Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Supplementary Appendix for "Physician-level variation in clinical outcomes and resource use in inpatient general medicine"

Amol A. Verma, Yishan Guo, Hae Young Jung, Andreas Laupacis, Muhammad Mamdani, Allan S. Detsky, Adina Weinerman, Terence Tang, Shail Rawal, Lauren Lapointe-Shaw, Janice L. Kwan, Fahad Razak

Table of Contents

Table R. Physician-level variation in 30-day readmission, single attending physician.

Table S. Physician-level variation in use of advanced imaging, single attending physician.

Table T. Characteristics of hospital admissions across physicians categorized by in-hospital mortality, excluding patients with a palliative diagnosis code

Appendix Sample Size Calculation

In order to determine whether there was sufficient sample size to determine if physician-level variations were stable over time, we estimated the sample size needed to identify a 1.4% physician-level difference in mortality and 2.3% difference in readmission rates. These differences reflect a 40% attenuation of the observed difference between the highest and lowest physician quartiles in our main analysis. We selected this difference because we observed a 42% attenuation in the physician-level difference in hospital length-of-stay and 36% attenuation in imaging use in the split-sample validation. To reflect the hierarchical nature of our data (hospitalizations clustered within physicians clustered within hospitals), we performed a power analysis by simulating hypothetical data based on 3-level logistic regression model estimates from our cohort.[1] Detailed steps follow below.

1. We used the data in our cohort (n = 103,503) to estimate physician- and hospital-level variation by fitting a 3-level logistic regression model with random intercept terms at physician and hospital levels.

2. We used parameter estimates from step 1 to generate simulated cohorts with varying numbers of physicians per hospital, using 3-level logistic regression models to predict the outcome of interest. The number of patients per physician was fixed at the average number in our sample (760) and the number of hospitals was fixed at 7 to reflect our study cohort.

3. For each simulated cohort, we replicated the main analysis from our manuscript, comparing physicians in the highest and lowest quartile (categorized within-hospital) for each outcome. We used cluster-adjusted chi-squared tests (accounting for hospital-level clustering)[2] to test the hypothesis that the true difference between quartiles was larger than 1.4% for mortality, 2.3% for readmission, and 0.7 days for length-of-stay.

4. To estimate power, we repeated steps 2 and 3 for 1000 iterations for each value of the numbers of physicians per hospital ranging from 2 to 30. Finally, we computed power as the proportion of the 1000 iterations where the result was statistically significant. The result is shown below.

Interpretation: Statistical power to detect the relevant mortality and readmission differences was lower than to detect differences in hospital length-of-stay. In our main study sample (7 hospitals, 135 physicians) there were approximately 20 physicians per hospital, which would offer nearly 80% power to detect the relevant difference in all three outcomes. However, in the split-sample validation (7 hospitals, 80 physicians), there was less statistical power, particularly for mortality. Moreover, our process of assigning physicians to quartiles within a hospital is likely much less reliable with the smaller number of physicians per hospital. Thus, we did not have sufficient sample size to demonstrate stability over time in physician-level variations in mortality or readmission.
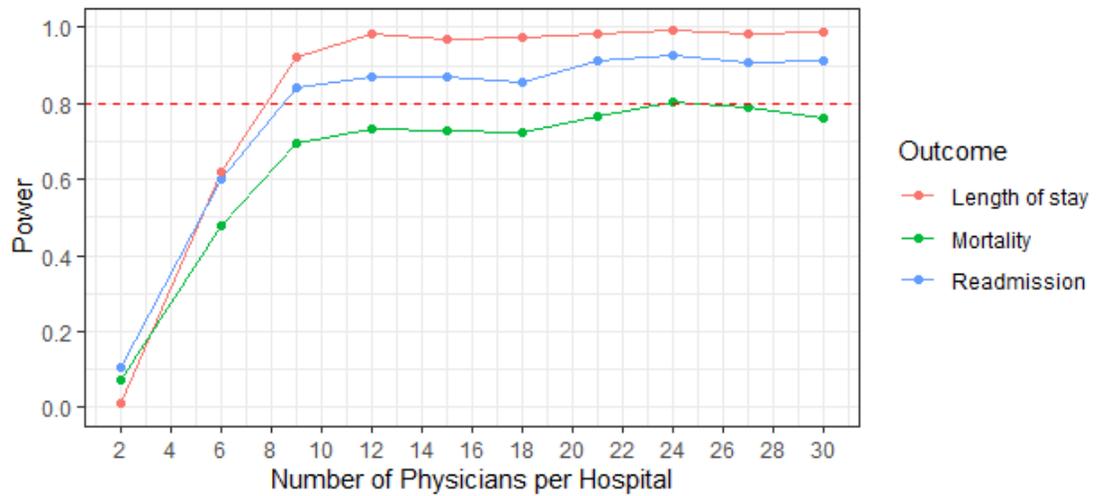
Reference:

1. Gelman A, Hill J. Data analysis using regression and multilevel/hierarchical models (Analytical Methods for Social Research). 2006. Cambridge: Cambridge University Press.

2. Donner A, Birkett N, Buck C. Randomization by Cluster: Sample Size Requirements and Analysis. *Am J Epidemiol* 1981;114(6):906-914. doi:10.1093/oxfordjournals.aje.a113261.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance
placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table A. Characteristics of hospital admissions across physicians categorized by length-of-stay.

Characteristic	Physician Length-of-Stay Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	27670	28294	23294	23827	
Length-of-stay – days, mean (SD)	5.7 (5.4)	6.1 (5.7)	6.4 (5.7)	6.9 (5.9)	0.22
Age – median (IQR)	72 (55, 83)	73 (56, 84)	73 (56, 84)	74 (57, 84)	0.07
Female Sex – N (%)	14054 (50.8)	14290 (50.5)	11825 (50.8)	12023 (50.5)	0.01
High Charlson Comorbidity Score[a] – N (%)	11438 (41.3)	12265 (43.3)	10107 (43.4)	10100 (42.4)	0.04
Day of admission – weekday	20407 (73.8)	20913 (73.9)	16965 (72.8)	17242 (72.4)	0.04
Time of admission – daytime[b]	5640 (20.4)	6305 (22.3)	4455 (19.1)	5883 (24.7)	0.14
Previous hospitalization within 30 days – Yes (%)	3035 (11.3)	3070 (11.2)	2554 (11.2)	2432 (10.5)	0.03
LAPS Score[c] – mean, SD	20.3 (17.4)	19.5 (17.2)	19.8 (17.4)	21.2 (17.9)	0.10
Discharge Diagnoses[d]					
Pneumonia	1511 (5.5)	1554 (5.5)	1290 (5.5)	1247 (5.2)	0.01
Urinary Tract Infection	1436 (5.2)	1564 (5.5)	1204 (5.2)	1313 (5.5)	0.02
Heart Failure	1308 (4.7)	1469 (5.2)	1223 (5.3)	1161 (4.9)	0.02
COPD	1219 (4.4)	1264 (4.5)	1038 (4.5)	1113 (4.7)	0.01
Stroke	829 (3.0)	797 (2.8)	720 (3.1)	987 (4.1)	0.07
Gastrointestinal Hemorrhage	856 (3.1)	867 (3.1)	689 (3.0)	669 (2.8)	0.02
Delirium, Dementia, Cognitive Disorder	769 (2.8)	803 (2.8)	661 (2.8)	707 (3.0)	0.01
Fluid and Electrolyte Disorder	778 (2.8)	764 (2.7)	627 (2.7)	596 (2.5)	0.02
Intestinal Infection	739 (2.7)	719 (2.5)	592 (2.5)	546 (2.3)	0.02
Diabetes mellitus with complication	670 (2.4)	664 (2.3)	539 (2.3)	581 (2.4)	<0.01

Table A Legend. Physicians were categorized into quartiles within each hospital based on length-of-stay. The "maximum standardized difference" was calculated by comparing the two quartiles with the largest mean difference. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table B. Characteristics of hospital admissions across physicians categorized by 30-day readmission.

Characteristic	Physician Readmission Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	25320	26683	27065	17016	
Readmission – N (%)	3513 (13.9)	4267 (16.0)	4446 (16.4)	3027 (17.8)	0.11
Age – median (IQR)	72 (56, 83)	71 (55, 83)	73 (56, 84)	72 (55, 83)	0.06
Female Sex – N (%)	12939 (51.1)	13170 (49.4)	13972 (51.6)	8698 (51.1)	0.05
High Charlson Comorbidity Score[a] – N (%)	9978 (39.4)	11033 (41.3)	11094 (41.0)	7222 (42.4)	0.06
Day of admission – weekday	18677 (73.8)	19780 (74.1)	19844 (73.3)	12176 (71.6)	0.06
Time of admission – daytime[b]	5531 (21.8)	5789 (21.7)	5223 (19.3)	4050 (23.8)	0.11
Previous hospitalization within 30 days – Yes (%)	2556 (10.2)	2925 (11.1)	2889 (10.9)	1841 (11.0)	0.03
LAPS Score[c] – mean, SD	19.4 (16.6)	18.7 (16.6)	20.0 (17.0)	19.5 (16.6)	0.07
Discharge Diagnoses[d]					
Pneumonia	1298 (5.1)	1496 (5.6)	1508 (5.6)	846 (5.0)	0.03
Urinary Tract Infection	1432 (5.7)	1405 (5.3)	1468 (5.4)	1045 (6.1)	0.04
Heart Failure	1169 (4.6)	1358 (5.1)	1380 (5.1)	873 (5.1)	0.02
COPD	1194 (4.7)	1194 (4.5)	1274 (4.7)	765 (4.5)	0.01
Stroke	887 (3.5)	792 (3.0)	756 (2.8)	481 (2.8)	0.04
Gastrointestinal Hemorrhage	742 (2.9)	884 (3.3)	819 (3.0)	495 (2.9)	0.02
Delirium, Dementia, Cognitive Disorder	739 (2.9)	738 (2.8)	796 (2.9)	497 (2.9)	0.01
Fluid and Electrolyte Disorder	726 (2.9)	704 (2.6)	723 (2.7)	514 (3.0)	0.02
Intestinal Infection	686 (2.7)	685 (2.6)	682 (2.5)	429 (2.5)	0.01
Diabetes mellitus with complication	625 (2.5)	649 (2.4)	659 (2.4)	440 (2.6)	0.01

Table B Legend. Physicians were categorized into quartiles within each hospital based on the rate of 30-day readmission at a participating hospital. Patients who died in hospital were excluded from the calculation. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Table C. Characteristics of hospital admissions across physicians categorized by advanced imaging.

Characteristic	Physician Imaging Quartile				Maximum Standardized Difference
	1	2	3	4	
Number of Admissions	29252	26348	19679	27806	
Advanced Imaging – tests, mean (SD)	1.1 (1.3)	1.2 (1.3)	1.3 (1.4)	1.5 (1.5)	0.26
Age – median (IQR)	73.0 (55, 84)	73 (56, 84)	73 (56, 84)	73 (56, 84)	0.03
Female Sex – N (%)	14958 (51.1)	13346 (50.7)	9952 (50.6)	13936 (50.1)	0.02
High Charlson Comorbidity Score[a] – N (%)	12488 (42.7)	11031 (41.9)	8120 (41.3)	12271 (44.1)	0.06
Day of admission – weekday	21532 (73.6)	18690 (70.9)	14580 (74.1)	20725 (74.5)	0.08
Time of admission – daytime[b]	6315 (21.6)	5452 (20.7)	4172 (21.2)	6344 (22.8)	0.05
Previous hospitalization within 30 days – Yes (%)	3254 (11.4)	2818 (11.0)	2037 (10.7)	2982 (11.0)	0.03
LAPS Score[c] – mean, SD	20.2 (17.5)	20.5 (17.5)	20.7 (17.7)	19.5 (17.2)	0.07
Discharge Diagnoses[d]					
Pneumonia	1535 (5.2)	1471 (5.6)	1043 (5.3)	1553 (5.6)	0.02
Urinary Tract Infection	1468 (5.0)	1423 (5.4)	1155 (5.9)	1471 (5.3)	0.04
Heart Failure	1527 (5.2)	1329 (5.0)	936 (4.8)	1369 (4.9)	0.02
COPD	1299 (4.4)	1287 (4.9)	846 (4.3)	1202 (4.3)	0.03
Stroke	831 (2.8)	774 (2.9)	626 (3.2)	1102 (4.0)	0.06
Gastrointestinal Hemorrhage	942 (3.2)	763 (2.9)	579 (2.9)	797 (2.9)	0.02
Delirium, Dementia, Cognitive Disorder	843 (2.9)	756 (2.9)	547 (2.8)	794 (2.9)	0.01
Fluid and Electrolyte Disorder	866 (3.0)	718 (2.7)	492 (2.5)	689 (2.5)	0.03
Intestinal Infection	764 (2.6)	630 (2.4)	508 (2.6)	694 (2.5)	0.01
Diabetes mellitus with complication	723 (2.5)	632 (2.4)	468 (2.4)	631 (2.3)	0.01

Table C Legend. Physicians were categorized into quartiles within each hospital based on the use of advanced imaging, defined as number of CT, ultrasound, and MRI scans per admission. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Table D. Physician-level variation in in-hospital mortality after propensity score matching.

	Lowest Physician Quartile	Highest Physician Quartile	Standardized Difference
Number of Admissions	13476	13476	
Mortality – N (%)	524 (3.9)	854 (6.3)	0.11*
Age – median (IQR)	72 (56, 83)	72 (56, 83)	<0.01
Female Sex – N (%)	6764 (50.2)	6764 (50.2)	<0.01
High Charlson Comorbidity Score[a] – N (%)	5927 (44.0)	6102 (45.3)	0.03
Day of admission – weekday	9979 (74.1)	10351 (76.8)	0.06
Time of admission – daytime[b]	2680 (19.9)	3361 (24.9)	0.12
Previous hospitalization within 30 days – Yes (%)	1474 (11.2)	1657 (12.6)	0.04
LAPS Score[c] – mean, SD	19.2 (16.8)	19.9 (17.2)	0.04
Discharge Diagnoses[d]			
Pneumonia	806 (6.0)	706 (5.2)	0.03
Urinary Tract Infection	773 (5.7)	691 (5.1)	0.03
Heart Failure	693 (5.1)	789 (5.9)	0.03
COPD	636 (4.7)	623 (4.6)	0.01
Stroke	349 (2.6)	276 (2.0)	0.04
Gastrointestinal Hemorrhage	438 (3.3)	520 (3.9)	0.03
Delirium, Dementia, Cognitive Disorder	393 (2.9)	403 (3.0)	<0.01
Fluid and Electrolyte Disorder	360 (2.7)	380 (2.8)	0.01
Intestinal Infection	367 (2.7)	359 (2.7)	<0.01
Diabetes mellitus with complication	318 (2.4)	362 (2.7)	0.02

Table D Legend. Physicians were categorized into quartiles within each hospital based on in-hospital mortality. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in mortality between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Table E. Physician-level variation in length-of-stay after propensity score matching.

	Lowest Physician Quartile	Highest Physician Quartile	Standardized Difference
Number of Admissions	18119	18119	
Length-of-Stay – days, mean (SD)	5.7 (5.4)	6.9 (5.9)	0.21*
Age – median (IQR)	74 (58, 84)	74 (58, 84)	<0.01
Female Sex – N (%)	9102 (50.2)	9102 (50.2)	<0.01
High Charlson Comorbidity Score[a] – N (%)	7522 (41.5)	7813 (43.1)	0.03
Day of admission – weekday	13343 (73.6)	13148 (72.6)	0.02
Time of admission – daytime[b]	3582 (19.8)	4212 (23.2)	0.09
Previous hospitalization within 30 days – Yes (%)	1883 (10.7)	1833 (10.4)	0.01
LAPS Score[c] – mean, SD	21.0 (17.5)	21.3 (17.9)	0.02
Discharge Diagnoses[d]			
Pneumonia	1046 (5.8)	984 (5.4)	0.02
Urinary Tract Infection	1006 (5.6)	1043 (5.8)	<0.01
Heart Failure	952 (5.3)	940 (5.2)	<0.01
COPD	847 (4.7)	953 (5.3)	0.03
Stroke	596 (3.3)	723 (4.0)	0.04
Gastrointestinal Hemorrhage	592 (3.3)	539 (3.0)	0.02
Delirium, Dementia, Cognitive Disorder	574 (3.2)	593 (3.3)	<0.01
Fluid and Electrolyte Disorder	534 (2.9)	445 (2.5)	0.03
Intestinal Infection	483 (2.7)	417 (2.3)	0.02
Diabetes mellitus with complication	430 (2.4)	473 (2.6)	0.02

Table E Legend. Physicians were categorized into quartiles within each hospital based on length-of-stay. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in length-of-stay between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Table F. Physician-level variation in 30-day readmission after propensity score matching.

	Lowest Physician Quartile	Highest Physician Quartile	Standardized Difference
Number of Admissions	13497	13497	
Readmission – N (%)	1927 (14.3)	2370 (17.6)	0.09*
Age – median (IQR)	74 (58, 84)	74 (58, 84)	<0.01
Female Sex – N (%)	6912 (51.2)	6912 (51.2)	<0.01
High Charlson Comorbidity Score[a] – N (%)	5670 (42.0)	5682 (42.1)	<0.01
Day of admission – weekday	9927 (73.5)	9661 (71.6)	0.04
Time of admission – daytime[b]	2920 (21.6)	3185 (23.6)	0.05
Previous hospitalization within 30 days – Yes (%)	1387 (10.4)	1435 (10.7)	0.01
LAPS Score[c] – mean, SD	19.8 (16.3)	20.1 (16.7)	0.02
Discharge Diagnoses[d]			
Pneumonia	758 (5.6)	710 (5.3)	0.02
Urinary Tract Infection	784 (5.8)	902 (6.7)	0.04
Heart Failure	688 (5.1)	772 (5.7)	0.03
COPD	691 (5.1)	688 (5.1)	<0.01
Stroke	467 (3.5)	434 (3.2)	0.01
Gastrointestinal Hemorrhage	412 (3.1)	429 (3.2)	0.01
Delirium, Dementia, Cognitive Disorder	445 (3.3)	456 (3.4)	0.01
Fluid and Electrolyte Disorder	421 (3.1)	448 (3.3)	0.01
Intestinal Infection	381 (2.8)	346 (2.6)	0.02
Diabetes mellitus with complication	341 (2.5)	355 (2.6)	0.01

Table F Legend. Physicians were categorized into quartiles within each hospital based on the rate of 30-day readmission at a participating hospital. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in readmission between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

10

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance
placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table G. Physician-level variation in use of advanced imaging after propensity score matching.

	Lowest Physician Quartile	Highest Physician Quartile	Standardized Difference
Number of Admissions	19821	19821	
Advanced Imaging – tests, mean (SD)	1.12 (1.27)	1.44 (1.48)	0.24*
Age – median (IQR)	73 (57, 84)	73 (57, 84)	<0.01
Female Sex – N (%)	9989 (50.4)	9989 (50.4)	<0.01
High Charlson Comorbidity Score[a] – N (%)	8493 (42.8)	8801 (44.4)	0.03
Day of admission – weekday	14593 (73.6)	14832 (74.8)	0.03
Time of admission – daytime[b]	4208 (21.2)	4699 (23.7)	0.06
Previous hospitalization within 30 days – Yes (%)	2178 (11.2)	2030 (10.5)	0.03
LAPS Score[c] – mean, SD	20.1 (17.3)	19.7 (17.4)	0.02
Discharge Diagnoses[d]			
Pneumonia	1019 (5.1)	1299 (6.6)	0.06
Urinary Tract Infection	1033 (5.2)	1179 (5.9)	0.03
Heart Failure	1150 (5.8)	876 (4.4)	0.06
COPD	931 (4.7)	1022 (5.2)	0.02
Stroke	562 (2.8)	665 (3.4)	0.03
Gastrointestinal Hemorrhage	687 (3.5)	543 (2.7)	0.04
Delirium, Dementia, Cognitive Disorder	620 (3.1)	622 (3.1)	<0.01
Fluid and Electrolyte Disorder	622 (3.1)	381 (1.9)	0.08
Intestinal Infection	555 (2.8)	486 (2.5)	0.02
Diabetes mellitus with complication	531 (2.7)	421 (2.1)	0.04

Table G Legend. Physicians were categorized into quartiles within each hospital based on the use of advanced imaging, defined as number of CT, ultrasound, and MRI scans per admission. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in advanced imaging use between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table H. Physician-level variation in in-hospital mortality after propensity score matching, restricted to 10 most common discharge diagnoses.

	Lowest Quartile	Highest Quartile	Standardized Difference
Number of Admissions	4443	4443	
Mortality – N (%)	144 (3.2)	218 (4.9)	0.09*
Age – median (IQR)	78 (65, 86)	78 (65, 86)	<0.01
Female Sex – N (%)	2243 (50.5)	2243 (50.5)	<0.01
High Charlson Comorbidity Score[a] – N (%)	2195 (49.4)	2304 (51.9)	0.05
Day of admission – weekday	3241 (72.9)	3559 (80.1)	0.17
Time of admission – daytime[b]	890 (20.0)	1134 (25.5)	0.13
Previous hospitalization within 30 days – Yes (%)	481 (11.0)	590 (13.6)	0.08
LAPS Score[c] – mean, SD	21.4 (16.9)	21.1 (16.2)	0.02
Discharge Diagnoses[d]			
Pneumonia	678 (15.3)	575 (12.9)	0.07
Urinary Tract Infection	667 (15.0)	621 (14.0)	0.03
Heart Failure	638 (14.4)	707 (15.9)	0.04
COPD	582 (13.1)	563 (12.7)	0.01
Stroke	296 (6.7)	259 (5.8)	0.03
Gastrointestinal Hemorrhage	385 (8.7)	446 (10.0)	0.05
Delirium, Dementia, Cognitive Disorder	342 (7.7)	346 (7.8)	<0.01
Fluid and Electrolyte Disorder	305 (6.9)	311 (7.0)	0.01
Intestinal Infection	288 (6.5)	300 (6.8)	0.01
Diabetes mellitus with complication	262 (5.9)	315 (7.1)	0.05

Table H Legend. Physicians were categorized into quartiles within each hospital based on in-hospital mortality. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in mortality between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [d]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Table I. Physician-level variation in length-of-stay after propensity score matching, restricted to 10 most common discharge diagnoses.

	Lowest Quartile	Highest Quartile	Standardized Difference
Number of Admissions	6236	6236	
Length-of-Stay – days, mean (SD)	5.82 (5.19)	7.04 (5.77)	0.22*
Age – median (IQR)	78 (66, 86)	78 (66, 86)	<0.01
Female Sex – N (%)	3194 (51.2)	3194 (51.2)	<0.01
High Charlson Comorbidity Score[a] – N (%)	2889 (46.3)	3074 (49.3)	0.06
Day of admission – weekday	4497 (72.1)	4460 (71.5)	0.01
Time of admission – daytime[b]	1273 (20.4)	1524 (24.4)	0.10
Previous hospitalization within 30 days – Yes (%)	687 (11.3)	731 (12.0)	0.02
LAPS Score[c] – mean, SD	22.9 (17.0)	23.6 (17.7)	0.04
Discharge Diagnoses[d]			
Pneumonia	916 (14.7)	898 (14.4)	<0.01
Urinary Tract Infection	918 (14.7)	951 (15.3)	0.02
Heart Failure	882 (14.1)	834 (13.4)	0.02
COPD	731 (11.7)	872 (14.0)	0.07
Stroke	497 (8.0)	595 (9.5)	0.06
Gastrointestinal Hemorrhage	521 (8.4)	460 (7.4)	0.04
Delirium, Dementia, Cognitive Disorder	540 (8.7)	521 (8.4)	0.01
Fluid and Electrolyte Disorder	455 (7.3)	382 (6.1)	0.05
Intestinal Infection	403 (6.5)	324 (5.2)	0.05
Diabetes mellitus with complication	373 (6.0)	399 (6.4)	0.02

Table I Legend. Physicians were categorized into quartiles within each hospital based on length-of-stay. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in length-of-stay between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

Table J. Physician-level variation in 30-day readmission after propensity score matching, restricted to 10 most common discharge diagnoses.

	Lowest Quartile	Highest Quartile	Standardized Difference
Number of Admissions	4642	4642	
Readmission – N (%)	647 (13.9)	839 (18.1)	0.11*
Age – median (IQR)	79 (67, 86)	79 (67, 86)	<0.01
Female Sex – N (%)	2417 (52.1)	2417 (52.1)	<0.01
High Charlson Comorbidity Score[a] – N (%)	2257 (48.6)	2339 (50.4)	0.04
Day of admission – weekday	3402 (73.3)	3301 (71.1)	0.05
Time of admission – daytime[b]	997 (21.5)	1119 (24.1)	0.06
Previous hospitalization within 30 days – Yes (%)	521 (11.3)	508 (11.1)	0.01
LAPS Score[c] – mean, SD	22.0 (16.2)	22.4 (16.5)	0.03
Discharge Diagnoses[d]			
Pneumonia	616 (13.3)	577 (12.4)	0.03
Urinary Tract Infection	669 (14.4)	759 (16.4)	0.05
Heart Failure	681 (14.7)	694 (15.0)	0.01
COPD	583 (12.6)	588 (12.7)	<0.01
Stroke	386 (8.3)	352 (7.6)	0.03
Gastrointestinal Hemorrhage	368 (7.9)	345 (7.4)	0.02
Delirium, Dementia, Cognitive Disorder	414 (8.9)	390 (8.4)	0.02
Fluid and Electrolyte Disorder	363 (7.8)	375 (8.1)	0.01
Intestinal Infection	286 (6.2)	279 (6.0)	0.01
Diabetes mellitus with complication	276 (5.9)	283 (6.1)	0.01

Table J Legend. Physicians were categorized into quartiles within each hospital based on the rate of 30-day readmission at a participating hospital. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in readmission between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

14

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table K. Physician-level variation in use of advanced imaging after propensity score matching, restricted to 10 most common discharge diagnoses.

	Lowest Quartile	Highest Quartile	Standardized Difference
Number of Admissions	6967	6967	
Advanced Imaging – tests, mean (SD)	0.97 (1.19)	1.22 (1.34)	0.20*
Age – median (IQR)	78 (65, 86)	78 (65, 86)	<0.01
Female Sex – N (%)	3589 (51.5)	3589 (51.5)	<0.01
High Charlson Comorbidity Score[a] – N (%)	3428 (49.2)	3395 (48.7)	<0.01
Day of admission – weekday	5033 (72.2)	5348 (76.8)	0.10
Time of admission – daytime[b]	1557 (22.3)	1784 (25.6)	0.08
Previous hospitalization within 30 days – Yes (%)	821 (12.1)	739 (10.9)	0.04
LAPS Score[c] – mean, SD	22.1 (16.8)	21.3 (17.0)	0.05
Discharge Diagnoses[d]			
Pneumonia	881 (12.6)	1316 (18.9)	0.17
Urinary Tract Infection	970 (13.9)	1186 (17.0)	0.09
Heart Failure	1090 (15.6)	802 (11.5)	0.12
COPD	832 (11.9)	1066 (15.3)	0.10
Stroke	477 (6.8)	477 (6.8)	<0.01
Gastrointestinal Hemorrhage	641 (9.2)	501 (7.2)	0.07
Delirium, Dementia, Cognitive Disorder	608 (8.7)	626 (9.0)	<0.01
Fluid and Electrolyte Disorder	497 (7.1)	243 (3.5)	0.16
Intestinal Infection	516 (7.4)	407 (5.8)	0.06
Diabetes mellitus with complication	455 (6.5)	343 (4.9)	0.07

Table K Legend. Physicians were categorized into quartiles within each hospital based on the use of advanced imaging, defined as number of CT, ultrasound, and MRI scans per admission. Admissions were matched in the highest and lowest quartile based on age, sex, hospital site, fiscal year of admission and propensity score. A standardized difference less than 0.1 is considered to be well-balanced. *The p-value for the difference in advanced imaging use between highest and lowest physician quartile was <0.01. [a]Charlson comorbidity score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 16:59 were considered "daytime" admissions. [c]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes.

15

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance
placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table L. Physician-level variation in in-hospital mortality, split-sample validation.

Admission Characteristics in Second Study Period	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	12409	15502	12598	11932	
Mortality in First Period* – N (%)	251 (3.8)	401 (4.7)	409 (5.4)	492 (7.1)	0.15
Mortality in Second Period – N (%)	493 (4.6)	607 (4.4)	485 (4.3)	527 (4.9)	0.03
Age – median (IQR)	73 (56, 84)	72 (56, 84)	73 (56, 84)	74 (57, 84)	0.04
Female Sex – N (%)	6366 (51.3)	7824 (50.5)	6243 (49.6)	6033 (50.6)	0.04
High Charlson Comorbidity Score[a] – N (%)	5179 (41.7)	6752 (43.6)	5398 (42.8)	5061 (42.4)	0.04
Day of admission – weekday	9145 (73.7)	10925 (70.5)	9361 (74.3)	8846 (74.1)	0.09
Time of admission – daytime[b]	2736 (22.0)	2955 (19.1)	2715 (21.6)	2569 (21.5)	0.07
Previous hospitalization within 30 days[c] – Yes (%)	1357 (11.1)	1760 (11.5)	1455 (11.7)	1331 (11.3)	0.02
LAPS Score[d] – mean, SD	21.30 (17.39)	20.60 (17.19)	20.34 (17.08)	20.46 (16.98)	0.06

Table L Legend. The 5-year sample was split and physicians were categorized into quartiles based on outcomes in the first 2 years and here we report patient characteristics and outcomes in the same quartiles in the last 3 years. *This reflects the differences in physician quartiles in the first 2 years. [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Table M. Physician-level variation in length-of-stay, split-sample validation.

Admission Characteristics in Second Study Period	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	14844	13958	10490	13149	
Length-of-Stay in First Period* – days, mean (SD)	5.62 (5.38)	6.30 (5.64)	6.50 (5.76)	6.95 (6.00)	0.23
Length-of-Stay in Second Period* – days, mean (SD)	5.76 (5.50)	6.15 (5.68)	6.29 (5.69)	6.45 (5.61)	0.13
Age – median (IQR)	74 (56, 85)	72 (56, 84)	72 (55, 83)	73 (57, 84)	0.05
Female Sex – N (%)	7672 (51.7)	6970 (49.9)	5274 (50.3)	6550 (49.8)	0.04
High Charlson Comorbidity Score[a] – N (%)	6296 (42.4)	5791 (41.5)	4547 (43.3)	5756 (43.8)	0.05
Day of admission – weekday	10985 (74.0)	10262 (73.5)	7450 (71.0)	9580 (72.9)	0.07
Time of admission – daytime[b]	3036 (20.5)	3140 (22.5)	2340 (22.3)	2459 (18.7)	0.09
Previous hospitalization within 30 days[c] – Yes (%)	1593 (10.9)	1657 (12.0)	1179 (11.4)	1474 (11.3)	0.04
LAPS Score[d] – mean, SD	20.77 (17.27)	21.12 (17.34)	20.15 (16.87)	20.50 (17.08)	0.06

Table M Legend. The 5-year sample was split and physicians were categorized into quartiles based on outcomes in the first 2 years and here we report patient characteristics and outcomes in the same quartiles in the last 3 years. *This reflects the differences in physician quartiles in the first 2 years. [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance
placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table N. Physician-level variation in 30-day readmission, split-sample validation.

Admission Characteristics in Second Study Period	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	14414	14203	12689	11135	
Readmission in First Period* – N (%)	1224 (13.6)	1209 (15.3)	1190 (16.1)	1190 (17.5)	0.11
Readmission in Second Period* – N (%)	2038 (15.0)	2202 (16.6)	1963 (16.4)	1656 (15.8)	0.04
Age – median (IQR)	72 (56, 84)	72 (55, 84)	73 (56, 84)	74 (57, 85)	0.06
Female Sex – N (%)	7331 (50.9)	7102 (50.0)	6337 (49.9)	5696 (51.2)	0.02
High Charlson Comorbidity Score[a] – N (%)	6077 (42.2)	6149 (43.3)	5357 (42.2)	4807 (43.2)	0.02
Day of admission – weekday	10561 (73.3)	10531 (74.1)	9329 (73.5)	7856 (70.6)	0.08
Time of admission – daytime[b]	2883 (20.0)	3143 (22.1)	2439 (19.2)	2510 (22.5)	0.08
Previous hospitalization within 30 days[c] – Yes (%)	1567 (11.0)	1648 (11.7)	1486 (11.9)	1202 (10.9)	0.03
LAPS Score[d] – mean, SD	20.42 (17.12)	20.75 (17.16)	21.15 (17.31)	20.36 (17.06)	0.04

Table N Legend. The 5-year sample was split and physicians were categorized into quartiles based on outcomes in the first 2 years and here we report patient characteristics and outcomes in the same quartiles in the last 3 years. *This reflects the differences in physician quartiles in the first 2 years. [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Table O. Physician-level variation in use of advanced imaging, split-sample validation.

Admission Characteristics in Second Study Period	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	15477	11861	10644	14459	
Imaging in First Period* – Tests, mean (SD)	1.16 (1.27)	1.24 (1.33)	1.37 (1.40)	1.54 (1.49)	0.28
Imaging in Second Period* – Tests, mean (SD)	1.10 (1.26)	1.25 (1.36)	1.27 (1.37)	1.36 (1.42)	0.20
Age – median (IQR)	74 (56, 84)	72 (55, 84)	71 (55, 83)	73 (57, 84)	0.08
Female Sex – N (%)	7977 (51.5)	5932 (50.0)	5286 (49.7)	7271 (50.3)	0.04
High Charlson Comorbidity Score[a] – N (%)	6624 (42.8)	4983 (42.0)	4463 (41.9)	6320 (43.7)	0.04
Day of admission – weekday	11090 (71.7)	8723 (73.5)	7819 (73.5)	10645 (73.6)	0.04
Time of admission – daytime[b]	3319 (21.4)	2574 (21.7)	2142 (20.1)	2940 (20.3)	0.04
Previous hospitalization within 30 days[c] – Yes (%)	1702 (11.1)	1342 (11.5)	1231 (11.7)	1628 (11.4)	0.02
LAPS Score[d] – mean, SD	21.08 (17.38)	20.69 (17.08)	20.51 (17.23)	20.34 (16.95)	0.04

Table O Legend. The 5-year sample was split and physicians were categorized into quartiles based on outcomes in the first 2 years and here we report patient characteristics and outcomes in the same quartiles in the last 3 years. *This reflects the differences in physician quartiles in the first 2 years. [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Table P. Physician-level variation in in-hospital mortality, single attending physician.

Admission Characteristics	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	14372	16252	20343	15015	
Mortality – N (%)	481 (3.4)	642 (4.0)	985 (4.9)	877 (5.9)	0.12
Age – median (IQR)	71 (54, 83)	70 (54, 83)	72 (54, 83)	71 (54, 83)	0.03
Female Sex – N (%)	7354 (51.2)	8105 (49.9)	10251 (50.4)	7556 (50.3)	0.03
High Charlson Comorbidity Score[a] – N (%)	5772 (40.2)	6327 (38.9)	8190 (40.3)	6166 (41.1)	0.04
Day of admission – weekday	10235 (71.2)	12208 (75.1)	15034 (73.9)	11259 (75.0)	0.09
Time of admission – daytime[b]	2903 (20.2)	3708 (22.8)	3824 (18.8)	3332 (22.2)	0.10
Previous hospitalization within 30 days[c] – Yes (%)	1452 (10.4)	1715 (10.9)	2196 (11.1)	1534 (10.5)	0.03
LAPS Score[d] – mean, SD	18.23 (16.56)	18.50 (16.53)	19.23 (16.73)	19.21 (17.02)	0.06

Table P Legend. This analysis included only hospitalizations with the same admitting, discharging, and most responsible physician (ie. only a single attending physician). [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Table Q. Physician-level variation in length-of-stay, single attending physician.

Admission Characteristics	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	14063	15129	18918	17872	
Length-of-stay – days, mean (SD)	481 (3.4)	642 (4.0)	985 (4.9)	877 (5.9)	0.12
Age – median (IQR)	72 (54, 83)	70 (53, 83)	71 (54, 83)	72 (54, 83)	0.05
Female Sex – N (%)	7142 (50.8)	7539 (49.8)	9630 (50.9)	8955 (50.1)	0.02
High Charlson Comorbidity Score[a] – N (%)	5270 (37.5)	6139 (40.6)	7660 (40.5)	7386 (41.3)	0.08
Day of admission – weekday	10496 (74.6)	11161 (73.8)	14200 (75.1)	12879 (72.1)	0.07
Time of admission – daytime[b]	2849 (20.3)	2884 (19.1)	4314 (22.8)	3720 (20.8)	0.09
Previous hospitalization within 30 days[c] – Yes (%)	1354 (9.9)	1667 (11.4)	2001 (10.9)	1875 (10.8)	0.05
LAPS Score[d] – mean, SD	19.36 (16.80)	18.89 (16.84)	18.44 (16.52)	18.76 (16.75)	0.06

Table Q Legend. This analysis included only hospitalizations with the same admitting, discharging, and most responsible physician (ie. only a single attending physician). [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Qual Saf

Table R. Physician-level variation in 30-day readmission, single attending physician.

Admission Characteristics	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	14070	16840	20322	14750	
Readmission – N (%)	1781 (13.5)	2377 (15.0)	3139 (16.5)	2441 (17.6)	0.11
Age – median (IQR)	71 (53, 83)	71 (54, 83)	71 (54, 83)	72 (54, 84)	0.04
Female Sex – N (%)	7064 (50.2)	8365 (49.7)	10277 (50.6)	7560 (51.3)	0.03
High Charlson Comorbidity Score[a] – N (%)	5539 (39.4)	6600 (39.2)	8347 (41.1)	5969 (40.5)	0.04
Day of admission – weekday	10555 (75.0)	12408 (73.7)	15208 (74.8)	10565 (71.6)	0.08
Time of admission – daytime[b]	2833 (20.1)	3500 (20.8)	4288 (21.1)	3146 (21.3)	0.03
Previous hospitalization within 30 days[c] – Yes (%)	1413 (10.3)	1703 (10.4)	2220 (11.3)	1561 (10.9)	0.03
LAPS Score[d] – mean, SD	18.69 (16.61)	18.41 (16.56)	18.82 (16.82)	19.44 (16.82)	0.06

Table R Legend. This analysis included only hospitalizations with the same admitting, discharging, and most responsible physician (ie. only a single attending physician). [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Table S. Physician-level variation in use of advanced imaging, single attending physician.

Admission Characteristics	Physician Quartile				Maximum standardized difference
	1	2	3	4	
Number of admissions	17828	16571	14997	16586	
Advanced Imaging – Tests, mean (SD)	0.93 (1.09)	1.04 (1.19)	1.13 (1.25)	1.23 (1.30)	0.25
Age – median (IQR)	71 (54, 83)	71 (54, 83)	71 (54, 83)	72 (54, 83)	0.03
Female Sex – N (%)	9086 (51.0)	8249 (49.8)	7611 (50.8)	8320 (50.2)	0.02
High Charlson Comorbidity Score[a] – N (%)	6975 (39.1)	6694 (40.4)	6118 (40.8)	6668 (40.2)	0.03
Day of admission – weekday	13288 (74.5)	12178 (73.5)	11168 (74.5)	12102 (73.0)	0.04
Time of admission – daytime[b]	961 (22.2)	3043 (18.4)	2893 (19.3)	3870 (23.3)	0.12
Previous hospitalization within 30 days[c] – Yes (%)	1822 (10.5)	1801 (11.2)	1580 (11.0)	1694 (10.5)	0.02
LAPS Score[d] – mean, SD	19.68 (17.11)	18.58 (16.58)	18.69 (16.64)	18.27 (16.46)	0.08

Table S Legend. This analysis included only hospitalizations with the same admitting, discharging, and most responsible physician (ie. only a single attending physician). [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest standardized difference for each variable.

Table T. Characteristics of hospital admissions across physicians categorized by in-hospital mortality, excluding patients with a palliative diagnosis code

Characteristic	All Hospital Admissions	Physician Mortality Quartile 1	Physician Mortality Quartile 2	Physician Mortality Quartile 3	Physician Mortality Quartile 4	Maximum Standardized Difference[f]
Number of admissions	85421	17652	23752	22484	21533	
Mortality – N (%)	1898 (2.2)	238 (1.3)	456 (1.9)	530 (2.4)	674 (3.1)	0.12*
Age – median (IQR)	72 (55, 83)	71 (54, 83)	72 (55, 83)	72 (55, 83)	72 (55, 83)	0.05
Female Sex – N (%)	43122 (50.5)	8839 (50.1)	12154 (51.2)	11321 (50.4)	10808 (50.2)	0.02
High Charlson Comorbidity Index Score[a] – N (%)	33612 (39.3)	7035 (39.9)	9332 (39.3)	8678 (38.6)	8567 (39.8)	0.03
Day of admission, weekday – N (%)	62902 (73.6)	12723 (72.1)	17464 (73.5)	16728 (74.4)	15987 (74.2)	0.05
Time of admission, daytime[b] – N (%)	18490 (21.6)	3887 (22.0)	4804 (20.2)	5142 (22.9)	4657 (21.6)	0.06
Hospitalization in previous 30 days[c] – N (%)	8985 (10.8)	1782 (10.4)	2504 (10.8)	2376 (10.9)	2323 (11.1)	0.02
LAPS[d] – mean, SD	19.0 (16.5)	18.3 (16.1)	18.5 (16.4)	19.4 (16.6)	19.8 (16.8)	0.10
Discharge Diagnoses[e] – N (%)						
Pneumonia	4811 (5.6)	910 (5.2)	1424 (6.0)	1289 (5.7)	1188 (5.5)	0.04
Urinary Tract Infection	4599 (5.4)	960 (5.4)	1247 (5.3)	1284 (5.7)	1108 (5.1)	0.03
Heart Failure	4448 (5.2)	889 (5.0)	1247 (5.3)	1196 (5.3)	1116 (5.2)	0.01
COPD	3990 (4.7)	852 (4.8)	1155 (4.9)	1024 (4.6)	959 (4.5)	0.02
Stroke	2344 (2.7)	442 (2.5)	652 (2.7)	658 (2.9)	592 (2.7)	0.03
Gastrointestinal Hemorrhage	2826 (3.3)	555 (3.1)	771 (3.2)	774 (3.4)	726 (3.4)	0.02
Delirium, Dementia, Cognitive Disorder	2314 (2.7)	531 (3.0)	621 (2.6)	579 (2.6)	583 (2.7)	0.03
Fluid and Electrolyte Disorder	2288 (2.7)	465 (2.6)	674 (2.8)	574 (2.6)	575 (2.7)	0.02
Intestinal Infection	2300 (2.7)	474 (2.7)	644 (2.7)	609 (2.7)	573 (2.7)	0.00
Diabetes mellitus with complication	2079 (2.4)	492 (2.8)	565 (2.4)	504 (2.2)	518 (2.4)	0.04

Table T Legend. Physicians were categorized into quartiles within each hospital based on the rate of in-patient mortality, after excluding patients with a "palliative" diagnostic code at hospital discharge (ICD-10-CA Z51.5). *The p-value for the difference in mortality between highest and lowest physician quartile was p=0.005. [a]Charlson Comorbidity Index score of 2 or greater was considered high comorbidity. [b]Admissions between 08:00 and 17:00 were considered "daytime" admissions. [c]To a GIM ward at a participating hospital. [d]LAPS: Laboratory-based acute physiology score, is a validated score to predict inpatient mortality, which ranges from 0 to 256 points, with higher scores indicating a higher risk of mortality. [e]The primary discharge diagnosis for each admission was categorized using the Clinical Classifications Software based on ICD-10 codes. [f]The maximum standardized difference across physician mortality quartiles was calculated using the two quartiles that had the largest absolute mean difference for each variable.

24