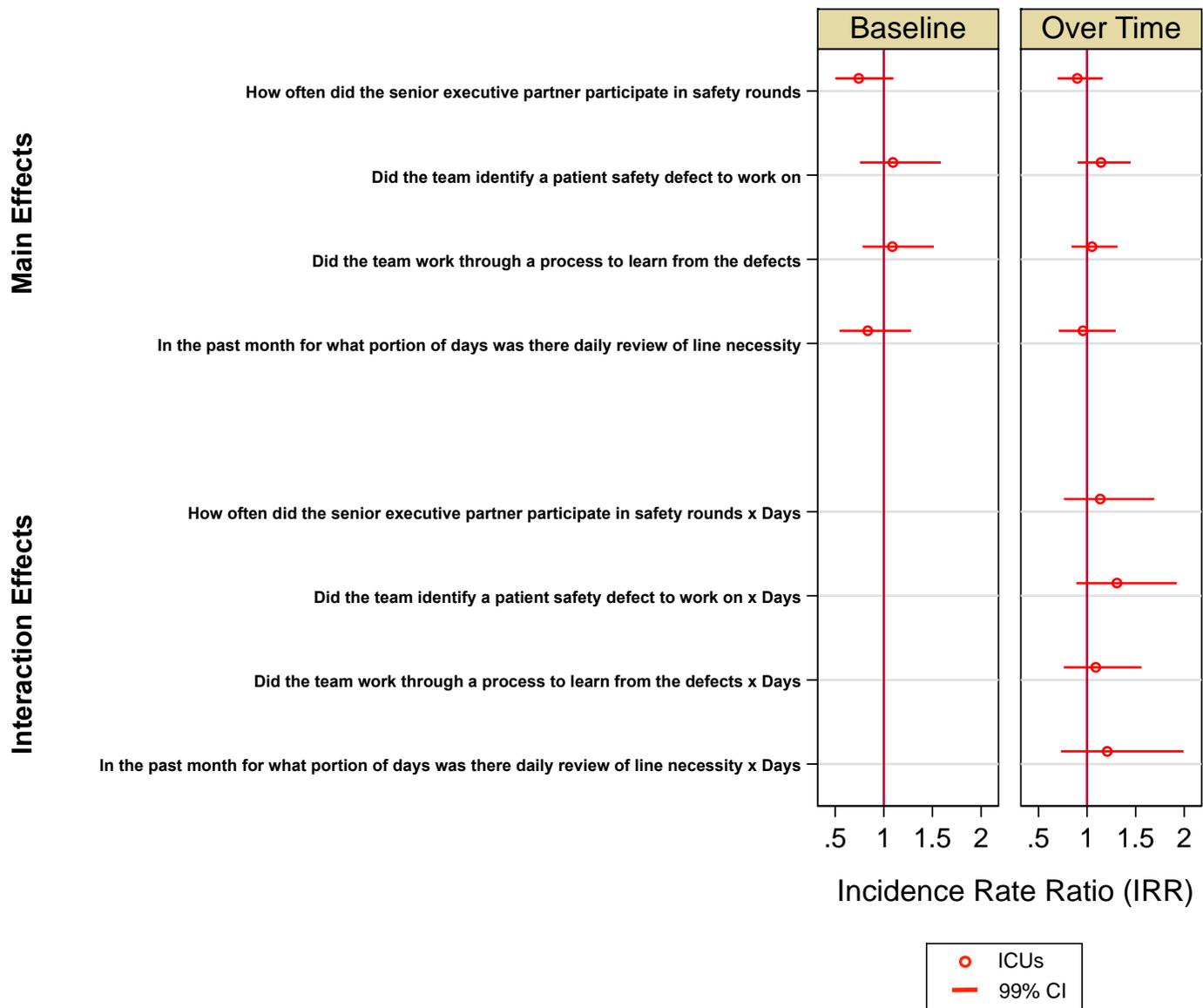
Appendix 3 Table 1. CLABSI TCT Questions and Frequency of Response at Baseline for Analytic Sample

Question	ICU (N=287) N (%)	non-ICU (N=61) N (%)
<i>Safety Activities</i>		
How often did the senior executive partner participate in safety rounds		
Less than once per month	200 (70)	46 (75)
Monthly	87 (30)	15 (25)
Did the team identify a patient safety defect to work on		
No	72 (25)	19 (31)
Yes	215 (75)	42 (69)
Did the team work through a process to learn from the defects		
No	102 (36)	25 (41)
Yes	185 (64)	36 (59)
<i>Technical Strategies</i>		
What portion of the time was hand hygiene used		
Never/Some	6 (2)	0 (0)
Most/All	276 (96)	49 (80)
N/A	5 (2)	12 (20)
What portion of the time was chlorhexidine skin prep of pt used		
Never/Some	2 (<1)	0 (0)
Most/All	280 (98)	49 (80)
N/A	5 (2)	12 (20)
What portion of the time was full drape of the patient used		
Never/Some	8 (3)	1 (<1)
Most/All	274 (95)	48 (79)
N/A	5 (2)	12 (20)
What portion of the time was femoral site avoided in adults		
Never/Some	18 (6)	0 (0)
Most/All	263 (92)	48 (79)
N/A	6 (2)	13 (21)
In the past month for what portion of days was there daily review of line necessity		
Never/Some	49 (17)	18 (30)
Most/All	238 (83)	43 (70)

Appendix 3 Table 2. CAUTI TCT Questions and Frequency of Response at Baseline for Analytic Sample

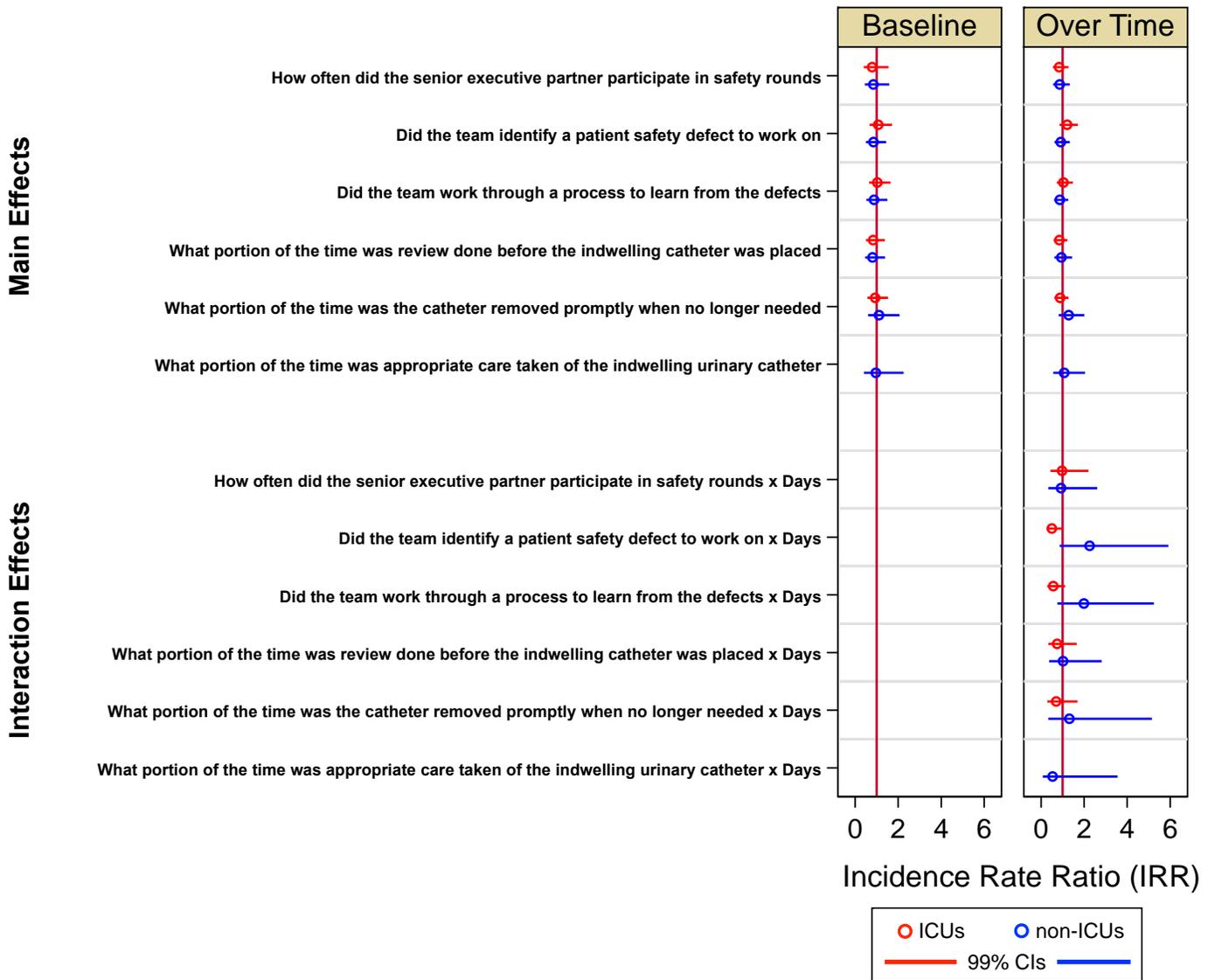
Question	ICU (N=160) N (%)	non-ICU (N=230) N (%)
Safety Activities		
How often did the senior executive partner participate in safety rounds		
Less than once per month	115 (72)	176 (77)
Monthly	45 (28)	54 (23)
Did the team identify a patient safety defect to work on		
No	76 (48)	118 (51)
Yes	84 (52)	112 (49)
Did the team work through a process to learn from the defects		
No	74 (46)	112 (49)
Yes	86 (54)	118 (51)
Technical Strategies		
What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter		
Never/Some	69 (43)	85 (37)
Most/All	91 (57)	145 (63)
What portion of the time was sterile technique used when the catheter was placed		
Never/Some	4 (3)	8 (3)
Most/All	156 (97)	222 (97)
What portion of the time was appropriate care taken of the indwelling urinary catheter (securing catheter, keeping bag below level of pt, closed system maintained)		
Never/Some	11 (7)	21 (9)
Most/All	149 (93)	209 (91)
What portion of the time was the catheter removed promptly when no longer needed		
Never/Some	44 (28)	56 (24)
Most/All	116 (72)	174 (76)

Appendix 3 Figure 1. CLABSI Coefficient Plots, TCT models



Due to the lack of variation in the responses to the items "What portion of the time was hand hygiene used", "What portion of the time was chlorhexidine skin prep of patient used", "What portion of the time was full drape of the patient used", "What portion of the time was femoral site avoided in adults" in the ICUs, these effects could not be modeled. Due to the small number of non-ICUs meeting inclusion criteria, TCT culture effects could be modeled.

Appendix 3 Figure 2. CAUTI Coefficient Plots, TCT models



Due to the lack of variation in the responses to the items "What portion of the time was sterile technique used when the catheter was placed" in both the ICUs and non-ICUs, this effect could not be modeled. Similarly, "What portion of the time was appropriate care taken of the indwelling urinary catheter" could not be modeled for the ICUs.

Appendix 3 Text 2. Model Details

The following tables give Team Checkup Tool model results for ICUs and non-ICUs for both the CLABSI and CAUTI collaboratives. Columns labeled “IRR” contain the Incident Rate Ratio for the effect. The IRR is the multiplicative effect of the item of interest. An $IRR > 1$ indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an $IRR < 1$ is a negative association, meaning a higher score for the item results in a lower outcome rate. For simplicity we used a significance criteria of $\alpha < 0.01$, hence, 99% confidence intervals (CIs) are reported. Where the confidence interval includes 1, the findings are considered to be not significant at $p < 0.01$. The variable Days was coded as the proportion of time to collaborative completion so that the corresponding coefficient represents the IRR for the entire collaborative period. Interactions with time test the hypothesis that the culture item affects the change in infection rate; these are labeled in the Variables column with the text “... x Days” .

Appendix 3 Table 3. CLABSI TCT Models, ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.02	(0.94,1.11)	0.48	1.03	(0.94,1.12)	0.42	1.03	(0.94,1.12)	0.41	1.03	(0.95,1.12)	0.38
Teaching Hospital	1.08	(0.71,1.63)	0.65	1.03	(0.68,1.56)	0.85	1.03	(0.68,1.55)	0.87	1.02	(0.68,1.54)	0.90
Rural Hospital	1.10	(0.59,2.05)	0.69	1.03	(0.55,1.92)	0.90	1.03	(0.55,1.91)	0.92	1.03	(0.55,1.91)	0.91
<i>How often did the senior executive partner participate in safety rounds</i>												
Monthly	0.74	(0.50,1.10)	0.05									
<i>Did the team identify a patient safety defect to work on</i>												
Yes				1.10	(0.76,1.59)	0.53						
<i>Did the team work through a process to learn from the defects</i>												
Yes							1.09	(0.78,1.51)	0.51			
<i>In the past month for what portion of days was there daily review of line necessity</i>												
Most/All										0.83	(0.54,1.28)	0.28

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “How often did the senior executive partner participate in safety rounds” on baseline rates, model 2 tested the effect of “Did the team identify a patient safety defect to work on” on baseline rates, model 3 tested the effect of “Did the team work through a process to learn from the defects” on baseline rates, and model 4 tested the effect of “In the past month for what portion of days was there daily review of line necessity” on baseline rates. TCT=Team Check-up Tool; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=287 units from 230 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the TCT on the CLABSI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the responses to the items “What portion of the time was hand hygiene used”, “What portion of the time was chlorhexidine skin prep of patient used”, “What portion of the time was full drape of the patient used”, “What portion of the time was femoral site avoided in adults” in the ICUs, these effects could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 4. CLABSI TCT Models, ICUs over time

VARIABLES	Model 1			Model 2			Model 3			Model 4		
	IRR*	99% CI	p									
Hospital Beds (100s)	1.03	(0.96,1.10)	0.28	1.03	(0.96,1.10)	0.25	1.03	(0.96,1.10)	0.24	1.03	(0.97,1.10)	0.23
Teaching Hospital	1.07	(0.78,1.47)	0.59	1.05	(0.76,1.44)	0.71	1.05	(0.77,1.44)	0.67	1.06	(0.77,1.45)	0.66
Rural Hospital	0.88	(0.55,1.41)	0.48	0.88	(0.55,1.40)	0.47	0.87	(0.54,1.39)	0.44	0.87	(0.54,1.39)	0.44
Days	0.52	(0.44,0.62)	<.001	0.43	(0.31,0.61)	<.001	0.50	(0.37,0.68)	<.001	0.46	(0.29,0.73)	<.001
<i>How often did the senior executive partner participate in safety rounds</i>												
Monthly	0.90	(0.70,1.16)	0.29									
Monthly x Days	1.14	(0.76,1.69)	0.41									
<i>Did the team identify a patient safety defect to work on</i>												
Yes				1.14	(0.90,1.45)	0.14						
Yes x Days				1.31	(0.89,1.92)	0.07						
<i>Did the team work through a process to learn from the defects</i>												
Yes							1.05	(0.84,1.31)	0.56			
Yes x Days							1.09	(0.76,1.56)	0.53			
<i>In the past month for what portion of days was there daily review of line necessity</i>												
Most/All										0.96	(0.71,1.30)	0.72
Most/All x Days										1.21	(0.73,1.99)	0.33

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “How often did the senior executive partner participate in safety rounds” on rates over time, model 2 tested the effect of “Did the team identify a patient safety defect to work on” on rates over time, model 3 tested the effect of “Did the team work through a process to learn from the defects” on rates over time, and model 4 tested the effect of “In the past month for what portion of days was there daily review of line necessity” on rates over time. TCT=Team Check-up Tool; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=287 units from 230 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the TCT on the CLABSI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the responses to the items “What portion of the time was hand hygiene used”, “What portion of the time was chlorhexidine skin prep of patient used”, “What portion of the time was full drape of the patient used”, “What portion of the time was femoral site avoided in adults” in the ICUs, these effects could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 5. CAUTI TCT Models, ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.16	(1.02,1.33)	0.003	1.17	(1.03,1.33)	0.002	1.17	(1.03,1.33)	0.002
Teaching Hospital	2.27	(1.05,4.89)	0.006	2.30	(1.07,4.90)	0.005	2.29	(1.06,4.91)	0.005
Rural Hospital	0.76	(0.30,1.96)	0.46	0.83	(0.33,2.12)	0.61	0.81	(0.32,2.06)	0.57
<i>How often did the senior executive partner participate in safety rounds</i>									
Monthly	0.79	(0.40,1.56)	0.37						
<i>Did the team identify a patient safety defect to work on</i>									
Yes				1.07	(0.67,1.72)	0.70			
<i>Did the team work through a process to learn from the defects</i>									
Yes							1.03	(0.65,1.64)	0.87

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “How often did the senior executive partner participate in safety rounds” on baseline rates, model 2 tested the effect of “Did the team identify a patient safety defect to work on” on baseline rates, model 3 tested the effect of “Did the team work through a process to learn from the defects” on baseline rates. TCT=Team Check-up Tool; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=160 units from 134 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the TCT on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled. Similarly, “What portion of the time was appropriate care taken of the indwelling urinary catheter” could not be modeled for the ICUs.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 5. CAUTI TCT Models, ICUs at Baseline (continued)

VARIABLES	Model 4			Model 5		
	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.17	(1.03,1.33)	0.002	1.17	(1.03,1.33)	0.002
Teaching Hospital	2.38	(1.10,5.17)	0.004	2.29	(1.07,4.90)	0.005
Rural Hospital	0.81	(0.32,2.04)	0.56	0.81	(0.32,2.03)	0.55
<i>What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter</i>						
Most/All	0.84	(0.51,1.38)	0.36			
<i>What portion of the time was catheter removed promptly when no longer needed</i>						
Most/All				0.94	(0.57,1.53)	0.73

All models controlled for hospital bed size, teaching status and rurality. Model 4 tested the effect of “What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter” on baseline rates, model 5 tested the effect of “What portion of the time was catheter removed promptly when no longer needed” on baseline rates. TCT=Team Check-up Tool; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=160 units from 134 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the TCT on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled. Similarly, “What portion of the time was appropriate care taken of the indwelling urinary catheter” could not be modeled for the ICUs.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 6. CAUTI TCT Models, ICUs over time

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.14	(1.02,1.28)	0.002	1.14	(1.02,1.28)	0.002	1.15	(1.03,1.28)	0.002
Teaching Hospital	2.14	(1.11,4.13)	0.003	2.22	(1.14,4.30)	0.002	2.14	(1.10,4.16)	0.003
Rural Hospital	0.95	(0.50,1.79)	0.83	1.00	(0.53,1.89)	0.99	0.98	(0.52,1.85)	0.93
Days	1.10	(0.75,1.60)	0.54	1.61	(0.97,2.66)	0.02	1.51	(0.90,2.53)	0.04
<i>How often did the senior executive partner participate in safety rounds</i>									
Monthly	0.84	(0.55,1.28)	0.28						
Monthly x Days	0.98	(0.43,2.21)	0.94						
<i>Did the team identify a patient safety defect to work on</i>									
Yes				1.21	(0.86,1.71)	0.15			
Yes x Days				0.50	(0.25,1.00)	0.01			
<i>Did the team work through a process to learn from the defects</i>									
Yes							1.04	(0.73,1.48)	0.77
Yes x Days							0.57	(0.29,1.12)	0.03

All models controlled for hospital bed size, teaching status and rurality. Model 1 tested the effect of “How often did the senior executive partner participate in safety rounds” on rates over time, model 2 tested the effect of “Did the team identify a patient safety defect to work on” on rates over time, model 3 tested the effect of “Did the team work through a process to learn from the defects” on rates over time. TCT=Team Check-up Tool; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=160 units from 134 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the TCT on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled. Similarly, “What portion of the time was appropriate care taken of the indwelling urinary catheter” could not be modeled for the ICUs.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 6. CAUTI TCT Models, ICUs over time (continued)

VARIABLES	Model 4			Model 5		
	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.15	(1.03,1.28)	0.001	1.15	(1.03,1.28)	0.001
Teaching Hospital	2.18	(1.14,4.20)	0.002	2.11	(1.10,4.07)	0.003
Rural Hospital	0.96	(0.51,1.81)	0.88	0.96	(0.51,1.81)	0.88
Days	1.38	(0.70,2.71)	0.22	1.49	(0.68,3.26)	0.19
<i>What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter</i>						
Most/All	0.85	(0.59,1.23)	0.25			
Most/All x Days	0.75	(0.34,1.66)	0.35			
<i>What portion of the time was catheter removed promptly when no longer needed</i>						
Most/All				0.89	(0.62,1.28)	0.40
Most/All x Days				0.71	(0.29,1.69)	0.30

All models controlled for hospital bed size, teaching status and rurality. Model 4 tested the effect of “What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter” on rates over time, model 5 tested the effect of “What portion of the time was catheter removed promptly when no longer needed” on rates over time. TCT=Team Check-up Tool; ICUs=intensive care units; IRR=incidence rate ratio; p=p-value. Model N=160 units from 134 hospitals. Due to the small number of ICUs in Critical Access Hospitals that responded to the TCT on the CAUTI collaborative, the effect of Critical Access Hospital status could not be modeled. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled. Similarly, “What portion of the time was appropriate care taken of the indwelling urinary catheter” could not be modeled for the ICUs.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 7. CAUTI TCT Models, non-ICUs at Baseline

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.99	(0.82,1.20)	0.90	0.99	(0.82,1.20)	0.90	0.99	(0.82,1.21)	0.93
Teaching Hospital	1.05	(0.29,3.77)	0.92	1.03	(0.29,3.70)	0.95	1.03	(0.29,3.69)	0.95
Rural Hospital	0.63	(0.28,1.39)	0.13	0.62	(0.28,1.38)	0.12	0.63	(0.28,1.39)	0.13
Critical Access Hospital	2.61	(1.07,6.33)	0.005	2.61	(1.08,6.30)	0.004	2.62	(1.09,6.33)	0.005
<i>How often did the senior executive partner participate in safety rounds</i>									
Monthly	0.85	(0.45,1.59)	0.50						
<i>Did the team identify a patient safety defect to work on</i>									
Yes				0.85	(0.51,1.44)	0.44			
<i>Did the team work through a process to learn from the defects</i>									
Yes							0.88	(0.52,1.50)	0.54

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of “How often did the senior executive partner participate in safety rounds” on baseline rates, model 2 tested the effect of “Did the team identify a patient safety defect to work on” on baseline rates, model 3 tested the effect of “Did the team work through a process to learn from the defects” on baseline rates. TCT=Team Check-up Tool; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=230 units from 185 hospitals. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 7. CAUTI TCT Models, non-ICUs at Baseline (continued)

VARIABLES	Model 4			Model 5			Model 6		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	0.99	(0.81,1.19)	0.84	0.99	(0.81,1.19)	0.84	0.98	(0.81,1.19)	0.80
Teaching Hospital	1.10	(0.31,3.90)	0.86	1.08	(0.30,3.85)	0.88	1.06	(0.30,3.78)	0.90
Rural Hospital	0.62	(0.28,1.38)	0.12	0.63	(0.28,1.39)	0.13	0.63	(0.28,1.40)	0.14
Critical Access Hospital	2.47	(1.01,6.05)	0.01	2.62	(1.08,6.35)	0.005	2.64	(1.09,6.40)	0.005
<i>What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter</i>									
Most/All	0.81	(0.47,1.39)	0.32						
<i>What portion of the time was appropriate care taken of the indwelling urinary catheter (securing catheter, keeping bag below level of pt, closed system maintained)</i>									
Most/All				0.96	(0.41,2.25)	0.91			
<i>What portion of the time was catheter removed promptly when no longer needed</i>									
Most/All							1.112	(0.60,2.06)	0.66

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 4 tested the effect of “What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter” on rates over time, model 5 tested the effect of “What portion of the time was appropriate care taken of the indwelling catheter” on rates over time, and model 6 tested the effect of “What portion of the time was catheter removed promptly when no longer needed” on rates over time. TCT=Team Check-up Tool; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=230 units from 185 hospitals. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 8. CAUTI TCT Models, non-ICUs over time

VARIABLES	Model 1			Model 2			Model 3		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.02	(0.87,1.20)	0.76	1.03	(0.87,1.21)	0.67	1.02	(0.87,1.20)	0.72
Teaching Hospital	1.11	(0.37,3.34)	0.81	1.11	(0.37,3.30)	0.81	1.11	(0.37,3.31)	0.81
Rural Hospital	0.70	(0.37,1.33)	0.15	0.71	(0.37,1.34)	0.16	0.71	(0.37,1.34)	0.16
Critical Access Hospital	2.61	(1.28,5.33)	<.001	2.66	(1.31,5.40)	<.001	2.63	(1.29,5.35)	<.001
Days	0.67	(0.40,1.14)	0.05	0.40	(0.19,0.84)	0.001	0.44	(0.21,0.90)	0.003
<i>How often did the senior executive partner participate in safety rounds</i>									
Monthly	0.87	(0.56,1.34)	0.39						
Monthly x Days	0.93	(0.33,2.61)	0.86						
<i>Did the team identify a patient safety defect to work on</i>									
Yes				0.92	(0.63,1.34)	0.55			
Yes x Days				2.26	(0.86,5.91)	0.03			
<i>Did the team work through a process to learn from the defects</i>									
Yes							0.87	(0.604,1.26)	0.34
Yes x Days							1.99	(0.757,5.24)	0.07

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 1 tested the effect of “How often did the senior executive partner participate in safety rounds” on rates over time, model 2 tested the effect of “Did the team identify a patient safety defect to work on” on rates over time, model 3 tested the effect of “Did the team work through a process to learn from the defects” on rates over time. TCT=Team Check-up Tool; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=230 units from 185 hospitals. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate.

Appendix 3 Table 8. CAUTI TCT Models, non-ICUs over time (continued)

VARIABLES	Model 4			Model 5			Model 6		
	IRR*	99% CI	p	IRR*	99% CI	p	IRR*	99% CI	p
Hospital Beds (100s)	1.02	(0.87,1.19)	0.79	1.02	(0.87,1.20)	0.77	1.01	(0.86,1.19)	0.84
Teaching Hospital	1.15	(0.39,3.38)	0.75	1.14	(0.39,3.36)	0.76	1.12	(0.38,3.34)	0.79
Rural Hospital	0.70	(0.37,1.33)	0.15	0.71	(0.37,1.33)	0.16	0.72	(0.38,1.37)	0.19
Critical Access Hospital	2.59	(1.27,5.30)	<.001	2.64	(1.30,5.36)	<.001	2.70	(1.32,5.50)	<.001
Days	0.64	(0.27,1.51)	0.18	1.15	(0.19,7.01)	0.84	0.49	(0.14,1.73)	0.15
<i>What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter</i>									
Most/All	0.95	(0.62,1.44)	0.74						
Most/All x Days	1.02	(0.37,2.82)	0.95						
<i>What portion of the time was appropriate care taken of the indwelling urinary catheter (securing catheter, keeping bag below level of pt, closed system maintained)</i>									
Most/All				1.08	(0.57,2.04)	0.77			
Most/All x Days				0.54	(0.08,3.55)	0.40			
<i>What portion of the time was catheter removed promptly when no longer needed</i>									
Most/All							1.28	(0.82,2.02)	0.15
Most/All x Days							1.32	(0.34,5.15)	0.60

All models controlled for hospital bed size, teaching status, critical access status and rurality. Model 4 tested the effect of “What portion of the time was review done before the indwelling catheter was placed to ensure there was an appropriate need for the catheter” on rates over time, model 5 tested the effect of “What portion of the time was appropriate care taken of the indwelling catheter” on rates over time, and model 6 tested the effect of “What portion of the time was catheter removed promptly when no longer needed” on rates over time. TCT=Team Check-up Tool; non-ICUs=non-intensive care units; IRR=incidence rate ratio; p=p-value. Model N=230 units from 185 hospitals. Due to the lack of variation in the responses to the items “What portion of the time was sterile technique used when the catheter was placed” in both the ICUs and non-ICUs, this effect could not be modeled.

*The IRR is the multiplicative effect of the item of interest. An IRR > 1 indicates a positive association, meaning a higher score for the item results in a higher outcome rate. Conversely, an IRR <1 is a negative association, meaning a higher score for the item results in a lower outcome rate..