High-Risk Medication Use by Nursing Home Residents Before and After Hospitalization

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Abstract

Background—Two prominent challenges in nursing home care are ensuring appropriate medication use and achieving high quality care as residents transition from the hospital to the

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nursing home and back. Research about prescribing practices at this important clinical juncture is limited.

Objective—To analyze the use of high-risk medications by nursing home residents before and after being hospitalized. We define high-risk medications using the Beers criteria for potentially inappropriate medication use.

Research Design, Subjects, Measures—Using a dataset with Medicare claims for inpatient and skilled nursing facility stays, and pharmacy claims for all medications dispensed in the nursing home setting, we examine high-risk medication use for hospitalized nursing home residents before and after being hospitalized. Our study population includes 52,559 dual-eligible nursing home residents aged 65 and older who are hospitalized and then readmitted to the same nursing home in 2008. Our primary outcome of interest is the use of high-risk medications in the 30 days before hospitalization and the 30 days following readmission to the same nursing home. We define high-risk medications using the Beers criteria for potentially inappropriate medication use.

Results—Around one in five hospitalized nursing home residents (21%) used at least one high-risk medication the day before hospitalization. Among individuals with high-risk medication use at hospitalization, the proportion using these medications dropped to 45% after nursing home readmission but increased thereafter, to 59% by the end of the 30-day period.

Conclusion—We found moderate levels of high-risk medication use by hospitalized nursing home residents before and after their hospital stays, constituting an important clinical and policy challenge.

INTRODUCTION

Two prominent policy challenges related to care of nursing home residents are ensuring appropriate medication use and high quality care as residents transition from the hospital to the nursing home and back. Research studies, media coverage, and government reports have highlighted challenges and opportunities in each of these areas, with payment and regulatory reforms focusing accordingly.(1–5) Improving residents' care following hospital discharge and aligning incentives for providers to do so has been a guiding principle for bundled payment initiatives and accountable care organizations alike, especially around reducing avoidable hospitalizations.(6) Minimizing high-risk medication use in the nursing home has been an important issue for policymakers and providers for more than a decade, with these initiatives gaining greater traction and achieving greater success recently in the area of antipsychotic prescribing.(7)

Despite the prominent focus in each of these two areas, there has been little work at their intersection, namely to analyze high-risk prescribing practices as individuals transition across care settings. Research on this topic has been inhibited by the lack of data on pharmacy claims as people transition from one setting to another. Obtaining pharmacy

claims from Medicare inpatient and skilled nursing facility stays is especially challenging, as separate administrative claims for services included in providers' bundled payments are unavailable. One exception is a strand of research focused on medication reconciliation between the hospital and nursing home that examines prescribing consistency across settings. Typically focused on limited samples of hospitals and nursing homes, these studies have identified medication discrepancies in the majority of discharges, noting that many of them are unintentional and can result in adverse drug events.(8–10) Other analyses have found substantial gaps in communication during care transitions, many of which center on medication use and require iterative steps between nursing home and hospital staff to resolve.(11, 12)

In this paper we analyze the use of high-risk medications by nursing home residents before and after being hospitalized. Comparing pre- and post-hospitalization periods provides a unique window into nursing home prescribing and in particular whether residents start, restart, or discontinue high-risk medications following hospital stays. We define high-risk medications by referencing Beers list criteria available during our study period for such medication use among older patients (described below). We take advantage of a rich data set from a large national sample of nursing home residents that includes all medications dispensed in the nursing home setting, regardless of payer.

METHODS

Design Overview

The study links the following datasets: resident demographic characteristics from Medicare Beneficiary Summary files; inpatient hospital claims from MedPAR files; and pharmacy claims from Omnicare, including those paid by Medicare (including those prescribed during a Part A Medicare-financed skilled nursing facility stay), Medicaid, and other payers. The pharmacy claims data included a unique resident identification number to allow for longitudinal tracking and linkage to other datasets and contained various elements about the medications for which claims were made, including payer information, National Drug Code (NDC), drug name, days supplied, an indicator for whether a copayment was paid on the claim, the date the prescription was written, and the date the prescription was filled. These pharmacy claims should accurately reflect dispensed medications since they are adjudicated online and incorporate subsequent corrections, where applicable (e.g., because of rejected claims). We include resident hospitalizations between January 1, 2008 and December 1, 2008, capturing pre-hospitalization medication use from December 1, 2007 and post-nursing home readmission medication use to December 31, 2008. We focus on medication use surrounding residents' first hospitalization during this time period.

Setting and Participants

Our study population includes dual-eligible (traditional Medicare and Medicaid) nursing home residents aged 65 and older who were hospitalized and then readmitted to the same nursing home following discharge in 2008 (verified by a nursing home's Medicare provider number, included in the pharmacy claims data). We focus on residents' first hospitalization during the study period only. Because we condition on residents returning to the same

facility and residing therein for the full 30-day observation period, our population is predominantly a long-stay nursing home population. The residents in our study lived in facilities that contracted with Omnicare as their long-term care pharmacy (LTCP) provider, all of which were included in the study's sample frame. Omnicare is the largest LTCP in the U.S, serving almost 50 percent of nursing home residents nationwide during the study period.

Outcomes

Our primary focus is on the use of high-risk medications in the 30 days before hospitalization and the 30 days following readmission to the same nursing home. We define high-risk medications using the Beers criteria for potentially inappropriate medication use. Originally developed in the early 1990s, the Beers criteria evaluated the appropriateness of prescribed medications in nursing home residents, explicitly noting the use of high-risk medications for the elderly for which safer alternatives exist.(13) These criteria were updated in 1997(14) to include potentially inappropriate prescribing for community-dwelling elderly patients and again in 2003(15) to incorporate greater specificity about medication dosage and patient conditions. A further updated version of the Beers list, published in 2012,(16) incorporated clinical information and refined identification methods to categorize high-risk medications.

We present results based on the use of any medications included on the 2003 Beers list that was current at the time of the study data (2008), focusing on medications broadly identified as high-risk independent of diagnosis or condition (i.e., Table 1 of Frick et al, 2003(15)). For a subset of these medications, prescribed dosage levels must be above the threshold specified in the Beers criteria to be labeled as high-risk (e.g., ferrous sulfate is only labeled high risk when prescribed at dosages above 325 mg/day).

Statistical Analyses

We present demographic and other information about residents who are hospitalized and then return to the same nursing home following discharge, including age, gender, and race; major diagnostic categories at hospital admission and hospital length of stay; and medication use on the day before hospital admission, including the total number of medications taken and the proportion using high-risk medications (Table 1). We categorize residents as using medications on a particular day if they have days supply remaining in their long-term care pharmacy prescription. As per regulation, we assume all medications are discarded when a resident is hospitalized and then again when they are readmitted to the same nursing home after the hospital stay (i.e., days supply do not carry over from the pre- to post-hospitalization periods or across the nursing home and hospital settings).

The next two figures display the proportion of residents using at least one high-risk medication on each day during the 30 days before hospital admission and during the 30 days subsequent to nursing home readmission. Figure 1 shows high-risk medication use across these time periods among all hospitalized residents; Figure 2 displays high-risk medication use across these time periods separately for people with and without high-risk medication use on the day before hospitalization. We do not have information about residents'

medication use in the hospital, denoted by the dashed vertical lines in each figure. As a sensitivity check, we also estimated these Figures including residents who died or were discharged during the 30-day post-readmission period in the study sample. Although these discharged residents comprised a sizeable minority of all residents who were hospitalized and then returned to the same facility (24%), these sensitivity analyses produced results that were similar to the results that are presented (results not shown).

Finally, we present frequencies of the 10 most prescribed high-risk medications from the 2003 Beers list, among: i) residents with any high-risk medication use the day before hospital admission; and ii) residents with high-risk medication use on day 3 and on day 30 following nursing home readmission, presented separately for residents who did and did not have high-risk medication use on the day before admission to the hospital (Table 2). We chose days 3 and 30 in the post-nursing home readmission period to assess whether particular high-risk medications are started sooner or later and whether discharge or death of residents later in the observation period affects our results.

RESULTS

Population and hospitalizations

Our study sample includes 52,559 dually eligible nursing home residents who were hospitalized in 2008. Around 72% were female; 83% were age 75 and above; and 81% were white. Around half of all hospitalizations fell into the major diagnostic categories of diseases or disorders of the respiratory system (22%), circulatory system (15%), and kidney or urinary tract (13%). The mean length of hospital stay was 5.61 days, with substantial variation across the cohort (sd=4.46).

Medication Use

On the day before hospitalization, nursing home residents used 8.5 drugs on average, and 21% of the study sample had high-risk medication use. Although the proportion using high-risk medications dipped marginally in the second week following readmission to the nursing home, the level of high-risk medication use was stable over the pre-hospitalization and post-readmission periods, generally hovering around 20% (Figure 1).

The pattern of use differed for those who did and did not have high-risk medication use on the day before hospitalization (Figure 2). For those who did not have high-risk medication use at hospitalization, there was an initial increase in use of these medications upon nursing home readmission (up to 14% on days 3 to 5), followed by a relatively stable rate of use subsequently of around 10%. For those who did have high-risk medication use on the day before hospitalization, the proportion of these residents using high-risk medications dropped to around 45% at day 3 and increased slowly thereafter, to 59% by the end of the 30-day period.

Table 2 shows the frequency of high-risk medication use, based on the 2003 Beers list, on the day before hospitalization and at days 3 and 30 for residents with and without high-risk medication use when hospitalized, respectively. For residents who were already taking a high-risk medication at the time of hospital admission, clonidine was the most prescribed

high-risk medication both at hospitalization and at days 3 and 30 following nursing home readmission. On the day before hospitalization, prescriptions for clonidine represented 14.7% of all high-risk medication prescriptions. The most frequently prescribed high-risk medications to these residents over the same timeframe included amiodarone, fluoxetine, and ferrous sulfate. Use among residents not taking a high-risk medication at hospitalization differed. Among these residents, clonidine, promethazine, and acetaminophen/propoxyphene napsylate (removed from the U.S. market in 2010) were the most prescribed high-risk medications three days following nursing home readmission. By day 30 after nursing home readmission, prescriptions for promethazine were less frequent for these residents, while prescriptions for ferrous sulfate were relatively more prominent than at day 3.

DISCUSSION

Approximately one in five hospitalized nursing home residents had some high-risk medication use on the day before hospitalization, a proportion that was remarkably consistent in the 30 days before residents were hospitalized and after they returned to the nursing home. Even though fewer than half of the residents who were using high-risk medications at hospitalization received prescriptions for them again in the initial days after nursing home readmission, this proportion increased to around 60% over the subsequent 30 days. Among residents who did not have a prescription for a high-risk medication at hospitalization, 14% received a prescription for one of these drugs in the initial days after their nursing home readmission, with this rate falling slightly and then remaining stable over the subsequent 30 days in the nursing home.

These results confirm that high-risk medication use is an important clinical challenge for nursing homes. They also suggest that nursing home prescribing practices play an important role in shaping such use among hospitalized residents in the weeks after their readmission to the nursing home.

Our study is one of the first to detail medication use by nursing home residents before and after their hospitalization. It takes advantage of data showing all prescription drugs dispensed in nursing homes regardless of payer, including those that are reimbursed within Medicare's bundled payment for care delivered during a skilled nursing facility stay. Although the limited research literature examining medication reconciliation between the hospital and nursing home finds significant discrepancies across settings,(3, 8–10, 17, 18) we take advantage of data that include a large cohort of residents nationwide to compare medication use before and after hospitalization. Moreover, focusing on high-risk medication use offers insights about the quality of prescribing as residents transition across settings and, more specifically, about the role of nursing homes in shaping these prescribing practices.

Nursing home residents transitioning back to the facility after hospitalization could have returned taking additional medications, including a greater number of potentially inappropriate or high-risk medications. If so, these medications could be tapered and discontinued over time following their return to the home. Although we are unable to observe medications prescribed during residents' hospital stays, our results are not consistent with this scenario. Around 60% of residents who were taking a high-risk

medication during the pre-hospitalization period were again taking one by 30 days following their readmission to the nursing home, even though fewer than half were taking these drugs upon initial nursing home readmission. In addition, a persistent minority of residents who did not have high-risk medication use prior to their hospital stay were taking high-risk prescriptions during the post-nursing home readmission period. This might signal high-risk medication use that was initiated in the hospital, but usage levels remained relatively steady over the subsequent 30-day period.

Our aim in defining high-risk medication use using the 2003 Beers criteria is to focus on a group of medications for which there was general consensus at the time of the study about their potential inappropriateness, independent of residents' diagnoses or conditions. Except in limited circumstances, neither nursing homes nor hospitals should have continued, started, or re-started these medications, even with (and perhaps *especially* with) the change in status that a hospitalization implied. Consequently, it is concerning to see both the moderate use of these medications prior to resident hospitalizations and the pull of residents back onto these drugs following their nursing home readmission. Nonetheless, there are situations where selective use of high-risk medications can be indicated. For example, amiodarone, one of the more frequently prescribed high-risk medications we observe, is a therapy that can be judiciously used to treat supraventricular arrhythmias effectively in patients with heart failure.(19)

Although the temporal focus of our study is at the nexus of nursing home residents' transitions to and from the hospital, our data and results focus more squarely on care provided in the nursing home. It is possible – and perhaps even likely(11, 12) – that the coordination of medication use between hospitals and nursing homes is poor, yet the problem our results identify is not primarily one of coordination. Even when interrupted by a hospital stay and accompanied by a subsequent decline in use, high-risk medication use generally recurred once residents were settled back into the nursing home. Consequently, although efforts to improve communication and rationalize financial incentives across settings of care (e.g., bundled payment initiatives) may improve the quality of prescribing along other margins, it is unclear whether such efforts would markedly impact the prescribing patterns we identified. Instead, either increased oversight of prescribing by regulators, payers, and providers may be needed or quality bonus payments such as the Star program in Medicare Advantage may be useful. The recent scrutiny of antipsychotic prescribing offers one potential model, as antipsychotic use rates have dropped dramatically in the context of greater regulatory oversight, increased Part D coverage restrictions, and bolstered quality improvement efforts on the part of providers.(7)

Our study has several limitations. We do not observe residents' medication use while they were in the hospital. We infer that residents' medication use immediately after hospital discharge and upon nursing home readmission reflected their clinical regimen in the hospital, especially when compared to prior and subsequent usage patterns that were ostensibly more under the nursing home's control. However, given hospital/nursing home medication reconciliation challenges identified in the research literature, there is likely some imprecision in this inference. Although Beers criteria have gained wide acceptance over the past two decades, they are not meant to regulate practice in a manner that supersedes the

clinical judgment and the assessment of a patient's physician. We also do not observe whether any adverse health events occurred among residents who use high-risk medications. On the other hand, the Beers criteria do not identify the universe of inappropriate prescribing, because defining such practices by a list of medications rather than other mechanisms may miss problems such as underuse and drug-drug interactions.

Our results are based on data from 2008 and reflect the policy and clinical environments at that time. Even though nursing home prescribing continues to be a persistent challenge for providers, regulators, and policymakers, our results could differ with more recent data or a more recent listing of high-risk medications. Moreover, the Centers for Medicare and Medicaid Services recently proposed tracking the use of high-risk medications as part of the Part D plan STAR quality ratings for 2014,(20) a move that can be further bolstered by plans' own internal monitoring of these drugs and plan design and payment review features to limit their use.(21) Finally, although our analyses include a large sample of nursing home residents nationwide, the data come from a single long-term care pharmacy; generalizing our findings to the nursing home sector as a whole should be done with caution.

In summary, our findings identify moderate levels of high-risk medication use by hospitalized nursing home residents both before and after their hospital stays, at least as of 2008. Although some high-risk medication use may have been initiated during the hospital stay, nursing homes seem to have played a role in driving the use of such medications by hospitalized residents who return to the facility. Broader trends in the use of high-risk medications following nursing home readmission represent an important clinical challenge that policymakers and providers should seek to address to ensure the health and safety of residents.

Acknowledgments

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21. For example, Humana requires prior authorization for all Beers list medications and has a separate form for this: https://http://www.humana.com/provider/medical-providers/pharmacy/rx-tools/prior-authorization.
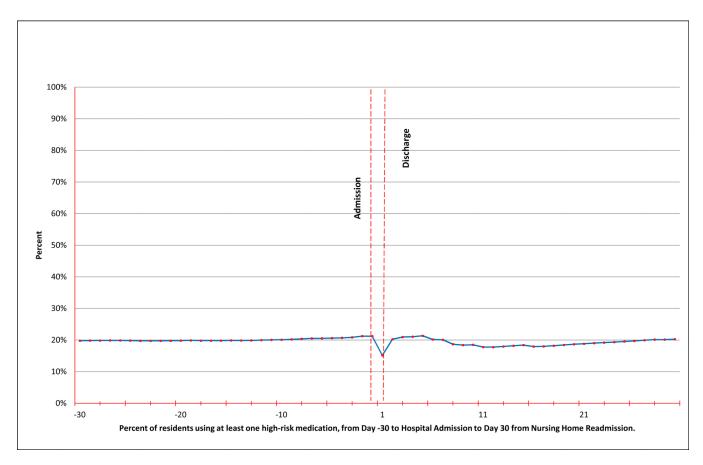
Figure 1. High-Risk Medication Use among Hospitalized Nursing Home Residents Readmitted to the Same Nursing Home, 30 Days Pre/Post, 2008

This figure shows high-risk medication use 30 days before a hospitalization and 30 days after readmission to the same nursing home, among all hospitalized residents.
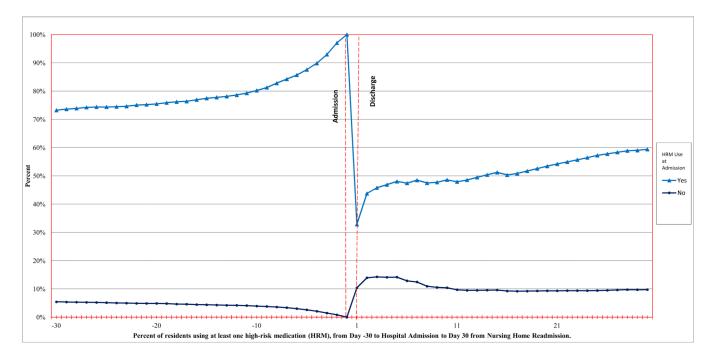
Figure 2. High-Risk Medication Use among Hospitalized NH Residents Readmitted to the Same NH, 30 Days Pre/Post, by Pre-Hospitalization HRM Use Status (Y/N) 2008

This figure displays high-risk medication use 30 days before hospitalization and 30 days after readmission to the same nursing home, presented separately for people with and without high-risk medication use on the day before hospitalization.

Table 1

Characteristics for Elderly Dual Eligible Nursing Home Residents Who Were Hospitalized and Returned to the Same Nursing Home in 2008

	Hospitalized Nursing Home Residents (52,659)

Sex:
  Female
  Male
	71.7% (37,775)
	28.3% (14,884)

Age:
  65–74
  75–84
  85–94
  95+
	17.0% (9,635)
	36.8% (19,519)
	39.6% (20,272)
	6.6% (3,233)

Race:
  White
  Black
  Other
	81.1% (42,688)
	14.5% (7,658)
	4.4% (2,313)

Hospital length-of-stay, days (sd)
Major diagnostic categories at admission to hospital
  Diseases and disorders of the respiratory system
  Diseases and disorders of the circulatory system
  Diseases and disorders of the kidney and urinary tract
  Diseases and disorders of the digestive system
Discharged to Medicare skilled nursing facility stay (%)
Total medications on the day before hospitalization (sd)
Percent taking a Beers medication on the day before hospitalization
	5.61 days (4.46)
	22.0%
	15.1%
	12.9%
	10.3%
	59.5%
	8.5 drugs (4.4)
	21.2%

Note: All residents reside in nursing homes that contracted with Omnicare as their long-term care pharmacy provider. Study cohort includes nursing home residents who were hospitalized and returned to the same nursing home following hospitalization in 2008 and who resided in the nursing home for 30 days following readmission.

Table 2

10 Most Frequently Prescribed Beers Medications at Hospitalization and at 30 Days Post Nursing Home Readmission, 2008

	Beers Use the Day before Hospitalization			Beers Use at Day 3 following NH Readmission						Beers Use at Day 30 following NH Readmission					
				Those with Beers Use at Hospitalization			Those without Beers Use at Hospitalization			Those with Beers Use at Hospitalization			Those without Beers Use at Hospitalization		
	Medication	Count	Percent of Beers Use	Medication	Count	Percent of Beers Use	Medication	Count	Percent of Beers Use	Medication	Count	Percent of Beers Use	Medication	Count	Percent of Beers Use
1	Clonidine	1925	14.7%	Clonidine	1181	18.0%	Clonidine	1001	14.9%	Clonidine	1410	17.7%	Ferrous Sulfate	741	17.2%
2	Fluoxetine	1105	8.4%	Amiodarone	587	8.9%	Promethazine	938	14.0%	Amiodarone	880	11.1%	Clonidine	547	12.7%
3	Ferrous Sulfate	1096	8.4%	Fluoxetine	545	8.3%	Acetaminophen/ Propoxyphene Napsylate	938	14.0%	Fluoxetine	854	10.7%	Nitrofurantoin	380	8.8%
4	Amiodarone	1065	8.1%	Acetaminophen/ Propoxyphene Napsylate	532	8.1%	Ferrous Sulfate	581	8.7%	Ferrous Sulfate	788	9.9%	Amiodarone	321	7.4%
5	Nitrofurantoin	1016	7.8%	Ferrous Sulfate	499	7.6%	Nitrofurantoin	533	7.9%	Doxazosin Mesylate	352	4.4%	Oxybutynin Chloride	315	7.3%
6	Acetaminophen/ Propoxyphene Napsylate	773	5.9%	Promethazine	453	6.9%	Lorazepam	444	6.6%	Acetaminophen/ Propoxyphene Napsylate	325	4.1%	Acetaminophen/ Propoxyphene Napsylate	234	5.4%
7	Promethazine	674	5.1%	Nitrofurantoin	282	4.3%	Oxybutynin Chloride	293	4.4%	Oxybutynin Chloride	323	4.1%	Fluoxetine	185	4.3%
8	Naproxen	527	4.0%	Oxybutynin	235	3.6%	Amiodarone	282	4.2%	Nitrofurantoin	296	3.7%	Promethazine	178	4.1%
9	Hydroxyzine	515	3.9%	Doxazosin Mesylate	234	3.6%	Hydroxyzine	238	3.5%	Amitriptyline	294	3.7%	Hydroxyzine	163	3.8%
10	Doxazosin Mesylate	468	3.6%	Hydroxyzine	232	3.5%	Diphenhydramine	226	3.4%	Hydroxyzine	244	3.1%	Digoxin	142	3.3%