Presenter Disclosure Information Elements

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A comparison of methods for identifying hospital performance outliers in cardiac surgery

A comparison of methods for identifying hospital performance outliers in cardiac surgery

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Supporting Quality Improvement

Which hospital should I visit given it performs <u>better</u> than the average?
Which hospital should be visited given it performs <u>worse</u> than the average?
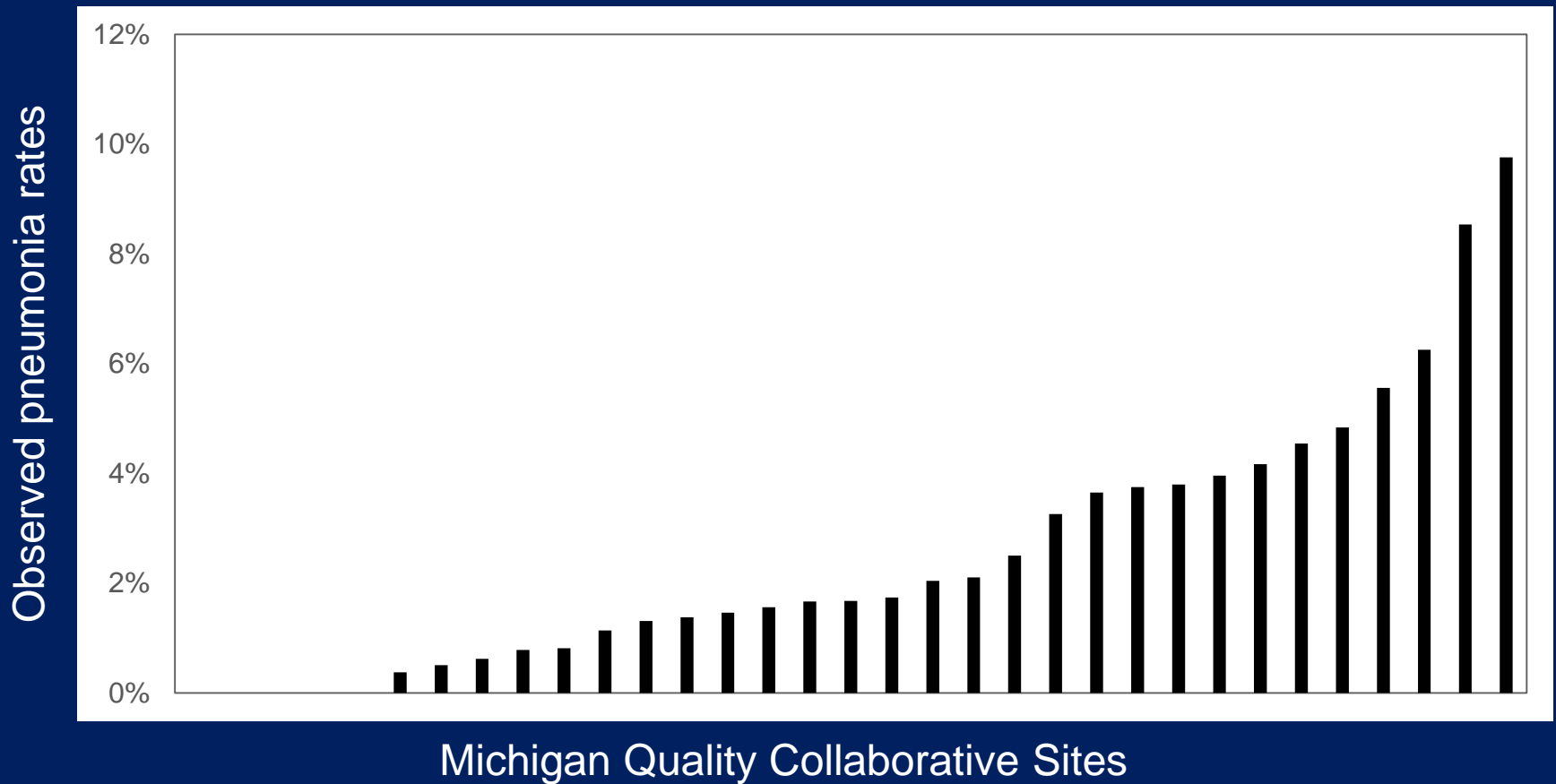
Methods for hospital performance assessment

Models	Pro	Con
Standard logistic	Simple	Not capture hospital effect
Fixed effect (hospital)	Unbiased	Large standard error for small hospital
Random effect (hospital)	Consistent	Bias occurs when hospital effect is correlated with patient effect. Shrinkage estimates.

Standardization methods	Reference population	Direct comparisons
Indirect standardization	Different	no
Direct standardization	Same	yes

- Used for public reporting and reimbursement purpose; unknown use for quality improvement activities
- Inconsistent hospital ranking across methods
- Lack of real data application for quality improvement.

Aim

To compare methods for identifying hospital performance outliers to support quality improvement

Methods

Sample:

  - 10,272 consecutive patients undergoing isolated coronary artery bypass graft (CABG) (2014 – 2015)

    - 33 centers participating in a statewide quality collaborative

    - Hospital case volume (41-615 cases/year):

     Small, Medium, Large by terciles

Outcome: Post-operative pneumonia
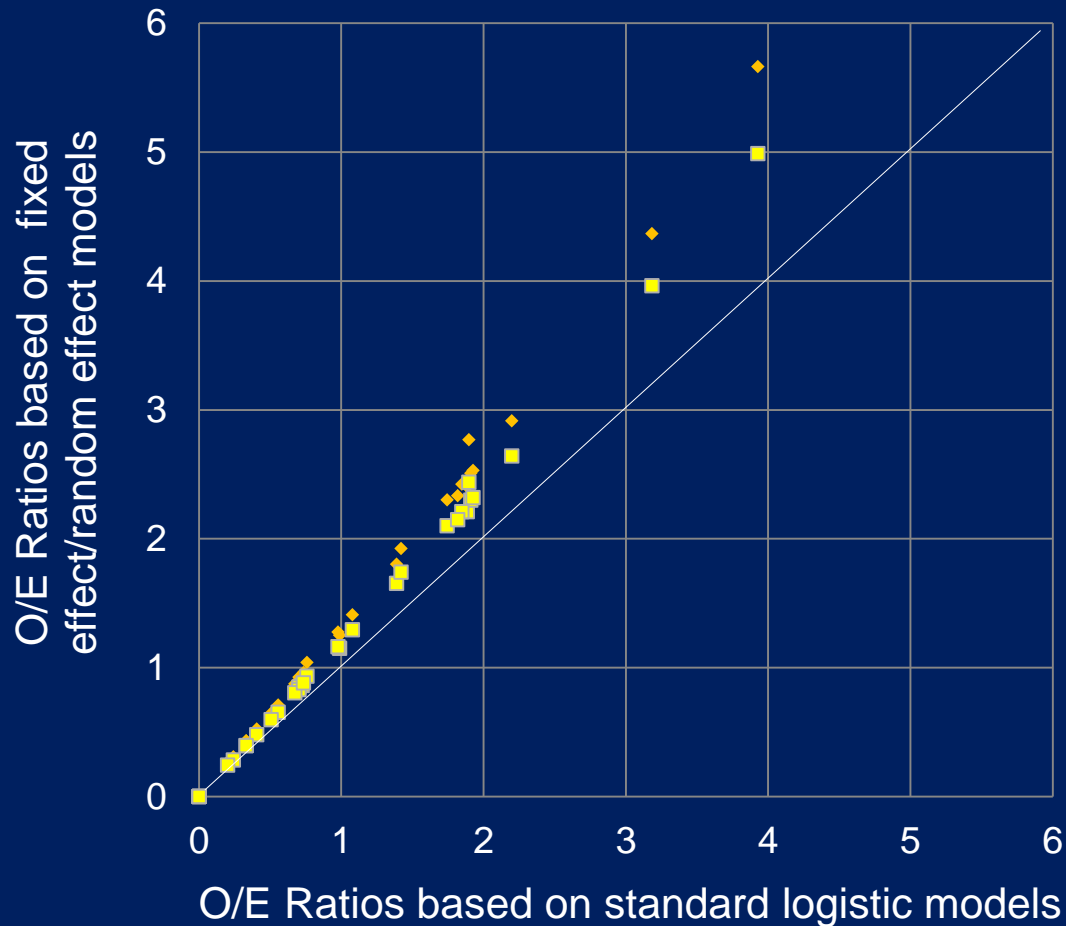
Covariates: Pre-operative patient risk factors

    (* age, race, hematocrit levels, white blood cell count, bilirubin levels, ejection fraction, dyslipidemia, chronic lung disease, peripheral arterial disease (PVD), cerebrovascular disease (CVD), liver disease, diabetes, home oxygen, history of pneumonia, history of arrhythmia, smoking status within 2 weeks prior to surgery, operative status)

Methods, continued

Model Type	Standardized method	Measures
1-Standard logistic regression	Indirect	O/E ratios, rates and Bootstrapping CI*
2- Fixed effects model	Indirect	O/E ratios, rates and Bootstrapping CI
	Direct	Rates
3- Random effects model	Indirect	O/E ratios, rates and Bootstrapping CI
	Direct	Rates

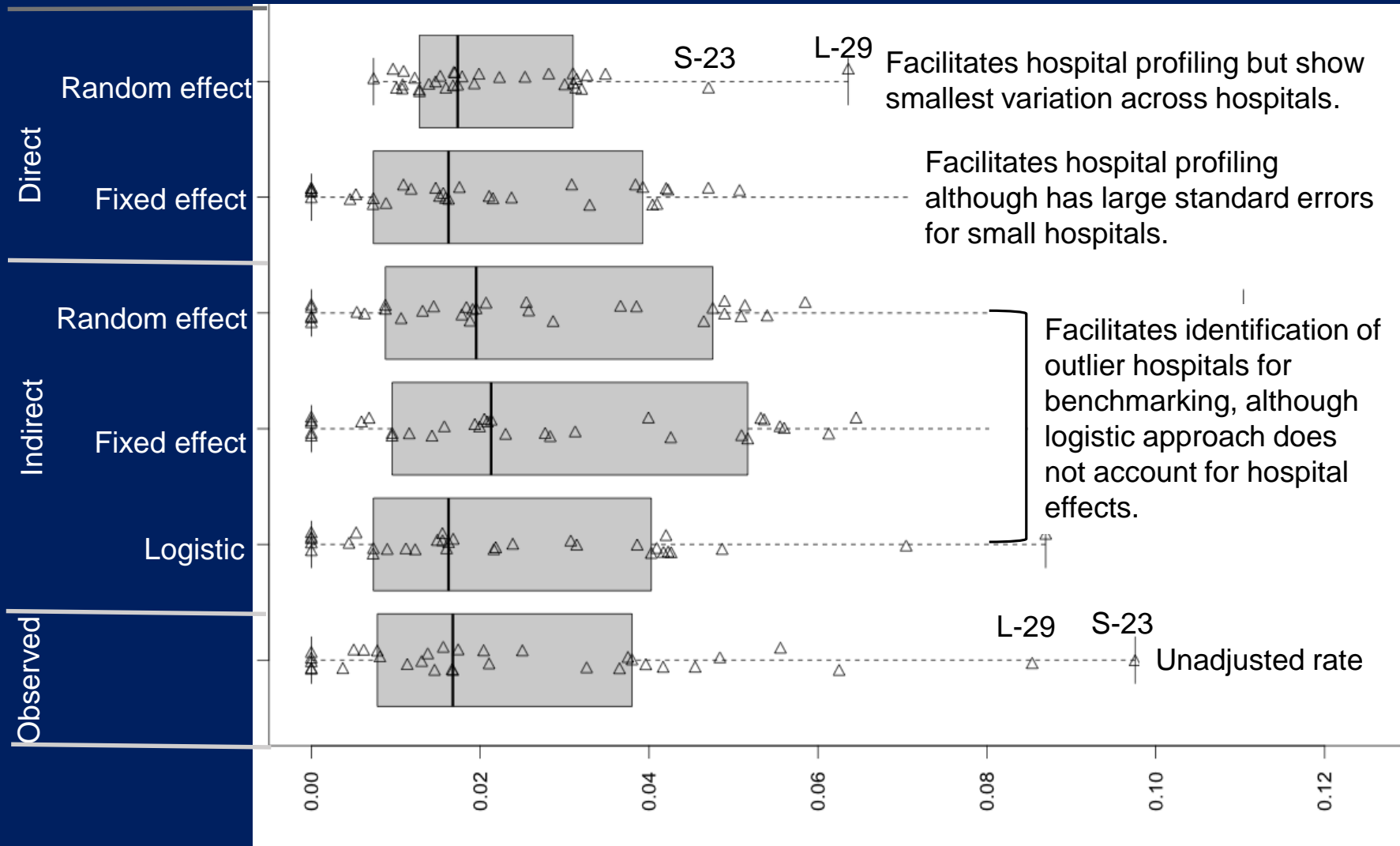* O/E: observed-to-expected; CI: confidence interval. .

Comparisons of O/E ratios from different models in indirect standardization
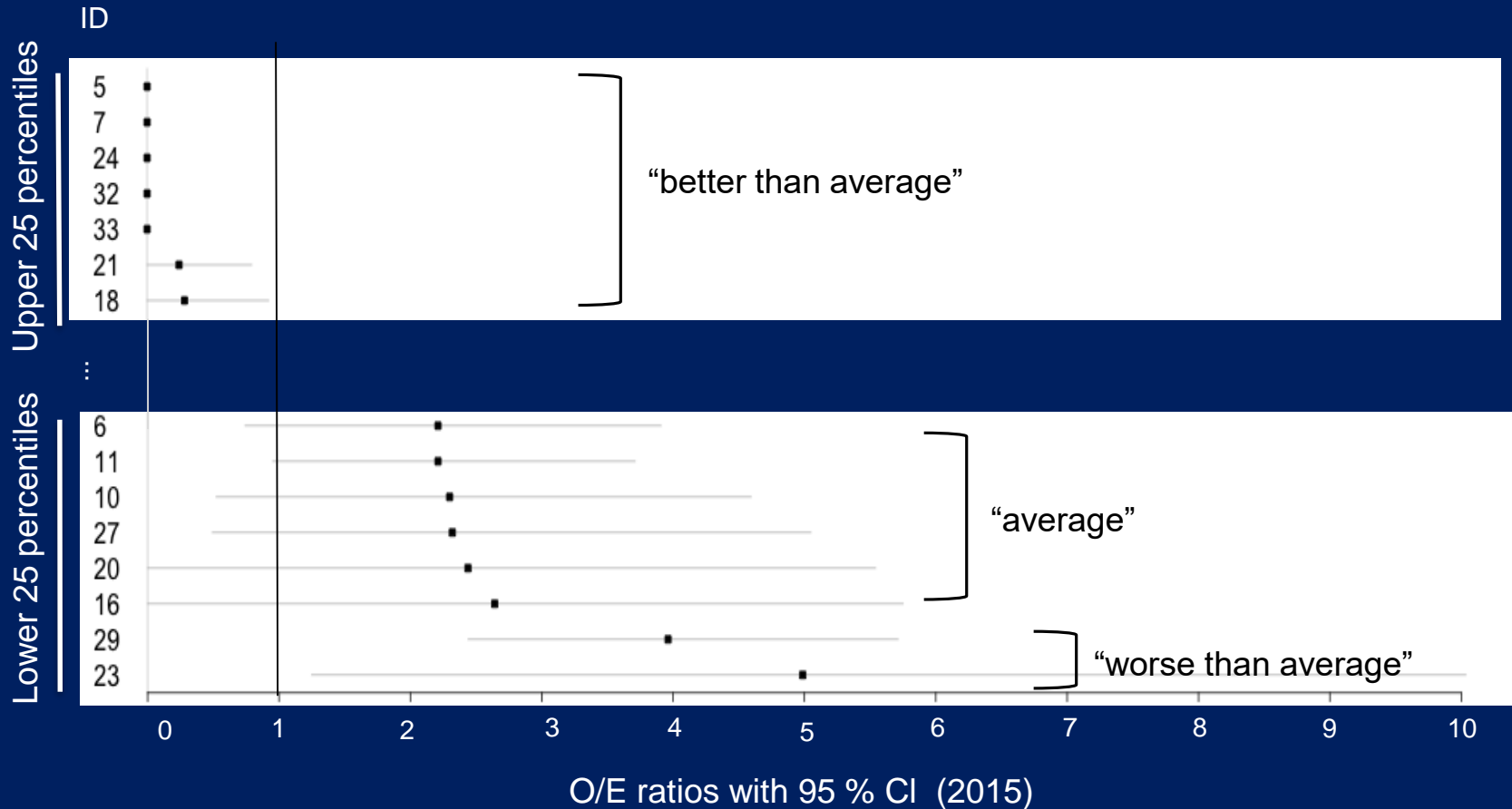

Overall intraclass correlation=0.97

Distribution of estimated pneumonia rates across statistical approaches

Pneumonia rate (2015)

Identifying performance outliers in indirect standardization

The vertical line is the reference line for O/E =1. Dots: O/E ratios; Grey lines: bootstrapping 95 % confidence intervals (CI) .

Different models in indirect standardization identified similar hospital outliers

Fixed effect model	Standard logistic			Random effect model		
	Better than average	Average	Worse than average	Better than average	Average	Worse than average
Better than average	7*			7		
Average	2 (M,L)	21		1 (M)	23	
Worse than average		2 (L,S)	1		1 (L)	2

* The number of hospitals in each performance tier

Limitations

- Evaluated only one post-operative outcome
- Limited generalizability outside of Michigan
- Limited number of hospitals

Conclusions

- We used real-world data to assess differences in performance outliers using various statistical methods.

- Direct standardization with the random effect model shrunk the standardized rates to the average.

- Our findings suggest that indirect standardization from fixed effect or random effect models should be considered for identifying hospital outliers for quality improvement.