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Racial, Income, and Marital Status Disparities in Hospital Readmissions Within a Veterans-Integrated Health Care Network

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Abstract

Hospital readmission is an important indicator of health care quality and currently used in determining hospital reimbursement rates by Centers for Medicare & Medicaid Services. Given the important policy implications, a better understanding of factors that influence readmission rates is needed. Racial disparities in readmission have been extensively studied, but income and marital status (a postdischarge care support indicator) disparities have received limited attention. By employing three Poisson regression models controlling for different confounders on 8,718 patients in a veterans-

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integrated health care network, this study assessed racial, income, and martial disparities in relation to total number of readmissions. In contrast to other studies, no racial and income disparities were found, but unmarried patients experienced significantly more readmissions: 16%, after controlling for the confounders. These findings render unique insight into health care policies aimed to improve race and income disparities, while challenging policy makers to reduce readmissions for those who lack family support.

Keywords

hospital readmissions, veterans, Poisson regression, rehospitalizations, racial disparities, demographic disparities

Racial disparities in health care utilization and quality, hospital readmission in particular, have been well studied and documented (Exworthy & Washington, 2006; Institute of Medicine, 2002; Jencks, Williams, & Coleman, 2009; Joynt, Orav, & Jha, 2011; Kansagara et al., 2011; Rathore et al., 2003). This issue has drawn renewed attention, as Centers for Medicare & Medicaid Services (CMS) has recently begun (since October 2012) to reduce payments to hospitals with excessive readmissions for three conditions (acute myocardial infarction [AMI], heart failure, and pneumonia). Moreover, CMS is now considering expanding the list of conditions in the near future (Pizer, 2013). Researchers and policy makers alike are concerned that hospitals serving disproportionally high numbers of Blacks may be unfairly punished (Joynt et al., 2011; McHugh, Carthon, & Kang, 2010).

Studies have consistently found that patients from minority groups are more likely to be rehospitalized, particularly for congestive heart failure (CHF; Alexander, Grumbach, Remy, Rowell, & Massie, 1999; Joynt, Orav, & Jha, 2011; McHugh, Carthon, & Kang, 2010; Rathore et al., 2003), AMI (McHugh et al., 2010), pneumonia (Joynt et al., 2011; McHugh, 2010), and diabetes (Jiang, Andrews, Stryer, & Friedman, 2005). In addition, emerging evidence suggests that marital status is related to readmission rates—patients who are unmarried or live alone are more likely to experience readmission (Arbaje et al., 2008; Hasan et al., 2009; Wong, Gan, Burns, Sin, & van Eden, 2008). However, almost all readmission studies examine whether a patient has been readmitted or not, which ignores the fact that many patients have multiple readmissions. Moreover, income, which is often correlated with race (Yu & Zhang, 2005), has been rarely analyzed with readmissions; only one study of CHF among veterans (Deswal et al., 2004) could be identified assessing the effect of income on readmissions.

To fill a gap in the literature, this study uses data from a veterans-integrated health care services network and examines two questions: (1) Do racial and income disparities exist in the total number of readmissions in an integrated health care network with equal access? (2) Is marital status an indicator of access to postdischarge family caregiving and social support associated with total number of readmissions?

Method

Study Population and Data Source

In this study, all-cause hospital readmissions in fiscal year (FY) 2011 in an integrated service network, Veterans Health care Network Upstate New York (VISN 2), were analyzed. Department of Veterans Affairs manages its operation that serves 5.7 million veteran patients annually through 21 integrated health care networks. VISN 2, with five medical centers and 31 outpatient clinics across upstate New York, serves 140,000 patients with an annual budget of over 1 billion dollars. Among the five medical centers, one does not have inpatient services. As a result, all 8,718 patients with hospitalizations in the four medical centers in VISN 2 in FY 2011 were included in this study. Data from 1 month of FY 2012 (October 2011) were also used to count readmissions following index hospitalizations that occurred in September 2011 (the last month of FY 2011).

Veterans Affairs (VA) National Patient Care Database (NPCD) hosted at the Austin Information Technology Center was the primary data source. The Patient Treatment File (PTF) and associated Census File in FY2011 and the first 30 days of FY2012 PTF were used to identify index hospitalizations and readmissions. In addition to encounter data such as admission, discharge dates, and *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9 CM) codes (a standardized classification system of disease and injury), PTF contains socioeconomic and demographic variables such as age, gender, race, and income. Decision Support System (DSS) files that contain patient care costs rather than claims or reimbursement amounts were used. DSS costs are the primary financial data for internal operations and congressional inquiries. DxCG file that contains patient risk scores or comorbidities was employed for case mix. For the last decade, the VA has been using DxCG, commercially available software (DxCG, n.d.), to systematically measure risk or case mix of all 5.7 million patients. This software groups patients according to their risk for poor health outcomes and classifies them into 781 clinically homogenous groups using *ICD-9 CM* codes, age, and gender as input data. These homogenous groups are further categorized into 184 hierarchical condition categories (HCC) that are similar to the HCCs used by CMS. A risk score for each patient is produced by dividing the average costs of the patients in the HCC by the grand average costs of all patients. The costs used to derive the risk score can be from either Medicare or a commercial population; the VA uses Medicare costs in calculating its patient risk score (DxCG, n.d.; Ellis & Ash, 1995; Liu et al., 2003; Sales et al., 2003; Zhao et al., 2005).

The data files used in this study (NPCD including PTF) are the gold standard for VA operational analysis and research. Most of the data fields such as admission, discharge dates, and clinical information including *ICD-9 CM* codes are routinely and rigorously validated with strict business rules. Its income information is means tested. One exception is that race information is often incomplete because the VA does not mandate veterans to report race status. However, for the last several years, the VA has systematically gathered race information from other data sources such as Medicare, and as a result, the updated race data are deemed accurate and reliable (Stroupe et al., 2010; Trivedi, Crebia, Wright, & Washington, 2011).

Study Variables

The dependent variable is the number of all-cause readmissions within 30 days after the initial hospitalization. As in other studies (Jencks et al., 2009; Joynt et al., 2011), a hospital readmission is defined as a hospitalization within 30 days after the initial or index discharge. All readmissions within 30 days following the index discharge were included except those hospitalizations of patients transferred from other hospitals.

Based on the literature and data availability in the VA, the independent variables were classified into four categories: (1) demographics: age, sex, marital status, number of dependents, race; (2) socioeconomic variables: patient income, service-connected disability rating (%), and patient insurance status (not covered by any insurance [equals 1, otherwise 0], enrolled in Medicare [equals 1, otherwise 0], enrolled in Medicaid [equals 1, otherwise 0], and covered by private insurance [equals 1, otherwise 0]); (3) prior utilization and cost: length of stay (LOS) of the index hospitalization (if more than one readmission, it is the average LOS of all admissions excluding the last readmission) and the prior year cost (FY2010); and (4) comorbidities and case mix. In addressing comorbidities, some studies only use a priori coexisting conditions ranging from a few to a couple of dozen (Jencks et al., 2009; Jha, Orav, & Epstein, 2009; Joynt et al., 2011), while others use a comprehensive measure (e.g., Charlson comorbidity index, Medicare mortality prediction system score) in addition to a set of coexisting conditions (Luthi et al., 2003; Rathore et al., 2003).

In this study, the DxCG risk score was chosen as the aggregated comorbidity measure (DxCG, n.d.). DxCG is a well-validated risk adjustor; most studies find DxCG is superior to other algorithms in predicting resource use (Ellis & Ash, 1995; Liu et al., 2003; Sales et al., 2003; Zhao et al., 2005). Despite its superiority, DxCG as a risk score in this study has its limitations: it uses Medicare cost rather than VA cost to calculate risk scores for VA patients, therefore it could overweight some conditions and underweight others; and it is designed to measure or predict cost rather than readmissions. To compensate for these potential limitations, DxCG was supplemented with a set of the most prevalent and/or expensive chronic conditions: hypertension, diabetes, CHF, chronic obstructive pulmonary disease (COPD), cancer, and depression. Existing data that included no identifiable patient private information were used in this study, and therefore exempted from institutional review board review under VA Title 38, Section 16.101(b)(4).

Modeling

To assess socioeconomic and demographic disparities in hospital readmissions in an integrated veterans health care network, this research focused on disparity in race, income, and marital status. Descriptive statistics and one-way analysis of variance (ANOVA) were used to assess the differences in the variables. Unlike other studies that analyze whether or not a patient had a readmission (regardless of the number of readmissions) using logistic regression, the number of readmissions was the dependent variable in this research. Number of readmissions is considered count data which can be modeled by either Poisson or Negative Binomial (NB) regression. Poisson regression model is most widely used when analyzing count data but requires the conditional variance of the data to equal the conditional mean. For reliable results, this assumption was tested and result indicated that the data were overdispersed (Pearson overdispersion scale = 1.71), that is, the variance was greater than the mean. As a result, generalized Poisson regression (Joe & Zhu, 2005) was utilized to correct the overdispersion. This yielded a Pearson overdispersion scale of 0.97, indicating that the overdispersion was well corrected. To ensure the results were independent of model selection, NB regression model was applied as a sensitivity analysis, and it produced almost identical results as the generalized Poisson model.

Only the results of the generalized Poisson regression are reported here. All the analyses were conducted using Proc GLM and GLIMMIX of SAS 9.2.

Analysis

Race, income, and marital disparities in readmissions were analyzed in two steps. First, using one-way ANOVA, differences in race, income, and marital status among the patients without readmissions, with only one readmission, and with two or more readmissions were tested (see Table 1). However, the results of univariate analyses could be biased due to the effects of other confounders such as disease severity. Three Poisson regression models were configured to examine the potential disparities by controlling for confounding factors at different levels. In Model 1, demographic, socioeconomic variables, and the hospital characteristics (fixed effect: four indicator variables for each medical center and one was omitted in the regression as the baseline) were controlled for; in Model 2, DxCG score as the total measure of a patient's disease severity or comorbidities was added; and in Model 3, DxCG was further augmented with the six most prevalent and expensive chronic conditions to ensure the results were not due to imperfect case-mix measurement.

Results

Among the 8,718 patients who had hospitalization/hospitalizations in FY 2011, 7,310 (84%) had no readmissions, 980 (11%) had one readmission, and 428 (5%) patients had two or more readmissions (the highest number of readmissions was 14). Seven thousand four hundred sixty-three (85.60%) patients were White, 965 (11.00%) were Black, 66 (0.76%) were Native American, 31 (0.36%) were Hispanic Black, 2 (0.02%) were Hispanic White, 28 (0.32%) were Hispanic other, 10 (0.11%) were Asian, and 153 (1.76%) were unknown.

As the convention of other studies (e.g., Joynt et al., 2011), race was dichotomized into Black versus non-Black patients (includes White and all other race/ethnic categories except Black) in the regression analyses (extensive sensitivity analyses with different classifications were also conducted). As shown in Table 1, 11% of the patients with no readmissions or one readmission was Black versus 12% of the patients with two or more readmissions. However, the difference was not statistically significant ($p = .725$), and insignificance remained even after controlling for confounding factors in all three models ($p = .973$, $p = .242$, and $p = .408$, respectively; see

Table 1. Descriptives of Independent Variables ($n = 8{,}718$).

	Patients without readmission *M* or % (*SD*)	Patients with one readmission *M* or % (*SD*)	Patients with two or more readmissions *M* or % (*SD*)	*p* Value[a]
Race status (*Black* = 1, otherwise 0)	11.0% (31.26)	11.3% (31.71)	12.2% (32.71)	.725
Patient income	25,202 (41,379)	25,060 (37,833)	23,652 (40,516)	.748
Age	66.43 (15.37)	67.01 (14.99)	67.12 (13.85)	.387
Sex (*male* = 1, otherwise 0)	94.1% (23.51)	95.5% (20.72)	97.2% (16.53)	.008
Number of dependents	0.21 (0.46)	0.20 (0.42)	0.18 (0.38)	.451
Marital status (*married* = 1, otherwise 0)	40.3% (49.05)	39.7% (48.95)	32.2% (46.80)	.004
Service-connected disability rating (%)	24.5% (36.69)	24.2% (36.69)	26.8% (39.04)	.438
No insurance	27.1% (44.47)	23.8% (42.59)	19.2% (39.40)	<.001
Enrolled in Medicare	60.4% (48.91)	64.6% (47.85)	70.3% (45.74)	<.001
Enrolled in Medicaid	1.7% (13.07)	2.7% (16.08)	3.7% (18.99)	.003
Covered by private insurance	10.7% (30.95)	9.0% (28.60)	6.8% (25.16)	.011
Length of stay[b]	5.65 (7.88)	6.43 (6.41)	7.10 (6.01)	<.001
Prior year patient cost (in logarithm)	8.65 (2.85)	9.17 (2.62)	9.68 (2.33)	<.001
DxCG score	2.85 (2.40)	4.13 (2.93)	5.66 (3.66)	<.001
Hypertension	46.8% (49.90)	42.0% (49.39)	35.1% (47.77)	<.001
Diabetes	16.3% (36.98)	20.3% (40.24)	26.9% (44.38)	<.001
Congestive heart failure	21.2% (40.84)	31.1% (46.32)	41.4% (49.30)	<.001
Chronic obstructive pulmonary disease	28.0% (44.88)	34.8% (47.66)	45.8% (49.88)	<.001
Cancer	22.5% (41.78)	25.6% (43.67)	28.7% (45.31)	.002
Depression	31.7% (46.53)	35.0% (47.72)	42.8% (49.53)	<.001
Medical center A	20.1% (40.01)	19.8% (39.87)	18.7% (39.03)	.764
Medical center B	34.6% (47.56)	35.6% (47.91)	34.3% (47.54)	.804
Medical center C	40.2% (49.04)	40.6% (49.12)	43.0% (49.56)	.527
Medical center D	5.1% (21.95)	4.0% (19.56)	4.0% (19.55)	.217

[a]*p* Values were produced by one-way analysis of variance (ANOVA).
[b]Length of stay refers to length of stay of index hospitalization for one readmission and for more than one readmission, it is the average length of stay across readmissions.

Table 2. Poisson Regression Parameter Estimates ($n = 8{,}718$).

	Model I			Model II			Model III		
	Parameter estimate	Risk adjusted relative risk[a]	p value	Parameter estimate	Risk adjusted relative risk[a]	p value	Parameter estimate	Risk adjusted relative risk[a]	p value
Intercept	−2.8596	0.0573	<.001	−2.4272	0.0883	<.001	−2.6018	0.0741	<.001
Race status (*Black* = 1, otherwise 0)	0.0028	1.0028	.973	−0.0979	0.9068	.242	−0.0694	0.9330	.408
Patient income	−0.0002	0.9998	.976	−0.0008	0.9992	.911	0.0026	1.0026	.707
Age	−0.0042	0.9958	.062	−0.0096	0.9905	<.001	−0.0103	0.9897	<.001
Sex (*male* = 1, otherwise 0)	0.4045	1.4985	.003	0.3134	1.3681	.023	0.3430	1.4091	.013
Number of dependents	0.0284	1.0288	.731	0.0186	1.0188	.821	0.0296	1.0301	.719
Marital status (*married* = 1, otherwise 0)	−0.1261	0.8816	.052	−0.1696	0.8440	.009	−0.1780	0.8369	.006
Service-connected disability rating (%)	−0.0007	0.9993	.390	−0.0011	0.9989	.194	−0.0012	0.9988	.148
No insurance	0.0156	1.0157	.888	0.0908	1.0951	.409	0.0698	1.0723	.524
Enrolled in Medicare	0.2661	1.3048	.008	0.3081	1.3609	.002	0.2589	1.2955	.009
Enrolled in Medicaid	0.6411	1.8986	<.001	0.7362	2.0879	<.001	0.6999	2.0136	<.001
Length of stay	0.0094	1.0095	<.001	−0.0110	0.9891	<.001	−0.0099	0.9901	.003
Prior year patient cost (in logarithm)	0.1063	1.1122	<.001	0.0591	1.0609	<.001	0.0459	1.0470	<.001
Medical center A	0.1655	1.1800	.257	0.0750	1.0779	.606	0.1564	1.1693	.282
Medical center B	0.2368	1.2672	.093	0.2607	1.2979	.062	0.3341	1.3967	.017
Medical center C	0.2647	1.3031	.058	0.1827	1.2005	.189	0.2411	1.2727	.083

(continued)

Table 2. (continued)

	Model I			Model II			Model III		
	Parameter estimate	Risk adjusted relative risk[a]	*p* value	Parameter estimate	Risk adjusted relative risk[a]	*p* value	Parameter estimate	Risk adjusted relative risk[a]	*p* value
DxCG score				0.1566	1.1696	<.001	0.1430	1.1537	<.001
Hypertension							0.0448	1.0458	.513
Diabetes							0.0475	1.0486	.468
Congestive heart failure							0.3370	1.4007	<.001
Chronic obstructive pulmonary disease							0.2653	1.3038	<.001
Cancer							0.0021	1.0021	.974
Depression							0.2919	1.3390	<.001

[a]Adjusted relative risk is calculated as the exponentiation of the parameter estimate (Halfon et al., 2006).

Table 2). The finding on patient income was similar: Average income of the patients without readmissions was \$25,202, \$25,060 for the patients with one readmission, and \$23,652 for patients with more than one readmission ($p = .748$). After controlling for the confounders, all three models found no income disparity in readmissions ($p = .976$, $p = .911$, and $p = .707$, respectively).

For marital status, 40% of the patients without readmissions or with one admission were married, while 32% of those patients who had two or more readmissions were married, a statistically significant result ($p = .004$). Further, all three models affirmed that married patients were less likely to be rehospitalized ($p = .052$, $p = .009$, and $p = .006$, respectively); the full model revealed that married patients had 16% fewer rehospitalizations if all other things equal. (The percentage was calculated by subtracting the adjusted relative risk from 1. In this example, 1 − 0.8369 resulted in .16 or 16%.)

Among the confounders, the average patient age without readmission was 66.40 compared with 67.00 and 67.10 in the groups with one readmission and two or more readmissions; the differences were not statistically significant ($p = .387$). However, after adjusting for other covariates, older patients were less likely to be rehospitalized in all the three models ($p = .062$, $p < .001$, and $p < .001$, respectively) with the p value of the first model slightly above .05. Among the patients without readmissions, 94% were male, and for those with one readmission and two or more readmissions, the percentages were 96% and 97% ($p = .008$). After controlling for confounders, all three models found male patients were more likely to be rehospitalized compared with female patients ($p = .003$, $p = .023$, and $p = .013$, respectively). The number of dependents and service-connected disability rating did not have statistically significant effects on readmissions.

The univariate analysis showed that patients who were not covered by any health insurance were less likely to be rehospitalized (27% of the patients without readmissions, 24% of those with one readmission, and 19% of those with two or more readmissions, $p < .001$). However, statistical significance disappeared after controlling for other factors. On the other hand, compared with patients covered with private insurance (omitted in the regressions as the baseline), patients enrolled in Medicare were more likely to be rehospitalized ($p = .008$, $p = .002$, and $p = .009$, respectively for the three models); and patients enrolled in Medicaid had similar outcomes ($p < .001$ for all the three models).

As expected, high prior year cost was associated with more rehospitalizations ($p < .001$ for all the three models); interestingly, the univariate analyses and Model 1 showed longer LOS of the index hospitalization was associated with more readmissions ($p < .001$). However, after controlling for case mix and other confounders, the result was reversed: Longer LOS was associated with fewer rehospitalizations (for Model 2, $p < .001$ and for Model 3, $p = .003$).

As shown in Table1, DxCG score and the six chronic conditions were statistically different among the patients with no readmissions, one admission, and more than one admission (all p values <.001 with the exception of cancer [$p = .002$]). However, in the regressions, only DxCG score, CHF, COPD, and depression showed statistical significance (all p values <.001). Finally, in the univariate analysis, the four medical centers showed no difference in readmissions. However, after controlling for all of the confounders in the third model, patients in medical center B were more likely to be rehospitalized (compared with medical center D which is omitted in the regression as the baseline); readmissions for medical center B were almost 40% higher compared with medical center D ($p = .017$).

Discussion

This study used generalized Poisson regression to examine racial, income, and marital status disparities on the number of rehospitalizations among 8,718 patients of a veterans-integrated health care network while controlling for other demographic variables, disease severity, health insurance coverage, and care setting (i.e., medical centers where care was received). One of the unique attributes of this study is the conceptualization of the dependent variable as number of readmissions, whereas previous research has examined readmission as a dichotomy (either readmitted or not). Although researchers have widely found race disparities in readmissions, this study revealed no disparities in race and income in an integrated health care network. However, marital status, a postdischarge environmental factor, was associated with rehospitalizations: The full model revealed that married patients had 16% fewer reshospitalizations. These results appear robust as three separate models produced consistent results.

To assure the findings were accurate and reliable, extensive sensitivity analyses were conducted: (1) Three Poisson models were ran with different risk adjustments; (2) NB modeling was also applied to the data; (3) same-cause readmissions and the three most commonly studied conditions (AMI, heart failure, and pneumonia) were examined; (4) the data were reanalyzed by combining all minority groups together versus White; and (5) prior year income was tested in the regressions to rule out its potential endogeneity bias. All of these analyses produced consistent results: Race and income were not correlated with the number of readmissions, while married patients experienced significantly fewer rehospitalizations.

This work suggests disparities in quality of care associated with race and income are not universal and may be dependent on factors associated with access to care and the health system's approach to care delivery. It also underscores the potential importance of postdischarge environmental factors on hospital readmissions. The American health care system tends to be highly fragmented, and the lack of care coordination often results in high cost and poor quality. To curb ever-rising health care costs, stakeholders have been promoting care delivery approaches that emphasize cooperation among providers (e.g., integrated care or medical home). This approach to care delivery, coupled with equal access to care with few financial barriers, has been implemented and improved in the VA since the inception of integrated health care networks in 1995 (Kizer, Demakis, & Feussner, 2000). The effort seems to be fruitful: In VISN 2, 1 of the 21 integrated health care networks nationwide, the present study found no racial and income disparities. In addition, the readmission rate in this research (16%), which is consistent with VA internal reports and published studies (Rosen et al., 2013), seems to be lower compared to the rates among Medicare patients (19.6%) as reported by Jencks et al. (2009). Although these findings are encouraging, they are inconclusive; VA patients may also seek care from other non-VA health care settings which, among other factors, may influence readmission rates.

Despite the progress made by the VA, the present study revealed substantial readmission disparities between married and unmarried patients. Patients who were unmarried were significantly more likely to be rehospitalized, which suggests that readmission rates are strongly influenced by postdischarge environmental factors. It is likely that unmarried patients may have lacked ready access to family caregivers and needed support to manage postdischarge care. This finding adds to the growing body of evidence that well-planned care transitions including support in the home are key in avoiding unnecessary rehospitalizations.

One paradoxical finding in the present study was that older patients were less likely to be rehospitalized after controlling for disease severity and other confounders. Although older patients have more chronic diseases and higher health care expenditures as they age, it is possible that older patients are less likely to seek intensive treatments for the same disease as their younger counterparts. Studies have consistently found that medical care costs at the end of life decrease with age (Felder, Meier, & Schmitt, 2000; Levinsky et al., 2001). Similarly, the longer average LOS of prior hospitalizations (excluding the last readmission) was associated with more rehospitalizations in the univariate analysis and the first model. However, after controlling for patient risk score in Models 2 and 3, the longer LOS was associated with fewer readmissions. These seemingly inconsistent results suggest that sicker patients experienced longer LOS and more readmissions, but after controlling for confounding variables, it appears longer LOS may reduce readmissions. In other words, for the same disease severity, short LOS may result in more readmissions.

Another interesting finding is that patients enrolled in Medicare or Medicaid were more likely to experience readmission compared with those who had private insurance. This could be due to characteristics of patients enrolled in Medicare or Medicaid that were not fully captured by other variables in the regressions; another possibility is that patients chose the VA over Medicare or Medicaid because of its superior quality of care (Asch et al., 2004). Further study of this phenomenon may be warranted. In addition, the univariate analysis showed that patients who did not have any health insurance coverage were significantly less likely to be rehospitalized. One could speculate that this is due to better quality of care in the VA since these patients almost solely rely on the VA for their care. However, after controlling for confounders, the difference disappeared. This suggests that patients who have no other health insurance coverage may be healthier than those covered by insurance; of course, further study is needed to provide conclusive evidence. This study also confirms that where patients receive care matters. The present study indicates one medical center in VISN 2 had a significantly higher readmission rate than others, but further investigation is needed to corroborate this finding.

These findings revealed that female patients were less likely to be rehospitalized compared with their male counterparts. On average, there were 15.30 readmissions per 100 female inpatients and 26.00 readmissions per 100 male inpatients ($p = .003$); if readmissions were counted no more than 1 time, then the readmission rates for female and male patients were 11.5% and 16.4%, respectively ($p = .005$). This finding could render meaningful policy implications for VA internal quality improvement, given the increasing number of female patients and the VA's growing commitment to serving female veterans (Womenvet, n.d.). This finding could serve as a catalyst for further research on why female patients in the VA were less likely to be rehospitalized.

Despite the strengths of this study such as comprehensive risk adjustments, three models which reached the same conclusions, extensive sensitivity analyses, and large sample size, it is not without limitations. The patients in this study were from one geographic location (i.e., upstate New York), which may limit the study's generalizability to the larger VA system or other health care settings. In addition, the VA serves a unique patient population that is mostly male (95% for the patients in this study). As a result, when compared to female patients, the finding that male patients are more likely to be rehospitalized may not be generalizable to non-VA health care contexts. Also, all other non-Black minority groups are less than 1% of the study population and could not be analyzed separately in any reliable way. Patients in this study could also be seeking care from other health care systems covered by Medicare, Medicaid, or private health insurance, but concurrent data of the actual utilization was not available; this could affect the accuracy of these results in spite of controlling for the enrollment in other programs or health plans.

Finally, as in most studies on this topic, all-cause readmissions were analyzed which inevitably included some readmissions that were not related to the initial hospitalizations. Same-cause readmissions were also analyzed as a sensitivity analysis, but some readmissions due to inadequate care during and after the initial hospitalization may be inadvertently excluded (e.g., readmissions for hypertension or renal failure may be due to poor care associated with the initial hospitalization for diabetes). Clearly, more research is needed.

Nevertheless, considering this is a readmission study and insurance status has been taken into account, the results should offer insightful policy implications. This work suggests disparities in quality of care (measured by hospital readmission) associated with race and income can be reduced. The lack of race and income disparities found in this investigation was observed in a health system that emphasizes integrated patient-centered care and presents few financial barriers for accessing care. On the other hand, integrated approaches to care delivery should also pay attention to care transitions upon discharge. Policy makers are challenged to address the postdischarge care needs of patients who may lack family caregiver support.

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