

Description of the MHS Health Level 7 Pharmacy Data for Public Health Surveillance

NMCPHC-EDC-TR-120-2021

By Beth Poitras MPH, Charlotte Neumann MPH, Stephen Rossi MPH, and Tina Luse MPH
EpiData Center

Prepared April, 2021

NAVY AND MARINE CORPS PUBLIC HEALTH CENTER
IMPROVING READINESS THROUGH PUBLIC HEALTH ACTION

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
21 Apr 2021	Technical	01 Oct 2009 - 26 Sep 2019

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Description of the MHS Health Level 7 Pharmacy Database for Public Health Surveillance	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Beth Poitras MPH, Charlotte Neumann MPH, Stephen Rossi MPH, Tina Luse MPH	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
The EpiData Center (EDC) Navy and Marine Corps Public Health Center (NMCPHC) 620 John Paul Jones Circle, Suite 1100 Portsmouth, VA 23708-2103	NMCPHC-EDC-TR-120-2021
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
The EpiData Center (EDC) Navy and Marine Corps Public Health Center (NMCPHC) 620 John Paul Jones Circle, Suite 1100 Portsmouth, VA 23708-2103	EDC, NMCPHC
	11. SPONSORING/MONITORING AGENCY REPORT NUMBER NMCPHC-EDC-TR-120-2021

12. DISTRIBUTION AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The EpiData Center (EDC) at the Navy and Marine Corps Public Health Center evaluated the Composite Health Care System (CHCS) Health Level 7-formatted (HL7) data source for its usefulness in health surveillance activities. This technical document explains the creation of prescription records, describes the pathway of data from healthcare provider to the EDC, provides a detailed descriptions of all variables within the databases, and assesses the databases' strengths and limitations. Given an understanding of the strengths and limitations of the data, HL7-formatted pharmacy data have proven to be a valuable source of health information for surveillance purposes. The data can be used for case identification when disease-specific treatment is available, can be matched with other data sources to enhance disease surveillance, or used to assess clinical practice guideline adherence for known cases. Furthermore, data are received in a timely fashion, allowing for near-real-time surveillance of diseases.

15. SUBJECT TERMS

Health Level 7 (HL7) formatted data, pharmacy database, Military Health System (MHS), public health disease surveillance, military health surveillance

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Beth Poitras MPH
U	U	U	UU	80	19b. TELEPONE NUMBER *(Include area code)* 757-953-0970

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI-Std Z39-18

Abstract

The EpiData Center (EDC) at the Navy and Marine Corps Public Health Center evaluated the Composite Health Care System (CHCS) Health Level 7-formatted (HL7) data source for its usefulness in health surveillance activities. This technical document explains the creation of prescription records, describes the pathway of data from healthcare provider to the EDC, provides a detailed descriptions of all variables within the databases, and assesses the databases' strengths and limitations. Given an understanding of the strengths and limitations of the data, HL7-formatted pharmacy data have proven to be a valuable source of health information for surveillance purposes. The data can be used for case identification when disease-specific treatment is available, can be matched with other data sources to enhance disease surveillance, or used to assess clinical practice guideline adherence for known cases. Furthermore, data are received in a timely fashion, allowing for near-real-time surveillance of diseases.

Contents

Executive Summary

The EpiData Center (EDC) at the Navy and Marine Corps Public Health Center (NMCPHC) utilizes the CHCS-generated, HL7-formatted pharmacy data sources (outpatient (OP), intravenous (IV) and unit dose (UD)) to enhance its public health surveillance. The OP database contains the pharmacy records associated with ambulatory and outpatient visits; the IV database contains intravenous pharmacy records associated with ambulatory and inpatient visits; and the UD database generally contains the pharmacy records associated with inpatient, same-day surgery, or outpatient emergency department visits. UD records generally correspond to pre-packaged, pre-measured drugs that are readily available on the inpatient unit or in a clinic. Current and retrospective OP records for Department of Defense (DoD) beneficiaries are available beginning 01 October 2006, while IV and UD records are available starting 06 July 2009. This technical document describes the pathway of pharmacy data from the healthcare provider to the EDC, provides a detailed description of all variables within the databases, and assesses the databases' strengths and limitations.

Pharmacy data include all medications dispersed at military treatment facility (MTF) pharmacies. Pharmacy data add a unique layer to the EDC's surveillance efforts. Dispersed medications are not limited to laboratory-confirmed cases, therefore they may provide information on presumptively or prophylactically treated cases. The pharmacy data may be merged with laboratory or encounter data to examine adherence to clinical practice guidelines; to examine the burden of a disease; to assist with case validation; or to enhance overall surveillance. Data on pharmacy transactions, therefore, can improve the robustness of surveillance systems based on lab results and/or clinical encounters.

Pharmacy data can be analyzed by unique patient, prescription order, or medication. Unique patients are identified in the data through the patient ID, a unique identifier that can be used to track individual patients through all pharmacy records. A unique order is defined as all records associated with each specific drug prescription or a combination of drugs administered through one IV. A unique record is defined as all transactions associated with each prescription for an individual patient. Multiple fields are used to assist in queries and surveillance based on specific disease or treatment context. The date and time variables distinguish timeframes among different prescription events.

The range of data fields enables assessment of the drug prescribed including the drug name, National Drug Code (NDC), provider's instructions, and the route, frequency, and duration of administration. These fields have several unique characteristics that should be considered prior to analysis. The project goal will dictate which fields are utilized in an analysis as each project is unique.

The completeness of the database as a whole continues to be assessed, however, most of the data fields of interest are complete. Analysis of the pharmacy data indicates that records are fed

to CHCS from a majority of the DoD MTFs. The timeliness of reporting is within the acceptable range for the Navy surveillance activities of one to three days.

It is currently not clear whether Defense Health Services Systems (DHSS) captures all CHCS pharmacy transactions. There are instances of missing data from specific MTFs which may encompass a single record, a groups of records, or days/weeks of records. The volume of missing data is unknown. An analysis of HL7-formatted outpatient pharmacy records compared with other pharmacy data sources (PDTS, M2) confirmed this suspicion.

The data are fed only from MTFs that have CHCS servers. Therefore, forward deployed clinics, contracted managed care support clinics, MTFs that utilize MHS GENESIS, and other MTFs that do not use CHCS are not captured in these data unless the prescription is taken to an MTF to be filled at a pharmacy that uses CHCS. Incomplete demographic information (e.g., marital status, race, and ethnicity) can limit the generalizability of these data to specific minority groups. Extra precautions need to be taken when extrapolating data to larger populations, and when comparing disease rates and trends among the military to non-military populations.

Background

The EpiData Center (EDC) at the Navy and Marine Corps Public Health Center (NMCPHC) utilizes the CHCS-generated, HL7-formatted pharmacy data sources (outpatient (OP), unit dose (UD), and intravenous (IV)) to enhance its public health surveillance. This technical document describes the pharmacy data which includes three pharmacy data types: outpatient (OP), intravenous (IV) and unit dose (UD). The OP database contains the pharmacy records associated with ambulatory and outpatient visits; the IV database contains intravenous pharmacy records associated with ambulatory and inpatient visits; and the UD database generally contains the pharmacy records associated with inpatient, same day surgery, or outpatient emergency department visits. UD records generally correspond to pre-packaged, pre-measured drugs that are readily available on the inpatient unit or in a clinic.

This technical document describes the pathway of pharmacy data from the healthcare provider to the EDC, provides a detailed description of all variables within the databases, and assesses the databases' strengths and limitations. Records for all DOD military service members (Army, Navy, Marine Corps, Air Force, and Coast Guard), US Public Health Service personnel, National Oceanic and Atmosphere Administration (NOAA) personnel, overseas civilian personnel, TRICARE-eligible dependents, and others who have prescriptions dispensed at MTFs, are included in the pharmacy datasets. OP records were available for EDC surveillance purposes beginning 01 October 2006 while IV and UD records were available starting 06 July 2009.

In February 2018, MTFs began the transition to a new platform for electronic medical records, MHS GENESIS. GENESIS will replace other systems of record in the MHS and, after implementation is completed, it will be the source of pharmacy data for surveillance purposes. At present, the EDC is unable to obtain data feeds from GENESIS; a process for obtaining this data is under review within the EDC. Currently, as initial facilities complete the transition to GENESIS, visibility is lost on related pharmacy occurrences.

Public Health Surveillance Applications

Pharmacy data add a unique layer to the EDC's surveillance efforts. Because these data are not limited to laboratory-confirmed cases, they can provide information on presumptively treated cases. Where treatment of a disease uses a specific medication, these data indicate the diagnosis more precisely than diagnosis codes from inpatient or encounter records as the codes in these records may be imprecise. Therefore, data on pharmacy transactions improve the robustness of surveillance systems based on lab results and/or encounter records.

The greatest value of pharmacy data for the Navy and Marine Corps currently lies in disease-specific treatments. However, many symptoms and treatments are not specific to a particular disease or condition. Consequently it is necessary to fully understand the treatments for a disease of interest and be aware of the other indications for which those treatments may be used.

Treatments for conditions such as influenza, malaria, and tuberculosis are relatively specific and may be useful proxies for a diagnosis when the dosage and length of treatment are considered.

Potential use of HL7-formatted pharmacy records is not limited to surveillance. Data on dispensed medications fills critical gaps in the military's ability to track medication compliance with regard to outcomes such as treatment of latent tuberculosis infection, high blood pressure, diabetes, or sexually transmitted infections. Coupled with laboratory and encounter data, disease management guidelines can be evaluated. Finally, these data provide valuable insight into antibiotic therapy and subsequent emerging resistance. An example of analysis completed using the HL7-formatted pharmacy outpatient dataset is provided in Appendix A.

Data Origination and Flow Process

Figure 1 illustrates the pharmacy data stream which includes all prescriptions that are filled at an MTF pharmacy. Several mechanisms of entry can occur; the most common process followed is described below along with notable exceptions.

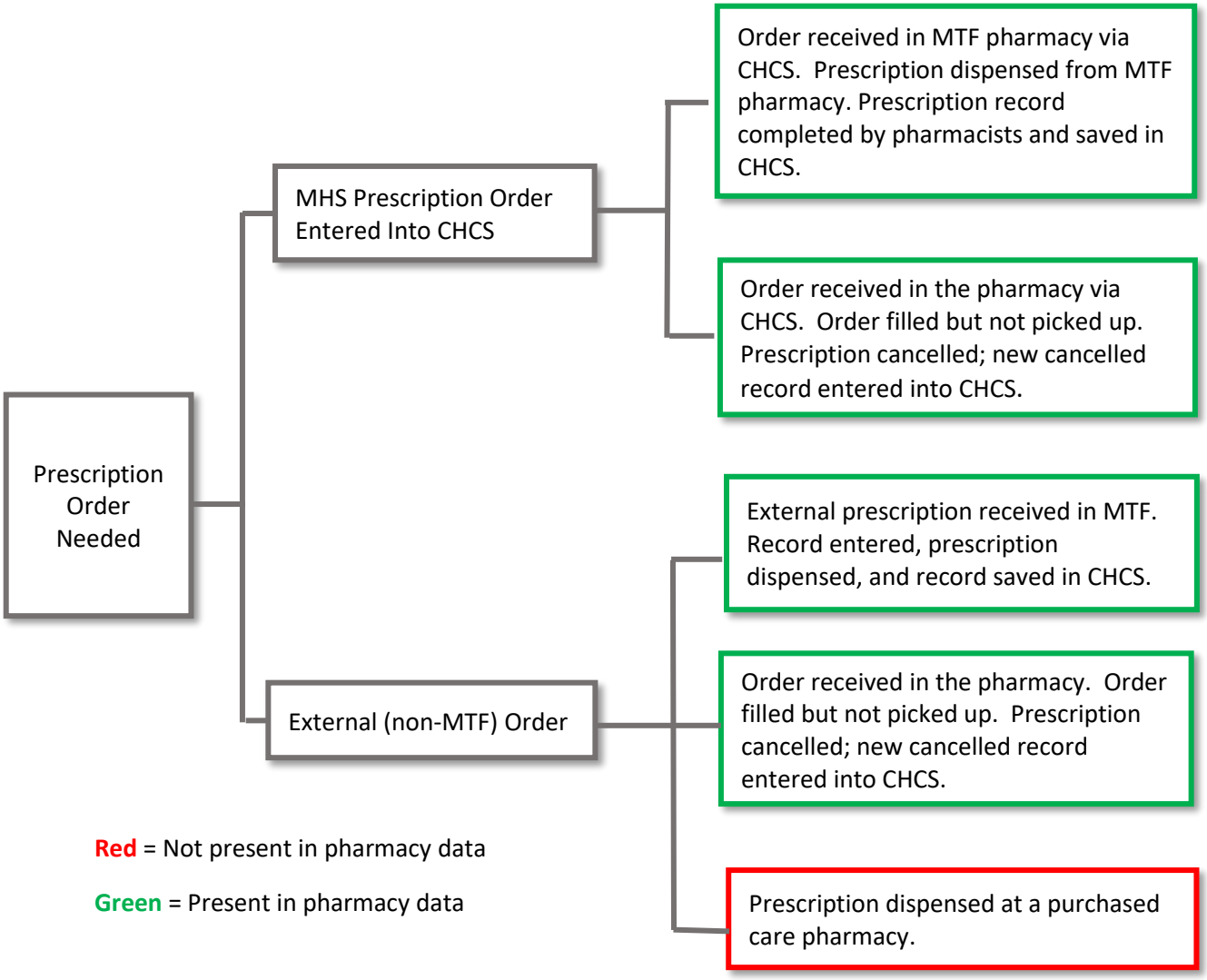
- A medication order is initially entered into the CHCS system by the prescribing (requesting) provider.
- The pharmacist receives the order via CHCS and verifies it.
- When the pharmacist fills the order and dispenses the medication, the record is completed and saved in the local CHCS system.
- If a prescription is edited upon verification, edits are made in the CHCS record.
- The pharmacist has the ability to cancel prescriptions per the physician or when the medication is not picked up by the patient.
- Each time a record is canceled, changed, edited, reordered, or refilled, a new record in CHCS is generated.

An alternative record creation process in CHCS is used when the prescription is received from a non-CHCS participating provider and filled at an MTF pharmacy. In this case, a written prescription is submitted to the pharmacy. The pharmacist creates the order and completes the record in CHCS as the prescription is verified and filled. This process can occur in several circumstances, including non-MTF doctor's visits and prescriptions written by ship-based clinicians, as neither use the CHCS system for ordering medications. All these activities in CHCS also generate HL7 messages for that prescription. Specifically, an HL7 message is generated when a label is printed for a new, refilled, or edited prescription. An HL7 message is also generated when a prescription is entered manually at a site that does not print labels for manual prescriptions, is marked non-compliant in CHCS, or is removed. Edited, refilled, and cancelled prescriptions in the HL7-formatted data will have the same order number as the original HL7 message for that prescription.

Dental clinics are associated with an MTF or ship, and prescriptions written there, like those written at an outpatient clinic, are received from the parent facility's pharmacy. Therefore the records follow the same entry pattern as those of their parent facility. Depending on the initial CHCS set-up, the clinic may not be explicitly named in the requesting facility fields. In this case, the dental clinic's parent facility may be listed in the requesting facility name. Consequently, identifying records from a dental clinic may include the two possible fields: Requesting Work Center; and Medical Expense and Performance Reporting System (MEPRS) code.

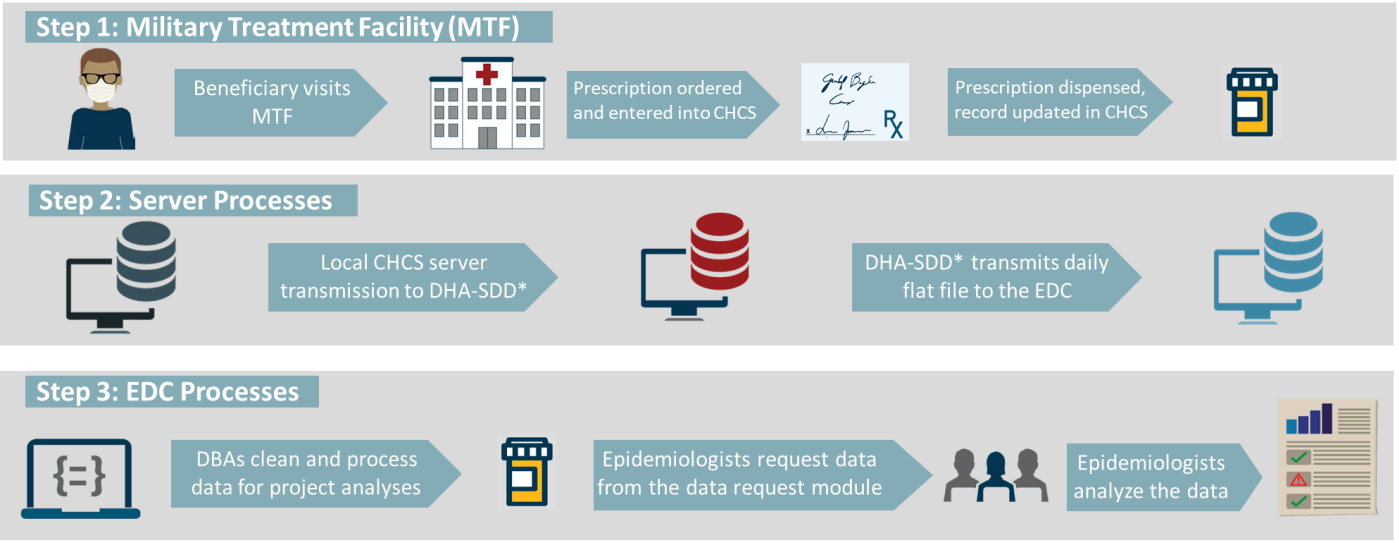
The HL7-formatted pharmacy data are limited to prescriptions filled at an MTF pharmacy that uses CHCS. Prescription orders entered into CHCS and not filled (a label is not printed at the pharmacy) are not seen in the HL7-formatted pharmacy OP data stream. Notably, prescriptions filled in a network pharmacy are also not included in this data stream.

Figure 1: HL7-formatted Pharmacy Data: Origination and Exclusions



After completion of the record in CHCS, a script is run to generate an HL7 message for each prescription. The HL7 message is then archived and batched with other HL7 messages on the local CHCS host. At least once a day, these HL7 messages are forwarded to Defense Health Agency-Solutions Delivery Division (DHA-SDD) main servers. Once forwarded, and receipt is verified by DHA-SDD, HL7 messages at the local host are deleted. Then these records are retrieved from the main servers and parsed into a database design four times a day. The EDC receives flat file extracts of the raw parsed data from DHA-SDD on a daily basis using a secure connection, as dictated by the Interface Control Document (ICD). The EDC database administrators clean and process the data for use by analysts. Figure 2 outlines the flow of pharmacy data from the MTF to the EDC.

Figure 2: HL7-formatted Pharmacy Data Flow from MTF to EDC



HL7 is not the only source for pharmacy data in the Military Health System (MHS). The Pharmacy Data Transaction Service (PDTS) is a centralized data repository that collects prescription information for all DOD beneficiaries that are filled at MTFs, retail locations, and mail order pharmacies. This service is set up as real-time provider of transaction support to ensure patient safety. During a patient visit, when a provider enters a prescription order into CHCS, information is sent to PDTS to review medication history and ensure that the medications prescribed will not adversely interact with other medications the patient is currently taking. The provider receives a response on his/her CHCS screen within 15 seconds.

PDTS data are collected, therefore, almost instantaneously and include information on prescription orders as opposed to medication fills. The Pharmacoeconomic Center has done extensive work with the PDTS data and continues to support TRICARE decision making (including formulary set-ups) using these data. Though these data include more prescriptions to beneficiaries that were not filled at military MTFs, they do not include inpatient medication

transactions, whereas the three HL7-formatted pharmacy data streams include both outpatient and inpatient transactions but lack data on prescriptions not filled at MTFs. The use of PDTS data is currently under exploration by the EDC.

Key Fields for Public Health Surveillance

Defining Duplicates

Within the HL7-formatted pharmacy data string, unique records can be identified in several ways. Duplicate rules should be checked against project objectives to ensure the desired outcome results. True duplicates are defined as records in which all fields are identical. One record should be retained. After true duplicates are eliminated, analysis should take into account that any changes to a new or existing medication transaction appear as a separate record in the HL7-formatted database. As described below, the data can be analyzed by unique prescription order, individual, or medication

Unique ID/Records

Patients are identified in the HL7-formatted pharmacy data from the Unique Patient ID (Sponsor ID + FMP). This unique identifier is generated by the analyst and can be used to track individual patients through all pharmacy records. Each unique patient can have multiple medication prescriptions in the HL7-formatted pharmacy data. One or more prescriptions may be prescribed during the same encounter.

The combination of Unique Patient ID and Order Number creates a unique record identifier for each prescription. The Order Control for each prescription designates its status (new, edited, cancelled, etc.). The analyst is able to identify an original order and all changes and modifications made to that order through the combination of the unique record identifier and the Order Control variable. When a prescription is edited, a new Message ID is generated. The values of Order Control represent the status of the prescription, and it is often necessary for cancelled, edited, replaced, and unknown status records to be removed prior to analysis.

Medication Dispensed

Several fields relate directly to the medication dispensed: Amount Dispensed, Drug Name, NDC Number, Provider's Administration Instructions, and Units. These fields have several unique characteristics that should be considered prior to analysis.

The Drug Name field should be standardized by the analyst. While this field at the minimum contains the drug name, it varies widely in terms of content. It may contain the trade name and/or generic name, as well as dosage and drug form (tablet, liquid). It is often necessary to search for the drug name of interest and to remove other extraneous information contained in this field. For example, the drug acetaminophen is present in the following forms for this field: Acetaminophen (Children's Tylenol) 160m, Acetaminophen 325mg Oral Tablet, and Acetaminophen 500mg Oral Tablet.

Provider's Administration Instructions are the actual written directions by the clinician, and are not formatted for ease of analysis. This free text field may be searched for terms relating to a specific prescription and often contains information regarding the route of administration, dosage, and duration; or explains whether the prescription is for prophylaxis or treatment.

Dosage of a medication is an important aspect of study design for analysis of these data. Due to clinical practice, it is common to see the same medication used for prophylaxis and for treatment in the HL7-formatted data. To distinguish the two situations, the analyst must know the appropriate dosage of the medication for each situation and the dosing schedule. It is important to consider whether the medication and dosage of interest is disease or condition specific. For example, amantadine is an anti-viral used to treat influenza but is also used to control body spasms associated with Parkinson's disease.

Date References

Figure 3 illustrates the date fields in the pharmacy datasets. The Transaction Date is the date that the prescription order is entered into the CHCS system by the provider. Data pulls for epidemiologic projects primarily use the Transaction Date to capture the timeframe when the patient is symptomatically ill and a prescription is first ordered or to evaluate the burden of care during a specific period of time. The initial treatment for chronic conditions may not be reflected in this date as prescriptions are generally renewed on a specific timeline at the time of follow-up care. CHCS automatically assigns a Message Date when a prescription label is printed and an order is completed in the system. This date approximates the Transaction Date but can vary by location. Some MTFs send messages in batches, therefore the date may not correlate to the actual Transaction Date. The Recent Refill Date indicates the date when the prescription was most recently refilled. If an order is filled but not picked up, the subsequent record for that prescription will be cancelled and the Refills Remaining will be reset. The Start Date is found in IV and UD records only. This is the start date of medication dispensing. The End Date is the date that the medication should be stopped. If the length of stay is unknown, the prescription may be ordered for a long period of time (e.g., 99 days); in that case the End Date will reflect a date 99 days past the Start Date. The prescription is cancelled at the time of discharge.

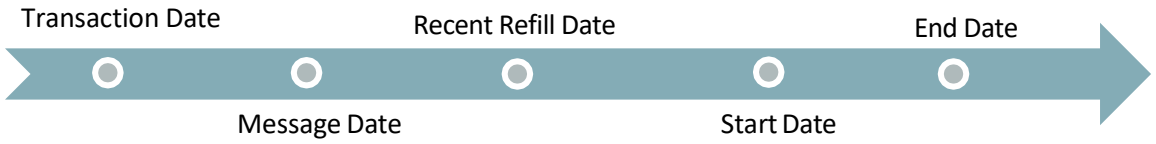


Figure 3: HL7 Pharmacy Date Fields

Variable Name	Interpretation
Transaction_Date	Date of the pharmacy order and entry into CHCS system.
Message_Date	Date that the order label is printed; order information sent to the CHCS server.
Recent_Refill_Date	Date of most recent refill; date when refill prescription label is printed.
Start_Date	Date the medication is to be started (UD and IV orders only).
End_Date	Date the medication is to be stopped (UD and IV orders only).

Data Structure and Analysis

HL7-formatted pharmacy data are retrieved by the EDC in a standard, pipe-delimited flat file from DHA-SDD. Full descriptions of fields (or "variables") are provided in detail in a subsequent section of this document (Field Descriptions). Each column within the data file is a fixed variable and each row contains a unique prescription transaction. Prescribed medications are associated with a unique record (row). Any additional changes (edits, cancellations, refills, etc.) to a record are in a separate row from the original transaction, but have the same Order Number. Due to data transmission gaps, all records for a specific transaction may not appear in the HL7-formatted pharmacy data (i.e., original order, refill, or cancellation), therefore analyses are project specific and dependent upon the records which are retained. OP, UD, and IV records have distinct formats. Below is an example of each dataset

The structure of IV records is shown in Figure 4. IV records are administered primarily in an inpatient setting; multiple drugs may be administered through one IV bag. In the example below, three drugs are administered. Each drug is entered in a unique record but all three drugs have the same Order Number, Message ID, and Order Control, which indicates that they are administered together. After the drugs have been administered, the order is cancelled (Order Control 'CA'); the Order Number remains the same, but the Message ID and Order Control change. Each time an IV is administered, a new order is generated.

Figure 4: Structure of HL7 Pharmacy IV Record

Record Type	Patient ID	Order Number	Order Control	Message ID	NDC Number	Drug Name
PIV	888999777	161004-21006	NW	RSCHED-4318635257	00169-1833-11	INSULIN REGULAR, HUMAN (NOVOLIN R) 100/ML INJECTION VIAL
PIV	888999777	161004-21006	NW	RSCHED-4318635257	00338-0017-02	DEXTROSE 5 % IN WATER (DEXTROSE IN WATER) 5 % INTRAVEN IV SOLN
PIV	888999777	161004-21006	NW	RSCHED-4318635257	00517-6510-25	SELENIUM 40 MCG/ML INTRAVEN VIAL
PIV	888999777	161004-21006	CA	RSCHED-4318639691	00169-1833-11	INSULIN REGULAR, HUMAN (NOVOLIN R) 100/ML INJECTION VIAL
PIV	888999777	161004-21006	CA	RSCHED-4318639691	00338-0017-02	DEXTROSE 5 % IN WATER (DEXTROSE IN WATER) 5 % INTRAVEN IV SOLN
PIV	888999777	161004-21006	CA	RSCHED-4318639691	00517-6510-25	SELENIUM 40 MCG/ML INTRAVEN VIAL

Unique Person

Unique Order

Unique Record

Revised Order Status

2 Unique Messages

3 Drugs

UD records correspond to pre-packaged, pre-measured drugs available on the inpatient unit or clinic. Drugs are administered orally, intramuscularly (injected), or through a pre-packaged IV. If a drug is administered daily during an inpatient stay, the duration field often reflects an extended period of time. This is to ensure that the drug is provided during the entire inpatient stay. At discharge, the prescription is cancelled.

The structure of UD records is shown in Figure 5. In this example, four drugs were dispensed and subsequently discontinued or cancelled. Drugs #1 and #2 were administered every six to eight hours for the duration of the stay (see Duration in Figure 5). Drug #3 was administered orally once. Drug #4 was an IV which was administered once over the course of approximately 14.5 hours (see Transaction Date and Transaction Time in Figure 5).

Figure 5: HL7 Pharmacy UD Record Structure

Sponsor ID	Order Number	Order Control	NDC Number	Drug Number	Transaction Date	Transaction Time	Amount Ordered	Units	Drug Form	Route of Administration	Quantity to Administer	Freq Admin Explicit Times	Duration
001	160730-02713	NW	00904-1982-60	ACETAMINOPHEN (MAPAP) 325 MG ORAL TABLET	07/30/2016	1246	2.0	EACH	TAB	PO	1	PRNQ6H	D180
001	160730-02713	DC	00904-1982-60	ACETAMINOPHEN (MAPAP) 325 MG ORAL TABLET	07/31/2016	1240	2.0	EACH	TAB	PO	1	PRNQ6H	D180
001	160730-02716	NW	42291-0338-50	IBUPROFEN 600 MG ORAL TABLET	07/30/2016	1246	1.0	EACH	TAB	PO	1	PRNQ8H	D100
001	160730-02716	DC	42291-0338-50	IBUPROFEN 600 MG ORAL TABLET	07/31/2016	1240	1.0	EACH	TAB	PO	1	PRNQ8H	D100
001	160730-04943	NW	00121-1465-15	POTASSIUM CHLORIDE 20MEQ/15ML ORAL LIQUID	07/30/2016	2206	2.0	EA	LIQ	PO	1		D1
001	160730-04943	CA	00121-1465-15	POTASSIUM CHLORIDE 20MEQ/15ML ORAL LIQUID	07/30/2016	2259	2.0	EA	LIQ	PO	1		D1
001	160730-04948	NW	00409-7074-26	POTASSIUM CHLORIDE 10MEQ/0.1L INTRAVEN PIGGYBACK	07/30/2016	2206	2.0	EACH	KIT	IV	1		D1
001	160730-04948	CA	00409-7074-26	POTASSIUM CHLORIDE 10MEQ/0.1L INTRAVEN PIGGYBACK	07/31/2016	1240	2.0	EACH	KIT	IV	1		D1

Figure 6 illustrates the structure of OP records. Original prescriptions and refills (unique orders) are visible in OP records. The Order Number, Drug Name, and Providers Instructions remain the same for the unique order. The Order Control and Transaction Date change and the Refills Remaining decrease as refills are dispensed.

In Figure 6, Patient #1 (outlined in red) filled a new prescription which was refilled twice. The Order Control, Transaction Date, Recent Refill Date, and Refills Remaining changed with each transaction within the unique order.

Seven rows delineate the unique order for omeprazole assigned to Patient #3 (outlined in blue), all with the same Order Number. The first Transaction Date was 11/9/2018; 90 tablets were dispensed with three refills remaining. In the second record, the first refill (Refill #1) was dispensed and Refills Remaining was reset to 2. This transaction was cancelled in the subsequent record. The Order Number, Drug Name, and Transaction Date are the same as the previous record but zero tablets were dispensed. Refills Remaining was reset to 3 (An Amount Dispense of zero effectively cancels the previous record with the same Order Number, Drug Name, and Transaction Date). The same scenario occurred for Refill #2. Most likely, a label was printed for the Refill #2 on 5/6/2019. When the prescription was not dispensed, it was cancelled (zero dispensed). A new label was printed and the prescription was dispensed on 6/27/2019; the record was generated with one remaining refill.

Figure 6: HL7 Pharmacy OP Record Structure

PT	Record Type	Order Number	Order Control	NDC Number	Drug Name	Transaction Date	Providers_Admin_Instructions	Amount Dispense	Recent Refill Date	Refills Remaining	
1	POP	190211-02347	NW	00378-7001-10	PAROXETINE HCL 10 MG ORAL TABLET	04/08/2019	TAKE ONE TABLET BY MOUTH EVERY DAY	90	04/08/2019	3	
1	POP	190211-02347	RE	00378-7001-10	PAROXETINE HCL 10 MG ORAL TABLET	07/08/2019	TAKE ONE TABLET BY MOUTH EVERY DAY	90	07/08/2019	2	New order refilled twice.
1	POP	190211-02347	RE	00378-7001-10	PAROXETINE HCL 10 MG ORAL TABLET	09/16/2019	TAKE ONE TABLET BY MOUTH EVERY DAY	90	09/16/2019	1	
2	POP	190128-00995	NW	42291-0834-10	TRAZODONE HCL 100 MG ORAL TABLET	01/28/2019	TAKE ONE AND ONE-HALF TABLETS BY MOUTH AT BEDTIME DAILY	135	01/28/2019	3	
2	POP	190128-00995	RE	42291-0834-10	TRAZODONE HCL 100 MG ORAL TABLET	04/23/2019	TAKE ONE AND ONE-HALF TABLETS BY MOUTH AT BEDTIME DAILY	135	04/23/2019	2	
2	POP	190128-00995	RE	42291-0834-10	TRAZODONE HCL 100 MG ORAL TABLET	07/26/2019	TAKE ONE AND ONE-HALF TABLETS BY MOUTH AT BEDTIME DAILY	135	07/26/2019	1	
3	POP	181105-00563	NW	00378-6150-01	OMEPRAZOLE 20 MG ORAL CAPSULE DR	11/09/2018	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	90	11/09/2018	3	New order with 3 refills
3	POP	181105-00563	RE	60429-0270-10	OMEPRAZOLE 20 MG ORAL CAPSULE DR	01/29/2019	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	90	01/29/2019	2	Refill #1
3	POP	181105-00563	RE	60429-0270-10	OMEPRAZOLE 20 MG ORAL CAPSULE DR	01/29/2019	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	0	01/29/2019	3	Refill #1 cancellation
3	POP	181105-00563	RE	51991-0643-10	OMEPRAZOLE 20 MG ORAL CAPSULE DR	02/01/2019	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	90	02/01/2019	2	Refill #1 dispensed
3	POP	181105-00563	RE	51991-0643-10	OMEPRAZOLE 20 MG ORAL CAPSULE DR	05/06/2019	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	90	05/06/2019	1	Refill #2
3	POP	181105-00563	RE	51991-0643-10	OMEPRAZOLE 20 MG ORAL CAPSULE DR	05/30/2019	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	0	05/06/2019	2	Refill #2 cancellation
3	POP	181105-00563	RE	51991-0643-10	OMEPRAZOLE 20 MG ORAL CAPSULE DR	06/27/2019	TAKE ONE CAPSULE DAILY BY MOUTH *TAKE UP TO ONE HOUR BEFORE A MEAL*	90	06/27/2019	1	Refill #2 dispensed. One refill remaining.

Strengths

Timeliness

DHSS includes several date and time fields in the data string provided to the EDC: Message Date, DHSS Load Date, Transaction Date, and Date of Most Recent Refill. To assess the timeliness of the data, compare the Transaction Date (date the order was placed into CHCS by the provider) to the Message Date (date the HL7 message was generated by CHCS) to estimate the time between the pharmacy transaction and the receipt of data at DHSS. The Message Date was also compared to the DHSS Load Date in order to determine the time between HL7 message generation at the local CHCS host and DHSS data parsing of the HL7 message into the database design.

On average, it took less than a day to generate an HL7 message. After generation, DHSS generally required about one day to process the message, with a range of 0-11 days (the most frequent lag times are 0, 1, or 2 days). It is assumed that NMCPHC receives these data within two days, although this assumption requires verification. This interval indicates that the timeliness of reporting is within acceptable ranges for the Navy surveillance activities. Future analysis and assessment goals include identification of lag times in relation to specific MTFs, drugs, or disease outcomes of interest.

Completeness

Records are received from the majority of shore-based MTFs of the CHCS system. As described in the limitations section below, data transmission depends upon the DHSS network. Due to the limitations of the network, gaps in the data do exist. The completeness of individual fields varies and the characteristics of each are described in detail in the field descriptions section at the end of this document. In general, some fields of particular interest, such as Sponsor ID, FMP, and Service are highly populated due to the business rules of CHCS.

Limitations

Completeness

Completeness of the data is unknown. When CHCS data are offline, data are not transmitted to the EDC. When the data flow is restored, the EDC may not receive all of the records during the period during which the data failed to transmit. For example, data with a Transaction Date during January 2014 are missing for one facility. It is important to be aware of these gaps during longitudinal analyses.

In February 2018, MTFs began the transition to a new platform for electronic medical records, GENESIS. GENESIS will replace other systems of record in the MHS and, after implementation is completed, it will be the source of pharmacy data for surveillance purposes.

At present, the EDC is unable to obtain data feeds from GENESIS; a process for obtaining these data is under review within the EDC but currently, as initial facilities complete the transition to GENESIS, visibility on related pharmacy occurrences is lost.

Inclusion

The pharmacy data include only MTFs that have CHCS servers. Mail orders, forward deployed clinics, contracted managed care support clinics, and other MTFs that do not use CHCS are not captured in these data unless the prescription is taken to an MTF to be filled at a pharmacy that uses CHCS. The CHCS system is not used to order or fill prescription medication on board ship. If shipboard personnel are referred to shore clinics or pharmacies for medications, this information is captured in the HL7-formatted data. In addition, dental clinics do not routinely appear in these data, though there are a small number of records that are reported from dental clinics. Further inquiries are required to understand why they do not appear. It is possible that these are outlying clinics with no CHCS connection.

Generalizability

Incomplete demographic information (e.g. marital status, race, and ethnicity) can limit the generalizability of these data to specific minority groups. Demographic information not provided in this database can be supplemented with other available personnel databases.

Comparability

These data are generated from the pharmaceutical treatment records of a highly specific patient population — military service members and other military beneficiaries — which differs from the general U.S. population in many ways, including average age, gender distribution, physical fitness, and health status. Further, this population has universal access to medical care, which is not true of many people living in the U.S. These differences limit the comparability to the general US population. Extra precautions need to be taken when extrapolating data to larger populations and also when comparing the disease rates and trends of the military and non-military populations.

All Data Fields (Variables)

Automatically Populated Fields

There are several types of automatically populated fields in the Pharmacy data. When a facility registers within the CHCS system, several variables are created, which identify the facility: Performing DMIS ID, Performing Facility, Performing Facility Service, Performing Work Center, Pharmacy Site, Requesting DMIS ID, Requesting Facility, Requesting Facility Service and Requesting Work Center. When DHSS compiles the data from the CHCS server, two fields are automatically populated: DHSS Load Date; and DHSS Load Time.

Each patient or beneficiary is registered in the Defense Eligibility Enrollment Reporting System (DEERS) under the Sponsor ID, which feeds into the CHCS system. When a patient presents at a medical facility, the Sponsor ID (usually the Social Security Number) is entered

and their name is chosen from a drop-down list. The following patient demographic fields are automatically populated after this selection, if they were entered when the patient was registered in DEERS: Date of Birth, Ethnicity, FMP, Gender, Marital Status, Patient Category, Patient ID, Race, Service, Sponsor ID, Sponsor UIC Code, and Sponsor UIC Description. If these data are not present in the system, a designated unknown value is entered, thereby assuring no missing values in these fields. Registration is completed and records updated when the sponsor reports to a new UIC and selects an MTF. Administrative personnel at the MTF have the ability to edit records at the time of visit.

As records are created, edited, and completed, several variables are created by the CHCS system: Date of Most Recent Refill, Date of Transaction, Time of Most Recent Refill and Time of Transaction. If necessary, the pharmacist can change these, but this change is not common practice. Msg Date, Msg Time, and Msg Sending Facility are created and assigned when the message (record) is sent to the CHCS server.

Field Descriptions

Observations are based on DOD data. Frequency distributions from database through 26 September 2019 were run on select data fields from the pharmacy databases to describe completeness. OP fields were available since 2004, and IV and UD fields were available since 2009, unless otherwise noted. These fields are presented in alphabetical order.

Table 1. Description of Fields in HL7-formatted Pharmacy Data (N=776,508,413 records as of 9/26/2019)

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
OP: Amount_Dispense UD: Amount_Ordered	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Numeric		OP: 0.02% (N=105,010) UD: 1.67% (N=1,220,340)	Amount dispensed as encoded by the pharmacy. May contain number of pills, number of milliliters, etc. The units of this value are indicated in the Units field. May be used to identify the purpose of the medication, prophylaxis or treatment. This is found only in OP and UD

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
DHSS_Load_Date	Automatically populated by CHCS; staff can edit but rarely do	YYYYMMDD		0% (N=0)	Date when DHSS loads the data from the central CHCS server. The field is used to determine the timeliness of reporting and to identify lags in reporting times from certain MTFs.
DHSS_Load_Time	Automatically populated by CHCS; staff can edit but rarely do	HHMM		0% (N=0)	Time component of the DHSS LOAD DATE field.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
DOB (Date of Birth)	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information	YYYYMMDD		OP: <1% (N=4,913) UD: <1% (N=166) IV: <1% (N=334)	It is possible to have inaccurate values for DOB. If the complete DOB is unknown but the year is confirmed, then CHCS enters zeros for the month and day. Not all dates for this field are valid (e.g., dates with a year in the early 1900s or a date with a year in the future). This field is required within CHCS.
OP: Drug_Name UD: Drug_Name	Drop-down menu from local CHCS server/AHLTA	Character		OP: 17.48% (N=120,527,469) UD: 2.85% (N=2,090,890)	The Drug Name field is a text translation of the NDC code. The general format: Scientific Name (Trade Name); Dosage. However, this format is not consistent. In many cases, the

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					last portion, after the trade name, is cut off at various places. This truncation creates problems when trying to analyze the frequency of medications using the drug name field. An alternative to this method would be to use the NDC Code field and then match to the corresponding drug name from another source. Those records missing a value for the drug name field are also missing the NDC code.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Drug_Form	Drop-down menu from local CHCS server/AHLTA	Character		UD: 1.66% (N=1,216,179)	Identifies the form of the drug to be dispensed. Examples include “CAP”, “INJ”, “OINT”, “SOLN” and “TAB”. This is in UD only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
EDIPN	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information	Numeric		OP: 71.55% (N=493,361,690) UD: 65.05% (N=47,677,008) IV: 68.9% (N=9,403,034) Entered into production 8/22/2015	Electronic Data Interchange Personal Number (EDIPN) is a DOD ID number specific to each beneficiary; this field has been included in the Pharmacy OP data since 2015, but not all beneficiaries have received an EDIPN. The field is not consistently populated to date, but will replace the SPONSOR ID/FMP for identification of unique patients after implementation is complete.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: End_Date IV: End_Date	Automatically populated in local CHCS server	YYYYMMDD		UD: 1.75% (N=1,284,219) IV: 3.43% (N=468,631)	Date the medication order is to be stopped. Obtained from the date portion of component 5 of the HL QUANTITY/TIMING data element. Format YYYYMMDD. Values of "00" denote imprecise date. This is found in UD and IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: End_Time IV: End_Time	Automatically populated in local CHCS server	YYYYMMDD		UD: 1.74% (N=1,272,595) IV: 3.35% (N=456,981)	Time the medication order is to be stopped. Obtained from the time portion of component 5 of the HL QUANTITY/TIMING data element. To include only the hours and minutes of the time. Format HHMM. This is found in UD and IV only.
Ethnicity	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining	Alphanumeric	Six (6) possible values: 1 – Hispanic 2 – South Eastern Asian 3 – Filipino 4 – Other Asian Pacific Islander 9 – Other Z – Unknown	OP: 16.18% (N=111,604,976) UD: 1.07% (N=781,194) IV: 3.3% (N=449,887)	Language or cultural group that the patient claims. The majority of records indicated “Other” (42.6%). More than 35% of records from Pharmacy OP were categorized as “Unknown.” “Hispanic”

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
	DEERS information				ethnicity made up 2.8% of the records within the DOD extract. The results indicated that the field of ETHNICITY may be self-identified and not consistently reported; those not reported are labeled as Unknown. The "Unknown" responses are assumed to be pre-populated in order to eliminate blanks within the database. It limits the ability to identify disease trends in minority groups and to identify diseases that have a disproportionate burden on these groups.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
File_Date	Created by EDC	YYYMMDD		0% (N=0)	Based on the date of the file, was created by data source and loaded into the database. (internal)

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
FMP	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information	Numeric (2 digits)	See Notes	OP: <1% (N=426) UD: : <1% (N=1,467) IV: : <1% (N=1,258)	Family Member Prefix – designates the relationship of the patient to the sponsor. In 2019, 50.7% of records had an FMP of 20 (sponsor) followed by 33.4% with an FMP of 30 (spouse of sponsor). Other possible values include 01-19 (child of sponsor, numbered in age order). Few records were missing an FMP value. Unknown entries are labeled as 99. List of values and % populated is available upon request.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Freq_Admin_Explicit_Times IV: Freq_Admin_Explicit_Times	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Character		UD: 11.9% (N=8,723,714) IV: 54.14% (N=7,388,626)	Explicitly lists the actual times referenced by the code in INTERVAL REPEAT PATTERN, in the following format: HHMM, HHMM, HHMM… This data is used to clarify the INTERVAL REPEAT PATTERN in cases where actual administration times vary within an institution. This is available in UD and IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD:Freq_Admin_Interval_Frequency IV: Freq_Admin_Interval_Frequency	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Character		UD: 19.44% (N=14,248,477) IV: 90.65% (N=12,370,953)	Lists the frequency with which the Order should be carried out (e.g., QD, 14D, etc.). CHCS documentation identifies this as "Frequency." This is available in UD and IV only.
UD: Freq_Admin_Repeat_Pattern IV: Freq_Admin_Repeat_Pattern	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Character		UD: 20.71% (N=15,179,631) IV: 44.04% (N=6,010,079)	Code indicating the repeat pattern for administration of the medication (e.g., BID, TID, Q2H, etc.). CHCS documentation identifies this as "Unexpanded Times." This is available in UD and IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Gender	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information	Single alpha character	Three (3) possible values: M – Male F – Female X – Unknown	OP: <1% (N=1,302) UD: <1% (N=101) IV: <1% (N=189)	Patient's sex. Values derived from the DOD Standard Gender Table. The majority of records were populated. The distribution between females and males is similar, "F" - 51.9% (N=357,672,083), "M" - 48.1% (N=331,891,628), "X" - 0% (N=7,107).
UD: Give_Units	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Character		UD: 1.66% (N=1,215,987)	Identifies the units dispensed. Examples include "EA", "MG", "ML", "TAB", and "UNIT". This is found in UD only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Marital_Status	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information	Single alpha character	Nine (9) possible values: A – Annulled D – Divorced I – Interlocutory Decree L – Legally Separated M – Married N – Never Married S – Single/Not Married W – Widow/ Widower Z – Unknown	OP: 14.12% (N=97,355,616) UD: 0.88% (N=642,868) IV: 2.69% (N=367,557)	Patient's marital status. Derived from DoD Standard File. The majority of records are classified as Married (41.2%, N=284,011,558) followed by Unknown (31.2%, N=214,138,590) and Single/Not Married (9.5%, N=65,742,630).

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Medication_Duration IV: Medication_Duration	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Character		UD: 1.65% (N=1,208,626) IV: 3.22% (N=440,065)	Indicates how long the medication order should be continued after it is started. If inpatient stay is unknown, duration may be for an extended time period (99 days). Upon discharge, order is cancelled. This is found only in UD and IV.
OP: Medication_Units UD: Medication_Units IV: Medication_Units	Drop-down menu from local CHCS server/AHLTA. Provider may override.	Character		OP: 48.05% (N=331,321,253) UD: 100% (N= 73,289,226) IV: 100% (N=13,647,057)	Units for the dispense amount as encoded by the pharmacy. This must be in simple units that reflect the actual quantity of the substance dispensed
MEPRS	Automatically populated when the	Four alpha characters	The first letter indicates the most general area:	OP: 17.72% (N=122,223,638)	Medical Expense and Performance Reporting System

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
	record is created		A – inpatient B – outpatient C – dental D – ancillary E – support services F – special programs G – medical readiness	UD: 0.04% (N=29,702) IV: 0.06% (N=8,581)	(MEPRS) CODE that indicates where the laboratory order was entered within the MTF. It is automatically populated when the record is created. This field is useful for tracking where people are seen within the MTF. It can indicate ambulatory care, special dialysis clinics, the maternity ward, etc. which can affect the interpretation of the data. The majority of records present in the OP dataset have a MEPRS code that begins with B (52.5%).

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					Inpatient records (MEPRS=A) records may be found in the OP dataset; these are generally related to cases where a patient was admitted to the hospital but picked up medications after discharge.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
MSG Date	Automatically populated when the message (record) is sent to CHCS server	YYYYMMDD		0% (N=0)	This date approximates the transaction time between the MTF and the regional CHCS site, but it can vary based on location. Some MTFs send messages in batches, therefore the time or date portions may not correlate to the actual transaction time. There are no missing values and all are valid dates.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
MSG_ID	Automatically populated when the message (record) is sent to CHCS server	Alphanumeric. Varies by MTF and may include numbers, letters, or numeric code that identify the MTF, or it can identify the function of the message		0% (N=0)	The Message ID is an alphanumeric code assigned to each batch of messages based on when the message is sent from CHCS to the server. The MSG ID is not unique to each record; each batch of messages is assigned one MSG ID.
MSG Sending Facility	Automatically populated when the message (record) is sent to CHCS server	Alphanumeric Four possible formats: A#### F#### HP#### N####		OP: 0% (N=10,449) UD: 0% (N=0) IV: 0% (N=0)	This field allows analysts to identify and track problems that arise in the transfer of messages from the MTFs to DHSS and the EDC.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
MSG Time	Automatically populated when the message (record) is sent to CHCS server	HHMM	0001 - 2359	0% (N=0)	Time when the message is sent from the MTF to the regional CHCS site. All times are valid entries. There are no missing values.
NDC_Number	Drop-down menu from local CHCS server/AHLTA	Alphanumeric		OP: 17.48% (N=120,526,373) UD: 2.85% (N=2,090,708) IV: 100% (N=13,647,057)	The National Drug Code (NDC) is a unique three-segment code used to identify a drug. The segments are separated by a back-slash ("\"). Every drug manufactured, prepared, propagated, compounded, or processed for commercial distribution is required to be registered with the FDA (Food and Drug

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					Administration) and receives an NDC. The first segment of the NDC is the labeler code, which identifies the company that manufactures or distributes the drug under its label. The second portion of the NDC is the product code which identifies the strength, dosage and formulation of the medication. The final segment is the package code which identifies the package size and type (i.e. number of pills). The NDC can have several configurations of character lengths:

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					4-4-2, 5-3-2, or 5-4-1.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Order_Control	Automatically populated from local CHCS server at the time of transaction	Two character	CA = Cancel DC = Discontinued HD = Hold NW = New RE = Refill RL = Release RN = Renew RO = Replacement order RP = Replace Order - modify XX = Edited order	OP: 0% (N=73) UD: 0% (N=18) IV: 0% (N=0)	This field allows analysts to track some of the changes made to an order over time, as well as to distinguish refills from new prescriptions. The identification of the order type is important if the question of interest relates to incident cases. Most records are classified as Refill — 30.0% (N=206,853,385); followed by New —27.6% (N=190,532,215); and Edited — 24.7% (N= 170,443,913).

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Order_Control_Code_Reason IV: Order_Control_Code_Reason	Generated by provider			UD: 96.55% (N=70,757,769) IV: 96.06% (N=13,109,772)	Explanation (either in coded or text form) of the reason for the order event described by the Order Control. This is found only in UD and IV.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Order_Number	Automatically populated by CHCS	#####-##### (11 numerical digits with a hyphen: The first 6 digits include the date and the last 5 digits include consecutive numbers for tests provided at that specific location)		OP: 0.50% (N=3,435,907) UD: 0% (N=2,299) IV: 0% (N=571)	Order number is a numeric code of 11 digits (xxxxxx-xxxxx) unique to each order but not unique for each record. An order can have multiple records that correspond to changes made to the order (e.g. changes in dosage or frequency of application, cancellations). All changes appear as individual records with the same order number. It is a plausible way to track a patient but it is not useful for identifying unique records.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Order_Priority IV: Order_Priority	Provider	Character	See Notes	UD: 1.65% (N=1,208,742) IV: 3.22% (N=440,065)	S= STAT A = ASAP R = Routine (Default) P = Pre-OP T = Timing Critical. This implies that it is critical to come as close as possible to the requested time. This is found only in UD and IV.
Order_Status	Automatically populated from local CHCS server at the time of transaction	Character	CA = Cancelled CM = Completed DC = Discontinued ER = Error, order not found HD = On hold IP = In process, unspecified RP = Order replaced SC = In process, scheduled	OP: 100% (N=689,571,896) UD: 50.56% (N=37,052,830) IV: 50.62% (N=6,908,400) Entered into production 12/16/2009	Status of an order

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Order_Text IV: Order_Text	Automatically populated from local CHCS server. Provider can override	Character		UD: 100% (N=73,289,226) IV: 100% (N=1,3647,057)	Text versions of the instructions accompanying the order. This is found only in UD and IV.
Ordering_Provider	Automatically populated by CHCS	Last Name, First Name, Middle Initial (three components separated by commas)	Last, First, MI	OP: 0% (N=250) UD: 0.03% (N=19,298) IV: 0.03% (N=4,249)	Indicates the name of the ordering physician. It is structured to facilitate analysis but could be separated if necessary.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
PATCAT	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information	Alphanumeric X## First letter refers to the sponsor's branch of service Following 2 digits correspond to the patient's relationship to the sponsor	Nine (9) possible values for sponsor branch: A – Army B – National Oceanic and Atmospheric Administration C – Coast Guard F – Air Force K – Other beneficiaries of the federal government M – Marine Corps N – Navy P – US Public Health Service R – NATO recipient	OP: 0.02% (N=129,096) UD: 0% (N=2,802) IV: 0.01% (N=1,587)	Indicates the patient's status with the uniformed services. For example: A11=Army Active Duty Member, A41=Army Dependents of Active Duty Member, etc. A complete list should be obtained from DOD resources. List of PATCAT values and % populated is available upon request.
Patient_ID	Automatically populated from DEERS after user enters	######### Nine-digit numeric value		OP: 0.21% (N=1,444,762) UD: 0.04% (N=28,696)	The PATIENT ID is intended to serve as a unique identifier for each patient. The

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
	SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information.	Patient's SSN when available		IV: 0.13% (N=17,878)	PATIENT ID is the patient's Social Security number (SSN) when available; however, the accuracy of this field cannot be assured based on the EDC's observations and analyses. In place of PATIENT ID, SPONSOR ID and FMP should be used to identify individual patients. This value is missing in 0.21% of records overall. It is important to preserve the entire PATIENT ID when importing the data into SAS or other analysis programs. The PATIENT ID field

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					needs to be imported as a character field so that leading zeros are not dropped.
Performing_DMIS_Facility_Name	Automated from DHSS	Character		OP: 22.8% (N=157,250,313) UD: 6.32% (N=4,632,490) IV: 4.51% (N=616,056)	Text translation of the DMIS ID provided in the PERFORMING DMIS ID field. This field indicates the laboratory facility name where the test was performed, not where the specimen was collected from the patient. This field is assigned by DHSS at the request of the EDC. The translation of the DMIS code on the official list is often more accurate than the Performing Facility

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					field in CHCS. Use of this field allows for more accurate analysis of geographic information. Because the field also is a translation of the performing facility field in CHCS, it will be missing when that variable has a missing value.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Performing_DMIS_ID	Automated from DHSS	Four numeric digits, import to SAS as character ####		OP: 18.16% (N=125,225,540) UD: 0.28% (N=203,631) IV: 0.27% (N=37,157)	Identifies the MTF that performed the laboratory test. This code allows for grouping of MTFs based on geographic location, as well the ability to identify parent/child relationships between installations.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Performing_Facility_Name	Automated from DHSS	Text field		19.25% (N=132,718,477) UD: 0.04% (N=30,425) IV: 0.15% (N=20,443)	The performing facility field in CHCS indicates the name of the MTF where the test was performed. This is a relatively standard text field. Problems are encountered if the text is entered incorrectly when the facility is registered in the system (e.g., misspellings).

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Performing_Facility_Service	Automated from DHSS	Single alpha character	Five (5) possible values: A – Army C – Coast Guard F – Air Force N – Navy P – DHA	OP: 24.48% (N=168,834,788) UD: 6.97% (N=5,106,691) IV: 4.80% (N=654,526)	Indicates the branch of service with which the MTF is associated. This value is determined from the DMIS code list provided to DHSS by the EDC. It is missing when the Performing Facility information is missing. This field is useful for limiting the observations included in an investigation. Often, the data available for use are limited by branch of service for the MTF or patient.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Performing_Work_Center_Name	Automated from CHCS	Unstructured text field		100% (N=689,571,896) UD: 0.04% (N=30,440) IV: 0.15% (N=20,432) Entered into production 11/06/2009	Indicates the work center within the laboratory that provided the service. This field is a relatively unstructured text field with many possible values. These locations are usually laboratories mapped according to the PERFORMING DMIS ID.
Pharmacy_Category_1	Created by EDC	Unstructured text field		OP: 0.31% (N=2,132,586) UD: 0.79% (N=577,404) IV: 1.64% (N=404,413) Entered into production 11/24/2006	Drug category 1 – EDC generated therapeutic drug usage. Drugs may be classified under multiple categories. Validity has not been established.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Pharmacy_Category_2	Created by EDC	Unstructured text field		OP: 83.70% (N=577,201,417) UD: 81.52% (N=59,745,117) IV: 93.62% (N=23,108,988) Entered into production 11/24/2006	Drug category 2 – EDC generated therapeutic drug usage. Drugs may be classified under multiple categories. Validity has not been established. Larger total for IV due to the parsing for Drug Name in RXC_Segment_Data variable.
Pharmacy_Category_3	Created by EDC	Unstructured text field		OP: 99.35% (N=657,525,197) UD: 93.14% (N=68,258,014) IV: 98.37% (N=24,283,108) Entered into production 11/24/2006	Drug category 3 – EDC generated therapeutic drug usage. Drugs may be classified under multiple categories. Validity has not been established. Larger total for IV due to the parsing for Drug Name in RXC_Segment_Data variable

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Pharmacy_Category_4	Created by EDC	Unstructured text field		OP: 99.28% (N=684,641,202) UD: 97.53% (N=71,479,137) IV: 99.76% (N=24,623,931) Entered into production 11/24/2006	Drug category 4 - EDC generated therapeutic drug usage. Drugs may be classified under multiple categories. Validity has not been established. Larger total for IV due to the parsing for Drug Name in RXC_Segment_Data variable
Pharmacy_Category_5	Created by EDC	Unstructured text field		OP: 99.99% (N=689,512,465) UD: 99.99% (N=73,281,833) IV: 100% (N=24,684,403) Entered into production 03/01/2012	Drug category 5 Larger total for IV due to the parsing for Drug Name in RXC_Segment_Data variable

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
OP: Pharmacy_Site	Automated from CHCS	Unstructured text field		OP: 17.73% (N=122,228,232)	The Pharmacy Site field indicates which pharmacy prepared the prescription. This is a text field that describes the location type of the pharmacy (e.g. SATELLITE PHARMACY or ER AFTER HOURS PHARMACY). This is found in OP only.
OP: Providers_Admin_Instructions	Provider	Unstructured text field		OP: 18.86% (N=130,081,322)	Provides the physician's instructions regarding how to use the medication (e.g., Take two times a day, Apply as directed by physician, etc). This field may be too cumbersome

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					to use in direct analysis but it could support findings from other fields. It can provide valuable information on dosing schedules, and help indicate the purpose for which the medication is prescribed. This is found in OP only.
UD: Quantity_to_Administer	Automatically populated from local CHCS server. Provider can override.	Numeric		UD: 0.07% (N=53,606)	Identifies the number of items for each administration of an ordered medication. This is found in UD only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Race	Automatically populated from DEERS after user enters SPONSOR ID; staff can edit; sponsor responsible for maintaining DEERS information.	Single alpha character	Six (6) possible values: C – White M – Asian or Pacific Islander N – Black R – American Indian or Alaskan Native X – Other Z – Unknown	OP: 13.30% (N=91,700,453) UD: 0.77% (N=567,285) IV: 2.39% (N=326,840)	Patient's racial classification. Derived from the DOD Standard File. In OP Most records were classified as White — 33.6% (N= 65,742,630); followed by Unknown — 32.7% (N= 225,256,710); Black — 9.4% (N=65,115,721); and Other — 8.5% (N=58,295,172).

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
OP: Recent_Refill_Date	Automated from local CHCS server	YYMMDD		OP: 5.26% (N=36,247,505)	Date of the most recent refill or dose dispensed. Obtained from the date portion of DATE/TIME of MOST RECENT REFILL. Values of "00" in DD or MM denote imprecise date. Replacement orders (RP) do not have a value in this field. Beneficial for monitoring treatment compliance for chronic conditions. This is found in OP only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
OP: Recent_Refill_Time	Automated from local CHCS server			OP: 3.10% (N=21,355,855)	Time of the most recent refill or dose dispensed. Obtained from the time portion of DATE/TIME of MOST RECENT REFILL. Format: HHMM This is found in OP only.
Record_Type	Automatically populate when the record is created	Three alpha characters	POP	0% (N=0)	Identifies the type of HL7 extract message record.
OP: Refills_Remaining	Automated from local CHCS server at the time of transaction			OP: 0.09% (N=598,341)	Number of Refills remaining on the prescription order This is found in OP only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Requesting_DMIS_Facility_Name	Automated from DHSS	Text field		OP: 7.25% (N=49,989,872) UD: 6.08% (N=4,453,619) IV: 4.27% (N=582,744)	Text translation of the DMIS ID provided in the REQUESTING DMIS ID field. This field indicates the laboratory facility name that is requesting laboratory service to be completed. This allows for more accurate investigations when geographic information is used, because it is created using an official DOD DMIS list. This field is a translation of the Requesting Facility field in CHCS; therefore, it will be missing when that field is missing in the record.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Requesting_DMIS_ID	Automated from CHCS	Four numeric digits ####		OP: 1.75% (N=12,037,728) UD: 4.95% (N=3,625,175) IV: 0% (N=89)	Four-digit code assigned by the DOD to all units in all installations to uniquely identify them. The code allows grouping of MTFs based on geographic location, as well as to identify parent/child relationships between installations. Importing this field in character format can prevent the loss of leading zeros, which may produce complications when producing summary statistics. Because this field is calculated based on the Requesting

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					Facility field, all records missing a value for that field are missing a value for the REQUESTING DMIS ID field. Missing values are limited and seen at few specific MTFs. Other records include test entries from inactive sites.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Requesting_Facility_Name	Automated from CHCS	Text field		OP: 1.73% (N=11,949,455) UD: 0% (N=27) IV: 0% (N=13)	Field in CHCS that indicates the name of the MTF where the order originated, and is a relatively standard text field. Problems are encountered if the text is entered incorrectly when the facility is registered in the system (e.g., misspellings). The field allows tracking of orders from origin to where they are filled.
Requesting_Facility_Service	Automated from CHCS	Single alpha character	Five (5) possible values: A – Army C – Coast Guard F – Air Force N – Navy P – DHA	OP: 8.01% (N=55,212,049) UD: 6.73% (N=4,935,605) IV: 4.56% (N=622,732)	Indicates the branch of service with which the MTF is associated. This value is determined from the DMIS code list provided to DHSS by the EDC. It is

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					missing from a record when the Requesting Facility information is missing. Because this field is mapped to the REQUESTING DMIS FACILITY NAME and the REQUESTING DMIS ID, the REQUESTING FACILITY SERVICE is missing when the other two fields are blank. This field is useful for limiting the observations by the branch of service. This may be necessary for comparison, as data compared to the HL7-formatted datasets are often

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
					service branch specific.
Requesting_Work_Center_Name	Automated from CHCS	Unstructured text field		OP: 0% (N=4,349) UD: 0% (N=27) IV: 0% (N=11)	The Requesting Work Center is the ward or clinic within the MTF that requests the laboratory test. Entries are labeled as DMIS ID number, clinic wards, service centers, and unknown/other MTF locations.
UD: Route of Administration IV: Route of Administration	Drop-down menu from local CHCS/AHLTA server Can be over-ridden by Provider	Character		UD: 1.7% (N=1,242,639) IV: 3.28% (N= 447,958)	Determines where the medication is being received by the patient. This is found in UD and IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
IV: RXC Segments		Character		IV: 3.28% (N=448,078)	A concatenated value where the parts are made up of: RXC Elements 1 (Comp Type), 2 (Comp NDC Number and Name), 3 (Comp Amount), and 4 (Comp Units). The elements are separated by a back-slash ("\"). This is found in IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Service	Automated from CHCS	Single alpha character	Nine (9) possible values: A – Army B – National Oceanic and Atmospheric Administration C – Coast Guard F – Air Force K – Other beneficiaries of the federal government M – Marine Corps N – Navy P – US Public Health Service R – NATO recipient	OP: 0.01% (N=90,830) UD: 0% (N=341) IV: 0% (N=502)	Refers to the service branch of the sponsor. The value is determined from the first component of the PATCAT field and the values are the same. Therefore, an equal number of records are missing the branch of service and PATCAT CODES. In 2018, the highest proportion of records belonged to the Army, Navy/Marine Corps, and Air Force, respectively.
Sponsor_ID	Automatically populated from DEERS after user enters SPONSOR ID;	Nine numeric digits with no dashes: #########	Sponsor's SSN with no dashes	OP: 0% (N=5,831) UD: 0.01% (N=8,461)	The SPONSOR ID (SSN) is not sufficient to identify a unique patient, but may be used with the

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
	staff can edit; sponsor responsible for maintaining DEERS information.			IV: 0.05% (N= 6,241)	FMP as a unique patient identifier. It is important to preserve the entire SSN when importing the data into any analysis program. The SSN variable needs to be imported as a character field so that leading zeros are not dropped. If the patient does not have a valid SSN or quality assurance (QA) testing is conducted, a pseudo-SSN may be created. These identifiers generally begin with 900 or have arbitrary identifiers such as 777777777, or three consecutive zeros.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Start_Date IV: Start_Date	Automated from local CHCS server at the time of transaction			UD: 1.65% (N= 1,209,853) IV: 3.43% (N=467,587)	Date the medication order is to be started. Obtained from the date portion of component 4 of the HL QUANTITY/TIMING data element. Format YYYYMMDD. Values of "00" denote imprecise date. This is found in UD and IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
UD: Start_Time IV: Start_Time	Automated from local CHCS server at the time of transaction			UD: 1.65% (N=1,209,287) IV: 3.34% (N=456,339)	Time the medication order is to be started. Obtained from the time portion of component 4 of the HL QUANTITY/TIMING data element. To include only the hours and minutes of the time. Format HHMM. This is found in UD and IV only.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Transaction_Date	Automated from local CHCS server at the time of transaction	YYYYMMDD		OP: 0% (N=322) UD: 0.02% (N=17,826) IV: 0.03% (N=3,765)	The Transaction Date is the date on which the order entered the CHCS system. It is different from the Message Date since the Message Date is generated when the label is printed and the Transaction Date more accurately approximates when the prescription is actually presented to the pharmacy. The Transaction Date is formatted YYYYMMDD and does not include missing values.

EDC Variable Name	Input Method	Field Format	Values	Percentage of Missing Values	Notes
Transaction_Time	Automated from local CHCS server at the time of transaction	HHMM		OP: 0% (N=322) UD: 0.02% (N=17,579) IV: 0.03% (N=3,765)	The field represents the time component of the Date of Transaction, formatted; HHMM.

Abbreviations and Acronyms

CHCS	Composite Health Care System
DEERS	Defense Eligibility Enrollment Reporting System
DHSS	Defense Health Services System
DMIS	Defense Medical Information System
DOD	Department of Defense
EDC	EpiData Center
FDA	Federal Drug Administration
FMP	Family Member Prefix
HL7	Health Level 7
ICD-9-CM **ICD-10-CM**	International Classification of Diseases, 9th or 10th Revision, Clinical Modification
MEPRS	Medical Expense and Performance Reporting System
MHS	Military Health System
MTF	Military Treatment Facility
NDC	National Drug Code (Can be in the form of a code or a name)
NMCPHC	Navy and Marine Corps Public Health Center
OP	Outpatient (Pharmacy Dataset)
PATCAT	Patient Category Code
PDTS	Pharmacy Data Transaction Service
SADR	Standard Ambulatory Data Record
SIDR	Standard Inpatient Data Record
SSN	Social Security Number
UD	Unit Dose
UIC	Unit Identification Code

Example Projects using Pharmacy Data

Project Name/Description	Population of Interest	Purpose	Impact
Diagnosis-based Metrics	DOD Beneficiaries	Identify high antibiotic use that impacts antibiotic resistance.	Identifies case rates of antibiotic prescribing for specific diseases and potential overprescribing trends.
Influenza SITREP Identification of influenza trends; an example of surveillance integrating multiple data sources (laboratory, pharmacy, encounter, and vaccination data)	DON Beneficiaries	Weekly update of laboratory positive influenza cases and antiviral prescribing trends.	Supports readiness through identification of weekly influenza prescribing trends. Differentiates influenza treatment vs. prophylaxis, isolating possible increases of disease.
Monthly Force Health Report: Identification of behavioral health trends.	DON Active Duty	Identify behavioral health trends through encounter, pharmacy, and self-reported survey data	Support readiness through the identification of dispensed psychotropic medications.
Clinical Practice Guideline Adherence	DON Active Duty	Identify adherence to disease prescribing recommendations.	Identify possible gaps in adherence to prescribing guidelines. Supports force health.
Diagnosis-based Metrics	DOD Beneficiaries	Identify high antibiotic use that impacts antibiotic resistance	Identify case rate of antibiotic prescribing for specific diagnosis