OJPHI

ISDS 2018 Conference Abstracts

ISDS INTERNATIONAL SOCIETY FOR DISEASE SURVEILLANCE

Data Model for Initiatives to Monitor Exposure to Antimicrobials (DataMIME)

Megan T. Patel*[1], Carlos Santos[2], Ron Price[3], George Nelson[4], Lauren Hall[5], Richard Platt[6] and William Trick[7]

[1]MRAIA, Chicago, IL, USA; [2]RUMC, Chicago, IL, USA; [3]LUMC, Maywood, IL, USA; [4]VUMC, Nashville, TN, USA; [5]BS&W, Dallas, TX, USA; [6]Harvard Pilgrim, Boston, IL, USA; [7]CCHHS, Chicago, IL, USA

Objective

Plan, develop, and pilot an open source system that could be integrated into the PCORnet (PCORI) and Sentinel (FDA) national common data models (CDMs) to generate antimicrobial use (AU) reports submittable to CDC's National Healthcare Safety Network (NHSN). The system included ancillary tables, and data quality and report generation queries. The DataMIME system will allow hospitals to generate comparable AU reports for hospital inpatients.

Introduction

Despite decades of attempts to promote judicious AU, the US has high rates of per-person antimicrobial consumption, and extremely high rates of carbapenem use[1]. Such profligate use is a key factor in the high rate of antimicrobial-resistant infections seen in US healthcare facilities[2]. Antimicrobial stewardship (AS) programs have been identified as a critical component of intervention strategies[3]. A core component of AS programs is tracking AU, which is needed to monitor trends in use, focus interventions on aberrant behaviors, promote judicious use, and evaluate the effectiveness of interventions. A system designed to extend two national data models would provide a scalable platform for rapid adoption of AU reporting.

Methods

Virtual meetings were held with all participating sites (five hospitals in IL, LA, and TN) to develop the ancillary tables to capture intrahospital patient movement, and administration of antimicrobial agents. Ancillary tables were designed & sites populated the tables with calendar year 2016 data. Data characterization was performed to assess overall table statistics, and verify mappings of facility unit locations to NHSN location codes, medications to RxNorm, and routes of administration to one of four SNOMED categories. Additional characterization focused on CDC's NHSN Validation Protocol for the AU module. Analytical queries were developed to produce the output metrics required for submission to the NHSN AU module.

Results

Two ancillary tables and two look-up tables were developed: a bed information table (Table 1) to capture local location codes with a date-time stamp for precise tracking of patient location; a separate location look-up table allows mapping to other terminologies (Table 2); and, an inpatient drug administration table (Table 3) to capture data from the electronic medication administration record (eMAR) or bar coding medication administration (BCMA) system, utilizing a route of administration look-up table (Table 4). The data model was structured to accommodate use cases with alternative mapping terminologies for local location code, local term for route of administration, local codes for medication, and the option of including the NDC code. All sites populated the ancillary tables. For the bed information table, all sites utilized their ADT table information for patient movement. For the medication administration table, most sites limited the inclusion criteria to the 89 antimicrobial agents required for reporting to the NHSN AU module. Aggregate results from participating sites for facility-wide measures and select antimicrobial agents are presented in Table 5.

Conclusions

The data model developed was able to produce the metrics required for reporting to CDC's NHSN AU module. The data dictionary language, implementation guidance, mappings, and queries will be distributed as a tool-kit for other PCORnet and Sentinel sites for reporting to the AU module. In addition, this CDM could allow for the development of additional metrics including excessive use of antibiotic combinations of redundant spectra, syndrome specific antibiotic use, or increased use of excessively broad spectrum antibiotic classes.

Table 1. Data dictionary for the Bed Information table

Field Name	Value set	Type	Required?	Definition
PATID		Char	Required	Person-level identifier used to link across tables.
ENCOUNTERID		Char	Required	Encounter-level identifier used to link across tables.
LOCAL_UNIT_CODE		Char	Required	Operational location within the facility at the unit level. For example, a facility has a medical ward denoted as 9W. This field would have the local code 9W.
LOCAL_BED_CODE		Char	Optional	Operational location within the facility at the bed level. This field may be populated if facilities are able to capture patient movement at the bed level. This field is not needed for AU reporting. If missing, this value should be null.
START_DATE		Date	Required	Start date at the location (YYYY-MM-DD format)
START_TIME		Char	Required	Start time at the location (HH:MI using 24-hour clock and zero-padding for hour and minute)
END_DATE		Date	Required	End date at the location. (YYYY-MM-DD format)
END_TIME		Char	Required	End time at the location (HH:MI using 24-hour clock and zero-padding for hour and minute)

Table 2. Data dictionary for the Location Look-up table

Field Name	Value set	Type	Required?	Definition
LOCAL_UNIT_CODE		Char	Required	Operational location within the facility at the unit level
LOC_TYPE	IP - Inpatient Unit AU - Ambulatory Unit OBS - Observation Unit ED - Emergency Department Unit	Char	Required	Type of facility unit location as specified by the value set: IP: Inpatient Unit AU: Ambulatory Unit OBS: Observation Unit ED: Emergency Department Unit **All facility locations** must have a LOC_TYPE associated with the LOCAL_UINIT_CODE, regardless of whether the unit has been mapped to an NHSN Location Code.
MAPPED_LOC_NAME		Char	Required May be Null	Mapped location code name
MAPPED_LOC_CODE	CDC NHSN Unit Type Code value set FDA Unit Type Code value set	Char	Required May be Null	Mapped location code for mapping vocabulary of choice (NHSN, FDA, etc.). Example: This field will be populated with the NHSN HL7_CODE from the look-up table managed locally by the facility and should be consistent with what is currently being reported by the facility to NHSN as an operational location with an "active" status. See Reference Table 3 for an example. If local location code cannot be mapped to an NHSN location, this value should be null. If the NHSN Unit location is not "active", this value should be null.
VOCABULARY	CDC FDA	Char	Required May be Null	Vocabulary for mapped code
START_DATE		Date	Required	Start date of mapped code (YYYY-MM-DD format)
END_DATE		Date	Required	End date of mapped code (YYYY-MM-DD format)
CUR_ROW_IND	Y - Yes N - No	Char (1)	Required	Indicator for whether the row is the current status for the mapped location

Table 3. Data dictionary for the Inpatient Drug Administration table

Field Name	Value set	Type	Required?	Definition
PATID		Char	Required	Person-level identifier used to link across tables.
ENCOUNTERID		Char	Required	Encounter-level identifier used to link across tables.
RXNORM_CUI		Char	Required	RxNORM mapping of the medication administered at the ingredient level (IN). This should be populated with one of the RxNorm CUI codes listed in the CUI field in Reference table 1.
RXNAME		Char	Required	Optional field for medication name from mapping table for RxNorm CUI. This field may be useful for verifying correct mapping of the the RxNorm CUI by comparing to the raw fields.
RXROUTE		Char	Required	Field for local value of route of administration of medication
RXDOSE		Numeric	Optional	Optional field for Administered Dose. If missing, this value should be null.
RXUOM		Char	Optional	Optional field for Administered Dose Units. If missing, this value should be null.
RXADATE		Date	Required	Date of Rx Administration. (YYYY-MM-DD format)
RXATIME		Char	Required	Time of Rx Administration. (HH:MI using 24-hour clock and zero-padding for hour and minute)
ADMIN_LOCATION_CODE		Char	Required	Local location code for patient location at the time of medication administration from eMAR or BCMA. This field may be useful for verifying the location of the patient from the bed information table.
RAW_RXCODE		Char	Optional	Optional field for originating value (local drug code) of RXNORM_CUI field, code that is available at the source (eMAR/BCMA), e.g. NDC code, generic name, etc. This field may be useful for verifying the correctness and or inclusiveness of RxNorm CUI mappings.
RAW_RXNAME		Char	Required	Required field for originating value of Medication administered from eMAR or BCMA. This field may be useful for verifying the correctness and or inclusiveness of RxNorm CUI mappings.
RXID		Char	Optional	Optional field to map back to source data and refer to the actual medical administration record in the source data, i.e. eMAR or BCMA.
NDC		Char	Optional	Optional field for National Drug Code; Please expunge any place holders (e.g., '-' or extra digit).

Table 4. Data dictionary for the Route of Administration Look-up table.

Field Name	Value set	Type	Required?	Definition
LOCAL_ROUTE		Char	Required	
MAPPED_ROUTE	RS - Respiratory tract route IM - Intramuscular route IV - Intravascular route DG - Digestive tract route OT - Other	Char(2)	Required	It is possible for more than one source value to be associated with one route of admin, see Reference Table 2 for examples. *Additional value sets may be associated with the vocabulary of choice
VOCABULARY	NHSN FDA	Char	Required	Vocabulary of mapped code
START_DATE		Date	Required	Start date of mapped value (YYYY-MM-DD format)
END_DATE		Date	Required	End date of mapped value (YYYY-MM-DD format) End date should be a future date if the mapping is current. For example: 2100-01-01 If a new mapping code is available for the local code, a current end date should be placed and a new row should be added to the table with the new mapping code

Table 5. Aggregate facility-wide measures for one month's worth of antimicrobial use data.

Antimicrobial Agent	Patient Days Present	Therapy Days
VANC - Vancomycin	30472	1958
PIPERWT - Piperacillin with Tazobactam	30472	1895
CEFAZ - Cefazolin	30472	1305
LEVO - Levofloxacin	30472	1006
METRO - Metronidazole	30472	968

Keywords

Data Model; Antimicrobial Use; NHSN; PCORnet; Sentinel

Acknowledgments

Helen Zhang, Alex Patino, Sue Zelisko, Ekta Kishen, Taoran Qiu, Julie Lange, Shazia Sathar, Laura Shockro

References

1. Van Boeckel TP, Brower C, Gilbert M, Grenfell BT, Levin SA, Robinson TP, Teillant A, Laxminarayan R. Global trends in antimicrobial use in food animals. *Proc Natl Acad Sci USA* 2015; 112(18):5649-54.
2. CDC. Antibiotic resistance threats in the United States, 2013. Atlanta, GA: US Dept. of HHS, CDC; 2013.
3. Dellit TH, Owens RC, McGowan JE, Gerding DN, Weinstein RA, Burke JP, et al. IDSA and the SHEA Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. *Clin Infect Dis* 2007; 44(2):159-77.

***Megan T. Patel**
E-mail: mtoth2@uic.edu