

# Antimicrobial Stewardship: Tracking, Reporting, Education



Alex Neukirch, PharmD  
Consultant Pharmacist  
Consonus Pharmacy



Nebraska  
Infection Control  
Network

1

## 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

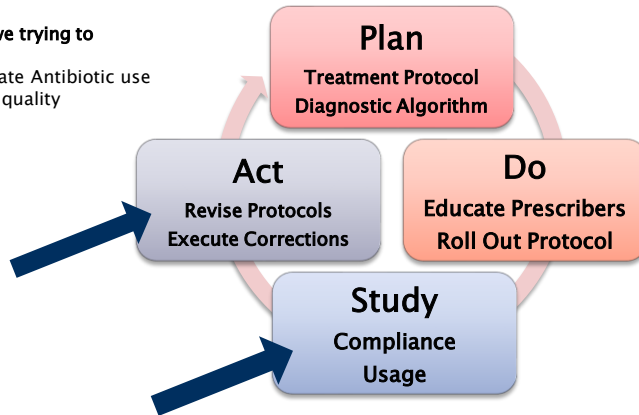
2

## The Performance Improvement Cycle

### Why we track Metrics

What are we trying to Improve?

- Appropriate Antibiotic use
- Resident quality of care

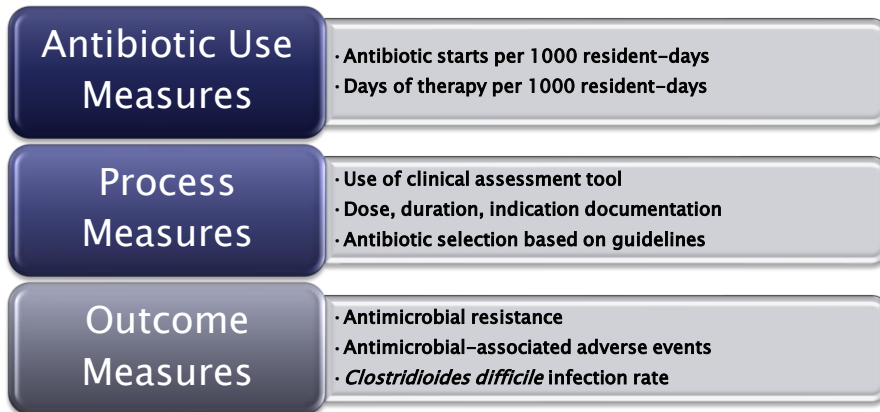


3

Tracking Core Element

4

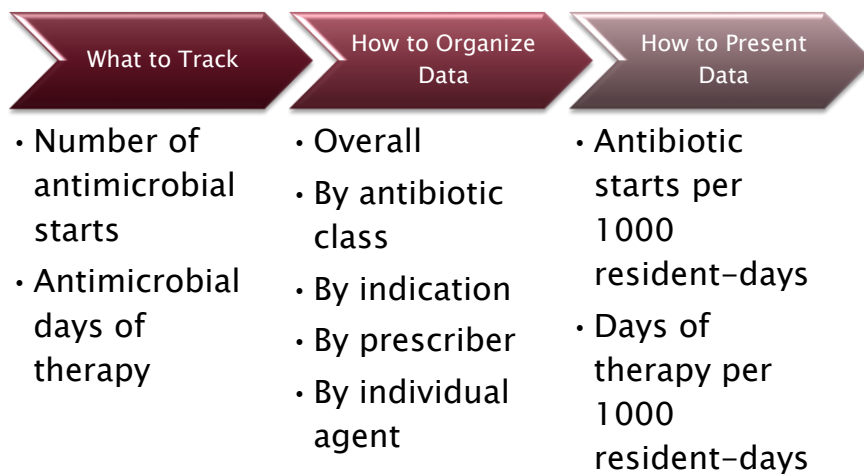
## What Should be Tracked?



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

5

## Tracking Antimicrobial Use



6

## Why Per 1000 Resident Days?

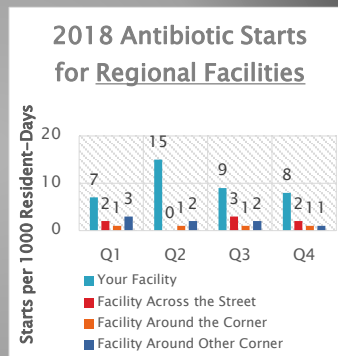
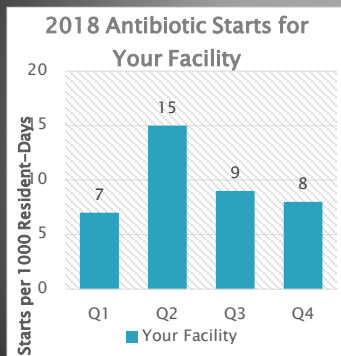
- ▶ Converts the number of starts, or days of therapy to a rate
- ▶ Allows comparison between facilities of differing size
- ▶ Recommend to do by month

### Example:

- ▶  $(\# \text{ of antibiotic starts in August} \div \# \text{ of resident days August}) \times 1000$
- ▶  $(\# \text{ of days of therapy in August} \div \# \text{ of resident days August}) \times 1000$

7

## Why Track Standardized Starts and Days of Therapy?



8

## 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**

Antimicrobial Use and Resistance (AUR) Module	1
Introduction	1
1. Antimicrobial Use (AU) Option	2
Introduction	2
Requirements	3
Data Analyses	8
References	16
Appendix A. Table of Instructions: Antimicrobial Use Option	17
<b>Appendix B. List of Antimicrobials</b>	<b>19</b>
Appendix C. Example Calculations of Antimicrobial Days	23
Appendix D. List of SAARs	26
Appendix E. Antimicrobial Groupings for SAAR & Rate Table Calculations	29
2. Antimicrobial Resistance (AR) Option	36
Introduction	36
Requirements	37
Data Analyses	45
References	54
Appendix F. List of Eligible Organisms for the NHSN AR Option	55
Appendix G. Technical and Isolate Based Report Variables	62
Appendix H. Denominator Data Variables	66
Appendix I. NHSN AR Option Phenotype Definitions	69
Appendix J. List of Skills and Goals	73

**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 data to be imported into NHSN. The format provided for data submission follows:

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

9

## Examples of Antimicrobials for Tracking

Antimicrobial Agent	Antimicrobial Category	Antimicrobial Class <sup>a</sup>	Antimicrobial Subclass <sup>a</sup>
AMANTADINE	Anti-influenza	M2 ion channel inhibitors	
AMIKACIN	Antibacterial	Aminoglycosides	
AMIKACIN LIPOSOMAL <sup>b</sup>	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 <sup>a</sup>	Antimicrobial Subclass <sup>a</sup>
CEFTODIOXIME	Antibacterial	Cephalosporins	Cephalosporin 3 <sup>rd</sup> generation
CEFTROZIL	Antibacterial	Cephalosporins	Cephalosporin 2 <sup>nd</sup> generation
CEFTAROLINE	Antibacterial	Cephalosporins	Cephalosporins with anti-MRSA activity
CEFTAZIDIME	Antibacterial	Cephalosporins	Cephalosporin 3 <sup>rd</sup> generation
CEFTAZIDIME/AVIBACTAM	Antibacterial	β-lactam/β-lactamase inhibitor combination	
CEFTOLOZANE/TAZOBACTAM	Antibacterial	β-lactam/β-lactamase inhibitor combination	
CEFTRIAXONE	Antibacterial	Cephalosporins	Cephalosporin 3 <sup>rd</sup> generation
CEFUROXIME	Antibacterial	Cephalosporins	Cephalosporin 2 <sup>nd</sup> generation
CEPHALEXIN	Antibacterial	Cephalosporins	Cephalosporin 1 <sup>st</sup> generation
CHLORAMPHENICOL	Antibacterial	Phenolics	
CIPROFLOXACIN	Antibacterial	Fluoroquinolones	
CLARITHROMYCIN	Antibacterial	Macrolides	
CLINDAMYCIN	Antibacterial	Lincosamides	
COLISTIMETHATE	Antibacterial	Polymyxins	
COLISTIN <sup>®</sup>	Antibacterial	Polymyxins	
DALBAVANCIN	Antibacterial	Glycopeptides	Lipoglycopeptides

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

10

## 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

11

## 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/>

12

# Determining Antibiotic Starts

## Pharmacy Dispense Report Example

### May Antibiotic Report

Product Name	Label Name	Dose Supply	Quantity Dispensed	Date of Service	The Clinician
SULFAMETHOXAZOLE-TRIMETHOPRIM	SULFAMETHOXAZOLE-TRIMETHOPRIM TABLET	5 15	15	10/1/2016	SULFAMETHOXAZOLE (SYSTEMIC)
CERHALEXIN	CERHALEXIN 500 MG CAPSULE	10 29	29	11/9/2016	CERHALEXIN (SYSTEMIC)
CERHALEXIN	CERHALEXIN 500 MG CAPSULE	10 29	29	11/9/2016	CERHALEXIN (SYSTEMIC)
CERHALEXIN	CERHALEXIN 250 MG CAPSULE	1 2	2	11/9/2016	CERHALEXIN (SYSTEMIC)
CERHALEXIN	CERHALEXIN 250 MG CAPSULE	1 2	2	11/9/2016	CERHALEXIN (SYSTEMIC)
CEFUROXIME	CEFUROXIME AXETIL 500 MG TAB	7 7	7	12/2/2016	CEFUROXIME (SYSTEMIC)
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	4 4	4	12/2/2016	CEFUROXIME (SYSTEMIC)
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1 1	1	12/16/2016	CEFUROXIME (SYSTEMIC)
CEFDIOXIME PROXETIL	CEFDIOXIME 200 MG TABLET	7 14	14	12/27/2016	CEFDIOXIME (SYSTEMIC)
CEFDIOXIME	CEFDIOXIME 200 MG TABLET	1 1	1	1/1/2017	CEFDIOXIME (SYSTEMIC)

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

13

# Other Things to Consider

### May Antibiotic Dispense Report

Product Name	Label Name	Dose Supply	Quantity Dispensed	Date of Service	The Clinician
SULFAMETHOXAZOLE-TRIMETHOPRIM	SULFAMETHOXAZOLE-TRIMETHOPRIM TABLET	5 15	15	10/1/2016	SULFAMETHOXAZOLE (SYSTEMIC)
CERHALEXIN	CERHALEXIN 500 MG CAPSULE	10 29	29	11/9/2016	CERHALEXIN (SYSTEMIC)
CERHALEXIN	CERHALEXIN 500 MG CAPSULE	10 29	29	11/9/2016	CERHALEXIN (SYSTEMIC)
CERHALEXIN	CERHALEXIN 250 MG CAPSULE	1 2	2	11/9/2016	CERHALEXIN (SYSTEMIC)
CERHALEXIN	CERHALEXIN 250 MG CAPSULE	1 2	2	11/9/2016	CERHALEXIN (SYSTEMIC)
CEFUROXIME	CEFUROXIME AXETIL 500 MG TAB	7 7	7	12/2/2016	CEFUROXIME (SYSTEMIC)
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	4 4	4	12/2/2016	CEFUROXIME (SYSTEMIC)
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1 1	1	12/16/2016	CEFUROXIME (SYSTEMIC)
CEFDIOXIME PROXETIL	CEFDIOXIME 200 MG TABLET	7 14	14	12/27/2016	CEFDIOXIME (SYSTEMIC)
CEFDIOXIME	CEFDIOXIME 200 MG TABLET	1 1	1	1/1/2017	CEFDIOXIME (SYSTEMIC)

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

14

## Determining Antibiotic Days of Therapy

### June Antibiotic Report

Product Name	Label Name	Days Supply	Quantity Dispensed	Date of Service	The Class/Name
AMOXICILLIN-CLAVULANATE POTASS	AMOXICIL-CLAV 400-57 MG/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	18	20	8/3/2016	TETRACYCLINES
CERHALEXIN	CERHALEXIN 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
NITROFURANTION	NITROFURANTION MCR 100 MG CAP	1	1	8/3/2016	URINARY ANTI-INFECTIVES
NITROFURANTION MONO-MACRO	NITROFURANTION MONO-MCR 100 MG	14	14	8/3/2016	URINARY ANTI-INFECTIVES
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1	1	8/3/2016	CEPHALOSPORINS

June 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

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

Cephalosporins = ??

15

## Other Things to Consider

### June Antibiotic Report

Product Name	Label Name	Days Supply	Quantity Dispensed	Date of Service	The Class/Name
AMOXICILLIN-CLAVULANATE POTASS	AMOXICIL-CLAV 400-57 MG/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	18	20	8/3/2016	TETRACYCLINES
CERHALEXIN	CERHALEXIN 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
NITROFURANTION	NITROFURANTION MCR 100 MG CAP	1	1	8/3/2016	URINARY ANTI-INFECTIVES
NITROFURANTION MONO-MACRO	NITROFURANTION MONO-MCR 100 MG	14	14	8/3/2016	URINARY ANTI-INFECTIVES
CEFUROXIME	CEFUROXIME AXETIL 250 MG TAB	1	1	8/3/2016	CEPHALOSPORINS

June 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)?

16





## 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?



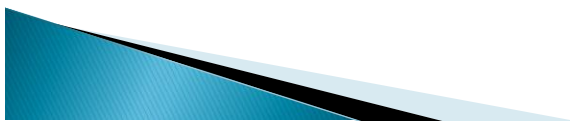
19

## Self-Assessment Question #2

---

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

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?



20

## 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

21

## Tracking Process Measures – *Compliance with Clinical Assessment*

<b><u>What to Track</u></b>	<b><u>How to Organize Data</u></b>	<b><u>How to Present Data</u></b>
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)	

22



## 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
  - Pharmacy
  - Antibiotic start/infection log
  - Indication **MUST** be documented for successful tracking



25

## 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 1<sup>st</sup> 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



26

## Tracking Outcome Measures -- Antibigram

Pathogens	Number of Isolates Tested	Percent Susceptible																			
		Ampicillin	Ampicillin/Sulbactam	Piperacillin/Tazobactam	Clindamycin	Cefazolin	Cefuroxime	Ceftriaxone	Cefepime	Ceftazidime	Aztreonam	Ertapenem	Meropenem	Azlocillin	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	Trimethoprim/Sulfamethoxazole	Micafungin <sup>1</sup>	Tetracycline
<i>Escherichia coli</i>	41	61	66	98	76	76	93	93	93	93	80	93	100	100	98	93	90	49	51	68	93
<i>Staphylococcus pneumoniae</i>	20 <sup>2</sup>	R <sup>3</sup>	80	95	90	100	100	100	95	100	95	100	100	100	100	100	95	95	90	70	85
<i>Proteus mirabilis</i>	16 <sup>2</sup>	81	94	100	100	100	100	100	100	100	100	100	100	100	100	100	19	38	56	R <sup>3</sup>	R <sup>3</sup>
<i>Enterococcus faecalis</i> <sup>4</sup>	11 <sup>1</sup>	100	--	--	--	R <sup>3</sup>	--	R <sup>3</sup>	--	--	--	--	--	--	--	27	45	R <sup>3</sup>	100	9	100

- What antibiotic should be selected if suspecting 1<sup>st</sup> 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?

27

## Tracking Outcome Measures – Infection Rates of Specific Organisms

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

28

# 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<sup>1</sup>
  - 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.

29

## Example of Tool for Evaluating ADR

[Facility Logo] Resident Label

**Adverse Drug Reaction Worksheet**

Evaluation Date: \_\_\_\_\_ Evaluating By: \_\_\_\_\_ Date of Adverse Reaction: \_\_\_\_\_

Suspect Medication: \_\_\_\_\_ Caring Resident: \_\_\_\_\_ 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** (Just the Naranjo Probability Scale below)

☐ Definite (5-9) ☐ Probable (3-4) ☐ Possible (1-2) ☐ 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

☐ Hospitalization ☐ Permanent damage ☐ Delayed discharge

☐ Other (specify) \_\_\_\_\_

Resident: \_\_\_\_\_ 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 Definite, Probable, Possible, or Doubtful related to the drug in question. (Interpretation of the probability classification can be found in Table 2 on the next page)

Question	Yes	No	No Answer	Score
1. Are there previous CONCOMITANT events 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 suspected 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 present in blood or other fluids in concentrations known to be toxic?	+1	0	0	
8. Was the reaction more severe than that of a placebo?	+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	
<b>Total Score</b>				

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

30

Table 1. List of Common Adverse Antimicrobial Reactions\*

Drug Class	Class Member	Common Adverse Reaction
Penicillin +/- Beta-Lactamase Inhibitors	Ampicillin, Amoxicillin-Sulbactam, Amoxicillin, Amoxicillin-Clavulanate, Cloxacillin, Dicloxacillin, Nafcillin, Oxacillin, Penicillin, Piperacillin-Tazobactam	Nausea, vomiting, diarrhea, <i>C. difficile</i> 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, Cefepime, Cefixime, Cefotaxime, Cefotetan, Cefprozil, Ceftriaxone, Cefuroxime, Cefuroxime-Auxibactam, Cefixime, Cefixime-Taxidol, Cefixime, Cefixime, Cephradon, Cephradon	Nausea, vomiting, diarrhea, <i>C. difficile</i> infection, allergic reactions (including rash, serum sickness), altered mental status
Carbapenems	Meropenem, Ertapenem, Imipenem-Cilastatin, Meropenem	Nausea, vomiting, diarrhea, <i>C. difficile</i> infection, seizure
Fluoroquinolones	Ciprofloxacin, Levofloxacin, Moxifloxacin	Disorientation, delirium, agitation, seizure, hypo- or hyperglycemia, peripheral neuropathy, tendon rupture, QT prolongation, nausea, vomiting, <i>C. difficile</i> infection, increased liver function tests, aortic dissection
Macrolides	Erythromycin, Clarithromycin	Nausea, vomiting, elevation in liver function tests, reversible tasteless or tasteless, taste alteration, phlebitis with IV therapy
Tetracyclines	Tetracycline, 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, worsened renal function, bone marrow suppression, hemolytic anemia, hyaline crystals (especially with sulfonamides)
Glycopeptides	Teicoplanin, Vancomycin IV	Redman syndrome (flushing, itching, hypotension), worsened renal function
Others	Clinidamycin, Metronidazole, Nitrofurantoin	All: Nausea, vomiting, Clinidamycin: diarrhea, <i>C. difficile</i> 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	8-9	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	5-7	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.

## 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



31



Reporting Core Element

32



## 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

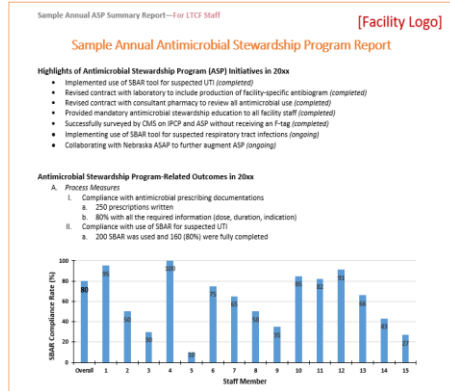
33

## Reporting Antimicrobial Stewardship Activities and Outcomes

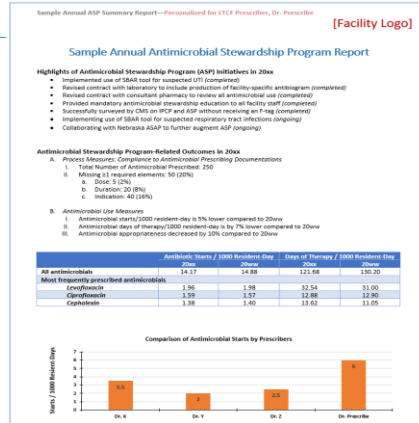
- ▶ Who to report to
  - Prescribers
  - Nursing staff
  - Selectively to residents/families
- ▶ What to report
  - Antibiotic use data (starts, DOT)
  - Rates of specific infections
  - Compliance to policy (met criteria before starting antibiotics)
  - \$\$ spent on antibiotics
- ▶ How to report
  - 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

34

# Examples of Annual ASP Report



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



35

## Education Core Element

36

# Antimicrobial Stewardship Education

Who to Educate	What to Educate	When to Educate	How to Educate
<ul style="list-style-type: none"> <li>Prescribers</li> <li>Nurses</li> <li>Residents</li> <li>Families</li> </ul>	<ul style="list-style-type: none"> <li>Appropriate use</li> <li>Consequences of misuse</li> <li>What is ASP</li> <li>Program goals</li> <li>Interventions</li> <li>Program leaders</li> </ul>	<ul style="list-style-type: none"> <li>Can vary</li> <li><u>Annually</u>: antibiogram, general ASP education</li> <li><u>Quarterly</u>: Resistance / <i>C diff</i> rates, DOT, antibiotic starts</li> <li><u>As needed</u>: New residents, employees, interventions</li> </ul>	<ul style="list-style-type: none"> <li>Pamphlets / Flyers</li> <li>Pocket guides</li> <li>Newsletters</li> <li>Face-to-face interactive lectures</li> <li>Web-based education</li> </ul>

37

## 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 continual 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: **Infectious Disease Director, Director of Nursing, and Pharmacy Director.** The 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/>

38

# Prescriber Education

**Nursing Home Healthcare Professionals: Be Antibiotics Aware**  
Effective Communication with Residents and Families

50-70% of nursing home residents are prescribed an antibiotic each year.

Effective communication with residents and their families helps to address inappropriate antibiotic use. At the center of this, nursing home healthcare professionals can help by offering the 4-part communication strategy shown below. Communication can significantly reduce inappropriate antibiotic prescribing in nursing homes.<sup>1</sup> Two scenarios using the communication strategy to decrease unnecessary prescription of antibiotics are described on the pages that follow.

**Healthcare professionals can use the 4-part Communication Strategy appropriate antibiotic use when there is a change in the resident's condition.**

- 1. Review findings:**  
Review relevant information such as symptoms or physical exam to support the decision about appropriate testing and antibiotic use.
- 2. Deliver a clear diagnosis:**  
Deliver a clear diagnosis that explains the change in the resident's condition.
- 3. Provide a FIRST negative, THEN positive treatment recommendation:**  
When an antibiotic is not needed, FIRST provide a negative trial that "rules out" the need for antibiotics. THEN provide a positive evaluation, management, and monitoring.
- 4. Discuss a contingency plan:**  
Outline a contingency plan that states what actions will be taken to improve, or if their condition worsens.

**SCENARIO 1**  
Ms. Smith's daughter is concerned because her mother did not sound like her. She is worried that her mother may have a urinary tract infection and needs antibiotics in most cases.

Asymptomatic bacteriuria refers to the isolation of bacteria in a urine culture from a resident with no symptoms of a urinary tract infection. Residents with asymptomatic bacteriuria should not receive antibiotics in most cases.

**Healthcare professionals can use the 4-part Communication Strategy above to avoid unnecessary testing and antibiotic treatment for residents with asymptomatic bacteriuria.**

- 1. Review findings:**  
Ms. Smith is less talkative than usual today. She is not complaining of pain or burning when she urinates and she has no other symptoms to suggest an infection. On a recent urine culture, her urine was found to have bacteria, but her abdomen is not tender.
- 2. Deliver a clear diagnosis:**  
Her urine is cleaner than usual, which seems more consistent with fluid. Urinary tract infection.
- 3. Provide a FIRST negative, THEN positive treatment recommendation:**  
Since the clinical findings do not indicate a urinary tract infection, we will not perform a urine culture. Instead, we will give her fluids and monitor her over the next 24 hours.
- 4. Discuss a contingency plan:**  
If Ms. Smith does not improve, develops a fever, or any new symptoms consistent with an infection, we will perform further testing and start antibiotics if needed.

**SCENARIO 2**  
Mr. Jones woke up with a cough. He is concerned and asks for an antibiotic because in the past, antibiotics have helped him feel better when he is sick.

Antibiotics should not be prescribed for residents with upper respiratory infections or acute uncomplicated bronchitis unless pneumonia is suspected, or they meet criteria for antibiotic initiation.<sup>2</sup>

Healthcare professionals can use the 4-part Communication Strategy<sup>3</sup> discussed above to avoid unnecessary antibiotic treatment for residents with respiratory tract infections.

- 1. Review findings:**  
Mr. Jones, I am sorry you are not feeling well today. When I examined you, your oxygen level and temperature were normal, you have no throat swelling or viral tenderness, and your lungs sounded clear.
- 2. Deliver a clear diagnosis:**  
The doctor and I discussed your symptoms. It seems that you have acute bronchitis, also known as a chest cold, which is most commonly caused by a virus.
- 3. Provide a FIRST negative, THEN positive treatment recommendation:**  
An antibiotic will not work against a viral infection, and may cause side effects, such as diarrhea. Instead, we will treat you for respiratory viruses, including flu. We will provide treatment to help you feel better and closely monitor your symptoms.
- 4. Discuss a contingency plan:**  
If you become short of breath, develop a fever or any other concerning symptoms, we will perform more testing, a chest X-ray, and start antibiotics if needed.

From: <https://www.cdc.gov/antibiotic-use/pdf/antibiotic-use-toolkit-508.pdf>. Accessed 9/1/24

39

## Resident/Family-Specific ASP Educations

**Core Elements for Antibiotic Stewardship in Nursing Homes**  
What You Need to Know About Antibiotics in a Nursing Home

**What are antibiotics?**  
Antibiotics are drugs used to treat infections caused by bacteria. They do not work for illnesses caused by viruses, like flu and most cases of bronchitis.

**When are antibiotics necessary?**  
There are times when antibiotics are appropriate.

**What is antibiotic stewardship?**  
Antibiotic stewardship refers to a set of commitments and actions designed to make sure patients receive the right drug, of the right antibiotic, for the right amount of time, and only when truly necessary. Improving antibiotic use will ensure these life-saving medications are effective and available when we need them.

**Are antibiotics needed - stop, proceed with caution, or go?**

These information is provided to you by Nebraska Antimicrobial Stewardship Assessment and Promotion Program (NASAP) and Nebraska Infection Control Assessment and Promotion Program (NICAP).

Decisions about antibiotic treatment should be made during conversations with your healthcare provider. There may be times when it is best to not use antibiotics.

**Antibiotics...**  
When should you take these infection fighting drugs?

Learn to protect yourself and your community

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

40

# 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](https://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
- Diarrhea
- Yeast infections

### 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
- Stomach tenderness or pain
- Loss of appetite
- 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

41

# Adopting Publically Available Educational Materials to Facility Need

**Care Objects 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 facility from getting sick, needing more help than 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 taking the common infections in its residents so they can be sure that actions are taken to reduce 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, etc.)?  
Did the facility request assistance from local public health authorities or any other partners?  
Why are these questions important? Should have open windows or rooms can make it easier for a contagious germ (like flu or norovirus) to spread quickly through a nursing home, while more facilities experience outbreaks, with detection and quickly starting 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 to minimize the risk to spread the disease of spreading the infection or getting it. Sometimes a facility might have to restrict visitors or stop new admissions temporarily in order to stop an outbreak. In these situations, it is 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 it 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 to 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

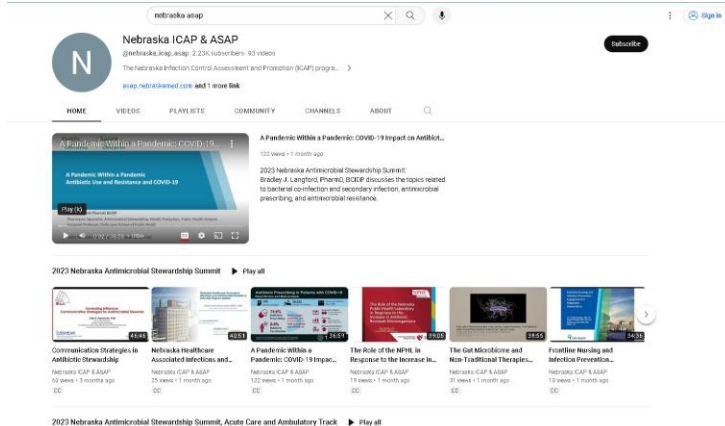
**Top 10 Infection Prevention Questions to Ask a Nursing Home's Leader**

- 1. What infections commonly occur among residents in this facility?**  
As with most common long-term 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?**  
I communicate 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 the season. Staff had a vaccination rate of 95.4% 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 being on 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 verbal reinforcement of hand hygiene for compliance of policy.
- 7. Are residents with oral diarrhea given separate toilet facilities until the cause of diarrhea is determined and/or the diarrhea is resolved?**  
When a resident has diarrhea with oral diarrhea, 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.

42

## Antimicrobial Stewardship Education



[https://www.youtube.com/@nebraska\\_icap\\_asap/featured](https://www.youtube.com/@nebraska_icap_asap/featured)

43

## 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

44



## Free Online Resources

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