ORIGINAL RESEARCH

Preventable Admissions on a General Medicine Service: Prevalence, Causes and Comparison with AHRQ Prevention Quality Indicators—A Cross-Sectional Analysis

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BACKGROUND: Rates of preventable admissions will soon be publicly reported and used in calculating performance-based payments. The current method of assessing preventable admissions, the Agency of Healthcare Research and Quality (AHRQ) Preventable Quality Indicators (PQI) rate, is drawn from claims data and was originally designed to assess population-level access to care.

OBJECTIVE: To identify the prevalence and causes of preventable admissions by attending physician review and to compare its performance with the PQI tool in identifying preventable admissions.

DESIGN: Cross-sectional survey.

SETTING: General medicine service at an academic medical center.

PARTICIPANTS: Consecutive inpatient admissions from December 1–15, 2013.

MAIN MEASURES: Survey of inpatient attending physicians regarding the preventability of the admissions, primary contributing factors and feasibility of prevention. For the same patients, the PQI tool was applied to determine the claims-derived preventable admission rate.

KEY RESULTS: Physicians rated all 322 admissions and classified 122 (38 %) as preventable, of which 31 (25 %) were readmissions. Readmissions were more likely to be rated preventable than other admissions (49 % vs. 35 %, $p = 0.04$). Application of the AHRQ PQI methodology identified 75 (23 %) preventable admissions. Thirty-one admissions (10 %) were classified as preventable by both methods, and the majority of admissions considered preventable by the AHRQ PQI method (44/78) were not considered preventable by physician assessment ($K = 0.04$). Of the preventable admissions, physicians assigned patient factors in 54 (44 %), clinician factors in 36 (30 %) and system factors in 32 (26 %).

CONCLUSIONS: A large proportion of admissions to a general medicine service appeared preventable, but AHRQ's PQI tool was unable to identify these admissions.

Before initiation of the PQI rate for use in pay-for-performance programs, further study is warranted.

BACKGROUND

Of the roughly 40 million hospital admissions per year in the USA, anywhere from 9–36 % are estimated to be preventable.[1–3] These preventable admissions and the complications that arise from them are a significant contributor to overall healthcare expenditures in the US.[4,5] More recently, the Centers for Medicare and Medicaid Services began using healthcare organizations' overall rate of preventable admissions in the assessment of the value of services it provides. The preventable admission rate factors in the incentives or penalties for various pay-for-performance programs and accountable care schemes.[6,7]

One approach to reducing preventable admissions begins by identifying specific admissions as being preventable and then assessing those factors that, if addressed in the weeks prior to admission, might have prevented the admission. This method produces both a rate of preventable admissions and potential targets for intervention. Past research has identified a combination of patient, physician and system factors that contribute to preventable admissions.[2,4] However, this method is labor intensive and cannot be automated for use in public reporting or pay for performance.

Alternatively, an organization's preventable admission rate can be derived from administrative claims data as specified in the Agency for Healthcare Research and Quality's (AHRQ) Prevention Quality Indicator (PQI) methodology. The PQI rate was originally designed to assess population-level access to primary care. Geographic areas with greater primary care access have lower PQI rates.[8,9] PQI indicators capture admissions due to conditions believed to "preventable" if the patients had access to high-quality ambulatory care. It includes conditions such as COPD and heart failure exacerbations,

uncontrolled diabetes, bacterial pneumonia, perforated appendix and urinary tract infection. At the population level, high rates of specific PQIs are meant as potential indicators of poor-quality care in the community and the starting point for a more in-depth investigation. Applying the PQI methodology to individual physician groups for the purposes of determining pay-for-performance adjustments is novel. CMS is currently assessing quality performance standards for physician practices and healthcare organizations participating in the Value-based Payment Modifier or Shared Savings Plan. When repurposed for this, two questions arise. First, how does the PQI compare to physician review of the preventability of an admission? Second, can it identify which admissions are preventable, thereby allowing hospitals to further investigate the causes of preventable admissions?

This study aims to answer these questions by incorporating real-time case reviews by the inpatient attending physician to determine the rate of preventable admissions and then compare these cases to preventable admissions derived using the PQI. We hypothesized that the AHRQ PQI tool would be imprecise and would fail to identify preventable admissions.

METHODS

Setting and Study Participants

We conducted a cross-sectional observational study of consecutive admissions to the General Medicine Service of an academic medical center (Cleveland Clinic Main Campus Hospital, Cleveland, Ohio) from December 1, 2013 to December 15, 2013. Transfers from other hospitals were excluded. A preventable admission was defined as an admission that could have been averted by addressing any system, clinician or patient factor at any point during the 2 weeks prior to admission.[2] The assessment of preventability was made on day 2 of the admission by the inpatient attending physician. If an admission was deemed preventable, he/she selected the principal factor that most contributed to the admission and rated the feasibility of prevention on a 4-point scale (very easy, somewhat easy, somewhat difficult, very difficult). The list of factors was based on past literature and refined using a Delphi method with a group of primary care, hospitalist and emergency medicine physicians prior to the start of the study (online appendix Fig. 1). A total of 15 doctors (5 in each specialty) were polled about factors they felt led to preventable admissions, and then the lists were combined and grouped into themes. The final list was again reviewed by the same group of doctors before using it for interview. A sample interview form explaining preventability together with the list of factors was given to the attending physicians to help guide their assessment of admissions (online appendix Form A).

Demographics, principal diagnosis ICD-9 code, readmission status, insurance information and contact with any outpatient provider, either telephonic or in person, in the 2 weeks prior to admission were gathered from the electronic medical record. The principal discharge diagnosis was used to calculate the AHRQ PQI preventable admission rate using PQI indicator codes available on the AHRQ website (http://www.qualityindicators.ahrq.gov/Modules/pqi_resources.aspx, last accessed January 7, 2016).

Validation

At the end of the study period, two attending physicians (N.V and J.P) who were blinded to the results of initial survey reviewed the EMR. Alternating admissions were chosen for assessment. Each reviewer independently assessed them for preventability using the same method. The results of each physician's determination were compared with those of the other and with the results of the attending survey to determine the level of interobserver reliability. The reviewers did not identify a principal contributing factor nor did they assess the feasibility of prevention.

Statistical Analysis

Continuous variables were expressed as mean ± SD for normally distributed variables and median or interquartile ranges for non-normally distributed variables. Categorical data were expressed in percentage frequency. Student t-test and Wilcoxon rank-sum test were used for continuous variables. Chi-square test and Fisher exact test were used for categorical variables to detect differences between the initial attending's assessment and the PQI. Interobserver agreement for assessment of preventability of admissions was assessed by using the kappa agreement statistic. The study protocol was reviewed by the Cleveland Clinic Institutional Review Board personnel prior to the start of study period and deemed exempt.

Funding Source. None.

RESULTS

Thirty-two attending physicians completed the surveys for all 322 consecutive admissions during the study period (100 % response rate) and classified 122 (38 %) as preventable. Interobserver agreement between the two independent physician reviewers and inpatient attending physician ($K = 0.43$) as well as between the two independent physician reviewers ($K = 0.51$) regarding the preventability of admissions was moderate.

Patient characteristics of preventable and non-preventable admissions appear in Table 1. Admissions rated as preventable were more likely to be male (48 % vs. 37 %, $p = 0.05$), African American (59 % vs. 39 %, $p = 0.01$) and insured with Medicaid (27 % vs. 12 %, $p = 0.006$). Readmissions were more likely to be rated preventable than other admissions (49 %

Table 1 Baseline Characteristics of the Population

	Total (N = 322) Mean (SD) or N (%)	Preventable admissions (N = 122) Mean (SD) or N (%)	Non- preventable admissions (N = 200) Mean (SD) or N (%)	Significance p- value
Age, years	59.77 (18.25)	57.29 (19.09)	61.28 (17.59)	0.06
Male	133 (41 %)	59 (48 %)	74 (37 %)	0.05
Race				
Caucasian	156 (48 %)	47 (39 %)	109 (55 %)	0.01
African American	150 (47 %)	72 (59 %)	78 (39 %)	
Other	16(5 %)	3(2 %)	13 (7 %)	
Hospitalized in past year	176 (55 %)	73 (60 %)	103 (52 %)	0.15
Readmission	63 (20 %)	31 (25 %)	32 (16 %)	0.04
Insurance				
Medicaid	57 (18 %)	33 (27 %)	24 (12 %)	0.006
Medicare	119 (37 %)	40 (33 %)	79 (40 %)	
Private	120 (37 %)	37 (30 %)	83 (42 %)	
Self-pay	23 (7 %)	10 (8 %)	13 (7 %)	
Contact with PCP within previous 14 days	77 (24 %)	29 (24 %)	48 (24 %)	0.96
Contact with other MD within previous 14 days	143 (44 %)	56 (46 %)	87 (44 %)	0.67

vs. 35 %, $p = 0.04$). The intensity of contact with either primary or specialty care physicians during the 14 days prior to admission did not differ between the preventable and non-preventable groups.

Preventable admissions were most commonly (44 %) attributed to patient factors, including non-adherence (17 %), mental health/substance abuse (8 %), poor health literacy (5 %), secondary gain from hospitalization (3 %) and poor home support (1 %). System factors were responsible for 32 (26 %) admissions, specifically inpatient management easier than outpatient (11 %), inadequate care at a nursing facility (5 %), inability to access outpatient providers (2 %) and complication from previous admission (1 %). The remaining 36 (30 %) admissions were due to clinician factors, including

threshold for admission too low (9 %), inadequate follow-up (8 %) and inappropriate diagnosis/treatment (7 %).

Of the 122 preventable admissions, 63 (52 %) were considered very or somewhat easy to prevent, while the remainder were very or somewhat difficult to prevent (Fig. 1). Preventable admissions for which clinician factors were chosen were considered the easiest to prevent, with 67 % assigned very or somewhat easy, whereas those for which patient factors were chosen were rated the most challenging, with 62 % assigned very or somewhat difficult to prevent. Only 15 admissions (12 %) were deemed very easy to prevent. These included inpatient management easier than outpatient (4/15, 27 %), low threshold for admission (4/15, 27 %) and non-adherence (3/15, 20 %).

Examples of preventable admissions due to patient factors included admissions for hypertensive urgency, hyperglycemic hyperosmolar state and recurrent deep vein thrombosis due to non-adherence, poor health literacy about the underlying disease process and patient refusal to follow-up. Examples of cases due to clinician factors included admission for localized skin rash, viral influenza upper respiratory infection (decreased threshold for admission) and readmissions due to inadequate management of acute kidney injury or fluid overload during a previous admission. Examples of system factors included admissions for recurrent deep vein thrombosis in the setting of inadequate follow-up with anticoagulation clinic and adrenal crisis or pancreatitis after delayed access to subspecialty providers following discharge.

The AHRQ PQI identified 75/322 (23 %) admissions as preventable. Thirty-one admissions (10 %) were classified as preventable by both the PQI and the attending physician's assessment, and the majority of admissions considered preventable by the AHRQ PQI method (44/78) were not considered preventable by the physician's assessment (Fig. 2). Overall agreement between attending physician review and PQI assessment of preventability was not different from chance ($K = 0.04$).

Primary Factors in Preventable Admissions (n=122)

Patient: 4 | 17 | 22 | 11 **44%**

Clinician: 6 | 18 | 10 **30%**

System: 5 | 13 | 9 | 4 **26%**

Legend:
☐ Very easy to prevent
☐ Somewhat easy to prevent
☐ Somewhat difficult to prevent
☐ Very difficult to prevent
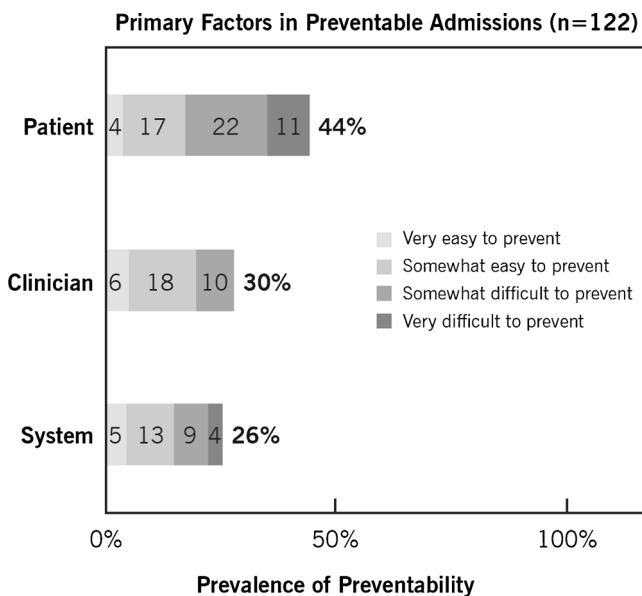
Prevalence of Preventability

Figure 1 Distribution of primary factors in preventable admissions and feasibility of prevention (the numbers in the boxes represent the total number of preventable admissions in that category)
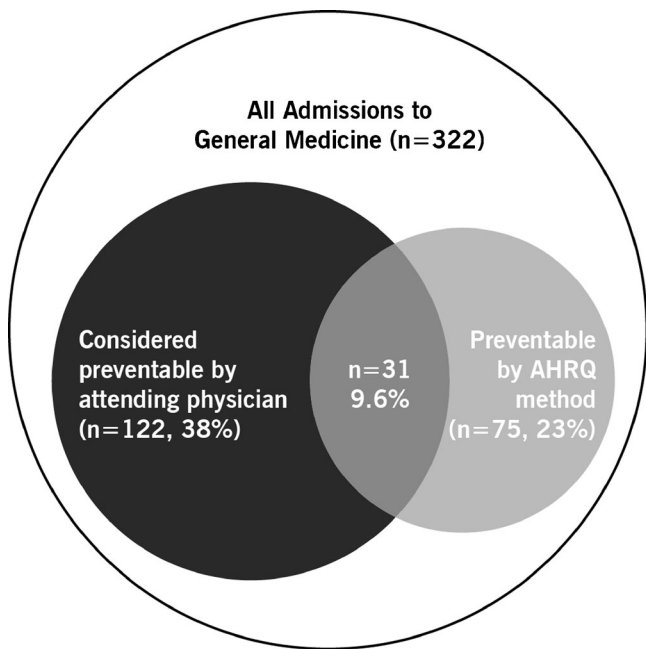
Figure 2 Comparison of preventability assessment by the attending MD with the AHRQ PQI (prevention quality indicator)

DISCUSSION

In this observational study of 322 consecutive admissions to a general medicine service, we found that 38 % were considered preventable by the inpatient attending physician. In contrast, the PQI tool identified 23 % of admissions as being preventable, but the overlap between these admissions and those identified by the physicians was no better than chance. Preventable admissions were most commonly attributable to patient factors, including non-adherence, mental health issues and substance abuse. Although half the preventable admissions were considered at least somewhat easy to prevent, only 12 % were considered very easy to prevent. These consisted mostly of admissions done for convenience or because the threshold for admission was considered too low.

For many years the US healthcare community has been focused on reducing readmissions in order to improve quality and reduce costs. Through assiduous measurement, public reporting, best practice sharing, process improvement and the threat of financial penalty, all-cause readmission rates have declined only slightly.[10,11] In our study, however, preventable readmissions accounted for less than 10 % of total admissions and only one-quarter of preventable admissions. Reducing the rate of preventable admissions, therefore, represents a much larger opportunity to improve healthcare value, but suffers from some of the same issues as reducing readmissions, in particular, the inability of current measures to identify specific admissions as preventable.

AHRQ's PQI method was developed to measure the adequacy of primary care in a region and to identify outliers for internal quality review. It is meant to be sensitive, but not specific. It presupposes that conditions such as COPD and heart failure exacerbations, uncontrolled diabetes, bacterial

pneumonia, ruptured appendix and urinary tract infection are affected by access to high-quality ambulatory care and that lower admission rates represent better care. In one sense this is correct. For example, bacterial pneumonia rates can be reduced by appropriate vaccination, and areas without access to vaccines might have higher rates of hospitalization for bacterial pneumonia. However, most bacterial pneumonia is not "preventable," and variation in rates at the hospital level may have many contributing factors, including chance. The PQI cannot identify an appropriate rate for hospital admissions within a given population. Equally important, as noted in our study, it cannot identify specific preventable admissions. Therefore, it cannot serve as a tool to help hospitals focus their prevention efforts. In this way, it resembles readmission rates—a measure that is easy to calculate but very hard to move. Despite these shortcomings, the PQI is increasingly being used to compare healthcare providers publicly and to calculate performance payments.[6,7]

To the best of our knowledge, our study is the first to evaluate the PQI method for assessment of preventable admissions *at a hospital level*, despite its growing use in pay-for-performance programs. The identification of preventable admissions by the PQI method in comparison to attending physician case review was in this case no better than chance. This finding suggests that its use in assessing preventable admission rates for public reporting and performance payment—a use for which it was neither originally designed nor validated—should be reconsidered.

Our method of assessment has several advantages over the PQI. First, it identified a larger proportion of admissions as preventable, allowing more opportunities for intervention. Second, it was able to identify factors present on an individual level that determine a hospitalization. Factors such as patient non-adherence, medication drug expenses, clinician's threshold for admission and home social support are not adequately captured in discharge diagnoses. The attending physician review integrates the complex interplay of medical, social, environmental and behavioral factors that contribute to preventability. Finally, it offers a tool for local quality improvement. Focusing departmental policies on as well as developing initiatives that address factors identified in "easy to prevent" admissions is a logical first step toward reducing the burden of preventable admissions. It also has drawbacks. The assessment is labor intensive and subjective in nature. As such it cannot be used to compare, reward or penalize hospitals.

Physician assessment for the preventability of admissions is not new. In the 1980s and 1990s, studies using similar methodology found preventable admission rates ranging from 9–33 %.[2,4,5,12] System and clinician factors predominated, with patient factors contributing less. These studies were undertaken prior to the widespread use of electronic health records linking outpatient providers, emergency departments and inpatient providers; the advent of patient-centered medical homes with care coordination programs; the availability of in-home hospital services such as intravenous antibiotics;

and the deployment of discharge planning and chronic disease management resources to reduce readmissions. The effect of these and other recent developments in healthcare delivery might be responsible for a higher proportion of patient factors (44 %) and lower proportions of system (26 %) and clinician (30 %) factors contributing to preventability in our study. Alternatively, differing thresholds for admission in the current era may have shifted both the perception of preventability and the proportion because of various causes.

Healthcare providers have limited performance improvement resources, which should be deployed to problems that are both important and solvable. For healthcare providers to reduce admission rates, they must understand why preventable admissions occur: 52 % of the preventable admissions in our study were considered very or somewhat easy to prevent, and these were more likely to be due to clinician factors such as inadequate follow-up, no contact between the admitting MD and primary care provider and the low threshold for admission. Although enhanced interaction with primary care through patient-centered medical homes and transitional care management might solve some of these problems, we found that the quantity of contact between patients and their outpatient physicians in the 2 weeks prior to admission did not appreciably differ between preventable and non-preventable admissions.

Our study has some important limitations. First the method of inpatient attending physician case review is subjective. However, we demonstrated a moderate rate of agreement between the inpatient attending's assessment and the blinded physician reviewers, suggesting a degree of reproducibility. A more objective method would certainly be required for public reporting and pay-for-performance contracts. Furthermore, including the patient's perspective on preventability would be useful, especially given reports of poor agreement between physicians and patients regarding preventability of their readmissions.[13] Second, our study was conducted at a single site, thereby limiting its generalizability. It would be a logical next step to deploy this method in different settings, to include additional services in differing types of hospitals (academic, rural, community, etc.). At our institution, we have an integrated health system model with shared electronic health records leading to good continuity of care. Despite this, we had a high rate of preventable admissions. Smaller community hospitals where such a system does not exist might exhibit higher rates. Furthermore, if the PQI method is shown to have differing accuracy based on the hospital type, this might further erode its utility in comparing hospitals on their preventable admissions performance.

CONCLUSION

Preventable admissions are common but difficult to identify using only administrative claims data. Attending physician case review is a potentially useful method for hospitals in their performance improvement efforts. Validation in different services and hospital types will be needed before these results can be generalized.

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