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Effect of post-discharge follow-up care on re-admissions among US veterans with congestive heart failure: a rural-urban comparison

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ABSTRACT

Introduction: Hospital re-admissions for patients with congestive heart failure (CHF) are relatively common and costly occurrences within the US health infrastructure, including the Veterans Affairs (VA) healthcare system. Little is known about CHF re-admissions among rural veteran patients, including the effects of socio-demographics and follow-up outpatient visits on these re-admissions. Purpose: To examine socio-demographics of US veterans with CHF who had 30 day potentially preventable re-admissions and compare the effect of 30 day VA post-discharge service use on these re-admissions for rural- and urban-dwelling veterans.

Methods: The 2005-2007 VA data were analyzed to examine patient characteristics and hospital admissions for 36 566 veterans with CHF. The CHF patients who were and were not re-admitted to a VA hospital within 30 days of discharge were identified. Logistic regression was used to examine and compare the effect of VA post-acute service use on re-admissions between rural- and urban-dwelling veterans.

Results: Re-admitted veterans tended to be older (p=.002), had disability status (p=.024) and had longer hospital stays (p<.001). Veterans Affairs follow-up visits were negatively associated with re-admissions for both rural and urban veterans with CHF (ORs

0.16–0.76). Rural veterans aged 65 years and older who had VA emergency room visits following discharge were at high risk for re-admission (OR=2.66).

Conclusions: Post-acute follow-up care is an important factor for promoting recovery and good health among hospitalized veterans with CHF, regardless of their rural or urban residence. Older, rural veterans with CHF are in need of special attention for VA discharge planning and follow up with primary care providers.

Key words: heart failure, rural populations, veterans.

Introduction

Congestive heart failure (CHF) affects an estimated 5 million Americans and approximately 550 000 people are diagnosed with CHF annually[1]. Congestive heart failure is the principal cause of death for approximately 400 000 persons annually in the USA[2]. The prevalence of CHF is expected to rise in future years due to several factors, including higher rates of cardiovascular disease and increased life expectancy resulting from advances in medical treatment and technology. Major clinical risk factors for CHF include advancing age, male sex, hypertension, myocardial infarction, diabetes mellitus, valvular disease and obesity[3-13].

Congestive heart failure is the most common diagnosis among hospitalized US Medicare patients[14] and is associated with six-month hospital re-admission rates of more than 40%[15]. Hospital re-admissions may indicate one factor or a combination of factors including: poor in-hospital care; insufficient discharge planning; uncoordinated transition care; and inadequate post-discharge and follow-up care[16-19]. The Medicare Payment Advisory Commission (MedPAC) has recommended public reporting of hospital-specific re-admission rates, with CHF as a priority condition[19]. In response to this recommendation, the Centers for Medicare and Medicaid (CMS) developed a 30 day risk-standardized re-admission measure for CHF, designed to measure and improve patient care quality and decrease costs[20].

Several studies have addressed socio-demographic and/or health factors related to re-admissions among CHF patients[21-28]; however, these studies had one or more of the following limitations: use of data from small geographic areas; incorporating definitions of re-admission that did not exclude re-hospitalizations due to other health conditions or planned stays (eg hospitalizations that were a part of the treatment regimen associated with the initial hospitalization); or use of variant, non-standard and extended post-discharge timeframes (eg 6 months; 1 year) for defining re-admission[29].

Some of these studies have examined veterans, a group that has been found to be at higher risk for hospital re-admissions[30,31]. Regarding patients' rurality of residence, one study involving older (ie ≥65 years) veterans found that rural-based patients were slightly more likely than urban-based patients to have unplanned 30 day re-admissions for all conditions combined and for several diagnostic categories, including circulatory disorders[32]. No studies were found which address demographic and health predictors of 30 day hospital re-admissions for CHF among veterans. Also, no studies were found which addressed the relationship between veterans' rurality of residence, use of post-acute care and CHF re-admissions. The objectives of this study were to derive 30 day CHF potentially preventable re-admission prevalence, delineate a socio-demographic profile of re-admitted CHF patients and compare the effect of post-acute VA physician service use on CHF re-admissions among rural- and urban-dwelling veterans.

Methods

Data sources

Subjects were identified using the VA Patient Treatment File (PTF) from the Department of VA's Austin Automation Center, a file that contains information on inpatient encounters in all VA hospitals, including demographics, income level, VA eligibility status (determined by several factors including the nature of a veteran's discharge from military service, length of service and VA adjudicated disabilities [commonly referred to as service-connected disabilities]), dates of admission and discharge, primary/secondary diagnosis and procedure codes (ie International Classification of Diseases, Ninth Revision-Clinical Modification [ICD-9-CM]; current procedural terminology [CPT]), admission source (eg transfer from another hospital, emergency room [ER], direct admission), hospital units where care was provided (eg medicine, surgery, intensive care unit) and discharge disposition. To complement the identification of deaths that occurred in the hospital, the VA Vital Status File was used to determine deaths that occurred after discharge. Veterans Affairs' geo-coded enrollment files were used to determine veteran rural residence and travel times to Veterans Affairs Medical Center (VAMC) facilities. Outpatient services received after discharge were identified in VA outpatient care files, which include information pertaining to all outpatient encounters in VA facilities. Variables include visit date, clinic type (eg ER, primary care clinic), provider type (eg nurse, physician), diagnosis codes and procedure codes.

Study cohorts

Creation of the study cohort involved three steps. First, admissions to acute care VA hospitals during the period October 2005 to September 2007 (ie Federal fiscal years 2006–2007) were identified, and categorized as a clinically related re-admission or other admission using the 3M Potentially Preventable Re-admissions (PPR) grouping software (3M company; Wallingford, CT, USA)[33]. The PPR software identifies rehospitalizations that may result from deficiencies in the process of care or treatment, rather than unrelated events that occur post-discharge. This software uses primary and secondary diagnosis codes, procedure codes and all-patient refined diagnosis related group (APR-DRG) codes to determine if two admissions are clinically related. If the admissions are clinically related and occur within the set time period (eg 30 days), the second admission is classified as a PPR.

Second, 36 566 admissions were defined as initial admissions with a primary diagnosis of CHF (ICD-9-CM codes 402.x1, 404.x1, 404.x3 or 428.xx). A total of 3568 initial admissions were excluded from the study due to having any one of the following factors: died within 30 days of their CHF admission; transferred to another hospital; admitted for trauma or malignancies; or had a missing or invalid home address (note: preventing the determination of rural/urban location). The remaining 32 998 admissions were divided into two cohorts: CHF admissions with a clinically-related re-admission (n=5698) within 30 days; and CHF admissions with no clinically-related re-admission (n=27 300) within 30 days.

The admissions were further split into two groups based on rural and urban residence through use of the VA's standard definition of rurality[34]. Level of rurality is designated based on a veteran's geo-coded address of primary residence at the end of FY2008. Veterans were classified as urban if they lived in a US Census Bureau defined urbanized area, which consists of contiguous densely settled block groups that along with adjacent densely settled census blocks that together encompass a population of at least 50 000 people. Veterans were categorized as rural if they did not reside in an urbanized area. Using this method, 21 664 urban veterans were classified with CHF, 3792 (17.5%) which had clinically related re-admissions to VA hospitals. Of the 11 334 rural veterans who were identified with CHF, 1906 (16.8%) had clinically related re-admissions to VA hospitals.

Additional patient characteristics were identified using the PTF discharge records, VA enrollment files, and outpatient

care files. Demographic characteristics included age, sex, and race (white, black, Hispanic and other), marital status, and income (≤$5,000, $5,001–$10k, $10,001–$15k, $15,001–$25k and >$25k). Travel times to the nearest VA primary care site were obtained from VA enrollment files and were derived using a methodology that incorporates information on road networks from the US Department of Transportation, population density from the US Census, and average travel times from the 2002 Urban Mobility Report[35]. Four types of follow-up VA outpatient visits were identified including: any physician or physician extender; primary care clinic; cardiology clinic; and ER/department. These visits were identified as having occurred within a 30 day period from the first day after discharge up to but not including the day of re-admission or the 13th day for those not re-admitted.

Statistical analysis

The prevalence of all variables for each cohort was described and compared using χ^2 tests. Also, logistic regression was used to estimate the relative odds of re-admission associated with each patient characteristic. Logistic regression models were generated separately for rural and urban patients and controlled for nine socio-demographic and healthcare factors, including: age; gender; marital status; annual income; VA health service eligibility; military service era; travel time to the nearest primary care source (minutes); and hospital length of stay (LOS). Additionally, the number of days until a specific outpatient visit type was included in the multivariable models and the coefficient associated with each outpatient visit type was used to estimate the relationship between time to first outpatient visit and the odds of re-admission. Significant interactions between the four VA outpatient visit variables and nine control variables were found using logistic regression. Results from models for rural and urban veterans were compared.

Results

Most of the 32 998 veterans hospitalized for CHF were male (Table 1). Approximately two- thirds of veterans were white, three-fourths had an income of less than $25,000 per year, half were married and approximately one-third were from rural communities. It was found that 17.3% of CHF patients had a 30 day PPR; by residential location, it was found that urban patients (17.5%) had higher re-admission prevalence than rural patients (16.8%), but the association was statistically non-significant (p=.121).

A number of socio-demographic factors were associated with CHF re-admission status (Table 1). Veterans under age 60 years were least likely to have re-admission, while those over 80 years were most likely (p=.002). Veterans Affairs health service eligibility status was also associated with re-admissions because veterans who received services due to low income or a disability were more likely to have a re-admission (p=.024). Although travel time to the nearest primary care source approached significance (p=.056), having a LOS in the hospital of more than 1 week was a possible indication of health condition severity influencing re-admission (p< .001).

The 30 day post-discharge VA outpatient visits for veterans by CHF re-admission status are described (Table 2). Although ER visits were more common among veterans who were re-admitted (p<.001), over 95% of veterans did not use ER visits for outpatient services. In contrast, visits to cardiology clinics were more frequent overall, and the proportion of re-admitted veterans who had a cardiology clinic visit was significantly lower compared with the proportion for non-readmitted veterans (14% vs 27%; p<.001). Similarly, veterans who were re-admitted were significantly less likely than non-readmitted veterans to have had a physician/extender visit (50% vs 75%; p<.001) or primary care clinic visit (30% vs 50%; p<.001).

There was also significant variation between re-admission status and time until the outpatient visits (Table 2). The percentage of veterans having a physician or physician extender visit earlier versus later in the month decreased more rapidly for the re-admission cohort (30% to 8%) compared with the no re-admission cohort (29% to 25%), which resembled the results for primary care and cardiology

clinic visits. For VA outpatient visits in the last 2 weeks of the 30 day period, the percentage of non-readmitted veterans was three to seven times higher than for re-admitted veterans. However, the percentage of veterans who saw a VA physician/extender in the first 6 days was essentially the same for both cohorts (29% and 30%).

Separate logistic regressions were performed for rural and urban veterans (Table 3). Both cohorts had decreases in re-admission risk when having had a VA cardiology clinic, primary care clinic or physician/extender visit in the 30 day post-discharge period. Also, longer time intervals between veterans' (both rural and urban alike) hospital discharges and follow-up visits were associated with greater reductions in re-admission risk. The odds of re-admission when having any physician or physician extender visit within the first 6 days was not significantly different from no visit at all, but those odds decreased to 0.52 (rural) and 0.73 (urban) during the next 6 days, and then to 0.58 (rural) and 0.40 (urban) if the person waited for 13 days or more. A similar pattern was found for primary care clinic visit where ORs ranged from 0.25 (13 to 30 days) to 0.57 (1 to 12 days) (rural and urban were almost identical), and cardiology clinic visits with ORs ranging from 0.16 (20 to 30 days) to 0.76 (1-10 days), with urban having greater variance.

Urban and rural differences in re-admissions were found primarily in demographics and use of the ER (Table 3). Unique predictors for rural veterans included use of the ER at least once for those aged 65 years or older, which increased re-admission risk by 166%. Unique urban aspects included visiting the ER at least once increasing risk of re-admission by 52% (for all ages), having low income or disability status increasing risk by 13% and having an initial hospital stay of 8 days or more increasing re-admission risk by 11%.

Discussion

The 2005-2007 VA patient data were used to derive the prevalence of 30 day potentially preventable hospital re-admissions among US veterans with CHF, examine socio-demographic traits of re-admitted veterans with CHF, and compare the effect of VA physician follow-up visits on re-admission for rural- and urban-based veterans. It was found that approximately one-sixth (17.3%) of discharged CHF patients incurred a 30 day PPR within the VA healthcare system. Re-admitted veterans, compared with non-readmitted veterans, tended to be older, had disability status, and had longer stays (ie 8 days or more) during their initial hospitalization. Urban veterans had a slightly higher prevalence of CHF re-admissions than rural veterans (17.5% vs 16.8%); therefore, no increased risk for CHF re-admissions was found for rural veterans.

Having a VA post-acute visit within 30 days of discharge at a primary care or cardiology clinic were each strongly negatively associated with CHF re-admissions for both rural and urban veterans. This finding is consistent with the results of several studies involving non-veteran patient populations[36-40]. Timely post-discharge follow-up care can promote positive health outcomes for the patient by allowing the healthcare provider to address any emerging health exacerbations, check for patient compliance with home care instructions and adjust (as needed) medication regimen/dosages. Coleman et al. found that using 'transition coaches' to assist chronically ill older patients and their caregivers by providing them with tools and skills that empower them to take a more active role in their care reduced re-admission rates[41]. This approach may be especially beneficial for veterans in rural communities who may experience access barriers due to greater distances to VA healthcare services and challenging terrain. However, a study by Weinberger et al. found that an intensive primary care intervention for severely chronically ill veterans increased the rate of re-admissions[42]. Clearly, additional research is needed to develop an evidence-base to identify what interventions are most effective in decreasing PPRs for veteran populations.

Table 1: Association of socio-demographics, healthcare factors and re-admission for 32 998 congestive heart failure admissions

Factor	30-Day re-admission *n* (%)		*p*
	No	Yes	
Rurality of residence			
Urban	17 872 (65.5)	3792 (66.6)	.121
Rural	9428 (34.5)	1906 (33.5)	
Age			
18–59	6299 (23.1)	1202 (21.1)	.002
60–64	3529 (12.9)	742 (13.0)	
65–74	6157 (22.6)	1263 (22.2)	
75–79	3931 (14.4)	827 (14.5)	
≥80	7384 (27.1)	1664 (29.2)	
Sex			
Male	26 822 (98.3)	5611 (98.5)	.259
Female	478 (1.8)	87 (1.5)	
Marital status			
Married	12 276 (45.0)	2608 (45.8)	.188
Divorced/separated	8487 (31.1)	1684 (29.6)	
Widowed	4001 (14.7)	877 (15.4)	
Never married	2476 (9.1)	518 (9.1)	
Race			
White	18 005 (68.4)	3794 (68.1)	.962
Black	6796 (25.8)	1453 (26.1)	
Hispanic	1231 (4.7)	265 (4.8)	
Other	284 (1.1)	62 (1.1)	
Income (annual)			
≤ $5,000	5316 (19.5)	1084 (19.0)	.765
$5,001–10k	3765 (13.8)	780 (13.7)	
$10,001–15k	5638 (20.7)	1203 (21.1)	
$15,001–25k	4858 (17.8)	991 (17.4)	
≥ $25,001	7723 (28.3)	1640 (28.8)	
VA Health Service eligibility			
Low Income	14 415 (52.8)	3015 (52.9)	.024
Disability	9752 (35.7)	2097 (36.8)	
Other	3133 (11.5)	586 (10.3)	
Travel time to primary healthcare source (min)			
0–15	12 131 (44.4)	2630 (46.2)	.056
16–30	7767 (28.5)	1612 (28.3)	
31–60	5623 (20.6)	1126 (19.8)	
61–90	1490 (5.5)	282 (5.0)	
≥ 91	289 (1.1)	48 (0.8)	
Length of initial hospital stay (days)			
1–2	1701 (6.2)	258 (4.5)	<.001
3–7	18 191 (66.6)	3628 (63.7)	
≥ 8	7408 (27.1)	1812 (31.8)	

VA, Veterans Affairs.

Table 2: Association of time to follow-up Veterans Affairs outpatient clinic visits and re-admissions for 32 998 CHF admissions

Outpatient visit	30-Day re-admission *n* (%)		*p*
	No	Yes	
VA emergency room			
Yes	662 (2.4)	197 (3.5)	<.001
No	26 638 (97.6)	5501 (96.5)	
Any VA physician or physician extender (days)			
None	6852 (25.1)	2723 (47.8)	<.001
1–6	7805 (28.6)	1704 (29.9)	
7–12	5779 (21.2)	817 (14.3)	
13–30	6864 (25.1)	454 (7.97)	
VA primary care clinic (days)			
None	12 530 (45.9)	4088 (71.7)	<.001
1–12	7809 (28.6)	1251 (22.0)	
13–30	6961 (25.5)	359 (6.3)	
VA Cardiology Clinic (days)			
None	19 934 (73.0)	4926 (86.5)	<.001
1–10	2899 (10.6)	498 (8.7)	
11–19	2222 (8.1)	211 (3.7)	
20–30	2245 (8.2)	63 (1.1)	

VA, Veterans Affairs.

It was found that the greater the time between patients' VA hospital discharge and use of VA follow-up outpatient care during the 30 day post-discharge period, the less likely patients were to be re-admitted. This finding may be due, in part, to veterans with shorter discharge-to-outpatient care intervals may have more serious health problems than those veterans who are able to wait longer for outpatient care. It may also indicate that veterans who receive comprehensive discharge planning and/or coordination of home care are better able to maintain their health after discharge[41] and, as a result, may have a lower need for immediate follow up. It may also reflect other factors not captured in the data such as home support (ie a family member or neighbor that monitors medication) or telehealth (ie telephone contacts with VA providers to monitor veterans' blood pressure and weight). Healthcare providers within the VA may want to consider care alternatives, such as telehealth follow-ups, for rural-dwelling veterans who may face transportation challenges in accessing VA healthcare services. Additional research is needed to determine if telehealth interventions for veterans decrease CHF re-admission rates, particularly for rural veterans.

A limitation of this study is the lack of information pertaining to health care provided outside of the VA system, such as an admission to a non-VA hospital following a discharge from a VA hospital. Rural veterans who seek care from VA and non-VA providers may utilize health care differently than veterans who rely solely on VA providers; thus, the co-management of care may impact the PPR risk for rural veterans. Also, other factors that are potentially predictive of re-admission risk were not accounted for in this study, including specific indicators of inpatient care quality, discharge planning, care coordination, home support, patient compliance and patient self-care. The inclusion of such factors in future studies would assist in determining the extent to which the type/quality of received care and patient health behaviors are associated with veterans' re-admission risk.

Table 3: Logistic regression analyses of predictors of 30 day potentially preventable re-admissions for 11 334 rural veterans and 21 664 urban veterans with CHF, controlling for demographic and healthcare factors

Predictor	Veteran location OR (95% CI)	
	Rural *n* = 11 334	Urban *n* = 21 664
Days to any VA physician or physician extender visit post-discharge		
No visit	1.00 (reference)	1.00 (reference)
1–6	0.92 (0.79–1.08)	0.98 (0.88–1.09)
7–12	0.52 (0.44–0.63)	0.73 (0.64–0.82)
13–30	0.38 (0.31–0.46)	0.40 (0.35–0.47)
Days to VA primary care clinic visit post-discharge		
No visit	1.00 (reference)	1.00 (reference)
1–12	0.57 (0.49–0.66)	0.56 (0.51–0.62)
13–30	0.26 (0.21–0.32)	0.25 (0.22–0.30)
Days to VA cardiology clinic visit post-discharge		
No Visit	1.00 (reference)	1.00 (reference)
1–10	0.66 (0.54–0.81)	0.76 (0.66–0.86)
11–19	0.58 (0.44–0.77)	0.56 (0.46–0.66)
20–30	0.23 (0.15–0.35)	0.16 (0.11–0.22)
VA Emergency room visits (30 days post-discharge)		
None	–	1.00 (reference)
≥ 1	–	1.52 (1.23–1.87)
Age and VA emergency room visit		
<65 or no visit	1.00 (reference)	–
≥65 and ER visit	2.66 (1.87–3.78)	–
LOS ≥8 days		
No	–	1.00 (reference)
Yes	–	1.11 (1.02–1.20)
VA Health service eligibility category		
Other	–	1.00 (reference)
Low income/disability	–	1.13 (1.01–1.27)

LOS, Length of stay; VA, Veterans Affairs.

Some rural/urban differences were noted regarding indicators of CHF re-admission, particularly among older veterans and the use of ERs. Differences among rural and urban veterans' likelihood of re-admission following use of the ER for outpatient care may be an indication of a healthcare access issue. Using an ER within 30 days post-discharge and having disability or low income VA eligibility status each independently increased the likelihood of CHF re-admission for urban veterans only. These factors may denote or contribute to veterans' higher condition severity and/or presence of CHF exacerbations, both of which would increase the likelihood of re-admission.

For rural veterans only, use of the ER by those aged 65 years or older was a significant, independent indicator of re-admission (OR=2.66, CI=1.87-3.78). Elderly veterans residing in rural areas may be more susceptible to delayed treatment of CHF complications due to transportation challenges and, hence, poorer access to VA clinics. Thus, rural-dwelling veterans with CHF may warrant special attention by VA healthcare providers for comprehensive discharge planning and follow-up care provided by healthcare providers who are familiar with their patients' unique situations, including home support, medical histories, health conditions, access to transportation and current treatment regimens. Further research is needed to examine

the care that is provided to rural veterans in their home communities.

The strength of this study is its in-depth examination of inpatient and outpatient care for rural and urban CHF patients, regardless of age, within the VA healthcare system. However, study results may not be generalizable to non-VA patients or co-managed veteran patients. Future studies on rural VA patients are needed which address these gaps, incorporate additional datasets, such as Medicare, and delineate care models which promote patient-centered discharge planning and coordinated, timely follow-up care for veterans in both rural and urban areas of the country.

Conclusion

Post-acute follow-up care is an important factor for promoting recovery and good health among hospitalized veterans with CHF, regardless of their rural or urban residence. Older, rural veterans with CHF are in need of special attention for VA discharge planning and follow up with primary care providers.

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