

Hospital Performance Based on 30-Day Risk Standardized Mortality and Long-Term Survival after Heart Failure Hospitalization An Analysis of the GWTG-HF Registry

Ambarish Pandey, MD

UT Southwestern Medical Center Dallas, TX

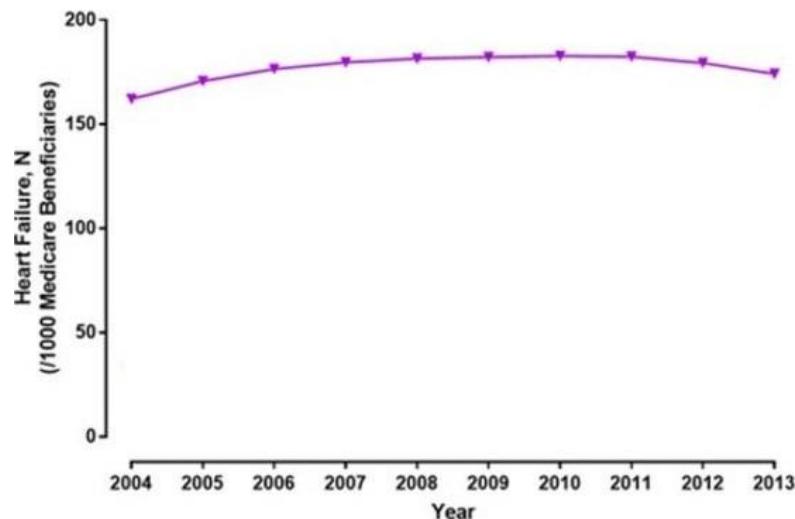
 @ambarish4786



ACC.18™

Burden of Heart Failure is Substantial & Associated with Worse Outcomes

Trends in HF Prevalence



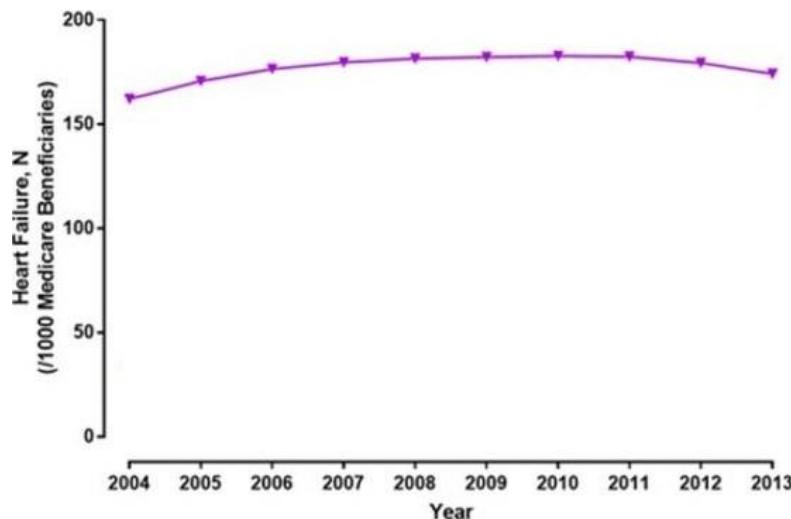
Khera, et al. Circulation HF 2017
Shah, et al. JACC 2017



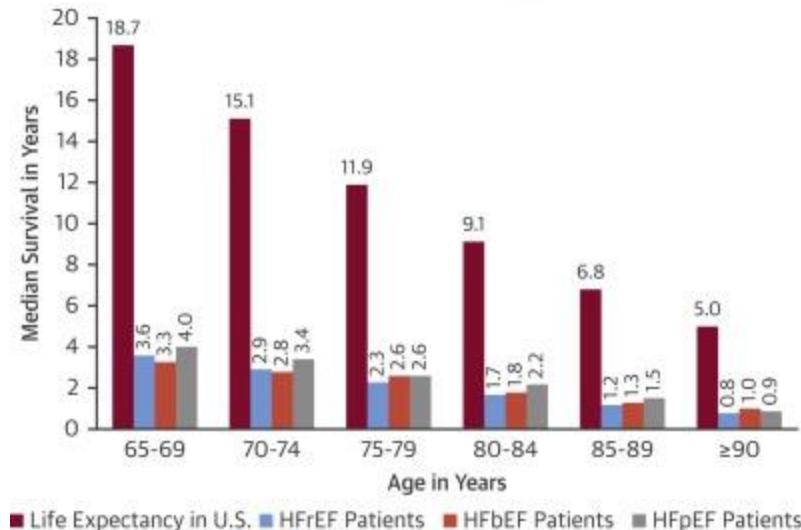
ACC.18™

Burden of Heart Failure is Substantial & Associated with Worse Outcomes

Trends in HF Prevalence



Median Survival in HF



Khera, et al. *Circulation HF* 2017

Shah, et al. *JACC* 2017



ACC.18™

Health Policies Are Increasingly Focused on Improving HF Care

2009

Public reporting of
30-day outcomes

Acute MI, HF, PNA



ACC.18™

Health Policies Are Increasingly Focused on Improving HF Care

2009

Public reporting of
30-day outcomes

2012

Hospital
Readmission
Reduction Program

Acute MI, HF, PNA

Penalty for higher
than expected 30-
day readmission
rates



ACC.18™

Health Policies Are Increasingly Focused on Improving HF Care

2009

Public reporting of 30-day outcomes

Acute MI, HF, PNA

2012

Hospital Readmission Reduction Program

Penalty for higher than expected 30-day readmission rates

2014

Value Based Purchasing Program

Penalty for higher than expected 30-day mortality rates

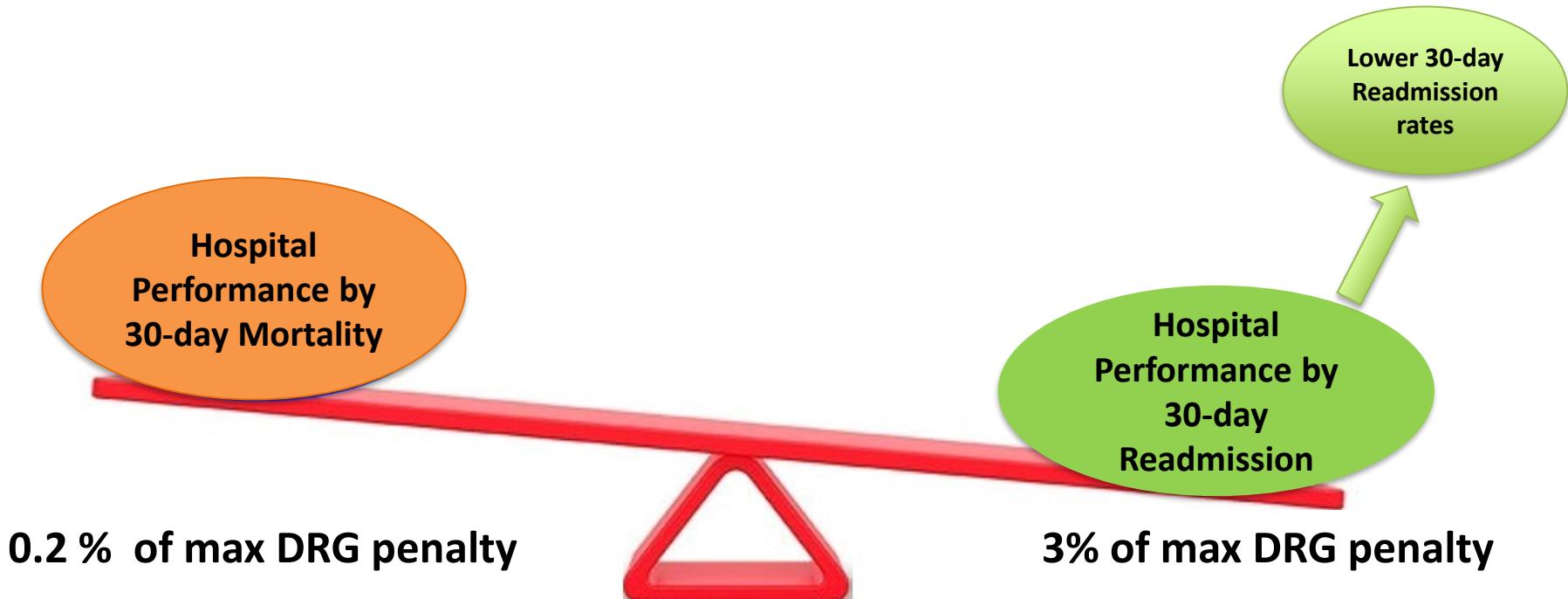


ACC.18™

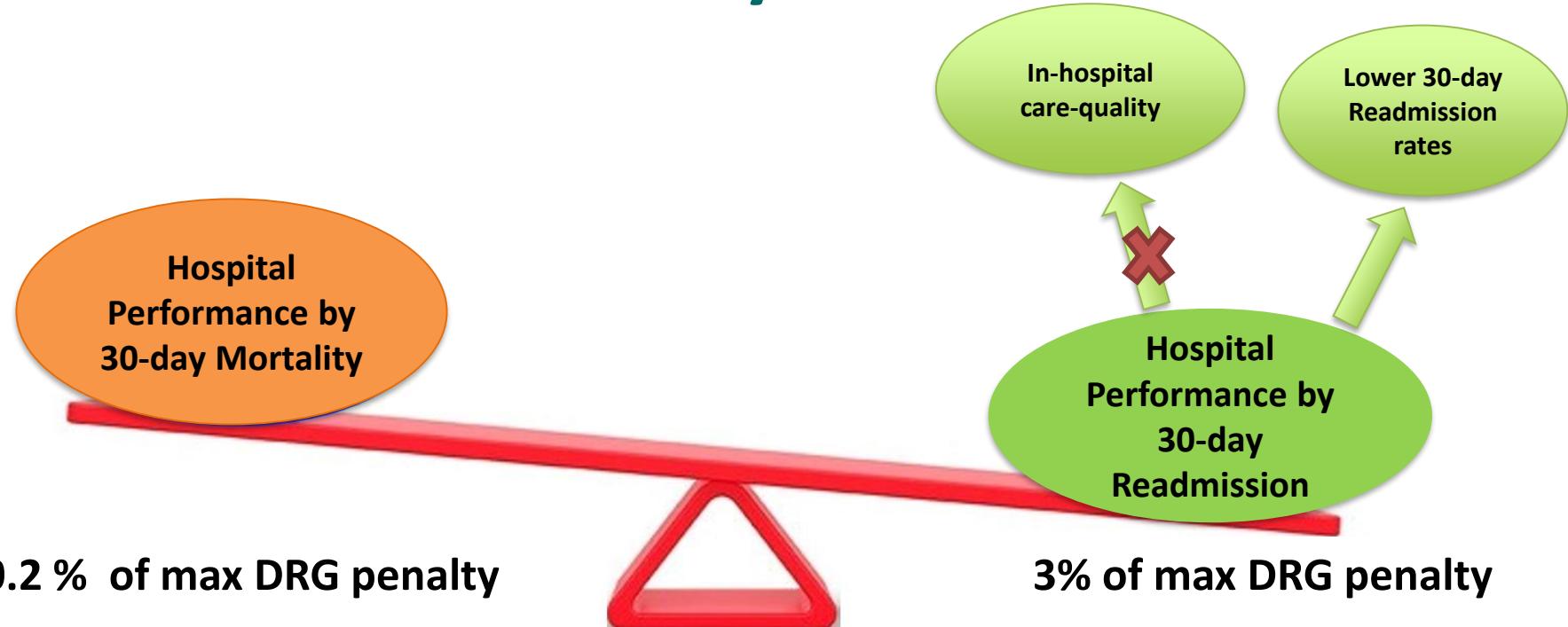
CMS Incentives Favor Readmission Prevention Over Mortality Reduction



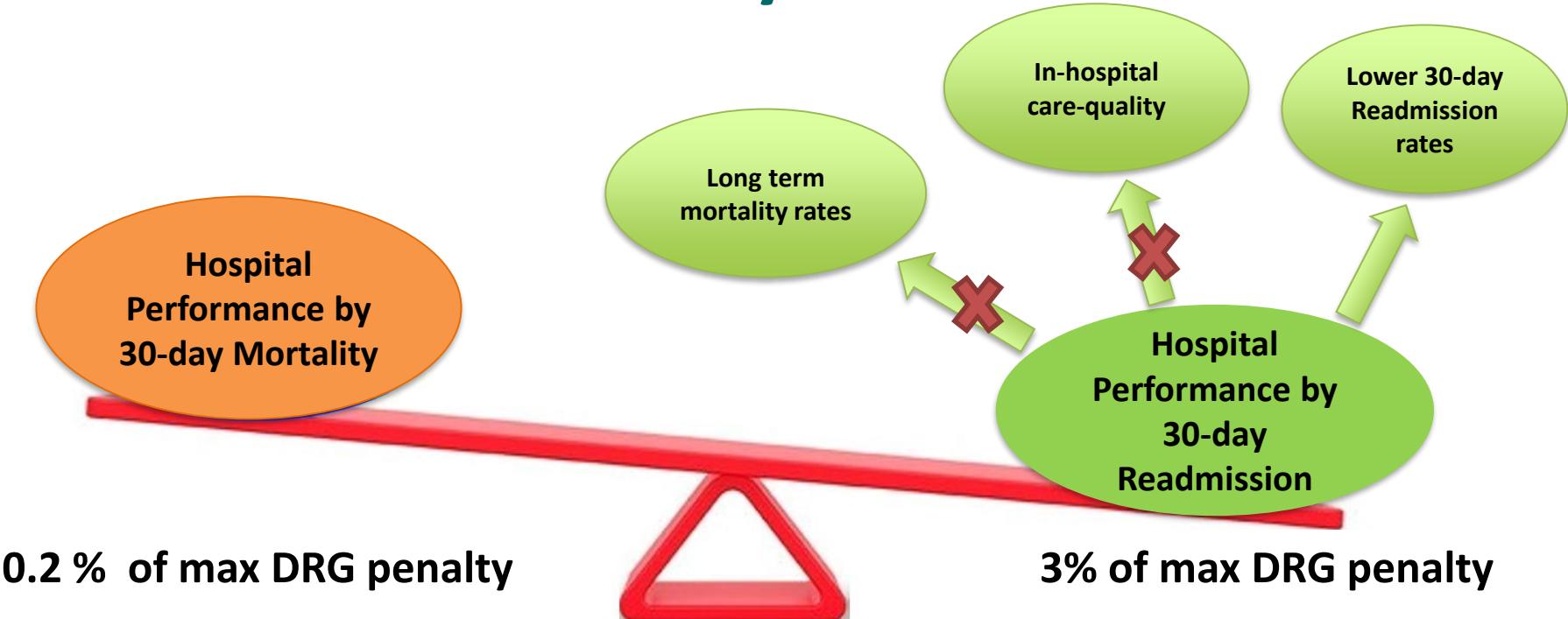
CMS Incentives Favor Readmission Prevention Over Mortality Reduction



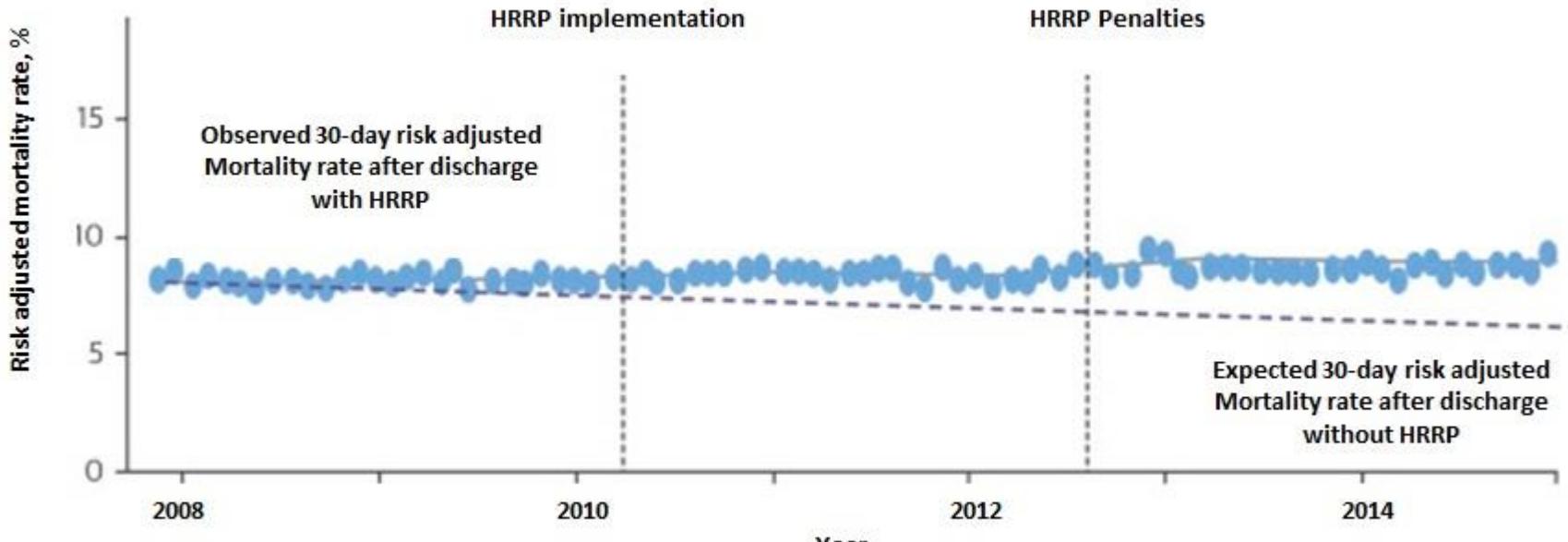
CMS Incentives Favor Readmission Prevention Over Mortality Reduction



CMS Incentives Favor Readmission Prevention Over Mortality Reduction



30-day HF Mortality Rates May Have Increased in The Readmission Penalty Era

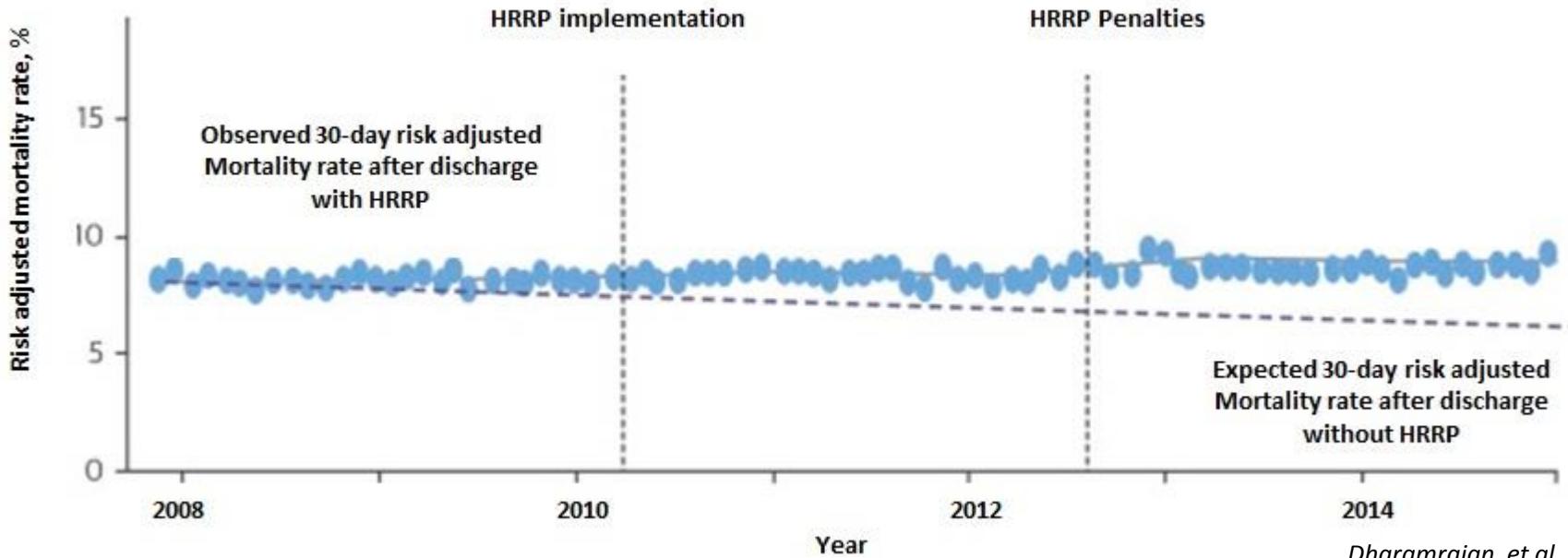


Dharamraj, et al. JAMA 2017
Fonarow, et al. JACC 2017



ACC.18™

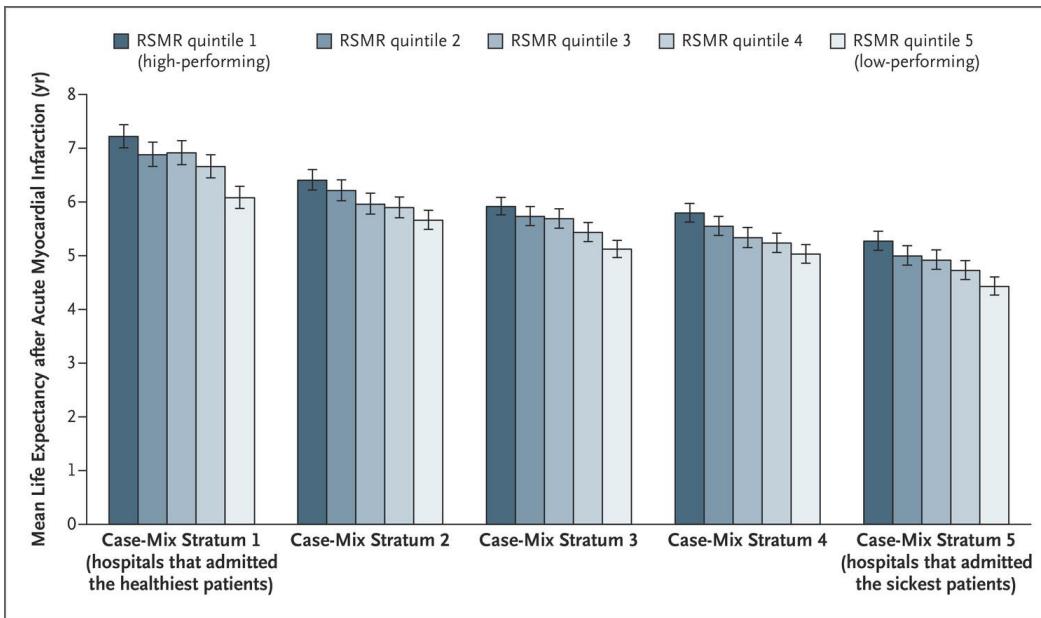
30-day HF Mortality Rates May Have Increased in The Readmission Penalty Era



Dharamraj, et al. JAMA 2017
Fonarow, et al. JACC 2017

Need Better Hospital Performance Metric for
HF Care and Outcomes

30-day Risk Standardized Mortality As a Performance Metric For Acute MI



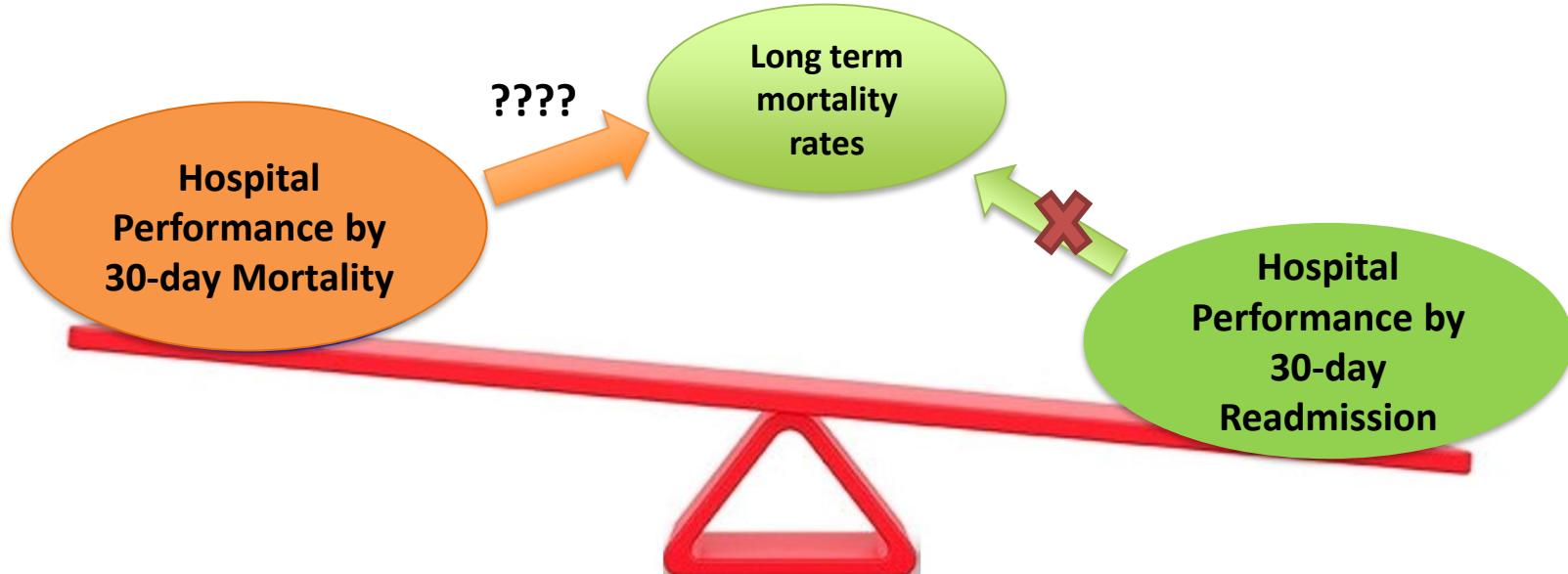
Lower 30-day RSMR for AMI is associated with better long-term survival

Bucholz, et al. NEJM 2016



ACC.18™

Knowledge Gap For Hospital Performance Metrics in Acute HF



Study Objective

Evaluate the association between hospital performance based on 30-day risk standardized mortality rate & long-term survival patients hospitalized with acute HF at GWTG-HF participating centers



ACC.18™

Study Hypothesis

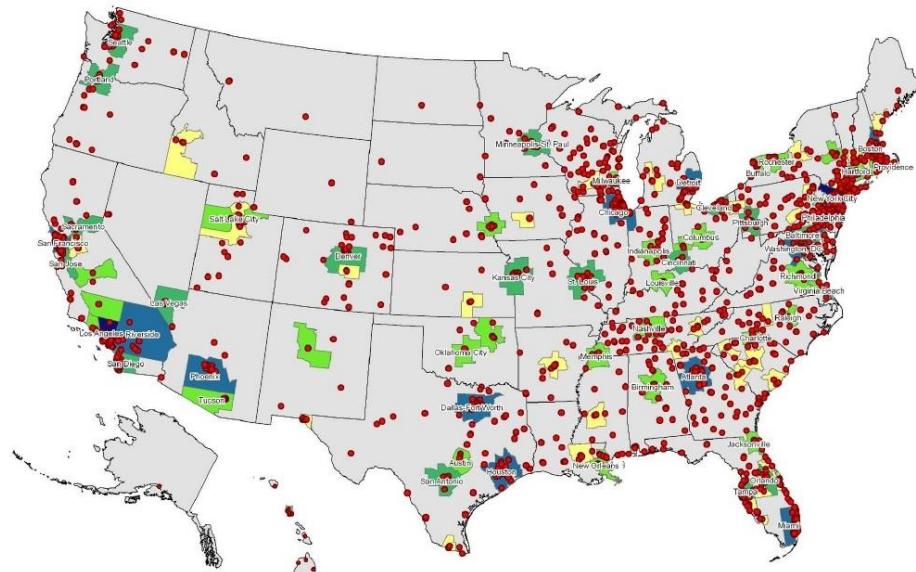
Better hospital performance based on 30-day RSMR will be associated with greater long-term survival among patients hospitalized with acute HF



ACC.18™

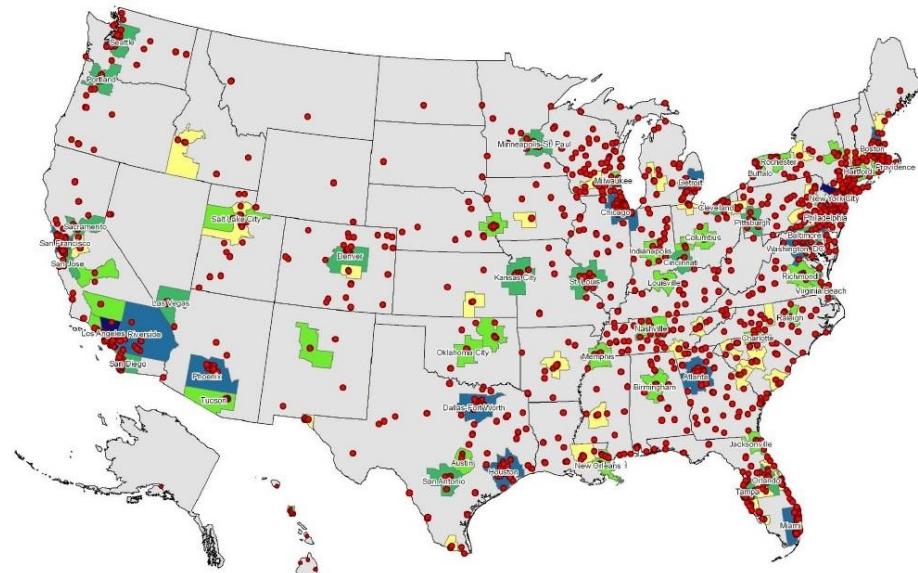
Study Population

- All GWTG-HF participating centers between 2005-2013



Study Population

- All GWTG-HF participating centers between 2005-2013
- Patients above 65 years age with available CMS linked data



Study Population

- All GWTG-HF participating centers between 2005-2013
- Patients above 65 years age with available CMS linked data

106,304 patients from 317 sites



ACC.18™

Primary Exposure Variable

30-day Risk Standardized Mortality Rate (RSMR)

- Multivariable hierarchical logistic models
- Adjusted for patient-level co-variates
- Hospitals treated as random effects



ACC.18™

Primary Exposure Variable

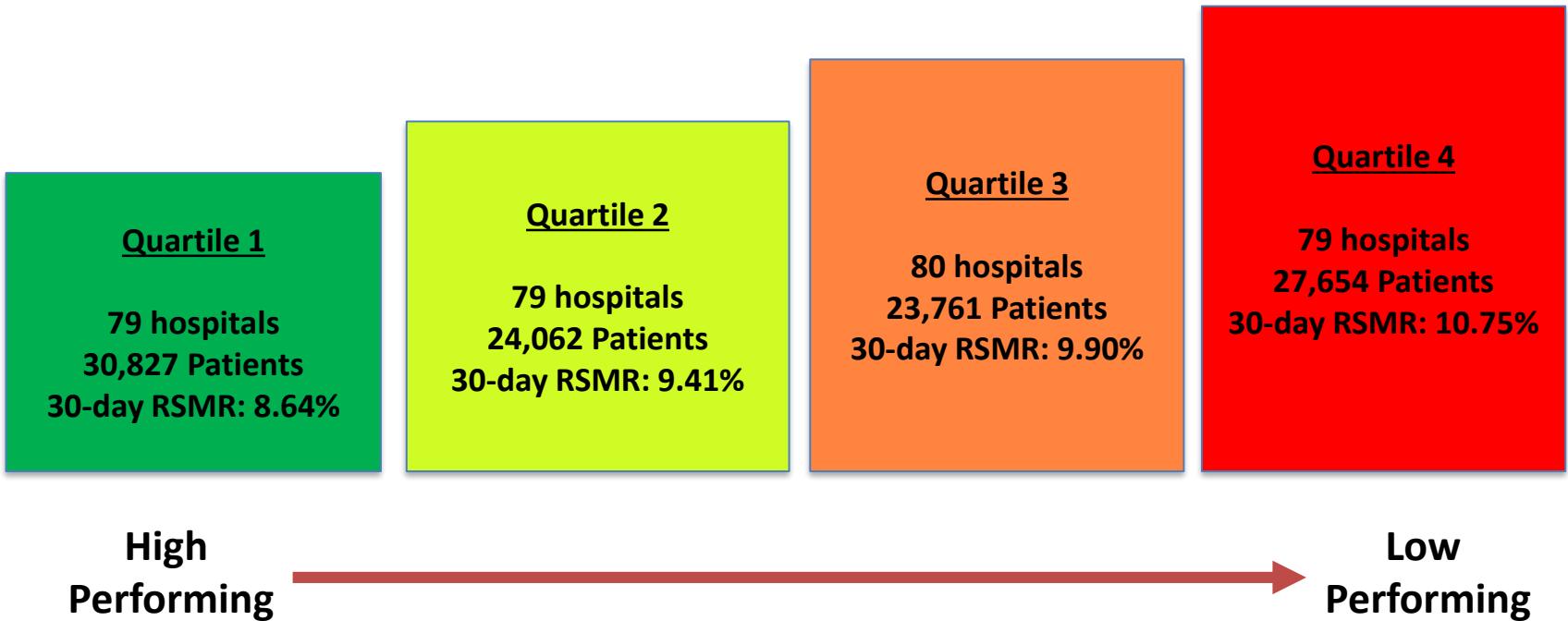
30-day Risk Standardized Mortality Rate (RSMR)

- Multivariable hierarchical logistic models
- Adjusted for patient-level co-variates
- Hospitals treated as random effects

$$\text{30-day RSMR} = \frac{\text{Predicted deaths (using hospital-specific intercept)}}{\text{Expected deaths (average hospital intercept)}} \times \text{Average mortality rate}$$



Study Cohort Stratification



ACC.18™

Adjusted Analysis

- Cox-proportional hazard models for long-term mortality risk
- Adjusted for patient-level and hospital-level co-variates
- Separate analysis for 30-day survivors



ACC.18™

Hospital Characteristics

Characteristics	Q1 (N = 79) High Performing	Q2 (N = 79)	Q3 (N = 80)	Q4 (N = 79) Low Performing
Teaching Hospital (%)	44	43	40	48
Primary PCI Capabilities (%)	80	71	81	73
Cardiac Surgery in-house (%)	66	56	61	57
Heart Transplant Center (%)	13	6	5	2
30-day RSMR, median (IQR)	8.64 (8.28 – 8.84)	9.41 (9.22 – 9.54)	9.90 (9.79 – 10.07)	10.75 (10.49 – 11.28)



Hospital Characteristics

Characteristics	Q1 (N = 79) High Performing	Q2 (N = 79)	Q3 (N = 80)	Q4 (N = 79) Low Performing
Teaching Hospital (%)	44	43	40	48
Primary PCI Capabilities (%)	80	71	81	73
Cardiac Surgery in- house (%)	66	56	61	57
Heart Transplant Center (%)	13	6	5	2
30-day RSMR, median (IQR)	8.64 (8.28 – 8.84)	9.41 (9.22 – 9.54)	9.90 (9.79 – 10.07)	10.75 (10.49 – 11.28)



Hospital Characteristics

Characteristics	Q1 (N = 79) High Performing	Q2 (N = 79)	Q3 (N = 80)	Q4 (N = 79) Low Performing
Teaching Hospital (%)	44	43	40	48
Primary PCI Capabilities (%)	80	71	81	73
Cardiac Surgery in- house (%)	66	56	61	57
Heart Transplant Center (%)	13	6	5	2
30-day RSMR, median (IQR)	8.64 (8.28 – 8.84)	9.41 (9.22 – 9.54)	9.90 (9.79 – 10.07)	10.75 (10.49 – 11.28)



Hospital Characteristics

Characteristics	Q1 (N = 79) High Performing	Q2 (N = 79)	Q3 (N = 80)	Q4 (N = 79) Low Performing
Teaching Hospital (%)	44	43	40	48
Primary PCI Capabilities (%)	80	71	81	73
Cardiac Surgery in-house (%)	66	56	61	57
Heart Transplant Center (%)	13	6	5	2
30-day RSMR, median (IQR)	8.64 (8.28 – 8.84)	9.41 (9.22 – 9.54)	9.90 (9.79 – 10.07)	10.75 (10.49 – 11.28)



Patient Characteristics

Characteristics	Q1 (N = 30,827) High Performing	Q2 (N = 24,062)	Q3 (N = 23,761)	Q4 (N = 27,654) Low Performing
Age (median, y)	81	80	80	81
Women (%)	54	54	55	54
White(%)	80	76	81	81
Diabetes (%)	38	40	39	39
Atrial Fibrillation (%)	42	40	40	41
Hx of HF Hospitalization (%)	12	13	12	11



Presentation Characteristics

Characteristics	Q1 (N = 30,827) High Performing	Q2 (N = 24,062)	Q3 (N = 23,761)	Q4 (N = 27,654) Low Performing
Systolic BP, mm Hg	138	139	138	140
Heart Rate	80	81	80	81
Sodium, mg/dl	139	138	138	140
BNP, pg/ml	789	715	779	819
Troponin, ng/dl	0.05	0.06	0.05	0.05
EF (%)	45	43	45	46
Creatinine, mg/dl	1.3	1.3	1.3	1.3



ACC.18™

Adherence to Guideline Directed HF Therapies Across Study Groups

Characteristics	Q1 (N = 30,827) High Performing	Q2 (N = 24,062)	Q3 (N = 23,761)	Q4 (N = 27,654) Low Performing
Evidence-based Beta-Blocker Use	86.4	86.3	86.2	85.4
ACE-i/ARB Use	91.9	92.1	89.2	91.0
Post Discharge HF follow-up	62.3	61.9	48.6	54.8
ICD placement Prior to discharge	43.4	48.7	42.2	40.7
CRT at discharge	48.9	43.8	44.4	38.0



Adherence to Guideline Directed HF Therapies Across Study Groups

Characteristics	Q1 (N = 30,827) High Performing	Q2 (N = 24,062)	Q3 (N = 23,761)	Q4 (N = 27,654) Low Performing
Evidence-based Beta-Blocker Use	86.4	86.3	86.2	85.4
ACE-i/ARB Use	91.9	92.1	89.2	91.0
Post Discharge HF follow-up	62.3	61.9	48.6	54.8
ICD placement Prior to discharge	43.4	48.7	42.2	40.7
CRT at discharge	48.9	43.8	44.4	38.0



Adherence to Guideline Directed HF Therapies Across Study Groups

Characteristics	Q1 (N = 30,827) High Performing	Q2 (N = 24,062)	Q3 (N = 23,761)	Q4 (N = 27,654) Low Performing
Evidence-based Beta-Blocker Use	86.4	86.3	86.2	85.4
ACE-i/ARB Use	91.9	92.1	89.2	91.0
Post Discharge HF follow-up	62.3	61.9	48.6	54.8
ICD placement Prior to discharge	43.4	48.7	42.2	40.7
CRT at discharge	48.9	43.8	44.4	38.0



Hospital Performance by 30-day RSMR and Long-term Survival

Long-term Outcomes	Q1	Q2	Q3	Q4
	High Performing			Low Performing
<i>Overall Population</i>				
Median Survival, days	717	685	654	579
(95% CI)	(700 – 734)	(668 – 705)	(636 – 674)	(565 – 594)



Hospital Performance by 30-day RSMR and Long-term Survival

Long-term Outcomes	Q1	Q2	Q3	Q4
	High Performing	Overall Population	Low Performing	
<i>Overall Population</i>				
Median Survival, days	717	685	654	579
(95% CI)	(700 – 734)	(668 – 705)	(636 – 674)	(565 – 594)
5-year Mortality (%)	75.6	76.2	76.9	79.6



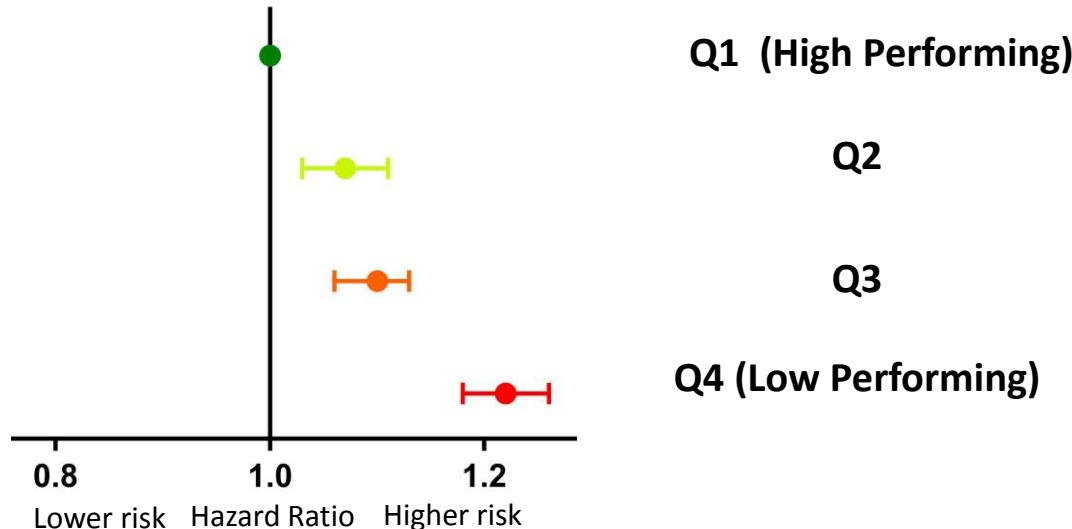
Hospital Performance by 30-day RSMR and Long-term Survival

Long-term Outcomes	Q1 High Performing	Q2	Q3	Q4 Low Performing
<i>Overall Population</i>				
Median Survival, days (95% CI)	717 (700 – 734)	685 (668 – 705)	654 (636 – 674)	579 (565 – 594)
5-year Mortality (%)	75.6	76.2	76.9	79.6
<i>30-day Survivors</i>				
Median Survival, days (95% CI)	832 (815 – 852)	825 (805 – 843)	814 (794 – 831)	759 (742 – 779)
5-year Mortality (%)	73.7	73.7	74.3	76.8



Adjusted Association of Hospital Performance by 30-day RSMR with 5-y Mortality

Overall Population



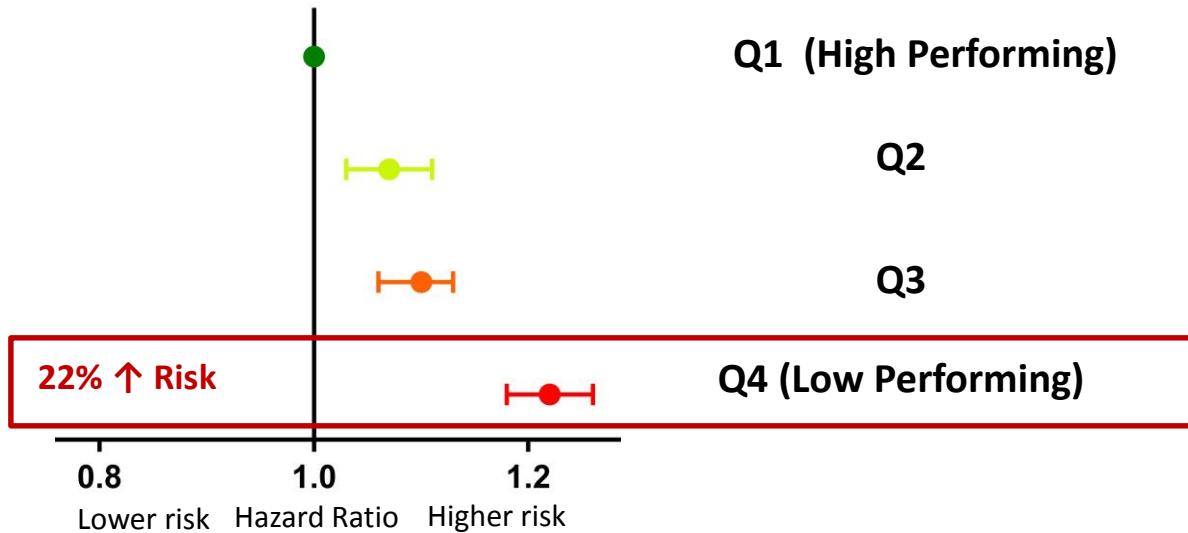
Adjusted for patient- and hospital-level covariates



ACC.18™

Adjusted Association of Hospital Performance by 30-day RSMR with 5-y Mortality

Overall Population



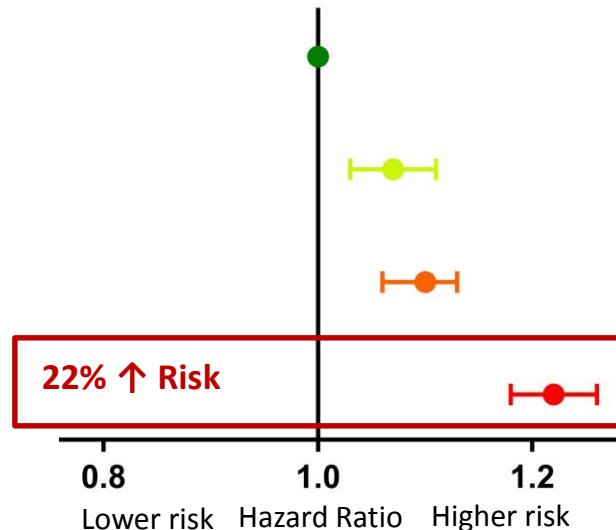
Adjusted for patient- and hospital-level covariates



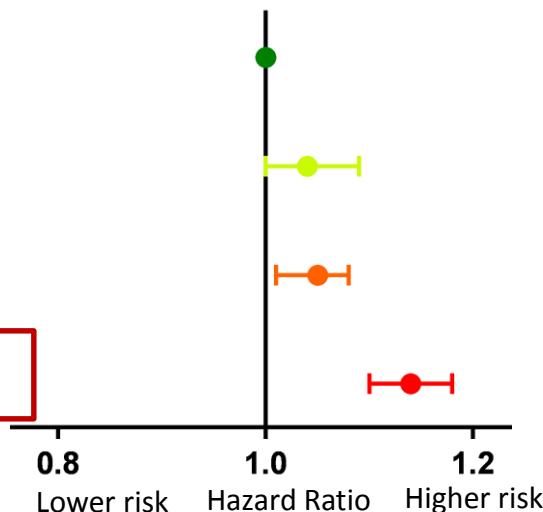
ACC.18™

Adjusted Association of Hospital Performance by 30-day RSMR with 5-y Mortality

Overall Population



30-day Survivors



Adjusted for patient- and hospital-level covariates



ACC.18™

Limitations

- Findings may not be generalizable to non-GWTG-HF centers
- Potential for residual or unmeasured confounding
- Cannot establish causation between hospital performance based on 30-day RSMR and long-term survival



ACC.18™

Conclusions

- High performing hospitals based on 30-day RSMR have better long-term survival for patients hospitalized with acute HF
- This survival advantage at centers with low 30-day RSMR continues to accrue beyond 30-days and persists in long-term
- 30-day RSMR may be a useful metric to incentivize quality care and improve long-term outcomes



ACC.18™

Acknowledgements

Co-authors

Kershaw Patel
Li Liang
Adam DeVore
Roland Matsouaka
Deepak Bhatt
Clyde Yancy
Adrian Hernandez
Paul Heidenreich
James de Lemos
Gregg Fonarow

Statistical Support

Duke Clinical Research Institute

Funding

The American Heart Association supports the Get With The Guidelines Heart Failure program (GWTG-HF). GWTG-HF has been previously funded through support from Medtronic, GlaxoSmithKline Ortho-McNeil and the AHA Pharmaceutical Roundtable.



ACC.18™

Association of Hospital Performance Based on 30-Day Risk-Standardized Mortality Rate With Long-term Survival After Heart Failure Hospitalization: An Analysis of the Get With The Guidelines-Heart Failure Registry

Ambarish Pandey, MD; Kershaw V. Patel, MD; Li Liang, PhD; Adam D. DeVore, MD, MHS; Roland Matsouaka, PhD; Deepak L. Bhatt, MD, MPH; Clyde W. Yancy, MD; Adrian F. Hernandez, MD, MHS; Paul A. Heidenreich, MD, MS; James A. de Lemos, MD; Gregg C. Fonarow, MD

IMPORTANCE Among patients hospitalized with heart failure (HF), the long-term clinical implications of hospitalization at hospitals based on 30-day risk-standardized mortality rates (RSMRs) is not known.

OBJECTIVE To evaluate the association of hospital-specific 30-day RSMR with long-term survival among patients hospitalized with HF in the American Heart Association Get With The Guidelines-HF registry.

DESIGN, SETTING, AND PARTICIPANTS The longitudinal observational study included 106 304 patients with HF who were admitted to 317 centers participating in the Get With The Guidelines-HF registry from January 1, 2005, to December 31, 2013, and had Medicare-linked follow-up data. Hospital-specific 30-day RSMR was calculated using a hierarchical logistic regression model. In the model, 30-day mortality rate was a binary outcome, patient baseline characteristics were included as covariates, and the hospitals were treated as random effects. The association of 30-day RSMR-based hospital groups (low to high 30-day RSMR: quartile 1 [Q1] to Q4) with long-term (1-year, 3-year, and 5-year) mortality was assessed using adjusted Cox models. Data analysis took place from June 29, 2017, to February 19, 2018.

EXPOSURES Thirty-day RSMR for participating hospitals.

MAIN OUTCOMES AND MEASURES One-year, 3-year, and 5-year mortality rates.

RESULTS Of the 106 304 patients included in the analysis, 57 552 (54.1%) were women and 84 595 (79.6%) were white, and the median (interquartile range) age was 81 (74-87) years. The 30-day RSMR ranged from 8.6% (Q1) to 10.7% (Q4). Hospitals in the low 30-day RSMR group had greater availability of advanced HF therapies, cardiac surgery, and percutaneous coronary interventions. In the primary landmark analyses among 30-day survivors, there was a graded inverse association between 30-day RSMR and long-term mortality (Q1 vs Q4: 5-year mortality, 73.7% vs 76.8%). In adjusted analysis, patients admitted to hospitals in the high 30-day RSMR group had 14% (95% CI, 10-18) higher relative hazards of 5-year mortality compared with those admitted to hospitals in the low 30-day RSMR group. Similar findings were observed in analyses of survival from admission, with 22% (95% CI, 18-26) higher relative hazards of 5-year mortality for patients admitted to Q4 vs Q1 hospitals.

CONCLUSIONS AND RELEVANCE Lower hospital-level 30-day RSMR is associated with greater 1-year, 3-year, and 5-year survival for patients with HF. These differences in 30-day survival continued to accrue beyond 30 days and persisted long term, suggesting that 30-day RSMR may be a useful HF performance metric to incentivize quality care and improve long-term outcomes.

JAMA Cardiol. doi:10.1001/jamacardio.2018.0579
Published online March 12, 2018.

 Supplemental content

JAMA Cardiology

Ambarish Pandey, Kershaw V. Patel, Li Liang, Adam D. DeVore, Roland Matsouaka, Deepak L. Bhatt, Clyde W. Yancy, Adrian F. Hernandez, Paul A. Heidenreich, James A. de Lemos, and Gregg C. Fonarow

Association of Hospital Performance Based on 30-Day Risk-Standardized Mortality Rate With Long-term Survival After Heart Failure Hospitalization: An Analysis of the Get With The Guidelines-Heart Failure Registry

Published online March 12, 2018

Available at jama.com and on The JAMA Network Reader at mobile.jamanetwork.com

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Gregg C. Fonarow, MD, Ahmanson-UCLA Cardiomyopathy Center, Ronald Reagan UCLA Medical Center, University of California, Los Angeles, 10833 LeConte Ave, Room 47123 CHS, Los Angeles, CA 90095-1679 (gfonarow@mednet.ucla.edu).



ACC.18™