Examining the association of social risk with heart failure readmission in the Veterans Health Administration

Charlie M. Wray1,2*, Marzieh Vali3, Louise C. Walter1,4, Lee Christensen5, Wendy Chapman6, Peter C. Austin7, Amy L. Byers8,9 and Salomeh Keyhani10

Abstract

Background: Previous research has found that social risk factors are associated with an increased risk of 30-day readmission. We aimed to assess the association of 5 social risk factors (living alone, lack of social support, marginal housing, substance abuse, and low income) with 30-day Heart Failure (HF) hospital readmissions within the Veterans Health Affairs (VA) and the impact of their inclusion on hospital readmission model performance.

Methods: We performed a retrospective cohort study using chart review and VA and Centers for Medicare and Medicaid Services (CMS) administrative data from a random sample of 1,500 elderly (≥65 years) Veterans hospitalized for HF in 2012. Using logistic regression, we examined whether any of the social risk factors were associated with 30-day readmission after adjusting for age alone and clinical variables used by CMS in its 30-day risk stratified readmission model. The impact of these five social risk factors on readmission model performance was assessed by comparing c-statistics, likelihood ratio tests, and the Hosmer-Lemeshow goodness-of-fit statistic.

Results: The prevalence varied among the 5 risk factors; low income (47% vs. 47%), lives alone (18% vs. 19%), substance abuse (14% vs. 16%), lacks social support (2% vs. <1%), and marginal housing (<1% vs. 3%) among readmitted and non-readmitted patients, respectively. Controlling for clinical factors contained in CMS readmission models, a lack of social support was found to be associated with an increased risk of 30-day readmission (OR 4.8, 95%CI 1.35–17.88), while marginal housing was noted to decrease readmission risk (OR 0.21, 95%CI 0.03–0.87). Living alone (OR: 0.9, 95%CI 0.64–1.26), substance abuse (OR 0.91, 95%CI 0.67–1.22), and having low income (OR 1.01, 95%CI 0.77–1.31) had no association with HF readmissions. Adding the five social risk factors to a CMS-based model (age and comorbid conditions; c-statistic 0.62) did not improve model performance (c-statistic: 0.62).

Conclusions: While a lack of social support was associated with 30-day readmission in the VA, its prevalence was low. Moreover, the inclusion of some social risk factors did not improve readmission model performance. In an integrated healthcare system like the VA, social risk factors may have a limited effect on 30-day readmission outcomes.

Keywords: Social Risk Factors, Heart Failure, Readmissions, Veterans Affairs

* Correspondence: Charlie.Wray@ucsf.edu
1Department of Medicine, University of California, San Francisco, USA
2Division of Hospital Medicine, San Francisco Veterans Affairs Medical Center, University of California San Francisco, 4150 Clement Street, San Francisco, CA 94121, USA
Full list of author information is available at the end of the article

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Background
Heart failure (HF) is a leading cause of hospitalization in the Veterans Health Administration (VA) with more than 17,000 Veterans hospitalized every year [1]. Because readmissions for HF are so common and costly in older populations, the VA closely tracks 30-day readmission rates. Understanding which clinical and social factors are predictive of readmission is important in reducing readmissions and improving health and health outcomes.

In non-VA populations, previous studies have found that social factors such as use of Medicaid insurance, low income, being unmarried, and high-risk behaviors (e.g., smoking and substance abuse) are associated with hospital readmission [2–6]. Yet, a recent systematic review found that among 52 articles that examined the effect of social factors on risk of readmission [3], only one examined their impact within the VA health care system [7]. Moreover, in this study the authors only assessed one social risk factor (rurality), leaving a gap in our understanding of what social risk factors impact readmission risk within the VA.

As the nation’s largest integrated health care system, the VA provides robust clinical and social support services that include: Patient-Aligned Care Teams (PACT) for all Veterans and specialty-focused PACTs for Homeless Veterans, extensive mental health support services, housing assistance, and transport assistance among many other services. Understanding the impact of social risk on heart failure readmissions in a health care system that attempts to guard against the adverse effects of several social determinants of health is unknown. The goal of this study was to describe the association of five social risk factors (living alone, lack of social support, marginal housing, substance abuse, and low income) thought to be important in older populations, and not readily available in administrative data on HF readmissions in a VA cohort. Such work could be helpful for the VA in understanding which non-clinical factors are impacting HF readmissions.

Methods
Data source and sample
Using VA administrative and Medicare claims data acquired from the VA Corporate Data Warehouse, we constructed a national cohort of Veterans among 10,761 Veterans, aged 65 and older, who were hospitalized for HF in 2012. Patients’ respective inpatient Medicare claims data were obtained from the Medicare Provider Analysis and Review (MedPAR) and Outpatient files. All Medicare records were linked to VA records via scrambled Social Security numbers and were provided by the VA Information Resource Center (VIIReC). Patients were identified by a primary discharge diagnosis from VA administrative data by using International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes. Because three of the assessed social risk factors (living alone, lack of social support, and marginal housing) were not widely captured in administrative data during our assessment period, we randomly selected 1,500 Veterans from this cohort to allow for chart abstraction of these variables.

Dependent variable
We followed model specifications outlined by the Center for Medicare and Medicaid Services (CMS) as the VA currently uses a CMS-based model to track hospital readmissions and for hospital profiling. Briefly, this model was approved by the National Quality Forum, to estimate hospital-specific readmission rates for Medicare patients hospitalized with HF. The model was developed and validated with Medicare administrative claims data and determined whether estimates from the claims model were good surrogates for the results of a medical record model. Like the CMS model, our main dependent variable was unplanned, all cause, 30-day readmission rates. All readmissions were defined as a subsequent inpatient admission to any acute care facility in either a VA or non-VA facility within 30-days of discharge from the index HF hospitalization, as outlined in the CMS technical documents used to define HF readmission [8].

Predictor variables
Demographic and clinical factors
We identified patient age and the 32 clinical variables that are utilized in the CMS HF readmission model for all-cause HF readmissions [8]. All variables were identified in administrative data 1 year prior to the index admission. Sex was not included as few female Veterans were admitted for HF. Race was not included as the CMS model does not include race and we did not want to alter the underlying base model with which we would be comparing.

Social risk factors
Because administrative data lacks information on several common social risk variables, we utilized two methods to extract patients’ social risk: (1) manual chart abstraction, and (2) administrative coding (e.g., ICD-9-CM). Using chart review, we extracted data on three variables (social support, housing, and living situation [i.e., living alone]) with limited or no data in administrative datasets. To do so, we created a manual to help chart abstractors identify measures of social risk from the medical record (See Supplement for more detail). Each variable was extracted by a pair of reviewers, with a third reviewer adjudicating any disagreements. Briefly, presence or lack of social support was defined based on the following criteria: (a) specific mentions of social support...
were pulled from. Readmission rates was also similar and the full sample (10,761) from which this cohort substantially different from those who were not readmitted. Of the 1,500 chart-reviewed patients, 312 (21 %) were readmitted within 30 days of hospital discharge. Of these, most were white (75 %), had a history of coronary artery disease (78 %), heart failure (96 %), cardiac arrhythmia (77 %), coronary artery disease (78 %), and renal failure (70 %). Rates of these conditions were not substantially different from those who were not readmitted and the full sample (10,761) from which this cohort were pulled from. Readmission rates was also similar between the full sample (20 %) and the chart-reviewed cohort (21 %). Among administratively extracted variables, the prevalence of the assessed social risk factors were similar between groups, with almost half (47 %) having low income, and many suffering from substance abuse (14 and 16 %) among readmitted and non-readmitted patients, respectively.

Among variables extracted through chart review, there was little difference in the prevalence of living alone (18 and 19 %) between groups. There were differences in the prevalence of lacks social support (2 and 0.5 %) and in those who were marginally housed (0.6 and 2 %) among readmitted and non-readmitted patients, respectively (Table 1).

Following adjustment for age (Model 1), and CMS-based predictors of readmission (Model 2), lacking social support was the only social risk factor associated with increased readmissions (Model 1: OR 5.46, 95 % CI 1.58–19.99; Model 2: OR: 4.65, 95 % CI 1.31–17.38). Marginal housing was noted to have a protective affect against readmissions in both models (Model 1: OR 0.25, 95 % CI 0.04–0.95; Model 2: OR 0.21, 95 % CI 0.03–0.87). Among clinical factors, only renal failure was associated with readmission (OR: 1.38, 95 % CI 1.02–1.87) (Table 2).

In assessing model performance, a model that included age and social risks (Model 1) had a c-statistic of 0.52. A CMS-based model (age and comorbid conditions only) had a c-statistic of 0.62 - which is similar to the c-statistic of the CMS model for HF reported in the literature [11]. Adding the five social risk factors to a model that included all clinical factors in the CMS-based readmission model (Model 2) led to a c-statistic of 0.62. Model fit, as assessed by the likelihood ratio test between Model 1 and Model 2, was improved with the addition of clinical risk factors (p-value = 0.04). Using the HL GOF test, both models displayed no evidence of lack-of-fit between observed and expected outcomes (HL GOF: Model 1 p-value: 0.8, Model 2 p-value: 0.7).

Discussion
Among five assessed social risk factors in a cohort of elderly Veterans hospitalized for heart failure, lacking social support was found to be associated with increased 30-day all-cause readmission while marginal housing appears to protect against readmission. Further, the inclusion of the assessed five social risk factors in a CMS-based readmission model appeared to have limited effect on model fit and performance.

Our analysis revealed several findings. First, while the estimated prevalence of a lack of social support was uncommon, it remained a moderate predictor of readmission. We hypothesize this may be due, in part, to the chart abstraction methodology we utilized. As the
Table 1 Characteristics for Patients Hospitalized for Heart Failure

|                        | Full Sample* (n = 9,261) | Chart-Reviewed (n = 1,500) |
|------------------------|--------------------------|---------------------------|
|                        | Yes (n = 1,944) | No (n = 7,317) | Yes (n = 312) | No (n = 1,188) |
| **Readmitted, No. (%)**|                         |                          |              |                |
| **Age, mean (SD), years** | 77.7 (9.0) | 76.9 (8.5) | 77.9 (8.3) | 77.8 (8.7) |
| **Social Risk Factors** |                         |                          |              |                |
| Lives Alone           | -- | -- | 57 (18) | 226 (19) |
| Lacks Social Support  | -- | -- | 6 (2) | 6 (0.5) |
| Marginal Housing      | -- | -- | 2 (<1) | 21 (2) |
| Substance Abuse       | 272 (14) | 1,097 (15) | 43 (14) | 189 (16) |
| Low Income            | 913 (48) | 3,512 (48) | 146 (47) | 555 (47) |
| **Clinical Factors**  |                         |                          |              |                |
| CABG                  | 1,516 (78) | 5,414 (74) | 247 (79) | 873 (73) |
| Heart Failure         | 1,846 (95) | 6,951 (95) | 300 (96) | 1,125 (95) |
| Acute Coronary Syndrome | 447 (23) | 1,609 (22) | 73 (23) | 250 (21) |
| Coronary Atherosclerosis | 1,516 (78) | 5,780 (79) | 243 (78) | 943 (79) |
| Cardiopulmonary-respiratory failure and shock | 447 (23) | 1,975 (27) | 77 (25) | 311 (26) |
| Valvular Heart Disease | 408 (21) | 2,195 (30) | 102 (21) | 374 (31) |
| Arrhythmia            | 1,438 (74) | 5,487 (75) | 240 (77) | 872 (73) |
| Other unspecified heart disease | 486 (25) | 1,390 (19) | 69 (23) | 226 (19) |
| Stroke                | 291 (15) | 658 (9) | 42 (13) | 119 (10) |
| Renal Failure         | 1,380 (71) | 4,317 (59) | 217 (70) | 712 (60) |
| COPD                  | 1,049 (54) | 4,024 (55) | 175 (56) | 626 (53) |
| Diabetes              | 1,185 (61) | 4,902 (67) | 193 (62) | 768 (65) |
| Protein-calorie malnutrition | 136 (7) | 292 (4) | 17 (5) | 41 (3) |
| Dementia              | 370 (19) | 951 (13) | 52 (17) | 178 (15) |
| Functional Disability | 291 (15) | 878 (12) | 41 (13) | 131 (11) |
| Metastatic cancer     | 39 (2) | 219 (3) | 5 (2) | 22 (2) |
| Major psychiatric disorders | 291 (15) | 878 (12) | 52 (17) | 135 (11) |
| Chronic liver disease | 252 (13) | 732 (10) | 36 (12) | 114 (10) |
| Severe hematologic disorders | 78 (4) | 220 (3) | 8 (3) | 30 (3) |
| Iron deficiency       | 1,069 (55) | 4,024 (55) | 175 (56) | 649 (55) |
| Depression            | 447 (23) | 1,609 (22) | 79 (25) | 247 (21) |
| Fibrosis of lung or other chronic lung disorder | 136 (7) | 512 (7) | 19 (6) | 76 (6) |
| Asthma                | 39 (2) | 219 (3) | 8 (3) | 52 (4) |
| End-stage renal disease | 97 (5) | 220 (3) | 12 (4) | 18 (2) |
| Nephritis             | 136 (7) | 289 (4) | 25 (8) | 63 (5) |
| Urinary tract disorders | 524 (27) | 1,756 (24) | 86 (28) | 291 (24) |
| Fluid and electrolyte disorders | 1,049 (54) | 3,365 (46) | 173 (55) | 538 (45) |
| Other psychiatric disorders | 388 (20) | 1,169 (16) | 65 (21) | 186 (16) |
| Peptic Ulcer and other specified GI tract disorders | 369 (19) | 1,243 (17) | 55 (18) | 173 (15) |
| Other GI tract disorders | 1,283 (66) | 4,317 (59) | 201 (64) | 718 (60) |
| Decubitus skin ulcer  | 213 (11) | 1,024 (14) | 39 (13) | 168 (14) |

Notes:
Abbreviations: Substance Abuse includes both drug and alcohol abuse; CABG coronary artery bypass graft, COPD chronic obstructive pulmonary disease, GI gastrointestinal, MI myocardial infarction, PCI percutaneous coronary intervention, VA Veterans Affairs; In adjusted analysis, each condition was adjusted for all respective comorbidities
*Full sample is the total (10,761) minus the chart-reviewed sample (1,500) with a total n = 9,261
**p >0.05 for all comparisons of full sample and chart-reviewed sample
*Variables extracted through manual chart review
instances noted through chart abstraction were likely strong signals of this characteristic, hence its significant association with the outcome. Moreover, this may imply that the finding of an association with our outcomes is a conservative estimate, considering the likelihood that the lack of social support experienced among the older veterans in this study is probably significantly higher than what we described (0.5–2%). Mechanistically, a lack of

| Condition                                  | Model 1: age + SRF | Model 2: CMS model + SRF |
|--------------------------------------------|-------------------|--------------------------|
| Age, mean (SD), years                     | 1 (0.99, 1.02)    | 1.0 (0.98, 1.02)         |
| Lives Alone⁴                              | 0.92 (0.66, 1.26) | 0.9 (0.64, 1.26)         |
| Lacks Social Support⁴                     | 5.46 (1.58, 19.99)| 4.65 (1.31, 17.38)       |
| Marginal Housing⁴                         | 0.25 (0.04, 0.95) | 0.21 (0.03, 0.87)        |
| Substance Abuse                           | 0.98 (0.73, 1.31) | 0.91 (0.67, 1.22)        |
| Low Income                                | 1 (0.78, 1.29)    | 1.01 (0.77, 1.31)        |
| CABG                                      | --                | 1.24 (0.89, 1.74)        |
| Heart Failure                             | --                | 1.22 (0.65, 2.47)        |
| Acute Coronary Syndrome                   | --                | 1.06 (0.76, 1.47)        |
| Coronary Atherosclerosis                  | --                | 0.81 (0.58, 1.14)        |
| Cardiopulmonary-respiratory failure and shock | --              | 0.76 (0.55, 1.04)        |
| Valvular Heart Disease                    | --                | 0.99 (0.74, 1.31)        |
| Arrhythmia                                | --                | 1.1 (0.81, 1.52)         |
| Other unspecified heart disease           | --                | 1.09 (0.78, 1.51)        |
| Stroke                                    | --                | 1.21 (0.79, 1.84)        |
| Renal Failure                             | --                | 1.38 (1.02, 1.87)        |
| COPD                                      | --                | 1.13 (0.86, 1.49)        |
| Diabetes                                  | --                | 0.79 (0.6, 1.05)         |
| Protein-calorie malnutrition              | --                | 1.41 (0.74, 2.62)        |
| Dementia                                  | --                | 0.95 (0.65, 1.38)        |
| Functional Disability                     | --                | 1.05 (0.68, 1.61)        |
| Metastatic cancer                         | --                | 0.73 (0.23, 1.9)         |
| Major psychiatric disorders               | --                | 1.39 (0.94, 2.03)        |
| Chronic liver disease                     | --                | 1.04 (0.67, 1.59)        |
| Severe hematologic disorders              | --                | 0.87 (0.35, 1.94)        |
| Iron deficiency                           | --                | 0.84 (0.63, 1.12)        |
| Depression                                | --                | 1.08 (0.78, 1.5)         |
| Fibrosis of lung or other chronic lung disorder | --            | 0.85 (0.48, 1.44)        |
| Asthma                                    | --                | 0.49 (0.21, 1.01)        |
| End-stage renal disease                   | --                | 1.82 (0.8, 4.01)         |
| Nephritis                                 | --                | 1.42 (0.82, 2.4)         |
| Urinary tract disorders                   | --                | 1.02 (0.75, 1.39)        |
| Fluid and electrolyte disorders           | --                | 1.29 (0.97, 1.71)        |
| Other psychiatric disorders               | --                | 1.27 (0.91, 1.77)        |
| Peptic Ulcer and other specified GI tract disorders | --            | 1.16 (0.8, 1.67)         |
| Other GI tract disorders                  | --                | 1.03 (0.77, 1.36)        |
| Decubitus skin ulcer                      | --                | 0.68 (0.44, 1.01)        |

Notes
Abbreviations: Substance Abuse includes both drug and alcohol abuse; CABG coronary artery bypass graft, COPD chronic obstructive pulmonary disease, GI gastrointestinal, MI myocardial infarction, PCI percutaneous coronary intervention, SRF Social Risk Factors, VA Veterans Affairs; In adjusted analysis, each condition was adjusted for all respective comorbidities
*Variables extracted through manual chart review
social support leading to increased readmission has face validity, as well – as those who have fewer support mechanisms may depend more on health care systems than those who have personal social support systems in place. Second, while also uncommon, marginal housing appeared to protect against readmission. We hypothesize that this may be due to the older (≥ 65 years), Veteran population that was assessed and the VA health care systems’ larger commitment to both medical and social needs of homeless Veterans [12, 13]. Thus, VA providers are more likely to discharge patients to post-acute care facilities, rather than to their own accord – limiting the patients’ probability of being readmitted in the 30-day time frame. This same mechanism may not be at play in individuals who lack social support as this quality is often difficult to ascertain and may not be shared with a provider, whereas lack of housing is a more obvious characteristic.

There are several reasons why, in this study, some social risks (lives alone, substance abuse, and low income) may not be as impactful as they are in other non-VA populations. First, the VA provides a number of social services that are commonly not offered in other health care systems, such as subsidized transportation to/from clinics and Patient-Aligned Care Teams that focus on socially vulnerable Veterans, among many others [14, 15]. Additionally, VA patients routinely receive post-hospitalization phone calls and in-home support services, if eligible. Thus, these integrated social services may be diminishing any effect these social factors impart on readmissions risks. Moreover, the only risk factor we found associated with increased 30-day readmission was lack of social support – which is a difficult risk factor for a health system to intervene upon. Second, while we assessed a variety of common risk factors shown to be influential in other settings, these specific factors may not play a tangible role in patients with heart failure – as prior studies have shown social risk variables are not universally impactful across all disease states [16]. Assessing other risks, such as access to transportation and medical literacy, which are also suspected to impact HF readmissions [17], would be beneficial. Third, the fidelity of the social risk variables could be playing a role in the low prevalence – as previous work has shown that social risk factors are substantially more prevalent than represented in administrative data [18]. We attempted to address this issue by extracting three risk factors through manual chart review, noting that the only factors shown to be associated with readmission (lack of social support and marginal housing) were those extracted in this method. Finally, the limited sample size may be impacting our ability to capture a signal with some risk factors. Though the sample size is modest, our approach did allow for manual chart abstraction of three social risk factors.

This study does have methodologic limitations. First, the cohort come from a 2012 data set which allowed us the ability to perform the chart review portion of this assessment. While this may impact the current validity of our findings, we note that studies have shown that underlying social determinants have remained impactful and present over long periods of time in the US [19]. Second, chart abstraction may not be sensitive enough to detect the presence of the assessed social risk factors – as this information may not be viewed as relevant to patient care, and thus, not documented in the chart by the provider. Third, there may be non-VA based social support mechanisms in place (e.g., meals-on-wheels) that could be impacting our findings that we were unable to ascertain or control for. Finally, the observational nature of this work does not allow us to speculate beyond associations, and the focus on elderly Veterans, limits generalizability.

Conclusions
In an elderly population of Veterans, lacking social support may be associated with increased risk of 30-day readmission in patients hospitalized for HF. Additionally, the inclusion of the five measured social risk factors (living alone, lack of social support, marginal housing, substance abuse, and low income) into a CMS-based readmission model does not improve model performance. The VAs integrated health care system, where many social risk factors are addressed through national programs, may be attenuating the deleterious impact some social risk factors have on hospital readmission.

Abbreviations
CMS: Centers for Medicare & Medicaid; HF: Heart Failure; HL GOF: Hosmer-Lemeshow goodness-of-fit; ICD-9-CM: International Classification of Disease, Ninth Revision, Clinical Modification; MedPAR: Medicare Provider Analysis and Review; PACT: Patient-Aligned Care Teams; VA: Veterans Health Administration; VReC: VA Information Resource Center

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s12913-021-06888-1.

Additional file 1.

Acknowledgements
Similar work was presented at the 2020 Society of General Internal Medicine National Conference.

Authors’ contributions
CMW, MV, LCW, LC, WC, and SK were responsible for study design, data analysis, interpretation, and creation of the manuscript. PCA and ALB were responsible for interpretation of results and editing of the manuscript. All authors read and approved the final manuscript.

Funding
This work was supported by NHLBI R01 RO1 HL116522-01A1. Support for VA/CMS data is provided by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Health Services Research Division.
Research and Development, VA Information Resource Center (Project Numbers SDR 02-237 and 98 – 004). The funders had no role in this study.

Availability of data and materials
The data that support the findings of this study are available from the Veterans Health Administration, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available.

Declarations

Ethics approval and consent to participate
No administrative permissions were required to access the raw data from Veterans Health Administration.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Author details
1. Department of Medicine, University of California, San Francisco, USA. 2. Division of Hospital Medicine, San Francisco Veterans Affairs Medical Center, University of California San Francisco, 3300 16th Street, San Francisco, CA 94115, USA. 3. Northern California Institute for Research and Education, San Francisco Veterans Affairs Medical Center, San Francisco, USA. 4. Division of Geriatrics, San Francisco Veterans Affairs Medical Center, San Francisco, USA. 5. Department of Biomedical Informatics, University of Utah, Salt Lake City, USA. 6. Centre for Digital Transformation of Health, University of Melbourne, Melbourne, Victoria, Australia. 7. Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Canada. 8. Department of Psychiatry, University of California, San Francisco, USA. 9. Mental Health Services, San Francisco Veterans Affairs Medical Center, San Francisco, USA. 10. Division of General Internal Medicine, San Francisco Veterans Affairs Medical Center, San Francisco, USA.

Received: 10 July 2020 Accepted: 10 August 2021

References

1. Krishnamurthi N, Francis J, Fihn SD, Meyer CS, Wholley MA. Leading causes of cardiovascular hospitalization in 8.45 million US veterans. PLoS One. 2018;13(3). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5864414/.[cited 15 Aug 2019].

2. Maddox KE, Redhead M, Hu J, Kind AJH, Zaslavsky AM, Nagasako EM, et al. Adjusting for social risk factors impacts performance and penalties in the hospital readmissions reduction program. Health Serv Res. 2019;54(2):327–36.

3. Calvillo-King L, Arnold D, Eubank KJ, Lo M, Yunyongying P, Stieglitz H, et al. Impact of social factors on risk of readmission or mortality in pneumonia and heart failure: systematic review. J Gen Intern Med. 2013;28(2):269–82.

4. Hu J, Gonsahn MD, Nerenz DR, Socioeconomic status and readmissions: evidence from an urban teaching hospital. Health Aff. 2014;33(1):778–85.

5. Hu J, Kind AJH, Nerenz D. Area deprivation index predicts readmission risk at an urban teaching hospital. Am J Med Qual. 2018;33(5):493–501.

6. Rodriguez F, Joynt KE, Lopez L, Saldana F, Jha AK. Readmission rates for Hispanic Medicare beneficiaries with heart failure and acute myocardial infarction. Am Heart J. 2011;162(2):254-61.e3.

7. Muus KJ, Knudson A, Klug MG, Gokun J, Sarrazin M, Kaboli P. Effect of post-discharge follow-up care on re-admissions among US veterans with congestive heart failure: a rural-urban comparison. Rural Remote Health. 2010;10(2):1447.

8. Keenan PS, Normand S-LT, Lin Z, Drye EE, Bhat KR, Ross JS, et al. An administrative claims measure suitable for profiling hospital performance on the basis of 30-day all-cause readmission rates among patients with heart failure. Circ Cardiovasc Qual Outcomes. 2008(1)(1):29–37.

9. Wray CM, Vail M, Abraham A, Zhang A, Walter LG, Keyhani S. Validation of Administrative measures of social and behavioral risk in Veterans Affairs medical records. J Gen Intern Med. 2019;34:796–8.

10. VA priority groups. Veterans Affairs. 2019. Available from: https://www.va.gov/health-care/eligibility/priority-groups.[cited 8 Nov 2019].

11. Kansagara D, Englander H, Salantro A, Kagen D, Theobald C, Freeman M, et al. Risk prediction models for hospital readmission: a systematic review. JAMA. 2011;306(15):1688–98.

12. Shulkin DJ. Beyond the VA crisis — becoming a high-performance network. N Engl J Med. 2016;374(11):1003–5.

13. Wray CM, Lopez L, Keyhani S. Comparing VA and Non-VA Care Quality. J Gen Intern Med. 2019;34(4):485–485.

14. Gundlapalli AV, Redd A, Bolton D, Vanneman ME, Carter ME, Johnson E, et al. Patient-aligned Care Team Engagement to Connect Veterans Experiencing Homelessness With Appropriate Health Care. Med Care. 2017;55:104.

15. O’Toole TP, Johnson EE, Aiello R, Kane V, Pape L. Tailoring Care to Vulnerable Populations by Incorporating Social Determinants of Health: the Veterans Health Administration’s “Homeless Patient Aligned Care Team” Program. Prev Chronic Dis. 2016;13:E44–4.

16. Meddings J, Reichert H, Smith SN, Iwashyna TJ, Langa KM, Hofer TP, et al. The Impact of Disability and Social Determinants of Health on Condition-Specific Readmissions beyond Medicare Risk Adjustments: A Cohort Study. J Gen Intern Med. 2017;32(1):71–80.

17. Felix HC, Seaberg B, Bursac Z, Thostenson J, Stewart MK. Why do patients keep coming back? Results of a Readmitted Patient Survey. Soc Work Health Care. 2015;54(1):1–15.

18. Navathe AS, Zhong F, Lei VJ, Chang FY, Sordo M, Topaz M, et al. Hospital readmission and social risk factors identified from physician notes. Health Serv Res. 2018;53(2):1110–36.

19. Singh GK, Daus GP, Allender M, Ramey CT, Martin EK, Perry C, et al. Social Determinants of Health in the United States: Addressing Major Health Inequality Trends for the Nation, 1935–2016. Int J MCH AIDS. 2017;6(2):139–64.

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