



Effect of Outpatient Visits and Discharge Destination on Potentially Preventable Readmissions for Congestive Heart Failure and Bacterial Pneumonia

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EXECUTIVE SUMMARY

Introduction and Purpose

Potentially preventable readmissions (PPRs) are costly in human and economic terms. PPRs add costs to an already costly disease and potentially contribute to increased anxiety, stress, and depression for patients and their families, and they suggest a decline in the patient's health that might have been avoided. PPRs also have a high price tag: health care spending associated with PPRs has been estimated at \$12-17.4 billion per year. Successful efforts to reduce preventable readmissions require a clearer understanding of factors that may increase or decrease PPRs.

This study explored the relationship between PPRs and a) use of outpatient follow-up care, b) discharge destination, c) rural versus urban residence of the patient, and d) time to follow-up care. We examined these factors in a large population of Medicare patients with a hospital stay for one of two prevalent diagnoses: congestive heart failure (CHF) and bacterial pneumonia.

Methods

Medicare Provider Analysis and Review (MedPAR) and outpatient data for years 2006-2007 were analyzed via 3M Potentially Preventable Readmission (PPR) software to exclude readmissions for reasons unrelated to patients' initial admissions. The study included a total of 1,013,725 pneumonia patients and 1,079,511 CHF patients nationwide. One-third (33%) of the pneumonia patients and 27% of the CHF patients were from rural areas.

Rates of readmission within 30 days of initial hospitalization were calculated and adjusted for illness severity, type of initial hospital (i.e. urban and rural Prospective Payment System (PPS), and critical access), and residential rurality of patient. Differences in readmission risk due to outpatient visits (defined as visits to physicians, physician assistants, clinical social workers, nurse practitioners, independent clinical laboratories, ambulance providers, and free-standing ambulatory surgical centers) and discharge destinations (i.e. routine, home health, swing beds, skilled nursing facilities, and other) were also calculated.

Results

Potentially preventable readmission rates ranged from 14% to nearly 20% depending on patient locations and condition. The unadjusted prevalence of PPR was 14.4% for urban pneumonia patients and 14.0% for rural patients. The unadjusted prevalence of PPR was 19.8% for urban CHF patients and 19.7% for rural patients.

Outpatient visits substantially reduced PPR risk for this population. Patients who had an outpatient visit within 30 days of their discharge reduced their risk of potentially preventable readmission by 27 to 31%. The positive effect of an outpatient visit was most pronounced for rural patients and was seen for both diagnoses.

Despite the significant impact of an outpatient visit, only about two-fifths of all patients in the study had evidence of an outpatient visit within 30 days of discharge (42% of pneumonia patients and 43% of CHF patients). Rural and urban patients had substantially the same outpatient visit rates.

The patient's discharge destination influenced PPR rates even when adjusted for severity. Routine (home) discharges had the lowest PPR prevalence, while skilled nursing facilities and swing beds had the highest PPR rates. Patients discharged to home health also had higher PPR rates, although many patients for whom home health care was ordered did not receive it within the 30-day post-discharge period.

PPR rates varied by rurality-destination combinations. Home health was associated with a higher PPR rate in rural areas, especially for CHF patients. Urban pneumonia and CHF patients discharged to skilled nursing facilities had the highest severity-adjusted PPR rates. The patient's rurality also influenced discharge destination: home health and skilled nursing facility discharges were more common for patients residing in urban areas, while swing bed and routine discharges were more common in small and isolated rural areas.

Discharge destination was also associated with time to outpatient visits. Patients discharged to swing beds had much shorter times between discharge and outpatient visit. Patients discharged to routine and home health destinations had longer times. Urban patients were also more likely to have outpatient visits sooner.

Conclusions

An outpatient visit within 30 days of discharge sharply reduced the risk of PPR in patients with either diagnosis. The impact of an outpatient visit was most pronounced in patients from small rural and isolated rural areas. The discharge destination of the patient also affected PPRs. Despite relatively low patient severity and timely outpatient visits, swing bed destination was associated with higher PPR risk, especially for pneumonia patients. Given the large increase in the number of CAHs in recent years and the importance of swing beds as a post-acute care option in rural areas (especially those areas without SNFs; Race et al., 2011; Reiter & Freeman, 2011), the relationship between swing bed discharges and readmission rates warrants further investigation.

These findings emphasize the importance of receiving timely post-discharge outpatient care *and* appropriate discharge destination for reducing readmissions, especially among rural-based patients.

INTRODUCTION

Importance of Potentially Preventable Readmissions (PPRs)

Current health care reform efforts seek to decrease the costs of care and increase efficiencies (White House, 2009). Potentially preventable readmissions (PPRs) among Medicare patients are examples of such inefficiencies and are currently targeted for closer examination and scrutiny across the country (Benbassat and Taragin, 2000; Goldfield et al., 2008). Hospital readmissions may indicate one or a combination of factors: poor in-hospital care; insufficient discharge planning; uncoordinated transition care; and/or inadequate follow-up care (Marcantonio et al., 1999; McAlister et al., 2001; Hunt et al., 2002; MedPAC, 2007).

As many as three quarters of readmissions among Medicare patients may be preventable (MedPAC, 2007). A national 30-day Medicare hospital readmission rate of 17.6% was reported in 2007, using 2005 data; 76% of these readmissions were identified as potentially preventable (MedPAC, 2007). Health care spending associated with PPRs has been estimated at \$12-17.4 billion per year (MedPAC, 2007; Jencks, Williams, and Coleman, 2009).

Factors Potentially Influencing PPRs

Timely outpatient follow-up care and the destination of the discharged patient have both been suggested as possible factors that could affect potentially preventable readmissions.

Rurality of patient. Rural residents are affected by distance and limited options in health care. This may provide fewer viable discharge options (e.g., home health care services may not be available) and/or may provide difficulty obtaining timely outpatient follow-up care than their urban counterparts. Thus rural residence should be considered in relationship with outpatient visits and discharge destination when studying PPRs.

Outpatient follow-up care. Studies examining the relationship between patients' use of post-hospital outpatient care (or related care interventions) and hospital readmissions have produced mixed results. Some studies have found that patients' use of follow-up care *decreased* the likelihood of being readmitted (Jencks, Williams, and Coleman, 2009; Azevedo et al., 2002; Gwadry-Sridhar et al., 2004; Coleman et al., 2006; Muus et al., 2010), whereas others have found that it *increased* readmissions (Weinberger, Oddone, and Henderson, 1996; Oddone et al., 1999) or had no effect (Gonseth et al., 2004; Li, Morrow-Howell, and Proctor, 2004). Few studies have examined the effect of post-acute care use on readmissions for rural- versus urban-based patients. One such study found that timely use of outpatient follow-up care curtailed 30-day readmissions among rural and urban veterans with CHF (Muus et al., 2010).

Coleman et al. (2006) found that using "transition coaches" to provide chronically ill older patients and their caregivers with tools and skills that empowered them to take a more active role in their care reduced readmission rates. This approach may be especially beneficial for patients in rural communities who may experience access barriers due to greater distances to health care services and challenging terrain. However, a study by Weinberger et al. (1996) found that an

intensive primary care intervention for severely chronically ill veterans increased the rate of readmissions.

Destination after discharge. Patients may be discharged from hospitals to a variety of settings other than home. Patients discharged to home may also be enrolled in home health care, which is home-based care that is physician-ordered, part-time, and medically necessary (e.g., nursing, physical therapy, occupational therapy) (CMS, 2010a, 2010b). Other destinations that provide more care include skilled nursing facilities (SNF) and swing beds. Hospitals that use the federal swing-bed program are small, rural facilities with fewer than 100 beds. Current Medicare reimbursement policy requires that only patients who need skilled care and who have spent a minimum of three days in an acute care hospital bed may be discharged to a swing bed (MDH, 2007).

Priority diagnoses for hospitalization and PPR among Medicare patients: CHF and bacterial pneumonia

Congestive heart failure (CHF) affects an estimated five million Americans and about 550,000 people are diagnosed with CHF annually (Rosamond et al., 2007). CHF is the principal cause of death for approximately 400,000 persons annually in the U.S. (Kannel and Belanger, 1991). In 2007, there were approximately 166,000 CHF patients who sought and received care in U.S. rural hospitals (Stranges et al., 2010). 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 gender, hypertension, myocardial infarction, diabetes mellitus, valvular disease and obesity (Kenchiah, Narula, and Vasan, 2004; Schocken et al., 2008; Levy et al., 2002; Gottdiener et al., 2000; He et al., 2001; Chen et al., 1999; Levy et al., 1996; Kannel et al., 1999; Chae et al., 1999; Ho, Pinsky, Kannel, and Levy, 1993; Kenchaiah et al., 2002).

CHF is the most common diagnosis among hospitalized Medicare patients (CMS, 2008) and is associated with six-month hospital readmission rates of more than 40 percent (Krumholz et al., 1997). The Medicare Payment Advisory Commission (MedPAC) has recommended public reporting of hospital-specific readmission rates, with CHF as a priority condition (MedPAC, 2007). In response to this recommendation, the Centers for Medicare and Medicaid Services (CMS) developed a 30-day risk-standardized readmission measure for CHF, designed to measure and improve patient care quality and decrease costs (Qualitynet.org, 2008).

CHF consensus care guidelines indicate that hospital-discharged patients and their caregivers should receive comprehensive written discharge instructions for follow-up appointments, but no specific timetable for such visits is offered. Other content in these written instructions pertain to diet, discharge medications, activity level, daily weight monitoring and what to do if CHF symptoms worsen. Additionally, these guidelines indicate that post-discharge systems of care (e.g., home care), if available, should be used to facilitate the transition to outpatient care for CHF patients.

Bacterial pneumonia is inflammation and consolidation of the lung tissue due to an infectious bacterial agent. Bacterial pneumonia has a significant health and economic impact on U.S. residents (American Lung Association, 2007). In 2003, approximately 65,000 people died of pneumonia in the U.S. (Hoyert, Kung, and Smith, 2005). Pneumonia and influenza represented a cost to the U.S. economy in 2004 of \$37.5 billion (American Lung Association, 2007). In 2007, approximately 267,000 pneumonia patients sought and received care in U.S. rural hospitals (Stranges et al., 2010). Bacterial pneumonia has been identified by the Agency for Healthcare Research and Quality (AHRQ) as one of 16 ‘ambulatory care sensitive’ conditions (ACSCs) (Davies et al., 2001). ACSCs are diagnoses for which timely and effective outpatient care can help to reduce the risks of hospitalization by preventing the onset of an illness or condition, controlling an acute episodic illness or condition, and/or managing a chronic disease or condition (Parchman and Culler, 1999).

Pneumococcal pneumonia, the leading type of bacterial pneumonia, is caused by the *Streptococcus pneumoniae* bacteria. Pneumococcal disease can be prevented among adults through one-time use of a vaccine, which is recommended for most persons aged 65 years and older (National Foundation for Infectious Disease, 2006). Groups that are at high risk for contracting pneumococcal disease, and thus possess indications for receiving the vaccine, include persons aged 65 and older, persons aged 2 to 64 with chronic underlying conditions (e.g., cardiovascular disease, chronic pulmonary disease, diabetes), alcoholics, persons with sickle cell disease, and immunocompromised persons (CDC, 1997; National Coalition for Adult Immunization, 1998; Wong-Beringer, Brodetsky and Quist, 2003). Despite strong clinical evidence of the pneumococcal vaccine’s effectiveness, it is believed that no more than 50% of individuals who are in these high risk groups actually receive it (National Foundation for Infectious Disease, 2006; CDC, 1997; National Coalition for Adult Immunization, 1998; Wong-Beringer, Brodetsky, and Quist, 2003; Bower, 2000).

PURPOSE OF THIS STUDY

To help inform the policy debate on Medicare readmissions, this study estimated the effect of discharge destination and outpatient visits on PPRs by residential rurality (i.e. urban, large rural, small rural, isolated rural) for Medicare patients hospitalized in 2006-2007 with pneumonia or CHF, two health conditions that are common causes of hospitalizations and readmissions. Specifically, the study addressed these questions:

- How does pneumonia and CHF patients’ residential rurality affect the association of outpatient visits and discharge destination with PPR rates?
- How does rurality affect the association of discharge destination with time to outpatient visit for pneumonia and CHF patients?

METHODS

Our study employed the 3M Health Information Systems’ Potentially Preventable Readmissions (PPR) software model. This model identifies PPRs using state and federal hospital data sets. Based on an extensive review of the existing permutations of diagnoses for index

hospitalizations and readmissions, the 3M analytic model determines the likelihood that a given readmission diagnosis is related to the index hospitalization and thus is potentially preventable (MedPAC, 2007). (See Appendix A for additional information regarding the 3M PPR software.)

We used Medicare Provider and Analysis Review (MedPAR) data (years 2006 and 2007) to estimate PPRs at 30-day intervals, employing the 3M PPR program and SAS v9.2. MedPAR data were matched with corresponding Medicare denominator files to obtain demographic information. The Medicare beneficiaries in the study included elderly beneficiaries (age 65 and older) and disabled beneficiaries under the age of 65. The 3M program was used on this combined data set to generate files that identified PPRs for patients.

The 3M-generated PPR data were also combined with files containing information on rurality (defined by linking hospital zip codes to Rural-Urban Commuting Area codes) and on the Critical Access Hospital (CAH) status of each hospital used by patients. Dates that a hospital became or ceased to be a CAH were used to signify CAH status at date of admission for the patient. Hospitals were grouped into three cohorts: urban Prospective Payment System (PPS), rural PPS, and CAH.

We defined an initial hospital as one in which a patient had an admission for a defined disease (CHF or pneumonia) that may have led to a readmission for reasons that were clinically related to that disease. The diagnoses (based on ICD-9 codes) for these diseases were taken from Medpar records.

The observations used were patient admissions to an initial hospital that did or did not lead to a readmission within 30 days. Readmissions to a different hospital than the initial hospital (regardless of state) were included. Readmissions for reasons not related to the patients' principal diagnosis or condition during their initial admission were excluded. Patients who died were also excluded. Transfers from one hospital to another were not considered as separate visits.

To estimate PPR rates we used the number of valid visits to an initial hospital that *did* result in a 30-day readmission relative to the number of valid visits that *did not* result in a 30-day readmission. Further details on the algorithm used by the 3M program to determine PPRs can be found in Goldfield et al. (2008).

Study Population

Approximately 50% of all valid pneumonia and CHF initial admissions from this cohort were randomly selected, stratifying by rurality (urban, large rural, small rural, and isolated rural as defined by RUCA codes) within each state. For both diagnoses, approximately two-thirds of patients were urban residents and the remaining third were distributed over the three rural residential categories.

- *Pneumonia.* Of the 1,013,725 pneumonia patients chosen, 694,863 (68.55%) were from urban areas, 144,836 (14.29%) were from large rural areas, 96,150 (9.48%) were from small rural areas, and 77,876 (7.68%) were from isolated rural areas.

- *Congestive heart failure.* Of the 1,079,511 CHF patients, 787,828 (72.98%) were from urban areas, 139,225 (12.90%) were from large rural areas, 86,012 (7.97%) were from small rural areas, and 66,466 (6.16%) were from isolated rural areas.

Obtaining Outpatient Information

Patients in the study population were then matched to records in the outpatient and carrier claims files from CMS for the years 2006 and 2007. Information on if and when a patient had an outpatient visit during the 30-day period (from the day after discharge up to 30 days for those not readmitted and up to the day before readmission for those readmitted) was used. We excluded outpatient visits on the day of readmission, since those visits may have led to readmission rather than prevent readmission.

The *outpatient claims file* includes visits to hospital outpatient departments, rural health clinics, federally qualified health centers (FQHCs), private clinics, renal dialysis facilities, outpatient rehabilitation facilities, comprehensive outpatient rehabilitation facilities, and community mental health centers. The *carrier claims file* contains final action claims data submitted by non-institutional providers. This includes visits to physicians, physician assistants, clinical social workers, nurse practitioners, independent clinical laboratories, ambulance providers, and free-standing ambulatory surgical centers (ResDAC, 2010).

Analysis Variables

A health condition severity score was calculated for each Medicare patient based on information from the patient's initial hospitalization, using Elixhauser-defined comorbidities (a scale unique to each disease) (Elixhauser, Steiner, Harris, and Coffey, 1998). Other control variables used included emergency room visit (yes or no), intensive care unit visit (yes or no), length of stay (LOS), and any type of surgical procedure performed (yes or no). Demographics included gender, race (white or other), age (under 65, 65 – 74, 75 +), and rurality of initial hospital (urban, rural, or CAH).

Outpatient visits were coded as yes or no. Discharge destinations after initial hospitalization were defined as routine (sent home), home health (sent home with orders for home health care), admitted to skilled nursing facility (SNF), admitted to a swing bed, or other (e.g., left on their own, rehab, or psychiatric hospital).

Statistical Analysis

Eight stepwise logistic regressions were conducted to predict PPRs, four for patients with bacterial pneumonia and four for patients with CHF. Each set of four regressions was based on patients from urban, large rural, small rural, and isolated rural areas, respectively. Variables with insignificant odds ratios were removed from the final model. Individual associations between outpatient visits and discharge destinations for different levels of rurality were shown while controlling for severity and demographics.

A cohort of patients who had outpatient visits was selected to test the association of time to outpatient visit with discharge destination. A composite severity score including comorbidities, Emergency (ER) visits, ICU visits, and procedures was created using logistic regression. ER visits, ICU visits, and procedures were associated with comorbidities and included in the severity composite score. An analysis of covariance (ANCOVA) was conducted to estimate differences in mean number of days from discharge to outpatient visit among patients of different discharge locations and rurality while adjusting for severity. Multiple comparisons between adjusted means were made with Scheffe’s test.

RESULTS

This section presents the major findings from our statistical analyses. We first study the association of outpatient visits and discharge destination on PPR. Second, we study the effect of discharge destination on time to outpatient visits.

Outpatient Visits and Discharge Destination Affect PPR

Table 1 shows the logistic regression results of outpatient visits and discharge destination on PPR while controlling for demographics and severity for 1,013,725 pneumonia and 1,079,511 CHF patients of all residential rurality groupings.

In the logistic models used to create the odds ratios displayed in Table 1, we used as reference values no outpatient visit, a routine discharge or ‘sent home without special care’, urban hospital, female, age 64 - 74, non-white race, no ER visit, no ICU visit, and no procedure done. In Table 1, the odds ratios reflect the odds relative to a routine (home) discharge.

Table 1. Significant odds ratios (all p < .01) from logistic regressions of outpatient and destination predicting PPR in bacterial pneumonia and CHF patients by residential rurality

Variable	Bacterial Pneumonia				CHF			
	Urban OR	Large Rural OR	Small Rural OR	Isolated Rural OR	Urban OR	Large Rural OR	Small Rural OR	Isolated Rural OR
Outpatient Visit								
Yes	0.729	0.712	0.699	0.700	0.734	0.718	0.715	0.691
Destination								
Home Health	1.413	1.490	1.451	1.432	1.285	1.308	1.331	1.336
Skilled Nursing (SNF)	1.605	1.430	1.306	1.286	1.373	1.191	1.138	1.128
Swing Bed	1.532	1.571	1.469	1.289	1.134	1.275	1.160	1.111
Other	.961	1.142	1.169	1.157	.787	.819	.882	.866
Demographics								
Rural Hospital	1.090	1.003	1.118	1.117	1.073		1.189	1.173
Critical Access (CAH)	1.170	1.131	1.124	1.146	1.250		1.187	1.221
Male	1.056	1.085	1.087	1.059	0.984			
< 65 Age	1.129		1.060	1.093	1.117	1.142	1.106	
75 + Age	1.070		1.083	1.117	1.042	1.049	1.063	
White	1.118				1.129	1.074		1.110

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Variable	Bacterial Pneumonia				CHF			
	Urban OR	Large Rural OR	Small Rural OR	Isolated Rural OR	Urban OR	Large Rural OR	Small Rural OR	Isolated Rural OR
Severity								
Severity Composite	1.133	1.144	1.125	1.137	1.136	1.122	1.119	1.130
Length of Stay	1.274	1.267	1.278	1.201	1.257	1.260	1.225	1.260
ER Visit	1.077	1.065			1.128	1.084	1.067	
ICU Visit	1.102	1.140	1.132	1.156	1.031			
Procedure	1.199	1.140	1.147	1.118	1.056			

Frequency of outpatient care. Forty-two percent (42%) of all pneumonia patients, regardless of rurality, received outpatient care within 30 days. The rate was similar for CHF patients; 43% received outpatient care within 30 days, again regardless of rurality.

Impact of outpatient follow-up care. Patients who had an outpatient visit within 30 days of discharge decreased their risk of PPR by 27 to 31%. This strong association was seen in both diagnoses and in urban and rural patients. Urban patients with either disease had a decreased PPR risk of approximately 27% (0.729 odds ratio for pneumonia patients and 0.734 odds ratio for urban CHF patients).

Rurality. Outpatient visits by patients living in highly rural areas were associated with the biggest reduction in risk of PPR. Small and isolated rural pneumonia patients with outpatient visits had decreased PPR rates of 30%. In CHF patients, the decreased PPR rate ranged from 28% for residents of large rural areas to 31% for residents of isolated rural areas.

Impact of discharge destination. Figures 1 and 2 show how patients from different geographic locations were being discharged, regardless of PPR. Discharge destinations were similar for both diseases. Urban patients had the smallest percentage of routine discharges (52% pneumonia, 56% CHF) and the largest percentage of SNF (24% pneumonia, 17% CHF) and HH (16% pneumonia, 21% CHF) discharges compared to rural patients. Small and isolated rural patients were discharged more often to swing beds (7-8% pneumonia, 4-5% CHF). SNFs were the most likely non-routine discharge location for pneumonia patients (16 to 24%) while home health was the most common for CHF patients (16 to 21%).

The patient's discharge destination was also strongly associated with PPR. Relative to a routine discharge (sent home with no special care), patients discharged to home health, skilled nursing facilities and swing bed all had increased risk of PPR in amounts that varied from 10 to 60%, depending on destination, residence and disease.

Figure 1. Discharge destination by residential rurality for all pneumonia patients

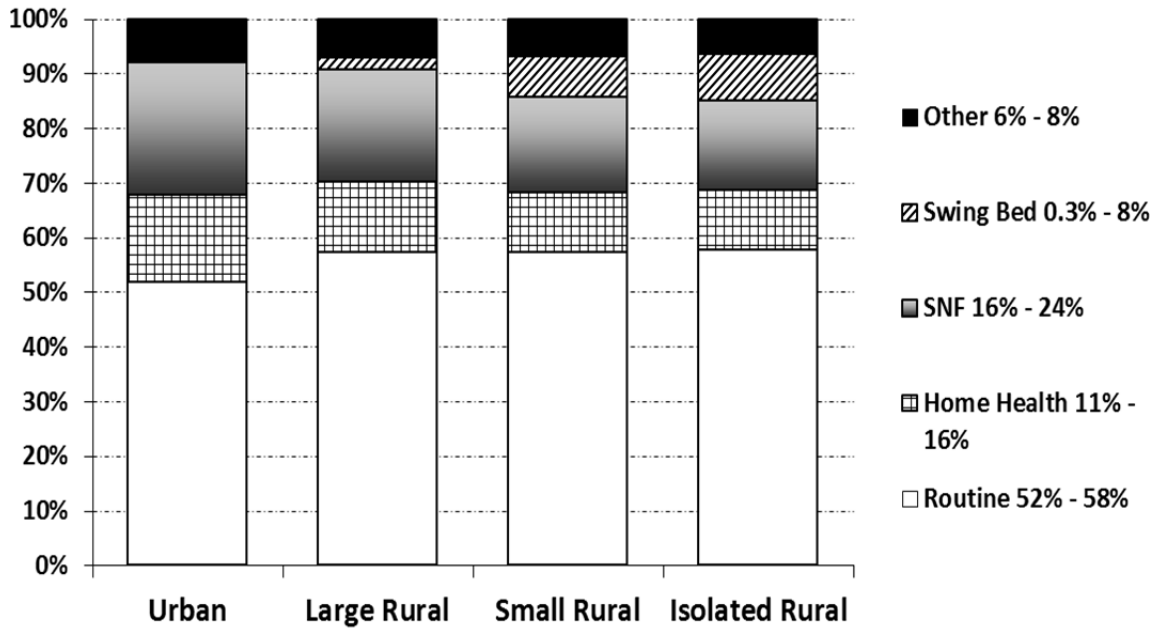
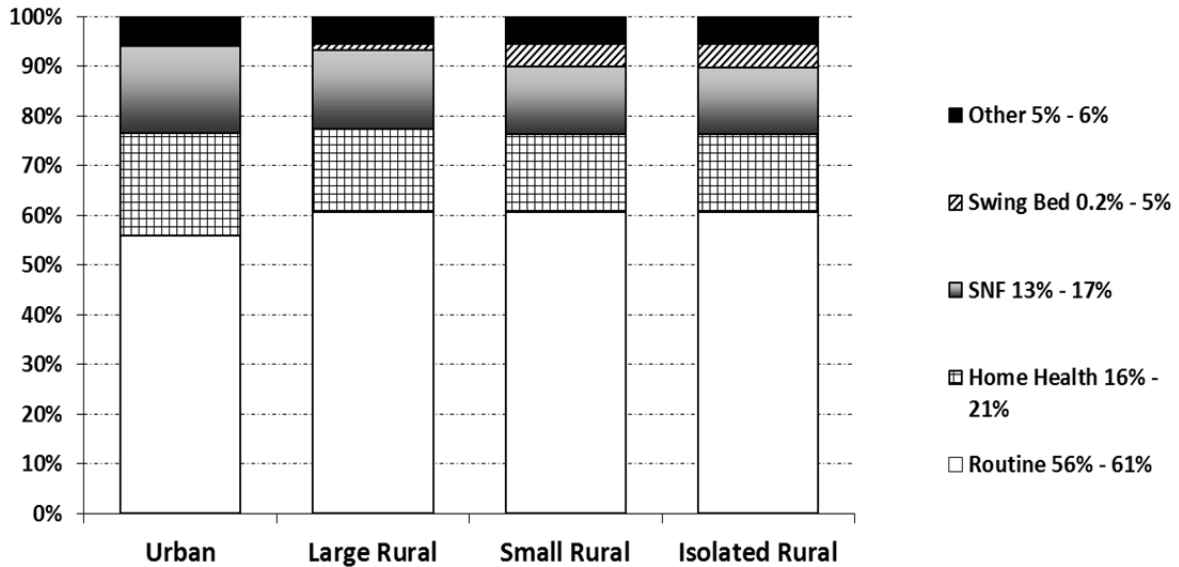


Figure 2. Discharge destination by residential rurality for all CHF patients



Figures 3 and 4 represent the percent of pneumonia and CHF patients who had a PPR for each discharge location by rurality when adjusted for severity using the logistic regression results. When adjusted for severity, the results show that:

- *Destination matters.* Patients discharged to ‘routine’ and ‘other’ locations had the lowest PPR rates in both diseases and across all urban and rural locations. SNF, home health and swing bed destinations are all associated with relatively high PPR rates, even when adjusting for severity.
- *Disease matters.* Adjusted PPR rates for CHF patients were higher overall (range: 14% - 23%) and also varied most dramatically by destination and rurality. Pneumonia PPR rates varied from 11% to 17%.
- *Rurality matters.* For urban patients, those discharged to SNFs had the highest PPR rates in both diseases. Among rural patients, the interaction of destination and disease is more complex. For example, discharges to home health care have the highest PPR rates for all rural CHF patients. For rural pneumonia patients, swing bed and home health destinations have the highest PPR rates, while swing bed rates and SNF rates are equal among isolated rural pneumonia patients.

Figure 3. Prevalence of pneumonia PPR in discharge destination groups by rurality, adjusted for demographics and severity

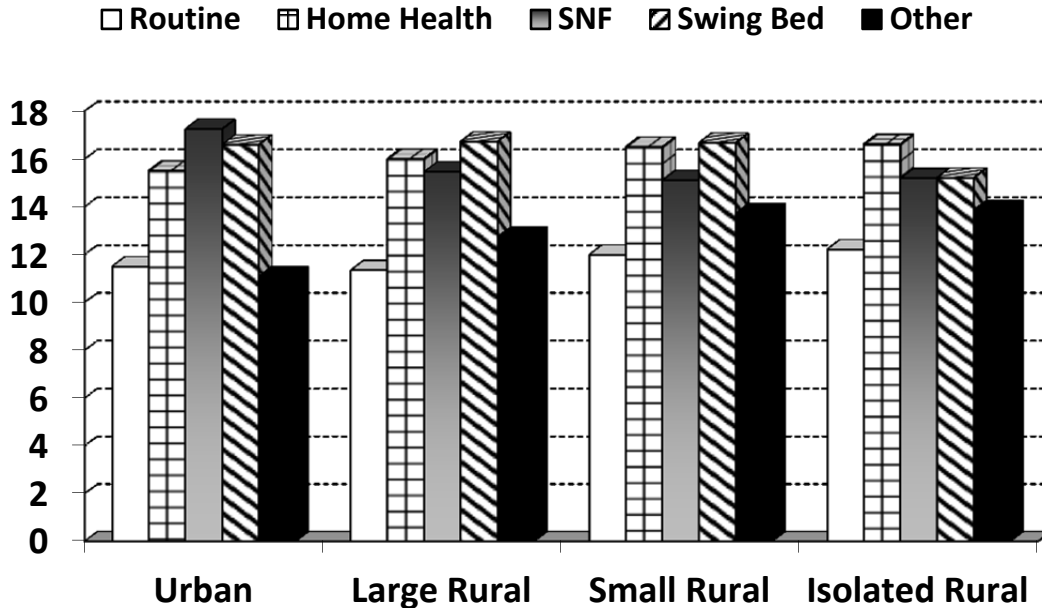
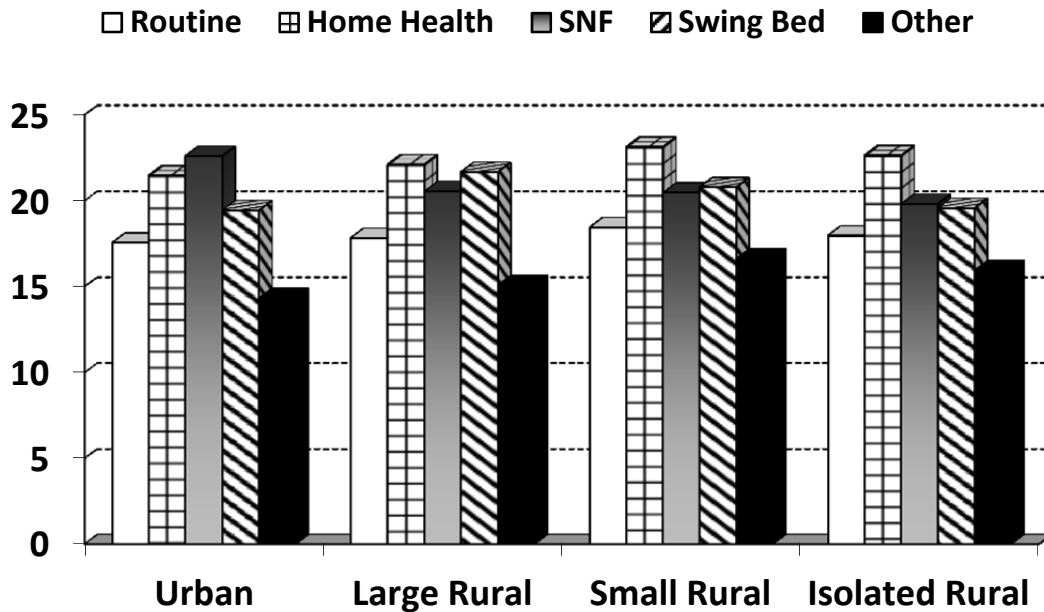


Figure 4. Prevalence of CHF PPR in discharge destination groups by rurality, adjusted for demographics and severity



Routine and other discharge destinations consistently had the lowest PPRs for pneumonia (routine: 11% to 12%; other: 11% to 14%) and CHF (routine: 17% to 18%; other: 14% to 17%) compared to home health (pneumonia: 16% to 17%; CHF 21% to 23%), SNF (pneumonia: 15% to 17%; CHF 20% to 23%), and swing bed (pneumonia: 15% to 17%; CHF 19% to 22%) (Figures 3 and 4, respectively). There appeared to be a consistent increase in PPR for patients with pneumonia or CHF who had a routine (+1%), home health (+1%), or other (+3%) discharge as rurality increases. PPRs for patients discharged to SNFs appeared to decrease as the rurality increased for both pneumonia (- 2%) and CHF (-3%) patients.

Figures 3 and 4 show a slight increase in PPR for patients with pneumonia or CHF who had a routine, home health, or other discharge as rurality increases. PPRs for patients discharged to SNFs appeared to *decrease* as rurality increased for both pneumonia and CHF patients.

The Effect of Discharge Destination on Time to Outpatient Visit

Since outpatient visits were strongly associated with a reduction in risk of PPR, we examined whether destination/rurality combinations affected the timeliness of outpatient visits. For this we identified patients who had an outpatient visit in the 30-day period following hospital discharge.

A composite severity score created from the comorbidity severity score, LOS, ER visits, ICU visits, and procedures was used as a control measure for the model. Urban residents had the highest severity score, followed by large rural, with small and isolated rural the lowest severity. Severity according to discharge location was, from highest to lowest, SNF, other, home health, routine, and swing bed. The severity score was linearly related to time of outpatient visit but did

not differ in its relationship with time to outpatient visit for different discharge locations (i.e. no interaction was found) and was used as a covariate in the model to reduce error variance.

Using an ANCOVA model, adjusted average days until visit were significantly different between urban patients and patients in any of the three rural groups (pneumonia: urban = 5.3 days, rural = 6.0 days, $p < .001$; CHF: urban = 4.9, rural = 5.6, $p < .001$). Urban patients had outpatient visits sooner than rural patients when adjusted for severity (Figure 5). The adjusted days until visit for the five discharge destination were all significantly different from each other (Figure 6). Patients discharged to swing beds had outpatient visits sooner than all others. Patients with routine and home health discharges had the longest discharge-to-outpatient visit time intervals (pneumonia: routine = 7.5, home health = 6.9, SNF = 6.0, swing bed = 6.2, other = 5.5, $p < .001$; CHF: routine = 6.8, home health = 6.1, SNF = 5.5, swing bed = 3.5, other = 4.9, $p < .001$).

Figure 5. Days to outpatient visit for patients with pneumonia and CHF by residential rurality

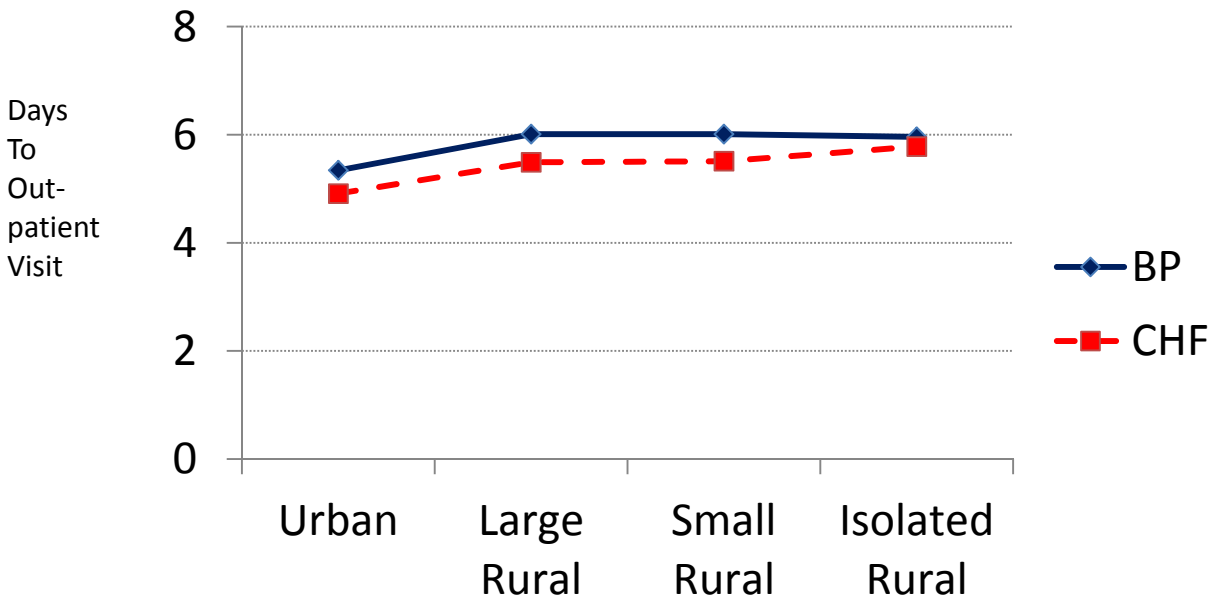


Figure 6. Days to outpatient visit for patients with pneumonia and CHF by discharge destination

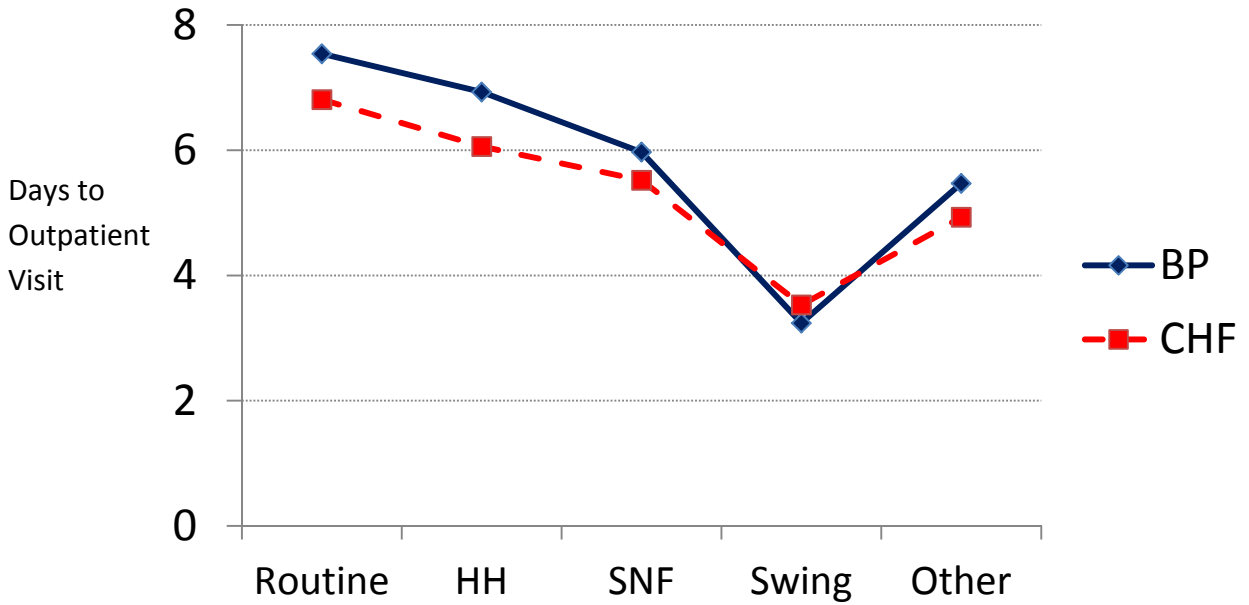
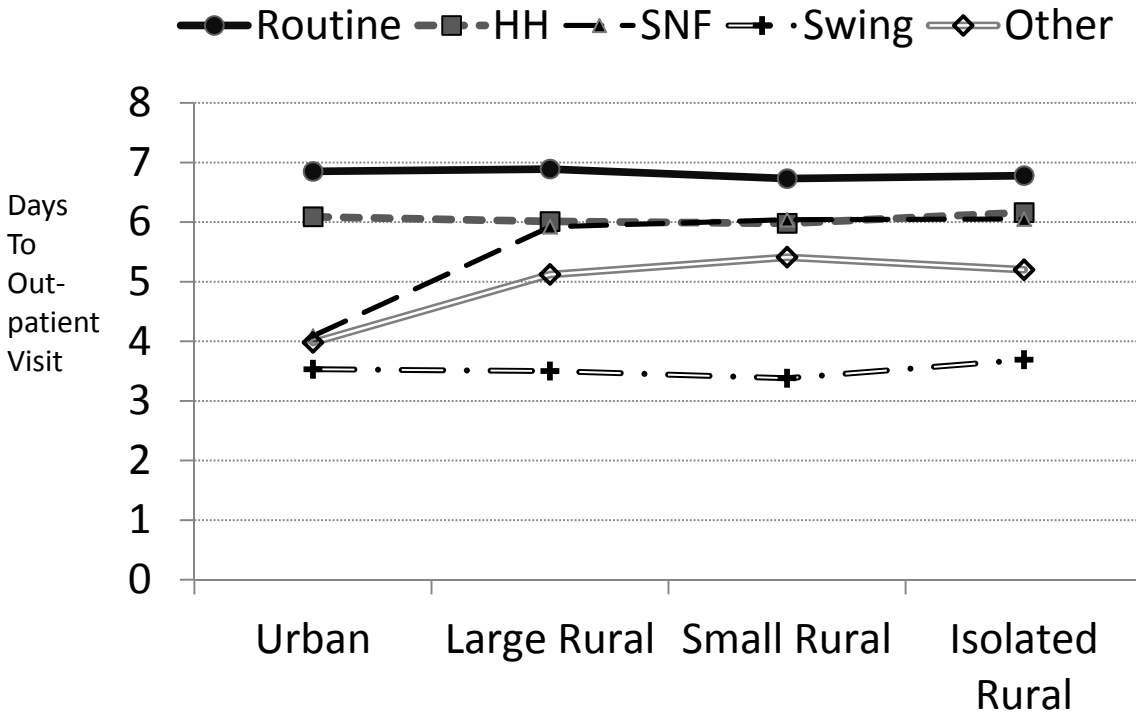
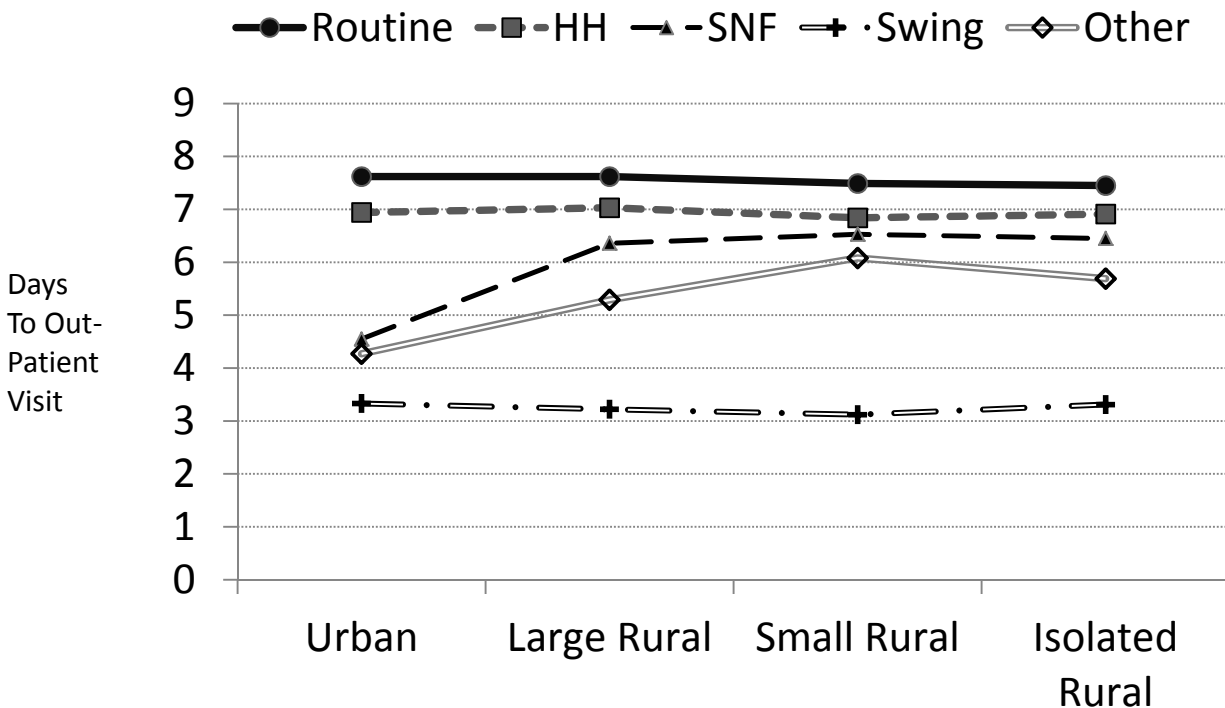


Figure 7. Days to outpatient visit for pneumonia patients by residential rurality and discharge destination



Figures 7 and 8 show the adjusted days until outpatient visit for the five discharge destinations by rurality. Routine (pneumonia: 6.8 days; CHF 7.5 days), home health (pneumonia: 6.0 days; CHF 6.9 days), and swing bed (pneumonia: 3.5 days; CHF 3.2 days) discharges had very little variation according to rurality. Routine and home health discharges had the longest amount of time between discharge and outpatient visit, and swing bed discharges the shortest. Both SNF and other discharges had significantly ($p < .001$) shorter time intervals for urban patients (pneumonia: 4.6 and 4.3; CHF: 4.1 and 4.0) and longer time intervals for rural patients (pneumonia: 6.5 and 6.0; CHF: 6.0 and 5.4).

Figure 8. Days to outpatient visit for CHF patients by residential rurality and discharge destination



CONCLUSIONS

This study addresses the following questions: 1) How do pneumonia and CHF patients’ destination after discharge and time to outpatient visit affect PPRs by residential rurality, while controlling for demographics and severity? 2) How does pneumonia and CHF patients’ destination after discharge affect time to outpatient visit by residential rurality, while controlling for severity?

Outpatient visits reduce PPRs

Our results confirm that an outpatient visit within 30 days of discharge can dramatically reduce the risk of a potentially preventable readmission for Medicare patients with bacterial pneumonia or congestive heart failure. An outpatient visit was associated with a 27% to 31% reduction in PPR risk.

The effect is strongest for the most rural patients

Our finding of a protective effect of post-discharge care on readmissions is consistent with several studies involving mostly non-rural patients and/or settings (Azevedo et al., 2002; Gwadry-Sridhar et al., 2004; Coleman et al., 2006; Phillips et al., 2004; McAlister, Lawson, Teo, and Armstrong, 2001). Timely post-discharge follow-up care may promote positive health outcomes, including a reduced likelihood of readmission, among patients by allowing health care providers to address any emerging health exacerbations, promote compliance with home care instructions and adjust (as needed) medication regimen/dosages.

A novel finding of our study was patients with either disease under study who resided in the most remote areas had the greatest PPR reductions via outpatient follow-up. This may be due in part to the relatively high baseline PPR rates among this patient cohort which yielded the greatest opportunity for rate improvements (i.e., reductions). Nonetheless, this finding stresses the critical importance of timely receipt of post-discharge follow-up care for rural patients with CHF or pneumonia.

Discharge destination affects PPR rates and timeliness of outpatient visits

Severity-adjusted PPR rates varied by disease, destination, and rurality. When adjusting for severity, discharge destination did affect time to outpatient visit for patients of different rurality groupings. Patients discharged to swing beds had relatively low severity scores but moderately high PPR rates, especially for pneumonia. As many rural patients are discharged to swing beds, this is an area of concern.

Swing beds

The current Medicare policy for swing beds is that an inpatient can be discharged to a swing bed after three days if the patient no longer needs acute care but still needs skilled care. The number of swing beds has increased in recent years due in part to the large influx of CAH designations (Race et al., 2011; Reiter & Freeman, 2011). A re-examination of the policy regarding the number of acute care days necessary for rural patients prior to discharge to a swing bed might be needed, given the high prevalence of readmissions from swing beds. Examination of the reimbursement incentives (or disincentives) for rural patients who are admitted to an acute bed and discharged to a swing bed may also be useful.

Home health

Patients discharged to home health were more likely to reside in urban or large rural areas, and had moderately high PPR rates, even after adjusting for their higher condition severity. But like routine discharges, home health discharges were linked to longer discharge-to-outpatient visit time intervals which were linked to lower PPR rates. These latter findings appear to be independent of the patients' residential rurality. Thus, home health as a discharge destination appeared to be a relevant factor in reducing PPR risk through their association with time to outpatient visit.

The home health and PPR linkage must be interpreted with caution because orders for home health care did not mean the patient actually received home health care services. Though 14 to 19% of all patients were discharged to home health care, only about 30% of those patients received home health care assistance during the 30-day period following discharge. Some of these patients may have had outpatient visits instead of home health visits, as 13 to 17% of patients discharged to home health care who have no home health visit did have an outpatient visit (higher percents for rural patients). Some may also choose not to use home health, either due to personal choice or difficulty in scheduling home health visits due to distance or availability issues. Further study should address why rural patients are not receiving the home health care they were assigned. Access to home health services may need to be improved so patients can reduce their risk of PPR.

Skilled Nursing Facilities

Urban patients who were discharged to SNFs received outpatient follow-up care about two days earlier than rural patients who were discharged to SNFs (approximately 4 days post discharge to outpatient visit versus 6 days). This difference in time to follow-up care might reflect the shortage of health care providers, especially primary care physicians, for SNF patients in rural areas (Rosenblatt & Hart, 2000; Colwill & Cultice, 2003). Distance can play an obvious role in obtaining timely outpatient follow-up care for rural patients discharged to their homes (Philbin et al., 2001), but it may also play a role in delaying care for SNF patients (Coburn & Bolda, 2001; Coburn, 2002), depending on physician travel time to a rural SNF.

Urban patients discharged to SNFs had higher PPR rates than their rural counterparts. This was true of both diagnoses and across all categories of rurality. Further research needs to be conducted to determine if the effect is due to physicians using SNFs differently in urban areas than in rural areas, or if SNFs in urban areas provide different treatment to patients than those in rural areas.

Summary and Directions for Future Research

Collectively, our findings emphasize the importance of both timely (within 30 days) post-discharge outpatient care *and* an appropriate discharge destination to reduce preventable readmissions, especially but not exclusively among rural residents. The study focused on Medicare patients with a diagnosis of either bacterial pneumonia or congestive heart failure; however, the results may likely be applicable to other diagnoses and to a broader patient population. Given that fewer than half of the patients in the study had evidence of any kind of outpatient follow-up within 30 days, policy action to encourage appropriate post-discharge follow-up care could have a major impact in improved patient health and reduced PPRs. Any such action should ensure that rural residents have accessible options for follow-up care.

Limitations

This study is based on administrative data and on a limited number of diseases. Though the PPR software controls for patients who have died, this information was limited to only deaths that

were recorded in the Medicare data. It was not possible to link all the data with death certificates to identify patients that died outside of the hospital. This may have deflated PPR rates in areas with poorer health care as these patients would have been considered non-readmissions.

The broad definition of “outpatient visit” used for this study was intended to capture chargeable interactions with health care providers after a hospital stay. Outpatient visits included visits to a variety of practitioners and providers. Thus, it is not possible to conclude that the post-hospital outpatient visit was always related to the initial hospitalization. However, since overall visits were strongly related to preventing unnecessary readmissions, it seems reasonable to conclude that a sizeable proportion of the visits assisted the patient in ways that helped preclude a PPR.

Additional research is needed to determine if alternatives to outpatient care such as telehealth interventions (e.g., telephone contacts with providers to monitor patients’ blood pressure and weight) decrease PPR rates, particularly for rural patients. Additional research could develop an evidence base to identify which types of outpatient interventions are most effective in decreasing PPRs.

The effect of swing bed use on PPRs should be investigated in more detail as well as the relationship between health care provider (especially primary care) supply and PPRs. Our study showed the importance of outpatient visits for urban and especially rural patients in reducing PPR risk. Discharge location had an important effect on PPR and outpatient use.

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Appendix A: 3M Potentially Preventable Readmission (PPR) software

The 3M Potentially Preventable Readmission (PPR) software offers specific advantages for estimating readmissions. First, it identifies clinically related readmissions using diagnoses and procedures performed to assign an APR-DRG for the admission. If the APR-DRG of an admission does not match that of the previous admission, it is not considered a clinically related readmission. This excludes admissions where a person may have first been hospitalized for a disease such as diabetes, but then was hospitalized for a car accident. They may still have diabetes as a secondary diagnosis, but the program identifies that diabetes is not the reason for admission and a different APR-DRG is assigned. The software can also identify if the admission is due to an underlying disease even if another diagnosis or procedure is listed. Second, the PPR software identifies chains or a series of readmissions. If a patient is repeatedly readmitted to a hospital within a given time period, that is considered one event or a chain of admissions. For example, if a person is readmitted 10 days following an initial admission, then again 14 days later, then 19 days later, then 32 days later, these form a chain of three admissions with one initial admission with a 30 day PPR, two readmissions in the chain, and one lone admission. This avoids counting an extra readmission when it was still related to just one initial admission. If this were for a 60 day PPR, there would be one chain with four admissions. The third way the PPR software controls for readmissions is to exclude types of admissions that are not true readmissions. These include admissions for trauma, cancer, burns, obstetrics, where the person had left against medical advice, or admissions to non-acute care facilities. If the patient is transferred or dies, the admission is also excluded. This avoids counting preventable type admissions, such as accidents, or counting admissions twice, such as when a transfer occurs (only the receiving hospital is counted), or counting admissions where it is impossible for the person to be readmitted, such as when they died at initial admission.

The 3M PPR program is also versatile for the user. The number of days to readmission is selected by the programmer. The user can also specify types of hospitals to be excluded. Data files into the program and output files are easily formatted and useable. The 3M program also provides information about the admission in the output, including the type of admission, the placement in the readmission chain, and the number of chains per patient.