Development and validation of a transitions-of-care pharmacist tool to predict potentially avoidable 30-day readmissions

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Purpose. A practical tool for predicting the risk of 30-day readmissions using data readily available to pharmacists before hospital discharge is described.

Methods. A retrospective cohort study to identify predictors of potentially avoidable 30-day readmissions was conducted using transitions-of-care pharmacy notes and electronic medical record data from a large health system. Through univariate and multivariable logistic regression analyses of factors associated with unplanned readmissions in the study cohort (n = 690) over a 22-month period, a risk prediction tool was developed. The tool's discriminative ability was assessed using the C statistic; its calibration was assessed using the Hosmer–Lemeshow goodness-of-fit test.

Results. Three factors predictive of readmission risk were identified; these variables—medication count, comobidity count, and health insurance status at discharge—form the 3-predictor MEDCOINS score. Among patients identified as being at high risk for readmission using the MEDCOINS tool, the estimated readmission risk was 22.5%, as compared with an observed readmission rate of 21.9%. The discriminatory performance of MEDCOINS scoring was fair (C statistic = 0.65 [95% confidence interval, 0.60–0.70]), with good calibration (Hosmer–Lemeshow p = 0.99).

Conclusion. Among a cohort of patients who were seen by a transitions-of-care pharmacist during an inpatient hospitalization, comorbidity burden, number of medications, and health insurance coverage were most predictive of 30-day readmission. The MEDCOINS tool was found to have fair discriminative ability and good calibration.

Keywords: pharmacist, pharmacy, readmission, rehospitalization, tool, transitions of care

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According to 2009 estimates, the risk of readmission within 30 days of hospital discharge is as high as 20%.[1] The rate of hospital readmissions has become a standard metric of quality of care.[2] In October 2012, the Centers for Medicare and Medicaid Services (CMS) began to invoke financial penalties for unplanned 30-day readmissions due to certain high-risk disease states. The CMS program has since been expanded and currently includes chronic obstructive pulmonary disease, heart failure, acute myocardial infarction, and pneumonia.[2,3] Nearly 3% of the Medicare program's total budget is dedicated to reimbursing hospitals for treating the aforementioned conditions, representing a significant financial stake.[2] Reducing unnecessary readmissions can alleviate costs, ensure that providers receive reimbursement for high-quality care, and guide efficient resource allocation.

Pharmacist-managed transitions-of-care programs may reduce the risk

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of readmission.[4-7] The transition from the acute hospital setting to the ambulatory care setting is a critical juncture for patients and families. When the transition is not managed well, it can lead to poor care coordination and avoidable readmissions, thus making a pharmacist-managed transitions-of-care service a crucial intervention for reducing readmissions. Project Re-Engineered Discharge, also known as Project RED, is one such program that involves patients discharged from Boston Medical Center.[7] In a study carried out by Project RED researchers, a pharmacist followed up with selected patients by telephone 2–4 days after discharge; patients in the intervention group were found to have a 30% lower rate of readmission within 30 days, as well as a better understanding of their medications, than a control group of discharged patients who did not receive those follow-up services.[7] However, there is no guidance for how to identify patients likely to benefit from continued pharmacist-managed transitions-of-care services like those provided by Project RED after they have had an initial appointment with a hospital-based transitions-of-care pharmacist. The use of prediction models could assist with targeting patients at highest readmission risk, who would benefit most from continued pharmacy education services and effective medication reconciliation after discharge.[4]

The purpose of the study described here was to develop a valid and practical prediction tool to identify hospitalized patients at highest risk for 30-day readmission at the time of discharge, thus providing a tool for pharmacists to discriminate patients likely to benefit most from continued pharmacy transitions-of-care services.

KEY POINTS

- In a cohort of patients who saw a transitions-of-care pharmacist during an inpatient hospitalization, 3 factors (medication burden, comorbidity burden, and health insurance status) were the most predictive of the risk of a potentially avoidable 30-day readmission.
- The internally validated 3-component MEDCOINS tool, designed for use by pharmacists, was found useful in predicting 30-day potentially avoidable hospital readmissions.
- Pharmacists can use the MEDCOINS tool to efficiently identify patients most likely to benefit from additional follow-up or other interventions to prevent readmissions.

Methods

Study design and population. The study was a retrospective cohort study including consecutive adult patients admitted to all services of a large academic medical center in Providence, Rhode Island, who had an initial encounter with an inpatient transitions-of-care pharmacist during the period December 4, 2013–September 30, 2015. The 719-bed hospital is a member of the state's largest health system, with 36,000 inpatient admissions per year. The data set and cohort were originally collected for the purpose of monitoring the transitions-of-care pharmacy program. To be eligible for receipt of pharmacy transitions-of-care services and subsequent inclusion in the study cohort, patients must have been at least 18 years of age at the time of admission and not admitted for an observation stay. At the time the data were collected, there was 1 transitions-of-care clinical pharmacy specialist who provided transitions-of-care services. Occasionally other staff members were trained to provide additional support. Currently, a clinical pharmacy specialist manages the operations of the transitions-of-care program, and the service itself is staffed by 2 inpatient pharmacists. There is 1 primary pharmacist who staffs the service most days of the week, and another pharmacist covers the service when the primary pharmacist is unavailable. Pharmacists currently do not routinely complete medication reconciliation on admission or at discharge, but discharge medication reconciliation performed by the transitions-of-care pharmacist may occur in some cases if patients are selected for education. The transitions-of-care pharmacist provides education to high-risk patients, such as those with high-risk disease states (as indicated by CMS), those initiated on high-risk or high-cost medications, and those with polypharmacy or adherence issues. Identification of patients occurs by various mechanisms: (1) Providers within the hospital can place a consult order for the transitions-of-care pharmacist to provide education to patients, (2) a nurse care manager affiliated with a large primary care practice in the state can consult the pharmacy transitions-of-care service when mutual patients are admitted to the health system with a CMS-indicated high-risk disease state, and (3) transitions-of-care pharmacists select patients according to a list (generated by the electronic medical record) of admitted patients with CMS-designated high-risk disease states and those taking high-risk or high-cost medications. At the time the data were collected, minimal postdischarge follow-up occurred; occasionally, handoffs from the transitions-of-care pharmacist to a primary care practice pharmacist occurred.

All patients included in the data set were successfully discharged. Patients were not eligible for inclusion if they died within 30 days of discharge. Since the cohort inclusion criteria were defined prior to the study, additional patients were excluded only if (1) a transitions-of-care pharmacist mistakenly included a patient who was less than 18 years old at the time of admission or who died within 30 days of discharge or (2) information on an im-

portant potential predictor was missing from the patient record. The study was approved by the institutional review board of the health system.

Study outcomes. Since each patient in the cohort could have had several hospitalizations during the study period, we selected the first observed hospitalization during which the patient was seen by the transitions-of-care pharmacist as the index hospitalization. After this index hospitalization, patients could have 1 of 2 mutually exclusive outcomes: (1) a potentially avoidable readmission within 30 days and (2) survival without a potentially avoidable readmission at 30 days. These outcomes were measured in the electronic medical record. Consistent with prior literature, we were interested in developing a predictive tool specific to avoidable readmissions and in the contrast between patients with such a readmission and those without any readmission. We defined readmissions as unavoidable if they were unplanned (e.g., were not scheduled at the time of the index admission or involved planned treatment follow-up or planned chemotherapy). To ensure that readmissions met these criteria, a postgraduate year 2 pharmacy resident reviewed every readmission and confirmed the classification as unplanned and potentially avoidable. Admissions to any inpatient service of any hospital within the health system were considered. Readmissions to facilities outside the health system were unobservable in the data set and therefore not considered.

Predictor variables. We collected data on several types of variables that are readily available to staff and transitions-of-care pharmacists in an acute care setting at the time of discharge. We deprioritized variables that are often missing from the electronic medical record, for which data collection would require that the pharmacist interrupt the standard transitions-of-care workflow, or for which data collection would require a significant investment of time (e.g., counting diagnoses over the 12 months prior to admission). The domains of included variables were demographic information, healthcare utilization during hospitalization, chronic medical conditions, medication burden, and transitions-of-care pharmacist encounter characteristics. Pharmacist encounter characteristics included the number and severity of medication-related problems identified, the amount of time spent with the patient, whether prescribers were contacted, and whether patients filled their discharge prescriptions using the hospital's onsite pharmacy. Variables were chosen a priori and according to the published literature. Since pharmacists at the study site do not regularly review administrative or billing data in the course of practice, only information from the electronic medical record and pharmacy notes was considered.

Statistical analysis. We used univariable logistic regression to test for differences in predischarge characteristics between patients with a potentially avoidable 30-day readmission and those without one. Using data on all individuals in the study cohort, we created a multivariable logistic regression model that included all potential predictors from the univariable models that were significant at the level of $p < 0.2$. A final multivariable regression model that included only significant predictors in the initial multivariable regression model was then created. The results of this final multivariable regression model were used to develop a prediction score by using a regression coefficient–based scoring method. Integer scores were assigned by dividing risk-factor coefficients by the smallest coefficient and rounding up to the nearest integer. Once model derivation was completed, the risk of a 30-day potentially avoidable readmission was categorized at 3 levels (low, moderate, and high) for ease of use.

The discrimination of the resulting score was assessed in the full cohort using a naive and 10-fold cross-validated C statistic. The C statistic identified the ability of the score to distinguish between patients with and without a 30-day potentially avoidable readmission. Cross-validation permits the entire study cohort to be used for both the development and validation of the model. The cross-validation procedure was repeated 10 times, using a new random division of the data each time, and then the 10 summary estimates of the C statistic were averaged. How well the predicted probabilities of readmission matched the actual risk (known as calibration) was assessed using the Hosmer–Lemeshow goodness-of-fit test, in which nonsignificant p values indicate that the model is a good fit. In conjunction with the Hosmer–Lemeshow goodness-of-fit test, we also assessed calibration by comparing the observed number of readmissions with the predicted number of readmissions within 10 deciles of the predicted risk. All analyses were performed using Stata, version 14.0 (Stata Corp. LLC, College Station, TX) software.

Results

Information on 718 patients was housed in the preexisting transitions-of-care pharmacy database. Of those patients, 690 (96%) were included in the study cohort; patients were excluded due to mortality within 30 days of hospital discharge (n = 3, 0.4%), a documented age of <18 years at index admission (n = 6, 0.8%), and missing information on 1 or more potential predictors (n = 19, 2.6%). The mean ± S.D. age of the study cohort was 65 ± 14 years (range, 18–96 years), and 54% of included individuals were male. Approximately 38% of the patients had 6 or more chronic conditions, and 43% were taking 10 or more medications at discharge. Additional data on patient characteristics are provided in Table 1. The overall observed rate of potentially avoidable 30-day readmission was 14.8%.

In univariable logistic regression, several covariates were identified as potentially important predictors, including the transitions-of-care pharmacist contacting the prescriber about

Table 1. Characteristics of Patients in Study Cohort (n = 690)[a]

Characteristic	No. (%)[b]
Age, yr	
Mean ± S.D.	65 ± 14
Range	18–96
Age group	
<55	137 (20)
55–64	161 (23)
65–74	217 (32)
≥75	175 (25)
Sex	
Female	315 (46)
Male	375 (54)
Health insurance status	
Private	147 (21)
None	205 (30)
Public[c]	338 (49)
No. medications at discharge	
<10	397 (57)
≥10	293 (43)
No. chronic conditions at discharge	
<6	427 (62)
≥6	263 (38)
CMS-designated high-risk condition present[d]	
No	98 (14)
Yes	592 (86)
ICU use before index hospitalization	
No	341 (49)
Yes	349 (51)
Time spent by pharmacist on patient's care, min[e]	
<45	185 (27)
45 to <130	397 (57)
≥130	108 (16)
Prescriber contacted by pharmacist about patient's medications	
No	442 (64)
Yes	248 (36)
Patient filled discharge prescriptions at onsite pharmacy	
No	641 (93)
Yes	49 (7)
No. medication-related problems identified by pharmacist	

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the patient's medications (odds ratio [OR] versus no contact, 1.4; 95% confidence interval [CI], 0.9–2.1; p = 0.18) and any use of an intensive care unit (ICU) during the hospitalization (OR versus no ICU use, 0.7; 95% CI, 0.5–1.1; p = 0.16 [Table 2]). After entering these variables into a multivariable logistic regression, the following ones remained significant independent predictors of 30-day potentially avoidable readmission after a transitions-of-care pharmacist encounter: lack of health insurance (OR versus private insurance, 1.8; 95% CI, 0.8–3.9; p = 0.14), public health insurance (OR versus private insurance, 2.4; 95% CI, 1.2–5.0; p = 0.02), use of 10 or more medications at discharge (OR versus use of less than 10 medications, 1.4; 95% CI, 0.9–2.4; p = 0.18), and 6 or more chronic conditions at discharge (OR versus less than 6 conditions, 1.9; 95% CI, 1.1–3.4; p = 0.02) (Table 2). These variables form the 3-predictor or MEDCOINS score: medication count, comorbidity count, and health insurance status at discharge.

Detailed MEDCOINS scoring information for the study patients is provided in Table 3. Using those scores, the risk of potentially avoidable readmission was stratified into 3 categories: low, moderate, and high. Low-risk patients (those with a MEDCOINS score of 0 or 1 point [n = 114, 16.5%]) were estimated to have a 5.7% risk of potentially avoidable readmission; the observed readmission rate in this group was 4.4%. Moderate-risk patients (those with a score of 2–4 points [n = 366, 53.0%]) had a 13.2% estimated risk and an observed readmission rate of 13.9%. High-risk patients (those with a score of 5 or 6 points [n = 210, 30.4%]) had a 22.5% estimated probability of potentially avoidable readmission and an observed readmission rate of 21.9%. Compared with low-risk individuals, moderate-risk individuals were 3.1 (95% CI, 1.3–7.8) times more likely and high-risk individuals were 5.0 (95% CI, 2.0–12.2) times more likely to have a 30-day potentially avoidable readmission.

The Hosmer–Lemeshow goodness-of-fit statistic indicated good calibration (p = 0.99). The discriminatory power of the MEDCOINS score was fair, with a naive C statistic of 0.65 and a 10-fold cross-validated C statistic of 0.65 (95% CI, 0.60–0.70).

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Table 1. Characteristics of Patients in Study Cohort (n = 690)[a]

Characteristic	No. (%)[b]
0	105 (15)
1	460 (67)
≥2	125 (18)
Any serious medication-related problems identified by pharmacist	
No	684 (99)
Yes	6 (1)

[a]CMS = Centers for Medicare and Medicaid Services, ICU = intensive care unit.
[b]Unless otherwise indicated.
[c]Public health insurance includes Medicare, Medicaid, or a combination of both.
[d]High-risk conditions were those designated by CMS under the Readmissions Reduction Program, including acute myocardial infarction, heart failure, pneumonia, chronic obstructive pulmonary disease, and diabetes.
[e]Includes time spent evaluating the patient and creating a care plan, educating or counseling the patient, and entering documentation in the medical record.

Discussion

In our study of 690 hospital discharges from a large academic health system, we developed and internally validated the MEDCOINS score to predict 30-day readmission risk after having an encounter with a transitions-of-care pharmacist. This practical model, which was designed for use by pharmacists, has fair discriminatory ability and excellent calibration. The model includes variables readily available to pharmacists to identify high-risk patients who would likely benefit from continued care in the ambulatory care setting after hospital discharge, thus enabling targeting of pharmacy services to those who need them most.

The 14.8% overall observed rate of 30-day potentially avoidable readmission in our study was consistent with findings in previous studies.[1] To our knowledge, no previous studies have developed tools to be used specifically by pharmacists to assist in identifying patients who would benefit from additional services of the type described in this article. Other models have been developed to identify patients at high risk for readmission, but those models were not designed for use by pharmacists or with ease of use (in terms of clinical pharmacy workflow) as a key development goal. A systematic review was conducted by Kansagara et al.[8] to evaluate 30 existing readmission risk prediction models. None of the reviewed models were developed for a specific end user (e.g., physician, pharmacist).

Findings from other 30-day readmission prediction tools and models were generally consistent with those of our study.[8,9] As demonstrated in previous studies[10-14] and thus expected in our own, the number of comorbidities present and the number of medications a patient was taking at discharge were important predictors of 30-day readmission. One of the "8Ps" of Project BOOST (Better Outcomes by Optimizing Safe Transitions)—a toolkit for discharge optimization—includes "problems with medications" or polypharmacy, defined as taking 10 or more routine medications, the same threshold identified as indicating high readmission risk in our study.[15] Other studies evaluating transitions-of-care programs also included the number of medications as part of the readmission risk assessment; however, the thresholds were different from those used with the MEDCOINS tool or were not specified.[8] Although medication count and comorbidity burden are typically used as predictors of readmission, several popular tools do not contain 1 or both of those predictors.[14,16,17] To our knowledge, the inclusion of health insurance status as a predictor of readmission was limited in prior tools, with only 1 study including that variable in the evaluated risk prediction model.[11] This variable may predict access to healthcare and, ultimately, the ability to adhere to a new discharge plan and is therefore important.

Strengths of our tool include utilization of variables and predictors that are readily available to the pharmacist. Pharmacists often collect the variables we considered as part of the usual course of chart review in preparation for patient counseling. Therefore, there would be little to no interruption of workflow in calculating the MEDCOINS score during clinical pharmacy practice. In addition, this tool was developed using data on readmissions that can be avoided rather than data on a mix of avoidable and unavoidable readmissions. We also included patients with a wide range of admission diagnoses to maximize the generalizability of our tool to as many patients as possible. The MEDCOINS tool can be used close to discharge to allow for timely preparation of post-discharge follow-up. The tool is simple enough to calculate by hand using the form we provide in the appendix, but it can also be incorporated into the electronic medical record and calculated automatically for each patient (along with population-level reporting metrics). In an ideal implementation, patients would be automatically identified as being at high risk (30 of every 100 patients with a MEDCOINS score of 5 or 6, on average) during hospitalization and enrolled in a follow-up program in which a pharmacist would

Table 2. Predictors of 30-Day Readmission in Univariable and Multivariable Models[a]

	Model					
	Univariable		Multivariable		Final Multivariable	
Factor	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Age range, yr						
<55	Reference		…[b]		…	
55–64	1.2 (0.6–2.3)	0.56	…		…	
65–74	1.1 (0.6–2.1)	0.76	…		…	
≥75	1.3 (0.7–2.4)	0.48	…		…	
Sex						
Female	Reference		…		…	
Male	0.9 (0.6–1.4)	0.60	…		…	
Health insurance status						
Private	Reference		Reference		Reference	
None	2.2 (1.0–4.6)	0.04	1.8 (0.8–3.9)	0.14	1.9 (0.9–4.1)	0.11
Public[c]	3.2 (1.6–6.4)	0.001	2.4 (1.2–5.0)	0.02	2.5 (1.3–5.2)	0.01
No. medications at discharge						
<10	Reference		Reference		Reference	
≥10	1.8 (1.1–2.8)	0.01	1.4 (0.8–2.3)	0.18	1.5 (0.9–2.4)	0.16
No. chronic conditions at discharge						
<6	Reference		Reference		Reference	
≥6	2.6 (1.6–4.3)	<0.001	1.9 (1.1–3.4)	0.02	2.1 (1.2–3.6)	0.01
CMS-designated high-risk condition present[d]						
No	Reference		Reference		…	
Yes	1.6 (0.8–3.2)	0.17	1.2 (0.6–2.5)	0.58	…	
ICU use during index hospitalization						
No	Reference		Reference		…	
Yes	0.7 (0.5–1.1)	0.16	0.8 (0.5–1.3)	0.43	…	
Time spent by pharmacist on patient's care, min[e]						
<45	Reference		…		…	
45 to <130	0.9 (0.5–1.5)	0.68	…		…	
≥130	1.3 (0.7–2.5)	0.48	…		…	
Prescriber contacted by pharmacist about patient's medications						
No	Reference		Reference		…	
Yes	1.4 (0.9–2.1)	0.18	1.1 (0.7–1.8)	0.61	…	
Patient filled medications at onsite pharmacy upon discharge						
No	Reference		…		…	
Yes	1.3 (0.6–2.9)	0.53	…		…	
No. medication-related problems identified by pharmacist						
0	Reference		…		…	
1	1.0 (0.5–1.8)	0.95	…		…	
≥2	0.6 (0.3–1.4)	0.23	…		…	

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Table 2. Predictors of 30-Day Readmission in Univariable and Multivariable Models[a]

	Model					
	Univariable		Multivariable		Final Multivariable	
Factor	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Any serious medication-related problem identified by pharmacist						
No	Reference		…		…	
Yes	2.9 (0.5–16.2)	0.22	…		…	

[a]OR = odds ratio, CI = confidence interval, CMS = Centers for Medicare and Medicaid Services, ICU = intensive care unit.
[b]Not evaluated.
[c]Public health insurance includes Medicare, Medicaid, or a combination of both.
[d]High-risk conditions are those designated by CMS under the Readmissions Reduction Program, including acute myocardial infarction, heart failure, pneumonia, chronic obstructive pulmonary disease, and diabetes.
[e]Includes time evaluating the patient and creating a care plan, educating or counseling the patient, and entering documention in the medical record.

Table 3. Details of MEDCOINS Scoring Before Risk Categorization (*n* = 690)

MEDCOINS Score	No. Patients With Score	No. 30-Day Readmissions	Observed Readmission Rate (%)[a]	Estimated Readmission Risk (%)
0	83	4	4.8	5.7
1	31	1	3.2	5.7
2	119	15	12.6	11.8
3	192	28	14.6	13.4
4	55	8	14.6	15.4
5	82	15	18.3	20.0
6	128	31	24.2	24.1

[a]As documented during the 22-month study period.

regularly screen for newly added patients and contact them via phone within 2 business days. During the phone call, the pharmacist could conduct a brief medication reconciliation and inquire if the patient has been adherent to discharge plans and medication changes; these activities would be in preparation for the eventual establishment of a complex care clinic, in which patients could also have a face-to-face visit with an interprofessional team including pharmacists. Phone follow-up encounters could then be assessed for the need for further improvements.

The results of our study must be interpreted in light of several limitations. Our prediction model was developed and validated using data from a single health system. Therefore, data on readmissions to outside facilities were not captured, although inter–health system collaborations could help overcome this limitation in the future. Our use of data from a single health system could also potentially limit the generalizability of our tool, so pharmacists who use it should verify that the distribution of characteristics in their institution's patient population is similar to that in our study cohort. We also recognize that there may be additional characteristics that could predict 30-day readmission but were not collected and available in our data set. For instance, some researchers using other readmission tools identified length of stay as a predictor of 30-day readmission[8,9,11,13,14,16]; however, that information was not collected in our study because other potential predictors were identified by our health-system stakeholders as being of greater importance. In addition, although other tools collected data on social factors, this information was not easily retrievable by the pharmacist and was of questionable validity when it was available. Therefore, data on social factors was ultimately not considered in the MEDCOINS tool. However, health insurance status may actually serve as a reason-

able proxy measure for several social determinants of hospital readmission. As pharmacy practice evolves and new information becomes readily available to pharmacists in their daily workflow, the MEDCOINS tool should be updated to include such characteristics, thereby maximizing the utility of the tool. However, the addition of new characteristics must be weighed against compromising the ease of use of the tool.

Since completion of this research, the MEDCOINS tool has been pilot tested as part of a postdischarge transitions-of-care follow-up program. The service is currently pharmacy resident driven. The pharmacy resident is enrolled in a postgraduate year 2 ambulatory care program and is currently on a transitions-of-care rotation. From January 5 through May 18, 2017, 63 patients were referred to the program, of whom 42 were contacted through outreach. The pharmacy resident performs discharge follow-up via telephone encounters approximately 1 half day per week; at times, this work is supplemented by clinical pharmacist involvement.

Patients are referred to the follow-up program by inpatient transitions-of-care pharmacists across 2 hospital affiliates within the health system. The inpatient transitions-of-care pharmacist calculates the MEDCOINS score for each patient seen while hospitalized. If the patient is identified as having a high risk of being readmitted within 30 days (i.e., a MEDCOINS score of 5 or 6), or if the score is less than 5 but the pharmacist determines that the patient would benefit from additional pharmacy intervention to reduce readmission risk, the inpatient transitions-of-care pharmacist refers the patient to the MEDCOINS follow-up program. The pharmacist is able to refer the patient by simply adding him or her to a follow-up list in the electronic medical record. This list indicates the date the patient was discharged and the reason for admission, among other information.

During discharge follow-up encounters, the pharmacist takes part in an interaction with the patient, which includes, at a minimum, a thorough medication reconciliation and review of changes made during hospitalization, adverse-effect identification and management, medication adherence review, and discussion of the importance of adherence to discharge instructions (e.g., attending follow-up provider appointments, obtaining follow-up laboratory tests, acquiring medications from the pharmacy in a timely manner). The pharmacist documents all patient encounters in the electronic medical record, including notation of interventions identified. If necessary, the pharmacist also reaches out to the patient's primary care provider to inform of discrepancies, consult for management of medication-related problems, and triage other issues beyond the scope of the pharmacist. An example of this was an intervention identified as "critical" in nature, targeting an elderly patient who was discovered to be taking nearly double the intended dose of a medication at the time of discharge. This discovery resulted in escalation of the intervention to the hospital's safety team to investigate a possible system error, potentially leading to an avoided readmission.

Data on outcomes for patients enrolled in the follow-up program are currently being collected. Notably, some of the problems intervened on by the outpatient transitions-of-care pharmacist included serious therapeutic duplications, issues related to medication access, nonadherence, lack of patient understanding of medication regimens, continued administration of discontinued medications, and adverse drug effects.

Conclusion

Among a cohort of patients who were seen by a transitions-of-care pharmacist during an inpatient hospitalization, comorbidity burden, number of medications, and health insurance coverage were most predictive of 30-day readmission. The MEDCOINS tool was found to have fair discriminative ability and good calibration.

Disclosures

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Appendix—Tool for predicting 30-day readmission risk

MEDCOINS Scoring Tool for Risk Assessment of Readmission

Step 1: Medication Count
- Number of medications at discharge:_____
  - o If ≥10 medications: **1 point**

Box 1

Step 2: Chronic Condition Count
- Number of chronic conditions at discharge:_____
  - o If ≥6 conditions: **2 points**

Box 2

Step 3: Health Insurance Coverage
- Type of health insurance (circle one): None Public[a] Private
  - o If None: **2 points**
  - o If Public: **3 points**

Box 3

Add the numbers in Box 1, Box 2, and Box 3 to calculate the MEDCOINS score, enter into box below,[b] and determine risk category using table:

MEDCOINS

Points	Risk Category	Estimated Risk (%) of Readmission
0–1	Low	5.7
2–4	Moderate	13.2
5–6	High	22.5

[a]Public health insurance includes Medicare, Medicaid, or a combination of both.

[b]Maximum score, 6 points