Role of Post-Acute Care in Readmissions for Preexisting Healthcare-Associated Infections

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OBJECTIVES: Although preventable, healthcare-associated infections (HAIs) are commonly observed in post-acute care settings for at-risk older adults and are a leading cause of hospital readmissions. However, whether HAIs resulting in avoidable readmissions for preexisting HAIs (the same HAI as at the index admission) are more common for patients discharged to post-acute care as opposed to home is unknown. We examined the risk of preexisting HAI readmissions according to patient discharge disposition and comorbidity level.

DESIGN: We used 2013-2014 national hospital discharge data to estimate the likelihood of readmissions for preexisting HAIs according to patients' discharge disposition and whether the likelihood varies according to patient comorbidity level, across four common types of HAIs (not including respiratory infections).

PARTICIPANTS: A total of 702 304 hospital discharges for Medicare beneficiaries 65 years or older.

MEASUREMENTS: Our outcome was a 30-day preexisting, or "linked," HAI readmission (readmission involving the same HAI diagnosis as at the index admission). Patient discharge disposition was skilled nursing facility (SNF), home health care, and home care without home health care ("home").

RESULTS: Of 702 304 index admissions involving HAI treatment, 353 073 (50%) were discharged to a SNF, 179 490 (26%) to home health care, and 169 872 (24%) to home. Overall, 17 523 (2.5%) of preexisting HAIs resulted in linked HAI readmissions, which were more common for *Clostridioides difficile* infections (4.0%) and urinary tract infections (2.4%) than surgical site infections (1.1%; $P < .001$). Being discharged to a SNF compared to home or to home health care was associated with a 1.15 percentage point (95% confidence interval = −1.29 to −1.00), or 38%, lower risk of a linked HAI readmission. This risk difference was observed to increase with greater patient comorbidity.

CONCLUSIONS: SNF discharges were associated with fewer avoidable readmissions for preexisting HAIs compared with home discharges. Further research to identify modifiable mechanisms that improve posthospital infection care at home is needed. **J Am Geriatr Soc 68:370-378, 2020.**

Key words: infections; readmissions; post-acute care; skilled nursing; comorbidity

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Healthcare-associated infections (HAIs) are preventable yet dangerous conditions with dire consequences including death.[1,2] Septicemia, which can result from untreated HAIs, ranks first among all readmission diagnoses,[3] and pneumonia and other infections (eg, postoperative and urinary tract) are also commonly observed reasons for readmission.[3,4] Skilled nursing facilities (SNFs) and home health care (HHC) are characterized as contributors to the "revolving door" of rehospitalization often due to infections and other preventable conditions.[5-8]

However, the role of post-acute care in preventing readmissions from *preexisting* infections (ie, diagnosed and treated at the index hospitalization), particularly for at-risk older patients, is unknown. SNFs may be more protective against readmissions from these infections due to the supervisory care of physicians and nurses who are trained in the basics

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of infection prevention and can recognize warning signs and symptoms of infection; conversely, infection programs in HHC agencies are less common,[9,10] and patients discharged home without HHC are more likely to encounter self-care challenges due to a lack of knowledge and limited, if any, supervision for prevention practices.[11,12] However, patients discharged to SNFs are likely to have greater rehabilitative needs and multimorbidity, exacerbating readmission risk.[13]

Previous work established that the risk of any type of readmission increases for patients discharged from the hospital with HAIs[14-16] and that new infections are routinely acquired in SNF and HHC settings.[6,17] More generally, it was reported that having the same diagnosis during both the admission and readmission (a "linked" readmission) is evidence for preventability of the readmission,[18] an observation that has resulted in targeting specific patient populations (such as heart failure patients) with follow-up clinical care.[19] In this study, we examined 30-day readmissions for preexisting HAIs that were also diagnosed during the index admission ("linked HAIs") to identify potentially remediable failures to provide high-quality postacute care for high-risk patients. Specifically, we assessed the risk of a linked HAI readmission for older patients discharged home vs to a SNF or to HHC. In addition, we assessed whether patient comorbidity modified the relationship between discharge disposition and linked HAI readmissions. We hypothesized that, after controlling for patient risk differences, SNFs, compared with HHC and home discharges, would be associated with reduced linked HAI readmission risk. Findings will provide insight into the adequacy of hospital discharges, patient disposition choice, and follow-up care for patients leaving the hospital with an existing HAI.

METHODS

Data Sources and Study Population

Data were obtained from the Nationwide Readmissions Database (NRD) of the Agency for Healthcare Research and Quality's Hospital Cost and Utilization Project. The NRD contains a sample of hospital discharges representing roughly half of US hospitalizations.[20] The data include primary and secondary *International Classification of Diseases*, *Ninth Revision* (ICD-9) diagnosis codes, ICD-9 procedure codes, the time between patient hospitalizations, length of stay, patient demographics, insurance type, and discharge disposition. We used data from January to November from each of the 2013 and 2014 NRDs. December data were not used because the data are not linkable across years, and at least 30 days of follow-up after the index discharge are required for observing readmissions.

Study Population

Following the criteria of the Centers for Medicare & Medicaid Services (CMS) for its all-cause hospital-wide readmission (HWR) measure,[21] we created an eligible index cohort of older Medicare beneficiaries discharged alive. We excluded observations for patients discharged against medical advice (which does not allow for a complete course of care), psychiatric and rehabilitation diagnoses (which often lead to specialty care rather than acute care hospital admissions), and cancer diagnoses (which have different readmission profiles than other diagnoses).[21] Supplementary Table S1 describes the sample derivation. Further details of the HWR cohort criteria can be found elsewhere.[4]

Because we were interested in observing linked HAIs, we narrowed the cohort to only those discharges that involved any of four common infection diagnoses that are included in Medicare's pay-for-performance program (the Hospital-Acquired Condition Reduction Program [HACRP])[22] that links payments to inpatient care quality—specifically, with penalties for hospital-acquired conditions: surgical site infections (SSIs), *Clostridioides difficile* (*C. diff.*), urinary tract infections (UTIs), and central line–associated bloodstream infections (CLABSIs). These infections are the highest cost or highest volume among all HAIs and considered preventable.[23] UTIs, SSIs, and *C. diff.* are each high-volume conditions; CLABSIs and SSIs are high-cost conditions.[24] This approach can highlight a potential gap in postdischarge quality of care for common and costly conditions targeted under Medicare's contested HACRP,[24] potentially identifying additional issues with how the program targets hospital-acquired conditions: specifically, effects that may result from HAIs if not properly treated.

HAI Identification at Index Hospitalization and Readmission

We used existing methodologies to identify HAIs (Table 1),[25-28] both at the index admission and the readmission. For the index admission, we first identified *any* infection diagnosis at the index admission (regardless of whether it was community acquired or hospital acquired). To do so, we used both primary and secondary diagnosis codes. However, at the readmission, we only wished to identify preexisting HAIs, that is, the same type of HAI as diagnosed at the index admission. Although the NRD allows for the identification of infections, the data do not explicitly identify whether infections were acquired in the hospital or the community because there is no present-on-admission (POA) indicator. To address this issue, we used existing methods[29,30] for identifying infections that were already present at the readmission. Specifically, we only used primary diagnoses of

Table 1. ICD-9 Diagnosis Codes to Identify Infections, 2013-2014 HCUP Data

Infection	Diagnosis codes and other identifiers
SSI	998.5, 998.51, 998.59, 996.69, 567.2, 567.21, 567.22, 567.23, 567.29, 567.9, 567.3, 567.31, 567.38, and 567.39 among surgical discharges
C. diff.	8.45
UTI	996.64, or a combination of one of 112.2, 590.1, 590.11, 590.2, 590.3, 590.80, 590.81, 595.0, 597.0, and 599.0 along with a procedure code for a catheterization (57.94, 57.95)
CLABSI	999.32 and a hospital length of stay >2 days

Abbreviations: *C. diff.*, *Clostridioides difficile*; CLABSI, central line–associated bloodstream infection; HCUP, Healthcare Cost and Utilization Project; ICD, *International Classification of Diseases*, *Ninth Revision*; SSI, surgical site infection; UTI, urinary tract infection.

Note: For infection identification at the index hospitalization, both primary and secondary diagnosis codes were used. For linked HAI readmissions, to identify infections that were present on readmission, only primary diagnosis codes were used.

infection that are more likely to indicate an existing infection as opposed to one acquired in the hospital.[29,31] We assessed the accuracy of this approach using a separate data set that did contain POA indicators: the 2008-2014 Health and Retirement Study (HRS) and linked Medicare data (Supplementary Table S2). This showed that many, but not all, POA HAIs were identified using only primary diagnoses, whereas the use of *both* primary *and* secondary diagnoses would result in a number of false positives.

Statistical Analysis

To assess the prevalence of infections at index discharge with readmissions for the same infection (linked HAI readmissions), we divided the number of linked HAI readmissions by the number of index admissions for the same HAI, for each of the four HAIs. To assess the role of discharge disposition in linked HAI readmissions, we first compared characteristics of discharges for patients discharged routinely to (1) home without home health care (HHC) (hereafter referred to as "home"), (2) home with HHC, and (3) a SNF or intermediate care facility (hereafter referred to as SNFs). Survey weights were used to produce national estimates of descriptive characteristics. We used χ^2 tests to compare proportions and F-tests to compare means, with a two-tailed $P < .05$ considered statistically significant. We then estimated a logistic regression model with cluster-robust standard errors (to account for clustering of patients within hospitals), controlling for patient demographics, a weighted comorbidity score, clinical cohort, length of stay at the index admission, and a dummy variable indicating the year of the discharge.

Because comparisons of odds ratios across multiple logistic regression models are inappropriate, we report predicted probabilities and risk differences with bootstrapped 95% bias-corrected confidence intervals (CIs) (obtained using a bootstrapping procedure with 1000 replications). Patient demographics included age, sex, and the quartile of the median household income in the patient's ZIP Code. Patient clinical status was measured using the Elixhauser comorbidity index.[32] To control for the type of clinical care at the index admission, we classified treatments during index hospitalizations into five cohorts: medicine, cardiorespiratory, cardiovascular, neurology, and surgery.[21]

Finally, we included an interaction term in a second regression model to allow the association between discharge disposition and linked HAI readmission to vary according to patient comorbidity level. Results of the interaction analysis are displayed graphically. We also conducted a sensitivity analysis examining whether the patient's severity of illness (the four-level All Patient Refined Diagnosis Related Group (APR-DRG) score, measured during the index hospitalization) modified the relationship between discharge disposition and readmission risk. This study was approved by the institutional review board at the University of Michigan.

RESULTS

As shown in Table 2, we identified 318 134 eligible index admissions involving HAI treatment that, using survey weights, generalized to 702 304 national HAI admissions during 2013-2014. Reporting survey-weighted results, of those 702 304 HAI admissions, 169 872 (24.2%) had home discharges, 353 073 (50.3%) had discharges to a SNF, and 179 490 (25.6%) had discharges to HHC. When compared with SNF discharges, patients discharged home were younger (75.9 vs 79.6 y; $P < .001$) and less often female (53.3% vs 55.9%; $P < .001$).

Table 2. Sociodemographic and Clinical Characteristics of Older (≥65 Years) Medicare Beneficiaries Overall and by Discharge Disposition for US Hospital Discharges, 2013-2014

			Discharge disposition		
	Overall N = 702 434	SNF N = 353 073	Home health N = 179 490	Routine N = 169 872	*P* Value
Mean age (SE)	78.2 (.1)	79.6 (.1)	77.6 (.1)	75.9 (.1)	
Female, No. (%)	383 678 (54.6)	197 462 (55.9)	95 716 (53.3)	90 500 (53.28)	
Median household income, No. (%)					<.001
1st quartile (lowest)	176 019 (25.4)	88 426 (25.4)	45 609 (25.7)	41 985 (25.1)	<.001
2nd quartile	188 811 (27.3)	95 623 (27.5)	46 315 (26.1)	46 873 (28.0)	
3rd quartile	167 105 (24.1)	83 837 (24.1)	42 036 (23.7)	41 233 (24.6)	<.001
4th quartile (highest)	160 884 (23.2)	80 287 (23.1)	43 355 (24.5)	37 242 (22.3)	
Mean length of stay (SE)	9.65 (.1)	11.44 (.1)	9.31 (.1)	6.31 (.0)	
Cohort, No. (%)					
Surgery	173 816 (24.7)	91 266 (25.9)	48 639 (27.1)	33 911 (20.0)	<.001
Cardiorespiratory	50 251 (7.2)	26 856 (7.6)	12 998 (7.2)	10 398 (6.1)	
Cardiovascular	17 323 (2.5)	8476 (2.4)	4276 (2.4)	4570 (2.7)	<.001
Neurology	14 882 (2.1)	10 152 (2.9)	2878 (1.6)	1852 (1.1)	
Medicine	446,162 (63.5)	216,323 (61.3)	110,699 (61.7)	119,140 (70.1)	
Mean comorbidity score (SE)	25.59 (.1)	27.75 (.1)	25.27 (.2)	21.44 (.1)	
Year, No. (%)					
2013	353 715 (50.4)	178 234 (50.5)	91 210 (50.8)	84 271 (49.6)	<.001
2014	348 719 (49.6)	174 838 (49.5)	88 280 (49.2)	85 601 (50.4)	

Abbreviations: SE, standard of error; SNF, skilled nursing facility.

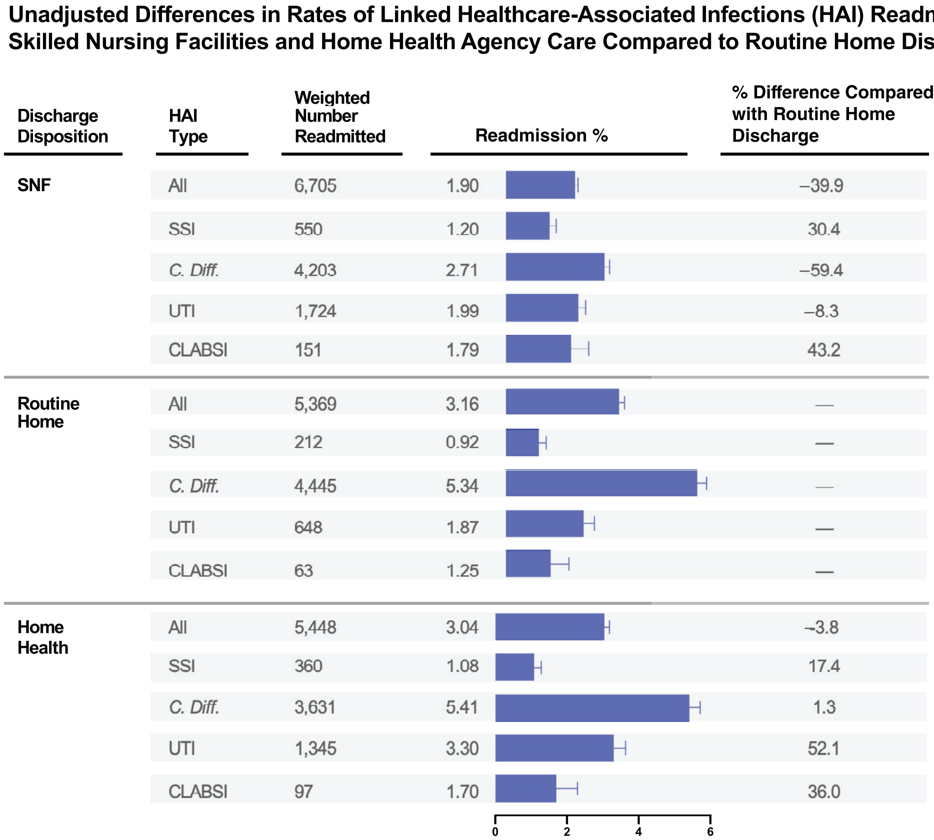

Figure 1. Survey weights were used to estimate the number of individuals readmitted and the percentage readmitted with a linked healthcare-associated infection (HAI). A linked HAI readmission is an unplanned readmission for the same HAI observed at the index admission. For instance, a patient who is discharged from the index (first) hospitalization with a surgical site infection (SSI) and then readmitted with an SSI would have a linked SSI readmission; if that same patient was readmitted with a central line–associated bloodstream infection (CLABSI) but not an SSI, then the patient would not have any linked HAI readmission. The percentage difference is how different skilled nursing facility (SNF; in this analysis SNF also includes intermediate care facilities) and home health linked HAI readmission rates are, respectively, compared with routine home discharge linked HAI readmission rates. Differences in linked HAI readmission rates were statistically significantly different across discharge dispositions when considering any HAI or the specific HAIs *Clostridioides difficile* (*C. diff.*) and urinary tract infections (UTIs) ($P < .001$), but not for SSIs ($P = .06$) and CLABSI ($P = .23$). [Color figure can be viewed at wileyonlinelibrary.com]

The mean hospital length of stay was 6.3 days for home discharges compared with 9.3 and 11.4 for HHC and SNF discharges, respectively ($P < .001$). Patients discharged to home had lower comorbidity scores: 21.4 compared with 25.3 and 27.8 for HHC and SNF ($P < .001$), respectively.

Weighted analyses indicated that 17 523 (2.5%) of index admissions involving treatment for an HAI resulted in a linked HAI readmission (ie, the same HAI type at readmission that was diagnosed at the index hospitalization) (Figure 1). Overall, HAI readmissions were more common for *C. diff.* (n = 12 279 readmissions, or 4.0% of 305 679 index *C. diff.* diagnoses) and UTI (n = 3717 readmissions, or 2.4% of 157 347 index UTI diagnoses) than for CLABSI (n = 311, or 1.6% of 19 182 index CLABSI diagnoses) or SSI (n = 1122, or 1.1% of 101 968 index SSI diagnoses) ($P < .001$).

Although patients discharged to a SNF had significantly higher mean (standard deviation [SD]) comorbidity scores than those discharged home and to HHC, respectively (27.8 [.1] vs 21.4 [.1] and 25.3 [.2]), of 702 434 index HAI diagnoses, linked HAI readmissions were more common for routine home (n = 5369, or 3.2%) and HHC (n = 5448, or 3.0%) discharges, compared with SNF discharges (n = 6705, or 1.9%) ($P < .001$). Among 305 679 index *C. diff.* diagnoses, *C. diff.* readmissions were nearly twice as common for home (n = 4445 [5.3%]) and HHC (n = 3631 [5.4%]) compared with SNF discharges (n = 4203 [2.7%]). Similarly, among 157 347 index UTI diagnoses, UTI readmissions were more common for home (n = 648 [2.2%]) and HHC (n = 1345 [3.3%]) compared with SNF discharges (n = 1724 [2.0%]).

In adjusted results illustrated in Figure 2, being discharged to a SNF compared with home or HHC was associated with a decreased risk of a linked HAI readmission. Overall, the risk was 1.15 percentage points lower (95% CI = −1.29 to −1.00). The risk of a linked *C. diff.* readmission was 2.15 percentage points lower (95% CI = −2.43 to −1.87) for an SNF compared with a routine home discharge. Conversely, the risk of a linked SSI readmission was .52 percentage points greater (95% CI = .25-.76) for a SNF compared with a routine home discharge. Compared with home discharges, the risks of linked readmissions for HHC discharges were also greater for *C. diff.* (risk difference [RD] = .44 absolute percentage points; 95% CI = .13-.80) and for UTI (RD = 1.06 absolute

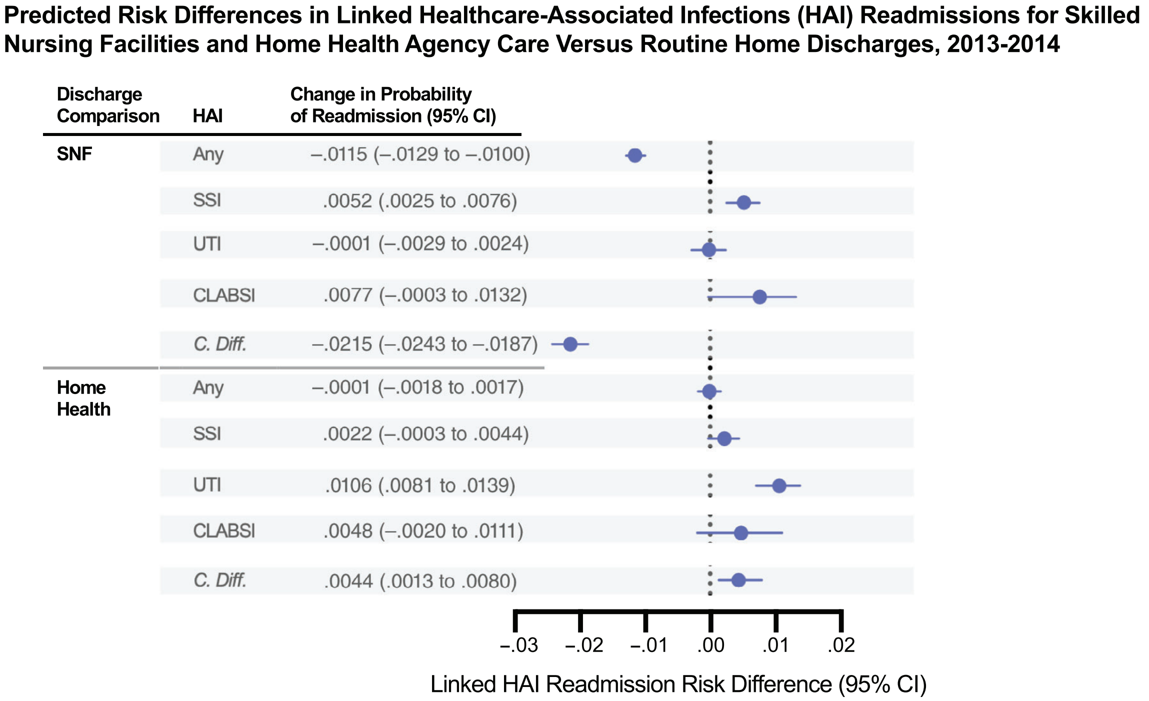

Figure 2. Risk differences in linked healthcare-associated infections (HAIs) were estimated using predicted probabilities obtained from logistic regression models that were adjusted for patient age, sex, income (quartile of median household income of the patient's ZIP Code), Elixhauser comorbidity index, clinical cohort, and length of stay at the index admission. A bootstrapping procedure with 1000 replications was used to obtain 95% bias-corrected confidence intervals (CIs) for the risk differences. *C. diff.*; CLABSI, central line–associated bloodstream infection; SNF, skilled nursing facility; SSI, surgical site infection; UTI, urinary tract infection. [Color figure can be viewed at wileyonlinelibrary.com]

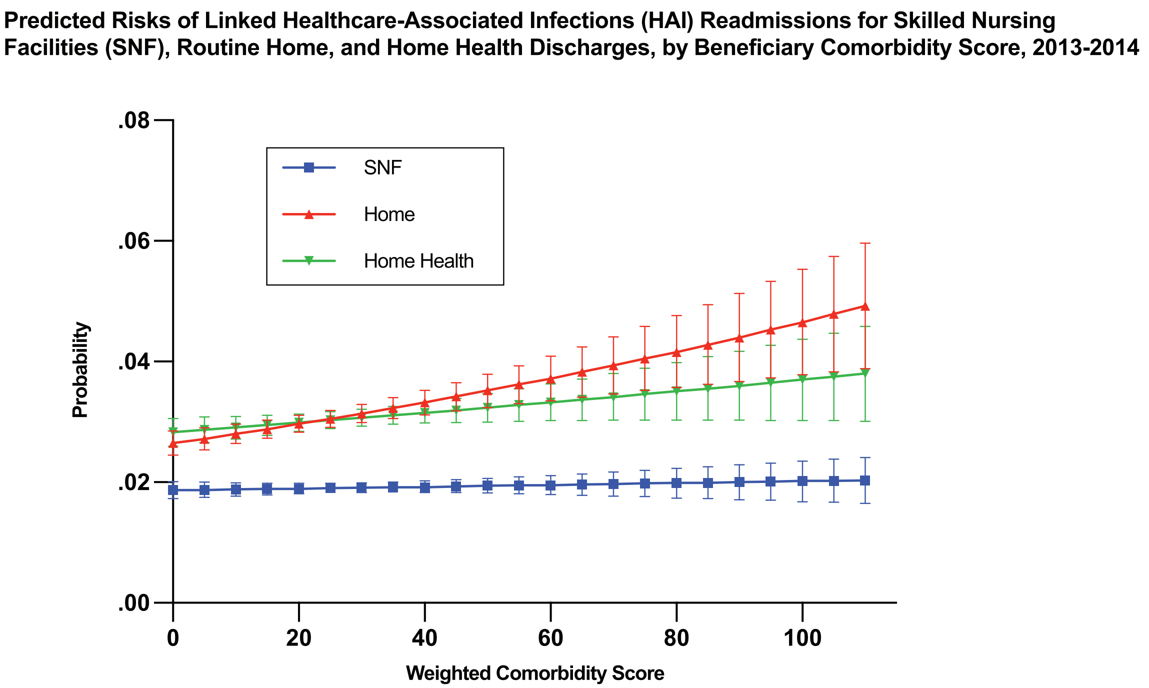

Figure 3. Predicted risks of linked healthcare-associated infections were estimated using predicted probabilities obtained from logistic regression models that were adjusted for patient age, sex, income (quartile of median household income of the patient's ZIP Code), Elixhauser (weighted) comorbidity index, clinical cohort, and length of stay at the index admission. A bootstrapping procedure with 1000 replications was used to obtain 95% bias-corrected confidence intervals for the risk differences. SNF, skilled nursing facility.

percentage points; 95% CI = .71-1.39). There were no differences in readmission risk, by patient discharge disposition, for CLABSIs.

As shown in Figure 3, the multivariable analysis showed a significant interaction between patient comorbidity and patient discharge disposition in predicting linked HAI readmission risk. The overall risk difference for a linked HAI readmission was observed to increase with greater patient comorbidity scores for each of home and HHC discharges, but not for SNF discharges. At a comorbidity score of 25, the risk of a linked HAI readmission was 1.9 (95% CI = 1.8-2.0) for SNF vs 3.1 (95% CI = 2.9-3.2) and 3.0 (95% CI = 2.9-3.2) for home and HHC discharges, respectively, and at a comorbidity score of 75, the respective risks at the three discharge dispositions were 2.0 (95% CI = 1.8-4.1), 4.1 (95% CI = 3.5-4.6), and 3.5 (95% CI = 3.0-3.9), respectively.

In a sensitivity analysis, there was reduced readmission risk for patients with moderate levels of severity of illness for patients discharged to SNFs relative to those discharged home or to HHC (Supplementary Figure S1).

DISCUSSION

From this study of older Medicare beneficiaries, we report three main findings. First, older Medicare beneficiaries with infections are experiencing potentially preventable HAI readmissions, with 2.5% of patients experiencing a linked HAI readmission. For *C. diff.*, these preventable readmissions were more common: 4% overall and less than 5% for those discharged to home or HHC. Second, these preventable HAI readmissions were less likely for patients discharged to SNFs compared with home and HHC discharges. They were also less likely for routine home compared with HHC discharges for *C. diff.* and UTIs. Third, the reduced risk of these linked HAI readmissions for SNF discharges increased with greater patient comorbidity. Together, these findings suggest that HAI treatment and follow-up may not be adequately addressed at discharge, with particular risk for sicker patients discharged to home.

Previous research observed associations between readmissions and HAIs but did not explore whether increased risks represented host factors associated with infections or the infections themselves.[16,33,34] Our study suggests that beyond simply being a marker for risks such as functional and cognitive vulnerabilities correlated with infections and readmissions,[9,35] initial HAIs are *explicitly* linked to readmitted HAIs, the presence of which signals potential treatment failures involving transitional and post-acute care, in particular for UTIs and *C. diff.* infections. These failures may reflect inpatient issues, such as inappropriate or inadequate antibiotic treatment during the index admission.[36,37] They might reflect transitional care problems, such as poor handoffs from the hospital team to the patient or caregiver regarding adherence to antibiotic treatments, insufficient postdischarge wound care,[38] or inadequate communication.[12,39] They may also reflect high out-of-pocket costs of HAI care (such as dressing supplies for wound care), postdischarge injuries,[4,38] and limited support to help patients and caregivers decide when to pursue readmission.[40]

Earlier work suggests that skilled caregiver support, including a structured infection prevention program, personnel, and monitoring, may be needed to ensure successful management of wound care and the safe use of feeding tubes and administration of antibiotics to treat infection.[10,41,42] Earlier findings also suggest that SNFs may be able to compensate for an infection recurrence.[10] Our findings are consistent with these earlier findings as well as recent work illustrating a reduced readmission risk for SNF compared with HHC patients.[13] In all, it may be that nursing facilities have the capacity to diagnose and provide adequate management and supervision for patients with recurrent *C. diff.* infection, including early evaluation by clinical providers, appropriate antibiotics, and rehydration, and thus avoid rehospitalization. Conversely, although home health agencies have staff trained to identify early signs of infections, which helps with monitoring compliance, some agencies may struggle with infection control[7] due to a lack of standardized guidelines for infection prevention efforts.[43] SNF protectiveness against readmissions for *preexisting* infections counters earlier reporting of SNFs as high-risk sites for the acquisition and transmission of infections.[9,10] Even though patients may *arrive* with infections, SNFs may successfully prevent infections from *leaving* the facility, avoiding a revolving door of infection-related readmissions.

Addressing vulnerable patient populations, such as those with multimorbidity, poses challenges for hospitals and post-acute care providers, including readmission prevention, with risks often increased for patients discharged to SNFs.[1,44] However, our findings show that patients with more comorbidities had a greater HAI readmission risk when discharged to home or to HHC compared with an SNF. Patient-specific risks associated with greater comorbidity, such as a compromised immune system, or the complexity of the antibiotic regimen prescribed, may affect the likelihood of success of treatment provided at the hospital or after discharge,[45] heightening the need for high-quality infection control practices in non-SNF settings. To address these needs, targeting of high-risk patients for increased surveillance outside SNFs—for example, instructions to notify the home health nurse and/or primary care provider office for specific symptoms of disease relapse among patients discharged home or to HHC—may be needed. Additionally, support from community health workers may provide an avenue for addressing these preventable reutilization experiences of at-risk older patients with infections.[46]

Limitations

Our work has several limitations. First, whereas Medicare's readmission policy applies to Medicare fee-for-service beneficiaries, the NRD data include Medicare Advantage (MA) beneficiaries. However, MA enrollees represent one-third of all Medicare beneficiaries[47] and can also benefit from improvements in transitional HAI prevention. Second, although Medicare's program targeting hospital-acquired conditions identifies HAIs using diagnosis codes, they correspond imperfectly to clinical conditions. There is evidence of both over- and underestimation of HAI point-in-time prevalence in administrative data,[48,49] although these concerns are mitigated when, as in the present study, examining HAIs over time (which can still provide consistent estimates).[48] Third, our approach for identifying HAIs present on readmission avoided false positives (as validated in our separate analysis of the method using HRS-Medicare data) at the expense of undercounting true positives, resulting in a conservative count of linked HAI readmissions.

Our results regarding the association of SNF care with reductions in linked HAI readmissions may be conservative due to patient compositional differences across post-acute care settings. Although we adjusted for patient demographics and clinical factors, there may be residual confounding due to greater unmeasured clinical risk for patients discharged to SNFs compared with home and HHC settings. Recent work by Werner et al[13] illustrated the importance of residual confounding by showing reduced risk for SNF compared with HHC care, when switching from a linear regression to an instrumental variable analysis, to ultimately find that SNFs were associated with fewer readmissions. Specifically, when they estimated a least squares regression model, patients discharged to HHC care had lower predicted readmission risks than those treated at a SNF. But when they controlled for confounding using the instrumental variable analysis, the results switched, and patients discharged to SNFs had lower predicted readmission risks than those discharged to HHCs.

Fourth, we did not include other potentially important conditions present on hospital discharge, such as lower respiratory infections including pneumonia that can have critical health implications for vulnerable patients.[5] However, we were interested in examining four high-cost and high-volume HAIs included in Medicare's incentive program targeting inpatient care quality to provide clinical and policy-relevant results that can identify areas to help improve care for vulnerable older patients.

These limitations notwithstanding, our findings indicate potential opportunities for improvements in infection control for recently discharged older Medicare beneficiaries. HAIs appear to merit greater attention in policy efforts. Although Medicare's hospital-acquired conditions policy addresses *inpatient* infections, *postdischarge* HAI control may also reduce hospitals' exposure to costly Medicare penalties for excess readmissions.[50] The findings further suggest that an incentive program targeting acquisition of inpatient conditions may not adequately address inpatient quality of care if it neglects to penalize postdischarge care lapses: specifically, hospitals that fail to fully treat dangerous infections that were either acquired in the hospital or already POA at the time of the hospitalization. At the same time, it is concerning that more than half of patients discharged with an HAI are sent to SNFs, given that patients entering nursing homes on antibiotics can lead to a proliferation of multidrug-resistant organisms in this setting.[42]

The findings may also have implications for care delivered under the incentives of Medicare's bundled care payment models. To improve patient outcomes while reducing costs across acute and post-acute settings, systems need to consider buttressing postdischarge support for HAI patients discharged home. They might additionally consider whether very high-risk HAI discharges (*C. diff.* with multiple chronic conditions) warrant higher priority for post-acute SNF recommendations. Other targets for improvement include developing training modules for patients and informal family caregivers or improving training for HHC nurses to coordinate care of HAI relapses, staving off the need for rehospitalization. Integrating efforts for infection prevention and control, healthcare systems might improve overall surveillance and care outcomes for at-risk older adults.[17]

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

Supplementary Table S1: Inclusion and Exclusion Criteria for Older (≥65) Medicare Beneficiaries with an Index Admission with a Healthcare-Acquired Infection (HAI) Diagnosis, 2013-2014

Supplementary Table S2: Test of Accuracy of Identification of Present-on-Admission Healthcare-Associated Infections (HAIs), Using a Reference Standard in Health and Retirement Study and Linked Medicare Data (2008-2014)

Supplementary Figure S1: Predicted Risks of Linked Healthcare-Associated Infections (HAI) Readmissions for Skilled Nursing Facilities (SNF), Routine Home, and Home Health Discharges, by Beneficiary Severity of Illness Score, 2013-2014

Editor's Note

This study highlights a very important point that has critical implications for improving the management of older patients discharged from the hospital after treatment for hospital-acquired infections (HAI). The investigators found that 30-day readmission involving the same HAI diagnosis as treated in the index hospitalization was almost 40% more frequent among patients discharged home than HAI-linked readmissions among patients discharged to skilled nursing facilities (SNF). Importantly, the risk difference increased with increasing comorbidity. This study probably substantially underestimates the magnitude of the problem for at least two reasons. First, the study excluded respiratory infections, which are also associated with hospital readmission. Second, many patients treated for HAI are readmitted for conditions that may not be coded as related to the HAI during the index admission, but in fact are clinically related. The fact that HAI-linked infections were more common for *Clostridioides difficile* infections is worth noting. Vulnerable older patients treated with antibiotics who get diarrhea are at risk for volume depletion and related acute kidney injury, as well as falls associated with fecal urgency and postural hypotension. Clinicians should keep this in mind and prescribe the minimal effective dose and duration of antibiotic therapy in order to prevent these complications. It makes sense that patients treated in SNFs have lower rates of HAI-linked readmission. Although many patients understandably want to be treated at home, some do not have adequate function, finances, and support to obtain optimal completion of treatment for an HAI in their home setting. SNF care helps ensure that patients receive antibiotics and other necessary medications, provides rehabilitative care, and monitors vital signs, fluid and nutritional intake so that changes in condition can be proactively identified and addressed. This study suggests that older patients with significant comorbidity being treated for an HAI should be strongly considered for a brief stay in a SNF after hospital discharge unless adequate care can be assured in the home setting.

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