Supplemental Online Content

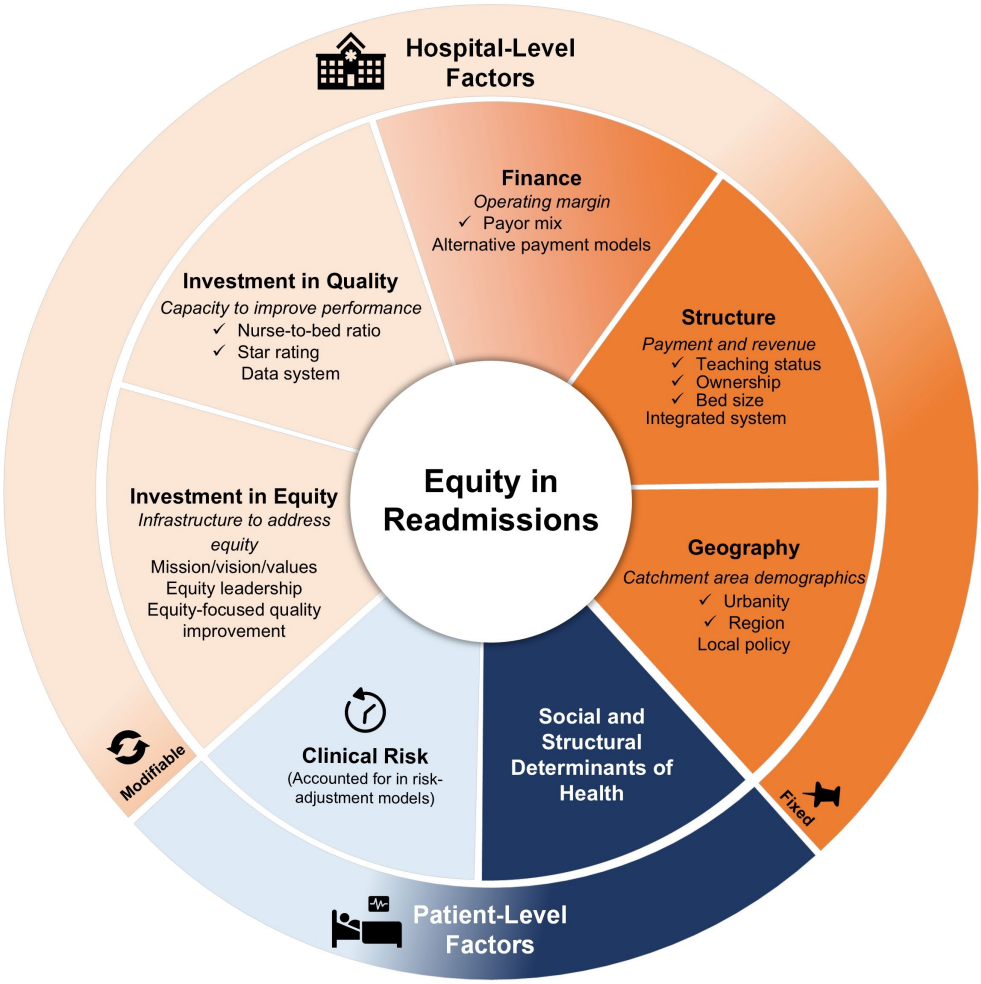
Nash KA, Weerahandi H, Yu H, et al. Measuring equity in readmission as a distinct assessment of hospital performance. *JAMA*. doi:10.1001/jama.2023.24874

This supplemental material has been provided by the authors to give readers additional information about their work.

eTable 1. Defining Hospitals With Equitable Readmissions by Insurance or Race

	Eligibility Criteria	Insurance	Race
Criterion I: Across-Hospital Method	Cared for at least 25 patients in at-risk group	Hospital's risk-standardized readmission rate[b] for dual eligible patients < median risk standardized readmission rate for dual eligible patients **across** all hospitals	Hospital's risk-standardized readmission rate for Black patients < median risk-standardized readmission rate for Black patients **across** all hospitals
Criterion II: Within- A-Single Hospital Method	Cared for at least 12 patients in at-risk group, 12 patients in the not at-risk group and 25 patients in total	The absolute adjusted readmission rate difference between dual eligible and non-dual eligible patients is **between** -1 and 1%	The absolute adjusted readmission rate difference between Black and White patients is **between** -1 and 1%

eFigure 1. Conceptual Model of Factors That May Impact Hospital Performance on Equitable Readmissions



eFigure 1 Legend: This conceptual model focuses on categories of hospital-level factors that may influence a hospital's capacity to provide equitable readmissions, while also acknowledging the role of patient-level factors - both clinical risk and the social & structural determinants of health. These categories of hospital-level factors range from modifiable to fixed, however no single category is definitively modifiable or definitively fixed. For each category we provide a brief justification – i.e. how and why that category of factors may influence a hospital's capacity to provide equitable readmissions in italicized text. We additionally provide examples of individual factors that we have and have not included in our analysis (Figure 3) (we indicate included factors with a check mark √). For example, a hospital's geography may impact a hospital's capacity to provide equitable readmissions by dictating its catchment area. Within the category of geography, we include urbanity and region in our analysis, and list local policy as an example of an additional geography factor not included in our current analysis.

eAppendix. Methods

Details about Risk-standardized readmission rate (RSRR) calculation

RSRR are calculated using a risk adjustment model which incorporates a hospital specific (latent) quality effect. This hospital specific effect – essentially the underlying quality signal of the hospital – is a reliability weighted average of the individual hospital quality estimate and the national hospital mean estimate. That is, it is essentially a volume weighted average of the hospital risk adjusted rate and the national risk adjusted rate. This 'shrinkage' towards the mean means that the smaller the hospital volume the more it is pulled toward the average.

RSRRs that are calculated among one subgroup (i.e. dual-eligible patients) cannot be compared to a different subgroup (i.e. non-dual-eligible patients). As detailed in the methods paper describing the development of the HWR measure (Horwitz et al, Ann Intern Med, doi: 10.7326/M13-3000), "this measure accounts for the diversity of conditions and procedures at different hospitals, to provide a fair assessment of relative hospital performance". As we demonstrate in the present manuscript, the hospitals that serve dual-eligible versus non-dual-eligible patients and Black versus white patients are different. Thus, the risk adjustment applied in one subgroup (dual-eligible patients) will be different from a different subgroup (non-dual-eligible patients). Because the adjustment is different when RSRR are calculated among subgroups, it would not be meaningful to compare RSRRs between subgroups. Instead, for comparison purposes, we illustrate the distribution of observed readmission rates (unadjusted readmission rates) between subgroups in Supplemental Figures 3a and 3b.

Details about calculation of Hospital Star Rating Scores

The hospital Star Ratings are constructed from underlying continuous scores; separate scores are constructed for each domain, and then these scores are averaged to create a single overall score. At the final step the overall score is categorized into 5 groups. However, for this analysis we are using the underlying continuous scores; these are all standardized (mean 0, SD 1), which gives them a natural interpretation.

eTable 2. Characteristics of Hospitals Ineligible[a] for Examination of Disparities by Insurance (Dual-Eligible Medicaid-Medicare Beneficiaries vs Non–Dual-Eligible) and Race (Black vs White Medicare Beneficiaries)

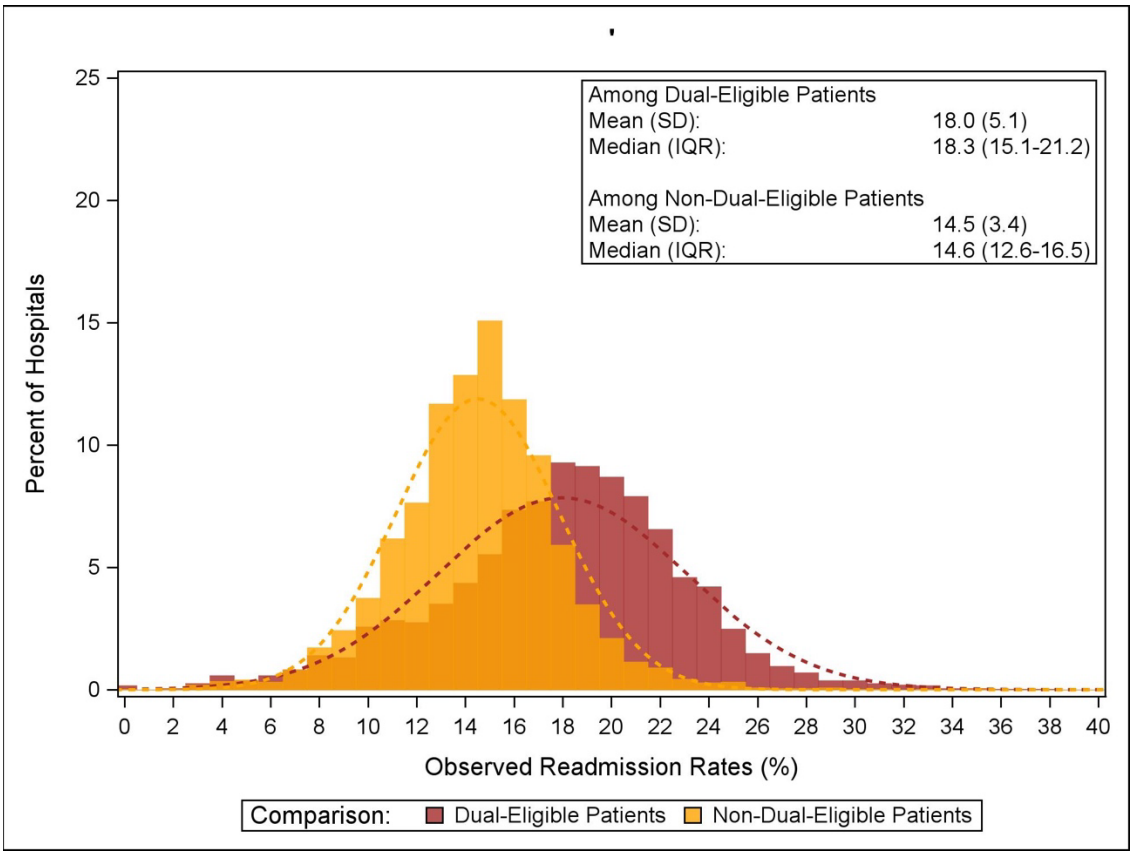
	Insurance (Dual-eligible) N =1,224	**Race (Black) N=2,676**
Hospital Patient Demographic Characteristics	**Median (IQR[g])**	
% Dual-Eligible Patients	N=1,224 12.7 (5.4-20.8)	N=2,676 16.4 (10.0-24.1)
% Black Patients	N=1,224 0 (0-2.6)	N=2,676 0.31 (0-1.51)
% White Patients	N=1,224 94.4 (83.9-98.4)	N=2,676 95.3 (88.3-97.9)
Disproportionate Share Hospital (DSH) Patient Percentage [b]	N=400 0.2 (0.00-0.3)	N=1,335 0.25 (0.2-0.3)
Hospital Characteristics	**n (%)**	
Teaching Status[c]	N=1,164	N=2,599
Non-Teaching Hospitals	1041 (89.4)	2157 (83.0)
Teaching Hospitals	121 (10.4)	429 (16.5)
Residency Hospitals	2 (0.2)	13 (0.5)
Ownership	N=1,205	N=2,651
Not for profit	542 (45.0)	1468 (55.4)
Public	405 (33.6)	717 (27.0)
For profit	237 (19.7)	425 (16.0)
Government	21 (1.7)	41 (1.6)
Region [d]		
Urbanity	N=1,203	N=2,649
Rural	700 (58.2)	1583 (59.8)
Urban	503 (41.8)	1066 (40.2)
Number of Beds[e]	N=1,205	N=2,651
0~99 beds	1105 (91.7)	2040 (77.0)
100~199 beds	60 (5.0)	389 (14.6)
200~299 beds	20 (1.7)	130 (4.9)
300~399 beds	11 (0.9)	58 (2.2)
400 or more beds	9 (0.7)	34 (1.3)
Nurse to Beds Ratio[f]	N=1,205	N=2,651
<=0.75	562 (46.6)	920 (34.7)
0.75-1	182 (15.1)	433 (16.3)
1-1.5	241 (20.0)	640 (24.1)
1.5-2	81 (6.7)	294 (11.1)
2+	139 (11.5)	364 (13.7)

[a] Hospitals ineligible for the Disparity Methods did not meet one or both of the following eligibility criteria: (1) Across-Hospitals method: Cared for at least 25 patients in at-risk group (2) Within-A-Single-Hospital method: Cared for at least 12 patients in at-risk group and 25 patients total.

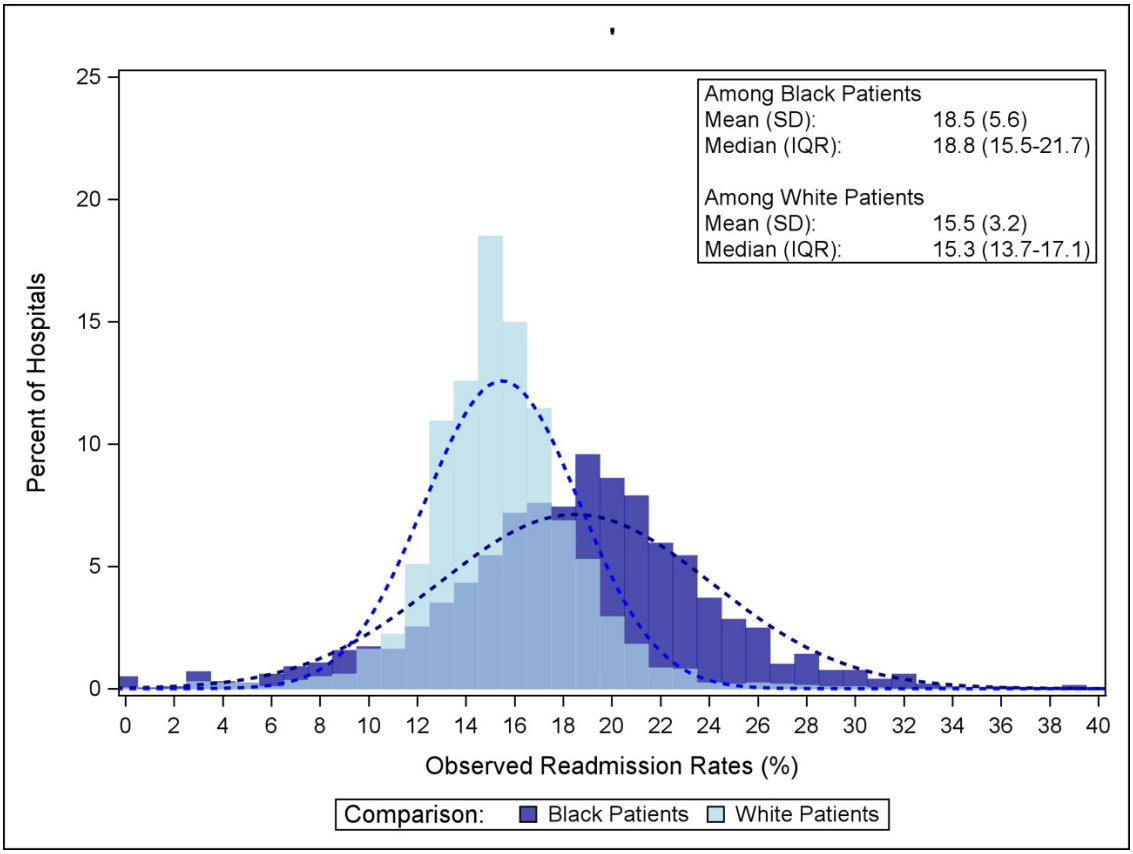
[b] Median and Interquartile Range (IQR) for Disproportionate Share Hospital (DSH) patient percentage were only calculated for hospitals that qualify for a Medicare DSH adjustment. Hospitals that do not qualify for DSH adjustment due to insufficient hospital days paid by Medicaid were not included in this calculation.

[c] Non-teaching hospitals: no associated medical school or residency program, Teaching hospitals: associated with medical school (with or without a residency program), Residency hospitals: associated with residency program but not a medical school
[d] see Supplemental Figures 2a and 2b: Percentage of Hospitals ineligible for Examination of Disparities by Insurance and Race in each State
[e] Bed size: Total number of staffed beds a hospital reports in the Medicare Provider of Service (POS) files.
[f] Nurse-to-Beds Ratio: calculated by dividing the number of employed full-time equivalent registered nurses reported in the American Hospital Association Survey by the total number of staffed beds reported in the Medicare Provider of Service (POS) file
[g] Interquartile range

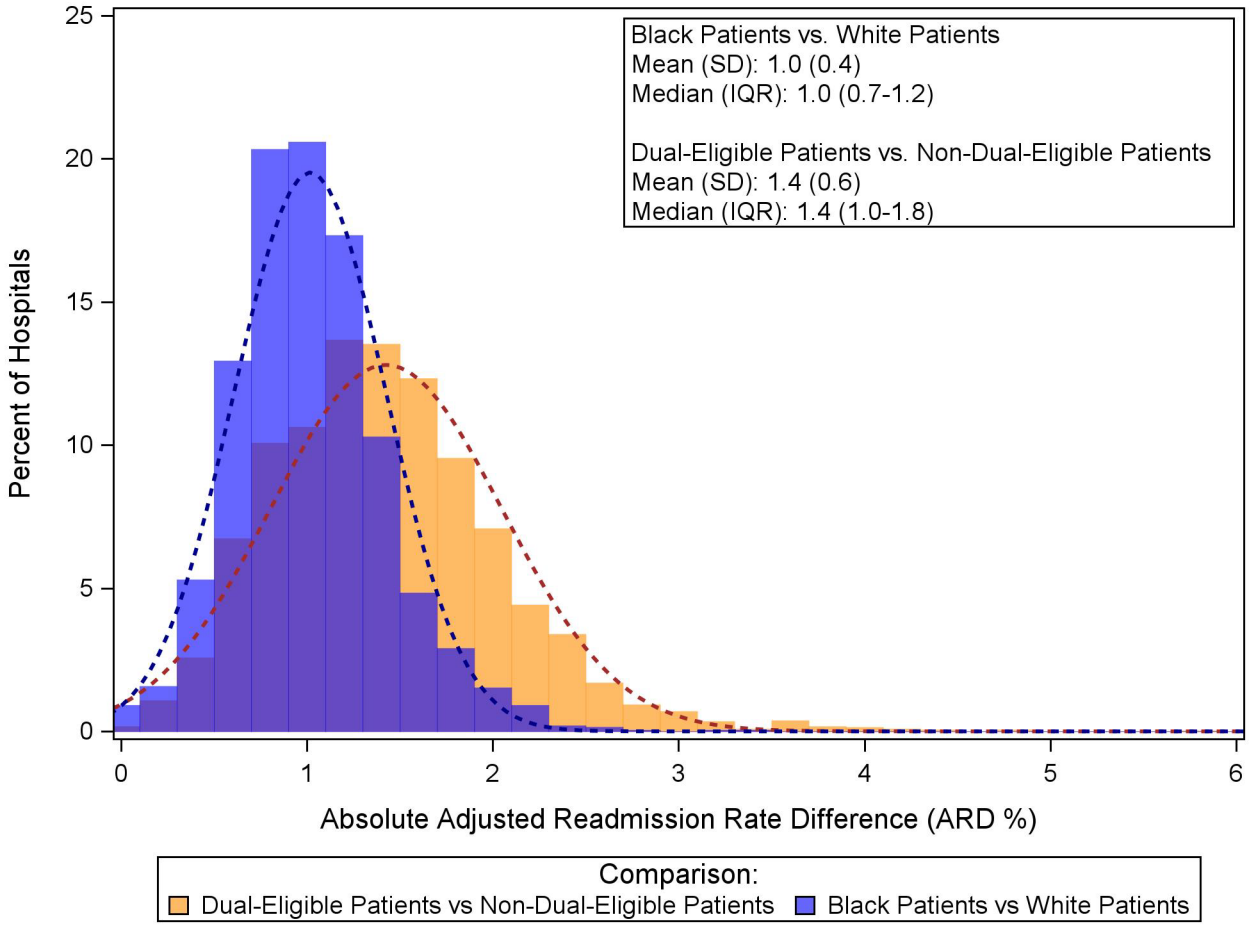
eFigure 2A. Distribution of Observed Readmission Rates for Dual-Eligible vs Non–Dual-Eligible Patients Among Hospitals Eligible for Disparity Methods by Insurance



eFigure 2B. Distribution of Observed Readmission Rates for Black vs White Patients Among Hospitals Eligible for Disparity Methods by Race



eFigure 2C. Distribution of the Absolute Adjusted Readmission Rate Difference Among Eligible Hospitals (Represents Performance on the Within-A-Single-Hospital Method)



eFigure 2 Legend: Panel 2a depicts the distribution of observed readmission rates for dual-eligible vs. non-dual-eligible patients among hospitals eligible for the disparity methods by insurance. Panel 2b depicts the distribution of observed readmission rates for Black vs. White patients among hospitals eligible for the disparity methods by race. This data provides context for the Across-Hospital criteria – Criterion I in our definition of the equitable readmissions measure. Though risk-standardized readmission rates (RSRR) are used for the Across-Hospitals criterion, and not observed readmission rates, for comparison purposes, we illustrate the distributions of the observed (unadjusted) readmission rates. RSRRs are calculated using a risk adjustment model that estimates a hospital specific effect based on the measured cohort. Thus, as with other risk adjusted metrics, it is not meaningful to compare RSRRs across different measured cohorts, such as between dual-eligible and non-dual-eligible and Black vs. White patients. Please see the Supplemental Methods for more information about RSRR calculations.

Panel 2c depicts the distribution of the absolute adjusted readmission rate difference (ARD) between dual-eligible patients versus non-dual-eligible patients and Black patients versus White patients across eligible hospitals. The ARD corresponds to the Within-A-Single-Hospital criterion– Criterion II for our definition of equitable readmissions. Hospitals met this criterion if, among their patient population, the absolute adjusted readmission rate difference (ARD) between the group at-risk and not at-risk of inequities was between -1 and 1%.