

September 8, 2016

DR. CHARLES E. DANIELS
Pharmacist-in-Chief
0657

**Subject: *Medication Tracking: Dispense to Administration
Report 2016-18***

The final report for Medication Tracking: Dispense to Administration Report 2016-18, is attached. We would like to thank all members of the department for their cooperation and assistance during the review.

Because we were able to reach agreement regarding management action plans in response to the audit recommendations, a formal response to the report is not requested. The findings included in this report will be added to our follow-up system. We will contact you at the appropriate time to evaluate the status of the management action plans.

UC wide policy requires that all draft reports be destroyed after the final report is issued. We also request that draft reports not be photocopied or otherwise redistributed.

David Meier
Director
Audit & Management Advisory Services

Attachment

cc: Margarita Baggett
 David Brenner
 Judy Bruner
 Lori Donaldson
 Jo Anna Lamott
 Patty Maysent
 Pierre Ouillet
 Cheryl Ross
 Raffi Simonian
 Sheryl Vacca

UC San Diego

AUDIT & MANAGEMENT ADVISORY SERVICES

Medication Tracking: Dispense to Administration
Report No. 2016-18
September 2016

Performed By:

Gabor Herman, Auditor
Christa Perkins, Manager

Approved By:

David Meier, Director

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY 2

II. BACKGROUND..... 3

III. AUDIT OBJECTIVE, SCOPE, AND PROCEDURES 4

IV. CONCLUSION..... 5

V. OBSERVATIONS REQUIRING MANAGEMENT ACTION 5

 A. Dispensed Medications Not Administered or Costed..... 5

 B. Variance in Administration and Cost Files 7

 C. Completeness of Dispensed Medication Costing 9

ATTACHMENT A – Discrepancies in Orders Dispensed and Administered

I. EXECUTIVE SUMMARY

Audit & Management Advisory Services (AMAS) has completed a review of Medication Tracking: Dispense to Administration as part of the approved audit plan for Fiscal Year 2015-16. The objective of our review was to evaluate the dispensing and administering of medications to identify gaps between medications dispensed in the Inpatient Pharmacy setting and those administered to patients, and the costing of those medications from an inventory perspective.

We concluded that, generally, medication orders flowed correctly from ADMs to patient MARs, to Pharmacy Cost files. We did note some discrepancies in this process, between ADM to MAR, or MAR to Cost files, which are described in the following section. Routine quality assurance activities and documented procedures could reduce these errors in the future. We also noted that Pharmacy costing procedures which called for costing medications based on the medication administration did not fully capture the replacement cost of all types of medications. During the review, Pharmacy management established a process to estimate the unused quantities of drugs to better reflect the full cost of the drug stock removed from stores. Management Action Plans to address these findings are summarized below.

A. Dispensed Medications Not Administered or Costed

1. Pharmacy management will evaluate patterns of medications dispensed but not administered based on the data in this report, to determine whether further review is needed.
2. Pharmacy management will consider developing and formalizing a monitoring process to ensure that all medication dispensed per prescription orders is administered and associated costs are removed from inventory. Exceptions should be reviewed on a periodic basis to validate that medications are dispensed for valid purpose.

B. Variance in Administration and Cost Files

1. Pharmacy management will periodically monitor for order numbers that fail to appear in the MAR logs and the Cost files.
2. Pharmacy management will document the dispensing to administration process, including which areas are recharging medications, and when and for which areas should prescription order numbers flow through the process from dispense to administration.

C. Completeness of Dispensed Medication Costing

1. Pharmacy management has established a process to estimate the unused quantities of drugs to better reflect the full cost of the drug stock removed from stores.
2. Pharmacy management will document inventory accounting policies and procedures for the department, including the preparation of monthly Cost Files, in order to enhance consistency and document business process controls.

Observations and related Management Action Plans are described in greater detail in section V. of this report.

II. BACKGROUND

Audit & Management Advisory Services (AMAS) has completed a review of Medication Tracking: Dispense to Administration as part of the approved audit plan for Fiscal Year 2015-16. This report summarizes the results of our review.

Inpatient Pharmacy provides the medications for all patients receiving care throughout the UC San Diego Health (UCSDH) facilities. Physicians enter prescription orders (orders) into the UCSDH electronic medical record (EMR) system, Epic. Orders are for a given period and frequency, and often list multiple drugs. An order may call for one medication to be administered once, or a several over a given length of time at given intervals. Prescription orders are approved by pharmacists. The dispensing and administration of the medications occurs under those same orders. The orders follow patients as they move from inpatient wards to treatment areas. The Medical Center wards are exclusively inpatient areas, whereas specialized procedure areas or departments, where inpatients and outpatients comingle, are termed as mixed use from the inpatient pharmacy's perspective. In these areas both inpatients and outpatients receive drugs from the Inpatient Pharmacy. Though the medication may be the same, Inpatient Pharmacy recognizes a different cost depending on each patient's status.

Inpatient Pharmacy medication delivery is primarily controlled through Automatic Dispensing Machines (ADMs). Though there is one Inpatient Pharmacy, there are many inpatient pharmacy locations with respect to inventory costing (pharmacy locations). Some of these are actual physical pharmacy locations; however, a majority of pharmacy locations are ADMs. Each patient floor and procedure area may have multiple ADMS that are linked.

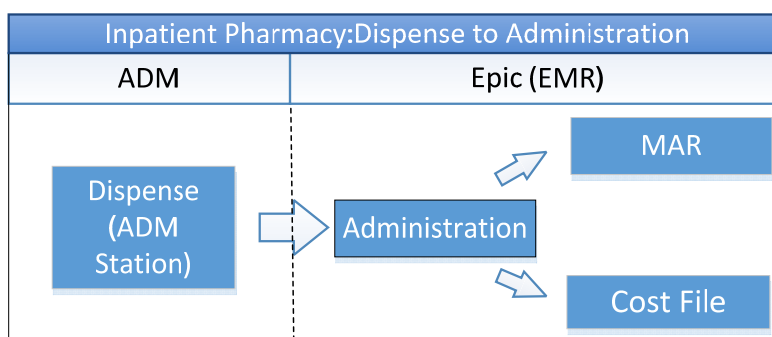
The ADMs are secure cabinets that only open for credentialed users. Nurses sign into the machines via the keyboard and a fingerprint reader. Only then can they select the patient for whom they are pulling medications. The machines make the appropriate drawer and bin available for the order and patient specified. All relevant data, including the person accessing the machine and the type of medication removed, is captured automatically in a dispense log. Medications within the machines are separately packaged such that a bar code is prominently featured. In effect the machines enable pharmacy to stock the appropriate medications close to where they are needed. The drug stocks in the machines are considered Pharmacy inventory and are considered dispensed when removed.

At the patient's bedside, prior to administration, nurses scan each medication using a hand held barcode reader linked to the Epic. In this way, Epic creates an entry on the patient's Medication Administration Record (MAR). In addition, nurses record the amount of medication actually given to the patient. In some cases, amount given may differ from the amount dispensed. For example, if an order calls for a half dose of a pill, the ADM records the dispense of one pill, the same pill is validated by Epic with the bedside scan, and the actual dose amount is manually recorded on the MAR which is part of the patients' medical record¹. Entries on the MAR serve as the official record of medication which lists data such as the exact amount, time, nurse, and the type of medication administered. The recording of a medication administration on the MAR forms the basis for entering a charge on the patient's account.

¹ Each patient has their own MAR with their electronic medical records. In this review, MAR refers to a collection of patient MARs, or a collective log of MARs.

Also at the point of administration, a corresponding entry is made in Pharmacy's cost of inventory (Cost File). The cost recorded upon administration mirrors the quantity administered to the patient, but also includes patient data so that Inpatient Pharmacy may recognize the appropriate costs depending on the recipients' status as in or outpatient. The actual costs are cumulative in detail so that it is possible to trace the cost via order number. At months end, the report is reviewed and the cumulative totals reflecting the costs of all administered medications is sent to Health System Accounting. Then the value of Inpatient Pharmacy's inventory is adjusted to remove the cost of the medications administered for the month.

The graphic below is a high level representation of the systems involved in the process.



In summary, this project is a three way analysis between the following:

- Dispense log from the ADM system,
- MAR which is the patient medication administration log; and,
- The Cost report which is a monthly adjustment of Pharmacy inventory.

Gaps in any of the steps above could indicate medications dispensed but not administered (possible leakage or waste), or medications administered without being accurately recorded for inventory costing purposes.

III. AUDIT OBJECTIVE, SCOPE, AND PROCEDURES

The objective of our review was to evaluate the dispensing and administering of medications to identify gaps between medications dispensed in the Inpatient Pharmacy setting and those administered to patients, and the costing of those medications from an inventory perspective. In order to achieve our objective, we performed the following:

- Reviewed the content of the ADM, MAR and Cost Files covering June, July and August 2015
- Interviewed the following:
 - Pharmacy Assistant Director;
 - Buyer IV;
 - Pharmacists at Hillcrest and Thornton Medical Centers;
- Observed nurses during medicine dispensing rounds;
- Loaded the content of ADM, MAR and Cost files into a database;

- Reviewed contents of database to validate that all data was successfully loaded;
- Completed analysis to understand why different logs may vary in order contents;
- Sampled a number of orders that differed in medication dispense counts on dispense, MAR and Cost Files;² and
- Performed comparative analysis to identify any variances.

Our scope included review of inpatient dispensing only, therefore we did not evaluate medications dispensed in the outpatient setting, in the operating room or procedure areas, or recharged from Pharmacy to other hospital units. Also, our review did not analyze data from a full 6-month inventory cycle, therefore our report does not make conclusions about semi-annual inventory accounting, or processes downstream from the Cost files.

IV. CONCLUSION

Based on our review, we concluded that, generally, medication orders flowed correctly from ADMs to patient MARs, to Pharmacy Cost files. We did note some discrepancies in this process, between ADM to MAR, or MAR to Cost files, which are described in the following section. Routine quality assurance activities and documented procedures could reduce these errors in the future. We also noted that Pharmacy costing procedures which called for costing medications based on the medication administration did not fully capture the replacement cost of all types of medications. During the review, Pharmacy management established a process to estimate the unused quantities of drugs to better reflect the full cost of the drug stock removed from stores. Opportunities for improvement are discussed in the balance of this report.

V. OBSERVATIONS REQUIRING MANAGEMENT ACTION

A.	Dispensed Medications Not Administered or Costed
Not all medication orders dispensed from ADMs were listed in the MAR or Cost files.	
Risk Statement/Effect	
Medications dispensed per valid prescription orders may not be administered to patients and/or the costs of such medications may not be removed from inventory.	
Management Action Plans	
A.1	Pharmacy management will evaluate patterns of medications dispensed but not administered based on the data in this report, to determine whether further review is needed.
A.2	Pharmacy management will consider developing and formalizing a monitoring process to ensure that all medication dispensed per prescription orders is administered and associated costs are removed from inventory. Exceptions should be reviewed on a periodic basis to validate that medications are dispensed for valid purpose.

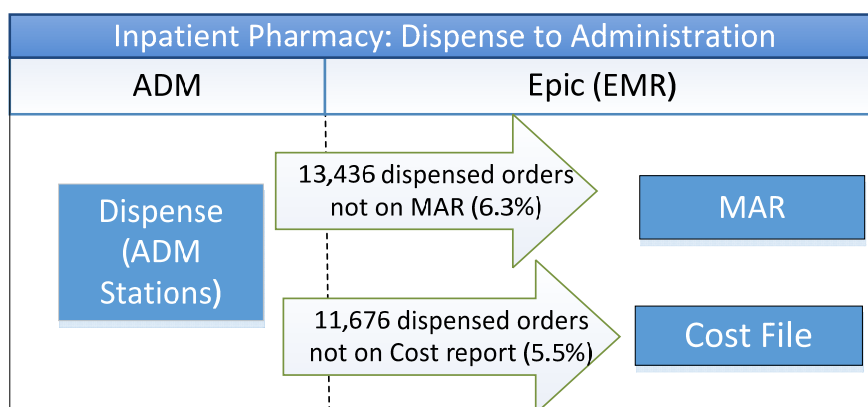
² Except where noted, the movement of medications was traced by prescription order.

A. Dispensed Medications Not Administered or Costed – Detailed Discussion

We compared data on removal of medications from the ADMs to administration data found in the MAR and in the Cost files. Medication dispensed from ADMs should appear down-stream as evidenced by the appearance of the same prescription order number under which it was removed. In general, we found the vast majority of medications were removed from ADMs per prescription orders and administered to patients, and subsequently costed. However, we noted some discrepancies, where medications dispenses were not found in downstream records.

For the three months under review, a total of 13,436 separate dispensed medication orders (6.3%) were not found on the MAR log. However, 1,764 of these orders did appear on the Cost File

For the same period, a total of 11,676 unique dispensed orders (5.5%) were not found on the Cost File. However, four of these order numbers did appear on the MAR log.



In order to better understand the number of missing orders, the medications and the dispensing locations, the missing orders were totaled by source, medication and charted at a high level.

Attachment A is a schedule of the discrepancies between medications dispensed and administered. Listed are only those medications that have been referenced by more than 20 separate prescription orders by dispensing location, in order to give insight into the flow of the most frequently called upon medications. The number in the field are not quantities of medication, but counts of prescription order numbers. They reflect how often each medication is called upon, and enable a common measure by which to evaluate the frequency of medication which may be in dissimilar format.

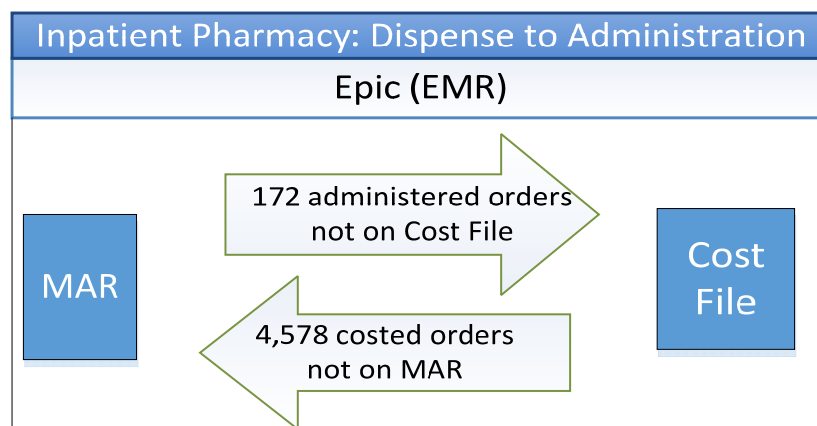
The most common item on the schedule is eye drops. There are four medications that are listed as controlled substances of various degrees. The medications have been all dispensed per orders reviewed by pharmacists, and detailed dispensing information is available for Pharmacy management to evaluate patterns of activity to explain why these dispensed medications are not appearing on MAR and/or Cost Files.

We noted that Pharmacy did not appear to have processes to routinely review discrepancies between medication orders dispensed, and those administered or costed. Documenting and formalizing a process to monitor and review dispensed prescriptions with respect to the MAR would provide Pharmacy with assurance that medications are used by the patients for whom the prescription order was approved.

B. Variance in Administration and Cost Files	
The contents of the MAR and Cost Files were not in agreement.	
Risk Statement/Effect	
Missing orders may indicate that the cost of the administered medications was not removed from inventory. Conversely, the costs of medications not administered could be incorrectly removed from inventory.	
Management Action Plans	
B.1	Pharmacy management will periodically monitor for order numbers that fail to appear in the MAR logs and the Cost files.
B.2	Pharmacy management will document the dispensing to administration process, including which areas are recharging medications, and when and for which areas should prescription order numbers flow through the process from dispense to administration.

B. Variance in Administration and Cost Files – Detailed Discussion

In order to evaluate the completeness of the Cost file, we compared the contents of the MAR to Pharmacy Cost files, and vice-versa. The first comparison determined that there were 172 distinct orders on the MAR that were not found on the Cost File. These orders were associated with 877 separate administrations, and 72³ different types of medicine.



³ Total unique dispensed items were 77; however, one was determined not to be a drug, and another four were drugs that could be used as “multi-dose”. For clarity, these five items were removed from further consideration.

Pharmacy management determined that the 72 medications were primarily multi-dose orders such as eye-drops, inhalers and lotions. The remaining balance of 22 different medications were of the single dose type. The approximate costs of the single dose medications are listed below.

Ref.	Medication	Calculated Cost
1	ACETAMINOPHEN 325 MG OR TABS	0.05
2	ALFENTANIL 500 MCG/ML IJ INJ	8.40
3	BUPIVACAINE HCL (PF) 0.25 % IJ SOLN	0.06
4	CEFAZOLIN SODIUM 1 GM IJ SOLR	2.80
5	CETIRIZINE HCL 10 MG OR TABS	0.11
6	EPINEPHRINE 1 MG/ML IJ SOLN	166.82
7	FENTANYL 2 MCG/ML-BUPIVACAINE 0.125% IN NAACL EPIDURAL	17.75
8	FENTANYL CITRATE 0.05 MG/ML IJ SOLN	0.40
9	GLYCOPYRROLATE 1 MG/5ML IJ SOLN	19.59
10	HYDROMORPHONE HCL 1 MG/ML IJ SOLN	0.92
11	IODIXANOL 320 MG/ML IV SOLN	115.24
12	IPRATROPIUM-ALBUTEROL 0.5-2.5 (3) MG/3ML IN SOLN	0.24
13	LACTATED RINGERS IV SOLN	1.00
14	LIDOCAINE HCL 1 % IJ SOLN	21.97
15	LIDOCAINE HCL 2 % IJ SOLN	0.25
16	LIDOCAINE-EPINEPHRINE 1 %-1:100000 IJ SOLN	0.63
17	METOCLOPRAMIDE HCL 5 MG/ML IJ SOLN	1.04
18	NEOSTIGMINE METHYLSULFATE 10 MG/10ML IV SOLN	3.50
19	SODIUM CHLORIDE 0.9 % IJ SOLN	0.06
20	SODIUM CHLORIDE 0.9 % IV SOLN	11.40
21	THROMBIN 20000 UNIT EX SOLR	6,193.44
22	VASOPRESSIN 20 UNIT/ML IV SOLN	1,318.50
	Total costs associated with unmatched (MAR to Cost) single dose medications	\$ 7,884.16

Each administration of the single dose medications should have appeared on the Cost File. With respect to multi-dose medications, the cost of each medication as associated with the first administration to patients should have been recorded at least once. Doing so is in keeping with charging at administration, which in cases of multi-dose medications the entire package is costed and charged at time of first administration.

Administering medications without removing the associated cost from inventory results in inaccurate monthly financial reports because not all the costs associated with drugs is recognized as a period expense. Another result is overvalued drug inventory on Inpatient Pharmacy's accounts. The under-costed inventory is not recognized in the process of replenishing dispensed stock because ordering is done base on par level basis. There is no direct link that compares the units of dispensed medication with the units ordered. At the next inventory count, the value of the inventory will be adjusted down to recognize the value of the actual stock on hand.

The second comparison determined that there 4,578 orders from cost files that were not found on the MAR. More specifically, medications with an approximate cost of \$132,000 are associated with these

orders, and their value was removed from cumulative inventory without there being a record of administration.

As Inpatient Pharmacy operates on a charge on administration methodology, the validity of these transactions must be verified where there is no matching administration record. From the process perspective, medications are dispensed and costed without Pharmacy being aware that some orders are not administered.

C.	Completeness of Dispensed Medication Costing
Inpatient Pharmacy procedures did not capture the full replacement cost of medications administered to patients.	
Risk Statement/Effect	
Undervaluing the costs of dispensed drugs overvalues the remaining inventory. The monthly financial statements will not match charges with complete costs, and periodic physical inventory counts will not locate the inventory on the accounts.	
Management Action Plans	
C.1	Pharmacy management has established a process to estimate the unused quantities of drugs to better reflect the full cost of the drug stock removed from stores.
C.2	Pharmacy management will document inventory accounting policies and procedures for the department, including the preparation of monthly Cost Files, in order to enhance consistency and document business process controls.

C. Completeness of Dispensed Medication Costing – Detailed Discussion

The “dispense to administration” process not only delivers medications as per orders, but does so correctly costed and recorded on the MAR. The resulting Cost Files and logs capture data about the complete flow of medications, and provides economically relevant data for management. However, we noted that processes did not fully account for replacement costs of inventory.

With the implementation of Epic, Pharmacy moved from a “charge on dispense” to a “charge on administration” method for charging for patients and recognizing the costs of the drugs. Under the prior “charge on dispense” method, the cost of the entire package was recognized when dispensed, and patients were charged for the entire quantity regardless how much was actually administered. With the “charge on administration” method, patients are charged the exact dose administered. For inventory costing purposes, the quantity administered is recognized. In this process waste, the difference between dispensed quantity and administered quantity, is never subtracted from inventory. The result is that Pharmacy’s inventory is overvalued because the monthly Cost Files do not recognize the cumulative total costs of medications which are unusable due to quantity differences between dispense and order.

Waste in this context is a result of providing the correct dosage. Whereas under “charge on administration” the waste cost was primarily passed on to patients, with the precision of charging on administration it can explicitly be recognized by rounding up to the next unit. As an entire package was removed from inventory, the full cost of the item removed can be recognized. In order to do this there needs to be a “rounding-up” to the next packaging unit. This holds true for the single dose medications that nurses remove from ADMs, one at a time for each patient. Any unused medications are discarded before the process is repeated for the next patient. The costs of unused portions is not recognized, and are never subtracted from inventory. The current charge on administration practice is accurate when the full economic unit, whether a pill, vial or other packaging, is administered.

The impact of this methodology would vary, depending on the drugs administered and the cost. For example, the drug National Drug Code (NDC) = 0409-XXXX-01 appeared in 6,371 separate orders during the three months under review. From the Cost Files, the total of all fractional units administered is 7,323 units, for a total cost of \$78,284. Calculating the cost of dispensed units by rounding up to the next whole replacement unit yields 9,691 units, for a total cost of \$108,919. The change represent a \$30,636 (39%) increase in costs associated with this one drug.

Calculating the “cost of inventory”, or the replacement cost of the drugs dispensed, is vital to accurately determine the value of the remaining inventory and reliably evaluate Pharmacy performance. At the end of the month, the total cost of dispensed drugs is subtracted from inventory account, thus the costs of the drugs becomes a period cost. By calculating the full volume of drugs dispensed, reliable replacement costs are used, and the remaining inventory is correctly valued. That part of the inventory which is expensed becomes a period cost and is matched with the corresponding patient charges in order to show the inpatient Pharmacy’s financial performance.

In effect there was a change in accounting practice brought about by implementation of the charge on administration method, and procedures had not changed to capture full quantities dispensed.

During this review, Pharmacy management implemented a process to estimate the unusable quantities of medication due to quantity differences between dispense and order. The estimate was applied to the inventory costs reported beginning in December 2015. This change should provide a more accurate estimation of Pharmacy inventory on a monthly basis.

Attachment A
 Discrepancies in Order Numbers Dispensed and Administered for June, July and August 2015
 Grouped by ADM Station Where Dispense Count is Greater than 20

Ref.	ADM station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	MedDescription	10E	3E	3W	5W	5W33	6E	6W	7E	7IMU	BICU	BIMU	CCU	CV_3-A	ICU	IMU	ISCC	MICU	SICU
1	artificial tears opht soln (CA 1 DROP PACKAGE)	642	47		51	65	24		111	60	226	33							25
2	narcotic drip (PYXIS) PACKAGE	599	72								108		146		52	44	106	71	
3	potassium chloride 20 mEq 50 ml BAG	272		111									36	103	22				
4	potassium chloride (CA) 20 mEq 50 ml BAG	233											174					28	31
5	magnesium sulfate 2000 mg 50 ml BAG	228		173										55					
6	NARC/midazolam Drip (PYXIS) PACKAGE	215											135					80	
7	NARC/LORazepam Drip (PYXIS) PACKAGE	76									76								
8	NARC/methadone IV (PYXIS) SYRINGE	43															43		
9	narcotic, pt's own (PYXIS) PACKAGE	37						37											
10	sucrose 24 % 1 ml Oral Syrin	27																27	
11	artificial tears opht soln 0.4 ml PACKAGE	21												21					
12	fentaNYL 100 mcg 2 ml Vial	21																	21