

RESEARCH ARTICLE

# Proprietary management and higher readmission rates: A correlation

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## Abstract

### Introduction

Reducing preventable readmissions among Medicare beneficiaries is an effective way to not only reduce the exorbitantly rising cost in healthcare but also as a measure to improve the quality of patient care. Many of the previous efforts in reducing readmission rate of patients have not been very successful because of ill-defined quality measures, improper data collection methods and lack of effective strategies based on data driven solutions.

### Methods

In this study, we analyzed the readmission data of patients for six major diseases including acute myocardial infarction (AMI), heart failure (HF), coronary artery bypass graft (CABG), pneumonia (PN), chronic obstructive pulmonary disease (COPD), and total hip arthroplasty and/or total knee arthroplasty (THA/TKA) from the Center for Medicare and Medicaid Readmissions Reduction Program (HRRP) program for the period 2012–2015 in context with the ownership structure of the hospitals.

### Results

Our analysis demonstrates that the readmission rates of patients were statistically higher in proprietary (for profit) hospitals compared to the government and non-profit hospitals which was independent of their geographical distribution across all six major diseases.

### Conclusion

This finding we believe has strong implications for policy makers to mitigate any potential risks in the quality of patient care arising from unintended revenue pressure in healthcare institutions.

## OPEN ACCESS

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## Introduction

Reducing preventable readmissions among Medicare patients has become an important national priority for healthcare policy makers. From the Medicare Payment Advisory Commission (MedPAC) report, almost one-fifth of Medicare beneficiaries discharged are readmitted within 30 days [1]. The majority of hospital readmissions fall in four big categories including: 1) postoperative surgical complications; 2) improper discharge care of patients; 3) reoccurrence of chronic conditions such as COPD or heart failure; and 4) patient's error in medication adherence [2]. A 2014 report identified that 10–50% of all the readmissions are potentially preventable readmissions and cost Medicare \$17.4 billion annually [3]. The heart failure and COPD patients have the highest readmission rate of 23%–26% among all the diseases [3].

Depending on the delivery of healthcare services, there are three main business models of providers including government, proprietary (for-profit), and non-profit [4]. The government healthcare institutions deliver healthcare services mostly from public funding, whereas the proprietary hospitals are owned by investors and shareholders who have self-financial interest and most of the profits from the proprietary hospital is distributed among them. The non-profit hospitals may be owned by the members of the organization, communities, regional health authorities, or a hospital trust. These owners do not derive any profits and the main purpose of non-profit hospitals is to provide healthcare services and maintain socio-economic stability within the organization. The non-profit hospital's surplus profits may be invested in the research or teaching activities depending upon the goals and the mission of the organization. [4].

Previous studies in the literature have focused on the causative factors of patient readmission such as socio-economic factors or hospital-level care processes to reduce the readmissions rate [5–7]. The ownership structure of providers, however, has recently emerged as another crucial paradigm governing the readmission risk among hospitalized patients [4]. Notably, non-profit health care institutions have been shown to provide better quality of patient care than for-profit health care institutions in multiple studies [8–12]. Some studies, in contrary, have shown better patient outcomes in for-profit institutions [13,14]. However, little research has been done to report how the ownership structure of hospital operation impacts the readmission rates of the patients in different disease categories. In this study, we analyzed the readmission ratio from Hospital Readmission Reduction Program (HRRP) database for 2012–2015 for six major disease categories including acute myocardial infarction (AMI), heart failure (HF), coronary artery bypass graft (CABG), pneumonia (PN), chronic obstructive pulmonary disease (COPD), and total hip arthroplasty and/or total knee arthroplasty (THA/TKA), in context of the ownership structure of the providers nationwide.

## Methods

Data on readmission ratios from 14,307 disease specific hospital reports was obtained from the national Hospital Readmission Reduction Program (HRRP) from 2012–2015 for six major diseases: AMI, HF, CABG, PN, COPD, and THA/TKA (Data sets 2017). Hospital ownership type was sourced from a Center for Medicaid and Medicare Services report (i.e. government, proprietary or non-profit by Provider Identifier) [15]. Using the provider identifier in both HRRP and the ownership file, the two data sets were mapped together. The calculations of the excess readmission ratio are based on the methodology used for the calculation of the CMS 30-day risk standardized readmission measures for the Hospital Inpatient Quality Reporting Program as described in the instructions for HRRP database [15]. A readmission ratio less than 1 is considered good, where a ratio greater than one implies excess readmission controlled for disease

severity. The readmission ratio was categorized into 4 intervals: <0.8, 0.8–0.99, 1.0–1.2 and >1.2 for each disease. Hospital ownership was additionally used to analyze the readmission ratios by focusing on the percentage of hospitals in each ratio category (Fig 1A). Readmission ratio of less <1 (Green Zone) was defined as a hospital having fewer readmissions than expected after adjustment for patient disease severity for the individual hospital. Hospitals with >1.0 (Red Zone) was defined as having more readmissions than expected. A Fischer exact analysis was conducted to calculate statistically significant differences between the groups of ownership and additionally the readmission ratios were graphed for each disease and ownership type by whisker-box plot. A list of the top and bottom 10 hospitals based on

A

Disease Measure	Hospital type	N	Readmission Ratio				Cutoffs				p Value
			Mean	SD	Median	IQR	< 0.8	0.8 - 0.99	1.0 - 1.2	> 1.2	
AMI National (N=2119)	Government	257	0.997	0.063	0.995	0.076	0.4%	52.5%	47.1%	0.0%	<.0001
	Proprietary	421	<b>1.014</b>	0.067	<b>1.009</b>	0.081	0.0%	43.9%	55.3%	0.7%	
	Non-Profit	1441	1.000	0.066	0.999	0.082	0.4%	50.7%	48.7%	0.2%	
CABG National (N=1024)	Government	112	1.006	0.078	0.995	0.105	0.0%	51.8%	47.3%	0.9%	<.0001
	Proprietary	197	<b>1.012</b>	0.092	<b>1.006</b>	0.098	0.5%	45.7%	51.8%	2.0%	
	Non-Profit	715	0.998	0.084	0.994	0.104	0.6%	52.5%	45.4%	1.5%	
COPD National (N=2868)	Government	469	0.995	0.06	0.995	0.076	0.0%	54.2%	45.6%	0.2%	<.0001
	Proprietary	572	<b>1.007</b>	0.066	<b>1.003</b>	0.08	0.0%	48.4%	51.1%	0.5%	
	Non-Profit	1827	1.001	0.07	0.996	0.088	0.0%	52.2%	47.2%	0.6%	
HF National (N=2874)	Government	464	1.001	0.069	0.999	0.084	0.2%	51.3%	47.6%	0.9%	<.0001
	Proprietary	573	<b>1.018</b>	0.074	<b>1.014</b>	0.098	0.2%	42.2%	56.5%	1.1%	
	Non-Profit	1837	0.996	0.079	0.992	0.099	0.4%	53.1%	45.6%	0.9%	
THA/TKA National (N=2461)	Government	321	1.012	0.136	0.994	0.155	3.7%	47.7%	40.5%	8.1%	<.0001
	Proprietary	517	<b>1.019</b>	0.137	<b>1.014</b>	0.164	4.5%	41.6%	45.6%	8.3%	
	Non-Profit	1623	1.001	0.133	0.992	0.162	5.6%	46.6%	40.8%	7.1%	
PN National (N=2961)	Government	505	1.000	0.085	0.988	0.102	0.6%	53.5%	44.5%	1.4%	<.0001
	Proprietary	591	<b>1.014</b>	0.088	<b>1.010</b>	0.114	0.7%	44.8%	51.6%	2.9%	
	Non-Profit	1865	0.999	0.091	0.993	0.118	0.9%	52.2%	44.6%	2.4%	

The highest values in each group is highlighted in bold

B

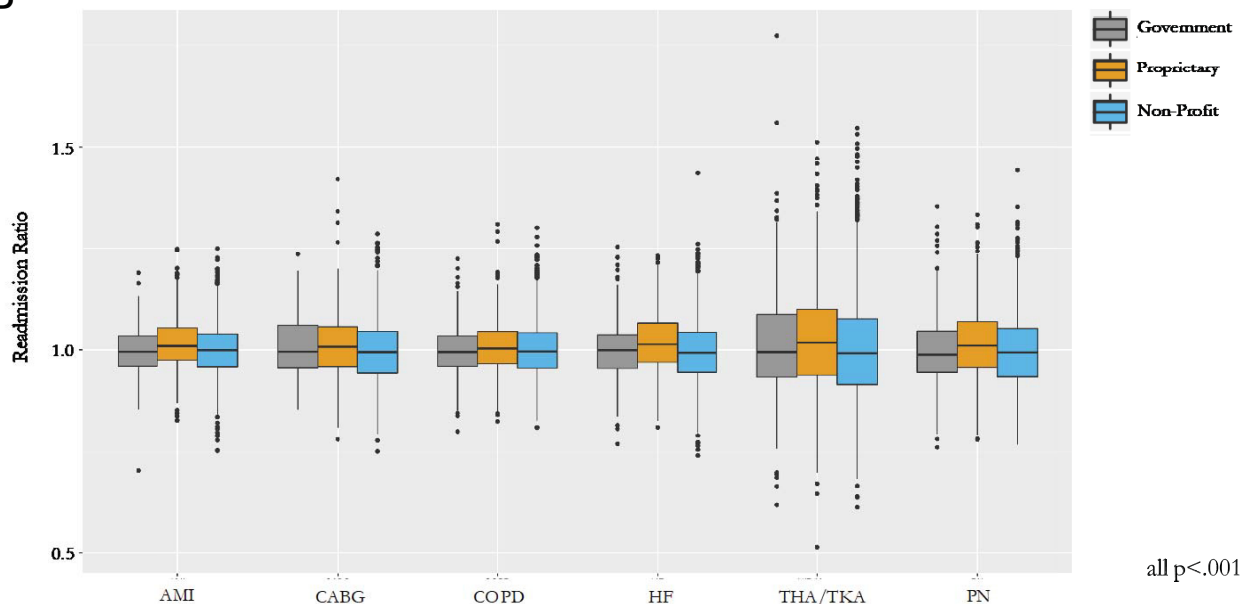


Fig 1. Readmission ratios for six major diseases: AMI, HF, CABG, PN, COPD, and THA/TKA by hospital type: Panel A reports the mean, median, standard deviation, as well as the results for the 4 intervals. Red zone represent readmission ration >1.0. The Green zone is readmission ratios < 1. Panel B reports the box and whisker plots of the results of the readmission ratios by hospital type and disease.

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readmission ratio for all six major diseases was created. The readmission ratio of various hospitals according to the ownership was also mapped to their geographical location using Tableau 10.5.

## Results

From the Fisher Exact analysis, we found a statistically significant difference between hospital ownership in readmission ratio among all six major diseases (all  $p < .0001$ , Fig 1A). The Green Zone (readmission ratio  $< 1$ ) was predominated by government and non-profit hospitals compared to their proprietary counterparts (Fig 1A). In contrast, the Red Zone (readmission ratio  $> 1$ ) was predominated by proprietary hospitals for all six major diseases (Fig 1A). As illustrated in Fig 1B, the median and mean readmission ratio was highest for proprietary hospitals for all six diseases (all  $p < .001$ ). In the top 10 hospital readmission ratio rankings, the government and non-profit hospitals predominated the list for HF, AMI, COPD, and CABG while proprietary hospitals were only included in the topmost ranking only for THA/TKA and PN (Fig 2) (7 Government, 44 non-profits, 9 proprietary). When examining the bottom 10 hospital readmission ratios across all 6 diseases for 60 hospitals; proprietary hospital have a large percentage of membership in this list 28% versus 15%. The breakdown is 6 Government, 37 non-profits, 17 proprietary. We next examined the overall geographical distribution of government, non-profits, and for-profit hospitals based on their readmission score. All three categories of hospitals were uniformly distributed geographically across United States irrespective of their readmission ratio indicating that the differences in quality of care between government, non-profits, and for-profit hospitals does not relate to their geographical location (Fig 3).

## Discussion

The current study has identified that the government and non-profit hospitals have statistically significant lower readmission ratios compared to the proprietary hospitals for all six major diseases. With the rising cost of the healthcare services, an important priority before healthcare policy makers is how to reduce the cost of healthcare services without compromising the safety of patients. Readmissions cost the healthcare system monetary penalties, but a larger concern to patients are the missed days or weeks with family and friends when they would otherwise be outside of the hospital.

Multiple studies have shown that ownership structure of Health Care organizations (HCOs) affect the performance of providers and patient outcomes [7–14]. While hospitals are different than many other HCO's, we compare the literature to other HCO as few studies on HCO ownership have been published. Similar to our study, Horwitz et al. have reported higher readmission rates for patients at for-profit hospitals among the 4474 hospitals analyzed for Medicare beneficiaries from July 2013–July 2014 [16]. Daras et al. have reported higher readmission rate for rehabilitation patients in the for-profit IRFs (Inpatient Rehabilitation Facilities) than the non-profit IRFs [8]. Although, the authors also reported geographical variation in their study with more readmission rates in IRFs in the South Atlantic and South Central regions than the New England, these readmissions were related to all cause-unplanned population which may have different mix of patients than what was observed in this study [8]. In another study, Devereaux et al. performed the meta-analysis of published and unpublished observational studies from 1973 to 1997, to compare the mortality rate of patients in for-profit vs not-for-profit dialysis centers, and reported significantly higher mortality risk associated with for-profit dialysis centers [9]. Another meta-analysis study based on 82 articles, performed by Comondore et al., from 1965–2003, reported higher quality of care in non-profit

A

Top 10 Hospital Ranking based on readmission ratio				
AMI National				
Ranking	Name or Hospital	State	Ratio	Type
1	UP HEALTH SYSTEM - MARQUETTE	MI	0.7043	Government
2	MARY HITCHCOCK MEMORIAL HOSPITAL	NH	0.7523	Non-Profit
3	ASANTE ROGUE REGIONAL MEDICAL CENTER	OR	0.7539	Non-Profit
4	BRYAN MEDICAL CENTER	NE	0.7786	Non-Profit
5	PROVIDENCE SACRED HEART MEDICAL CENTER	WA	0.7888	Non-Profit
6	BILLINGS CLINIC HOSPITAL	MT	0.7900	Non-Profit
7	FRENCH HOSPITAL MEDICAL CENTER	CA	0.7977	Non-Profit
8	GOOD SAMARITAN REGIONAL MEDICAL CENTER	OR	0.8069	Non-Profit
9	HAYS MEDICAL CENTER	KS	0.8123	Non-Profit
10	MEMORIAL MISSION HOSPITAL AND ASHEVILLE SURGE	NC	0.8215	Non-Profit
CABG National				
Ranking	Name	State	Ratio	Type
1	SUTTER MEDICAL CENTER, SACRAMENTO	CA	0.7508	Non-Profit
2	PIEDMONT HOSPITAL	GA	0.7780	Non-Profit
3	AVERA HEART HOSPITAL OF SOUTH DAKOTA	SD	0.7808	Proprietary
4	BRYAN MEDICAL CENTER	NE	0.7933	Non-Profit
5	ST LUKE'S REGIONAL MEDICAL CENTER	ID	0.7993	Non-Profit
6	ST LUKE'S HOSPITAL BETHLEHEM	PA	0.8090	Non-Profit
7	CHI HEALTH NEBRASKA HEART	NE	0.8092	Non-Profit
8	ASPIRUS WAUSAU HOSPITAL	WI	0.8101	Proprietary
9	BRIGHTMAN AND WOMEN'S HOSPITAL	MA	0.8108	Non-Profit
10	MIAMI VALLEY HOSPITAL	OH	0.8111	Non-Profit
COPD National				
Ranking	Name	State	Ratio	Type
1	SCHNECK MEDICAL CENTER	IN	0.8003	Government
2	CENTRA HEALTH-ST ANTHONY HOSPITAL	CO	0.8096	Non-Profit
3	SOUTHERN OCEAN MEDICAL CENTER	NJ	0.8109	Non-Profit
4	EASTERN IDAHO REGIONAL MEDICAL CENTER	ID	0.8248	Proprietary
5	ADVOCATE SOUTH SUBURBAN HOSPITAL	IL	0.8272	Non-Profit
6	BELOIT MEMORIAL HOSPITAL	WI	0.8284	Non-Profit
7	AUGUSTA HEALTH	VA	0.8291	Non-Profit
8	OPELOUSAS GENERAL HEALTH SYSTEM	LA	0.8590	Government
9	WEATHERFORD REGIONAL MEDICAL CENTER	TX	0.8415	Proprietary
10	CHRISTUS ST VINCENT REGIONAL MEDICAL CENTER	NM	0.8419	Non-Profit
HF National				
Ranking	Name	State	Ratio	Type
1	LANCASTER GENERAL HOSPITAL	PA	0.7410	Non-Profit
2	MCLAREN - NORTHERN MICHIGAN	MI	0.7549	Non-Profit
3	SANTA BARBARA COTTAGE HOSPITAL	CA	0.7645	Non-Profit
4	KOONEN HEALTH	ID	0.7694	Government
5	OKLAHOMA HEART HOSPITAL, LLC	OK	0.7700	Proprietary
6	ST FRANCIS DOWNTOWN	SC	0.7708	Non-Profit
7	ST MARY'S HOSPITAL	WI	0.7732	Non-Profit
8	MCKAY DEE HOSPITAL	UT	0.7900	Non-Profit
9	BRYAN MEDICAL CENTER	NE	0.7973	Non-Profit
10	TRINITY REGIONAL MEDICAL CENTER	IA	0.7993	Non-Profit
THA/TKA National				
Ranking	Name	State	Ratio	Type
1	HOAG ORTHOPEDIC INSTITUTE	CA	0.5142	Proprietary
2	BEEBE MEDICAL CENTER	DE	0.6154	Non-Profit
3	REX HOSPITAL	NC	0.6207	Government
4	FREEMAN HEALTH SYSTEM - FREEMAN WEST	MO	0.6391	Non-Profit
5	PROVIDENCE SAINT JOHN'S HEALTH CENTER	WA	0.6409	Non-Profit
6	KANSAS MEDICAL CENTER LLC	KS	0.6480	Proprietary
7	SARASOTA MEMORIAL HOSPITAL	FL	0.6655	Government
8	CHI HEALTH GOOD SAMARITAN	NE	0.6666	Non-Profit
9	KANSAS SURGERY & RECOVERY CENTER	KS	0.6719	Proprietary
10	BELLIN MEMORIAL HOSPITAL	WI	0.6844	Non-Profit
PN National				
Ranking	Name	State	Ratio	Type
1	ST LUKE'S PATIENTS MEDICAL CENTER	TX	0.7591	Proprietary
2	JOHNSON MEMORIAL HOSPITAL	IN	0.7608	Government
3	PROVIDENCE HOLY FAMILY HOSPITAL	WA	0.7672	Non-Profit
4	QUEEN OF THE VALLEY MEDICAL CENTER	CA	0.7715	Non-Profit
5	MILLS PENINSULA MEDICAL CENTER	CA	0.7749	Non-Profit
6	AVERA MCKENNA HOSPITAL & UNIVERSITY HEALTH C	SD	0.7752	Non-Profit
7	MERCY HOSPITAL	IA	0.7762	Non-Profit
8	LAKELAND COMMUNITY HOSPITAL	AL	0.7767	Non-Profit
9	MEMORIAL HEALTH UNIV MED CEN, INC	GA	0.7771	Non-Profit
10	GORDON HOSPITAL	GA	0.7779	Non-Profit

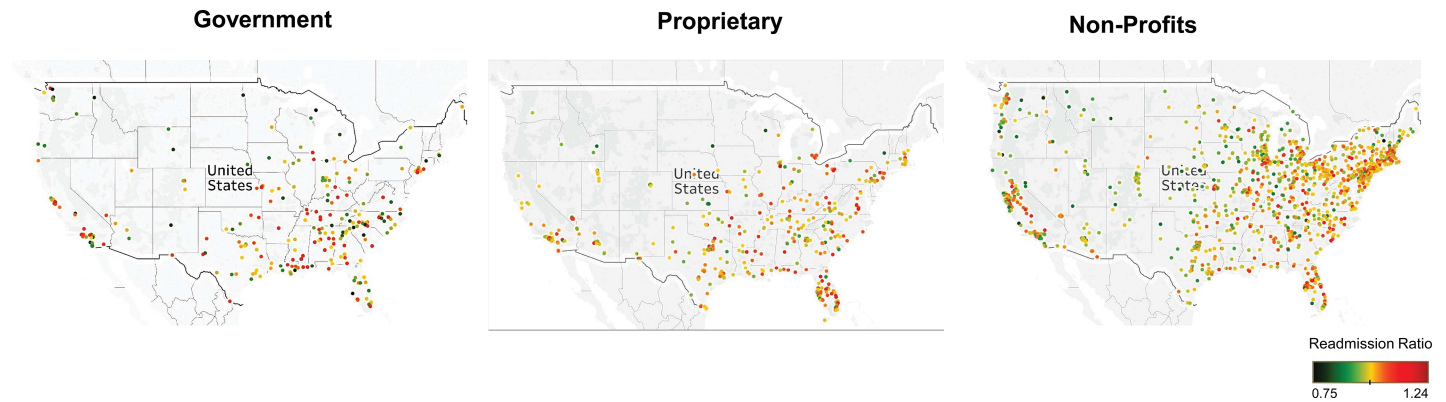
B

Worst 10 Hospital Ranking based on readmission ratio				
AMI National				
Ranking	Name or Hospital	State	Ratio	Type
1	TUFTS MEDICAL CENTER	MA	1.2491	Non-Profit
2	FRANCISCAN ST JAMES HEALTH	IL	1.2479	Proprietary
3	CENTINELA HOSPITAL MEDICAL CENTER	CA	1.2448	Proprietary
4	ST LUKE'S ROOSEVELT HOSPITAL	NY	1.2261	Non-Profit
5	LAKELAND REGIONAL MEDICAL CENTER	FL	1.2208	Non-Profit
6	JFK MEDICAL CENTER	FL	1.2048	Proprietary
7	NORTH FLORIDA REGIONAL MEDICAL CENTER	FL	1.1998	Proprietary
8	JFK MEDICAL CTR - ANTHONY M. YELENCISCS COMMUNITY	NJ	1.1995	Non-Profit
9	ADVOCATE CHRIST HOSPITAL & MEDICAL CENTER	IL	1.1991	Non-Profit
10	REGIONAL MEDICAL CENTER OF SAN JOSE	CA	1.1984	Non-Profit
CABG National				
Ranking	Name	State	Ratio	Type
1	KENTUCKIANA MEDICAL CENTER LLC	IN	1.4190	Proprietary
2	NORTH FLORIDA REGIONAL MEDICAL CENTER	FL	1.3406	Proprietary
3	LAWNWOOD REGIONAL MEDICAL CENTER & HEART INSTITUTE	FL	1.3126	Proprietary
4	BETH ISRAEL DEACONSIS MEDICAL CENTER	MA	1.2852	Non-Profit
5	SUNRISE HOSPITAL AND MEDICAL CENTER	NV	1.2651	Proprietary
6	SETON MEDICAL CENTER ALSTIN	TX	1.2638	Non-Profit
7	GOVERNANT MEDICAL CENTER	MI	1.2614	Non-Profit
8	GOOD SAMARITAN REGIONAL HLTH CENTER	IL	1.2527	Non-Profit
9	INNOVA FAIRFAX HOSPITAL	VA	1.2477	Non-Profit
10	PIKEVILLE MEDICAL CENTER	KY	1.2441	Non-Profit
COPD National				
Ranking	Name	State	Ratio	Type
1	POTTSTOWN MEMORIAL MEDICAL CENTER	PA	1.3087	Proprietary
2	MONROE COUNTY MEDICAL CENTER	KY	1.3000	Non-Profit
3	ST DAVIDS SOUTH AUSTIN MEDICAL CENTER	TX	1.2911	Proprietary
4	HARLAN ARH HOSPITAL	KY	1.2777	Non-Profit
5	SUMNER REGIONAL MEDICAL CENTER	TN	1.2674	Proprietary
6	WYCKOFF HEIGHTS MEDICAL CENTER	NY	1.2572	Non-Profit
7	MARION GENERAL HOSPITAL	OH	1.2320	Non-Profit
8	PERKIN MEMORIAL HOSPITAL	IL	1.2297	Non-Profit
9	ST JOHN'S EPISCOPAL HOSPITAL AT SOUTH SHORE	NY	1.2260	Non-Profit
10	JFK MEDICAL CTR - ANTHONY M. YELENCISCS COMMUNITY	NJ	1.2260	Non-Profit
HF National				
Ranking	Name	State	Ratio	Type
1	HARLAN ARH HOSPITAL	KY	1.4337	Non-Profit
2	CORNING HOSPITAL	NY	1.2608	Non-Profit
3	KINGS COUNTY HOSPITAL CENTER	NY	1.2536	Government
4	MOUNT SINAI BETH ISRAEL/PETRIE CAMPUS	NY	1.2474	Non-Profit
5	AVENTURA HOSPITAL AND MEDICAL CENTER	FL	1.2372	Non-Profit
6	BEAUMONT HOSPITAL - WAYNE	MI	1.2347	Non-Profit
7	KENTUCKIANA MEDICAL CENTER LLC	IN	1.2349	Proprietary
8	KINGSBROOK JEWISH MEDICAL CENTER	NY	1.2296	Non-Profit
9	SSM HEALTH ST. MARY'S HOSPITAL - JEFFERSON CITY	MO	1.2293	Proprietary
10	PIEDMONT HENRY HOSPITAL	GA	1.2273	Government
THA/TKA National				
Ranking	Name	State	Ratio	Type
1	UNIVERSITY OF TEXAS MEDICAL BRANCH	TX	1.7729	Government
2	NORTHERN HOSPITAL OF SULLY COUNTY	NC	1.5588	Government
3	CHRISTIAN HOSPITAL NORTHEAST-NORTHWEST	MO	1.5461	Non-Profit
4	FAUQUER HOSPITAL	VA	1.5314	Non-Profit
5	GADDEN REGIONAL MEDICAL CENTER	AL	1.5118	Proprietary
6	ST JOSEPH'S REGIONAL MEDICAL CENTER	NJ	1.5083	Non-Profit
7	ADVOCATE CHRIST HOSPITAL & MEDICAL CENTER	IL	1.4967	Non-Profit
8	HALLMARK HEALTH SYSTEM	MA	1.4819	Non-Profit
9	MERCY HEALTH - WEST HOSPITAL	OH	1.4776	Non-Profit
10	RESTON HOSPITAL CENTER	VA	1.4775	Non-Profit
PN National				
Ranking	Name	State	Ratio	Type
1	ST JOHN'S EPISCOPAL HOSPITAL AT SOUTH SHORE	NY	1.4407	Non-Profit
2	QUEENS HOSPITAL CENTER	NY	1.3522	Government
3	HAZARD ARH REGIONAL MEDICAL CENTER	KY	1.3510	Non-Profit
4	LAWNWOOD REGIONAL MEDICAL CENTER & HEART INSTITUTE	FL	1.3320	Proprietary
5	METHODIST HOSPITALS INC	IN	1.3138	Non-Profit
6	GROVILLE HOSPITAL	CA	1.3093	Non-Profit
7	BYRD REGIONAL HOSPITAL	LA	1.3084	Proprietary
8	UNIVERSITY HOSPITAL OF BROOKLYN (DOWNSTATE)	NY	1.3027	Government
9	ST LUCIE MEDICAL CENTER	FL	1.3020	Proprietary
10	WYCKOFF HEIGHTS MEDICAL CENTER	NY	1.2995	Non-Profit

Fig 2. Panel A. A list of the top 10 best hospitals per disease readmission ratio for all six diseases. Panel B. A list of the bottom 10 hospitals per disease readmission ratio for all six diseases.

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nursing homes compared to the for-profit facilities [10]. The non-profit nursing homes were associated with higher quality staffing and lower pressure ulcer prevalence compared to the for-profit nursing homes [10]. Hillmer et al. similarly reported better quality of care associated with non-profit nursing homes using qualitative systematic review of 38 studies from 1990–2002 [11]. Rosenau et al. reported that non-profits were judged 59% of the time superior,



**Fig 3. A geographical mapping of hospital readmission ratio results in three different panels by hospital type, Government, Proprietary, Non-Profit.**

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whereas for-profits were judged to be superior only 12% of the time [12]. Their study was based on the systematic review of two decades of articles published since 1980–2003 [12]. Some of the studies, however, have reported better care quality in for-profit institutions [13–14]. Leleu et al., for instance, have shown reduced readmission in for-profit teaching and fully integrated hospitals than their counterparts [13]. Akintoye et al., have reported reduced mortality in for-profit hospitals among HF patient from 2013–2014 nationwide [14]. There could be multiple reasons ascribed to this discrepancy such as specificity to a particular disease category, temporal differences or use of different database.

The analysis of readmission ratio reported in this study is based on the most current data set available yet since the start of the HRRP program in 2012. One additional caveat to readmission is a recently published study by Fonarow et al. showing that a reduction of readmission rate in HF patients, after HRRP implementation, was accompanied by a concomitant rise in the risk adjusted mortality rate [17]. Due to the nature of the government reported HRRP data, this new risk is unable to be assessed but requires further research in the future.

The Center for Healthcare Quality and Policy Reform (CHQPR) has suggested five basic approaches to payment reform [18]: 1) Don't pay providers for readmissions, 2) Provide incentive to providers to implement programs to reduce readmissions, 3) Pay providers bonuses/incentives based on readmission rates, 4) Don't pay provider for readmissions meeting specific criteria, and 5) Make patient care comprehensive regardless of number of hospitalizations and readmissions. The larger concern from a policy perspective is why proprietary hospitals have such a different readmission ratio than their other counterparts. The relatively lack of resources at proprietary HCOs due to higher taxes and focus on maximizing the return on investment may lead to recruitment of less qualified staff or less investment in medical technology resulting in inferior quality of care than the government or non-profit institutions [4]. With the shrinking revenues in healthcare market and a move towards the value based payment system, the particular aspect of provider ownership on delivery of healthcare services is becoming more crucial. The policy makers need to carefully evaluate and design healthcare policies that mitigate potential risks associated with unintended revenue pressure in harming patients.

### Strengths and limitations

The major strengths of this study is that the findings described herein are based on nationally available HRRP database that includes all of the hospitals with the associated illness, currently operating across the United States. Due to the unrestricted availability of this publicly reported

data, the results of the study can be independently investigated and reproduced by any research group working in this field. Another major strength of this study is that the HRRP database includes readmission ratio which is normalized based on the severity of illness of the patients treated in the hospital. The major limitations of this study is that the data are derived and limited by the accuracy of the disease severity adjustment. Another limitation is the accurate categorization of hospitals in different ownership types, this study is reliant on the proper categorization by the government. The final limitation in this study is that we only examine six disease categories collected by the government. The readmission ratio has not been calculated for all admissions to a hospital and different diseases could have different ratios.

## Conclusions

The underperformance of proprietary (for-profit) hospitals in the current study may be associated with several factors including stakeholder's expectations for operating profits; different patient insurance portfolios; limitations of the HRRP disease adjustment; or other factors. As health care markets continue becoming more consolidated, it is critical to conduct additional study to understand the impact of provider ownership on patient outcomes.

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