Antimicrobial Stewardship: Tracking, Reporting, Education

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Key Points

- Outline components recommended by CDC for tracking, reporting, and education
- Provide specific examples of parameters and metrics for tracking
- Review strategies to report antimicrobial stewardship-related activities and outcomes
- Present methods to provide antimicrobial stewardship-related education

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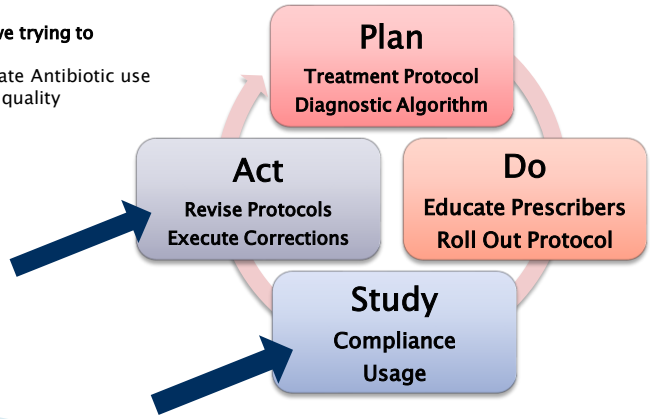
The Performance Improvement Cycle
Why we track Metrics

What are we trying to Improve?
- Appropriate Antibiotic use
- Resident quality of care



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Tracking Core Element

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What Should be Tracked?

Antibiotic Use Measures	· Antibiotic starts per 1000 resident-days · Days of therapy per 1000 resident-days
Process Measures	· Use of clinical assessment tool · Dose, duration, indication documentation · Antibiotic selection based on guidelines
Outcome Measures	· Antimicrobial resistance · Antimicrobial-associated adverse events · *Clostridioides difficile* infection rate

https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

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Tracking Antimicrobial Use

What to Track	How to Organize Data	How to Present Data
• Number of antimicrobial starts • Antimicrobial days of therapy	• Overall • By antibiotic class • By indication • By prescriber • By individual agent	• Antibiotic starts per 1000 resident-days • Days of therapy per 1000 resident-days

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Why Per 1000 Resident Days?

- Converts the number of starts, or days of therapy to a rate
- Allows comparison between facilities of differing size
- Recommend to do by month

Example:

- (# of antibiotic starts in August ÷ # of resident days August) X 1000
- (# of days of therapy in August÷ # of resident days August) X 1000

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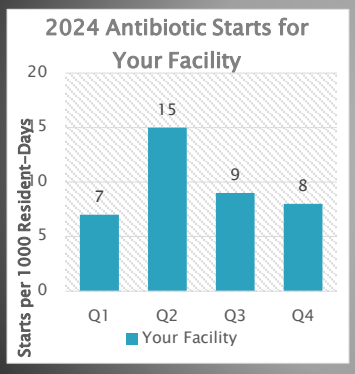
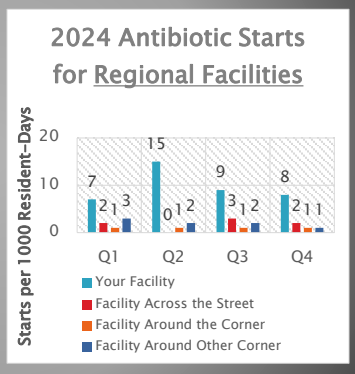
Why Track Standardized Starts and Days of Therapy?





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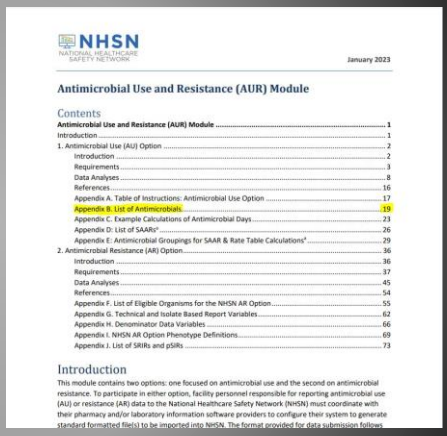
What Antimicrobials Should be Tracked?

- Search "CDC NHSN AUR MODULE"
- CDC document on how to submit antibiotic use data to NHSN AUR module
- Provides comprehensive list of antimicrobials
- Classifies as Anti-viral, Anti-bacterial, or Anti-fungal
- Provides Drug Class information
- Only lists generic names



NHSN
NATIONAL HEALTHCARE SAFETY NETWORK

January 2023

Antimicrobial Use and Resistance (AUR) Module

Contents

Introduction

This module contains two options: one focused on antimicrobial use and the second on antimicrobial resistance. To participate in either option, facility personnel responsible for reporting antimicrobial use (AU) or resistance (AR) data to the National Healthcare Safety Network (NHSN) must coordinate with their pharmacy and/or laboratory information software providers to configure their system to generate standard formatted file(s) to be imported into NHSN. The format provided for data submission follows

https://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf Accessed 9/21/23

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Examples of Antimicrobials for Tracking

Antimicrobial Agent	Antimicrobial Category	Antimicrobial Class[a]	Antimicrobial Subclass[a]
AMANTADINE	Anti-influenza	M2 ion channel inhibitors	
AMIKACIN	Antibacterial	Aminoglycosides	
AMIKACIN LIPOSOMAL[b]	Antibacterial	Aminoglycosides	
AMOXICILLIN	Antibacterial	Penicillins	Aminopenicillin
AMOXICILLIN/ CLAVULANATE	Antibacterial	β-lactam/β-lactamase inhibitor combination	
AMPHOTERICIN B	Antifungal	Polyenes	
AMPHOTERICIN B LIPID COMPLEX	Antifungal	Polyenes	
AMPHOTERICIN B LIPOSOMAL	Antifungal	Polyenes	
AMPICILLIN	Antibacterial	Penicillins	Aminopenicillin
AMPICILLIN/ SULBACTAM	Antibacterial	β-lactam/β-lactamase inhibitor combination	
ANIDULAFUNGIN	Antifungal	Echinocandins	
AZITHROMYCIN	Antibacterial	Macrolides	
AZTREONAM	Antibacterial	Monobactams	

Antimicrobial Agent	Antimicrobial Category	Antimicrobial Class[a]	Antimicrobial Subclass[a]
CEFPODOXIME	Antibacterial	Cephalosporins	Cephalosporin 3rd generation
CEFPROZIL	Antibacterial	Cephalosporins	Cephalosporin 2nd generation
CEFTAROLINE	Antibacterial	Cephalosporins	Cephalosporins with anti-MRSA activity
CEFTAZIDIME	Antibacterial	Cephalosporins	Cephalosporin 3rd generation
CEFTAZIDIME/AVIBACTAM	Antibacterial	β-lactam/β-lactamase inhibitor combination	
CEFTOLOZANE/ TAZOBACTAM	Antibacterial	β-lactam/β-lactamase inhibitor combination	
CEFTRIAXONE	Antibacterial	Cephalosporins	Cephalosporin 3rd generation
CEFUROXIME	Antibacterial	Cephalosporins	Cephalosporin 2nd generation
CEPHALEXIN	Antibacterial	Cephalosporins	Cephalosporin 1st generation
CHLORAMPHENICOL	Antibacterial	Phenicols	
CIPROFLOXACIN	Antibacterial	Fluoroquinolones	
CLARITHROMYCIN	Antibacterial	Macrolides	
CLINDAMYCIN	Antibacterial	Lincosamides	
COLISTIMETHATE	Antibacterial	Polymyxins	
COLISTIN[c]	Antibacterial	Polymyxins	
DALBAVANCIN	Antibacterial	Glycopeptides	Lipoglycopeptides

https://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf Accessed 9/21/23

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Drugs That Should NOT Be Counted

- Antivirals
- Topical antifungals
  - Nystatin, clotrimazole, ketoconazole
- Topical antibiotics
  - Triple antibiotic, bacitracin, mupirocin
- Antibiotic-containing eye and ear drops/ointments
  - Gentamicin, tobramycin, erythromycin
- Agents that work within GI tract or not absorbed
  - Sulfasalazine, rifaximin
  - Exceptions: vancomycin PO, fidaxomicin
- Urinary tract antiseptic/analgesic
  - Methenamine, phenazopyridine

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Determining Antibiotic Starts

- Obtain data
  - Antibiotic dispense report from pharmacy
    - Quick/Easy to obtain, but may require some fixing (see example)
  - Antibiotic start log
    - More work upfront, but greater control over data

Infection and Antibiotic Start Log Collections
Infection and Antibiotic Start Log Template
Infection and Antibiotic Start Log Template Version 2
Infection and Antibiotic Start Log Template Version 2 (demo only)

https://asap.nebraskamed.com/facilities/long-term-care/tools-and-templates-for-long-term-care/

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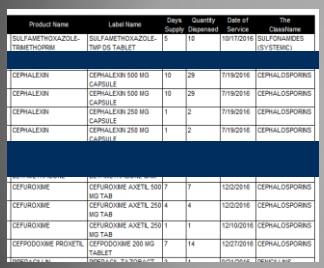
Determining Antibiotic Starts

Pharmacy Dispense Report Example

May Antibiotic Report



Product Name	Label Name	Days Supply	Quantity Dispensed	Date of Service	The ClassName
SULFAMETHOXAZOLE-TRIMETHOPRIM	SULFAMETHOXAZOLE-TMP DS TABLET	5	10	10/17/2016	SULFONAMIDES (SYSTEMIC)
CEPHALEXIN	CEPHALEXIN 500 MG CAPSULE	10	29	7/19/2016	CEPHALOSPORINS
CEPHALEXIN	CEPHALEXIN 500 MG CAPSULE	10	29	7/19/2016	CEPHALOSPORINS
CEPHALEXIN	CEPHALEXIN 250 MG CAPSULE	1	2	7/19/2016	CEPHALOSPORINS
CEPHALEXIN	CEPHALEXIN 250 MG CAPSULE	1	2	7/19/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 500 MG TAB	7	7	12/2/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	4	4	12/2/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1	1	12/10/2016	CEPHALOSPORINS
CEFPODOXIME PROXETIL	CEFPODOXIME 200 MG TABLET	7	14	12/27/2016	CEPHALOSPORINS

May Resident-Days = 450

- Remove agents that shouldn't be counted
  - Bacitracin, clotrimazole
- Assume each line represent one antibiotic start
  - 9 lines = 9 starts
- Calculate starts/1000 resident-days

$$\frac{9\ starts}{450\ resident-days} * 1000 = 20$$

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Other Things to Consider

May Antibiotic Dispense Report

Product Name	Label Name	Days Supply	Quantity Dispensed	Date of Service	The ClassName
SULFAMETHOXAZOLE-TRIMETHOPRIM	SULFAMETHOXAZOLE-TMP DS TABLET	5	10	10/17/2016	SULFONAMIDES (SYSTEMIC)
CEPHALEXIN	CEPHALEXIN 500 MG CAPSULE	10	29	7/19/2016	CEPHALOSPORINS
CEPHALEXIN	CEPHALEXIN 500 MG CAPSULE	10	29	7/19/2016	CEPHALOSPORINS
CEPHALEXIN	CEPHALEXIN 250 MG CAPSULE	1	2	7/19/2016	CEPHALOSPORINS
CEPHALEXIN	CEPHALEXIN 250 MG CAPSULE	1	2	7/19/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 500 MG TAB	7	7	12/2/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	4	4	12/2/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1	1	12/10/2016	CEPHALOSPORINS
CEFPODOXIME PROXETIL	CEFPODOXIME 200 MG TABLET	7	14	12/27/2016	CEPHALOSPORINS

May Resident-Days = 450

- Duplicate listing with same drug, dose, and duration
  - For different residents?
    - Need patient level data to confirm
  - Charge to different insurance?
    - Need patient level data and prescription number
- Was any antibiotic ordered, dispensed, but not given?
  - Request pharmacy for drug crediting report if available
  - Review antibiotic start log

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Determining Antibiotic Days of Therapy

August Antibiotic Report

Product Name	Label Name	Days Supply	Quantity Dispensed	Date of Service	The ClassName
AMOXICILLIN-CLAVULANATE POTASS	AMOX-CLAV 400-57 MG/5 ML SUSP	7	100	8/1/2016	PENICILLINS
CEFUROXIME	CEFUROXIME AXETIL 25	1	2	8/2/2016	CEPHALOSPORINS
	MG TAB				
DOXYCYCLINE HYCLATE	DOXYCYCLINE	10	20	8/3/2016	TETRACYCLINES
	HYCLATE 100 MG TAB				
CEPHALEXIN	CEPHALEXIN 500 MG	7	21	8/3/2016	CEPHALOSPORINS
	CAPSULE				
CEFUROXIME	CEFUROXIME AXETIL 25	9	18	8/3/2016	CEPHALOSPORINS
	MG TAB				
DOXYCYCLINE HYCLATE	DOXYCYCLINE	7	14	8/3/2016	TETRACYCLINES
	HYCLATE 100 MG TAB				
NITROFURANTOIN	NITROFURANTOIN MCR	1	1	8/3/2016	URINARY ANTI-
	100 MG CAP				INFECTIVES
NITROFURANTOIN MONO-	NITROFURANTOIN MONO-	7	14	8/3/2016	URINARY ANTI-
MACRO	MCR 100 MG				INFECTIVES
CEFTRIAXONE	CEFTRIAXONE 10 GM	5	1	8/4/2016	CEPHALOSPORINS

August Resident-Days = 490

- Obtain data
  - Antibiotic dispensing report
  - Antibiotic start log if duration recorded
- Remove drug that should not be counted *(none)*
- Sum up 'Days Supply' for all antibiotics or for specific classes
  - All agents: 49 days
  - Cephalosporins: 17 days
- Calculate days of therapy (DOT) per 1000 resident-days

$$\text{All} = \frac{49\ days}{490\ resident-days} * 1000 = 100$$

$$\text{Cephalosporins} = ??$$

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Other Things to Consider

August Antibiotic Report

Product Name	Label Name	Days Supply	Quantity Dispensed	Date of Service	The ClassName
AMOXICILLIN-CLAVULANATE POTASS	AMOX-CLAV 400-57 MG/5 ML SUSP	7	100	8/1/2016	PENICILLINS
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1	2	8/2/2016	CEPHALOSPORINS
DOXYCYCLINE HYCLATE	DOXYCYCLINE HYCLATE 100 MG TAB	10	20	8/3/2016	TETRACYCLINES
CEPHALEXIN	CEPHALEXIN 500 MG CAPSULE	7	21	8/3/2016	CEPHALOSPORINS
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	9	18	8/3/2016	CEPHALOSPORINS
DOXYCYCLINE HYCLATE	DOXYCYCLINE HYCLATE 100 MG TAB	7	14	8/3/2016	TETRACYCLINES
NITROFURANTOIN	NITROFURANTOIN MCR 100 MG CAP	1	1	8/3/2016	URINARY ANTI-INFECTIVES
NITROFURANTOIN MONO-MACRO	NITROFURANTOIN MONO-MCR 100 MG	7	14	8/3/2016	URINARY ANTI-INFECTIVES
CEFTRIAXONE	CEFTRIAXONE 10 GM	5	1	8/4/2016	CEPHALOSPORINS

August Resident-Days = 490

- Was antibiotic prescribed and dispensed but not given at all?
- Was antibiotic stopped earlier than initially prescribed?
- What happens if patient only received
  1 dose out of many prescribed for a single day (e.g., doxycycline)?

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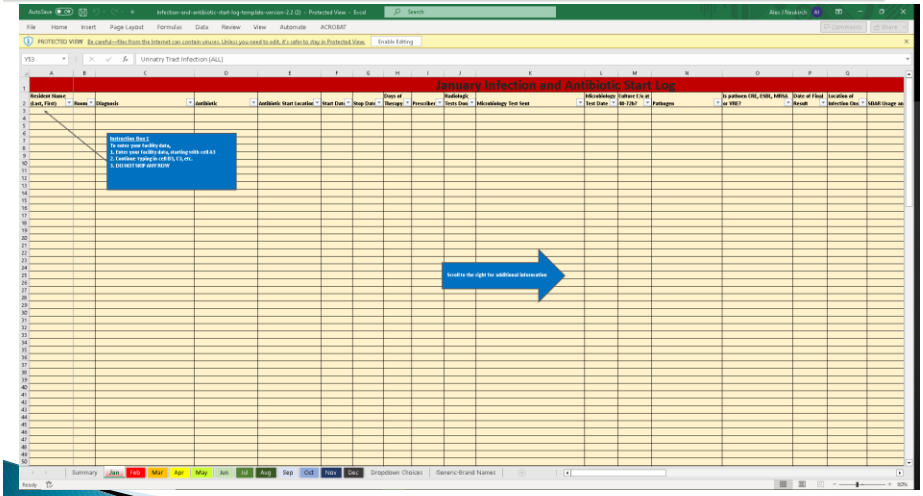
Electronic Infection and Antibiotic Start Log using Microsoft Excel



Available at: https://asap.nebraskamed.com/long-term-care/tools-templates-long-term-care/. Accessed 9/21/23.

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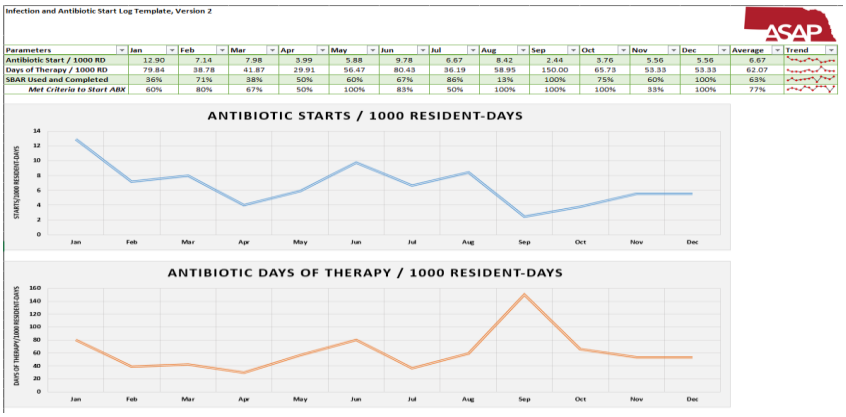
Electronic Infection and Antimicrobial Start Log using Microsoft Excel



Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Trend
Antibiotic Start / 1000 RD	12.90	7.14	7.98	3.99	5.88	9.78	6.67	8.42	2.44	3.76	5.56	5.56	6.67	
Days of Therapy / 1000 RD	79.84	38.78	41.87	29.91	56.47	80.43	36.19	58.95	150.00	65.73	53.33	53.33	62.07	
SBAR Used and Completed	36%	71%	38%	50%	60%	67%	86%	13%	100%	75%	60%	100%	63%	
Met Criteria to Start ABX	60%	80%	67%	50%	100%	83%	50%	100%	100%	100%	33%	100%	77%	

Available at: https://asap.nebraskamed.com/long-term-care/tools-templates-long-term-care/. Accessed 4/15/2019.

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Self-Assessment Question #1

A resident was taking azithromycin and amoxicillin for 5 days for community-acquired pneumonia

1. What is the total number of antibiotic starts?
2. What is the total days of therapy?

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Self-Assessment Question #2

A resident started Nitrofurantoin twice a day for 5 days starting the evening of September 30th, and finished the course on the morning of October 5th.

1. Does the start count for September, or October?
2. What are the total days of therapy for September?
3. What are the total days of therapy for October?

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Why Track So Many Use Metrics?

Antibiotic Starts

- Assess impact of initiatives that address when antibiotics are not appropriate
  (e.g., asymptomatic bacteriuria)

Days of Therapy

- Assess impact of interventions that shorten duration of therapy
- Better metric to monitor overall antibiotic use over time

Standardizing by Patient-Days

- Account for variations in number of residents and lengths of stay
- Allow within facility comparison over time
- Make between facility comparison possible

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Tracking Process Measures – *Compliance with Clinical Assessment*

What to Track	How to Organize Data	How to Present Data
Was assessment tool used? (Y/N)	Overall (200 assessment performed)	% of time assessment tool used for an infection
Which tool was used? (UTI SBAR, RTI SBAR)	By type of infection (UTI, SSTI)	% of suspected infection met criteria before starting ABX
Were criteria met? (Y/N)	By unit (2 east, 2 west)	
Who assessed the resident? (Nurse A, Nurse B)	By person assessing resident (Nurse A, Nurse B)	

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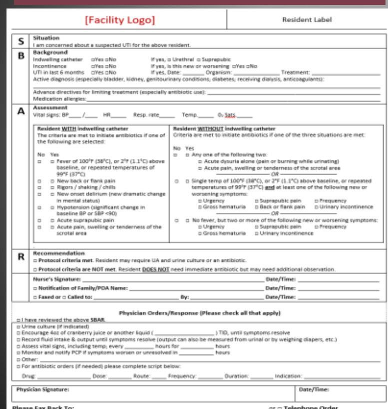
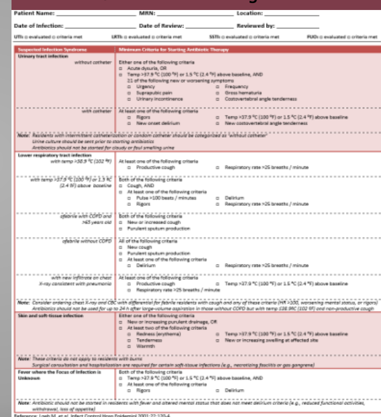
Examples of Clinical Assessment Tools

UTI SBAR



Loeb Criteria for Initiating Antibiotic



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Tracking Process Measure – *Prescribing Documentation*

What to Track
- Antibiotic orders with dose, frequency, duration, indication documented

How to Organize Data
- Overall
- By prescribers

How to Present Data
- % of all antibiotic orders with required documentation
- % of antibiotic orders from a specific prescriber with required documentation

Logistics
- Capture data before getting missing info
- Request nurses to capture info for all new antibiotic orders

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Tracking Process Measure – *Antibiotic Selection Based on Guidelines*

- Only if facility-specific treatment guidelines are available
  - Based on national guidelines, resistance pattern, prescriber preferences
  - Work with consultant pharmacists, medical directors to create
- What to track
  - Frequency guideline-recommended antibiotics are selected
  - Frequency the correct dose is selected
  - Frequency correct duration is prescribed
- Capture data monthly or quarterly if antibiotic use is low
- Data can be from
  - Consultant Pharmacist
  - Antibiotic start/infection log
  - Indication MUST be documented for successful tracking

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Tracking Outcome Measures – *Antibiogram*

- Antibiotic susceptibility patterns for specific organisms in a period
- Based on >30 isolates of an organism to increase statistical power
  - But >20 isolates acceptable per AHRQ
  - Can increase isolates by increasing timespan (e.g., to 24 months)
- Should only base information on 1st positive culture from multiple consecutive positives
- If large number of positive cultures, can categorize antibiogram
  - By culture source (e.g., urine cultures)
  - By nursing units

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Tracking Outcome Measures -- *Antibiogram*

Nursing Home Antibiotic Susceptibility Report for Most Commonly Isolated Pathogens
January 2015 to December 2015

Pathogens	Number of Isolate Tested	Percent Susceptible																						
		Ampicillin	Ampicillin/Sulbactam	Piperacillin/Tazobactam	Cefazolin	Cefuroxime	Cefotaxime	Ceftazidime	Ceftriaxone	Cefepime	Cefoxitin	Aztreonam	Ertapenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	Trimethoprim/Sulfa	Nitrofurantoin[1]	Tetracycline	Daptomycin	Linezolid	Vancomycin
Gram Negative Organisms																								
Escherichia coli	41	61	66	98	76	76	93	93	93	93	80	93	100	100	98	93	90	49	51	68	93	68	--	--	--
Klebsiella pneumoniae	20[2]	R[3]	80	95	90	100	100	100	95	100	95	100	100	100	100	100	100	95	95	90	70	85	--	--	--
Proteus mirabilis	16[2]	81	94	100	100	100	100	100	100	100	100	100	100	100	100	100	100	19	38	56	R[3]	R[3]	--	--	--
Gram Positive Organism																									
Enterococcus faecalis[4]	11[2]	100	--	--	--	--	R[3]	--	R[3]	--	--	--	--	--	--	--	--	27	45	R[3]	100	9	100	100	100

1. Nitrofurantoin is reported for urine isolates only and this antibiotic should only be used for cystitis.
2. Antibiogram created for organisms with less than 30 total isolates are of questionable statistical significance. Interpret data with caution.
3. Organism with intrinsic resistance to this antibiotic.
4. For *Enterococcus*, susceptibilities for ciprofloxacin, levofloxacin, and tetracycline are reported for urine isolates only.

- What antibiotic should be selected if suspecting 1st episode of UTI in a resident?
- Things to consider
  - Does patient have history of UTI where culture data is available?
  - What is the most likely organism in UTI?
  - What is the antibiotic with the highest percent susceptibility?
  - Can antibiotic only be given PO? Is antibiotic readily available in NH?

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Tracking Outcome Measures – *Infection Rates of Specific Organisms*

- NHSN tracking
  - MRSA (methicillin-resistant *Staphylococcus aureus*)
  - VRE (vancomycin-resistant enterococci)
  - ESBL (extend spectrum β-lactamase) Gram negative bacilli
  - CRE (carbapenem-resistant *Enterobacteriaceae*)
  - *Clostridioides difficile* infections
- Data can be standardized by
  - Resident-Days
  - Number of new admissions
- Why track them?
  - Direct consequences of the extent of antibiotic use AND infection control practices

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Other Outcome Measures – *Adverse Drug Events (ADR)*

- Rates of antibiotic-related adverse events
  - *C difficile* infections
  - Diarrhea, loose stools unrelated to CDI
  - Rash, hives
  - Fluoroquinolones: Tendon rupture, hypo/hyperglycemia, confusion, seizure, neuropathy, others
- Requires careful review of clinical records to determine causality
  - Naranjo adverse drug reaction probability scale[1]
  - Classify causal relationship as definite, probable, possible, doubtful
- Request assistance from
  - Consultant pharmacist as part of monthly drug use evaluation
  - Medical director
  - Specific nurse caring for resident who experienced the ADR

Naranjo CA, *et al*. Clin Pharmacol Ther 1981:30:239-45.

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Example of Tool for Evaluating ADR

[Facility Logo] | Resident Label

Adverse Drug Reaction Worksheet

Evaluation Date: ________ **Evaluated By:** ________ **Date of Adverse Reaction:** ________

Suspect Medication: ________ **Dosing Regimen:** ________ **Is medication new?** ☐ Yes ☐ No

Adverse Reaction: ________
(Refer to a list of common adverse antimicrobial reactions in Table 1 on the next page)

Probability Reaction Related to Medication (from the Naranjo Probability Scale below):

☐ Definite (≥ 9) ☐ Probable (5-8) ☐ Possible (1-4) ☐ Doubtful (0)

Consequence of Adverse Reaction (check all that apply):

☐ No change-therapy continued ☐ Therapy changed to another agent ☐ Therapy discontinued
☐ Increased monitoring ☐ Symptomatic medical treatment ☐ Corrective surgical procedure
☐ Disability ☐ Permanent Damage ☐ Delayed discharge
☐ Hospitalization ☐ Other (specify): ________

Reviewer: ________ **Date:** ________

Naranjo Adverse Drug Reaction Probability Scale (with modifications)

The following scale is used to assess the likelihood a particular adverse reaction is related to a medication. Answer each of the 10 questions, calculate total score, and determine if an adverse drug reaction is Definitely, Probably, Possibly, or unlikely related to the drug in question. *(Interpretation of the probability classification can be found in Table 2 on the next page)*

Question	Yes	No	Do Not Know	Score
1. Are there previous CONCLUSIVE reports on this reaction?	+1	0	0	
2. Did the adverse reaction appear after the suspected drug was administered?	+2	−1	0	
3. Did the adverse reaction improve when the drug was discontinued or a specific antagonist given?	+1	0	0	
4. Did the adverse reaction reappear when the drug was readministered?	+2	−1	0	
5. Are there alternative causes (other than the suspect drug) that could have caused the reaction?	−1	+2	0	
6. Did the reaction reappear when a placebo was given?	−1	+1	0	
7. Was the drug detected in blood or other fluids in concentrations known to be toxic?	+1	0	0	
8. Was the reaction more severe when dose was increased or less severe when dose was decreased?	+1	0	0	
9. Did the patient have a similar reaction to the same or similar drugs in any previous exposure?	+1	0	0	
10. Was the adverse reaction confirmed by any objective evidence?	+1	0	0	
	Total Score			

Table 1. List of Common Adverse Antimicrobial Reactions*

Drug Class	Class Member	Common Adverse Reaction
Penicillins +/- Beta-Lactamase inhibitors	Ampicillin, Ampicillin-Sulbactam, Amoxicillin, Amoxicillin-Clavulanate, Cloxacillin, Dicloxacillin, Nafcillin, Oxacillin, Penicillin, Piperacillin-Tazobactam	Nausea, vomiting, diarrhea, *C difficile* infection, allergic reactions (including rash, hemolytic anemia), elevated serum creatinine, bone marrow suppression with long-term use, phlebitis with IV therapy
Cephalosporins +/- Beta-Lactamase Inhibitors	Cefaclor, Cefazolin, Cefdinir, Cefditoren, Cefepime, Cefixime, Cefotetan, Cefoxitin, Cefpodoxime, Cefprozil, Ceftaroline, Ceftazidime, Ceftazidime-Avibactam, Ceftibuten, Ceftolozane-Tazobactam, Ceftriaxone, Cefuroxime, Cephadroxil, Cephalexin	Nausea, vomiting diarrhea, *C difficile* infection, allergic reactions (including rash, serum sickness), altered mental status
Carbapenems	Doripenem, Ertapenem, Imipenem-Cilastatin, Meropenem	Nausea, vomiting, diarrhea, *C difficile* infection, seizure
Fluoroquinolones	Ciprofloxacin, Delafloxacin Levofloxacin, Moxifloxacin	Disorientation, delirium, agitation, seizure, hypo- or hyper-glycemia, peripheral neuropathy, tendon rupture, QT prolongation, nausea, vomiting, *C difficile* infection, increased in liver function tests, aortic dissection
Macrolides	Azithromycin, Clarithromycin, Erythromycin	Nausea, vomiting, elevation in liver function tests, reversible tinnitus or deafness, taste alteration, phlebitis with IV therapy
Tetracyclines	Doxycycline, Minocycline, Tetracycline	Nausea, vomiting, sunburn, esophageal ulcer, phlebitis with IV therapy, teeth discoloration
Sulfonamides	Sulfamethoxazole-Trimethoprim	Allergic reactions (rash, hives, drug fever, Steven Johnson Syndrome), headache, sunburn, hyperkalemia, worsen renal functions, bone marrow suppression, hemolytic anemia, hypoglycemia (especially with sulfonylureas)
Glycopeptides	Telavancin, Vancomycin IV	Redman syndrome (flushing, itching, hypotension), worsened renal functions
Others	Clindamycin, Metronidazole, Nitrofurantoin	All: Nausea, vomiting; Clindamycin: diarrhea, *C difficile* infection, taste alteration; Metronidazole: disulfiram reaction after alcohol (flushing, dyspnea), taste alteration, peripheral neuropathy, confusion; Nitrofurantoin: interstitial pneumonitis especially with chronic use, hemolytic anemia

* The above list does not include all antimicrobials or all adverse drug reactions. Consult drug references and published literature for additional information if an adverse drug reaction not listed above is suspected.

Table 2. Interpretation of Probability Categories

Category	Score Range	Interpretation
Definite	≥ 9	Reaction 1) followed a reasonable temporal sequence after a drug or in which a toxic drug level had been established in body fluids or tissues; 2) followed a recognized response to the suspected drug; and 3) was confirmed by withdrawal but not by exposure to the drug
Probably	5 – 8	Reaction 1) followed a reasonable temporal sequence after a drug; 2) followed a recognized response to the suspected drug; 3) was confirmed by withdrawal but not by exposure to the drug; 4) could not be reasonably explained by the known characteristics of the patient's clinical state
Possible	1 – 4	Reaction 1) followed a temporal sequence after a drug; 2) possibly followed a recognized pattern to the suspected drug; 3) could be explained by characteristics of the patient's disease
Doubtful	0	Reaction was likely related to factors other than a drug

Reference
Naranjo CA, *et al.* A method for estimating the probability of adverse drug reactions. Clin Pharmacol Ther 1981:30:239-45.

From: https://asap.nebraskamed.com/long-term-care/tools-templates-long-term-care/. Accessed 4/15/19.

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Other Antibiotic Use/Outcome Measures NOT Covered

- Defined daily dose (DDD) per 1000 resident-days
  - Requires more calculations
  - DDD definitions may not reflect how antibiotics are usually dosed
- Point prevalence survey
  - % residents receiving antibiotics on a single day
  - Easier to determine but does not inform overall use
- Antibiotic utilization ratio
  - Total monthly DOT/total monthly resident-days
  - Represent average DOT in a single resident-day
- Antibiotic-related costs
  - Important from an administrative perspective
  - Costs fluctuate and may not represent overall use

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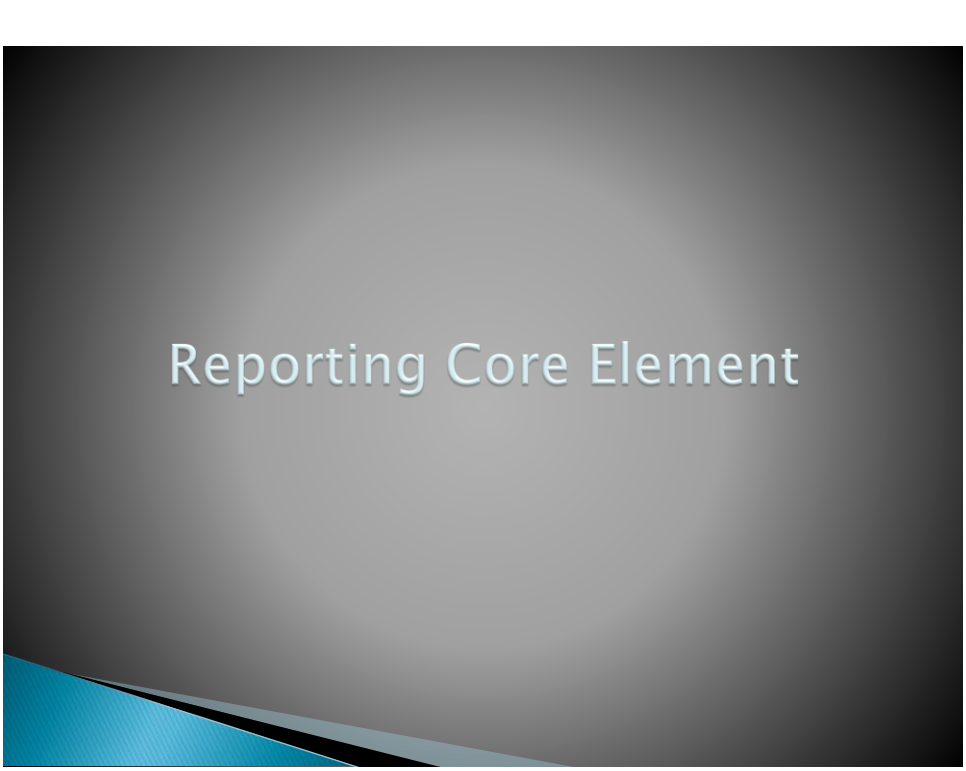

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Reporting Antimicrobial Stewardship Data Activities and Outcomes

- CDC recommends reporting tracked data to:
  - Clinical providers
  - Nursing staff
- ASAP experience from onsite visits
- Tracked data typically only available to a select few (e.g., QAPI)
- What good is it if no one knows about it!
  - Data can increase buy-in
  - Resistance rate may deter use
  - Rate of inappropriate UA/culture may improve use of assessment tool
  - Justify your existence in the facility

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Reporting Antimicrobial Stewardship Activities and Outcomes

- Who to report to
  - Prescribers
  - Nursing staff
  - Selectively to residents/families
- What to report
  - Antibiotic use data (starts, DOT)
  - Rates of specific infections
  - Compliance to policy (met criteria before starting antibiotics)
  - $$ spent on antibiotics
- How to report
  - Use existing system
    - Newsletter, QAPI report
  - Frequency varies based on type and volume of information
    - Annually for antibiogram, antibiotic spending
    - Quarterly, semi-annually, or annually for other info

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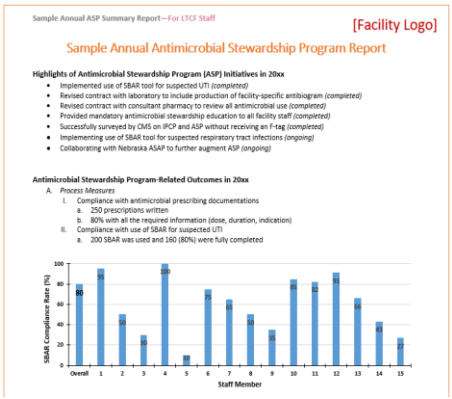
Examples of Annual ASP Report



Sample Annual ASP Summary Report—For LTCF Staff

[Facility Logo]

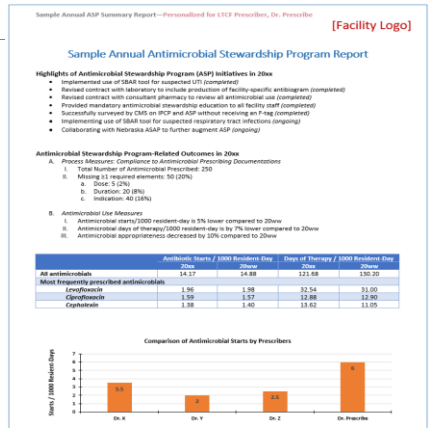
Sample Annual Antimicrobial Stewardship Program Report

Highlights of Antimicrobial Stewardship Program (ASP) Initiatives in 20xx

- Implemented use of SBAR tool for suspected UTI *(completed)*
- Revised contract with laboratory to include production of facility-specific antibiogram *(completed)*
- Revised contract with consultant pharmacy to review all antimicrobial use *(completed)*
- Provided mandatory antimicrobial stewardship education to all facility staff *(completed)*
- Successfully surveyed by CMS on IPCP and ASP without receiving an F-tag *(completed)*
- Implementing use of SBAR tool for suspected respiratory tract infections *(ongoing)*
- Collaborating with Nebraska ASAP to further augment ASP *(ongoing)*

Antimicrobial Stewardship Program-Related Outcomes in 20xx

A. *Process Measures*
   I. Compliance with antimicrobial prescribing documentations
      a. 250 prescriptions written
      b. 80% with all the required information (dose, duration, indication)
   II. Compliance with use of SBAR for suspected UTI
      a. 200 SBAR was used and 160 (80%) were fully completed



Sample Annual ASP Summary Report—Personalized for LTCF Prescriber, Dr. Prescribe

[Facility Logo]

Sample Annual Antimicrobial Stewardship Program Report

Highlights of Antimicrobial Stewardship Program (ASP) Initiatives in 20xx

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Antimicrobial Stewardship Program-Related Outcomes in 20xx

A. *Process Measures: Compliance to Antimicrobial Prescribing Documentations*
   I. Total Number of Antimicrobial Prescribed: 250
   II. Missing ≥1 required elements: 50 (20%)
      a. Dose: 5 (2%)
      b. Duration: 20 (8%)
      c. Indication: 40 (16%)

B. *Antimicrobial Use Measures*
   I. Antimicrobial starts/1000 resident-day is 5% lower compared to 20wxw
   II. Antimicrobial days of therapy/1000 resident-day is by 7% lower compared to 20wxw
   III. Antimicrobial appropriateness decreased by 10% compared to 20wxw

	Antibiotic Starts / 1000 Resident-Day		Days of Therapy / 1000 Resident-Day	
	20xx	20wxw	20xx	20wxw
All antimicrobials	14.17	14.88	121.68	130.20
Most frequently prescribed antimicrobials				
Levofloxacin	1.96	1.98	32.54	31.00
Ciprofloxacin	1.59	1.57	12.88	12.90
Cephalexin	1.38	1.40	13.62	11.05

From: https://asap.nebraskamed.com/long-term-care/tools-templates-long-term-care/. Accessed 4/15/19.

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Education Core Element

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Antimicrobial Stewardship Education

Who to Educate	What to Educate	When to Educate	How to Educate
• Prescribers • Nurses • Residents • Families	• Appropriate use • Mcgeer/Loeb Criteria • Consequences of misuse • What is ASP • Program goals • Interventions • Program leaders	• As needed • *Annually*: antibiogram, general ASP education • *Quarterly*: Resistance / *C diff* rates, DOT, antibiotic starts • *As needed*: New residents, employees, interventions	• Pamphlets / Flyers • Pocket guides • Newsletters • Face-to-face interactive lectures • Web-based education

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Example of ASP Education

[Facility Logo]

FROM: [Executive Director, Medical Director, Director of Nursing, etc.]

DATE: [Date]

RE: Antimicrobial Stewardship Program

Antibiotics are among the most commonly prescribed medications within long-term care facilities. However, misuse of antibiotics can lead to undesirable outcomes including emergence of multidrug resistant pathogens, development of *Clostridium difficile* infections, adverse drug reactions, increased mortality, and higher costs.

As part of the continuing commitment to provide high quality care to all our residents, the leadership team of [facility name] has created an Antibiotic Stewardship Program (ASP). This program will promote appropriate use of antibiotics in our facility. The overall goal of ASP is to prevent undesirable outcomes related to antibiotic misuse by optimizing the selection of drug, dose, route, and duration of therapy. Antibiotic use protocols and systems to monitor antibiotic use will be implemented to achieve ASP goals.

The ASP will be a part of the facility's Infection Prevention and Control Program. Infection preventionist will play a central role and the key leaders accountable for the program include [Medical Director, Director of Nursing, Consultant Pharmacist, etc.]. This multidisciplinary team will regularly review appropriateness of antibiotic courses and make recommendations for adjustment in practice where necessary, establish new or revise existing protocols relevant to appropriate antibiotic prescribing, monitor and report patterns of antibiotic use and resistance; and provide education on responsible use of antibiotics.

The success of this initiative requires the full participation and support of those who prescribe, prepare, administer, and receive antimicrobial therapy. The facility will provide adequate staffing and resources to support the functions and goals of the ASP. ASP team will engage prescribing providers, staff, residents, and residents' families to ensure that antibiotic use protocols can be implemented smoothly. Facility leadership is confident that with the help of frontline staff, support of prescribing providers, understanding of resident and families, and guidance of ASP team, we will improve quality of care and minimize untoward consequences of antibiotic therapy.

Consequence of misuse

What is ASP & Goal of ASP

Program leaders

Specific ASP tasks

Who is responsible

https://asap.nebraskamed.com/facilities/long-term-care/educational-materials-for-long-term-care/

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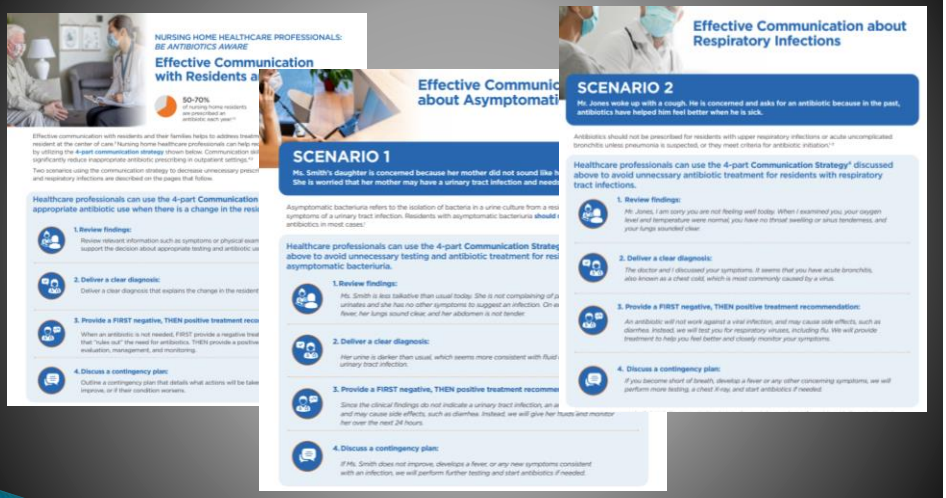
Prescriber Education



From: https://www.cdc.gov/antibiotic-use/pdfs/NursingHome-Toolkit-508.pdf. Accessed 9/1/24

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Resident/Family-Specific ASP Educations

From: https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html. Accessed 9/18/17.

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Resident/Family-Specific ASP Educations – Trifold Brochure

Why does taking antibiotics lead to antibiotic resistance?

Any time you take antibiotics, they can cause side effects and contribute to the development of antibiotic resistance. Antibiotic resistance is one of the most urgent threats to the public's health.

Always remember:

1. Antibiotic resistance does not mean the body is becoming resistant to antibiotics; it means bacteria are developing the ability to defeat the antibiotics designed to kill them.
2. When bacteria become resistant, antibiotics cannot fight them, and the bacteria multiply.
3. Some resistant bacteria can be harder to treat and can spread to other residents in the nursing home.

Up to 70% of residents in a nursing home receive one or more courses of antibiotics each year.

What if I have questions about antibiotics?

Talk to your healthcare professional if you have any questions about your antibiotics, such as:

- What infection does this antibiotic treat and do you know I have that infection?
- How long do I need to take this antibiotic?
- What are the potential side effects from this antibiotic?
- Could any of my other medications interact with this antibiotic?
- How will you know that the antibiotic is working for my infection?

Improving the way healthcare professionals prescribe antibiotics, and the way we take antibiotics, helps keep us healthy now, helps fight antibiotic resistance, and ensures that these life-saving drugs will be available for future generations.

40%–75% of antibiotics prescribed in nursing homes may be unnecessary or inappropriate.

To learn more about antibiotic prescribing and use, visit **www.cdc.gov/antibiotic-use** or call 1-800-CDC-INFO.

Do You Need Antibiotics?

Why is it important to *Be Antibiotics Aware* in nursing homes?

Antibiotics are life-saving drugs and are frequently prescribed in nursing homes. Remember, when antibiotics are needed, their benefits outweigh the risks of side effects and antibiotic resistance.

When antibiotics aren't needed, they won't help you, and the side effects could still cause harm.

What do antibiotics treat?

Antibiotics are only needed for treating certain infections caused by bacteria. Antibiotics are critical tools for treating life-threatening conditions such as pneumonia and sepsis, which is the body's extreme response to an infection.

What don't antibiotics treat?

Antibiotics do not work on viruses, such as those that cause colds, flu, bronchitis, or runny noses, even if the mucus is thick, yellow, or green. Antibiotics also won't help some common bacterial infections, including most cases of bronchitis, many sinus infections, and some ear infections.

What are the potential side effects of antibiotics?

Common side effects from antibiotics can include:

- Rash
- Nausea
- Yeast infections
- Dizziness
- Diarrhea

More serious side effects can include:

- Life-threatening allergic reactions
- Interactions between antibiotics and other medications
- Infections with antibiotic-resistant bacteria, including *C. difficile* (or *C. diff*)

What is a *C. diff* infection?

C. diff is a bacterial infection that needs immediate treatment. It can cause severe diarrhea that can lead to severe colon damage and death.

Antibiotics fight bacterial infections by killing bad germs, but can also get rid of the good germs that protect your body against harmful infections. The effect of antibiotics can last as long as several months. If you come in contact with *C. diff* germs during this time, you can get sick.

Symptoms of a *C. diff* infection include:

- Severe diarrhea
- Fever
- Loss of appetite
- Stomach tenderness or pain
- Nausea

More than 3 million Americans receive care or reside in nursing homes every year.

How can I stay healthy?

You can stay healthy and keep others healthy by:

- Insisting healthcare professionals and visitors clean their hands before touching you by washing with soap and water for 20 seconds or using a hand sanitizer that contains at least 60% alcohol
- Covering your cough to prevent the spread of germs
- Asking family or friends not to visit when they don't feel well
- Staying in your room when sick
- Protecting yourself by getting vaccines for flu and pneumonia and encouraging others around you to do the same

Talk to your healthcare professional about steps you can take to stay healthy and prevent infections.

From: https://www.cdc.gov/antibiotic-use/pdfs/AU-nursing-home-trifold-brochure-P.pdf. Accessed 9/1/24

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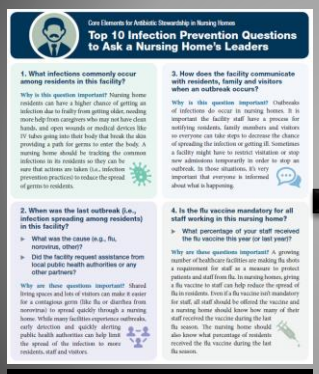
Adopting Publically Available Educational Materials to Facility Need



Core Elements for Antibiotic Stewardship in Nursing Homes

Top 10 Infection Prevention Questions to Ask a Nursing Home's Leaders

1. What infections commonly occur among residents in this facility?

Why is this question important? Nursing home residents can have a higher chance of getting an infection due to frailty from getting older, needing more help from caregivers who may not have clean hands, and open wounds or medical devices like IV tubes going into their body that break the skin providing a path for germs to enter the body. A nursing home should be tracking the common infections in its residents so they can be sure that actions are taken (i.e., infection prevention practices) to reduce the spread of germs to residents.

2. When was the last outbreak (i.e., infection spreading among residents) in this facility?

- What was the cause (e.g., flu, norovirus, other)?
- Did the facility request assistance from local public health authorities or any other partners?

Why are these questions important? Shared living spaces and lots of visitors can make it easier for a contagious germ (like flu or diarrhea from norovirus) to spread quickly through a nursing home. While many facilities experience outbreaks, early detection and quickly alerting public health authorities can help limit the spread of the infection to more residents, staff and visitors.

3. How does the facility communicate with residents, family and visitors when an outbreak occurs?

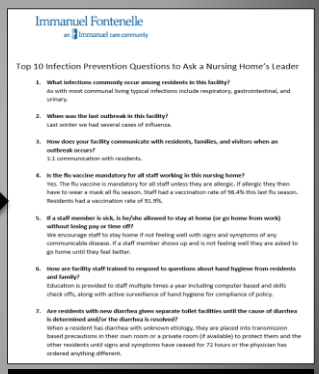
Why is this question important? Outbreaks of infections do occur in nursing homes. It is important the facility staff have a process for notifying residents, family members and visitors so everyone can take steps to decrease the chance of spreading the infection or getting ill. Sometimes a facility might have to restrict visitation or stop new admissions temporarily in order to stop an outbreak. In those situations, it's very important that everyone is informed about what is happening.

4. Is the flu vaccine mandatory for all staff working in this nursing home?

- What percentage of your staff received the flu vaccine this year (or last year)?

Why are these questions important? A growing number of healthcare facilities are making flu shots a requirement for staff as a measure to protect patients and staff from flu. In nursing homes, giving a flu vaccine to staff can help reduce the spread of flu in residents. Even if a flu vaccine isn't mandatory for staff, all staff should be offered the vaccine and a nursing home should know how many of their staff received the vaccine during the last flu season. The nursing home should also know what percentage of residents received the flu vaccine during the last flu season.

From: https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html. Accessed 9/19/17.



Immanuel Fontenelle

an Immanuel care community

Top 10 Infection Prevention Questions to Ask a Nursing Home's Leader

1. **What infections commonly occur among residents in this facility?**
   As with most communal living typical infections include respiratory, gastrointestinal, and urinary.
2. **When was the last outbreak in this facility?**
   Last winter we had several cases of influenza.
3. **How does your facility communicate with residents, families, and visitors when an outbreak occurs?**
   1:1 communication with residents.
4. **Is the flu vaccine mandatory for all staff working in this nursing home?**
   Yes. The flu vaccine is mandatory for all staff unless they are allergic. If allergic they then have to wear a mask all flu season. Staff had a vaccination rate of 98.4% this last flu season. Residents had a vaccination rate of 91.9%.
5. **If a staff member is sick, is he/she allowed to stay at home (or go home from work) without losing pay or time off?**
   We encourage staff to stay home if not feeling well with signs and symptoms of any communicable disease. If a staff member shows up and is not feeling well they are asked to go home until they feel better.
6. **How are facility staff trained to respond to questions about hand hygiene from residents and family?**
   Education is provided to staff multiple times a year including computer based and skills check offs, along with active surveillance of hand hygiene for compliance of policy.
7. **Are residents with new diarrhea given separate toilet facilities until the cause of diarrhea is determined and/or the diarrhea is resolved?**
   When a resident has diarrhea with unknown etiology, they are placed into transmission based precautions in their own room or a private room (if available) to protect them and the other residents until signs and symptoms have ceased for 72 hours or the physician has ordered anything different.

Courtesy of Chase Griffin, RN, Immanuel Fontenelle (now , Omaha, NE.

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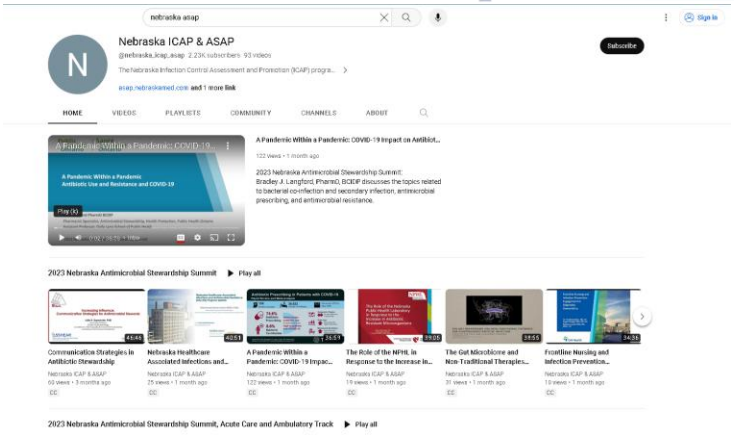
Antimicrobial Stewardship Education



https://www.youtube.com/@nebraska_icap_asap/featured

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Summary

- Tracking, reporting, and education are important core elements that have direct impact on antimicrobial use
- Tracking includes policy compliance, antibiotic use, antibiotic resistance, and infection rates
- Reporting should inform prescribers, staff, residents of ASP activities and outcomes
- Education should be target audience specific and include goals of ASP, appropriate antibiotic prescribing/use

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Free Online Resources

- Nebraska ASAP (asap.nebraskamed.com)
- CDC (cdc.gov/longtermcare/prevention/antibiotic-stewardship.html)
- AHRQ (ahrq.gov/nhguide/index.html)
- University of Rochester (rochesterpatientsafety.com/)

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