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Supporting Information

Supplementary results

This appendix was part of the submitted manuscript and has been peer reviewed.
It is posted as supplied by the authors.

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Table 1. Population and hospital episode numbers by state

	South Australia	Victoria	Combined
2018 population[1]	1 733 500	6 526 400	8 259 900
All public hospitals	76	134	210
Study hospitals	12 (16%)	26 (19%)	38 (18%)
Public hospitals: all care episodes	1 715 343	7 014 084	8 729 427
Study hospitals: all care episodes	1 403 085 (81.8%)	5 188 823 (74.0%)	6 591 908 (75.5%)
Public hospitals: adult multiple-day acute care episodes	NA	1 462 686	
Study hospitals: adult multiple day acute care episodes	369 725	1 189 253 (81.3%)	1 558 978
Study hospitals adult multiple-day acute care episodes with hospital acquired complications	36 066 (9.8%)	115 420 (9.7%)	151 486 (9.7%)
Public hospitals: adult multiple-day care episodes, bed-days	NA	7 767 189	
Study hospitals: adult multiple-day care episodes, bed-days	2 741 866	7 288 052 (93.8%)	10 029 918

NA = not available.
Study hospital = acute care public hospital with on-site intensive care unit.

Table 2. Peer group hospital-acquired complication (HAC) rates and most frequent subclasses

	HAC code	All study hospitals	South Australia	Victoria	Tertiary referral	Major metropolitan	Major regional
Hospitals	—	38	12	26	9	15	12
Hospital episodes	all	1 558 978	368 493	1 190 485	674 934	661 120	222 924
HAC events	all	214 286	45 359	173 605	123 794	63 962	23 865
Hospital episodes with HAC	all	151 486	36 066	115 420	85 462	48 345 (7.31)	17 679 (7.93)
HAC per 100 episodes	all	9.72 (9.67-9.77)	9.79 (9.69-9.89)	9.70 (9.64-9.75)	12.7 (12.6-12.8)	7.31 (7.25-7.38)	7.93 (7.81-8.05)
HAC per 100 bed-days	all	2.14 (2.13–2.15)	1.66 (1.65–1.68)	2.31 (2.30–2.32)	2.56 (2.55–2.58)	1.66 (1.65–1.67)	1.69 (1.93–1.98)
Most frequent hospital-acquired complications, by class							
Acute delirium	11.1	28 006 (1.80%)	5336 (1.45%)	22 670 (1.90%)	16 216 (2.40%)	8344 (1.26%)	3446 (1.55%)
Hospital-associated pneumonia	3.3	24 554 (1.58%)	7351 (1.99%)	17 203 (1.46%)	14 936 (2.21%)	7416 (1.12%)	2202 (0.99%)
Tachyarrhythmia	14.2	18 257 (1.17%)	3231 (0.88%)	15 026 (1.26%)	11 904 (1.76%)	4233 (0.64%)	2120 (0.95%)
Urinary infection	3.1	18 241 (1.17%)	4811 (1.31%)	13 430 (1.13%)	10 585 (1.57%)	5277 (0.80%)	2379 (1.07%)
Sepsis (severe infection)	3.9	12 114 (0.78%)	1906 (0.52%)	10 208 (0.86%)	6829 (1.01%)	4241 (0.64%)	1044 (0.47%)
Post-operative bleeding	4.1	12 049 (0.77%)	1046 (0.28%)	11 003 (0.92%)	6562 (0.97%)	4030 (0.61%)	1457 (0.65%)
Acute respiratory failure	6.1	10 519 (0.67%)	1149 (0.31%)	9370 (0.79%)	6968 (1.03%)	2618 (0.40%)	933 (0.42%)
Hypoglycaemia	13.2	9117 (0.58%)	1663 (0.45%)	7454 (0.63%)	5006 (0.74%)	3235 (0.49%)	876 (0.39%)
Aspiration pneumonitis	6.2	7435 (0.48%)	2081 (0.56%)	5354 (0.45%)	4479 (0.66%)	2206 (0.33%)	750 (0.34%)
Gastrointestinal bleeding, ulcer, or perforation	9.1	6706 (0.43%)	1121 (0.30%)	5585 (0.47%)	3600 (0.53%)	2210 (0.33%)	896 (0.40%)

Table 3. Covariates for propensity risk prediction, by hospital-acquired complication class

	Hospital-acquired complication class												
	1	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Demographic covariates													
Age (per year)	0.0048	0.0086	0.0035	0.0006	0.0015	0.0003	0.0097	0.0049	0.0065	0.0192	-0.0007	-0.0027	0.0110
Planned admission	0.2067	0.1422	0.2742	0.6923	0.5154	0.3468	0.3506	0.3232	0.6370	0.3530	-0.5156	0.1261	0.0306
Emergency Dept admit	0.1243		0.0049	0.0541	0.2702	0.2003	0.1651	0.2347		0.1580	-0.5831	0.0671	
Frailty	0.3475	0.5557	0.4512	0.1370	0.3411	0.1564	0.3097	0.1859			1.5090	0.1968	
Male	0.0484	-0.0630	-0.0345	0.0880	0.1132	0.0551	0.1030	0.0905		0.0965	-0.0636		
Age-care resident	0.1599			-0.1718									
Transfer in	0.0474		0.2500	0.2392	0.0836	0.2160	0.1323			0.3677		0.1009	
Comorbidity covariates													
Anaemia, chronic			0.3071	0.6044	0.1759	0.2596	0.2719	0.6062		0.1437		0.1025	
Cancer	0.1475		0.3320	0.3072	0.1019	0.2222	0.0777			0.1614		0.1236	
Chronic heart failure	0.3188	0.1532	0.8972	0.3150	1.0129	0.3621	0.8900	0.3899		0.5771		0.1487	
Congenital heart disease					0.3484		0.2041			0.1839			
Chronic liver disease	0.1303		0.2122	0.1018	0.2244		0.4835	0.2525	-0.2867	0.2758		0.1727	0.6061
Other chronic neurology	0.2178	0.0954	0.2114		0.2845		0.0847			0.4905		0.1503	
Coagulopathy	0.3865	0.2002	0.6885	0.5640	0.4248	0.4142	0.7291	0.6767	2.6964		0.2078	0.4791	0.6929
Cerebral palsy	0.5163				0.4667			0.4117		-0.1762		0.2890	
Chronic obstructive pulmonary diseases		0.1222	0.2909		0.4053	-0.0803	0.0617	0.1413	0.1882	0.0927			0.2667
Chronic kidney disease	0.0969	0.1243	0.1866	0.1179	0.0674				0.0859	0.1134		0.1577	
Rheumatologic disease			0.1559		0.0627		0.2927	0.1018					0.2238
Dementia	-0.1979		-0.1271	-0.2371	-0.1171		-0.2162	-0.1621		0.1493	-0.2679	-0.0636	
Depression	0.1814	0.1928	0.1703	0.0425		0.1687		0.0984		0.2289			
Diabetes	0.0904	0.0757	0.1335	0.0549	0.0777		0.5466		0.1085	0.1012		0.9478	
Recreational drug use	0.0461	0.1840	0.0732			0.1269	0.0891		0.3553	0.2503			
Chronic arrhythmia	0.2262		0.4523	0.3117	0.3891	0.3601	0.4095	0.1887		0.3988	0.2274	0.2661	0.5396
Chronic electrolyte disorders	0.3066	0.1571	0.4926	0.3009	0.5450	0.2981	0.5906	0.2919		0.5134	0.2858	0.4348	
Chronic alcohol diseases		0.1711							-0.3305		-0.0895		-0.1153
Hemiplegia	0.2658		0.3018		0.2999	0.2323		0.1523		0.0885	0.2372	0.1912	
Hypertension			0.0316			3.9233	0.1815		0.0074			0.1434	-0.0246
Iron deficiency anaemia	0.0921	0.1187	0.1455			0.1282	0.1488	0.1846					0.2224
Metastatic cancer		0.1797		-0.1770	-0.0730					0.0028			-0.1007
Hypothyroidism			0.1036				0.1343			0.2084		0.1463	
Neuromyopathies	0.2119		0.1043		0.3313	0.4552		0.1530					
Pulmonary hypertension	0.1890	0.0692	0.3460	0.1698	0.2875	1.8400	0.2332	0.2998	0.1501	0.1295		0.1465	0.4910
Treatment limitation decision	0.1651			-0.2313	0.2067	-0.0990		0.0978				-0.1319	
Psychiatric illness	0.1123		0.1235		0.1013				0.5608	0.4995			
Peptic ulcer disease					0.2199			0.9359		0.0872			
Peripheral vascular disease	0.3028	0.2203	0.3054	0.5370	0.1931		0.3533	0.1864		0.2963	0.1910	0.1826	
Valvular heart disease				0.2392		-0.2272	0.3147		-0.0727	0.1810			
Weight loss	0.2788		0.2811	0.1145	0.2135	0.1884	0.1370	0.2279		0.2641	0.1592	1.2553	
Obesity	0.2943		0.2267	0.1893	0.3420		0.1344	0.1377	0.3280				
Acute major trauma covariates													
Abdominal	0.2193	0.4255	0.4107	0.5079	0.1948	0.2675	0.2795	0.1624				0.2075	

Hospital-acquired complication class													
	1	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Thoracic	0.1855	0.3528	0.3858	0.1398	0.3906	0.3304	0.1680		0.2474	0.4256			
Cervical spine	0.4547		0.4010	0.1062	0.4902	0.4895				0.5237		0.2765	
Thoraco-lumbar spine	0.2501	0.3285	0.2498		0.1889		0.0566			0.2243			
Traumatic brain injury		1.3251	0.1437		0.1803	0.2931	-0.0770						
Burns			0.3769			0.3387	0.1879			0.4740		0.1858	
Acute diagnoses													
Acute coronary syndromes		0.1331	0.1614	0.3400	0.1162	0.1215	0.2068	0.1956		0.0646			
Acute heart failure	-0.2169		-0.7492	-0.3877	-0.8151	-0.5370	-0.5090	-0.3543	0.1353	-0.5425			
Acute kidney injury				-0.0540			-1.9145	0.0422				-0.1453	
Appendicitis			0.2833	0.2993						0.1151			
Adult respiratory distress syndrome	0.4880		0.6162				0.6161			0.5333			
Pre-hospital cardiac arrest	0.3710		0.4427		0.6646		0.3956			0.4265			
Aspiration pneumonitis	0.2160		0.1778	0.1424	-0.1153				-0.0660				
Acute asthma			-0.1829	-0.1298	-0.1663								
Community-acquired pneumonia, bacterial			-0.5244	-0.2438	0.0438		-0.0292		0.0133				
Community acquired pneumonia, viral	0.1795		-0.2458		0.2645		0.1080			0.1526		0.1406	
Bradycardia			-0.1154		-0.1076		-0.0800	-0.0903				-0.1792	
Breast cancer			-0.1728	0.1296			-0.1434						
Cardiogenic shock			0.3994				0.3007			0.3266			
Cellulitis			-0.0365	-0.1168	-0.1204	0.2081							0.1524
Cholangitis			0.2980	0.1952			0.1735			0.0578			
Cerebral abscess			0.3037			0.5674	0.2767	0.4173		0.3465	0.3664		
Intracranial tumour		0.4848	-0.2655				-0.2767				0.5100		
Coagulopathy, acquired	-0.2840		-0.5549	-0.4893	-0.3299	-0.3486	-0.6030	-0.5159	-2.2645	-0.4081	-0.2040	-0.3920	-0.6088
Bowel cancer							0.1025	0.4221			0.1863		
Acute delirium	-0.0866		-0.1323	-0.1734	-0.1063	-0.1327	-0.1177	-0.0804	-0.1793	-0.9876	-0.2810		
Diverticulitis			0.4845	0.6451			0.2186			0.2512		0.3684	
Diabetic ketoacidosis										0.2233		0.5052	
Encephalitis			0.3589		0.2830	0.3875	0.4223			0.6756	0.2955	0.2512	
Endocarditis			0.2291										0.6457
Epilepsy	0.0868			-0.1306	0.2642	0.1112			0.2769				
Fractured hip	0.4330	-0.0718	0.6379	0.6733	0.3756	0.1345	0.3495	0.1749		0.9674			
Gastric cancer			0.1491	-0.1263	0.2236	0.1203		0.2684					
Guillain-Barre syndrome	0.3638		0.4586		0.4711								
Gastrointestinal haemorrhage	-0.0205			-0.1881		0.1692		-0.1771					
Mesenteric ischaemia			0.1401				0.2429	0.1829		0.1181			
Glomerulonephritis			0.1248	0.3488				0.1368					
Head/neck cancer				0.2839	0.3445		-0.2436			0.0611			
Hepatic cirrhosis		0.2737						0.1470			0.1651	-0.2057	-0.3586
Hepatobiliary cancer							0.0967	0.1964					
Acute liver failure					-0.0750								-0.3472
Acquired immuno-deficiency Syndrome	0.3211							0.1990					

Hospital-acquired complication class													
	1	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Hyperosmolar diabetic disease states							0.2785						
Hypothermia injury	0.4262		0.2601	0.4175	0.3480							0.4885	
Intracerebral haemorrhage			0.3324		0.4103	0.1766				0.3854	0.3120		
Acute leukaemia		0.3970	0.6548	-0.3388	0.1595	0.2331	0.2302	0.1682	-1.1594	0.0431	0.1833	0.2642	
Acute lymphoma		-2.5204	0.3401			0.3187	0.2114		-0.8984		0.1254		-3.2117
Lung cancer					0.2422								
Melanoma											0.2503		
Myelodysplastic syndrome			0.3108			0.3157	0.2595						
Meningitis							0.4681			0.3565			
Multiple myeloma		-2.5232	0.4416			0.1484	0.2832		-0.7956				-3.1417
Necrotising fasciitis	0.5133		0.1125	0.2132				0.1358					
Bowel obstruction	0.1193		0.3966	0.3816	0.3474		0.1827	0.1611		0.1640	0.1042	0.2369	
Oesophageal cancer			0.1349		0.4378			0.2659					
Uterine/ovarian cancer							0.1783						
Osteomyelitis	0.3159	0.4401	0.1988	0.3101					0.1938	0.1209		0.2936	
Pancreatic cancer				-0.1468	-0.1004			0.3415		-0.1352			
Acute pancreatitis			0.2285		0.1519	0.2207		0.1371		0.0769		0.3348	
Peritonitis	0.2126		0.3502	0.3664	0.1358			0.4136		0.2929		0.1852	
Pressure injury area	-		0.1450							0.0642		-0.0521	
Prostate cancer			-0.1094		-0.1974	-0.1869				-0.0669	0.2270		
Pulmonary fibrosis					0.3433								0.4080
Pyelonepr hitis			-0.0227		-0.0898		-0.0490						
Reflux nephropathy			0.2610			-0.1573	0.5108						
Respiratory failure	0.1746			-0.0722	-0.1020	0.5844	0.0290			0.1228			
Subarachnoid haemorrhage	0.3107	-1.0974	0.5810	0.2383	0.4491					0.5216	0.4246	0.2873	-0.0283
Septic shock	0.0944				0.1635		0.0798		-0.2015	0.1654			
Sepsis	0.2995				0.3200		0.4683						
Circulatory shock				0.2174			0.1692	0.0975			0.1119	0.0929	0.1499
Status epilepticus			0.1559							0.3257		0.1621	
Acute stroke		0.2005	0.0742		0.2965	-0.2246				0.1689	0.1714		
Atrial tachyarrhythmia	-0.1293		-0.2415	-0.1791	-0.2323		-0.2201		0.1702	-0.2289	-0.1872	-0.2568	
Acute toxic syndrome			0.2530		0.5793		0.1784			0.3398	-0.4583	0.1320	
Urinary tract infection			0.0593	-0.2092			0.1860					-0.0836	-0.1435
Ventricular tachyarrhythmia	-0.1386					-0.8325	-0.1731	-0.1119	0.1895			-0.2163	
Venous thrombo-embolism			-0.1138						0.1968	-0.1710		-0.1576	
Clinical/laboratory signs													
Hypotension			-0.0737	-0.1349	-0.1519	-0.0937	-0.2692	-0.1209			-0.2064	-0.2128	
Fluid overload						-0.0776	-0.0525			-0.1000			
Impaired consciousness	-0.1531		-0.2725		-0.1992	-0.2080	-0.2852	-0.1345	-0.3707	0.0483	-0.4066	-0.1677	
Hyperglycaemia	0.3468		0.3788	0.3288	0.3323		0.5709	0.2107		0.4626	0.1879	0.4902	
Hyperkalaemia			-0.0718		-0.1074								
Hypernatraemia			-0.1438			-0.2362	-0.1630			-0.1260	-0.3711	-0.3380	
Hypokalaemia	-0.2618	-0.1368	-0.3996	-0.2676	-0.3898	-0.3065	-0.6623	-0.2284		-0.4265	-0.3195	-0.5687	

Hospital-acquired complication class													
	1	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Hyponatraemia	-0.1840			-0.2697	-0.4329	104.0181	-0.5379	-0.2160		-0.3584	-0.2792	-0.4055	
Metabolic acidosis			-0.2634		-0.1961		-0.1658			-0.2188	-0.2596	-0.1848	
Metabolic alkalosis							-0.2098						
Positive microbiology	0.2101		-0.0789		0.1312	0.2050	0.3243	0.1060		0.2324		0.0780	
Model constant	138.251	-55.985	22.385	-66.665	47.391		27.600	15.119	101.009	3.994	229.858	15.046	86.771
Number of covariates	62	33	94	63	81	57	83	57	30	76	38	58	23

Table 4. Hospital acquired complication risk prediction models: rationale for selecting probit estimators

HAC Class	1	2	3	4	6	7	8	9	10	11	12	13	14
	Information criteria probit *v* logit model												
***Δ* BIC**	–117.64	–31.77	–1061.06	–47.87	–586.83	–69.53	–1817.5	–187.01	–468.23	–776.17	–0.3	–2790.2	–147.97
***Δ* McFadden R^2**	0.002	0.001	0.000	0.003	–0.001	0.003	0.006	0.002	0.006	0.003	0.000	0.016	0.004

BIC = Bayesian information criterion.

Covariates were selected from on-admission demographic, diagnostic and comorbidity descriptors, as described in main text. The probit estimator was the preferred model[2] based on the information criteria (table 4) and binned residual plots (figure 3). The large study population with unbalanced hospital-acquired complication event frequencies possibly explains the difference in estimator performance.[2]

The probit coefficient differs from linear and logit regression coefficients; it describes the effect of a unit change in the covariate on the *z*-score or the probability of the cumulative (normal) distribution function of the outcome (dependent variable). The sign and size of probit coefficient indicate the direction and magnitude of the coefficient effect on the outcome variable; e.g., a large positive coefficient is associated with a large increase the probability of the outcome. Estimating the derivative (dYdX) of the margins — the effect on the outcome of a unit change in the covariate — is often preferred, and easier to interpret, as displayed in figures 1 and 4.

For readers more familiar with logistic regression and odds ratios (OR), an approximation of the logistic coefficient is as follows: ßlogit ≈ 1.61 x ßprobit and odds ratio ≈ e^(1.61 x ßprobit).

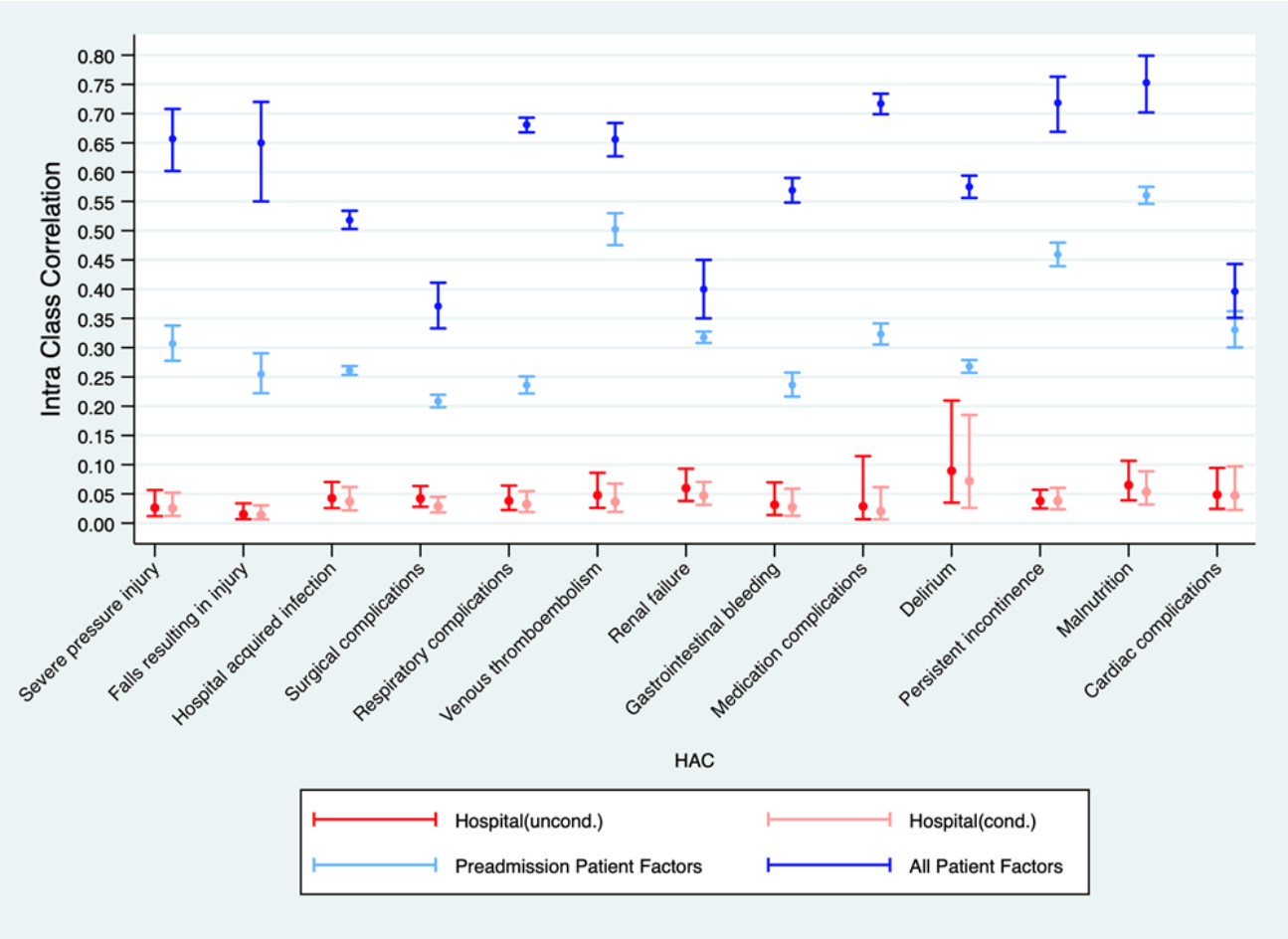
Table 5. Coefficients of variation and intra-class correlation coefficients

HAC code	HAC events	CV	Unconditional hospital level ICC	Conditional hospital level ICC	Unique patient risk score	Conditional patient level ICC	Conditional jurisdiction/peer group level ICC
1	3360	0.545	0.026 (0.012-0.056)	0.026 (0.012-0.052)	153 664	0.657 (0.602-0.708	0.016 (0.004-0.059)
2	1187	0.477	0.015 (0.007-0.034)	0.014 (0.006-0.031)	100 621	0.576 (0.550-0.602)	0.020 (0.012-0.033)
3	56 788	0.525	0.043 (0.26-0.070)	0.037 (0.022-0.062)	200 185	0.518 (0.503-0.534)	0.029 (0.078-0.102)
4	21 854	0.497	0.042 (0.028-0.063)	0.029 (0.018-0.045)	181 369	0.371 (0.333-0.411)	0.043 (0.008-0.200)
6	17 676	0.685	0.038 (0.023-0.064)	0.032 (0.019-0.055)	210 740	0.681 (0.668-0.693)	0.016 (0.008-0.198)
7	5571	0.795	0.048 (0.026-0.086)	0.036 (0.019-0.068)	76 860	0.656 (0.627-0.684)	0.028 (0.007-0.114)
8	33 200	0.593	0.060 (0.038-0.093)	0.047 (0.031-0.070)	195 014	0.318 (0.309-0.327)	0.005 (0.004-0.005)
9	6706	0.483	0.032 (0.014-0.070)	0.027 (0.012-0.059)	167 805	0.569 (0.548-0.590)	0.022 (0.007-0.069)
10	5810	0.420	0.029 (0.007-0.115)	0.020 (0.007-0.062)	179 825	0.717 (0.699-0.734)	0.004 (0.001-0.009)
11	28 006	0.565	0.090 (0.035-0.210)	0.072 (0.026-0.185)	167 392	0.575 (0.556-0.594)	0.009 (0.003-0.024)
12	3640	0.677	0.038 (0.025-0.057)	0.038 (0.024-0.060)	105 797	0.459 (0.439-0.480)	0.031 (0.011-0.084)
13	15 425	0.672	0.065 (0.039-0.107)	0.053 (0.032-0.089)	201 170	0.753 (0.702-0.799)	0.080 (0.014-0.342)
14	2286	0.680	0.049 (0.025-0.094)	0.047 (0.022-0.097)	100 613	0.396 (0.350-0.443	0.038 (0.012-0.114)
15*	4778	18.050	0.607 (0.412-0.773)	0.581 (0.263-0.863)	8411	0.626 (0.595-0.656)	0.027 (0.007-0.088)

As clinical diagnosis and selection of clinical treatment (e.g., surgery, or chemotherapy, or antibiotics) are the result of clinical decisions, guidelines and clinician judgement, there are risks of human and system errors. The table includes the conditional (adjusted) and unconditional (unadjusted, without patient factors) ICCs for the hospital level, and the conditional ICCs for the other two factors (also depicted in figure 1).

CV = coefficient of variation in crude hospital rates = [standard deviation] / [mean rate]; for this article we selected a conservative value of CV > 0.20 as indicating clinically significant variation to reduce the risk of type II error.

Figure 1. Intra-class correlations (and 95% CI) for each hospital-acquired complication class

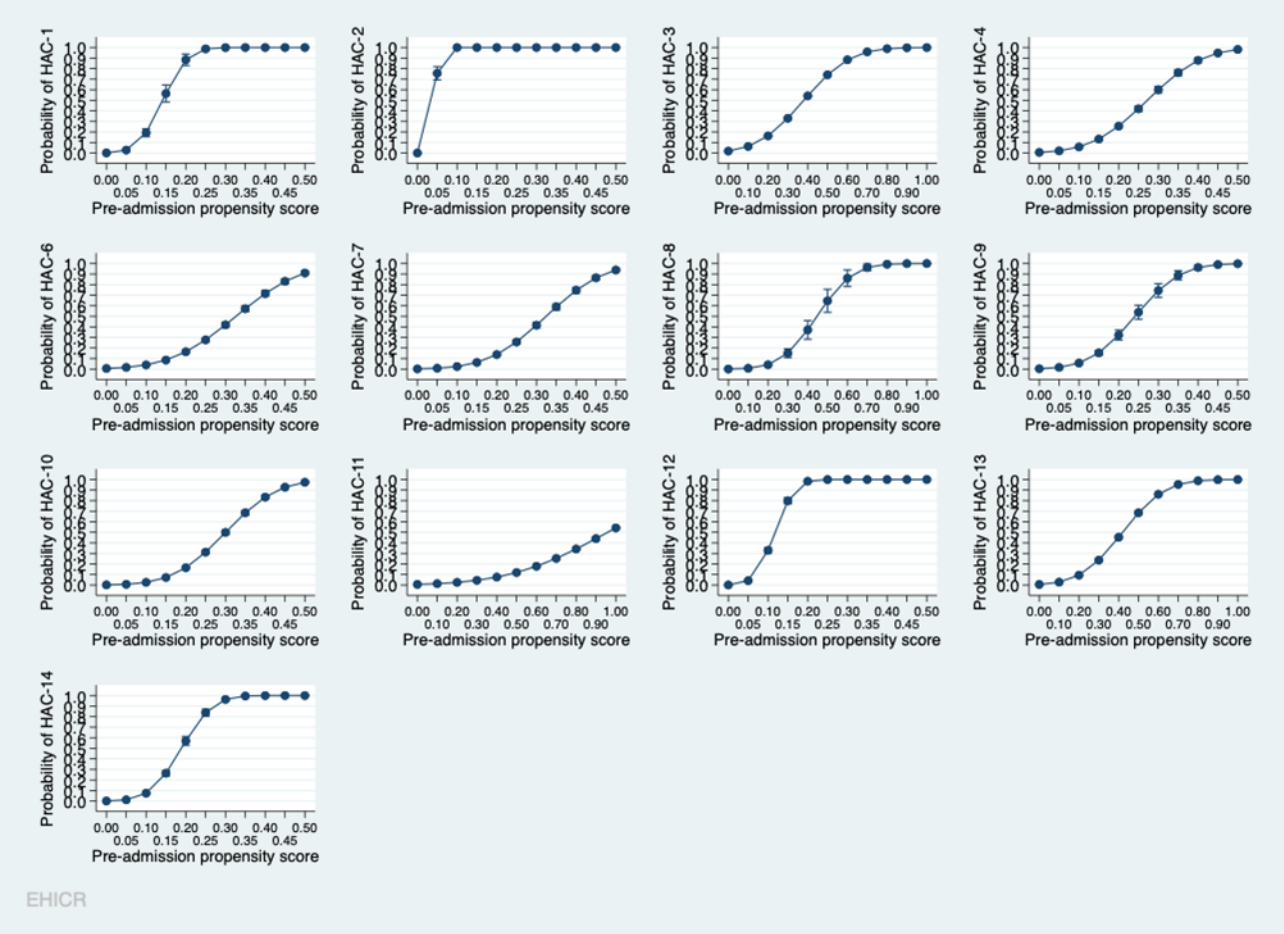


Hospital ICC is shown as both unadjusted/unconditional ICC (red bars) and after adjustment (conditional; pink bar) for pre-admission patient factors. Patient-related factor ICC is shown by the blue bars: pre-admission-only factors (demographic characteristics, chronic disease) by light-blue bars, and all on-admission factors (including all coded admission diagnoses and clinical signs) by the dark-blue bars. ICC values are probabilities and are not additive.

Mean ICC for pre-admission patient factors (excluding admission diagnosis): 0.33 (95% CI, 0.30-0.37).

Mean ICC for on-admission patient factors (including admission diagnosis): 0.55 (95% CI, 0.53-0.57).

Figure 2. Sensitivity analysis: margin plots (95% CI) for conditional probability of hospital-acquired complication event based on patient-related factors present prior to admission, by hospital-acquired complication class



We re-estimated patient propensity for hospital-acquired complication events, restricting this analysis to patient demographic factors and chronic disease present before arrival at hospital; i.e., excluding acute admission diagnoses and clinical symptoms. Note the different abscissa scale for hospital-acquired complication classes 3, 8, 11, 13. The binned residuals are depicted in figure 3; individual clinical covariates are tabulated in table 3.

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Figure 3. Sensitivity analysis: binned residuals (and 95% CI boundaries) for probit models fitted to each hospital-acquired complication class, incorporating pre-admission patient factors

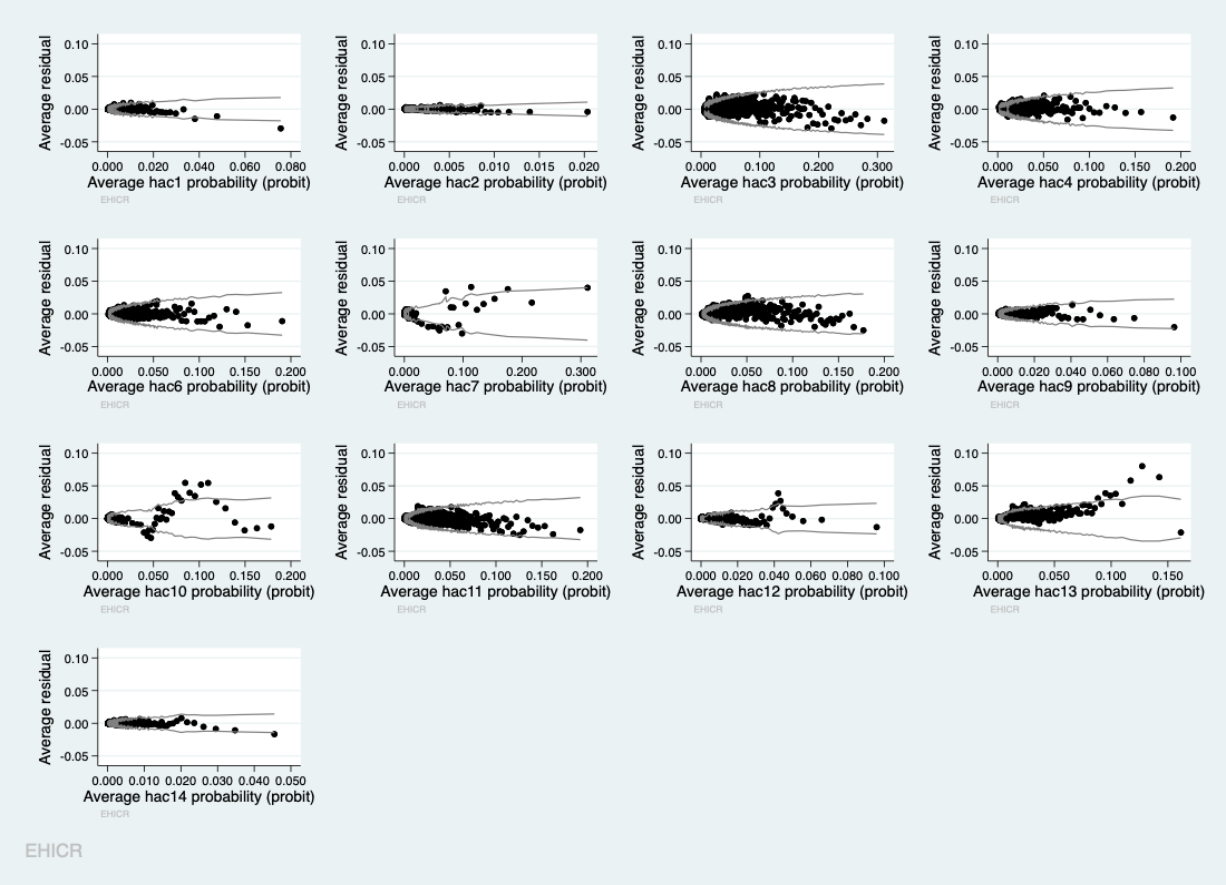
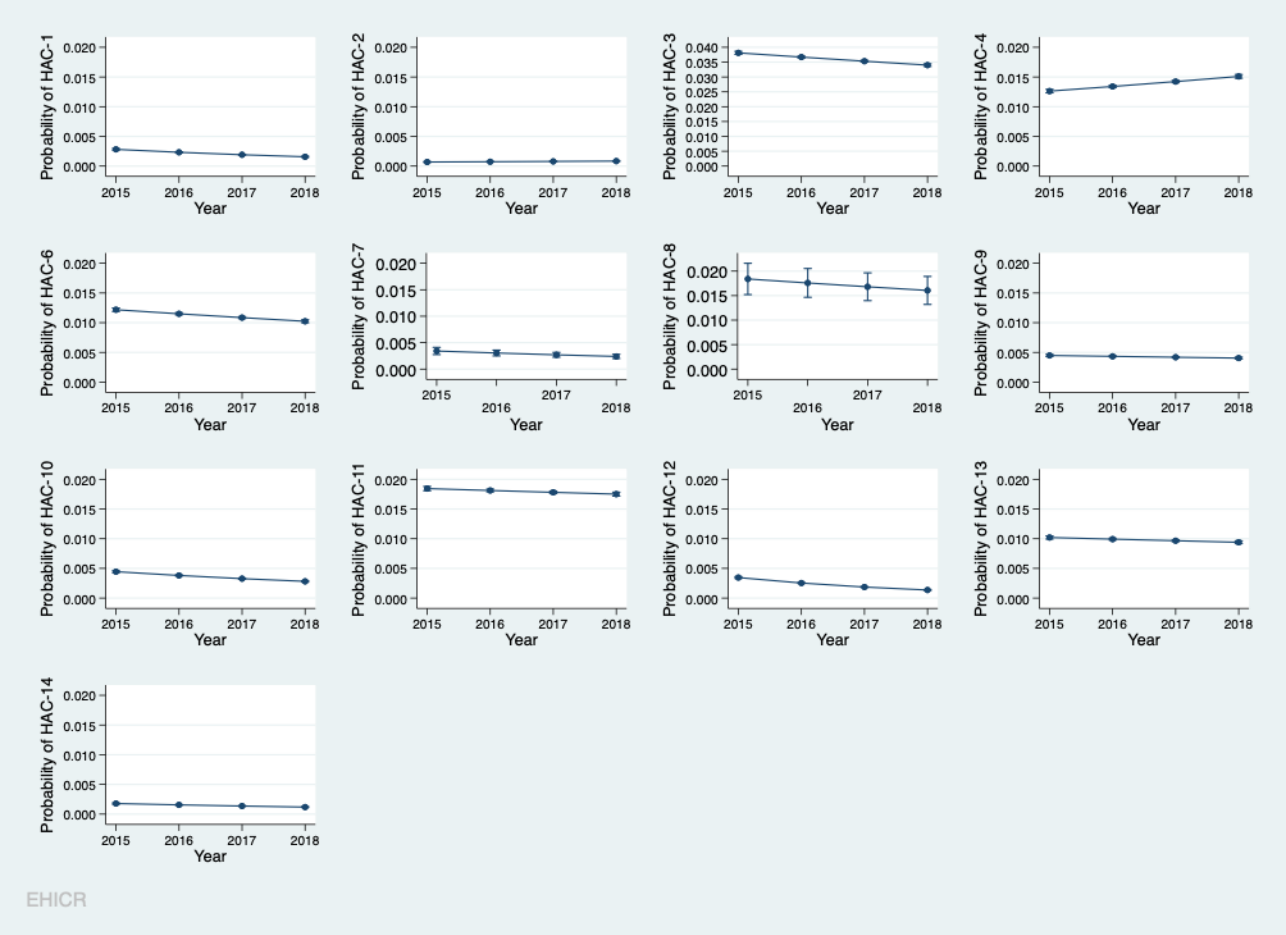


Figure 4. Margin plots (95% CI) for change in conditional probability of hospital-acquired complication, by class



There was an overall decline of 0.45 [95% CI, 0.42–0.49] per 100 separations per year. The annual change for each hospital-acquired complication subclass, adjusted for patient factors, are presented in table 6.

A small increase in reported hospital-acquired complication was observed in two categories (2. falls with injury; 4. surgical complications) and small declines in nine categories (1. pressure injury; 3. hospital-acquired infections; 6. acute respiratory complications; 7. venous thrombo-embolism; 10. medication complications; 11. delirium; 12. incontinence; 14. cardiac complications; 15 perineal tear during delivery [not shown]). Whether these changes reflect changes in clinical documentation or coding, or a clinically significant change in event rates, cannot be deduced from these data.

Table 6. Derivative of the margins (95% CI) for annual trend for each hospital-acquired complication class.

hospital-acquired complication	Year trend per 100 separations
1. Pressure injury, severe grade 3/4	–0.037 (–0.044 to –0.031)
2. Falls resulting in injury	+0.007 (+0.004 to +0.011)
3. Hospital acquired infection	–0.103 (–0.128 to –0.077)
4. Surgical complications	+0.132 (+0.119 to +0.146)
6. Respiratory complications	–0.027 (–0.040 to –0.015)
7. Venous thrombo-embolism	–0.029 (–0.004 to –0.022)
8. Renal failure	–0.007 (–0.035 to –0.002)
9. Gastrointestinal bleeding	–0.006 (–0.001 to +0.004)
10. Medication complications	–0.045 (–0.053 to –0.037)
11. Delirium	–0.014 (–0.020 to –0.007)
12. Persistent incontinence	–0.065 (–0.072 to –0.059)
13. Malnutrition	+0.009 (–0.003 to +0.022)
14. Cardiac complications	–0.028 (–0.032 to–0.023)
All hospital-acquired complication events	–0.454 (–0.492 to –0.416)

Data adjusted for patient risk score. Derivative of the margins indicates the rate of change in hospital-acquired complication events per 100 separations for each one year time increment

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1. Australian Bureau of Statistics. Population: states and territories. https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release#states-and-territories (viewed Aug 2021).

2. Hahn ED, Soyer R. Probit and logit models: Differences in the multivariate realm. *Journal of the Royal Statistical Society, Series B* 2005; https://home.gwu.edu/~soyer/mv1h.pdf (accessed August 2021).