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Medication Errors in Outpatient Hematology and Oncology Clinics

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Abstract

Oncology care is increasingly provided in outpatient settings because of its increased patient convenience and decreased cost. Reported medication errors in this setting have not been fully explored and give cause for examination. A query of the Pennsylvania Patient Safety Reporting System (PA-PSRS) database for reports from July 2015 through June 2017 in outpatient hematology and oncology clinics affiliated with hospitals or health systems revealed 1,015 reported medication errors. More than half (53.7%, n = 545) reached the patient. The most commonly reported event types included dose omissions (15.3%, n = 155) and wrong dose/over dosage (13.1%, n = 133). High-alert medications were reported in 55.5% (n = 563) of the events. Antineoplastic agents made up 94.3% (n = 531) of medication errors reported with high-alert medications. Due to the potential hazards associated with antineoplastic agents, special care is warranted to reduce the risk of errors associated with this class of medications. Error reduction strategies in outpatient hematology and oncology clinics begin with a risk assessment of medication use processes and focus on patient information, order communication, quality processes, and risk management.

Introduction

Errors may occur with any medication; however, chemotherapy presents unique dangers due to narrow therapeutic indices, potential toxicity even at therapeutic dosages, complex regimens, and a vulnerable cancer patient population.¹ Experts estimate that there are more than 20 million visits for chemotherapy annually in the United States.^{2,3} Of these visits, the vast majority are in ambulatory settings where the chemotherapy is administered by nurses.

Despite this, few medication-error studies have been conducted in outpatient hematology and oncology clinics.⁴⁻⁶ Existing literature describes medication errors occurring in the inpatient setting on oncology units. Ford et al. characterized self-reported errors from nurses in a two-year prospective study in which nurses recorded 141 medication administration errors.⁷ Forty-one percent of these errors were nurse administration errors, 38% were nurse or pharmacy dispensing errors, and 21% were order writing and transcribing errors.⁷

Pennsylvania Patient Safety Authority analysts reviewed medication errors associated with outpatient hematology and oncology clinics affiliated with hospitals or health systems. Analysts sought to characterize the types of medication-error events that occurred in this practice setting, identify contributing factors, and describe appropriate system-based risk reduction strategies.

Methods

Analysts queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) database for medication error events that occurred from July 2015 through June 2017 and were categorized as occurring in outpatient hematology and oncology clinics affiliated with hospitals or health systems.

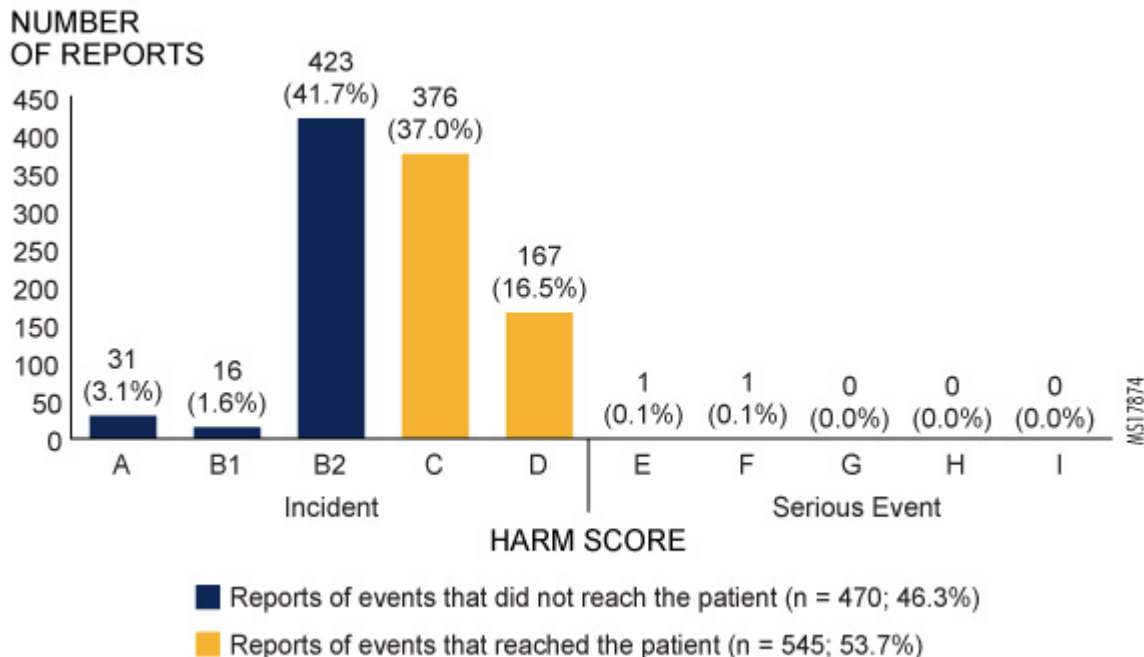
In PA-PSRS, outpatient care area types include "O/P" as part of the name. Analysts queried the care area type field for reports that included "O/P." The data was then filtered in Excel for care area types that indicated they were from oncology and hematology clinics.

Reports were analyzed based on the medication name, event type, event description, nodes of the medication use process, and harm score,⁸ adapted from the National Coordinating Council for Medication Error Reporting and Prevention harm index,⁹ as provided by the reporting facility. Analysts completed the medication-name field in reports in which a medication-name data field was left blank or incomplete but the name was provided in the event description. Reports related to both chemotherapy and non-chemotherapy medications (e.g., pre-medications, analgesics, and colony stimulating factors) were included in the analysis. Errors with an event type categorized as "Other" by the reporting facility were further evaluated to classify the event type. Analysts also examined all the reported event details for common contributing factors associated with reported events.

Results

The query yielded 1,015 event reports of potential or actual medication errors. More than one-half (53.7%, n = 545) of events reached the patient (PA-PSRS harm score C through I).⁸ More than forty-three percent (43.3%; n = 439) of events were reported as errors that were intercepted before reaching the patient (harm score B1 = 1.6% [n = 16] and B2 = 41.7% [n = 423]), and 3.1% (n = 31) of events were reported as circumstances or events that have the capacity to cause error (harm score A; Figure 1).

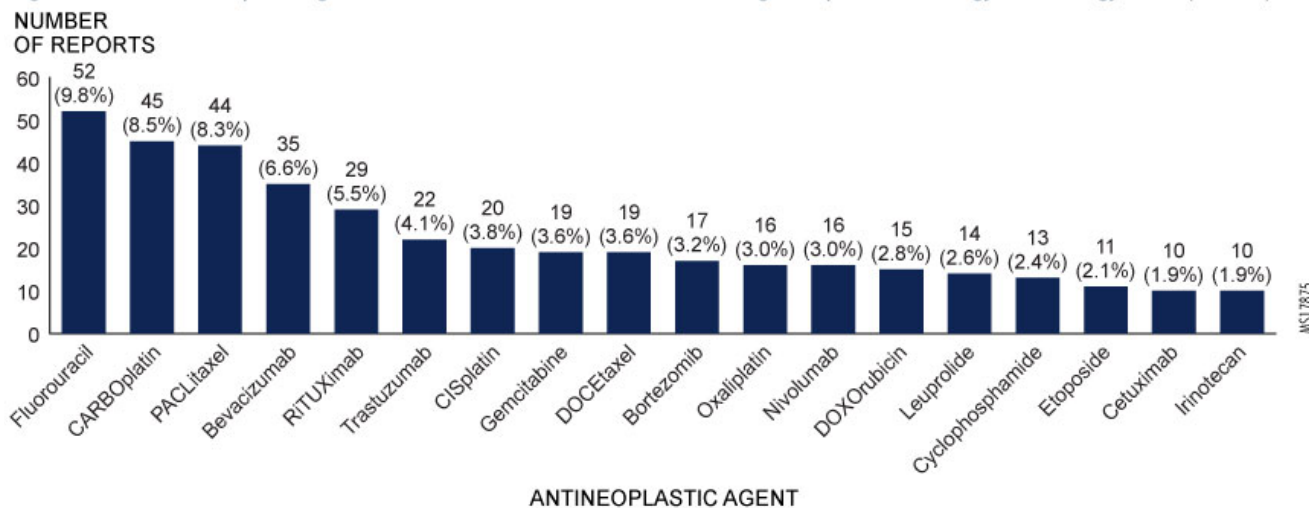
Figure 1. Harm Scores for Medication-Error Events Occurring in Outpatient Hematology and Oncology Clinics (N = 1,015)



Note: Data reported through the Pennsylvania Patient Safety Reporting System, July 2015 through June 2017.

This analysis included reported events that involved antineoplastic medications in addition to other medication classes such as chemotherapy pre-medications. It is notable that most reported events were related to antineoplastic agents, which are high-alert medications. High-alert medications, or medications that pose an increased risk of patient harm when involved in medication errors,¹⁰ were reported in more than half (55.5%, n = 563) of reported events. The most commonly prescribed high-alert drug class was antineoplastic agents (94.3%, n = 531 of 563), followed by opioid analgesics (2.3%, n = 13 of 563), and anticoagulants (1.4%, n = 8 of 563). Fluorouracil, CARBOplatin, and PACLitaxel were the three most commonly reported antineoplastic agents (Figure 2). Overall, antineoplastic agents, colony stimulating factors (e.g., pegfilgrastim), and systemic corticosteroids (e.g., dexamethasone) were the most common medication classes involved in medication-error events (Figure 3).

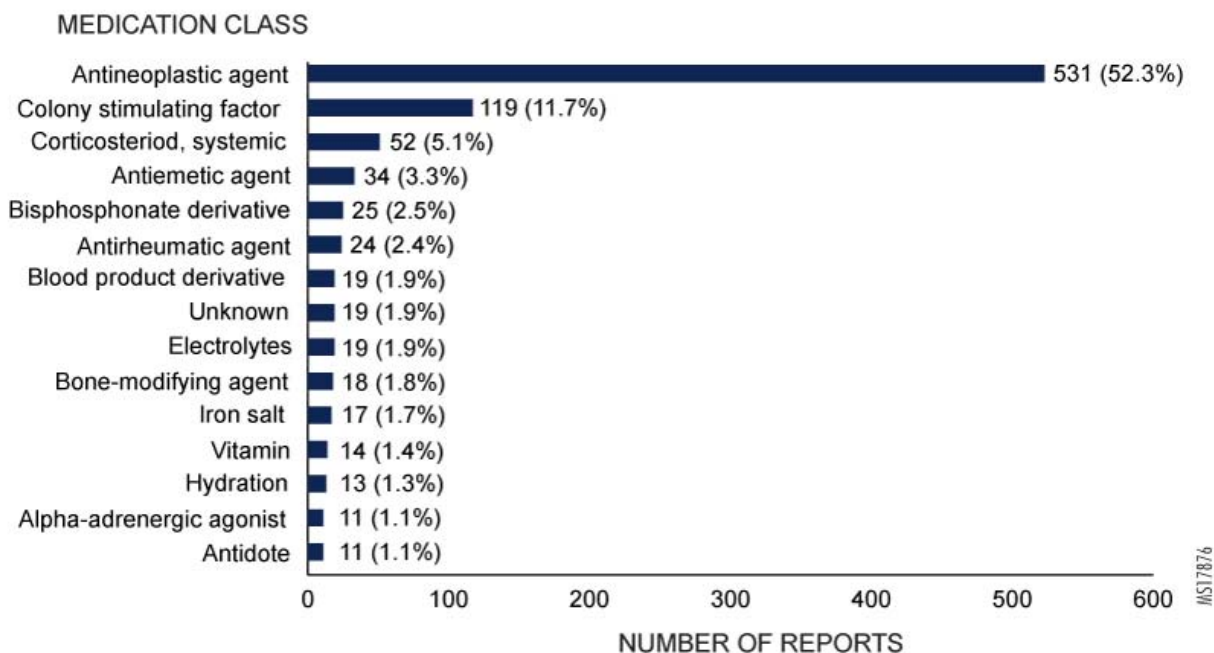
Figure 2. Common Antineoplastic Agents Involved in Medication-Error Events Occurring in Outpatient Hematology and Oncology Clinics (N = 531*)



Note: Data reported through the Pennsylvania Patient Safety Reporting System, July 2015 through June 2017.

* The sum of the reports is less than 1,015 because only a subset of the reports involved antineoplastic agents and only the top 18 antineoplastic agents are displayed (n = 407 of 531).

Figure 3. Common Medication Classes* Involved in Medication-Error Event Reports Occurring in Outpatient Hematology and Oncology Clinics (N = 1,015)

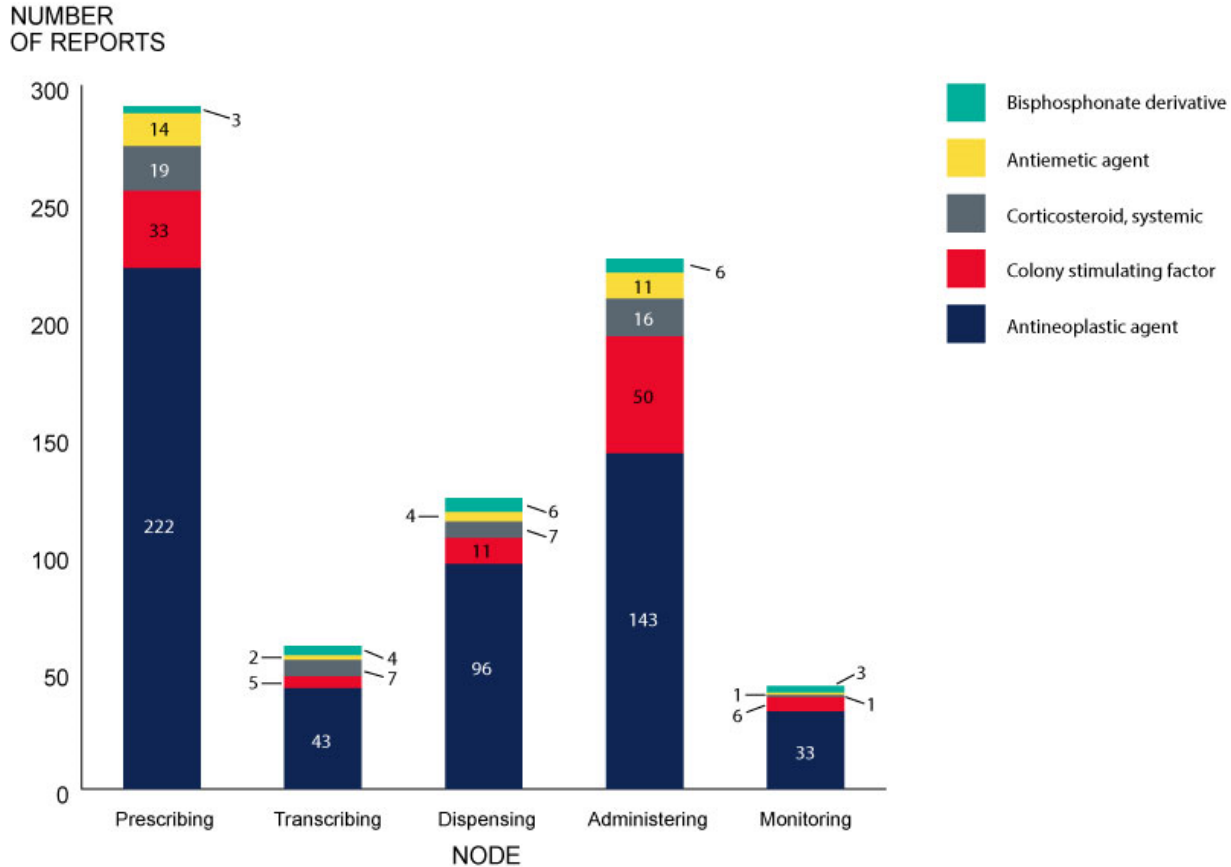


Notes: Data reported through the Pennsylvania Patient Safety Reporting System, July 2015 through June 2017.

* Only the top 15 medication classes are displayed (n= 926 of 1,015).

Medication errors occurred during every step of the medication use process (Figure 4). Errors most frequently involved the prescribing node followed by the administering node.

Figure 4. Common Medication Classes Involved at Each Node of the Medication Use Process for Medication-Error Events Occurring in Outpatient Hematology and Oncology Clinics (N = 1,015)*

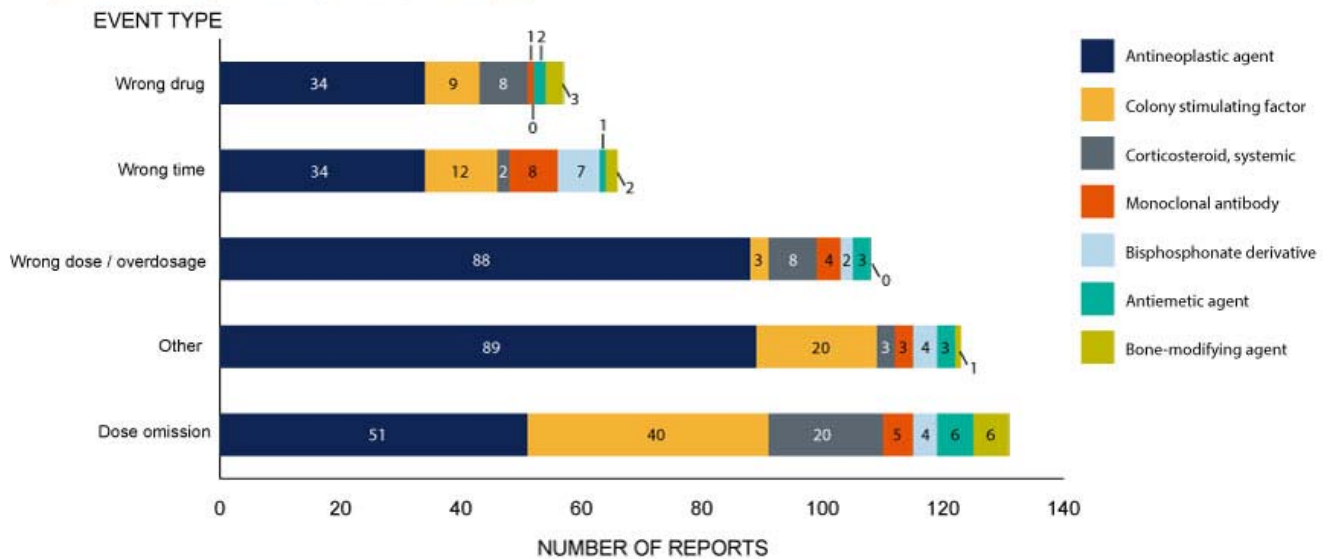


Note: Data reported through the Pennsylvania Patient Safety Reporting System, July 2015 through June 2017.
 * Facilities may select zero, one, or multiple nodes for a given medication-error report.

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The most commonly reported event types were dose omissions, "Other," and wrong dose/over dosage. The medication classes associated with the five most commonly reported event types can be seen in Figure 5.

Figure 5. Medication Classes Associated with Common Event Types* for Medication-Error Events Occurring in Outpatient Hematology and Oncology Clinics (N = 600 reports)



Note: Data reported through the Pennsylvania Patient Safety Reporting System, July 2015 through June 2017.
 * Event types are defined by Pennsylvania Patient Safety Reporting System taxonomy and are assigned to events by healthcare facilities at the time of report submission. Only the top five events types are displayed (n = 485 of 600).

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Dose Omission

About three-fourths (74.2%, n = 115 of 155) of dose omission events were reported as reaching the patient, and one of these events (0.6%) resulted in patient harm. The dose omission event that resulted in patient harm involved an antineoplastic agent. Following is the dose-omission event that resulted in patient harm:*

A patient received four cycles of EP (etoposide and CISplatin) over two months. The patient also previously underwent surgical resection at another hospital. It was determined that the patient probably should have received bleomycin in the initial treatment regimen.

The most commonly reported medication classes associated with dose omissions were antineoplastic agents (32.9%, n = 51 of 155), colony stimulating factors (25.8%, n = 40), and systemic corticosteroids (12.9%, n = 20). The most common medications associated with dose omissions were pegfilgrastim (20.6%, n = 32), dexamethasone (10.3%, n = 16), bevacizumab (5.2%, n = 8), fluorouracil (5.2%, n = 8), and denosumab (4.5%, n = 7). In addition to systemic corticosteroids, which are typically included as chemotherapy pre-medications, additional chemotherapy pre-medications such as antiemetic agents and combinations of antiemetic agents with alpha-adrenergic agonists, antihistamines, and anti-inflammatory agents made up 14.2% (n = 22) of dose omission events. Following are examples of dose-omission events reported through PA-PSRS:

Order sent to [infusion center] from the physician's office. Order written as Herceptin® [trastuzumab] 2 mg/kg (184 mg) in 250 mL NS [normal saline] IV [intravenously] over 30 minutes Cycle day 8 and day 15 Q 21 days. Order interpreted as "Administer Q 21 days" when intended dosing was Day 1, Day 8, and Day 15. Patient missed doses due Day 8 and Day 15. Oncologist notified and patient informed. Dosing schedule adjusted. Oncologist altered schedule for remaining chemo doses.

Zofran® [ondansetron] order was missed on day one and day two of chemotherapy. Chemotherapy order with multiple cross outs. Zofran order printed in small font and not in the same section as other pre-medications.

Wrong Dose/Over Dosage

The medication classes most commonly involved in wrong dose/over dosage events were antineoplastic agents (66.2%, n = 88 of 133) and systemic corticosteroids (4.5%, n = 6 of 133). The three most common antineoplastic agents involved in these events were CARBOplatin (15.9%; n = 14 of 88), bevacizumab (8.0%, n = 7 of 88), and riTUXimab (6.8%, n = 6 of 88). Most wrong dose/over dosage events were intercepted before reaching the patient (66.2%, n = 88 of 133).

Although none of the wrong dose/over dosage events resulted in patient harm, almost one-third (33.1%, n = 44 of 133) of these events reached the patient and 10.5% (n = 14 of 133) of these events reached the patient and required monitoring or intervention to preclude patient harm. In addition, 15.0% (n = 20 of 133) of wrong dose/over dosage events were at least in part due to patient information errors, particularly incorrect patient weight, height, body surface area (BSA), and serum creatinine level. Following are examples of wrong dose/over dosage events reported through PA-PSRS:

Female outpatient with diagnosis of metastatic breast cancer arrived at the [infusion center] for continuation of her chemotherapy regimen. Upon review of the orders by the pharmacist, it was noted that the doses of Perjeta® [pertuzumab] and Herceptin® [trastuzumab] were incorrect. The doses were too high as they were based off the loading doses the patient received on her previous visit. The pharmacist contacted the prescriber who changed the orders for both drugs to the appropriate doses. The patient received the correct doses of both chemotherapy drugs.

Pharmacist entering chemotherapy for future appointment noted that there was a 5 cm discrepancy of height from previous doses. All previous chemotherapy doses were calculated based on a height of 145 cm. Upcoming dose was calculated based on a height of 150 cm. This resulted in an increase of dose. Pharmacist confirmed with ordering office that the patient's height was 150 cm and that the previous height was incorrect. All previous doses were given at the lower dose.

Wrong Time

Wrong-time events comprised 7.8% (n = 79) of 1,015 reports. More than half of these events (64.6%; n = 51 of 79) reached the patient, with 11.4% (n = 9) of the events requiring monitoring or intervention to preclude patient harm. Antineoplastic agents were the only high-alert medication class involved in wrong-time events and were also the most common medication class associated with wrong-time errors (43.0%, n = 34). Other medication classes commonly associated with wrong-time events were colony stimulating factors (15.2%, n = 12), bisphosphonate derivatives (8.9%, n = 7), and antirheumatic agents (7.6%, n = 6). Fluorouracil (17.6%, n = 6 of 34) and RiTUXimab (11.8%, n = 4) were the two most common antineoplastic agents involved in wrong-time events. Analysts identified 30 (38.0%) of 79 reports that were attributable to schedule errors and 12 (15.2%) reports that were attributable to treatment delays. Following is an example of a wrong-time event reported through PA-PSRS:

Patient in the infusion center for 1st cycle of chemotherapy. Orders were written for Gemzar® (gemcitabine) IV x1 on day 1 and day 8. CARBOplatin IV x1 on day 8. Orders clearly state the days of administration. Patient received Gemzar as ordered but also received the CARBOplatin that was ordered for day 8 on day 1. This was missed by both nurses, who did independent double checks, and by the pharmacy, which profiled the medication and sent it up to the infusion center to administer. Spoke with nurse and she will make physician aware of event. Patient scheduled to come back the following week for day 8 Gemzar and Neulasta® [pegfilgrastim] on body injector. Error was caught by coding department who was coding the chart and questioned why CARBOplatin was given on day 1. No patient harm identified from this event.

Wrong Drug

Wrong-drug errors were identified in 7.8% (n = 79) of 1,015 reports. The medication classes most commonly involved in wrong-drug events included antineoplastic agents (43.0%, n = 34 of 79), colony stimulating factors (11.4%, n = 9), and systemic corticosteroids (10.1%, n = 8). PACLitaxel made up 14.7% (n = 5 of 34) of wrong-drug errors related to antineoplastic agents. DOCEtaxel and CISplatin were each cited in 8.8% (n = 3 of 34) wrong-drug error reports involving antineoplastic agents. Almost half of wrong-drug errors involved high-alert medications (46.8%, n = 37 of 79). Two of these high-alert medication events involved confusion between morphine and HYDROmorphine while 33 events were related to antineoplastic agents. Analysts identified that 24.1% (n = 19 of 79) of the wrong-drug reports were attributable to name similarity. Six of these name pairs are included on the Institute for Safe Medication Practices Confused Drug Name List (Table).¹¹

Table. Commonly Confused Drug Pairs

Drug Name	Similar Name
CARBOplatin	CISplatin
inFLIXimab	riTUXimab
morphine	HYDROmorphine
rOPINIRole	risperidONE
SOLU-Medrol® (methylprednisolone sodium succinate)	Solu-CORTEF® (hydrocortisone sodium succinate)
Taxotere® (DOCEtaxel)	Taxol® (PACLitaxel)

Following are examples of wrong-drug events reported through PA-PSRS:

Patient with an Hx [history] of adenocarcinoma of the left lung. Physician ordered medroxyPROGESTERone 40 mg for patient, this did not seem correct. I called physician and he said he meant to order methylPREDNISolone 40 mg. Physician corrected order.

Patient was originally ordered riTUXimab. Gemcitabine and oxaliplatin [were ordered for the following day]. A nurse indicated order OK, riTUXimab was processed, mixed, delivered, and administration initiated. Later, the order date for the gemcitabine/oxaliplatin was moved, and second nurse questioned administration of riTUXimab. On further investigation, it was determined that the patient should not have received riTUXimab.

Filgrastim (Neupogen®) 300 mcg subcutaneous ordered. Infusion nurse went to the automated dispensing cabinet to remove. There was no drug in refrigerator. Pharmacy dispensed Granix® [tbo-filgrastim] 300 mcg subcutaneous to infusion nurse. Upon infusion nurse scanning drug, she received the message "this drug cannot be given in this encounter." RN proceeded despite the message. Granix 300 mcg subcutaneous given. (Granix is an auto-substitute for Neupogen).

3 mg of morphine sulfate ordered, HYDROmorphone 3 mg given. Physician aware. Patient stable time of discharge.

Patient Information

Analysts also identified trends involving patient information events, which included errors related to patient weight, height, serum creatinine, BSA, identity, current medication, and other missing or inaccurate patient information. These made up 8.5% of all reports (n = 86). Almost half of these events (45.3%, n = 39 of 86) resulted in dosing errors, including under- and overdosing events in which at least one antineoplastic agent was mentioned in 84.6% (n = 33 of 39). For example, there were dosing errors related to the use of old, outdated patient weights. The use of wrong-patient weights and heights or the wrong unit of measurement contributed to incorrect BSA calculations, which in turn may have contributed to dosing errors. In addition, the inappropriate use of ideal body weight or adjusted body weight may have also contributed to dosing errors. Wrong-patient identification was the second most common event type (27.9%, n = 24 of 86) in which patient information was a contributing factor. Following are examples of wrong-patient information events reported through PA-PSRS:

In preparation for stem cell transplantation, patient had a 24-hour urine creatinine clearance measured. Patient completed this and brought sample to the lab for analysis. Lab automatically calculates corrected creatinine clearance based on calculations using patient height in cm and weight in kg. Laboratory inappropriately used height in inches instead of centimeters, which resulted in a significant overestimation of the actual urine creatinine clearance. This was discovered by patient's physician who identified the wrong value used in the equation and notified lab to correct. Could have resulted in chemotherapy overdose if not caught in advance.

Two patients present for different doses of Procrit® [epoetin alfa]: patient A 60,000 units, patient B 20,000 units. Patient name band and drug scanned, and warning was ignored. Patient was not positively identified, but answered to patient B's name. Patient A given 20,000 units and then an additional 40,000 units given to correct error. Patient B received correct dose.

Patient is 5 ft, 4.5 inches. It was written as such on the chart. Transferred to a later date as 54.5 inches. The patient received 2 cycles of etoposide and CARBOplatin at 54.5 rather than 64.5 inches.

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.

Discussion

Errors that occurred in outpatient hematology and oncology clinics affiliated with hospitals or health systems spanned six different harm scores,⁸ more than 40 different medication classes, and each of the nodes of the medication use process (i.e., prescribing, transcribing, dispensing, administering, and monitoring). Consistent with conclusions by Schwappach and Wernli,¹ medication errors in administration accounted for many events, exceeded only by prescribing errors.

More than one-half of events (53.7%, n = 545 of 1,015) reached the patient in the current analysis of errors in outpatient hematology and oncology clinics. This is in contrast to the analysis by Lennes et al., in which 27.0% of reported chemotherapy errors (n = 89) reached the patient out of a total of 330 reported chemotherapy errors.¹² The analysis by Lennes et al. differs from this PA-PSRS analysis in that chemotherapy-related safety events occurred over five years, 2010 through 2014, at Massachusetts General Hospital and its affiliate practices, whereas the current PA-PSRS analysis included any error that occurred in an outpatient oncology and hematology clinic, even errors unrelated to chemotherapy, and excluded events that occurred in inpatient practice settings. In addition, the PA-PSRS analysis included outpatient hematology and oncology clinics associated with multiple different hospitals and health systems in Pennsylvania. It is not clear why more errors reached patients in Pennsylvania outpatient hematology and oncology clinics than in the inpatient settings of Massachusetts General Hospital and its affiliate practices. One potential explanation is that while the PA-PSRS analysis included errors related to chemotherapy, analysts also captured ancillary medication errors and medication errors related to chemotherapy pre-medications. Further comparative research would be needed to assess the differences in errors between inpatient and outpatient oncology care settings.

Recognizing and addressing areas of vulnerability in the complex process of chemotherapy delivery is critical to maximizing safety. Analysts found that errors occurred most frequently during the prescribing and administering nodes, which might be attributable to the complexity of many chemotherapy regimens. Similarly, a retrospective observational study in the outpatient oncology setting reported a 20% prescribing error rate.¹³ These prescribing errors were incomplete orders mostly related to missing dosages, route of administration, infusion rate, or other prescription elements. In a priority-setting study, cancer-care clinicians ranked the prescribing node as the most vulnerable to medication safety threats.¹⁴ In another outpatient oncology setting, a retrospective record review of outpatient adult and pediatric visits identified administration node errors (56%) followed by the prescribing node errors (36%) as the most common.⁵

Errors that occurred during the administering node comprised nearly one-third of errors. These errors can present patient safety risks because there may be fewer opportunities for intervention built into the system during or after this stage of the medication use process. Schulmeister surveyed oncology nurses involved in chemotherapy administration in the United States about their personal experience with errors.¹⁵ Of the chemotherapy medication errors reported, 39% involved over- and underdosing, 21% involved schedule and timing errors, 18% involved wrong drugs, and 14% involved chemotherapy given to the wrong patient.¹⁵ Less common errors included infusion-rate errors, omission of drugs or hydration, and improper preparation of drugs. Ten percent of these errors required medical intervention and prolonged hospital stays. Even with barcode medication administration (BCMA) technology instituted to prevent administration errors, administration errors can go unnoticed and therefore also unreported.¹⁶

Antineoplastic agents, colony stimulating factors, and corticosteroids were most commonly involved in reported events regardless of the medication use node or event type. The most common event type was dose omissions. Omission of a colony stimulating factor could result in prolonged neutropenia, predispose patients to risk of infections, and delay future treatments.¹⁷ In addition, analysts found that chemotherapy pre-medications, which include systemic corticosteroids, were also involved in the dose omission events, which may adversely impact patient comfort and outcomes. Similarly, antineoplastic agents, colony stimulating factors, and bisphosphonate derivatives were commonly associated with wrong-time events, which may also adversely affect patient outcomes.

Wrong dose/over dosage and under dosage events were often associated with inaccurate or lack of patient information. Events were mostly attributed to problems with patient weight. A variety of problems were described in the event descriptions, which included outdated patient weight, wrong unit used for documenting the patient's weight (kilogram versus pound), mix-up between ideal and actual weight, and subsequent wrong BSA calculation. Such inadvertent dosing errors with high-alert medications, especially chemotherapy, may expose patients to increased toxicity or reduced probability of cure, or other effects.¹⁸ Current patient information, including patient's height, weight, BSA, laboratory values, cardiac function tests, and current medications are important to guide appropriate chemotherapy prescribing, and this information needs to be readily available throughout the medication use process so various checks can be implemented.

Some of the medication errors observed in this analysis may be prevented with safeguards such as electronic-based or paper-based chemotherapy order templates.¹² Standardization and simplification of the chemotherapy order and dose calculation processes reduce the risk of medication errors. For example, many electronic order entry or computerized prescriber order entry (CPOE) systems are capable of automatic chemotherapy dosage calculations based on patient height, weight, and laboratory values in the patient's record; however, the usefulness of these systems are limited by the accuracy of the available patient information.¹⁹ For example, outdated patient weights or delayed laboratory results, as observed in events reported to the Authority, may result in incorrect dose calculations. This may be caused by up-to-date patient information that is not readily available at the time of prescribing, dispensing, preparing, and administering.

However, technology alone is insufficient to capture all discrepancies. Suzuki et al. found that despite the use of CPOE in Japan, use of a pharmacy documentation and intervention tool, in this case a paper-based tool, supported pharmacists in their review of chemotherapy orders and helped identify important interventions not caught by the CPOE system. The intervention tool included critical information needed for accurate chemotherapy verification, such as patient information, regimen cycle, antineoplastic drugs (including dose, route, and rate), pre-medications, and supportive drugs.²⁰

Limitations

The reports included in this analysis are from outpatient hematology and oncology clinics affiliated with hospitals or health systems, and the results of this study may not apply to other patient care settings. In-depth analysis by the Authority of medication error reports from outpatient hematology and oncology clinics is limited by the information reported through PA-PSRS, including the event descriptions. As with all reporting systems, the type and number of reports collected depend on the degree to which facility reporting is accurate and complete. Although the narrative fields of the reports help analysts discern what happened during the event, they may not contain details describing how the event deviated from the standard operation or which factors contributed to the event.

Risk Reduction Strategies

Efforts to prevent harm from medication errors in outpatient hematology and oncology clinics can focus on either reducing the occurrence of potential errors before they happen or mitigating the risk of adverse outcomes associated with errors that reach the patient. Consider the strategies listed below, which are based on events reported to the Authority, current literature, and observations from the Institute for Safe Medication Practices:

Communicating Drug Orders and Other Drug Information

- Use either electronic or paper chemotherapy templates to standardize chemotherapy orders.

- Require reference(s) of primary literature if ordering chemotherapy outside of the chemotherapy template.
- Define a process to immediately communicate, document, and explain rationale for order changes and clarifications to the patient's healthcare team, including updating orders previously entered or processed when patient information, such as patient weight and serum creatinine levels, change.²¹
- Explicitly write or indicate specific days for chemotherapy drugs (e.g., write as "Day 1, 2, 3").²¹
- Develop policies and procedures that guide healthcare practitioners to identify, verify, and document the current cycle and the day within the cycle of chemotherapy (e.g., cycle 3 of 6, day 3 of 5) against an established treatment protocol before each dose is administered.²¹
- Include the patient-specific dose and the mg/kg, mg/m², units/m², or other dosing method used to calculate the patient-specific dose for all chemotherapy drug orders (e.g., for a 1.67 m² patient: 240 mg/m²; dose = 400 mg).²¹
- Create chemotherapy order sets that include appropriate pre- and post-chemotherapy medications (e.g., colony stimulating factors).²¹

Quality Processes and Risk Management

- Implement a two-pharmacist independent double check of all chemotherapy orders prior to dispensing.
- Build hard stops that cannot be overridden, as appropriate, in computer systems for orders that exceed established maximum dose limits.²¹
- Enable dose-error reduction software with soft stops and catastrophic or hard stops on electronic ordering systems and smart infusion pumps to intercept and prevent wrong dose/wrong infusion rate errors that can occur when programming pumps, calculating doses, or prescribing medications.²¹
- When double checking prescribed chemotherapy doses, verify the patient's BSA using the patient's height and weight (in metric units) entered into the computer, and recalculate the actual dose (mg/m² or mg/kg).²¹
- Incorporate an independent double check of the prescriber's calculated dose for chemotherapy—according to the protocol or treatment plan—that considers the chemotherapy cycle before administering the drug.²¹
- Ensure that independent double checks, whenever required by the organization's policy, are always performed and documented in the CPOE system and electronic health record.²²
- Institute a time-out immediately before administering the chemotherapy. During this time-out, two licensed healthcare practitioners independently double check the correct patient, compare the drug label to the order/medication administration record, verify the drug, diluent, dose, route, and rate, as well as pump settings, pump channel, and line attachment as applicable.²¹
- Implement bar coding systems to verify drug selection prior to compounding and dispensing chemotherapy and treatment-related drugs (includes robotic dispensing) and at the point of care to verify chemotherapy and treatment-related drug selection prior to administering medications.²¹
- Implement a chemotherapy error policy to direct healthcare practitioners to report and evaluate chemotherapy medication errors.
- Institute a system to review, learn from, and disseminate chemotherapy errors.

Patient Information

- Institute a structured process to collect and document, in a designated location, the patient's current (actual) height and weight in metric units.²¹
- Evaluate pertinent monitoring parameters before and throughout chemotherapy, such as absolute neutrophil count (ANC) before and during each treatment cycle.²¹
- Design policies and procedures as well as electronic order entry systems to prevent processing of chemotherapy orders before patient weight, height, updated laboratory test results, allergies, and associated reactions have been identified, documented, and reviewed.²¹
- Ensure prescribers document on the order which "dosing weight" (i.e., actual, ideal, or adjusted body weight) will be used to calculate the dose of the chemotherapy.²¹
- Develop an institution-specific weight and height policy that defines when changes in patient weight and height should trigger recalculating medication doses.
- Use a standard method defined by your organization to calculate ideal body weight or adjusted body weight (in metric units).²¹

Patient Education

- Educate patients about their chemotherapy regimen, including the name of the agent(s) used, therapeutic indication, usual and actual doses, expected and possible adverse effects, methods for preventing or managing adverse effects, and when to follow up with their prescriber.¹⁹
- Involve patients in error detection and prevention.^{1,23,24} Instruct patients on how they can protect themselves from medication errors. Inform patients of their right to ask questions and seek satisfactory answers.¹⁹
- Implement a chemotherapy error policy to direct caregivers on what to do in the event of a chemotherapy error or overdose.

Conclusion

Of all the medication errors reported from hospital and health system–affiliated outpatient hematology and oncology clinics to the Authority from July 2015 through June 2017, the most common error types included dose omission, wrong dose/over dosage, wrong time, and wrong drug. For each of these event types, antineoplastic medications were the drugs most commonly involved. Despite the attention given to antineoplastic medications as high-alert medications and several published safe practice recommendations, preventable medication errors still occur.^{1,21} Layers of risk reduction strategies that address the underlying causes of errors are needed to prevent errors and mitigate harm when an error reaches a patient. Although the number of reports with harm submitted to the Authority was small, organizations can use the data presented here to proactively evaluate the safety systems in place in their outpatient hematology and oncology clinics to minimize the risk for harm for their patients and to prevent similar errors from recurring.

Notes

1. Schwappach DL, Wernli M. Medication errors in chemotherapy: incidence, types and involvement of patients in prevention. A review of the literature. *Eur J Cancer Care (Engl)*. 2010 May;19(3):285-92. Also available: <http://dx.doi.org/10.1111/j.1365-2354.2009.01127.x> (<http://dx.doi.org/10.1111/j.1365-2354.2009.01127.x>). PMID: 19708929.
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