Who is the Antimicrobial Steward?

J. Njeri Wainaina, MD FACP
Assistant Professor of Medicine
Division of Infectious Diseases and
Section of Perioperative Medicine

MCW
LEARN. LIVE. CARE. CURE.

Disclosures

- None

MCW
LEARN. LIVE. CARE. CURE.

Objectives

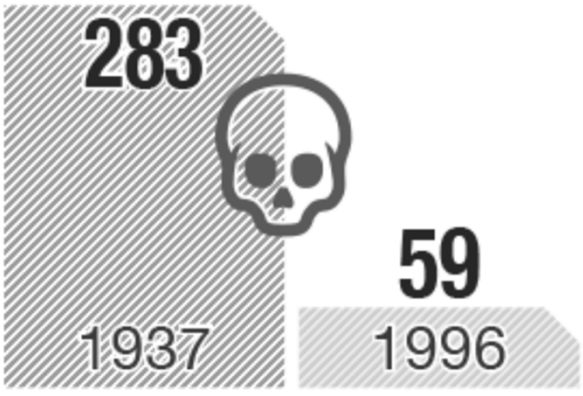
- Highlight the role of antimicrobial stewardship in clinical practice
- Facilitate recognition of daily opportunities for improved antibiotic prescription
- Identify practical and effective antimicrobial strategies that can be used everyday

MCW
LEARN. LIVE. CARE. CURE.

Antibiotics are powerful

REDUCED INFECTIOUS DISEASE MORTALITY RATE

Per 100,000 Population



MCW
LEARN. LIVE. CARE. CURE.

Antimicrobials are the cornerstone of modern medicine

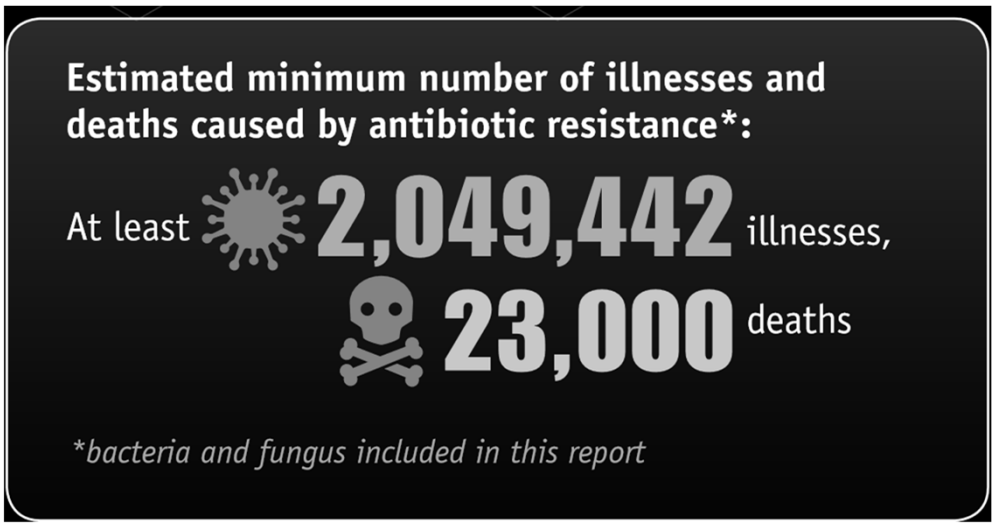
PREMATURE INFANT CARE

COMPLICATED SURGERIES

CRITICAL CARE

ORGAN TRANSPLANTS

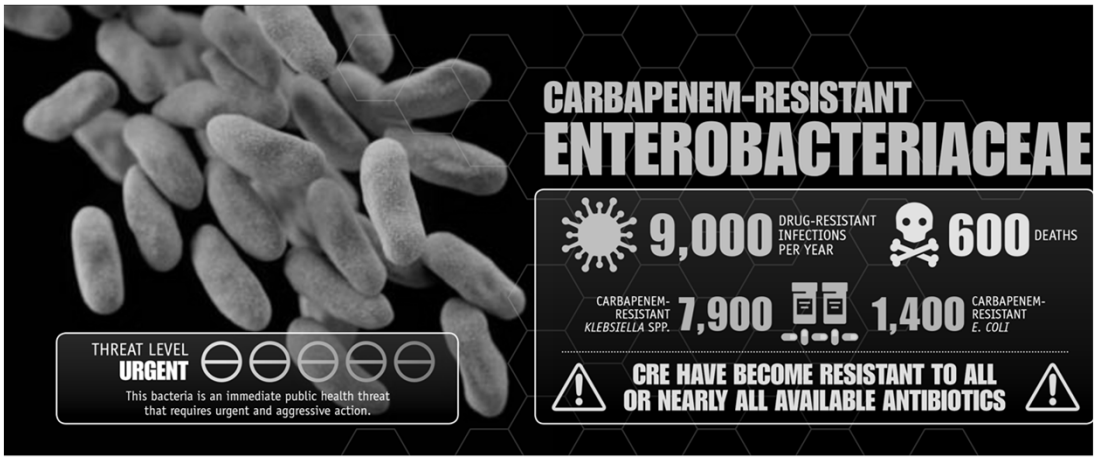
MCW
LEARN. LIVE. CARE. CURE.



MCW
LEARN. LIVE. CARE. CURE.

Centers for Disease Control and Prevention. *Antibiotic resistance threats in the United States, 2013.* Accessed Nov 30th, 2014.

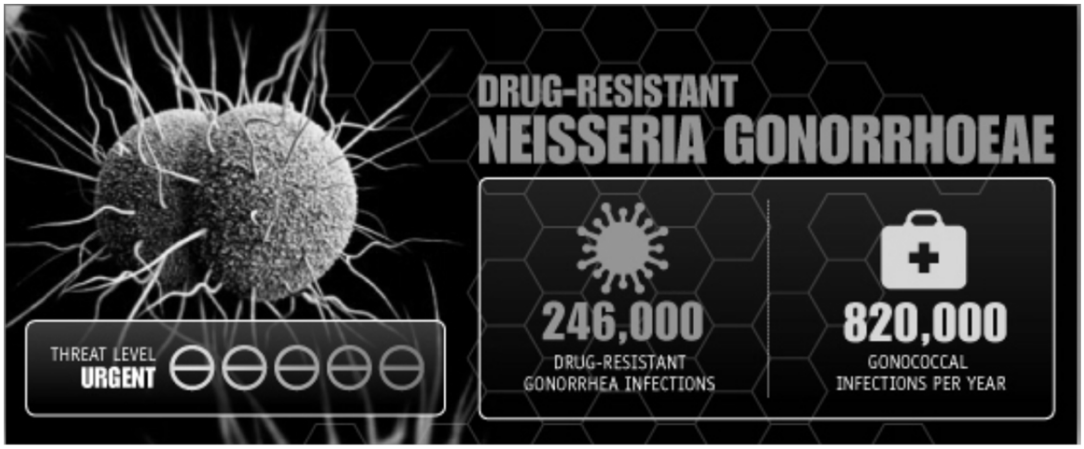
Antibiotic resistance threats in the US: Level - Urgent



MCW
LEARN. LIVE. CARE. CURE.

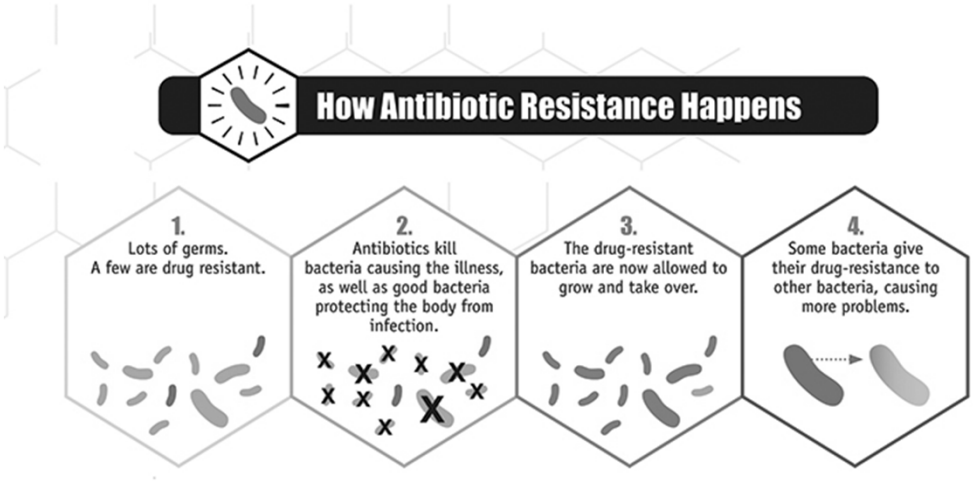
CDC: Antibiotic Resistance Threats, 2013. Accessed Sept 7, 2015

In case you thought, they lived only in the hospital……..



MCW
LEARN. LIVE. CARE. CURE.

CDC: Antibiotic Resistance Threats, 2013. Accessed Sept 7, 2015



MCW
LEARN. LIVE. CARE. CURE.

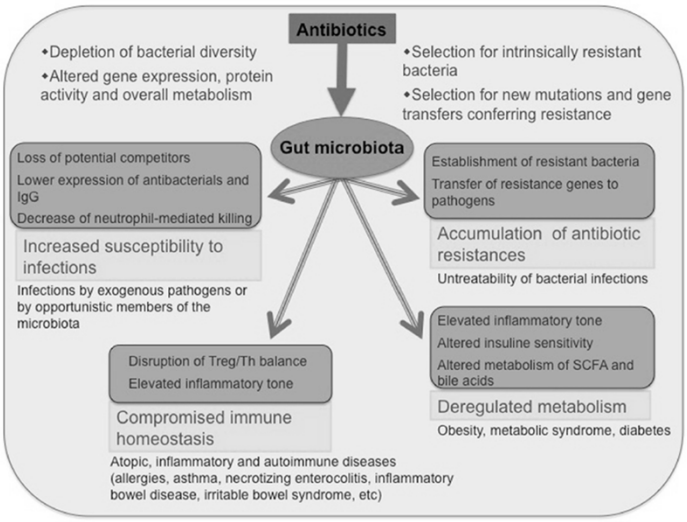
Centers for Disease Control and Prevention. *Antibiotic resistance threats in the United States, 2013.* Accessed Nov 30th, 2014 ,

Antibiotic-resistant infections

- Lead to increased morbidity and mortality
- Require the use of alternative antibiotics
  - Broader
  - Can be more toxic
  - Expensive
- Cost more to treat

MCW
LEARN. LIVE. CARE. CURE.

Microbiome Implications of Antimicrobial Resistance



MCW
LEARN. LIVE. CARE. CURE.

Francino, ML. Antibiotics and the Human Gut Microbiome: Dysbiosis and Accumulation of Resistances. Frontiers in Microbiology, Jan 2015

Burden of *Clostridium Difficile* infection in the US, 2011

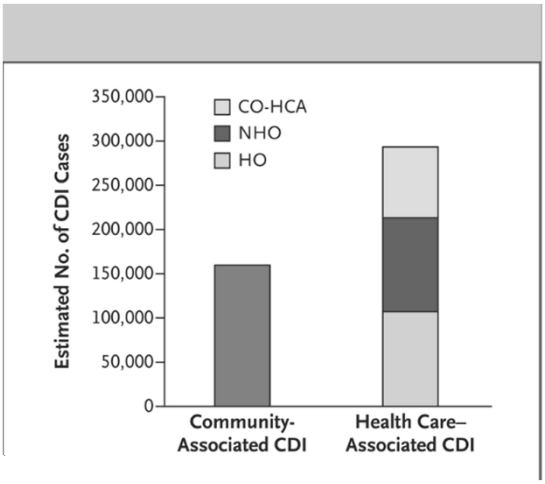


Figure 1. Estimated U.S. Burden of *Clostridium difficile* Infection (CDI), According to the Location of Stool Collection and Inpatient Health Care Exposure, 2011.

Of the estimated cases of community-associated CDI, 82% were estimated to be associated with outpatient health care exposure.[11] CO-HCA denotes community-onset health care–associated infection, HO hospital onset, and NHO nursing home onset.

The NEW ENGLAND JOURNAL of MEDICINE

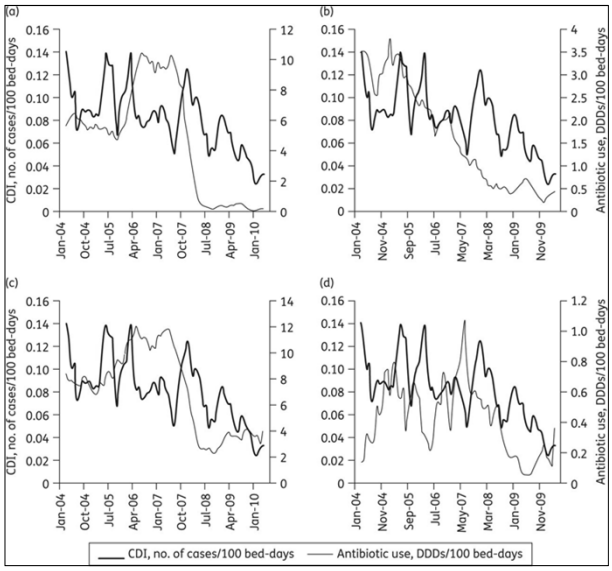
MCW
LEARN. LIVE. CARE. CURE.

Lessa, FC, et al. NEJM 2015

Antibiotic use is the most modifiable risk factor for C difficile infection

2nd-generation cephalosporins

3rd-generation cephalosporins



Quinolones

Clindamycin

MCW
LEARN. LIVE. CARE. CURE.

Journal of Antimicrobial Chemotherapy

Aldeyab M A et al. J. Antimicrob. Chemother. 2012;67:2988-2996

So:

- Antibiotics are key to effective healthcare, but this is threatened by increasing resistance.
- Antibiotics are not benign and should be used with caution to minimize potential harms.

MCW
LEARN. LIVE. CARE. CURE.

The most modifiable risk factor for antibiotic resistance is antibiotic prescribing

- About 50% of antibiotics prescribed in the inpatient setting are inappropriate
- About 30% of outpatient antibiotic prescriptions in the US are unnecessary

MCW
LEARN. LIVE. CARE. CURE.

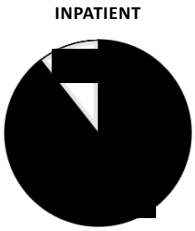
Some stats….

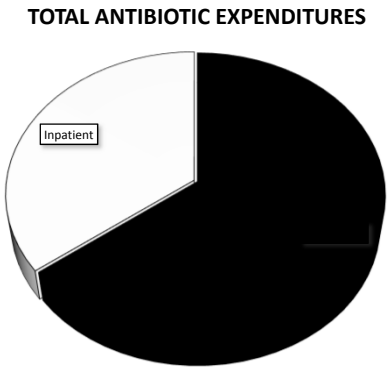
- The majority of antibiotic use occurs in the outpatient setting
  - >60% of antibiotic expenditure
  - 80-90% of antibiotic volume

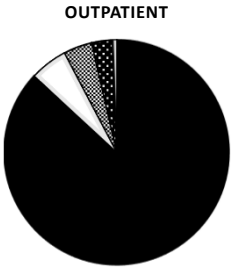
MCW
LEARN. LIVE. CARE. CURE.

Suda KJ, et al. J Antimicrob Chemother 2013
Public Health England. ESPAUR report 2014
Public Health Agency of Sweden. Consumption of antibiotics and occurrence of antibiotic resistance in Sweden [Internet] 2015

A national evaluation of antibiotic expenditures by healthcare setting in the United States, 2009



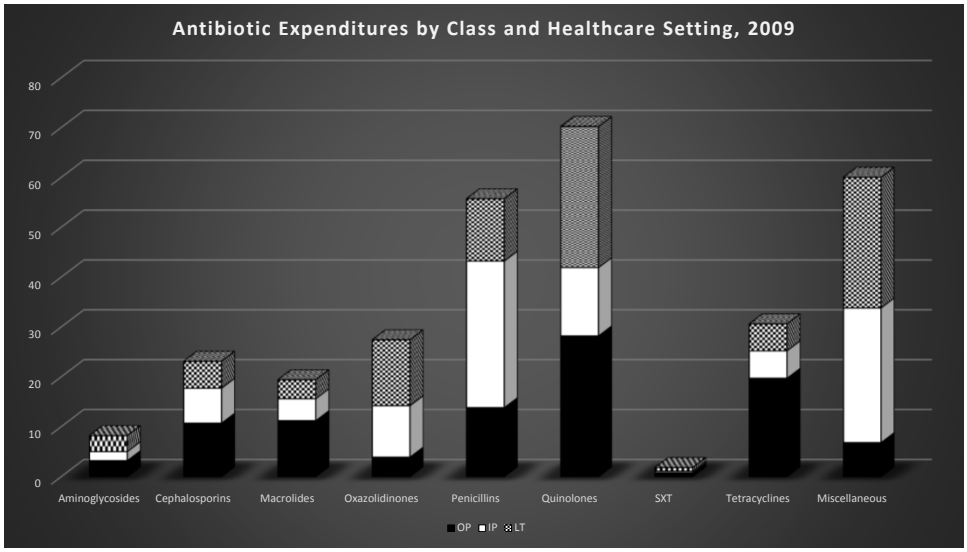




MCW
LEARN. LIVE. CARE. CURE.

Suda KJ, et al. J Antimicrob Chemother 2013;68:715–8

Journal of Antimicrobial Chemotherapy



Suda KJ, et al. J Antimicrob Chemother 2013;68:715–8.

Antibiotic prescribing for adults in ambulatory care in the USA, 2007–09

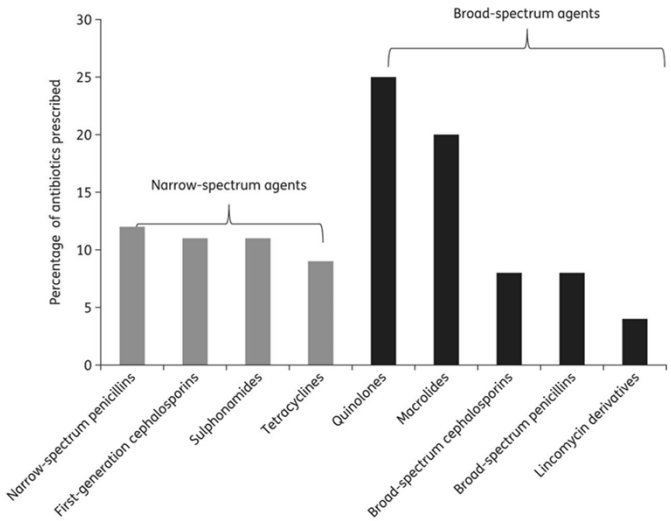
- Objective: To determine patterns of ambulatory antibiotic prescribing in US adults, including spectrum and indication.
- Method: Used data from the National Ambulatory and National Hospital Ambulatory medical care surveys of 2007 to 2009

MCW
LEARN. LIVE. CARE. CURE.

Journal of Antimicrobial Chemotherapy

Daniel J. Shapiro et al. J. Antimicrob. Chemother. 2014;69:234-240

Percentage of antibiotics prescribed according to antibiotic classes for adult ambulatory visits, 2007–09.



MCW
LEARN. LIVE. CARE. CURE.

Journal of Antimicrobial Chemotherapy

Daniel J. Shapiro et al. J. Antimicrob. Chemother. 2014;69:234-240

Antibiotic prescribing for adults in ambulatory care in the USA, 2007–09

	N (millions)	Antibiotics prescribed (%)	Broad spectrum antibiotics prescribed (%)
Respiratory	40	38	74
ARTI, antibiotics potentially indicated	13	65	65
ARTI, antibiotics rarely indicated	13	51	80
Other respiratory, antibiotics rarely indicated	14	23	76
UTIs	8	60	69

MCW
LEARN. LIVE. CARE. CURE.

Journal of Antimicrobial Chemotherapy

Daniel J. Shapiro et al. J. Antimicrob. Chemother. 2014;69:234-240

Inappropriate Antibiotic Prescriptions Among US Ambulatory Care Visits, 2010 - 2011

- 506 prescriptions/1000 population
- 221 antibiotic prescriptions/1000 population for acute respiratory conditions
- 69% were appropriate

MCW
LEARN. LIVE. CARE. CURE.

JAMA The Journal of the American Medical Association

Fleming-Dutra KE, Hersh AL, Shapiro DJ, et al. Prevalence of Inappropriate Antibiotic Prescriptions Among US Ambulatory Care Visits, 2010-2011. *JAMA.* May 2016

Table 1. Sampled Visits and Ambulatory Care Visits With Antibiotics Prescribed by Age Group and Diagnosis From the US NAMCS/NHAMCS, 2010-2011

Diagnosis[a]	Age Group, y: 0-19 — Unweighted No. Sampled Visits	0-19 — Weighted Visits With Antibiotics Prescribed, % (95% CI)	20-64 — Unweighted No. Sampled Visits	20-64 — Weighted Visits With Antibiotics Prescribed, % (95% CI)	≥65 — Unweighted No. Sampled Visits	≥65 — Weighted Visits With Antibiotics Prescribed, % (95% CI)	All Ages — Unweighted No. Sampled Visits	All Ages — Weighted Visits With Antibiotics Prescribed, % (95% CI)
Sinusitis	549	84.7 (79.1-89.0)	1492	70.9 (66.4-75.0)	256	53.8 (44.4-62.9)	2297	72.2 (68.2-75.9)
Suppurative otitis media	2083	82.0 (78.2-85.3)	415	69.0 (59.1-77.4)	50	[b]	2548	79.5 (76.0-82.7)
Pharyngitis	1580	56.2 (49.8-62.4)	1107	72.4 (66.8-77.4)	65	[b]	2752	62.2 (57.2-67.0)
Skin, cutaneous, and mucosal infections	1053	48.7 (42.8-54.7)	2591	53.5 (50.0-57.0)	536	39.8 (31.6-48.5)	4180	50.0 (46.9-53.1)
Other skin, cutaneous, and mucosal conditions	4631	11.3 (9.4-13.4)	8828	11.0 (9.1-13.2)	4654	6.5 (4.4-9.5)	18 113	9.6 (8.0-11.5)
Urinary tract infections	554	73.2 (63.9-80.9)	1821	75.0 (69.4-80.0)	627	65.2 (56.8-72.8)	3002	72.2 (67.7-76.3)
Viral upper respiratory tract infection	2083	21.2 (16.9-26.3)	931	43.0 (36.7-49.5)	200	39.4 (27.2-53.1)	3214	29.6 (25.7-33.8)
Bronchitis or bronchiolitis[c]	491	55.2 (45.3-64.8)	821	72.4 (60.1-82.1)	193	60.9 (45.9-74.0)	1505	64.5 (56.6-71.6)
Other gastrointestinal conditions	1338	9.3 (6.3-13.3)	4252	14.8 (12.4-17.5)	1007	8.3 (5.6-12.2)	6597	12.4 (10.7-14.4)
Other genitourinary conditions	702	16.1 (12.0-21.4)	4739	10.7 (8.8-12.9)	1315	10.6 (8.2-13.6)	6756	11.1 (9.6-12.8)
Miscellaneous bacterial infections	1693	14.0 (10.4-18.5)	1895	19.5 (15.9-23.7)	215	29.0 (17.8-43.4)	3803	17.7 (15.0-20.7)
Other respiratory conditions (eg, chronic bronchitis)	510	23.5 (15.6-33.7)	1234	15.7 (11.9-20.4)	854	15.2 (11.4-20.0)	2598	16.8 (14.0-20.2)
Gastrointestinal infections	1729	10.4 (7.2-14.6)	4409	10.1 (8.0-12.6)	862	8.0 (4.9-12.7)	7000	9.7 (8.0-11.8)
Pneumonia	348	79.2 (69.1-86.6)	295	56.5 (47.0-65.7)	183	36.6 (24.7-50.5)	826	61.3 (54.1-68.0)
Acne	321	46.4 (38.9-54.1)	273	41.5 (33.6-49.9)	11	[b]	605	43.8 (38.2-49.5)
Asthma or allergy	1572	9.2 (7.3-11.4)	1398	12.0 (9.0-15.8)	236	7.5 (3.8-14.3)	3206	10.3 (8.4-12.4)
Miscellaneous nonbacterial infections	299	[c]	752	10.8 (7.1-16.1)	112	[b]	1163	8.4 (5.7-12.3)
Nonsuppurative otitis media	269	22.2 (16.0-30.0)	93	[b]	26	[b]	388	20.3 (14.9-27.0)
Influenza	76	[b]	113	[b]	9	[b]	198	[b]
Viral pneumonia	5	[b]	4	[b]	0	[b]	9	[b]
Remaining codes not listed elsewhere	20 944	3.2 (2.7-3.7)	69 564	3.6 (3.2-3.9)	22 764	4.2 (3.7-4.7)	113 272	3.7 (3.4-4.0)
All conditions	42 830	19.5 (18.1-20.9)	107 027	11.7 (10.9-12.5)	34 175	8.4 (7.7-9.2)	184 032	12.6 (12.0-13.3)

Abbreviation: NAMCS/NHAMCS, National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey.

[a] Diagnostic categories were created based on the most likely indication for an antibiotic prescription in a tiered fashion. Tier 1 diagnoses were those in which antibiotics are almost always indicated: pneumonia, urinary tract infection, or miscellaneous bacterial infections (eg, pertussis and syphilis). Tier 2 diagnoses are those for which antibiotics may be indicated: sinusitis, suppurative otitis media; skin, cutaneous, and mucosal infections, pharyngitis, gastrointestinal infections, and acne. Tier 3 diagnoses were all other diagnostic categories for which antibiotics are not indicated. In assigning each visit a single diagnosis, priority was given to tier 1 diagnoses, then tier 2 diagnoses, then tier 3 diagnoses. See eTable 2 in the Supplement for full details and included *International Classification of Diseases, Ninth Revision, Clinical Modification* codes for diagnostic categories.

[b] Value does not meet standard of reliability or precision.

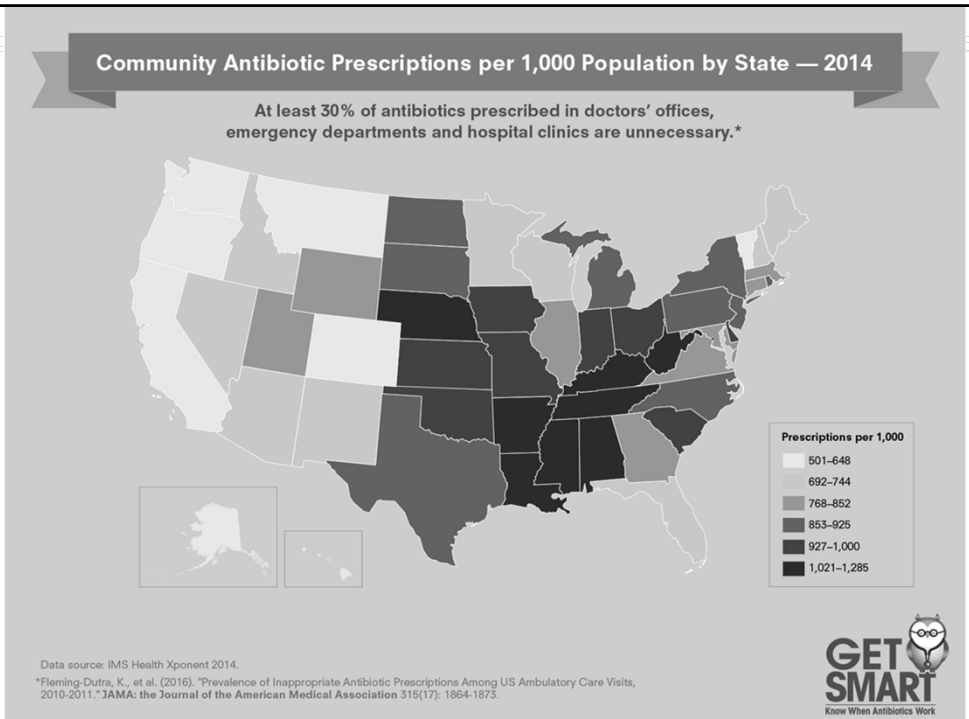
[c] Bronchitis or bronchiolitis includes visits with bronchitis, not specified as acute or chronic, and acute bronchitis and bronchiolitis but excludes visits in which the second or third diagnosis was chronic bronchitis, emphysema, or chronic obstructive pulmonary disease.

LEADING INDICATIONS

Respiratory
Sinusitis (72.2%)
Suppurative otitis media (79.5%)
Non suppurative otitis media (20.3%)
Pharyngitis (62.2%)
Viral URIs (29.6%)
Bronchitis/bronchiolitis (64.5%)
Pneumonia (61.3%)

UTIs (72.2%)

SSTIs
Acne (43.8%)
Skin,cutaneous and mucosal infections (50.0%)



Primary care clinicians' perceptions about antibiotic prescribing for acute bronchitis: a qualitative study

- Objective: To identify and understand primary care clinicians perceptions about antibiotic prescribing for acute bronchitis
- Method: Semi-structured interviews with 13 PCPs in Boston, MA

MCW
LEARN. LIVE. CARE. CURE.

Dempsey PP, Businger AC, Whaley LE, Gagne JJ, Linder JA. BMC Fam Pract 2014;15:194.

Views on acute bronchitis guidelines and antibiotic prescribing

- All the clinicians agreed with the guidelines, that antibiotics are not indicated for acute bronchitis
- Clinicians felt other clinicians overused antibiotics

MCW
LEARN. LIVE. CARE. CURE.

Dempsey PP, Businger AC, Whaley LE, Gagne JJ, Linder JA. BMC Fam Pra 2014;15:19

Barriers to guideline adherence

- Perceived patient demand
- Lack of accountability
- Time and money
- Other clinicians misconceptions
- Diagnostic uncertainty and defensive practice
- Concern for patient dissatisfaction

MCW
LEARN. LIVE. CARE. CURE.

Dempsey PP, Businger AC, Whaley LE, Gagne JJ, Linder JA. BMC Fam Pract 2014;15:194.

Strategies to reduce inappropriate antibiotic prescribing

- Patient education – handouts, posters, nonantibiotic prescriptions
- Communication strategies
- Clinical decision support
- Pre-visit triage by nurse
- Quality reports

MCW
LEARN. LIVE. CARE. CURE.

Nudging Guideline-Concordant Antibiotic Prescribing

- Setting: 5 primary care clinics in Los Angeles
- Context: ARI treatment
- Intervention: Poster-sized letters featuring clinician photographs and signatures stating their commitment to avoid inappropriate antibiotic prescribing for URIs

MCW
LEARN. LIVE. CARE. CURE.

Meeker D, Knight TK, Friedberg MW, et al. JAMA Intern Med 2014

The JAMA Network

From: **Nudging Guideline-Concordant Antibiotic Prescribing A Randomized Clinical Trial**

Table 4. Changes in Adjusted Rates[a] of Inappropriate Antibiotic Prescribing for ARIs

	Poster Condition		Control Condition	
Characteristic	Baseline	Final Measurement	Baseline	Final Measurement
Inappropriate prescribing rate, % (95% CI)	43.5 (38.5 to 49.0)	33.7 (25.1 to 43.1)	42.8 (38.1 to 48.1)	52.7 (44.2 to 61.9)
Absolute percentage change, baseline to final measurement (95% CI)	−9.8 (0.0 to −19.3)		9.9 (0.0 to 20.2)	
Difference in differences between poster condition and control (95% CI)	−19.7 (−5.8 to −33.04)[b]			

Abbreviation: ARI, acute respiratory infection.

[a] Adjusted for demographic characteristics and insurance status.

[b] P=.02 for the difference.

JAMA Intern Med. 2014;174(3):425-431. doi:10.1001/jamainternmed.2013.14191

Calling Acute Bronchitis a Chest Cold May Improve Patient Satisfaction with Appropriate Antibiotic Use

- Setting: Family practice clinics at 3 separate sites in SW and central Pennsylvania
- Method: Patient survey

MCW
LEARN. LIVE. CARE. CURE.

Phillip, TG, Hickner, J. J Am Board Fam Pract. 2005 Nov-Dec

Their questionnaire

- *You have had a cough for one week now that is not going away. You are bringing up phlegm that is a dark gray color. You had a fever at the beginning of the illness, but do not have one now. You do not have runny nose or sore throat. The doctor examines your ears, nose, throat, and listens to your chest with a stethoscope. You came in because you wondered if an antibiotic would help you get better faster.*
- *The doctor tells you that you have a viral upper respiratory tract infection/chest cold/bronchitis. He says that you will get over it just as fast without an antibiotic and does not prescribe one.*

1. How satisfied are you with the diagnosis?
2. How satisfied are you with not receiving an antibiotic prescription?

MCW
LEARN. LIVE. CARE. CURE.

Phillip, TG, Hickner, J. J Am Board Fam Pract. 2005 Nov-Dec

Patient satisfaction with Not Receiving an Antibiotic when Presented with Different Diagnostic Labels to Describe a Scenario of Acute Cough Illness

Diagnostic label	Satisfied or Very satisfied (%)	Neither satisfied nor dissatisfied (%)	Dissatisfied or Very Dissatisfied (%)
Viral URI	58		13
Chest cold	50		17
Bronchitis	45		26

MCW
LEARN. LIVE. CARE. CURE.

Phillip, TG, Hickner, J. J Am Board Fam Pract. 2005 Nov-Dec

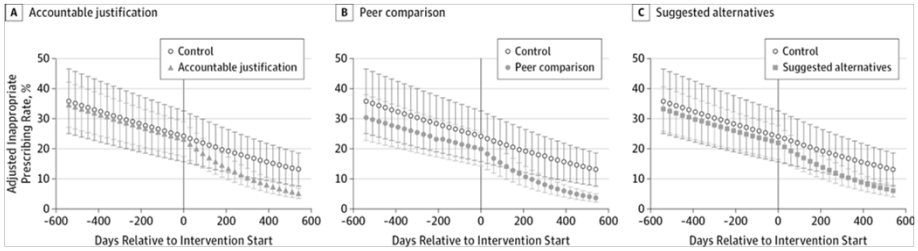
Effect of Behavioral Interventions on Inappropriate Antibiotic Prescribing Among Primary Care Practices

- Setting: 47 primary care practices in Boston and Los Angeles
- Context: ARI treatment
- Interventions:
  - Suggested alternatives
  - Accountable justification
  - Peer comparison

MCW
LEARN. LIVE. CARE. CURE.

The JAMA Network

Adjusted Rates of Antibiotic Prescribing at Primary Care Office Visits for Antibiotic-Inappropriate Acute Respiratory Tract Infections Over Time.



Δ difference: -5.0% (p=0.66)

Δ difference: -7.0% (p<0. 001)

Δ difference: -5.2% (p<0.001)

JAMA. 2016;315(6):562-570. doi:10.1001/jama.2016.0275

Antibiotic Prescribing Rates for Antibiotic-Inappropriate Acute Respiratory Tract Infections During the Baseline and Intervention Periods, by Study Group

Intervention	Antibiotic prescribing rate (%)		Absolute difference
	Baseline period	Intervention period	
Control	37.1	24.0	13.1
Suggested alternatives	49.6	30.2	19.4
Accountable justification	33.3	16.4	16.9
Peer comparison	35.0	19.2	15.8
Suggested alternatives + Accountable justification	35.5	16.0	19.5
Suggested alternatives + Peer comparison	24.4	6.9	17.5
Accountable justification + Peer comparison	33.1	15.2	17.9
All three	25.6	10.0	15.6

MCW
LEARN. LIVE. CARE. CURE.

Meeker D, Linder JA, Fox CR, et al. JAMA 2016;315:562–70.

Antibiotic stewardship at the frontline

- ≈ 50% of antibiotics prescribed are inappropriate
- The most modifiable risk factor for antibiotic resistance is antibiotic use
- The most modifiable risk factor for *C difficile* infection is antibiotic use

MCW
LEARN. LIVE. CARE. CURE.

Antibiotic stewardship everyday

- Antibiotics are usually not necessary for URIs and ASB
- A mindful, patient-centered, guideline-concordant approach will aid optimal antibiotic prescribing
- There are multiple tools and strategies that can be used to facilitate appropriate antibiotic use

MCW
LEARN. LIVE. CARE. CURE.

So, who is the antibiotic steward?

You are!

Thank you!

MCW
LEARN. LIVE. CARE. CURE.