



The Core Elements of

Antibiotic Stewardship for Nursing Homes

APPENDIX C: Tracking and Reporting Antimicrobial Use—Advanced



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I. Introduction

The Core Elements of Antibiotic Stewardship for Nursing Homes highlight how tracking and reporting antimicrobial use will allow long-term care (LTC) facilities to identify opportunities to improve antimicrobial prescribing, optimize resident safety, evaluate the impact of stewardship activities, and meet the stewardship Core Elements.¹

The purpose of this document is to provide a comprehensive review of **data sources**, **data elements** and **antimicrobial use measures** that can be used to generate an antimicrobial use report for a facility or multifacility organization. This guide was developed to support LTC antibiotic stewardship leads and subject matter experts interested in modernizing their antimicrobial use reporting. Accompanied by the technical expertise of LTC vendors and drug expertise of consultant pharmacists, stewards can analyze their own antimicrobial data to produce an **antimicrobial surveillance log** (line list) and **antimicrobial use reports**.

- **Antimicrobial surveillance logs** are a tool that lists all residents receiving an antimicrobial course and can be generated for different time periods (e.g., weekly or monthly).
- **Antimicrobial use reports** contain summarized antimicrobial use data to describe prescribing volume and rates at the facility. Antimicrobial use reports can also be generated at specific time intervals (e.g., monthly, quarterly, yearly).

The Centers for Medicare & Medicaid Services (CMS) require LTC facilities to have an antibiotic stewardship program that includes a system to monitor antimicrobial use.² Every LTC facility should implement an antibiotic stewardship policy that meets or exceeds CMS requirements.³

II. Data Sources for Tracking and Reporting Antimicrobial Use

The LTC stewardship lead can leverage a variety of **data sources** to track antimicrobial use. Limitations and availability of **data elements** for calculation of **antimicrobial use measures** may vary by data source.⁴

Utilizing electronic data sources, such as electronic health record (EHR) or LTC pharmacy data, limits the need for manual tracking and minimizes burden on facility staff. Automated reporting of electronically extracted resident- and facility-level antimicrobial use data enables sustainable reporting.

Table 1. Data Sources for Tracking and Reporting Antimicrobial Use in Long-term Care Facilities

Characteristic	Electronic Health Record (EHR)	Long-Term Care (LTC) Pharmacy	Manual Tracking and Reporting
Data Source	<ul style="list-style-type: none"> Medication order or administration 	<ul style="list-style-type: none"> Medication transaction 	<ul style="list-style-type: none"> Facility health records
Description	<ul style="list-style-type: none"> The availability and use of an EHR system for medication orders is increasing. Medication orders or medication administration records (MAR) can be used.⁵ 	<ul style="list-style-type: none"> Facilities contract with LTC pharmacies to dispense and deliver medications. Antimicrobial use data can be captured through pharmacy transactions. 	<ul style="list-style-type: none"> Antimicrobial use reports are produced by review of the medical record and manual documentation.
Implementation	<ul style="list-style-type: none"> Facilities can leverage their antimicrobial orders or MAR. Antimicrobial use reports can be generated by working with the EHR vendor, or with the support of local information technology expertise. 	<ul style="list-style-type: none"> LTC pharmacy vendors can generate antimicrobial use reports based on antimicrobial transaction data.⁷⁻¹⁰ Most LTC pharmacies also provide services such as drug regimen reviews or medication management performed by a consultant pharmacist. 	<ul style="list-style-type: none"> LTC facilities staff can generate antimicrobial use reports by collecting data elements in the medical record.¹¹
Advantages	<ul style="list-style-type: none"> Automated reporting minimizes burden on LTC staff. Data elements such as resident demographic characteristics, admission and discharge dates, and census data are available. Treatment indication may be available. Data can be used to generate an antimicrobial surveillance log and antimicrobial use report. 	<ul style="list-style-type: none"> Automated reporting minimizes burden on LTC staff. LTC pharmacies widely used by LTC facilities. LTC consultant pharmacists can provide stewardship expertise. Data can be used to generate an antimicrobial surveillance log and antimicrobial use report. 	<ul style="list-style-type: none"> Manual review allows for the assessment of appropriateness using clinical information.¹² Can be integrated into infection surveillance. Several infection surveillance templates are available.¹¹ May be the only available data source.
Limitations	<ul style="list-style-type: none"> Uptake of EHR products may be variable. Modules for antimicrobial tracking may require additional cost. Administration data may not be available. 	<ul style="list-style-type: none"> Multiple LTC pharmacies may supply a single facility. Treatment indication, resident demographic characteristics and census data may not be available. 	<ul style="list-style-type: none"> Time and labor intensive Challenging to sustain

III. Data Elements for Tracking and Reporting Antimicrobial Use

Antimicrobial use **data elements** contain specific information that describes resident characteristics, the antimicrobial prescription, and the number of residents/resident-days at the facility to calculate **antimicrobial use measures**.

Table 2. Data Elements for Tracking and Reporting Antimicrobial Use

Data Element	Resident-level Data
Resident Identifier	Tracking the number of unique residents on antibiotics.
Demographic Characteristics	Characterizing residents on antibiotics by age, sex, and race/ethnicity.
Admission Date	Comparing antimicrobial start date to admission date allows the stratification of antibiotic courses by type of stay and site of initiation . <i>Note: The admission date will change if a resident is transferred to another healthcare facility for a period of time (e.g., 3 or more days).</i>
Type of Stay	Stratifying antimicrobial use rates as long-stay (residents who reside long-term in the facility) and short-stay (residents who are admitted for a limited time for specific care needs, typically following a hospitalization). Short-stay: Difference between the Antimicrobial Start Date and Admission Date \leq 100 days Long-stay: Difference between the Antimicrobial Start Date and Admission Date $>$ 100 days Short-stay residents have higher antimicrobial use rates than long-stay residents and type of stay may be important for facility-level risk adjustment. ^{10,13}
Data Element	Antimicrobial-level Data
Antimicrobial Name, Class, and Route	Tracking systemic antimicrobial agents, classes, and route of administration (e.g., oral, intravenous, intramuscular) will help to characterize prescribing practices.
Antimicrobial Start and End Date	Tracking the antimicrobial start and end date is needed to calculate course duration and stratify antibiotic courses by type of stay and site of initiation.
Site of Initiation	Stratifying antimicrobial use by site of initiation can inform the need for prescribing improvements among facility prescribers or referring hospitals. Hospital-initiated: Difference between course start date and admission date \leq 2 days Facility-initiated: Difference between course start date and admission date $>$ 2 days
Indication	Describing the diagnosis or reason associated with antimicrobial course (e.g., urinary tract, respiratory, or skin and soft tissue infection) to evaluate appropriateness when available.
Prescriber	Reporting antimicrobial use by individual prescribers will allow for audit and feedback interventions. ¹⁴
Data Element	Facility-level Data
Number of Unique Residents	Adding the number of residents at the facility from the first through the last day of the month. <i>Note: Can be stratified by type of stay.</i>
Number of Resident-Days	Reporting the total count of the number of residents at the facility each calendar day of the month. <i>Note: Can be stratified by type of stay.</i>

IV. Antimicrobial Use Measures

Antimicrobial use measures are calculated using the data elements for quantifying and tracking antimicrobial prescribing over time.¹⁵ There are several antimicrobial use measures that can be considered to report antimicrobial use volume in a facility. Antimicrobial use measures can be stratified by antimicrobial class, agent, route, indication (if available), site of initiation (i.e., hospital or facility), and type of stay (i.e., short-stay or long-stay). All measures can be reported for different time periods (e.g., month, quarter, and year).

Table 3. Antimicrobial Use Measures

Measure	Description	Calculation
Residents on Antimicrobial	The number of unique residents receiving an antimicrobial in a time period (e.g., month, quarter, and year).	Percent of Residents Receiving Antimicrobials $\frac{\text{Total number of residents on an antimicrobial}}{\text{Total number of unique residents}} \times 100$
Antimicrobial course	An antibiotic course may be associated with multiple antimicrobial orders. One course combines multiple orders with: <ul style="list-style-type: none"> • Same drug, route, and resident • ≤ 3-day gap • Start Date of course is the start date of the first order • End Date of course is the end date of the last order <i>Note: This applies to medication orders, administrations or pharmacy dispenses.</i>	Rate of Antimicrobial Courses $\frac{\text{Total number of antimicrobial courses}}{\text{Total resident-days}} \times 1,000$
Antimicrobial Course Duration	The number of days of an antimicrobial course from the start to the end date, inclusive of the start date. (End Date – Start Date) + 1	Percent Distribution of Course Durations by specific duration groupings (e.g., 1, 2–7, 8–41, ≥42 days). Or mean course duration and range $\text{Mean duration} = \frac{\text{Sum of all course durations}}{\text{Total number of courses}}$
Antimicrobial Days of Therapy (DOT)	A calendar day that a resident receives a specific antimicrobial. Total DOTs can be calculated as the sum of all antimicrobial course durations.	Rate of Total Antimicrobial Days of Therapy $\frac{\text{Antimicrobial days of therapy}}{\text{Total resident-days}} \times 1,000$

Table 4. Additional Antimicrobial Use Measures for Consideration

Measure	Description	Calculation
Antimicrobial Length of Therapy (LOT)	Number of days a resident receives an antimicrobial for a specific infection, regardless of the number or route of different drugs. The LOT will be less than or equivalent to the DOT.	Rate of Total Antimicrobial Length of Therapy $\frac{\text{Antimicrobial length of therapy}}{\text{Total resident-days}} \times 1,000$
Residents on Antimicrobial in One Day	Point prevalence surveys track the proportion of residents receiving antimicrobials during a specific point in time (e.g., one day in a week or a month). Prevalence surveys do not portray the volume of antimicrobial use over time. ¹⁷	Percent of Residents Receiving an Antimicrobial in One Day $\frac{\text{Number of residents on antimicrobial in one day}}{\text{Total residents in the facility}} \times 100$

V. Conclusions

This document provides an overview of **antimicrobial use data sources, data elements, and measures** for LTC antibiotic stewardship leads. Tracking and reporting of antimicrobial volume may not allow for direct assessment of appropriateness of prescribing. Lack of documentation of prescribing indication, variability in the clinical presentation of infections in older adults, and limited availability of LTC-specific criteria add to the challenges of assessment of appropriateness in this setting.¹² Tracking and reporting antimicrobial use volume can be used to:

- Generate an antimicrobial surveillance log or “line list” to serve as a tracking log for facility staff reviewing all residents on antimicrobial courses.¹¹
- Develop antimicrobial use reports to describe baseline prescribing rates, track changes over time, identify where further evaluation of prescribing practices is needed, and assess impact of stewardship interventions.^{15,18}
- Track specific antimicrobial classes that may be a target for improvement (e.g., fluoroquinolones) or agents used for the treatment of specific infections, such as *Clostridioides difficile* infection.
- Identify the site of initiation (facility- or outside facility-initiated) of antimicrobial courses and tailor stewardship interventions by engaging prescribers or referring hospitals.
- Characterize courses that are ≤ 1 and > 42 days to evaluate the proportion of antibiotic courses used for prophylaxis and assess the need for focused interventions.
- Report total DOTs or the proportion of antimicrobial courses that are > 7 days to assess the effectiveness of an intervention that targets the duration of antibiotic courses (e.g., “antibiotic time-out”).
- Report prescribing rates for individual prescribers to inform audit and feedback interventions with peer comparisons, which have been shown to reduce course duration.^{1,14}

Automated reporting of antimicrobial use volume allows for sustainable tracking and highlights where manual chart review is needed to improve prescribing practices. This document outlines how antibiotic stewardship experts can support a facility or group of facilities in leveraging different data sources to meet the Tracking and Reporting Core Elements.

VI. References

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