CENTER FOR OUTCOMES RESEARCH AND EVALUATION

Approach to the Sociodemographic Status Trial Period: Readmission and Excess Days in Acute Care Measures

NQF Admissions/Readmissions Committee

June 8, 2016

YALE NEW HAVEN HEALTH

Yale-CORE Measures Evaluated at Today's Meeting

- Endorsement Maintenance
  - Heart Failure Readmission
  - Pneumonia Readmission
  - Chronic Obstructive Pulmonary Disease Readmission
  - Hospital-Wide Readmission

Yale-CORE Measures Evaluated at Today's Meeting

- Initial Endorsement
  - Hybrid Hospital-Wide Readmission
  - Excess Days in Acute Care (EDAC)
    - Acute Myocardial Infarction
    - Heart Failure
    - Pneumonia

Objective of Presentation

- Provide overview of response to NQF's SDS Trial Period
- Specific aspects of individual measures will be addressed during measure discussion

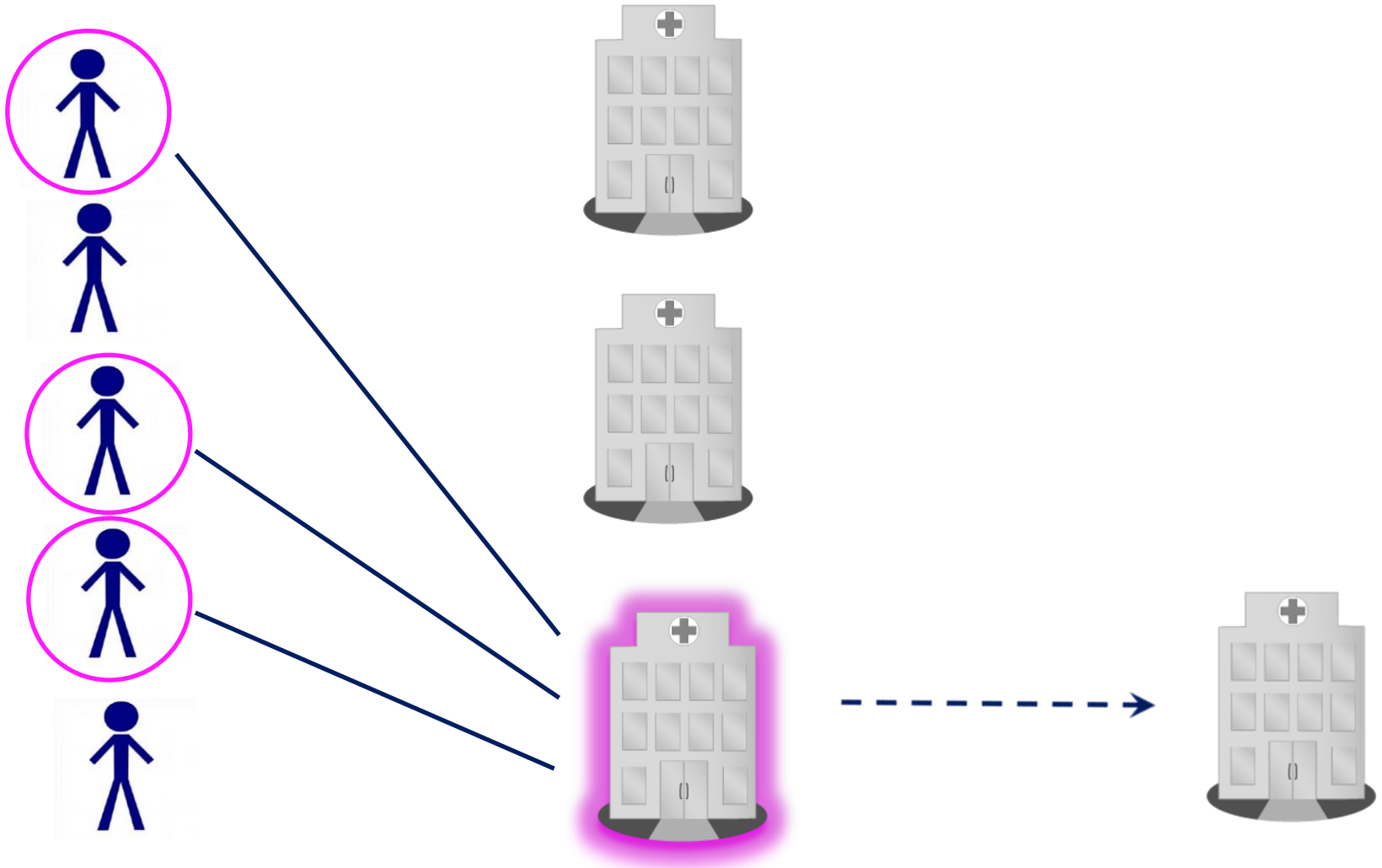
Outline

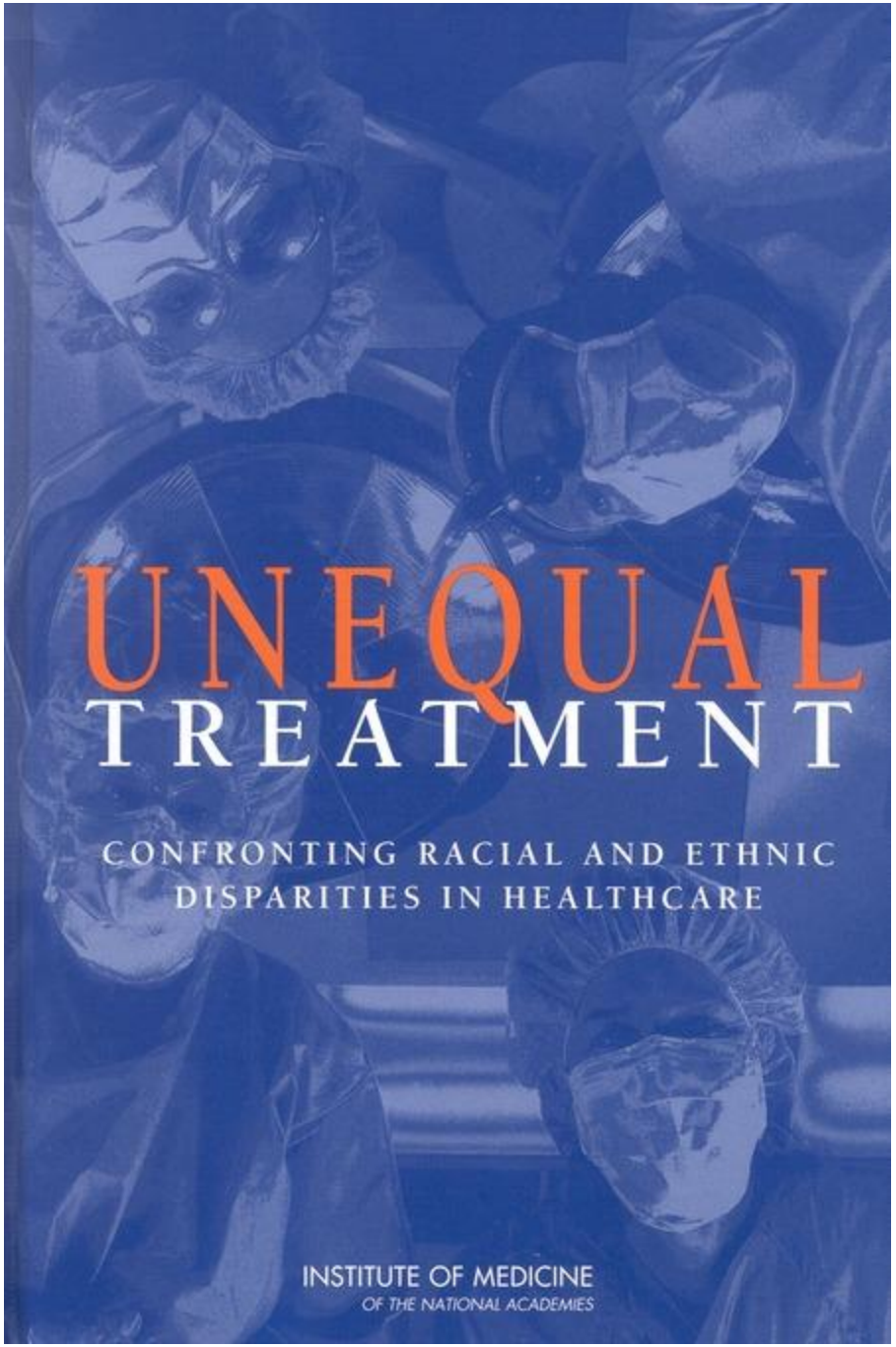
- Background/Overview
  - Guidance from NQF
  - Conceptual framework
- Methods for evaluating SDS adjustment
  - Variable selection
  - Analytic approach
- Results
  - Example from heart failure readmission
- Summary and Recommendations

NQF's Instructions Regarding SDS Trial

- Assess for patient-level adjustment
  - "If a conceptual relationship exists between a patient-level sociodemographic factor and outcome, it should be tested empirically."
- Examine within and between hospital effects
  - Hospital and patient contribution to risk
- Empiric results and conceptual model drive decisions regarding risk-adjustment

Patient and Hospital Contribution to Readmission Risk




UNEQUAL
TREATMENT
CONFRONTING RACIAL AND ETHNIC
DISPARITIES IN HEALTHCARE
INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

Why are patients with social risk factors at higher risk of readmission?

- Patients of low socioeconomic backgrounds are “sicker”
  - How much do differences in illness explain differences in risk of readmission?

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  - How much is hospital effect driving readmission risk?

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- Patients of low socioeconomic are “sicker”
  - How much do differences in illness explain differences in risk of readmission?
- Patients of low socioeconomic status present at hospitals with higher readmission risk
  - How much is hospital effect driving readmission risk?
- Patients of low socioeconomic status face other challenges that elevate risk of readmission
  - Differential care within hospital
  - Post-discharge challenges

Implications for Risk Adjustment

- Differences in illness
  - Risk adjustment not needed if accounted for by current model
- Readmission risk at hospitals predominantly caring for patients of low SES
  - Risk adjustment would lessen ability to detect a true quality signal
- Remaining patient-level risk
  - Risk adjustment would obscure quality differences due to differential care
  - Factors beyond hospital mitigation might warrant adjustment

Evaluating Measures for SDS Adjustment: Variable Selection

Approach to Variable Selection

- **Sought to identify data sources assessing sociodemographic status with following characteristics:**
  - Patient-level variables, or proxies for patient-level
  - Can be linked to Medicare Fee-for-Service claims
  - Available for all, or nearly all, over 65 year-old Medicare patients
  - Currently available

Available National Data Sources

- **Medicare Claims and Enrollment Data**
  - Eligibility for Medicaid (dual-eligible)
  - Low Income subsidy
  - Race
- **American Community Survey**
  - Administered annually on sample of US households
  - 5-years combined for representative data
  - Linked 9-digit ZIP code to obtain data at census block group level
  - Adjusted for cost-of-living differences

Medicare Data Sources

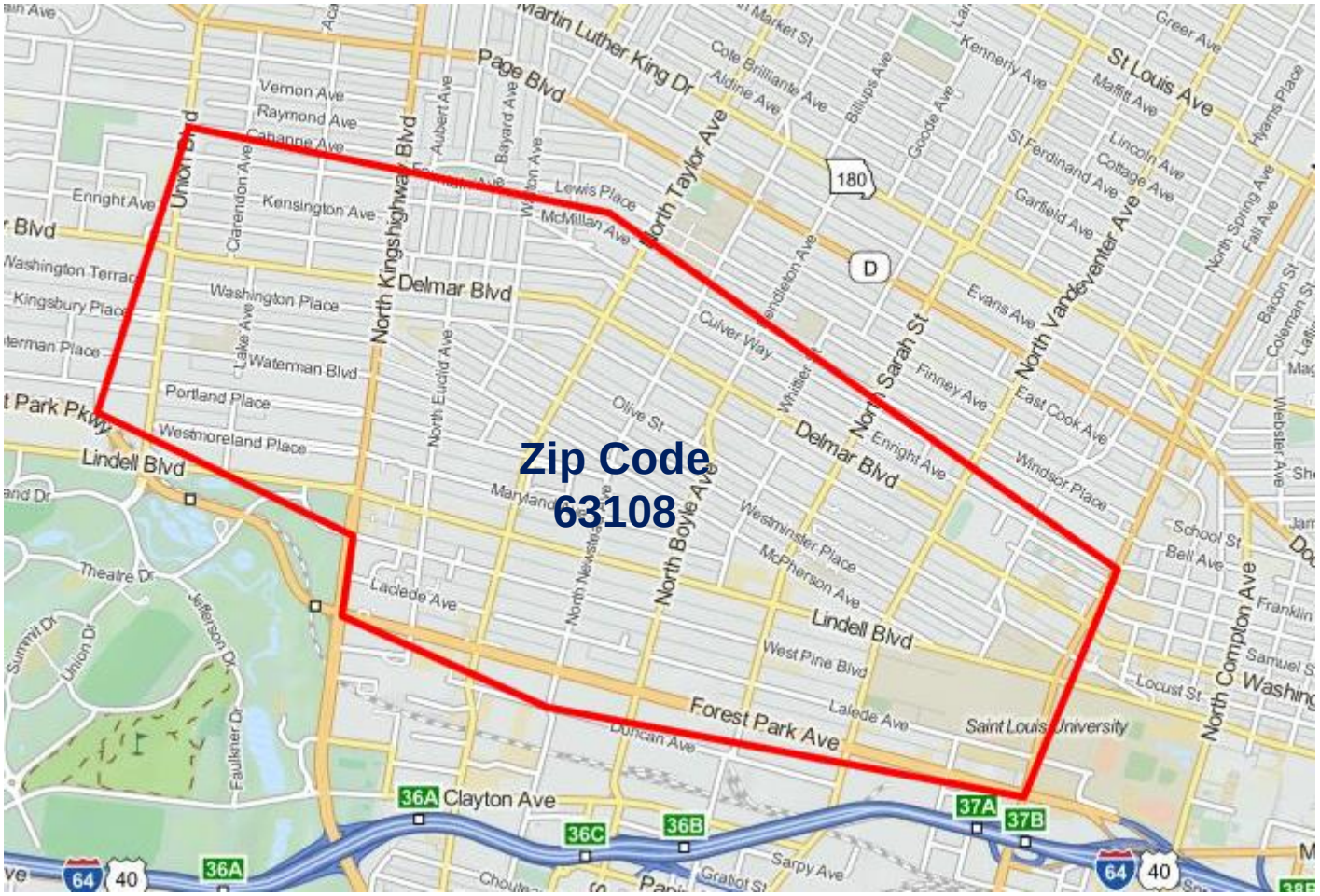
- **Patient-level variables of Income and Assets**
  - Medicare-Medicaid dual eligibility status
    - Medicaid qualification for over 65 is based on income and assets and is applied consistently across states
  - Low-income subsidy (LIS)
    - LIS used only within Part D Program
    - All dual eligible beneficiaries qualify for the LIS and are captured by LIS variable (85% overlap)
  - CORE used dual-eligibility in analyses

American Community Survey

- **AHRQ SES Index (validated for Medicare)**

  - Percent persons with less than a high school degree
  - Percent persons with a bachelor's degree or higher
  - Percent persons living below the poverty level
  - Percent persons unemployed
  - Percent housing units with more than 1 occupant per room
  - Median value of owner-occupied housing unit
  - Median household income

Zip Code vs. Census Block Group



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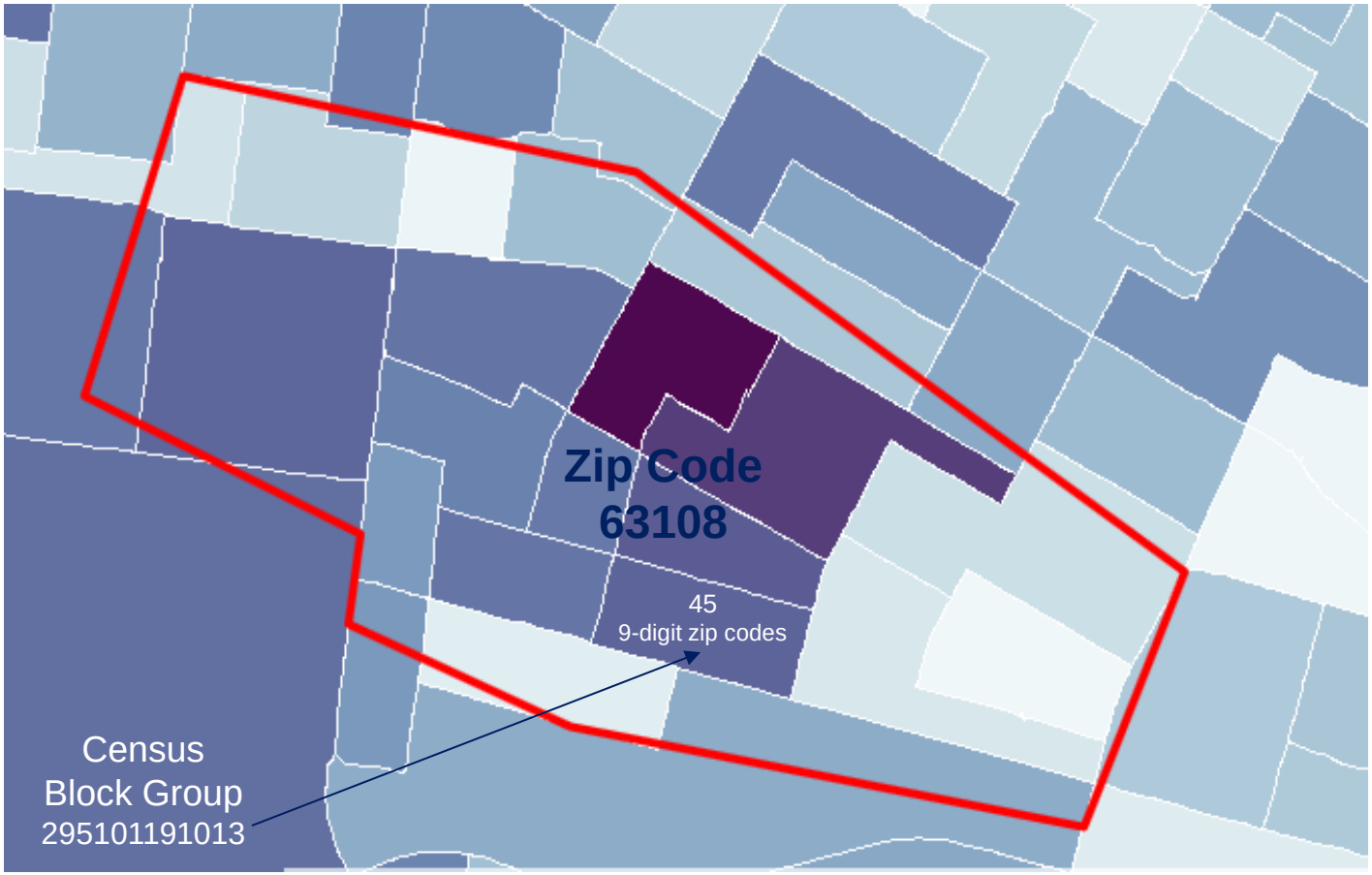


Medicare Data Sources

- **Race**
  - Not a proxy for SES
  - Evaluated for comparison with SES and clinical variables
  - Black and white are the only race categories with high sensitivity and specificity in Medicare data

Source: Validating Medicare's Race and Ethnicity Data. Kimberly Proctor and Carla Hodge. CMS, Office of Minority Health. (Using 2010 and 2000 Census data and 2011-2009 American Community Survey)

Evaluating Measures for SDS Adjustment: Analytic Approach

Examining Causal Pathways

- Differences in illness
  - SDS risk factor in context of multivariable model
  - Impact on model performance and hospital results
- Readmission risk at hospitals predominantly caring for patients of low SES
  - Conduct contextual analyses to separate hospital-level effect from patient-level effect
- Remaining patient-level risk
  - Contextual analysis will also show patient-level effect

Initial Analytic Questions

- Is there a difference in readmission rates by socioeconomic status?
- Is the relationship between SES and readmission attenuated in the multivariable risk-model (accounting for clinical factors)?
- Does adding SES improve model performance?
- Does adding SES to the risk model change hospital results?

Observed Readmission Rates

Measure	Variables	Observed Readmission Rate for Low SES or Black Patients	Observed Readmission Rate for Non-Low SES or Non-Black Patients
HF Readmission	Dual Eligibility	25.5%	21.9%
	AHRQ SES Index	24.3%	21.8%
	Race	24.8%	22.1%

Multivariable Model (Heart Failure)

Variable	Univariate Model		Multivariable Model	
	Odds Ratio	P-Value	Odds Ratio	P-Value
Dual Eligibility	1.22	<.0001	1.08	<.0001
AHRQ Index	1.15	<.0001	1.08	<.0001
Race	1.17	<.0001	1.08	<.0001
Range of Odds Ratios for Clinical Factors in Multivariable Model (0.994,1.182)				

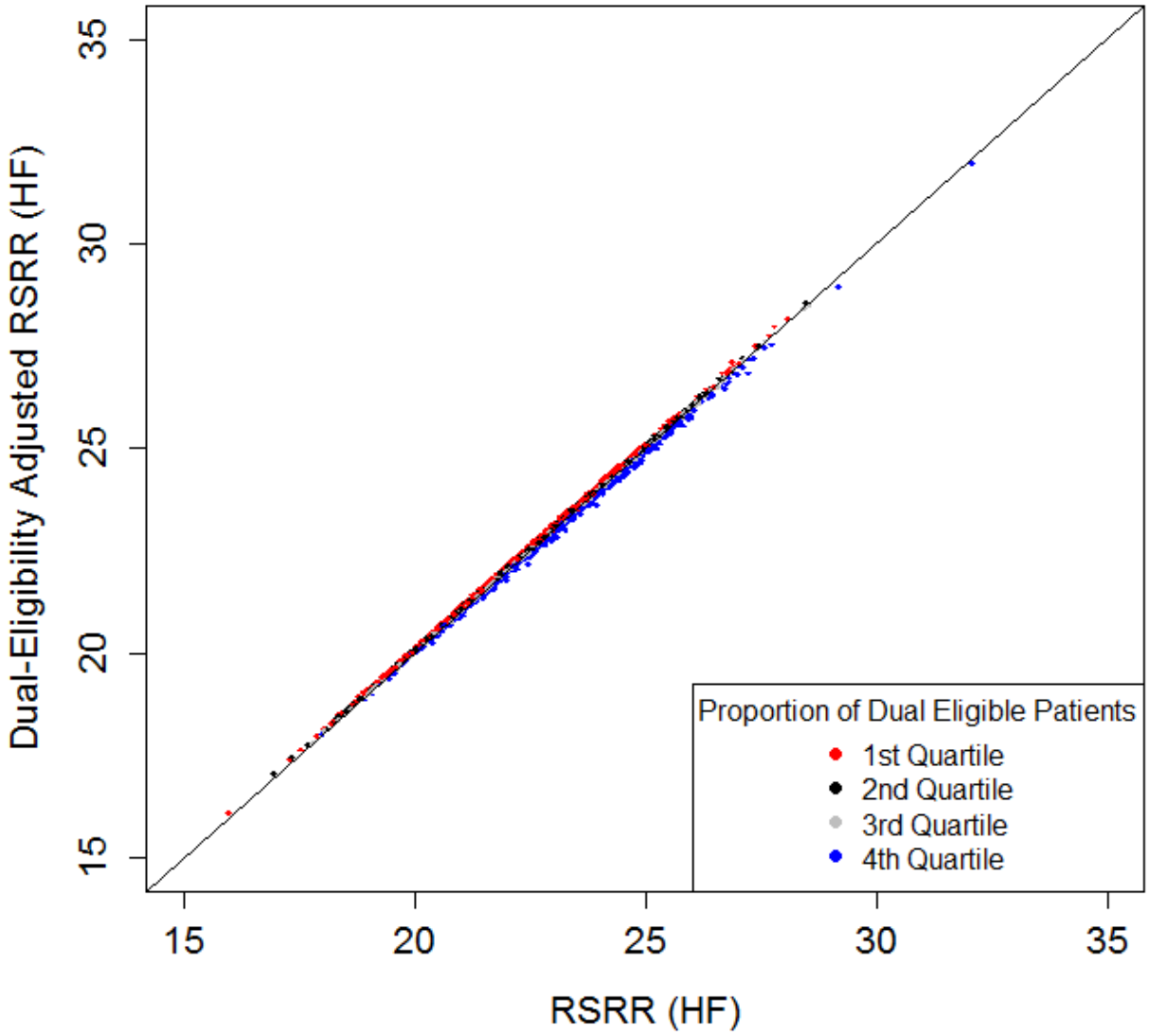
Model Performance Unchanged with Addition of SDS

C-Statistics for Each Model for Readmission Measures

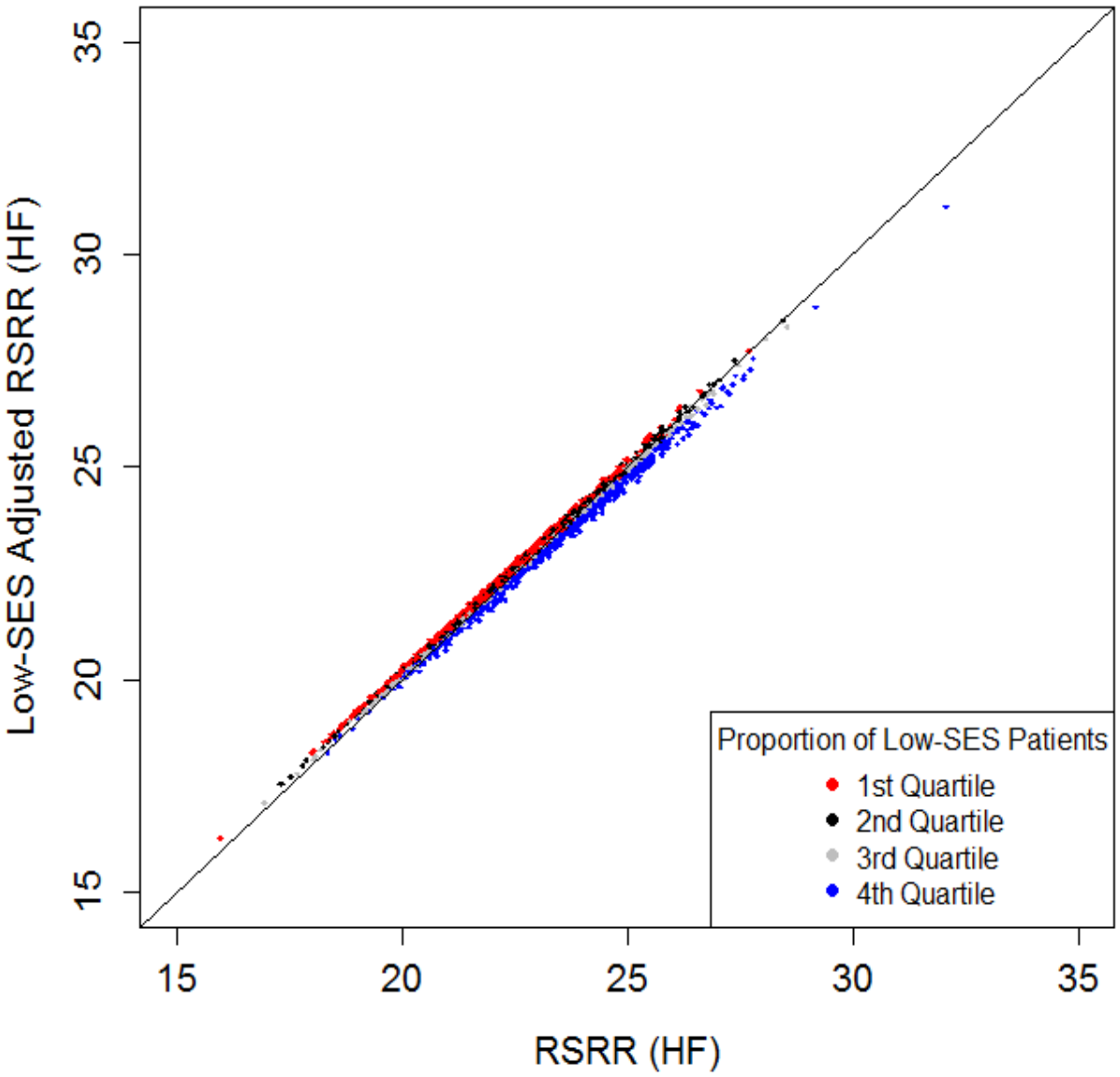
Measure	Variables Included in the Model	C-Statistic
HF Readmission	Current*	0.608
	Current + Dual Eligibility	0.609
	Current + AHRQ Index	0.609
	Current + Race	0.609

* Current indicates inclusion of all current risk-adjustment variables

Adjustment for Dual Eligibility



Adjustment for AHRQ SES Index



Absolute Change in RSRRs with SDS Adjustment

Percentile	Current Model Adjusted for Dual Eligibility	Current Model Adjusted for AHRQ SES Indicator	Current Model Adjusted for All 3 Variables
Maximum	0.21 %	0.30%	0.60%
95%	0.11%	0.21%	0.25%
75%	0.06%	0.11%	0.13%
Median Percentage	**0.02%**	**0.04%**	**0.04%**
25%	-0.01%	-0.05%	-0.06%
5%	-0.10%	-0.24%	-0.32%
Minimum	-0.41%	-0.97%	-1.17%

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Contextual Analysis: Patient vs. Hospital-level Effects

- Contextual analysis or "Decomposition"
  - Used to untangle causal pathways
  - Estimates independent effect of hospital and patient on readmission risk

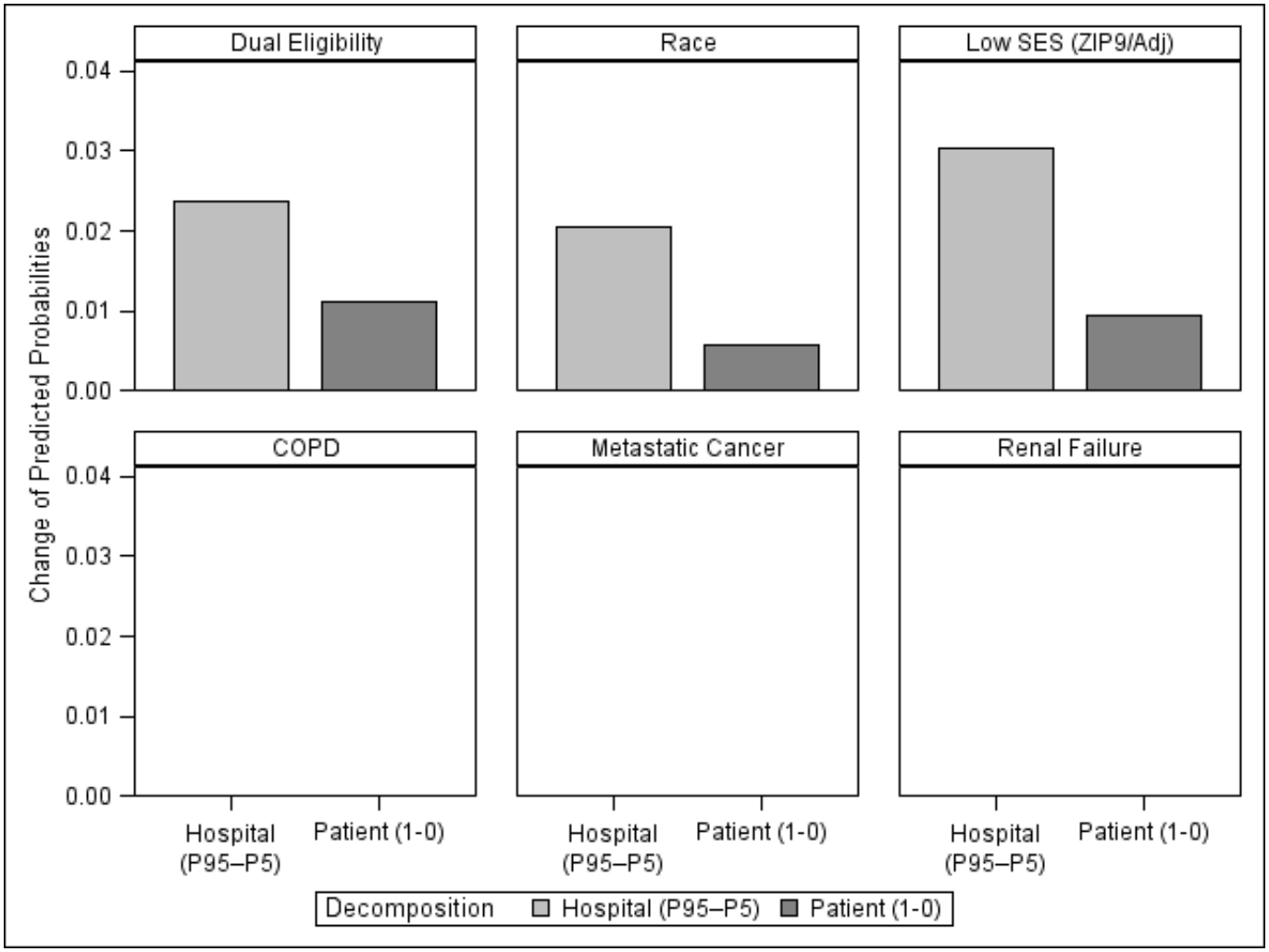
Patient vs. Hospital-level Effects

- Hospital-level effect:
  - Higher readmission risk for all patients at hospitals caring for low SES patients
- Patient-level effect:
  - May be due to patient effect or differential within hospital care

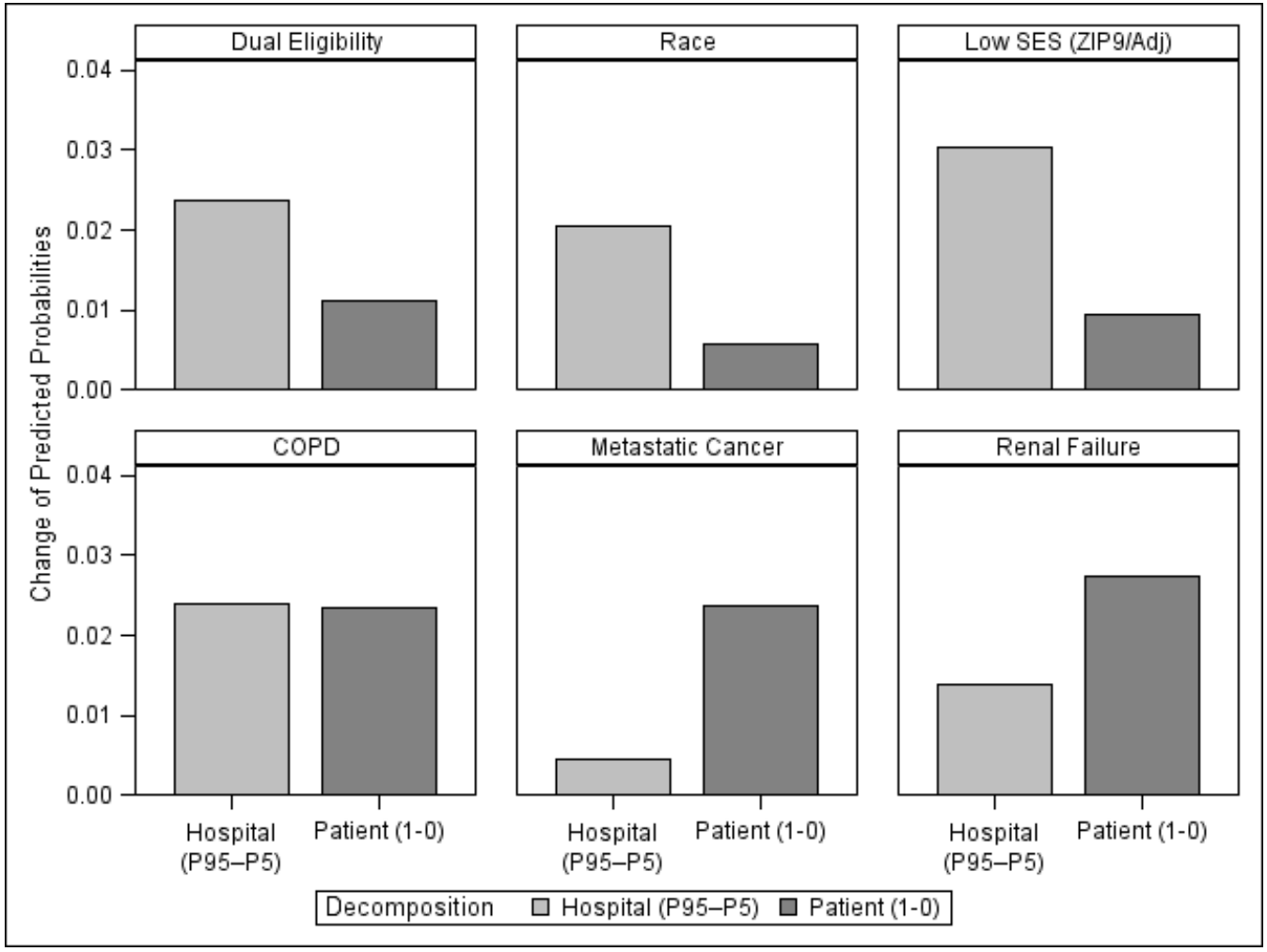
Interpreting Results

- Hospital-level effect:
  - Difference between predicted probability of readmission for an average patient at hospitals with many low SES versus hospitals with few
  - Comparison between on 95th and 5th percentile hospitals
- Patient-level effect:
  - Difference in predicted probability of readmission for patient having low SES factor versus not

Hospital and Patient-Level Predicted Probabilities for SES and Race



Comparison with Clinical Variables



Summary of Findings

- Modest relationship between patient-level SES and readmission in CMS readmission measures
- Addition of SES does not improve model or meaningfully change hospital results
- More substantial hospital component of risk for SES and race variables, in contrast to clinical variables

Implications for Patient-level Risk Adjustment for SES

- Including SES would be responsive to concerns about small portion of readmission risk that may be hard for hospitals to mediate
- However, inclusion of SES variables would not make meaningful difference in hospital scores or penalties
- Predominance of the SES risk attributable to the hospital suggests inclusion of SES variables is not consistent with goals of quality measurement
- Recommend against adding patient-level SES adjustment to current models

Thank you

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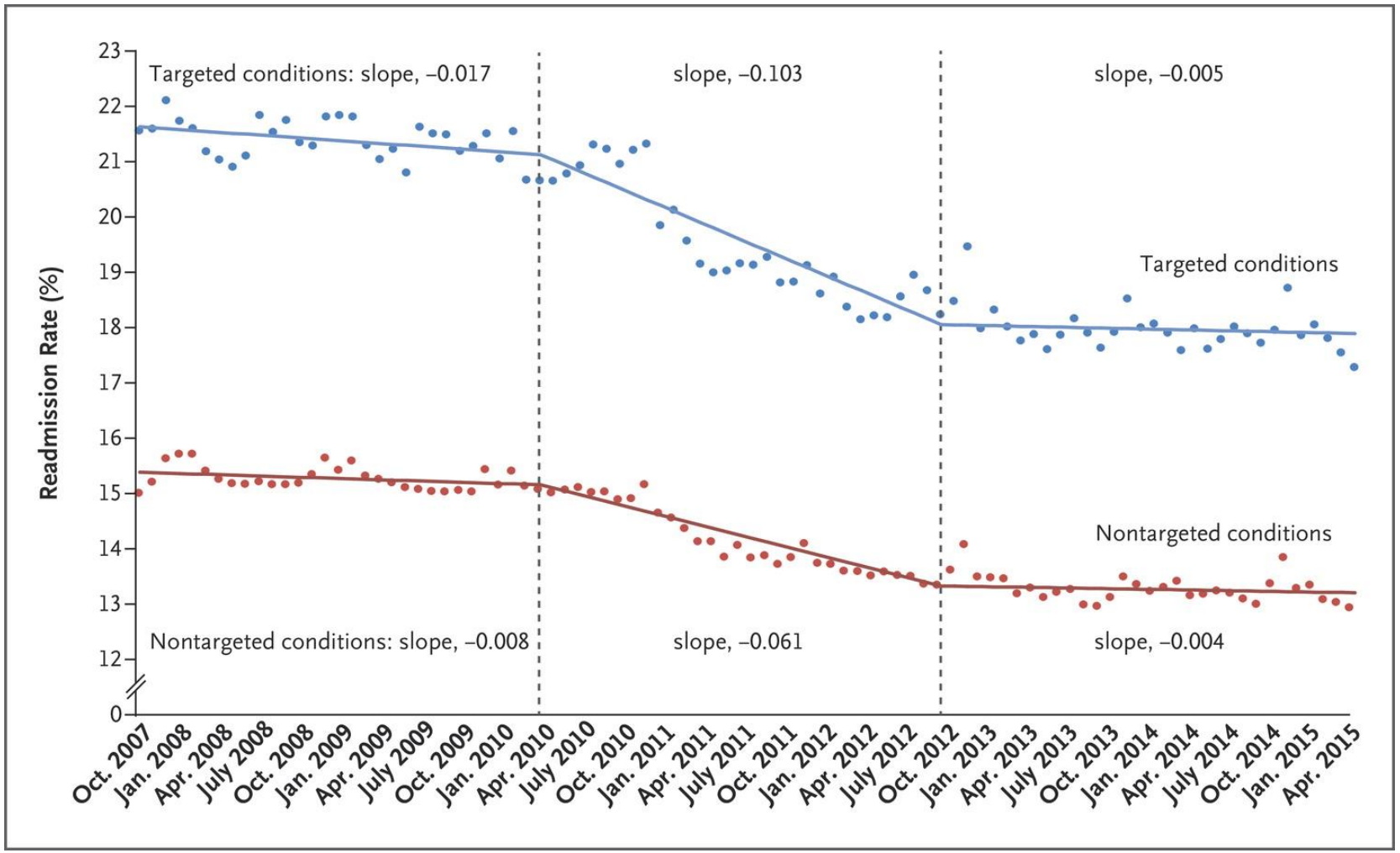
on behalf of Yale-CORE Quality Measurement Programs

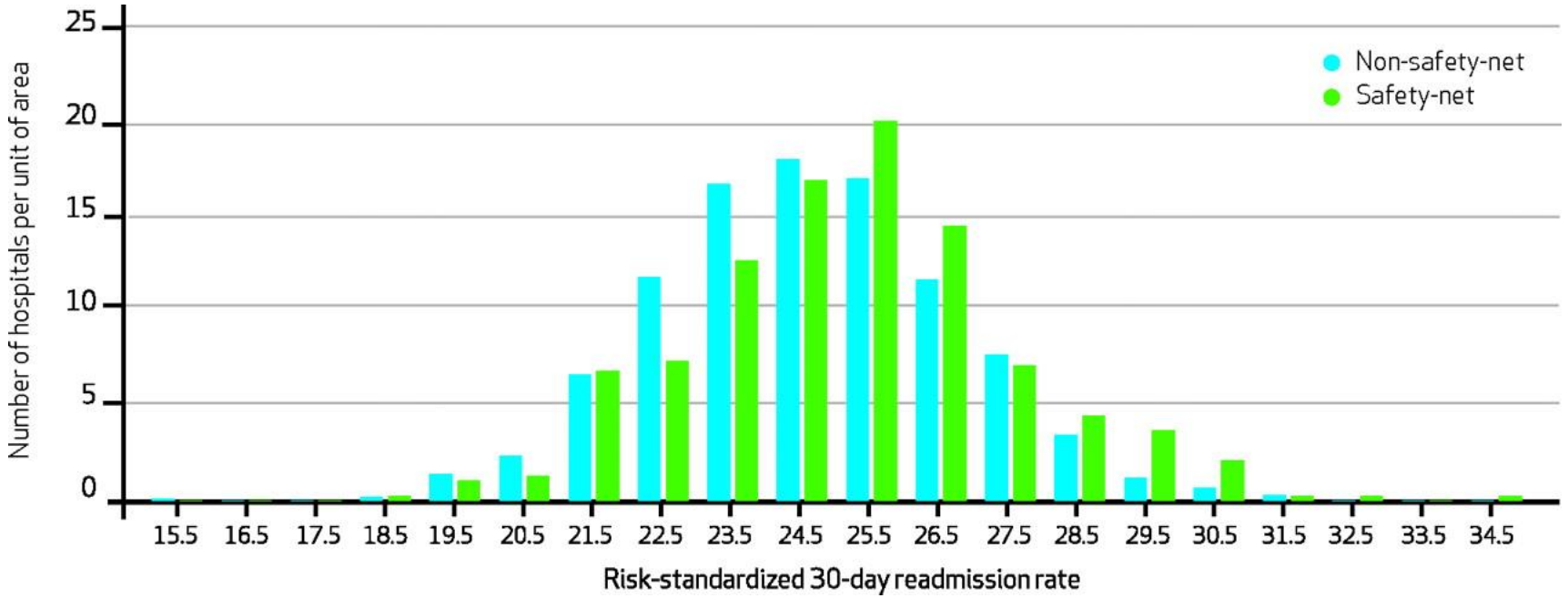
Back-up Slides

Readmission Rates Improving



Zuckerman RB et al. N Engl J Med 2016;374:1543-1551.

Heart Failure Readmission Rates in Safety Net versus Non-Safety Net



Joseph S. Ross et al. Health Aff 2012;31:1739-1748

Distribution of HF RSRRs by Proportion of Patients with Low AHRQ SES Index Scores

Data Element	Low proportion of patients equal to or below AHRQ SES index score of 42.7 (≤9.2%)	High proportion of patients equal to or below AHRQ SES score of 42.7 (≥38.3%)
Number of Hospitals	999	999
Number of Patients	257,667	218,581
Maximum	27.7	32.08
90th percentile	23.7	25.08
75th percentile	22.77	23.99
Median (50th percentile)	21.92	22.82
25th percentile	21.16	21.96
10th percentile	20.31	21.15
Minimum	15.98	18.36

Observed Readmission Rates

Observed Bivariate Association between SES/Race and Readmission

Measure	Variables Included in the Model	Observed Readmission Rate for Low SES or Black Patients	Observed Readmission Rate for Non-Low SES or Non-Black Patients
AMI Readmission	Dual Eligibility	21.1%	16.4%
	Race	21.2%	16.6%
	AHRQ Index	18.9%	16.4%
HF Readmission	Dual Eligibility	25.5%	21.9%
	Race	24.8%	22.1%
	AHRQ Index	24.3%	21.8%
PN Readmission	Dual Eligibility	20.0%	17.1%
	Race	22.2%	17.2%
	AHRQ Index	19.3%	17.1%

Model Performance

C-Statistics for Each Model for Readmission Measures

Measure	Variables Included in the Model	C-Statistic
AMI Readmission	Current*	0.650
	Current + Dual Eligibility	0.651
	Current + Race	0.651
	Current + AHRQ Index	0.651
HF Readmission	Current*	0.608
	Current + Dual Eligibility	0.609
	Current + Race	0.609
	Current + AHRQ Index	0.609
PN Readmission	Current*	0.633
	Current + Dual Eligibility	0.634
	Current + Race	0.634
	Current + AHRQ Index	0.634

* Current indicates inclusion of all current risk-adjustment variables

Multivariable models

Observed Multivariate Association between SES/Race and Readmission

Measure	Variables Included in the Model	Odds Ratio	P-Value
AMI Readmission	Current + Dual Eligibility	1.13	<0.0001
	Current + Race	1.13	<0.0001
	Current + AHRQ Index	1.09	<0.0001
HF Readmission	Current + Dual Eligibility	1.08	<0.0001
	Current + Race	1.08	<0.0001
	Current + AHRQ Index	1.08	<0.0001
PN Readmission	Current + Dual Eligibility	1.06	<0.0001
	Current + Race	1.19	<0.0001
	Current + AHRQ Index	1.07	<0.0001

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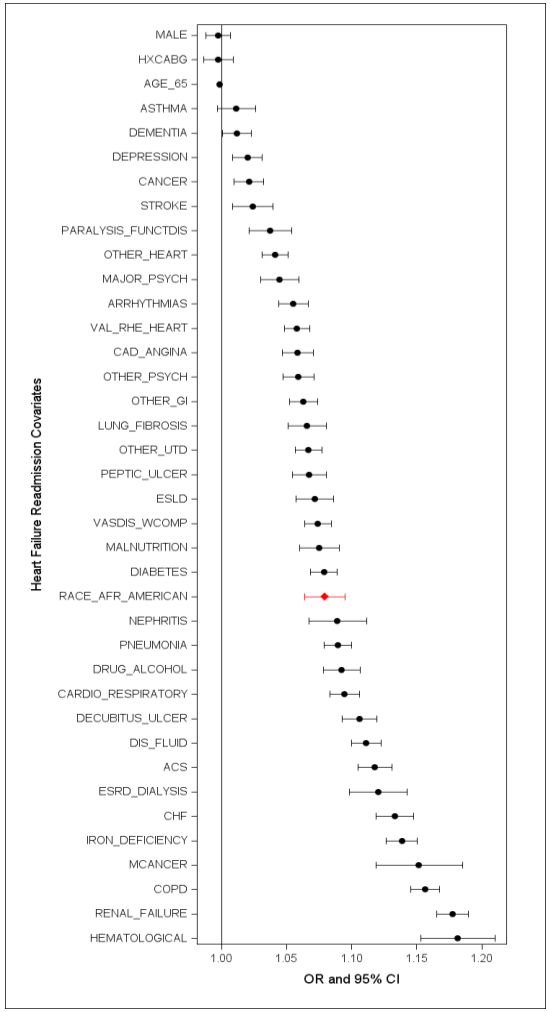
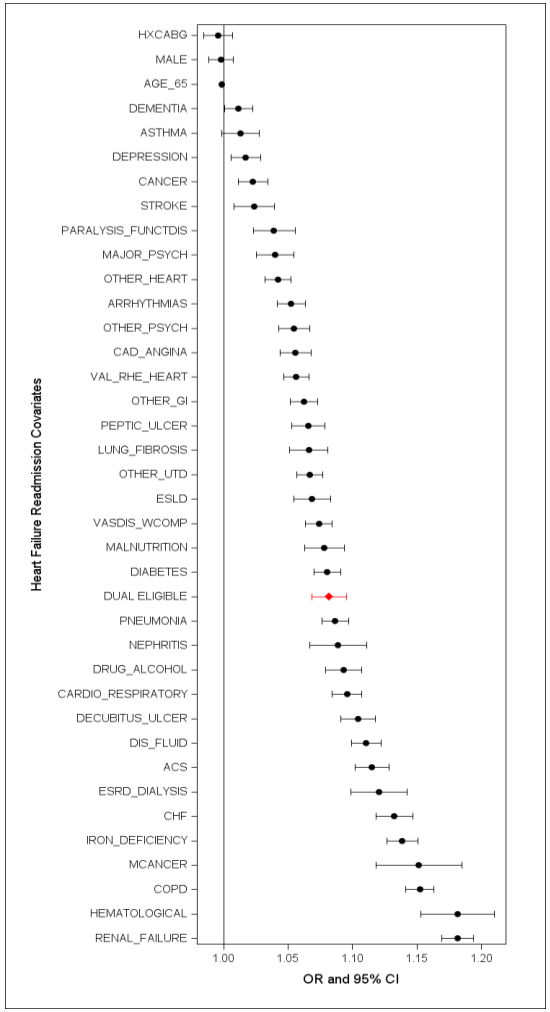
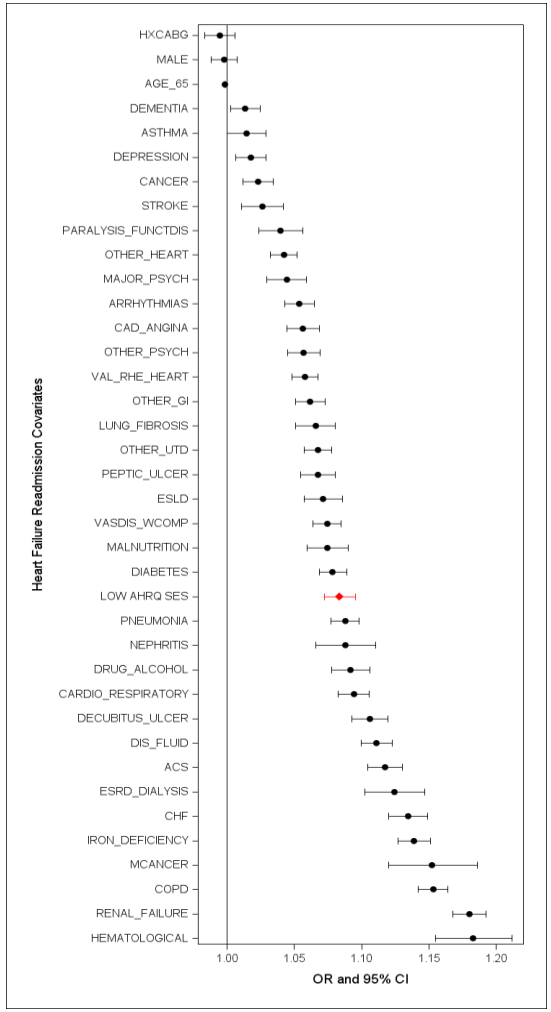
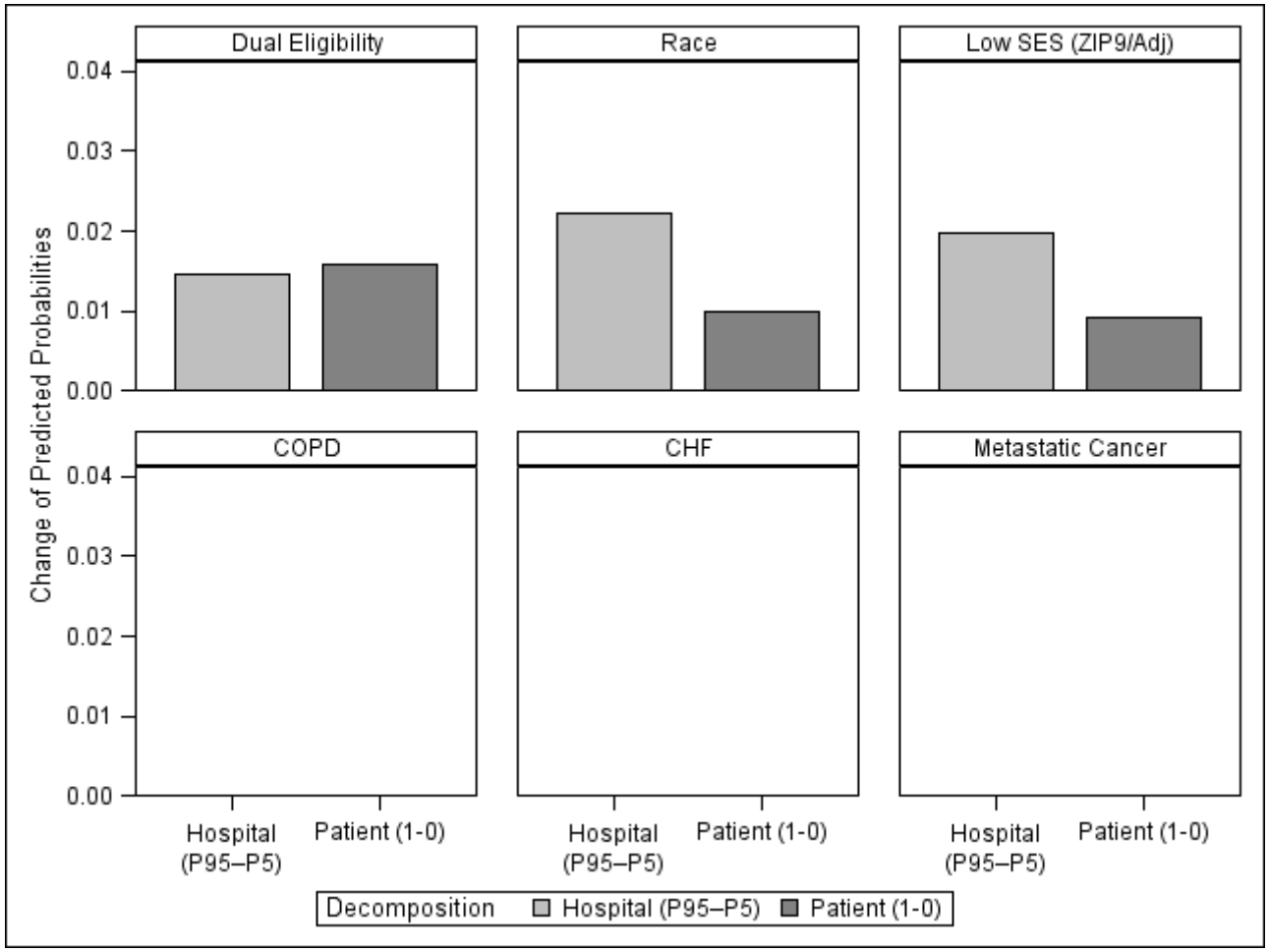
Odds Ratios for Clinical and SDS Variables in Multivariable Model







Change of Predicted Probabilities for SES and Race Compared with Clinical Variables (AMI)



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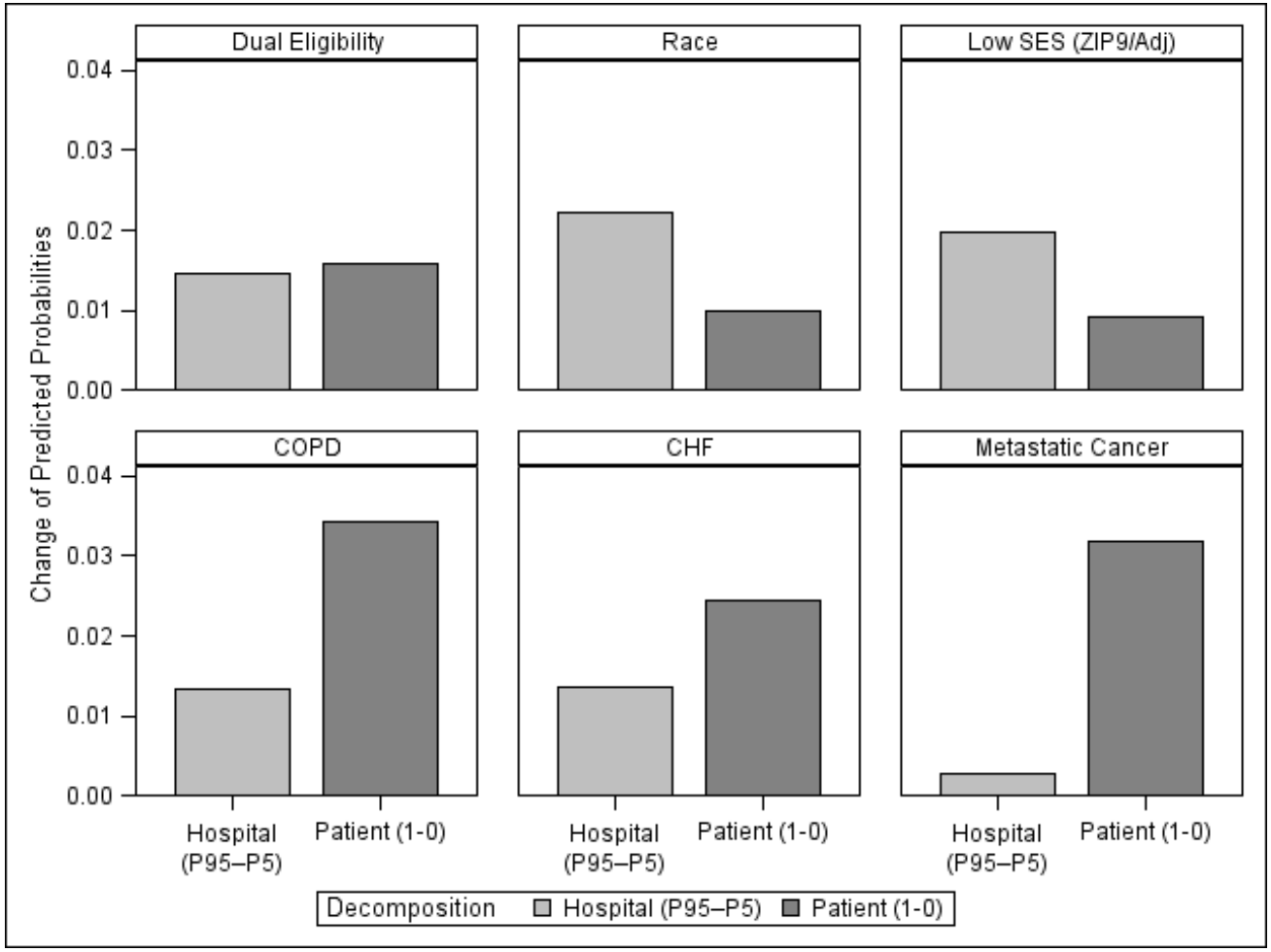
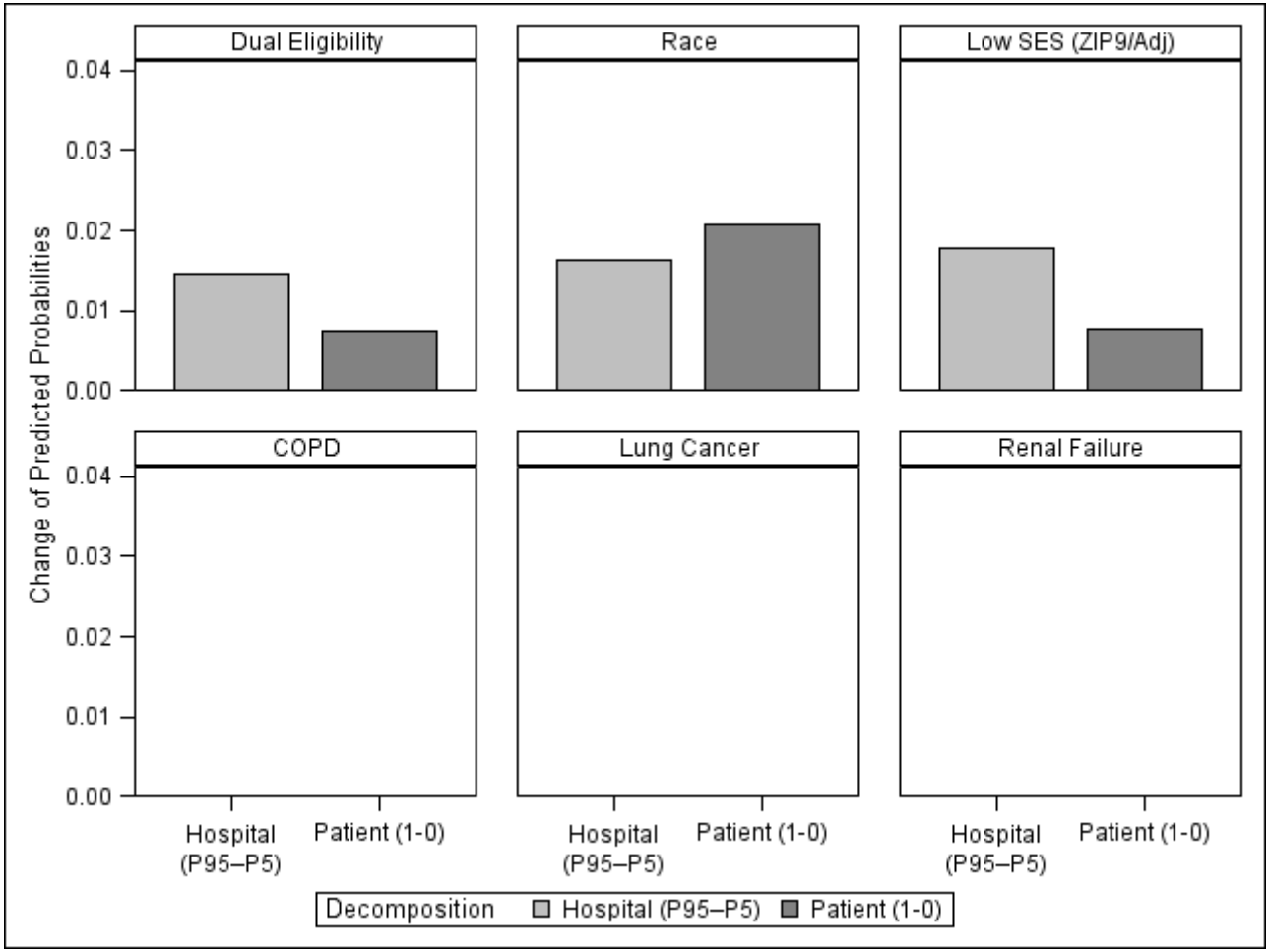
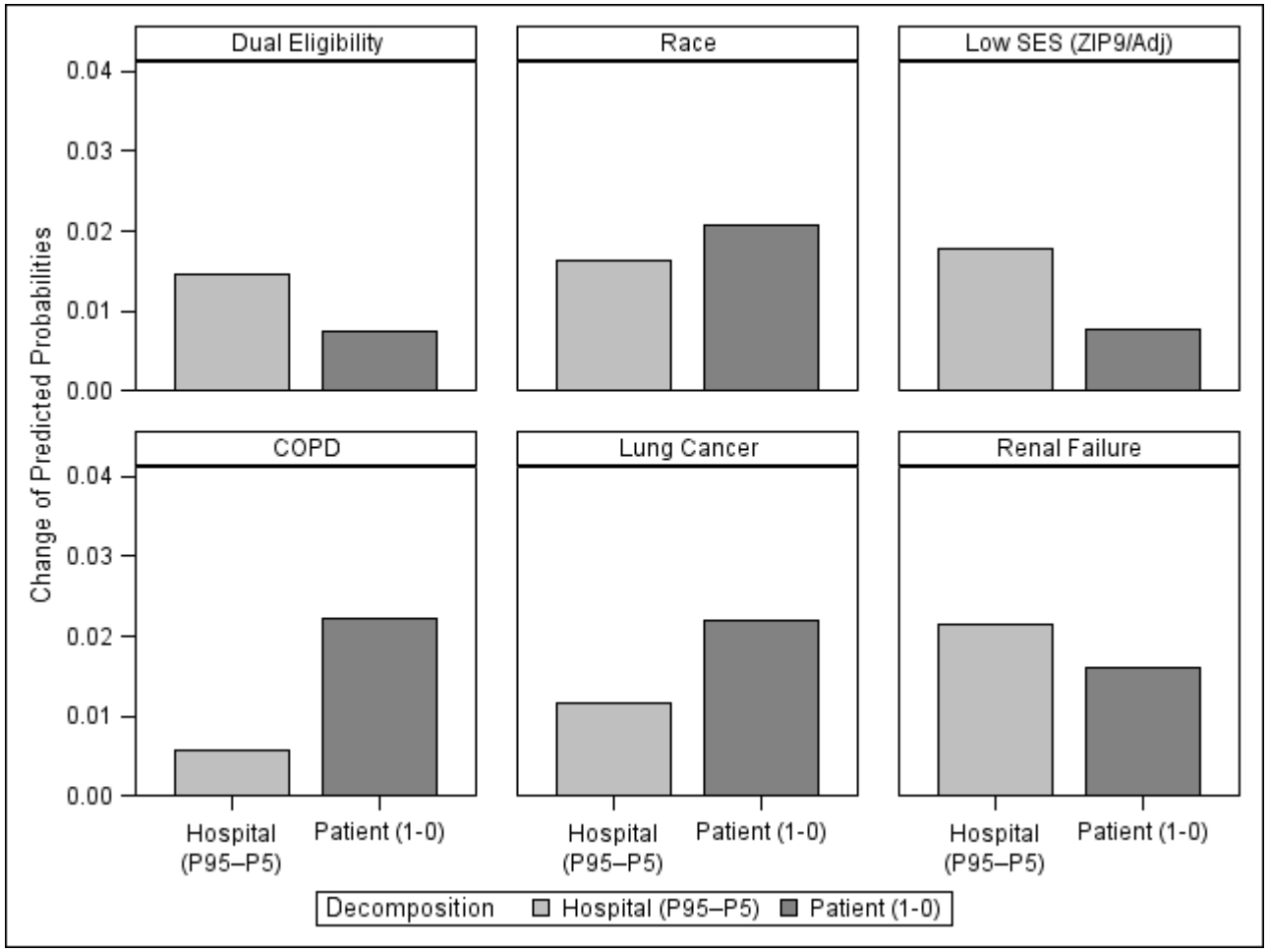


Change of Predicted Probabilities for SES and Race Compared with Clinical Variables (Pneumonia)



Change of Predicted Probabilities for SES and Race Compared with Clinical Variables (Pneumonia)



American Community Survey

- **Availability of SDS variables – Neighborhood as proxy for patient SDS**

  - Percent persons with less than a high school degree
  - Percent persons with a high school degree
  - Percent persons with some college education
  - Percent persons with a bachelor's degree or higher
  - Education index (a weighted average of variables 1-4 above)
  - Percent persons living below the poverty level
  - Percent persons employed
  - Percent persons unemployed
  - Percent occupied housing unit
  - Percent owner-occupied housing unit
  - Percent households with Supplemental
  - Security Income (SSI)
  - Percent households with public assistance income
  - Percent households with no vehicle available
  - Percent housing units with more than 1 occupant per room
  - Percent housing units with 10 or more units in structure
  - Median rental
  - Median value of owner-occupied housing unit
  - Median household income
  - Median family household income
  - Average individual income
  - Median individual income

Frequently Used Variables

- **Nagasako EM, Reidhead M, Waterman B, Dunagan WC. Adding socioeconomic data to hospital readmissions calculations may produce more useful results. Health affairs (Project Hope). May 2014;33(5):786-791.**
  - Census-tract poverty rate, median income, educational attainment, housing, vacancy rate, and unemployment rate
- **Hu J, Gonsahn MD, Nerenz DR. Socioeconomic status and readmissions: evidence from an urban teaching hospital. Health affairs (Project Hope). 2014;33(5):778-785.**
  - Race (black or nonblack), Marital status
  - Street address geocoded to Census Block Group level and mapped to data from 2000 census to obtain SES neighborhood characteristics: Poverty (based on % neighborhood population below FPL); Education; Median household income; also created binary variable for each SES factor to compare patients living in neighborhoods with low SES to other patients

Frequently Used Variables

- **Barnett ML, Hsu J, McWilliams JM. Patient Characteristics and Differences in Hospital Readmission Rates. JAMA internal medicine. Nov 2015;175(11):1803-1812.**
  - Health and Retirement Survey: race/ethnicity; education; labor force status; household income & assets; supplemental & prescription drug coverage; whether participants required proxy to respond on their behalf; measures of household structure and social supports
  - Linked 2009-2012 inpatient Medicare claims and enrollment files (N=8,067 admissions): Medicaid enrollment
- **Joynt KE, Jha AK. Characteristics of hospitals receiving penalties under the Hospital Readmissions Reduction Program. Jama. Jan 23 2013;309(4):342-343.**
  - 2011 American Hospital Association annual survey: hospital size (# beds); major teaching hospitals (membership in Council of Teaching Hospitals); DSH index

AHRQ SES Index

- The AHRQ SES Index was recalculated using 2009-2013 ACS data at the census block group level
- Patient 9-digit ZIP codes are mapped via vendor software to the AHRQ index at the census block group level
  - We are able to calculate an AHRQ SES Index for Census Block Groups that can be linked to 99.9% of the 9-digit zip codes in the US

Approach to Variable Selection

- **Availability of** Hospital-Level **SDS variables**
  - Medicare Part A inpatient and Part B outpatient claims, Medicare Part D data, and EDB
    - Supplemental security income (SSI)
    - Disproportionate Share Hospital (DSH) index
    - % Dual Eligible (aggregated to hospital level)
  - American Hospital Association (AHA) Survey
    - % Medicaid patients served

Community-Level Variables

- **County variables:**
  - Area Health Resources File
  - RWJ County Health rankings
- **Hospital Referral Region variables:**
  - Dartmouth Atlas
  - Aggregated ZIP code measures
- Community level variables are assumed to affect all hospitals in the community equally