

Appendix A1: Crosswalk of Proxy Measures, Hospital Domains, and Contextual Factors from Quality Improvement Literature			
Hospital Domains/Proxy Measures	Definition	Contextual Factor	Source (see footnote)
Organizational Type			
<i>Medicare Day Rate</i>	Total inpatient Medicare days divided by total inpatient days	Financial Status	a,b,d
<i>Medicaid Day Rate</i>	Total inpatient Medicaid days divided by total inpatient days	Financial Status	a,b,d
<i>Medical Education Expenditure Rate</i>	Total expenditure on medical education programs (post-graduate medical education, nursing degree, and allied health programs) divided by total expenditure on medical services	Teaching Status	a,b
<i>Research Expenditure Rate</i>	Total expenditure on hospital research divided by total expenditure on medical services	Organizational Complexity	b,d
<i>Nonprofit Hospital</i>	Non-profit=1; otherwise=0	Ownership	a
<i>For-Profit Hospital</i>	Investor owned=1; otherwise=0	Ownership	a
<i>Public Hospital</i>	Government (any level)=1; otherwise=0	Ownership	a
Organizational Structure			
<i>Outpatient Rate</i>	Total hospital outpatient revenue divided by total hospital revenue (inpatient + outpatient)	Service Mix	a,e
<i>IT Expenditure Rate</i>	Total expenditure on hospital-related data processing divided by total expenditure on medical services	IT Infrastructure	a,b,c
Leadership			
<i>Quality Review Expenditure</i>	Total expenditure on review of medical care quality (000s of 2019 dollars)	Physician Involvement	a,b,c,d
Market Conditions			
<i>Number of HSA-Market Competitors</i>	Total number of competitors (hospitals) within the hospital's HSA (Hospital Service Area)	Competition	a,c
<i>Average HSA-Competitor PSI #7</i>	Weighted-average (based on bed size) observed PSI #7 of all competitors (hospitals) within the hospital's HSA	Competition	a,c
<i>Average HSA-Competitor PSI #8</i>	Weighted-average (based on bed size) observed PSI #8 of all competitors (hospitals) within the hospital's HSA	Competition	a,c
<i>Average HSA-Competitor PSI #4</i>	Weighted-average (based on bed size) observed PSI #4 of all competitors (hospitals) within the hospital's HSA	Competition	a,c

Sources:

- a. Kaplan HC, Brady PW, Dritz MC, et al. The influence of context on quality improvement success in health care: a systematic review of the literature. *Milbank Q*. Dec 2010;88(4):500–59. doi:10.1111/j.1468-0009.2010.00611.x
- b. Taylor SL, Dy S, Foy R, et al. What context features might be important determinants of the effectiveness of patient safety practice interventions? . *BMJ Quality and Safety*. 2011;20:611–617. doi:https://doi.org/10.1136/bmjqs.2010.049379
- c. Kaplan HC, Provost LP, Froehle CM, Margolis PA. The Model for Understanding Success in Quality (MUSIQ): building a theory of context in healthcare quality improvement. *BMJ Qual Saf*. Jan 2012;21(1):13–20. doi:10.1136/bmjqs-2011-000010
- d. Shekelle PG, Pronovost PJ, Wachter RM, et al. The top patient safety strategies that can be encouraged for adoption now. *Ann Intern Med*. Mar 5 2013;158(5 Pt 2):365–8. doi:http://10.7326/0003-4819-158-5-201303051-00001
- e. Bates, D. W., & Singh, H. (2018). Two decades since To Err Is Human: An assessment of progress and emerging priorities In patient safety. *Health Aff (Millwood)*, 37(11), 1736–1743. https://doi.org/http://10.1377/hlthaff.2018.0738

Appendix A2: Differences of Means (or Proportions), Sample vs. Non-Sample Hospitals			
	Sample	Non-Sample	p-value
	N=1781 (137 Hosps.)	N=211(22 Hosps.)	
	Mean/Prop.	Mean/Prop.	
PSI Rates (Outcomes):			
PSI #7 (CLABSI)	0.401	0.221	0.000
PSI #8 (Patient Falls)	0.092	0.105	0.236
PSI #4 (FTR)	0.123	0.130	0.173
Nursing-based Investments:			
Nursing Administration Expenditure (Education)	\$1,030	\$414	0.000
FTE Non-Physician Per-Patient Staffing (Staffing)	3.04	3.92	0.000
Hospital Domains/ Proxy Measures:			
Organizational Type			
Medicare Day Rate	0.57	0.60	0.001
Medicaid Day Rate	0.15	0.12	0.000
Medical Education Expenditure Rate	0.0507	0.0147	0.000
Research Expenditure Rate	0.00172	0.00041	0.007
Nonprofit Hospital	0.40	0.43	0.460
For-Profit Hospital	0.48	0.50	0.561
Public Hospital	0.11	0.07	0.038
Organizational Structure			
Outpatient Rate	0.407	0.504	0.000
IT Expenditure Rate	0.164	0.158	0.432
Leadership			
Quality Review Expenditure	\$2,458	\$1,131	0.000
Market Conditions			
Number of HSA-Market Competitors	2.58	3.29	0.016
Average HSA-Competitor PSI #7	1.03	0.48	0.085
Average HSA-Competitor PSI #8	0.07	0.06	0.378
Average HSA-Competitor PSI #4	0.08	0.06	0.017
Size (not proxy measures):			
Total Inpatient and Outpatient Revenue (000s of 2019 dollars)	\$1,561,088	\$563,985	0.000
Total Hospital Beds	386	175	0.000
Total Annual Inpatient Days	80,544	28,695	0.000

Appendix A3: Complete Nonlinear (Main) Regression Results (2007 - 2019) ^a										
Regressions:	PSI #7 (CLABSI)				PSI #8 (Patient Falls)				PSI #4 (FTR)	
	Modified Coeff. ^b	Robust Std. Err. ^c	z		Modified Coeff.	Robust Std. Err.	z		Modified Coeff.	Robust Std. Err.
Panel A. Baseline (2007-2010)										
	-0.351	0.025	-14.2	**	-0.043	0.015	-2.98	**	Omitted	
2007										
2008	Omitted				-0.004	0.012	-0.33		-0.007	0.005
2009	-0.025	0.026	-0.96		Omitted				-0.005	0.006
2010	-0.049	0.029	-1.71	*	-0.008	0.015	-0.50		-0.0047	0.006
Education	0.045	0.000	1.84	*	-0.006	0.000	-0.96		-0.005	0.000
Staffing	0.012	0.016	0.59		0.0001	0.007	0.01		-0.002	0.003
Panel A. Post-Announcement of HVBP (2011-2013)										
Post-HVBP Trend	-0.136	0.015	-8.90	**	-0.009	0.004	-2.14	**	-0.0008	0.002
Education x HVBP Dummy	-0.068	0.000	-1.70	*	-0.001	0.000	-0.19		0.005	0.000
Staffing x HVBP Dummy	-0.045	0.011	-2.93	**	-0.004	0.004	-0.87		-0.003	0.002
Panel C. Post-Announcement HACRP (2014-2019)										
Post-HACRP Trend	0.119	0.016	7.46	**	0.009	0.005	1.81	*	-0.005	0.003
Education x HACRP Dummy	-0.006	0.000	-0.23		0.012	0.000	2.51	**	0.003	0.000
Staffing x HACRP Dummy	0.075	0.011	4.75	**	0.008	0.003	1.75	*	0.003	0.001
Panel D. Hospital Domains										
Organizational Type:										
Medicare Day Rate	-0.026	0.289	-0.71		-0.013	0.107	-0.95		0.009	0.053
Medicaid Day Rate	-0.055	0.493	-1.37		-0.019	0.146	-1.58		0.005	0.068
Medical Education Expenditure Rate	0.008	0.158	0.38		-0.014	0.022	-4.75	**	-0.001	0.013
Research Expenditure Rate	0.023	2.874	1.15		0.005	1.030	0.69		0.002	0.310
For-Profit Hospital (Omitted: Nonprofit Hospital)	-0.004	0.068	-0.06		-0.005	0.029	-0.18		0.015	0.017
Public Hospital (Omitted: Nonprofit Hospital)	0.041	0.088	0.47		0.048	0.044	1.08		0.005	0.013
Organizational Structure:										
Outpatient Rate	-0.025	0.357	-0.70		-0.025	0.124	-1.97	**	0.001	0.038
IT Expenditure Rate	-0.007	0.110	-0.59		-0.002	0.046	-0.44		0.002	0.027
Leadership:										
Quality Review Expenditure	-0.036	0.000	-1.25		0.001	0.000	0.19		-0.001	0.000
Market Conditions:										
Number of HSA-Market Competitors	0.063	0.006	2.74	**	0.012	0.002	1.49		0.000	0.001
Average HSA-Competitor PSI #7	0.012	0.002	1.17		-0.003	0.001	-0.76		-0.001	0.000
Average HSA-Competitor PSI #8	-0.008	0.022	-1.84	*	-0.004	0.016	-1.41		-0.001	0.007
Average HSA-Competitor PSI #4	0.005	0.075	0.77		-0.004	0.044	-0.97		0.000	0.020
Panel E. Administrative Control										
ICD10 (Post 2015)	-0.003	0.017	-0.18		0.007	0.012	0.59		0.020	0.006
Within R ² :	0.439				0.039				0.020	

Appendix A4: Calibration Parameters (p) for Proxy (Hospital Domain) Control Variables ^a						
	Baseline (2007-2010)	Post-HVBP (2011-2013)		Post-HACRP (2014-2019)		
	<i>Education (PSI #7)</i>	<i>Education x HVBP Dummy (PSI #7)</i>	<i>Staffing x HVBP Dummy (PSI #7)</i>	<i>Staffing x HACRP Dummy (PSI #7)</i>	<i>Education x HACRP Dummy (PSI #8)</i>	<i>Staffing x HACRP Dummy (PSI #8)</i>
Organizational Type						
<i>Medicare Day Rate</i>	0.148	0.085	0.936	0.134	0.274	0.342
<i>Medicaid Day Rate</i>	0.017	0.039	0.853	1.416	0.215	1.102
<i>Medical Education Expenditure Rate</i>	0.094	0.065	0.040	0.086	0.118	0.072
<i>Research Expenditure Rate</i>	0.572	0.825	0.145	0.081	1.916	0.076
<i>For-Profit Hospital</i>	0.037	0.032	0.185	0.061	0.088	0.004
<i>Public Hospital</i>	0.030	0.028	0.105	0.279	0.144	0.271
Organizational Structure						
<i>Outpatient Rate</i>	0.030	0.076	0.495	0.351	0.043	0.272
<i>IT Expenditure Rate</i>	0.041	0.024	0.285	0.002	0.059	0.039
Leadership						
<i>Quality Review Expenditure</i>	0.023	0.008	0.076	0.089	0.086	0.064
Market Conditions						
<i>Number of HSA-Market Competitors</i>	1.736	1.242	0.386	0.219	0.404	0.270
<i>Average HSA-Competitor PSI #7</i>	0.032	0.035	0.052	0.020	0.015	0.054
<i>Average HSA-Competitor PSI #8</i>	0.015	0.006	0.013	0.023	0.026	0.008
<i>Average HSA-Competitor PSI #4</i>	0.038	0.011	0.035	0.026	0.008	0.030

^ap (calibration parameter): For each of the 13 proxy variables, X_r ($r = 1$ to 13), $p_r = [\text{var}(\pi.X_r)]^{0.5} / [\text{var}(\pi.X_r)]^{0.5}$, where (π, π_r) is the vector of coefficients for the proxy variables from "first-stage" regressions of each quality investment covariate (including baseline and both sets of VBP interaction covariates) against all other observable covariates. See Diegert, Masten, and Poirier (2026).