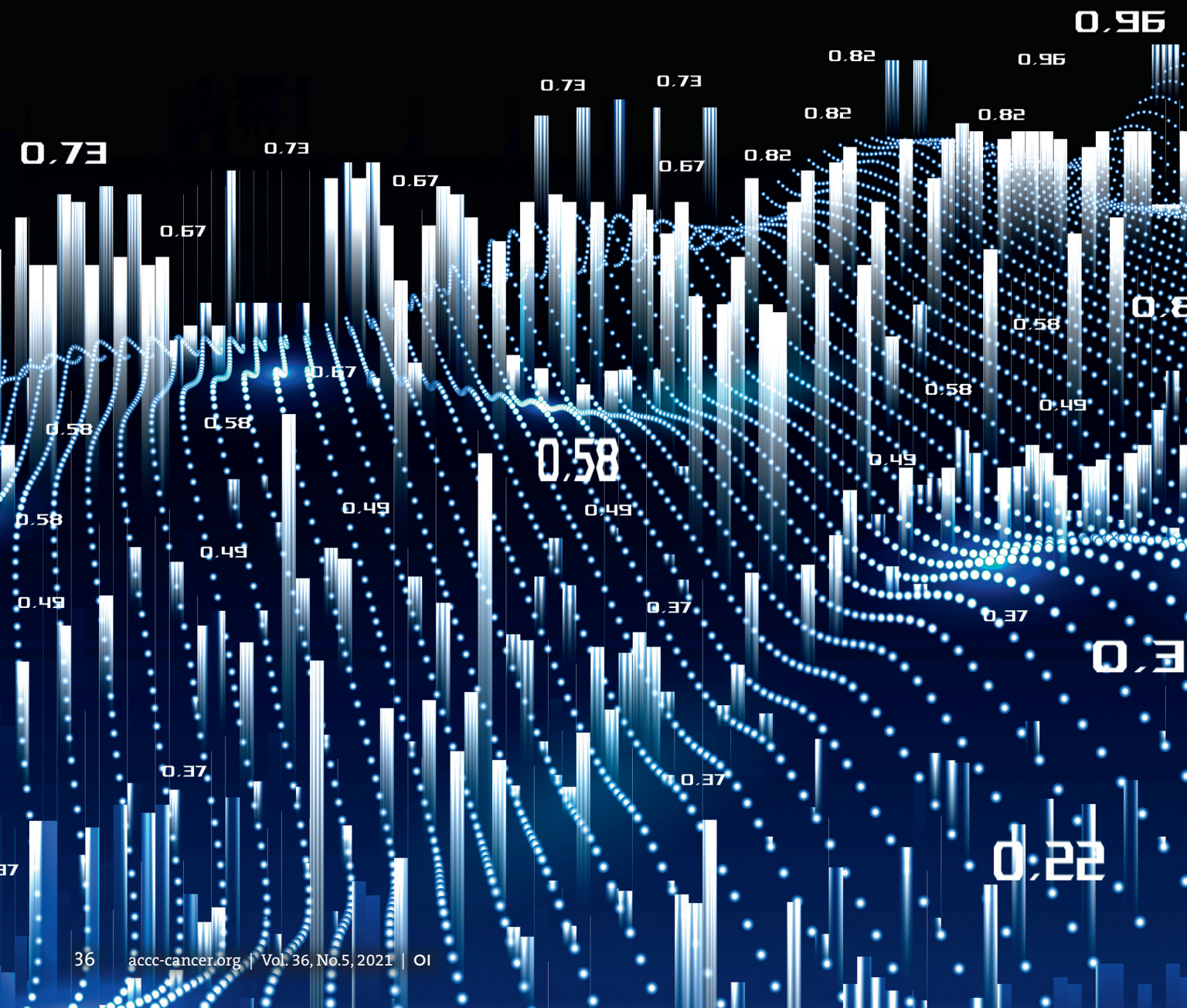


# Mining Data to Improve Care Coordination of Patients with Hematologic Malignancies



## Abstract

**Purpose:** The purpose of this study was to assess patient, disease, and medication-related factors that affect the rate of unplanned readmissions before next chemotherapy cycle or within 30 days since last chemotherapy admission in patients with hematologic malignancies.

**Methods:** This study is a retrospective chart review. All patients with leukemia, lymphoma, or multiple myeloma aged >18 years who received chemotherapy over a three-year period were evaluated.

**Results:** A total of 107 inpatient chemotherapy encounters and 47 patients were included. Of those encounters that led to readmission, 68.7 percent ( $n = 22/32$ ,  $p = 0.2212$ ) did not have medications filled prior to discharge, 78.1 percent ( $n = 25/32$ ,  $p = 0.4026$ ) did not receive a follow-up phone call, and 50 percent ( $n = 16/32$ ,  $p = 0.0233$ ) did not attend their follow-up appointment. In the readmission group, 9 patients had an adverse event (AE) and none were communicated upon discharge. In the not readmitted group, 34 had an AE and 15 were communicated upon discharge (100 percent vs. 44 percent;  $p = 0.0169$ ).

**Conclusions:** Factors that contributed to readmission in this patient population include providers not communicating upon discharge whether the patient had an AE during treatment and patients not attending their follow-up appointment. There is a need to improve transitions of care coordination and communication in patients with hematologic malignancies.

The term *transitions of care* refers to the movement of patients between various healthcare settings and/or healthcare providers. Ineffective transitions of care have been shown to increase the number of adverse events (AEs), patient safety issues, 30-day hospital readmission rates, and costs.<sup>1,2</sup> It was estimated that avoidable complications and unnecessary hospital readmissions due to inadequate transitions of care were responsible for \$25 billion to \$45 billion in 2011 alone.<sup>2</sup> A study by Jencks and colleagues, analyzing Medicare patient claims from October 2003 to December 2004, concluded that about 20 percent of Medicare patients were readmitted within 30 days, about 50 percent of whom did not receive post-discharge follow-up.<sup>3</sup> Another prospective cohort study found that one in five patients transitioned from hospital to home experienced an AE within three weeks of discharge. Of these AEs, 66 percent were concluded to be medication related.<sup>4</sup>

Three common root causes of ineffective transitions of care have been identified by the Joint Commission: communication, patient education, and follow-up breakdowns.<sup>5</sup> Implementation of medication reconciliation and expectations for handoffs are national patient safety goals recognized by the Joint Commission. The World Health Organization also has published strategies for hospitals to implement effective transitions of care.<sup>1</sup> Currently, there is no gold standard model or guideline specifically for medication transitions, but some essential components have been identified in the literature, including medication reconciliation, structured discharge communication, and facilitation (e.g., meds to beds, patient education, and timely post-discharge follow-up).

Patients with cancer are a complex and high-risk patient population. Patients with hematologic malignancies often require brief admissions for monthly chemotherapy due to an inability

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**Brown and colleagues concluded that 33 percent of readmissions within 7 days of discharge were for potentially preventable complications, including nausea, vomiting, dehydration, and pain.<sup>7,8</sup>**

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to deliver treatment safely in the outpatient setting. In addition to the base cancer treatment plan, patients can require initiation of prophylactic antimicrobials, antiemetics, anticoagulation, steroids, pain medications, colony-stimulating factor drugs and other adjuvant medications, as well as new high-risk oral anti-cancer treatments added into treatment regimens that need to be coordinated prior to discharge. Proper education and follow-up at discharge becomes even more critical. Chemotherapy itself requires frequent follow-up for blood work, symptom management, and evaluation of cancer response. All of these factors increase the risk for ineffective and unsafe transitions of care in oncology patients and higher readmission rates.

Shank and colleagues identified common transition of care challenges in patients receiving cancer treatment. Causes are similar to those identified by the Joint Commission in the general population. Specific challenges to good transitions of care identified include patient health literacy, medication adherence, comorbidities, transportation access to care services, age, and financial issues. System factors identified include lack of staff, communication of complex care across health systems, caring for multiple patients, and challenges in communicating discharge plans with outpatient providers.<sup>6</sup>

A systematic review of 56 studies of hospital readmissions among patients with cancer by Bell and colleagues found that the highest 30-day readmission rates (up to 34 percent) were found in patients with bladder, pancreatic, ovarian, and hematologic malignancies.<sup>7</sup> Predictors of readmission included patients with significant comorbidities, male gender, older age, more advanced disease, and low socio-economic status. The top five medication- and disease-related reasons for readmission included gastrointestinal complications (nausea, vomiting, diarrhea), infection, nutritional complications (dehydration, malnutrition), surgical complications (blood loss), and cardiopulmonary complications (respiratory, pneumonia). Brown and colleagues concluded that 33 percent of readmissions within 7 days of discharge were for potentially preventable complications, including nausea, vomiting, dehydration, and pain.<sup>7,8</sup> In 2014 an academic medical center implemented a process improvement project to reduce 30-day unplanned hospital readmissions in palliative and medical

oncology patients. The improvement project included provider education, nursing phone calls within 48 hours of discharge, and post-discharge follow-up provider appointments within five business days. Before the project, readmission rates from January 2013 to April 2014 were 27.4 percent; after project implementation, readmission rates dropped to 22.9 percent ( $p < 0.01$ ; relative risk reduction = 18 percent).<sup>9</sup>

### **Objectives and Purpose**

This study was conducted to evaluate the current transition of care processes and to identify areas of needed improvement and potential for increased involvement of the oncology pharmacist. The primary objective of this study was to evaluate medication-related factors that affect the rate of unplanned readmissions before subsequent chemotherapy cycles or within 30-days of admission where chemotherapy was administered. Secondary objectives included identifying whether all changes in medications, treatment plans, and AEs noted during admission where chemotherapy was received were communicated upon discharge to the patient's outpatient provider and whether all required appointments were made and attended by patients post-discharge. This study assessed the current medication transition of care processes in patients with hematologic malignancies at the MetroHealth System and attempted to find areas for consistent pharmacist involvement and overall process improvement.

### **Methodology**

This study is a retrospective chart review approved by MetroHealth Systems' Institutional Review Board. The study included all patients with leukemia, lymphoma, multiple myeloma, and myelodysplastic syndrome aged 18 years and older who received inpatient chemotherapy treatment while admitted at MetroHealth. The only exclusion criteria were patients under the age of 18 years old. All patient data were extracted from MetroHealth Systems' electronic medical record system (EPIC), including Care Everywhere.<sup>TM</sup>

The data collection period was from Jan. 1, 2015, to Jan. 1, 2018, to capture and assess a sufficient number of patients. All data collected were stored in the secure electronic database REDCap.<sup>TM</sup> Demographic data collected included age, sex, ethnicity, insurance type, and preferred language. Medical information collected included malignancy type, attendance and communication to patients of the required appointments for outpatient follow-up after discharge, treatment regimen, route of chemotherapy, number of chemotherapy cycles, adverse effects (infusion reactions, drug toxicity, nausea, decline in organ function, or allergic reactions) during treatment, treatment plan modifications during admission, and disposition location. Other information collected included discharge education, whether patients' prescriptions were filled prior to discharge, follow-up phone calls, medication-related discharge summary information and after-visit summary information, follow-up appointments, and readmission information.

**Table 1. Baseline Demographics**

	Total Patients	Inpatient Encounters/ Cycles
	47	107
Total Number		%
Females	16	34
Males	31	66
Median age	64	N/A
Ethnicity		
African American	19	40.4
American Indian/ Alaskan Native	1	2.1
Caucasian	24	51.1
Hispanic	1	2.1
Other	2	4.3
Insurance Type		
Commercial insurance	9	19.1
Medicaid	16	34
Medicare	14	29.8
Uninsured	8	17
Preferred Language		
English	44	93.6
Spanish	1	2.1
Other	2	4.3
Malignancy		
Leukemia	11	23.40
Lymphoma	19	40.42
Multiple myeloma	17	36.17
Myelodysplastic syndrome	0	0

**Statistical Analysis**

Descriptive statistics were used for all data points including continuous data. Chi-square/Fisher’s exact tests were used for categorical data. A *p* value less than 0.05 was used to determine statistical significance.

**Results**

Forty-seven patients met the inclusion criteria for this study. A majority of patients were male (66 percent) with a median age of 64 years old. Baseline demographics are listed in Table 1, left. When looking at the primary endpoint of readmission, there were no statistically significant demographic differences between the patients who were readmitted and those who were not (Table 2, p. 40).

Overall, 32 patients were readmitted prior to their next cycle or within 30 days of last admission and therefore met the primary endpoint. Reasons for readmission were separated into four groups: cancer-related (46 percent), non-cancer-related (11 percent), infection (38 percent), and medication-related (5 percent). Cancer-related readmissions were those readmissions directly due to cancer or the expected side effects of cancer treatment (e.g., tumor lysis syndrome, neutropenia, and thrombocytopenia). Non-cancer-related readmissions included readmissions for reasons not directly due to the patient’s cancer or chemotherapy (e.g., surgical complications, hypotension, chronic obstructive pulmonary disease exacerbation, etc.). Readmissions for infection included patients who had a diagnosis code for infection and were treated with antibiotics (including febrile neutropenia). Readmissions that were considered medication-related included acute kidney injury directly related to nephrotoxic chemotherapy, nausea, vomiting, dehydration, and chemotherapy-induced diarrhea. These designations were applied consistently to all data points examined by one reviewer according to the documentation in the electronic medical record for the readmission encounter.

Of the 32 readmissions, 16 developed infection and/or febrile neutropenia. Of the 16 patients with infection, 3 did not receive any type of prophylactic antimicrobials at discharge, and 6 did not receive growth factor support. Of those who did not receive prophylactic antimicrobials, at least one patient qualified for antimicrobials based on their malignancy treatment risks as per the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology.<sup>10</sup> Of the 6 patients who did not receive growth factor support, two were scheduled to receive it but did not attend the follow-up appointment.

Table 3, p. 41 lists the results of studied readmission factors. The data were collected for all encounters and compared between patients who did and did not meet the primary endpoint of readmission. Thirty-five patients did not attend their follow-up appointments with the oncologist (16 [56 percent] in the readmitted group vs. 19 [25.3 percent] in the not readmitted group; *p* = 0.0233). Of those 16 patients who were readmitted, reasons for not attending their follow-up appointment included readmission prior to follow-up (5; 31.2 percent), appointment was not scheduled (4; 25 percent), lack of transportation (1; 6.2 percent),

**Table 2. Comparing Baseline Demographics Between Patients Not Readmitted and Readmitted**

<b>N = 107 Total Encounters</b>	<b>Not Readmitted (n = 75)</b>	<b>Readmitted (n = 32)</b>	<b>p Value</b>
Gender: male, n (%)	55 (73.3)	23 (71.9)	1.00
Age: >60 years, n (%)	54 (72)	19 (59.3)	0.2573
Ethnicity: Caucasian, n (%)	41 (54.6)	14 (43.7)	0.3985
Insurance:			
Medicare/Medicaid, n (%)	54 (72)	22 (68.7)	0.8169
Uninsured, n (%)	12 (16)	7 (21.8)	0.4180
Language: English, n (%)	71 (94.6)	30 (93.7)	1.00
Malignancy:			
Leukemia, n (%)	18 (24)	5 (16.6)	0.4436
Lymphoma, n (%)	43 (57.3)	23 (71.8)	0.1949
Multiple myeloma, n (%)	14 (18.6)	4 (12.5)	0.5763

patient had to reschedule (1; 6.2 percent), and no-show/unknown (5; 31.2 percent).

Of the 43 patients who had an adverse reaction during treatment, 24 events (55 percent) were not communicated upon discharge. In the readmission group, 9 patients had adverse effects and none of those events were communicated upon discharge ( $n = 9/9$ ; 100 percent); in the not readmitted group, 34 had adverse effects and 15 were communicated upon discharge ( $n = 15/34$ ; 44 percent;  $p = 0.0169$ ; 95 percent confidence interval, 0.0074-1.7261). Of the 36 patients who had treatment plan modifications made while they were admitted, 24 (66 percent) were not communicated upon discharge. In the readmission group, 11 patients had changes made to their medications, 7 of which ( $n = 7/11$ ; 63 percent) were communicated; in the not readmitted group, 25 had changes made to their medications, 17 of which ( $n = 17/25$ ; 68 percent) were not communicated upon discharge ( $p = 1.00$ ).

## Discussion

MetroHealth System is a 730-bed teaching hospital; it is common for attending physicians and residents to rotate between multiple services and patients. According to MetroHealth Systems' scheduling data, patients can have up to five physicians involved in their care on a weekly basis. This increases the opportunities for communication breakdowns during transitions of care. MetroHealth is also a safety net hospital with more than 20 outpatient locations, including three centers for cancer care and a dedicated 17-bed inpatient unit. Patient factors, such as health literacy, adherence, communication across the system, and financial issues, are also of great importance within our cancer population.

Currently there are limited transitions of care measures in

place in the oncology patient population at many institutions, including MetroHealth. Transitions of care strategies currently implemented by the oncology service line at MetroHealth include a social work discharge huddle, a mandatory medication reconciliation upon care transition, and the provision to patients at discharge of an after-visit summary that includes an updated medication list, event summary of the hospital admission, and subsequent follow-up appointments. Pharmacists often make notes in the patients' treatment plan, but these notes are not visible to providers. MetroHealth System's oncology service line is moving to a hospitalist model where the primary oncologists provide consults only, which increases the need for multidisciplinary communication and good transitions of care. Several other institutions follow a similar model and may benefit from the thoughts and data in this article.

There were several limitations noted during this study. There was a change in nursing documentation in the electronic medical record that required formal documentation of education provided by nursing at discharge. This affected over half of the encounters. Another limitation was that patients may have been admitted to outside facilities that our electronic medical record system does not have access to, so medication transitions could not be verified and readmissions could not be accounted for. In addition, this is a retrospective, single-center study in a relatively small patient population.

Future directions for process improvement include several oncology pharmacist-led interventions. Examples include a formalized pharmacist medication transitions of care note, patient medication education at discharge with specific focus on encouraging use of the Meds to Beds program, and attempting to ensure

**Table 3. Results of Studied Readmission Factors**

<b>N = 107 Total Encounters</b>	<b>All Encounters (n = 107)</b>	<b>Not Readmitted (n = 75)</b>	<b>Readmitted (n = 32)</b>	<b>p Value</b>
Cycle #1, n (%)	56 (52.3)	38 (60.6)	18 (56.2)	0.6746
Adverse reactions during treatment, n (%)	43 (40.1)	34 (45.5)	9 (28.1)	0.1318
Modifications made to treatment plan, n (%)	36 (33.6)	25 (33.3)	11 (34.3)	1.00
Pharmacy notes added to treatment plan, n (%)	53 (49.5)	36 (48)	17 (53.1)	0.6765
Transferred while inpatient (intensive care unit/ telehealth), n (%)	11 (10.3)	6 (8)	5 (15.6)	0.2985
No verbal discharge education, n (%)	43 (40.1)	32 (42.6)	10 (31.2)	0.2893
No medications filled prior to discharge, n (%)	88 (82.2)	60 (80)	22 (68.7)	0.2212
No follow-up phone call, n (%)	89 (83.1)	64 (85.3)	25 (78.1)	0.4026
Had scheduled follow-up with oncologist at discharge, n (%)	69 (47.2)	47 (62.6)	22 (68.1)	0.6606
Disposition location, n (%)				
Home	77 (71.9)	58 (77.3)	19 (59.3)	<b>0.0652</b>
Homecare	12 (12.1)	8 (10.6)	5 (15.6)	0.5237
Homeless	5 (4.6)	2 (2.6)	3 (9.3)	0.1567
Skilled nursing facility	6 (5.6)	2 (2.6)	4 (12.5)	<b>0.0641</b>
Did not attend follow-up appointment with oncologist, n (%)	72 (67.2)	19 (25.3)	16 (50)	<b>0.0233</b>

Note: Significant values  $p < 0.05$  have been bolded.


that all patients have scheduled follow-up appointments within a specified time frame for laboratory monitoring, patient assessment, and medication administrations—all of which should be communicated in writing to the patient, caregiver, and family prior to discharge.

### Conclusion

This study shows that the most significant factors that contributed to readmission in patients with hematologic malignancies at MetroHealth System included patients not attending follow-up appointments with the primary oncologist ( $p = 0.0233$ ) and lack of communication to the outpatient provider of adverse reactions that occurred during treatment ( $p = 0.0169$ ). One factor trending toward statistical significance was readmission from a skilled

**Lack of provider communication of adverse reactions and attendance at follow-up appointments prevents the outpatient oncologist from being able to make modifications in patient care that could prevent subsequent readmissions.**

nursing facility ( $p = 0.0641$ ), suggesting that transitions to those locations at discharge need a more formalized process or scrutiny. There is a need to further evaluate why patients did not attend follow-up appointments (e.g., transportation issues, lack of appointment awareness, or other). Lack of provider communication of adverse reactions and attendance at follow-up appointments prevents the outpatient oncologist from being able to make modifications in patient care that could prevent subsequent readmissions.

Overall, there is a need to improve the medication transitions of care process and general discharge communication regarding medications and follow-up care in this population. 

### Acknowledgment

Nilam Patel, PharmD, BCPS, is acknowledged for her contribution to this research project.

### Disclosure Statement

The authors report no conflict of interest.

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