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Measuring Non-Administration of Ordered Medications in the Pediatric Inpatient Setting

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Abstract

Objective—Medication compliance in inpatient settings shows some significant gaps for adult patients. In pediatric settings prescribing and other administration errors have been studied but missed doses have not been specifically studied in the pediatric inpatient setting. We intended to apply health information technology and data processing methods to study the medication compliance for pediatric patients at our institution.

Study Design—We collected medication ordering, dispensing, and administration data spanning 42 months (7/1/2010 through 12/31/2013) for pediatric inpatients admitted to a major tertiary pediatric hospital. We analyzed the orders for which either the corresponding administration record was missing or the records indicated non-administration.

Results—There were only 596 medication orders without corresponding administration records, accounting for less than 0.05% of 1.6 Million orders for 56,000 patients. There were 40,999 orders with corresponding administration records indicating non-administration (or less than 3% of all orders). Overall order compliance of the nursing staff was 97.35%, with another 2.6% of orders

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Conflict of Interest:

None of the authors of this study have any Conflict of Interest.

Authors' Contribution:

The authors of this article worked as a team to devise and design the study, collect the data, and analyze and interpret the collected data. The initial draft of the paper, created by the first author, was revised with the input from all the authors before creating the final version for submission, which was circulated among and approved by all the authors. The team of authors is a multidisciplinary team of informaticians. Four of the authors have a clinical background (two physicians practicing pediatrics, one pharmacist, and one registered nurse). The clinicians contributed the expertise and insights of their respective fields of practice.

having a documented reason for non-administration. The top two medication classes comprising the missed and non-administered orders were “Alimentary tract and metabolism drugs” and “Nervous system drugs”.

Conclusion—Measurement of medication compliance is an important quality measure of patient safety and quality of care. Our study found a small proportion of non-administered medication orders and discovered corresponding reasons illustrating how health information technology can help to measure the quality of the medication process from ordering and dispensing to administration at a major healthcare institution.

Keywords

Pediatrics; Inpatients; Medication Compliance; Hospital Medication Systems; Health Information Technology

INTRODUCTION

Medication errors can occur at any step in the medication process from ordering, dispensing, administration, and documentation.¹ In this paper we focus on the administration process and specifically on the aspect of missed doses. The term ‘adherence’, frequently used in outpatient settings, indicates a patient following providers’ advice (on medication or health-behavior) and signifies the patient’s active role in achieving a common goal of disease treatment. ‘Compliance’, more often used in inpatient settings, indicates a passive role by patient and an active role of the medical staff (e.g., nurses and pharmacists)². For the purpose of this study, we define compliance as the proportion of medication orders that culminate in actual administration to the patient in an inpatient setting and focus on the ‘missed’ administrations – either due to non-documentation or an indicated reason; while the adherence is the proportion of ordered medications that are actually taken by the patient in the ambulatory setting. Though the medication compliance rates in an inpatient setting are expected to be higher than adherence rates observed in outpatient environments, the inpatient compliance is influenced by the complexities of patient care as well as hospital policies, procedures, and staffing states³. Much of the inpatient medication compliance literature concentrates on patient factors^{4,5}. However, a qualitative study by Elder et al. indicates that the compliance by the nursing staff plays an important role in the medication process that culminates in administration of the ordered doses⁶, and reveals the impact of a previously unrecognized nursing staff’s assessment of individual patient risks and benefits of the medication to the patients. This study by Elder et al., of inpatient venous thromboembolism prophylaxis orders for subcutaneous heparin, found a compliance rate of only 80% in certain nursing units at a major academic medical center, with a significant variation between nursing units. Other recent studies have also indicated significant compliance gaps in the inpatient medication process^{7,8}.

Potential communication barriers with caregivers are of particular concern in pediatrics since children depend on others for appropriate medication administration⁹. Parents in most cases act as proxy for the pediatric patient and may often need guidance about the medication treatment from the nursing staff at the hospital¹⁰. Given the observed gap for medication

administration in adults⁶, we considered it worthwhile to examine the medication process for similar inconsistencies and gaps in a pediatric population.

In pediatric inpatient settings, medication is generally administered by nursing staff and occasionally by parents¹⁰. Compliance for pediatric inpatient settings is therefore more dependent on the integrity of the medication dispensing and administration process¹¹. Medication management for pediatric patients is more complex and poses higher safety risks due to the developmental gradient of children and their inability to buffer errors due to limited internal reserves^{10,12}. It is therefore important that every medication ordered for a pediatric patient is delivered and administered as intended by the provider. Further, it is in the interest of a healthcare institution to periodically assess the robustness of medication compliance to ensure quality of care. Some limited work was done in examining the medication process in general, after relocation of a children's hospital at an academic medical center¹¹. This paper focuses on the analysis of missed doses for pediatric inpatient population of a major tertiary pediatric hospital and describes 'Medication Compliance' as the proportion of medication orders that culminate in actual administration to the patient. Additional studies were spawned to analyze administration-times and other detailed aspects of the deviations.

METHODS

This retrospective cross-sectional study uses the Enterprise Data Warehouse (EDW) at the Vanderbilt University Medical Center (VUMC) that receives daily feeds from Vanderbilt's operational systems, such as Vanderbilt's order entry system (Horizon Order Entry and WizOrder)¹³ and the electronic Medication Administration Record (eMAR) System. We queried datasets that contain data on medication orders, dispensing, administration, patient encounters, and demographics using Structured Query Language.

We isolated pediatric patients (less than 19 years of age on the date of admission) in the EDW based on their inpatient encounters (including admissions and observational stays) and extracted their demographic information. For this pediatric patient dataset, we collected all orders from July 01, 2010 through December 31, 2013 (42 months). To identify the medication orders, we included only orders serviced by pharmacy, and applied filters to exclude orders for pharmacy consultations. We also excluded orders where the administration was not mandatory (e.g., PRN orders) or was not routinely recorded in the medication administration record (e.g., TPN orders were recorded by nurses as fluids and not medications). For the medication orders collected, we isolated the corresponding pharmacy dispensing data, medication administration data, and the patients' unit location at the time of the order (Figure 1).

In the next step, we identified medication orders that did not have a corresponding matching administration record – we labeled this set of order records the “*missed-admin*” subset. Orders not explicitly for a medication (e.g., orders named 'PHARMACY MESSAGE') or for discontinuation of medications were also excluded. We further excluded the orders for patients, who were not in a pediatric unit, and all orders from the pediatric emergency department since it used a paper-based MAR process.

At VUMC, nurses may select a REASON (from a predefined list) to indicate why a medication was not administered or delayed. The presence of a (non-zero) REASON-CODE indicates a deviation from the order. Some non-zero REASON-CODEs indicate that medication was ‘not administered’ – others refer to deviation in timing or route. We labeled the set of orders with the corresponding administration records indicating ‘not administered’ REASON-CODEs as ‘*non-admin*’ subset. Figure 2 shows the schematic view of separating the *missed-admin* and *non-admin* subsets.

We further analyzed the orders in the *missed-admin* or *non-admin* subsets with respect to the medication class. Because of the nature of the data stored, the medication details (name, dose, frequency, etc.) are contained in a free-text attribute. We used MedEx¹⁴ to extract the medication details from the text attribute, and Anatomical Therapeutic Chemical (ATC) Classification¹⁵ to classify the medications.

Since the orders in the ‘*missed-admin*’ subset did not have corresponding administration records, the proportions are with respect to the # of orders, while those for the ‘*non-admin*’ are with respect to the # of administration records. Administration records are related to the corresponding order by respective order number (order-identifier). Each order may have multiple administration records. Wherever appropriate, we have used number of distinct orders. χ^2 test was used to check the association between respective categories of administration records. We used statistical package R [64-bit version 2.15.2 (2012-10-26)]¹⁶ for statistical analyses.

The EDW uses Oracle 11g database engine and is behind a firewall. This data collection and analysis effort was part of a larger effort to study medication compliance for pediatric inpatients at VUMC. We obtained the Vanderbilt IRB approval for this Medication Compliance Study.

RESULTS

We isolated the demographic data for 56,428 distinct pediatric patients (26,006 Females), who were inpatients or observation patients, with 110,435 encounters. Over half of the patients (30,442 or ~54%) were less than 3 years old (18,360 or ~33% neonates) with 51,443 (~47%) encounters. There were 1,570,994 medication order records for these patients, with 3,742,013 matching administration records. Only 596 distinct medication order records did not have a valid matching administration record (the *missed-admin set*). Table 1 summarizes these results.

Medication class distribution

Of the 596 “*missed-admin*” orders, half (50%) were for the “Alimentary Tract and Metabolism Drugs” (e.g., antiemetic medications like Ondansetron, steroids like Prednisolone, etc.), 14.4% were for the “Nervous system Drugs” (e.g., pain medications like Morphine), and 10.9% were for the “Antiinfectives for Systemic Use” (Influenza Virus Vaccine, Ampicillin, etc.). Table 2 shows the distribution of the “*missed-admin*” orders by (ATC) drug-class.

The distribution of administration records with non-zero REASON-CODEs is shown in Table 3. We grouped the non-zero REASON-CODEs into three categories: “Administered per Protocol”, “Permitted Deviations”, and “*Not Administered*”. “Administered per Protocol” indicates that the medication was given in a modified manner, for example, delayed when the patient was off the unit; and “Permitted Deviations” indicates that the medication was not administered for valid ‘circumstantial reasons’ (e.g. patient already received dose in the operating room). We categorized the remaining REASON-CODEs as “*Not Administered*”. 69,614 administration records had REASON-CODEs indicating that the respective medications were *not administered*, which corresponded to 40,999 distinct medication orders (Table 1). A quarter (26.1%) of the administration records with non-zero REASON-CODEs corresponded to the “**Not Administered**” category. Of all the medication orders in the “Not Administered” category almost half of the administrations missed (20,455 out of 40,999 or 49.9%) were the first doses.

Table 4 shows the cross-tabulation of four select REASON-CODEs in “*Permitted Deviations*” category (NPO, Sleeping, No-IV Access, and Sedated) by drug-class. Almost half (46.1%) of the doses with one of these four “*Permitted Deviations*” REASON-CODEs were for the “Alimentary Tract and Metabolism Drugs” (e.g., electrolytes like Potassium Chloride, pancreatic enzymes like Creon, laxatives like Docusate Sodium, H2-blockers like Famotidine), over 12% of them were for the “Nervous System Drugs” (e.g., pain medications like Acetaminophen and Methadone), and almost 9% of them were “Genito-Urinary System and Sex Hormones” (e.g., vitamins like Poly-VI-Sol w/Fe, Cholecalciferol, and Ascorbic Acid). The χ^2 analysis indicated that the non-administration in these four Permitted Deviations was significantly associated with the ATC drug class ($P < 0.01$). Certain drugs that are considered more critical and time sensitive (such as antimicrobials, cardiac medication, anti-neoplastic medications, or hormones) accounted for a small proportion in these categories suggesting that nurses potentially worked harder to administer these medications (by attempting another IV access, for example) and were less likely to override administration instructions for critical drugs using these specific reason codes.

Of the 40,999 distinct *non-admin* order records, shown in Table 5, a third (33.1%) were for the “Alimentary Tract and Metabolism Drugs” (e.g., Docusate Sodium, Pancrelipase, etc.), a sixth (16.7%) of those orders were for pain management labeled “Nervous System Drugs” (e.g., Morphine, Fentanyl, etc.), and over a tenth (10.3) were for what ATC labeled as “Cardiovascular System Drugs” but also included medications to manage pain (e.g., Emla Cream, Ibuprofen, Lidocaine, etc.). The χ^2 test between the non-admin orders and all orders showed that the proportion of non-administered medications differed significantly across medication classes ($p < 0.01$).

DISCUSSION

The medication process (ordering, dispensing, and administration) is one of the most complex processes in pediatric care^{17,18}. Hospital leadership is entrusted to ensure that health care processes work in a sufficiently reliable manner at both macro and micro levels thus assuring safety for patients and quality of care. Among various aspects of the medication process, medication compliance is a quality measure that one would want to

control for a given healthcare facility. However, to our knowledge the reliability of the medication process is not routinely assessed and no studies have evaluated medication compliance in a pediatric hospital. Medication compliance in the inpatient settings cannot be assumed to be perfect (or even passable) without taking relevant efforts to measure it. For this retrospective study, we used health information technology to measure the quality status of the medication process at various levels^{19,20}.

The small number of missing administration records (596 of the total 1,570,994 orders – <0.05%) shows robustness of the Vanderbilt eMAR, which reminds nurses to document every scheduled dose. This small gap could reflect truly not administered and undocumented doses. Or these could have been lost due to the validation phase of the extract-transform-load (ETL) processes that transfer data from the operational healthcare systems (CPOE, MAR, Pharmacy Information Systems) into the enterprise data warehouse (EDW). At the micro level the missing administration records may well be a tolerable error of the EDW. Further analysis revealed that most (75.3% or 449) of the missed-admin orders were for ‘Alimentary tract and metabolic drugs’, ‘Nervous system drugs’, and ‘Antiinfectives for systemic Use’.

The *non-admin* orders corresponded to < 3% (40,999 distinct orders) of the total 1,570,994. As an overall proportion this may be tolerable. Though the corresponding absolute number of over 40,000 may seem concerning, the breakdown of the REASONS suggests a high level of hospital protocol use, implying an active decision making process explaining missed medication administration. Further, the distribution of medication classes demonstrates that certain classes are more likely not to be administered. Almost a half (49.8% or 20,565) of these non-administered doses consisted of the ‘Alimentary tract and metabolic drugs’ and medications associated with pain management. The missed doses under “Permitted Deviations” reason category also consisted of similar medications. Certain critical and time sensitive medications such as anti-infective medications and pain medications have a lower rate of non-administration, suggesting that nurses, and perhaps parents, consider medication class in decision making about medication administration. However, *further research is needed to explore why certain medication classes are less likely to be administered*. Additional investigation of all the administration groups under “Not Administered” (Table 3) is also needed to understand the true reasons and whether any finer classification of ‘REASONS’ is required.

The total number of distinct orders with missing administration record represented about 1% of all of the orders for which no deemed administration occurred (either administration record was missing or a reason for non-administration existed). Thus the clinical staff complied with the institutional policy and procedures by either administering the medication order (97.35%) or documenting a reason for non-administration (2.35%) for more than 99.95% of (1.6 Million) medication orders. Amongst the non-administered orders, almost 99% had a code indicating the reason for non-administration.

Limitations

This paper presents a high-level analysis of the missed doses and does not explore the reasons for non-administrations. This study had several limitations:

- Focusing on the medication compliance for a single institution limits our ability to extend the conclusions to other organizations. A study (or audit) across multiple institutions, especially under different hospital managements, could reveal varying levels of compliance due to different organization and management practices.
- Our study included only those orders serviced by pharmacy to make sure that all data attributes of the complete medication process – from initiation of order through the administration step – are available. As a result, we missed certain medication orders not managed by pharmacy.
- We excluded the PRN orders because administration for those occurs ‘as required’. Therefore, our results do not reflect potential erroneous non-administration of these medications.
- A minor limitation pertains to non-medication items (e.g., dressings or emergency kits). Pharmacy dispenses these items and they were included in our initial data collection. However, serendipitously those records were automatically excluded from the medication class distribution – since such items were not classified into any of the existing ATC classes.
- Another limitation is the fact that ATC classification of drugs has little clinical relevance without knowledge of the diagnosis (e.g. Erythromycin may be used as an antibiotic or a motility drug). Future studies are planned to review ATC classification along with diagnoses.
- This study did not analyze any medication errors nor did we cross-walk our findings with medication error reports limiting our conclusions.
- A final limitation included the fact that we concentrated on a binary outcome: Administration or Non-administration. Medication compliance further includes timely administration and the right route. We are planning a subsequent study to explore time from ordering to dispensing and administration for individual medication orders.

CONCLUSION

Our findings indicated that the medication process in pediatric practice at Vanderbilt is quite robust. Fewer than 3% of the orders were not administered resulting in a compliance rate of 97.35%. More than 2.6% of the remaining non-administered orders had appropriately logged administration records with corresponding REASONS for non-administration. The data suggest that nurses use their professional expertise and discretion in non-administration based on lower administration rates of certain medication classes. A detailed analysis of the orders with REASON-CODEs of ‘Patient/Family refused’ could also shed more light on the reasons of refusal.

To our knowledge, this is the first study of its kind conducted at a sizable pediatric healthcare institution. We were able to establish baseline performance data for the medication process. Studies of this nature may help to understand the status of the

medication process in pediatric care, may serve to be the means to unravel other unknown gaps in the process, and may spawn further detailed studies of sub-processes and locales within the institution. Such studies may potentially allow comparison between organizations.

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Abbreviations

ATC	Anatomical Therapeutic Chemical
EDW	Enterprise Data Warehouse
EHR	Electronic Health Record
eMAR	electronic Medication Administration Records
ETL	Extract-transform-load
IRB	Institutional Review Board
IV	Intra-Venous
MAR	Medication Administration Records
NPO	Nil per os (Nothing by mouth)
PRN	Pro re nata (as in PRN orders)
Prop	Proportion
TPN	Total Parenteral (or Peripheral) Nutrition
VPH	Vanderbilt Pediatric Hospital
VUMC	Vanderbilt University Medical Center

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Highlights

- This study uses Health Information Technology to measure the quality of the medication process from ordering and dispensing to administration at an institutional level.
- To our knowledge, this is the first study of its kind conducted at a sizable pediatric healthcare institution.
- Studies of this nature help to understand the status of medication process in pediatric care, may serve to be the means to unravel other unknown gaps in the process, and may spawn further detailed studies of sub-processes and locales within an institution.
- Studies of this kind can help to establish baseline performance data for medication process and also allow comparison between organizations or institutions.

Summary Table

What's Known on This Subject	<ul style="list-style-type: none">• Even though medication administration is a major task in pediatric hospitals, the (missed) administrations are not routinely tracked• Very little is known on the subject of medication compliance in inpatient pediatric care settings.
What This Study Adds	<ul style="list-style-type: none">• This study used EHR data repository and information technology methods to evaluate the health of the medication process through missing and non-administered doses.• Approaches used in this study may lead to novel quality measures for health care systems in pediatrics and other disciplines of medical practice.

Figure 1.

Schematic showing the data extraction and from EDW objects for ordering, dispensing, and administration data, and related data filtration.

Figure 2. Schematic showing the processing and segregating the *missed-admin* and *non-admin* data sets.

Table 1

Overview of Pediatric Medication Administration Data

Parameter	Value
Distinct Pediatric Inpatients	56,428
Encounters	110,435
Distinct number of Medication Orders	1,570,994
Matching Administration Records	3,742,013
Missing administration records (<i>missed-admin subset</i>)	596
Administration records with REASON-CODE indicating non-administration (Table 3) (<i>non-admin subset</i>)	69,614
Distinct medication orders corresponding to the administration with a REASON-CODE indicating non-administration (Table 3)	40,999

Table 2Medication Class (ATC) Distribution for “*missed-admin*” Orders

Anatomical Therapeutic Chemical (ATC) Class	Count	Prop. %
ALIMENTARY TRACT AND METABOLISM DRUGS	298	50.0
NERVOUS SYSTEM DRUGS	86	14.4
ANTIINFECTIVES FOR SYSTEMIC USE	65	10.9
CARDIOVASCULAR SYSTEM DRUGS	52	8.7
DERMATOLOGICALS	45	7.6
BLOOD AND BLOOD FORMING ORGAN DRUGS	20	3.4
MUSCULO-SKELETAL SYSTEM DRUGS	12	2.0
RESPIRATORY SYSTEM DRUGS	8	1.3
VARIOUS DRUG CLASSES IN ATC	4	0.7
SYSTEMIC HORMONAL PREPARATIONS, EXCL. SEX HORMONES AND INSULINS	3	0.5
ANTINEOPLASTIC AND IMMUNOMODULATING AGENTS	3	0.5

Table 3

The Medication Administration Records with a Non-Zero REASON-CODE (indicating Non-Administration or Deviation from the Stipulated Order)

Description	Category	Administration Count	Proportion (%)	Category Prop. (%)
Already given	Administered per Protocol	92,530	35.50	52.5
Given by Other		21,676	8.32	
Schedule Change		18,510	7.10	
See Procedure/Code rec		1,540	0.59	
See alt route		1,443	0.55	
See MAR		745	0.29	
Given Off Unit		226	0.09	
Med/Patch Removed		85	0.03	
Given by MD		25	0.01	
Med Discontinued	Permitted Deviations	18,429	7.07	20.8
Per MD order		10,919	4.19	
NPO		10,782	4.14	
Per Parameter		3,631	1.39	
Sleeping		3,398	1.30	
No insulin required		2,288	0.88	
No IV access		2,176	0.83	
Nauseated/Vomiting		1,973	0.76	
Sedated		272	0.10	
Unable to swallow		216	0.08	
Not on Unit		121	0.05	
VPH Partial Patient		66	0.03	
Other- annotate	Not Administered	39,111	15.00	26.7
Patient/Family refused		29,587	11.35	
Acknowledged		573	0.22	
REASON NOT GIVEN		290	0.11	
Med not available		53	0.02	
All		260,665	100.0	

Table 4
Medication Class (ATC) Distribution in Administrations with Select Reasons in “Permitted Deviations” Category

Anatomical Therapeutic Chemical (ATC) Class	Reason in Permitted Category				Sum of 4 Select Reasons	All Orders ^a	Prop. by ATC (%) ^b
	NPO	Sleeping	No-IV Access	Sedated			
ALIMENTARY TRACT AND METABOLISM DRUGS	3,490	900	479	38	4,907	213,903	2.3
NERVOUS SYSTEM DRUGS	667	405	116	128	1,316	189,643	0.7
GENITO URINARY SYSTEM AND SEX HORMONES	904	27	3	5	939	14,118	6.7
DERMATOLOGICALS	251	309	299	15	874	82,102	1.1
CARDIOVASCULAR SYSTEM DRUGS	619	103	58	36	816	84,475	1.0
ANTIINFECTIVES FOR SYSTEMIC USE	165	30	609	1	805	67,624	1.2
RESPIRATORY SYSTEM DRUGS	212	143	5	10	370	39,879	0.9
BLOOD AND BLOOD FORMING ORGAN DRUGS	119	46	117	4	286	46,922	0.6
MUSCULO-SKELETAL SYSTEM DRUGS	56	12	142	9	219	14,072	1.6
SENSORY ORGAN DRUGS	6	37	2	3	48	12,656	0.4
VARIOUS DRUG CLASSES IN ATC	44	0	2	0	46	1,203	3.8
ANTINEOPLASTIC AND IMMUNOMODULATING AGENTS	9	0	2	1	12	9,824	0.1
SYSTEMIC HORMONAL PREPARATIONS, EXCL. SEX HORMONES AND INSULINS	6	0	2	0	8	2,109	0.4
ANTIPARASITIC PRODUCTS, INSECTICIDES AND REPELLENTS	1	0	0	0	1	320	0.3

^aThis is count of all medication orders with the indicated Anatomical Therapeutic Chemical (ATC) Class (left-most column) of the ordered medication.

^bThis indicates the proportion of orders of Select Reason with respect to all orders in respective ATC (for each row).

Table 5

Medication Class (ATC) distribution for *non-admin* orders (corresponding to the administration REASON-CODEs indicating non-administration).

Anatomical Therapeutic Chemical (ATC) Class	Non-Admin orders ^a	All Orders ^b	Prop. by ATC (%) ^c
ALIMENTARY TRACT AND METABOLISM DRUGS	13,665	172,888	7.9
NERVOUS SYSTEM DRUGS	6,900	173,344	4.0
CARDIOVASCULAR SYSTEM DRUGS	4,235	72,578	5.9
DERMATOLOGICALS	3,960	68,090	5.8
RESPIRATORY SYSTEM DRUGS	3,323	28,871	11.5
ANTIINFECTIVES FOR SYSTEMIC USE	3,245	55,500	5.9
BLOOD AND BLOOD FORMING ORGAN DRUGS	2,568	42,882	6.0
SENSORY ORGAN DRUGS	1,196	8,169	14.6
GENITO URINARY SYSTEM AND SEX HORMONES	1,022	9,900	10.3
MUSCULO-SKELETAL SYSTEM DRUGS	716	11,515	6.2
ANTINEOPLASTIC AND IMMUNOMODULATING AGENTS	138	9,301	1.5
VARIOUS DRUG CLASSES IN ATC	126	984	12.8
SYSTEMIC HORMONAL PREPARATIONS, EXCL. SEX HORMONES AND INSULINS	123	1,893	6.5
ANTIPARASITIC PRODUCTS, INSECTICIDES AND REPELLENTS	11	289	3.8

^aBecause a few medications were categorized into multiple medication classes, the total sum of numbers in the “Non-Admin orders” column of this table is slightly larger than the number of distinct non-admin orders (40,999).

^bThis is count of all medication orders with the indicated Anatomical Therapeutic Chemical (ATC) Class (left-most column) of the ordered medication.

^cThis indicates the proportion of orders of Select Reason (see Table 4) with respect to all orders in respective ATC (for each row).