

# Health Equity and Hospital Readmissions: Does Inclusion of Patient Functional and Social Complexity Improve Predictiveness?

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## BACKGROUND

Medicare's Hospital Readmissions Reduction Program (HRRP) was intended to encourage hospitals to improve care for older adults. However, the program has raised health equity concerns because its risk-adjustment model does not account for patient social complexity; the concern is that HRRP may aggravate healthcare disparities by penalizing financially challenged hospitals and reducing their resources to improve care.<sup>1</sup> While the HRRP assesses hospitals for penalties based upon readmission performance that is adjusted for patient age, sex, and clinical severity of illness, it does not account for functional and social patient factors. Because of this, it may assume similar readmission risk for hospitals that treat more or fewer functionally and socially complex patients, even if risks appreciably differ for these patients. As a result, the program may generate unwarranted penalties and financial pressure for resource-scarce hospitals that serve socially complex patients.<sup>1–3</sup> However, whether inclusion of patient functional and social factors improves HRRP's discrimination, or ability to distinguish patients who are or are not readmitted, is unknown.

## METHODS

We examined 1742 observations for fee-for-service Medicare beneficiaries ages  $\geq 65$  years from 2006 to 2012 Medicare hospital and linked Health and Retirement Study (HRS) data. Social support data were obtained from the HRS Psychosocial and Lifestyle Questionnaire (PLQ), given every other wave to a randomly chosen half of the full HRS sample. Outcomes were CMS unplanned hospital-wide 30-day readmissions.<sup>4</sup> We compared the discrimination of three

models: (1) the CMS base model (adjusting for age, sex, and clinical risk factors), (2) the CMS base model additionally adjusting for patient sociodemographics, functional/health status, health behaviors, and social factors (“full model”), and (3) the CMS base model additionally adjusting for income and race (“proxy model”). Patient health and social factors and healthy behavior were modeled as four latent factors using factor analysis: (1) socioeconomic status was indicated by household income and wealth; (2) poor health and functioning by self-rated health, indices of chronic conditions and difficulties with activities of daily living (ADL) and instrumental ADLs, receipt of home care, cognitive impairment, and use of psychiatric medications; (3) negative social support was indicated by negative support from spouse, child, other family, and friends; and (4) healthy behaviors by regular vigorous, moderate, and light household physical activity. Predictiveness was measured using model concordance, or the c-statistic.

## RESULTS

The sample had an average age of 74.8 years and was majority male. On average, respondents had 2.0 chronic conditions, with 35% reporting fair or poor health (Table 1). Overall, 11.9% of respondents were readmitted. We observed limited differences in latent factors measuring health/functioning, social factors, and health behaviors by readmission status. In multivariable analyses, compared to the base CMS model (c-statistic: 0.647), the full model (c-statistic: 0.667) had better predictiveness ( $p = 0.04$ ), but the proxy model (c-statistic: 0.653) did not ( $p = 0.14$ ) (Table 2).

## DISCUSSION

Our findings offer new understandings for health equity and the Hospital Readmission Reduction Program (HRRP). Although many policymakers expect including functional and social patient factors to better clinically predict readmission,<sup>2,5</sup> this study found that inclusion of a broad set of

**Table 1 Characteristics of Older (≥ 65) Medicare Beneficiaries with Eligible Index Admissions, 2006–2012 (n = 1744)**

	Mean (SD)/%
Age	74.8 (6.8)
Male (%)	58
Race/ethnicity (%)	
Non-Hispanic White	82.8
African-American	11.0
Hispanic	3.7
Other	2.5
Education (%)	
Less than high school	21.9
High school	37.5
Some college	21.0
College and above	19.6
Income (thousands \$)	58.8 (67.7)
Wealth (thousands \$)	530.8 (1033.3)
Self-rated health (%)	
Excellent/very good	26.4
Good	38.4
Fair/poor	35.3
Number of chronic conditions (0–6)	2.0 (1.2)
ADL Limitations (0–5)	0.3 (0.8)
IADL Limitations (0–3)	0.1 (0.3)
Number of functional limitations (0–12)	4.7 (3.0)
Cognitive impairment (%)	2.7
Psychiatric medication use (%)	16.5
Home care use (%)	14.5
Regular physical activity (%)	
Vigorous	20.1
Moderate	48.2
Light	52.5
Negative social support (1–4)	
Spouse	1.9 (0.7)
Child	1.6 (0.6)
Other family	1.5 (0.6)
Friend	1.4 (0.5)

risk adjusters measuring these factors improved model discrimination, but only marginally. This suggests that existing risk adjustment largely captures patient complexity and that unexplained portions of readmission risk may instead involve provider performance or access to quality care in the community. Financial support for readmission prevention programs in hospitals serving vulnerable patients may therefore be of greater benefit for health equity than modification of HRRP. Moreover, the findings suggest that the collection and use of patient factors or their proxies (such as race and income) to modify HRRP risk-adjustment may be controversial given small gains in observed model discrimination, the costs of collecting patient complexity data,<sup>1,6</sup> and concerns about creating different standards of care for vulnerable versus other patients.<sup>1</sup>

Our study was limited by the use of the small PLQ sample which, although critical for obtaining patient social support data, potentially reduced our ability to detect differences in model predictiveness. There was also evidence of differential PLQ participation by health status that could have reduced the salience of social complexity for readmission. However, the discrimination of a much larger model omitting social support was unchanged, suggesting that patient functional and social risk factors are not driving differences in measured hospital readmission performance.

**Table 2 Model Predictiveness of Older (≥ 65) Medicare Beneficiary Hospital Readmissions With and Without Patient Social and Health Behavior Risk Factors, 2006–2012 (n = 1744)**

	CMS model* OR (SE)	Full model <sup>†</sup> OR (SE)	Proxy model <sup>‡</sup> OR (SE)
Age	1.01 (0.01)	1.01 (0.01)	1.01 (0.01)
Male	1.53 (0.25) <sup>§</sup>	1.60 (0.01) <sup>§</sup>	1.52 (0.25) <sup>§</sup>
Socioeconomic status	–	1.00 (0.07)	0.84 (0.14)
Race/ethnicity (reference: non-Hispanic White)	–	–	–
African-American	–	1.39 (0.33)	1.45 (0.34)
Hispanic	–	1.20 (0.48)	1.29 (0.49)
Other	–	1.01 (0.51)	1.20 (0.59)
Education (reference: less than high school)	–	–	–
High school	–	0.91 (0.20)	–
Some college	–	0.78 (0.20)	–
College and above	–	1.27 (0.33)	–
Poor health/functioning	–	1.07 (0.07)	–
Negative social support	–	1.13 (0.09)	–
Healthy behaviors	–	0.82 (0.20)	–
C-statistic (95% CI)	0.647 (0.607–0.686)	0.667 <sup>¶</sup> (0.627–0.706)	0.653 (0.613–0.693)

<sup>§</sup>*p* < 0.05 for association between model predictor and readmissions outcome. <sup>¶</sup>*p* < 0.05 for difference in model predictiveness compared to the CMS base model. \*CMS is the CMS base model adjusting for age, sex, and severity of illness measured using condition categories from the Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS). <sup>†</sup>Full is the CMS base model plus educational status, race/ethnicity, and latent factor variables indicating poor health and functional status, negative social support, and healthy behaviors. The variables comprising the latent factor variable indicating: (1) socioeconomic status are total household income and total household wealth; (2) poor health and functioning are self-rated health (measured from poor to excellent), index of chronic conditions (hypertension, diabetes, cancer, lung disease, heart failure, and stroke), index of difficulties with activities of daily living (ADL: bathing, dressing, eating, getting in/out of bed, walking across a room), index of difficulties with instrumental ADLs (preparing a meal, grocery shopping, phone calls), index of functional limitations (0–12), receipt of home care, cognitive impairment (measured as a score of ≤ 8 (range of 0–35) on HRS<sup>7</sup> modified Telephone Interview of Cognitive Status), use of psychiatric medications; (3) negative social support are negative support (measured from 1 to 4) from each of spouse, child, other family, friends; (4) healthy behaviors are vigorous (e.g., running or jogging, swimming), moderate (e.g., gardening, walking at a moderate pace), and light household (e.g., vacuuming, laundry) physical activity ≥ 1 time per week. <sup>‡</sup>Proxy is the CMS base model plus socioeconomic status, household income, and race/ethnicity

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#### Compliance with Ethical Standards:

**Conflict of Interest:** Thomas Braun receives some salary support from OncoImmune for his work as a biostatistician on a Phase II drug trial. Ninez Ponce has a position on the multicultural advisory board for Nielsen, Inc. All remaining authors declare that they do not have a conflict of interest.

## REFERENCES

1. National Quality Forum. Risk adjustment for socioeconomic status or other sociodemographic factors. Washington, DC: National Quality Forum; August 2014.
2. MedPAC. The hospital readmission penalty: How well is it working? 2015; <http://www.medpac.gov/-blog-/medpacblog/2015/03/24/the-hospital-readmission-penalty-how-well-is-it-working>. Accessed July 25, 2018.
3. **Mellor J, Daly M, Smith M.** Does It pay to penalize hospitals for excess readmissions? Intended and unintended consequences of Medicare's Hospital Readmissions Reductions Program. *Health Econ* 2016;n/a-n/a.
4. Yale/CORE. 2015 measure and specifications report: Hospital-wide all-cause unplanned readmission measure. New Haven, CT: Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (YNHSC/CORE); March 2015 2015.
5. **Joynt KE, Jha AK.** A path forward on Medicare readmissions. *N Engl J Med* 2013;368(13):1175-1177.
6. Office of the Assistant Secretary for Planning and Evaluation. Social risk factors and performance under Medicare's Value-Based Purchasing programs. Washington, D.C.: Department of Health and Human Services; December 2016 2016.