

The crest of the University of Pennsylvania is centered in the background. It features a shield with a red top section containing two open books and a central figure. The bottom section is white with a blue diamond shape containing a white circle.

Creating Outpatient Stewardship Metrics that Work for You

Keith Hamilton, MD

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Hospital of the University of Pennsylvania

Outpatient Antibiotics

266 million

Courses of antibiotics
prescribed per year in US



889

prescriptions per 1000 children



789

prescriptions per 1000 adults



Shapiro DJ, et al. J Antimicrob Chemother 2014.
Suda KJ, et al. J Antimicrob Chemother 2013.
Hicks LA, et al. Clin Infect Dis 2015.

Outpatient Antibiotics

41%

Of all antibiotics are prescribed for respiratory infections

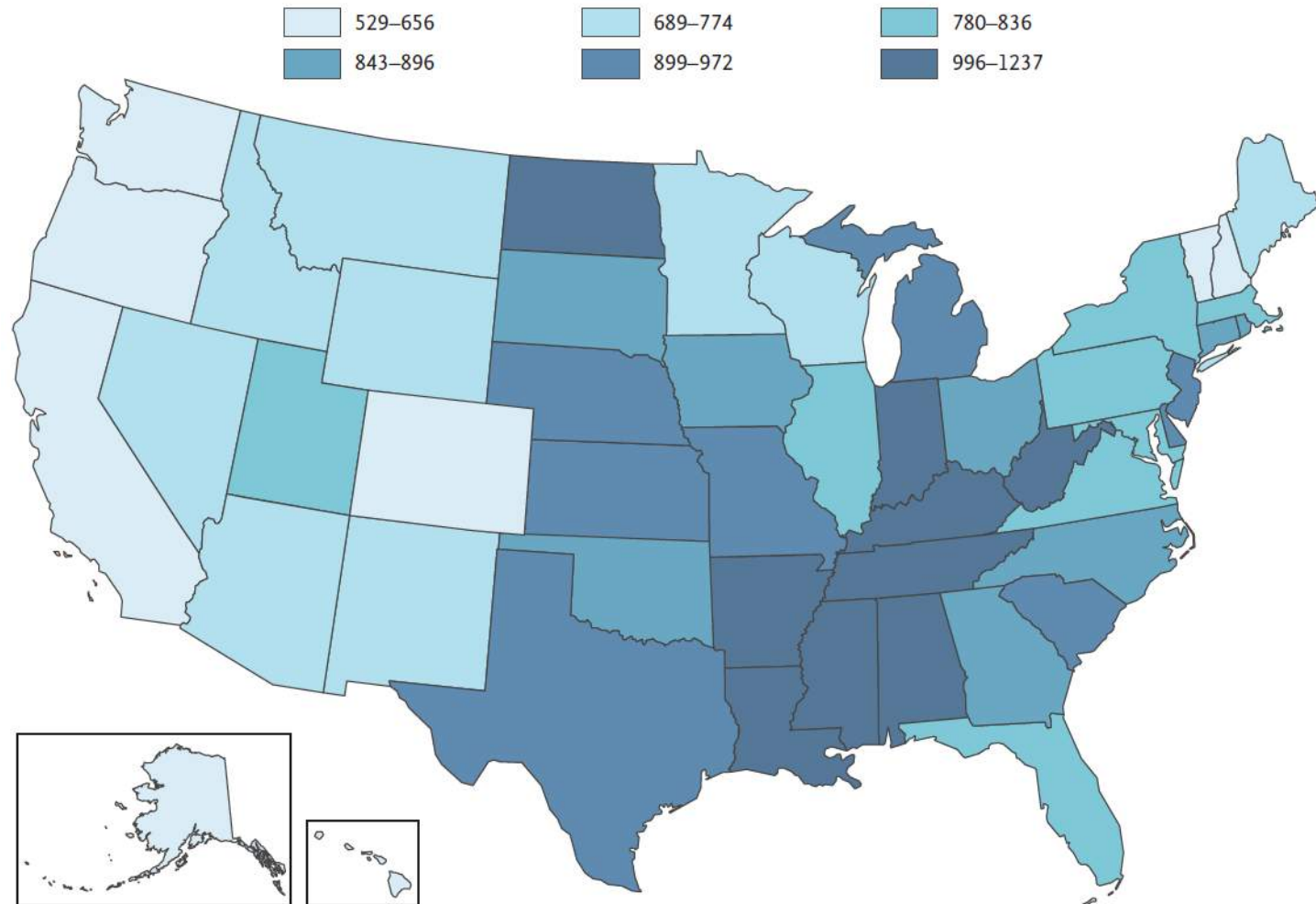
71% 
of all **bronchitis** visits

80% 
of all **sinusitis** visits

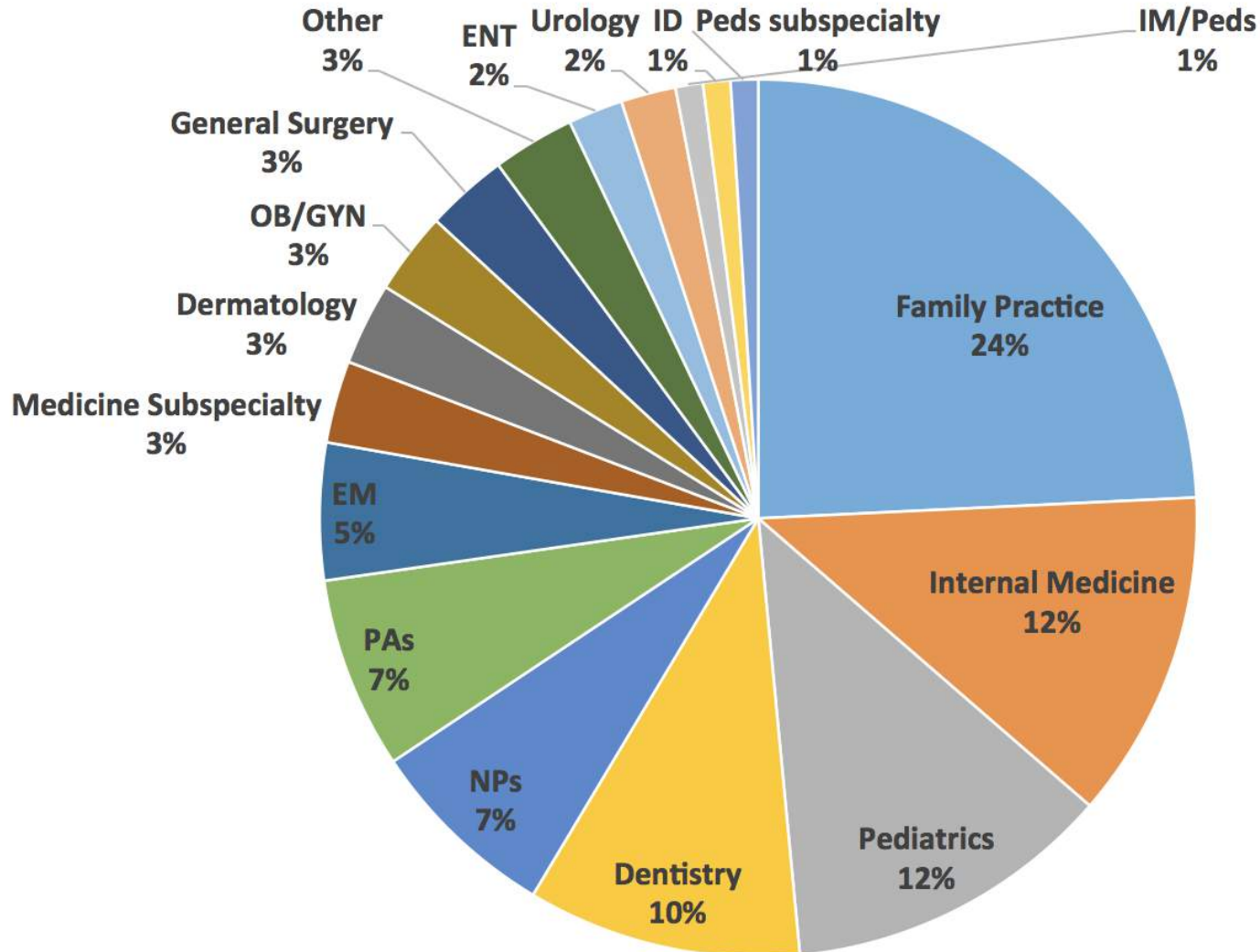
50%

Of all antibiotics in ambulatory patients are inappropriate

Prescriptions per 1000 person-years



Outpatient Antibiotic Use



CDC Core Elements



Commitment

Demonstrate dedication to and accountability for optimizing antibiotic prescribing and patient safety



Action for policy and practice

Implement at least one policy or practice to improve antibiotic prescribing, assess whether it is working, and modify as needed.



Tracking and reporting

Monitor antibiotic prescribing practices and other regular feedback to clinicians, or have clinicians assess their own prescribing practices themselves



Education and expertise

Provide educational resources to clinicians and patients on antibiotic prescribing and ensure access to needed expertise on optimizing antibiotic prescribing

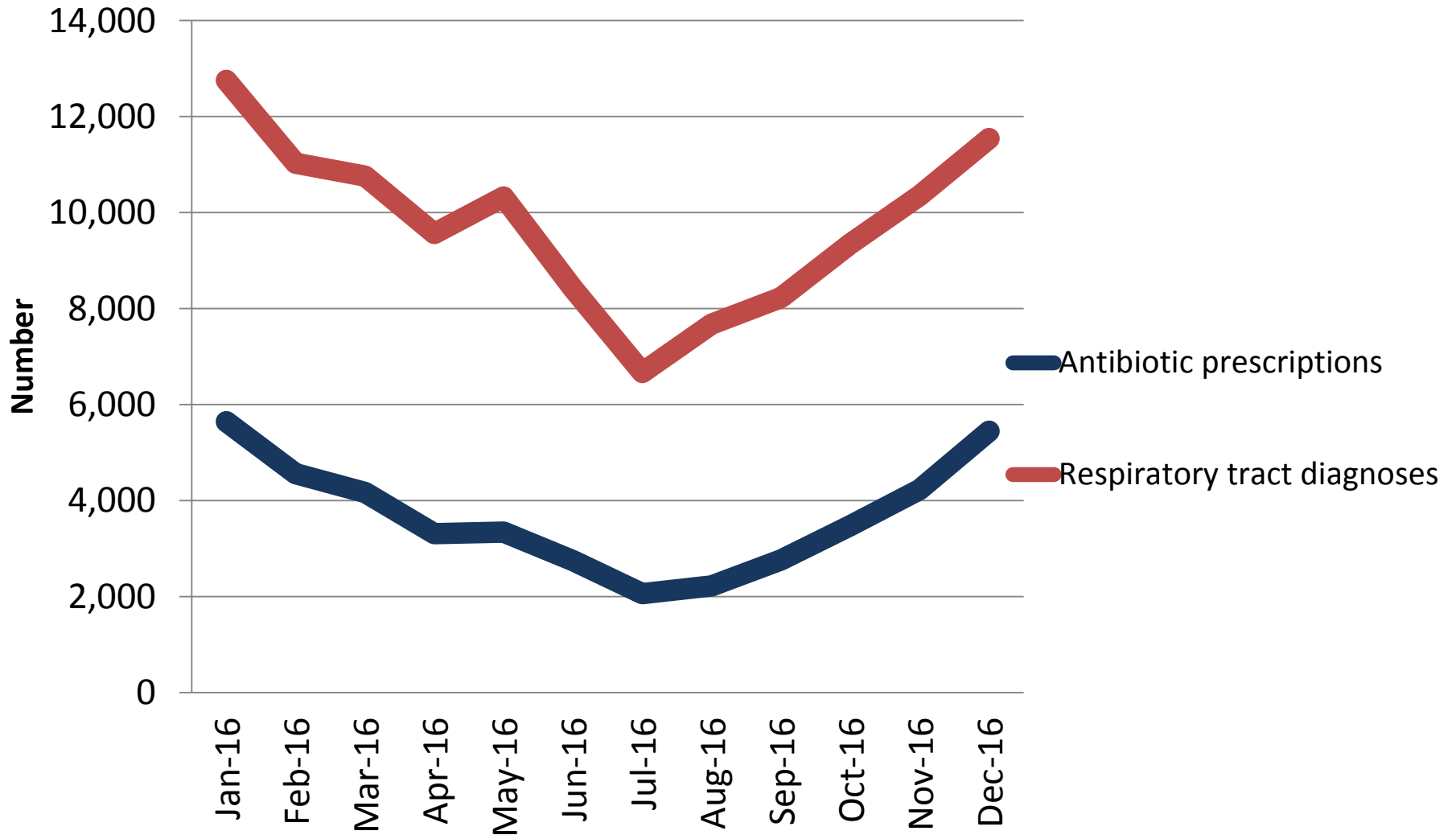
Outline

- **Creating Metrics:** Goal to determine **simple metrics** that best correlate with inappropriate antimicrobial prescribing for respiratory infections in the general medicine and family medicine ambulatory practice setting
- **Making Data Work for You:** Goal to examine the effectiveness of an **intervention involving feedback** on prescribing practices to improve antimicrobial prescribing in the general internal medicine (IM) and family medicine (FM) ambulatory practice setting

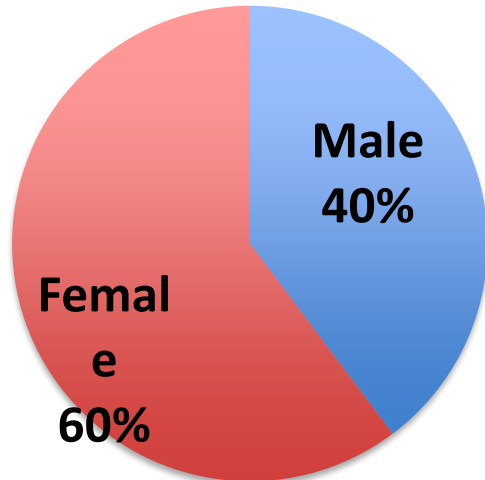
Setting

- **32 primary care practices** in University of Pennsylvania Health System (UPHS)
- **9,189 visits per month** in which respiratory tract diagnoses coded in these practices
- Antibiotics prescribed in **36.8%** of visits (**3,382 antibiotic prescriptions** per month)
- Includes only **attending physicians** and **advanced practice providers**
- Includes only **adult patients** ≥ 18 years old

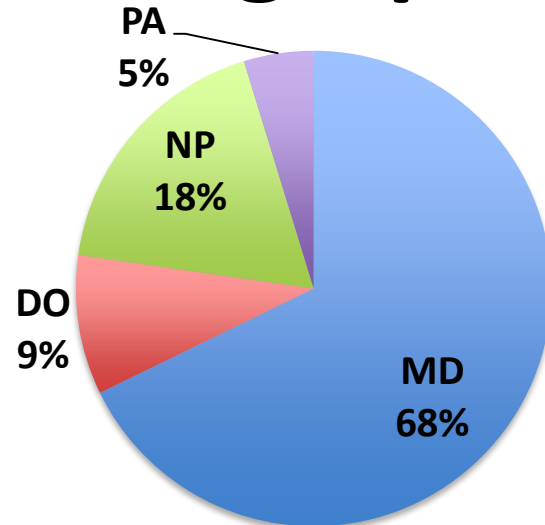
Setting



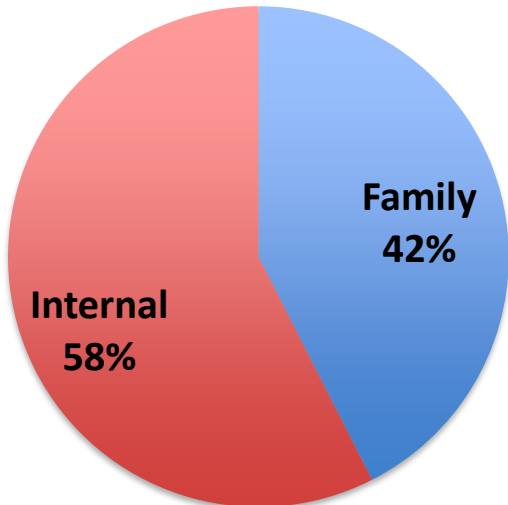
Provider/Clinic Demographics



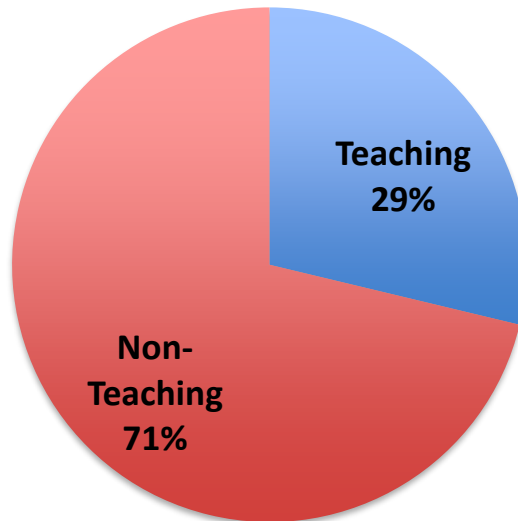
Gender



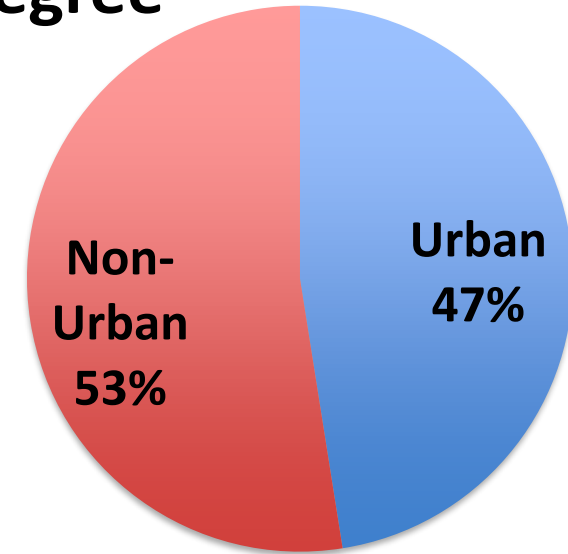
Degree



Specialty



Teaching



Location

Appropriateness

- Identified respiratory tract diagnoses by **ICD-10 code**
- Defined appropriateness of antibiotic prescribing based on **modified IDSA treatment criteria**
- Reviewed **1,200 records** from **60 providers**
- Double coded 15% of all chart reviews with **92% concordance** (165/180)

Metrics

- Defined **respiratory tract diagnoses** by ICD-10 code
 - Defined specific diagnostic groups (sinusitis, bronchitis, pneumonia, pharyngitis, otitis media, non-specific respiratory symptoms)
 - Defined respiratory tract diagnoses for which antibiotics should almost never be prescribed (**Tier 3 diagnoses**) by ICD-10 code
- Calculated mean Charlson comorbidity index (CCI) for each provider to determine expected prescribing by quartile of CCI as denominator for **observed:expected (O:E) ratio**

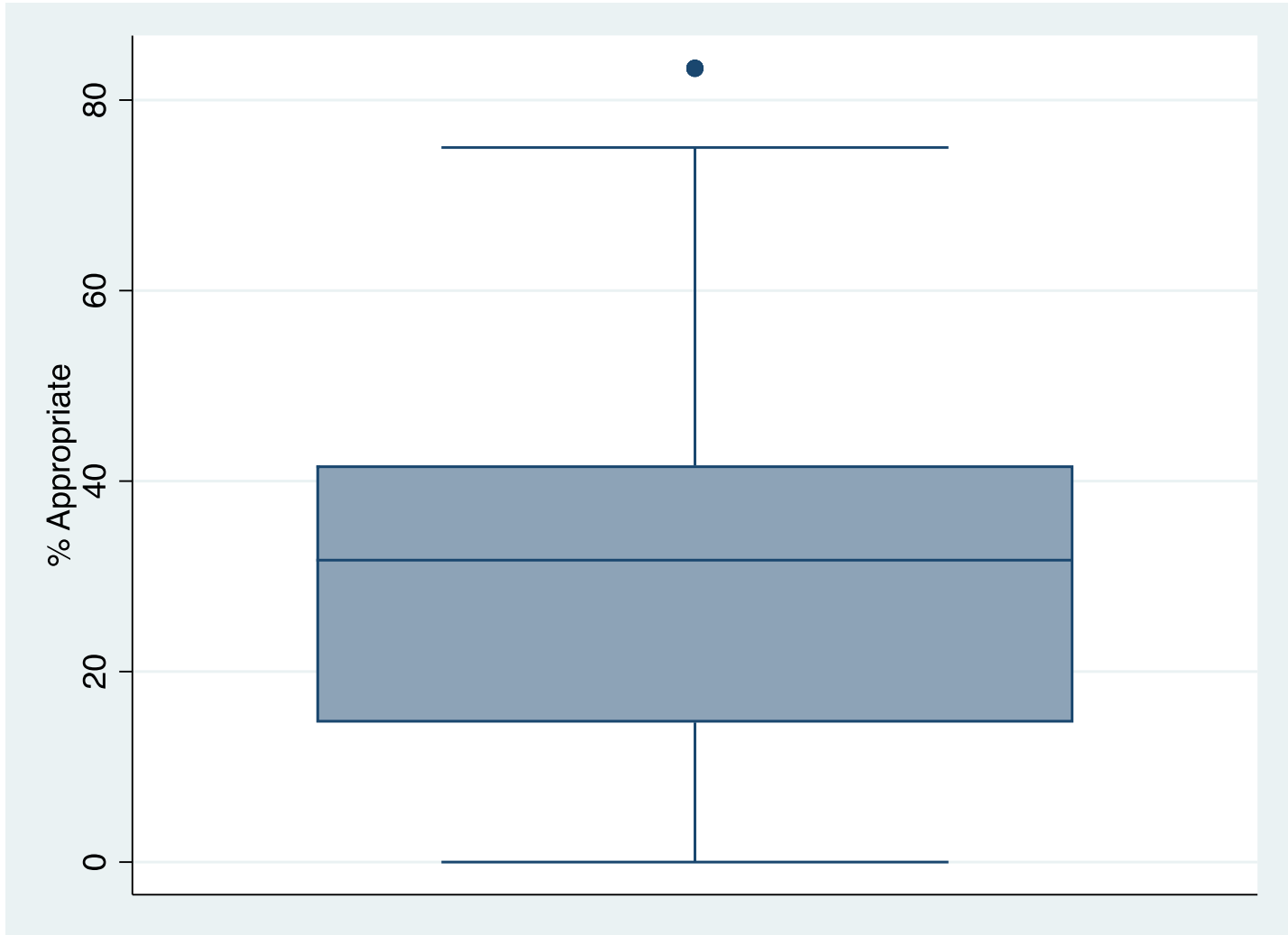
Prescribing Tiers

Diagnostic category	Example diagnoses
Tier 1 – Antibiotics almost always indicated	Pneumonia, urinary tract infection, sexually transmitted infections, other miscellaneous bacterial infections
Tier 2 – Antibiotics may be indicated	Acne, pharyngitis, sinusitis, skin and mucosal infections, gastrointestinal infections, suppurative otitis media
Tier 3 – Antibiotics not indicated	Asthma, allergy, bronchitis, influenza, viral upper respiratory infections, nonsuppurative otitis media, all other codes not listed elsewhere

31%

of antibiotic prescriptions
were **appropriate**

Appropriateness

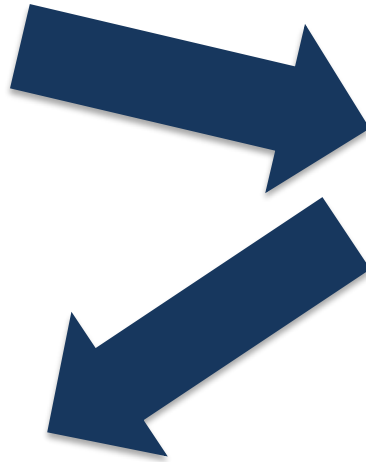


Demographics

Characteristic	Category	Mean % appropriate	p-value
Medical Degree	MD and DO NP and PA	41.8% 28.4%	0.02
Gender	Female Male	34.3% 26.9%	0.10
Specialty	Internal Medicine Family Medicine	36.9% 24.5%	0.01
Board Certification	Before 1997 After 1997	36.7% 25.2%	0.02
Teaching Status	Teaching Non-Teaching	49.2% 26.6%	<0.001

Metrics

1,200
office visits reviewed



Metric	R ²	p-value
% prescribing for tier 3 visits	0.24	<0.0001
% prescribing for respiratory visits	0.23	<0.0001
% prescribing for URTI visits	0.20	<0.0001
% prescribing for LRTI visits	0.19	<0.0001
Mean Charlson comorbidity index	0.044	0.11

Metrics

1,200
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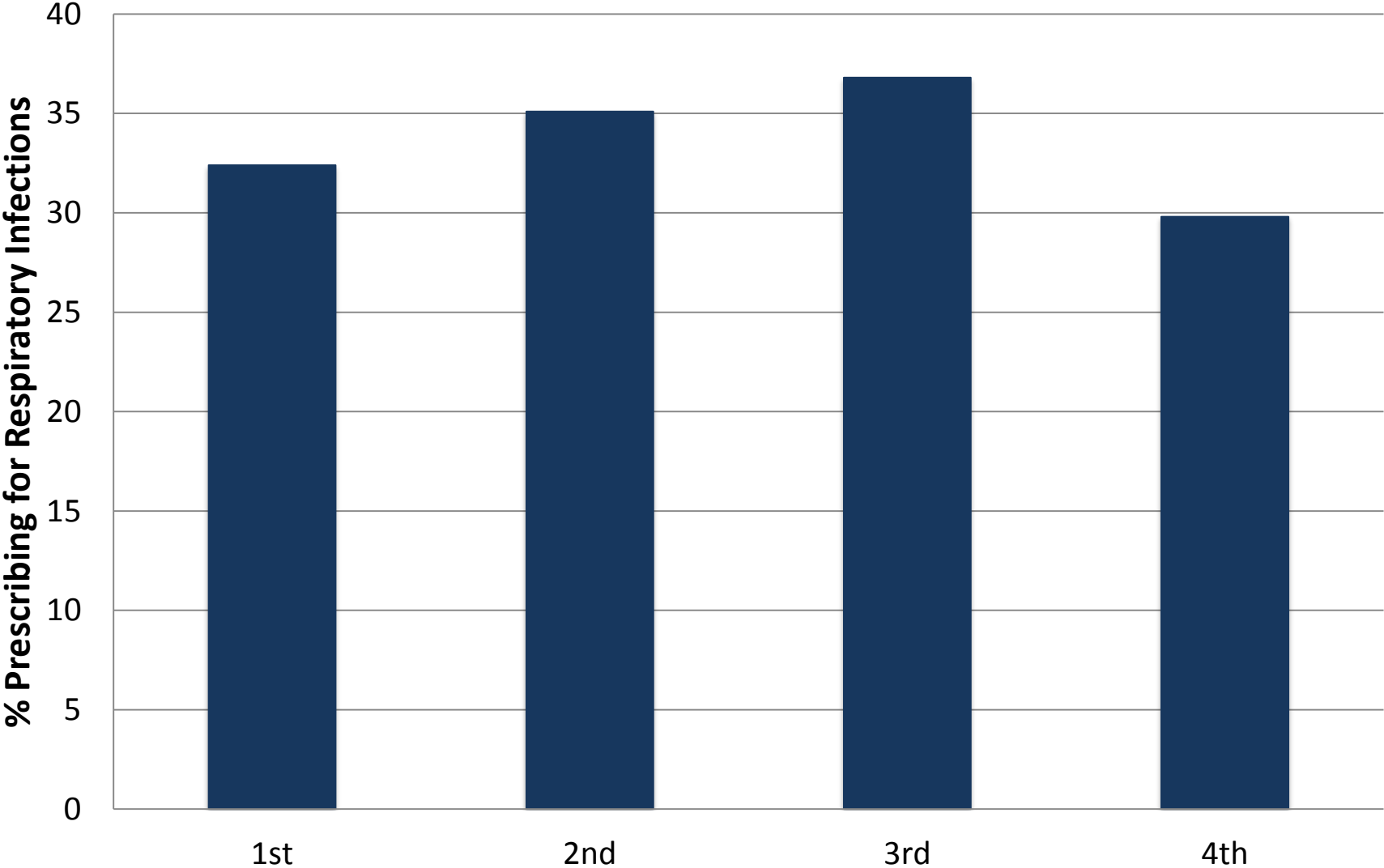
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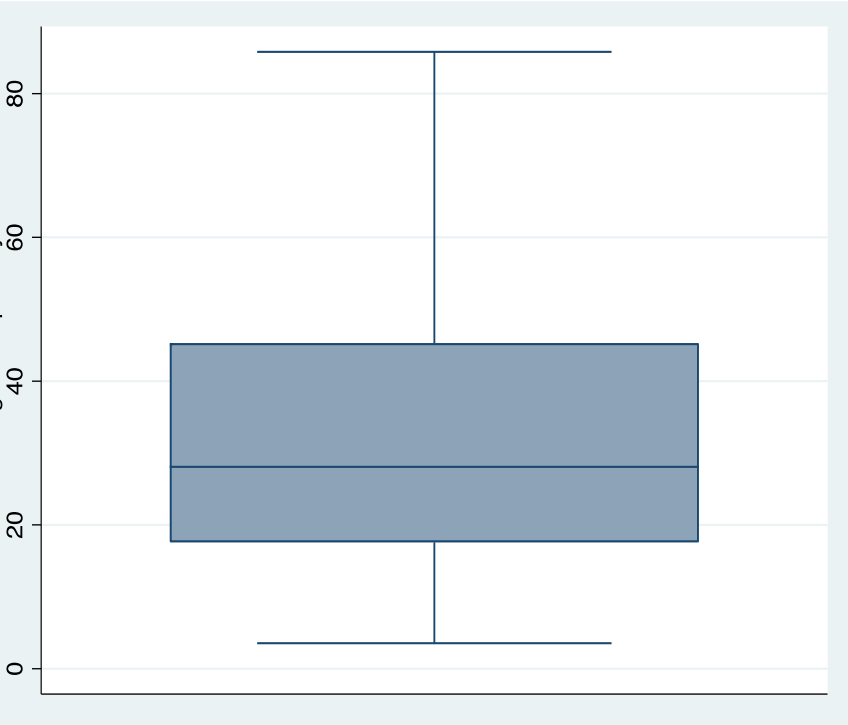
Metrics

- Charlson Comorbidity Index (CCI) by quartile
 - 1st: 1.14-3.82
 - 2nd: 3.82-4.59
 - 3rd: 4.59-5.43
 - 4th: 5.43-15.75
- Mean percent prescribing by CCI quartile
 - 1st: 32.4%
 - 2nd: 35.1%
 - 3rd: 36.8%
 - 4th: 29.8%
- O:E Ratio and Appropriateness: $R^2=0.04$, $p=0.75$

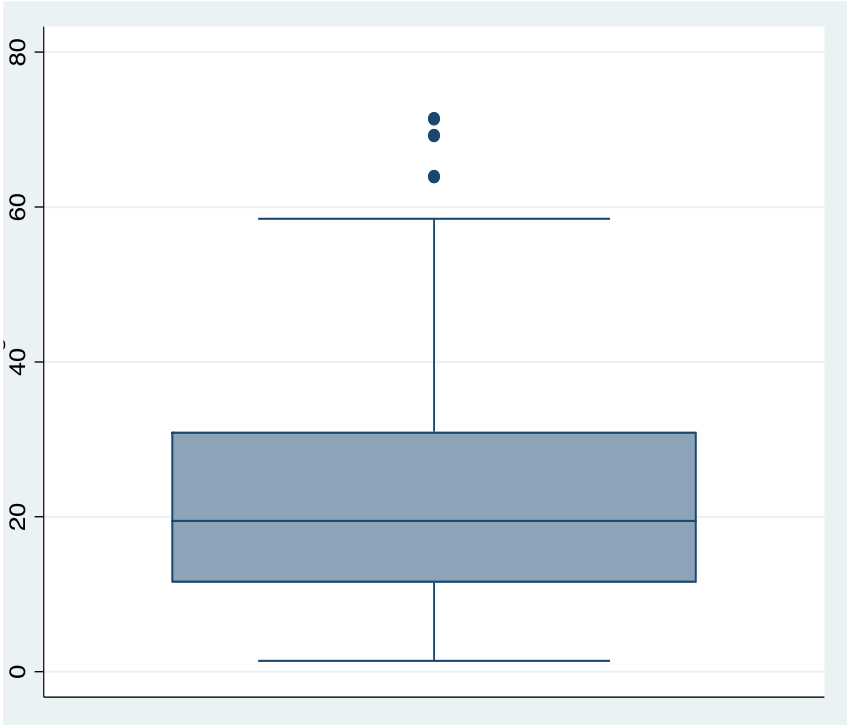
Metrics



Metrics



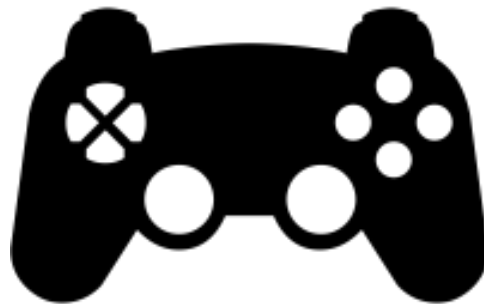
% prescribing for
All Respiratory
diagnosis visits



% prescribing for
Tier 3
diagnosis visits

Gaming Audits

- If auditing specific diagnoses (e.g. bronchitis), prescribers often decrease their prescribing
- Diagnostic coding shift may occur in response to the audit (e.g. shifting coding from bronchitis to pneumonia)



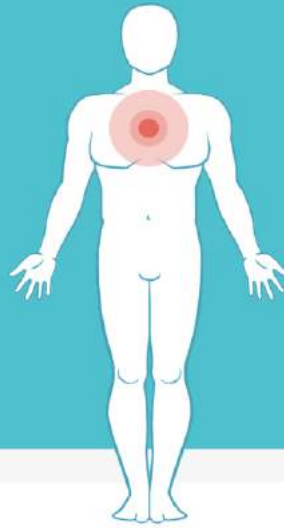
Intervention

- 32 primary care clinics randomized into **6 clusters**
- A cluster receives an **educational session** each month from October 2017-March 2018 followed by **monthly feedback** on two metrics
- After the educational session, each provider receives **feedback through September 2018**

Cluster 1	Baseline Period	Intervention	Intervention	Intervention	Intervention	Intervention	Intervention	Intervention Follow-up	Post-intervention Follow-up
Cluster 2		Intervention	Intervention	Intervention	Intervention	Intervention	Intervention		
Cluster 3		Intervention	Intervention	Intervention	Intervention	Intervention	Intervention		
Cluster 4		Intervention	Intervention	Intervention	Intervention	Intervention	Intervention		
Cluster 5		Intervention	Intervention	Intervention	Intervention	Intervention	Intervention		
Cluster 6		Intervention	Intervention	Intervention	Intervention	Intervention	Intervention		
	7/1/2016 – 9/30/2017	10/1/2017 – 10/31/2017	11/1/2017 – 11/30/2017	12/1/2017 – 12/31/2017	1/1/2018 – 1/31/2018	2/1/2018 – 2/28/2018	3/1/2018 – 3/31/2018	4/1/2018 – 9/30/2018	10/1/2018 – 12/31/2019

Education

Optimizing Antibiotic
Prescribing for
Respiratory Infections
in Adult Patients

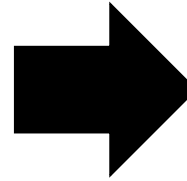


Optimizing Antibiotic
Prescribing for
Respiratory Infections
in Adult Patients



Education

- **Appropriate Prescribing**



- 1** Clear diagnosis

- **Communication Strategies**



- 2** Negative treatment recommendation

- 3** Positive treatment recommendation

- **Resources**

- 4** Contingency plan

Resources

Optimizing Antibiotic Prescribing for Respiratory Infections

1. Sinusitis

When to prescribe antibiotics?

Persistent Symptoms > 10days without improvement or
Severe Fever > 102F or "Double-sickening"
Better and then worse

Purulent + Painful +

What to prescribe?

Amoxicillin-clavulanate
875-125mg q12 x 5-7d

PENICILLIN ALLERGY
Doxycycline 100mg BID x 5-7d
OR
Levofloxacin 500mg daily x 5-7d

2. Community Acquired Pneumonia

When to Prescribe Antibiotics?

- Fevers/chills
- Shortness of breath
- Cough
- Chest pain
- Abnormal Lung exam



Infiltrate on chest imaging

What to prescribe?

Amoxicillin 1g TID x 5d
AND
Azithromycin 500mg x 1 THEN 250mg x 4d

PENICILLIN ALLERGY
Levofloxacin 750mg PO daily x 5d

3. Acute Bronchitis

When to prescribe?

COPD or Bronchiectasis + Flare of symptoms + Purulent sputum

What to prescribe?

Azithromycin 500mg x 1 PLUS 250mg daily x 4d
OR
Doxycycline 100mg BID x 7d

4. Pharyngitis

What to prescribe?

When to prescribe?

Positive throat culture for group A strep OR Positive Rapid Test

Amoxicillin 500mg Twice daily x 10d

PENICILLIN ALLERGY
Cephalexin 500mg twice daily x 10d
OR
Azithromycin 500mg daily x 5d

** Avoid cephalexin in patients with history of severe allergy to penicillin such as hives, angioedema, and anaphylaxis.

5. Pertussis

When to prescribe?

Treatment: Cough >= 2 weeks and/or



Paroxysms of cough, inspiratory whoop or post-tussive vomiting and/or

Close contact

Positive test for B. pertussis (culture, PCR or serology)

Prophylaxis:

Close contact with known pertussis

What to prescribe?

Azithromycin 500mg x 1d PLUS 250mg daily x 4d

6. Otitis media

What to prescribe?

When to prescribe?

Unilateral ear pain or fever

Evidence of an inflammatory middle ear effusion (TM erythema, bulging, or opacification)

Amoxicillin 875mg OR 1,000mg PO q12 x 7d

PENICILLIN ALLERGY
Azithromycin 500mg x 1 THEN 250mg x 4d

Prescribing for Respiratory Infections

	Acute Bronchitis	Non-strep Pharyngitis	URI
Sinusitis	✓	✓	✓
	✓	✓	✓
			?
	✓		?
	✓		?
	?		
	?		?
Nasal decongestant (oxymetazoline)	?		?
Intranasal glucocorticoids	?		
Throat lozenge/spray		✓	✓
Hot tea/soup		✓	✓
Humidifier	✓	✓	✓
Antihistamine + decongestant			?


PennChart Dotphrases for Respiratory Tract Infections for Patient Education:











.bronchitisASP .sinusitisASP .pharyngitisnotstrepASP .uriASP



Resources

Name:

Content Owners & Users Synonyms

 Do not include PHI or patient-specific data in SmartPhrases.

 **B**      Insert SmartText    

 1 2 3 4 5 

You have **acute bronchitis**, which is sometimes called a “chest cold.” Bronchitis is caused by inflammation in the large airways of the lungs which leads to cough and mucous production.

Bronchitis is almost always caused by a virus and many people will have symptoms of an upper respiratory infection (sore throat, headache, runny nose) before they develop bronchitis. Since this is a viral infection, antibiotics do not work and are not recommended.

Most patients feel better in 1 to 3 weeks.

In addition to getting plenty of rest and drinking plenty of fluids, you can try the following remedies to help your symptoms:

- Throat lozenges
- Hot tea with lemon or honey

Feedback

Subject: Antibiotic Prescribing Performance

Dear Dr. XXXXXX,

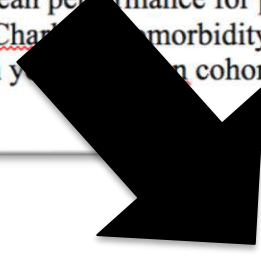
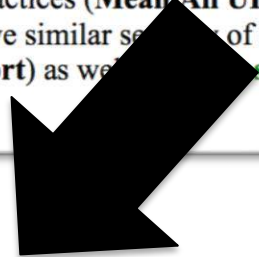
Penn Medicine has begun an initiative to optimize antibiotic prescribing for respiratory infections in adult patients.

We are measuring prescriber performance on two metrics:

- 1) Percent of visits with a **respiratory tract infection diagnosis** in which an antibiotic is prescribed
- 2) Percent of visits with a **respiratory tract infection diagnosis that usually does not require an antibiotic** (bronchitis, viral infections, non-streptococcal pharyngitis, etc.) in which an antibiotic is prescribed

We have found that both of these metrics **correlate strongly with unnecessary antibiotic prescribing.**

Included below you will find **your** monthly performance on both of these metrics. Each chart compares your performance to the mean performance for all prescribers in Penn Medicine primary care practices (**Mean All UPHS**) and the mean performance for prescribers with patients that have similar severity of illness scores (Charlson comorbidity index) (**Mean Charlson Cohort**) as well as **Best Performer** in your cohort.

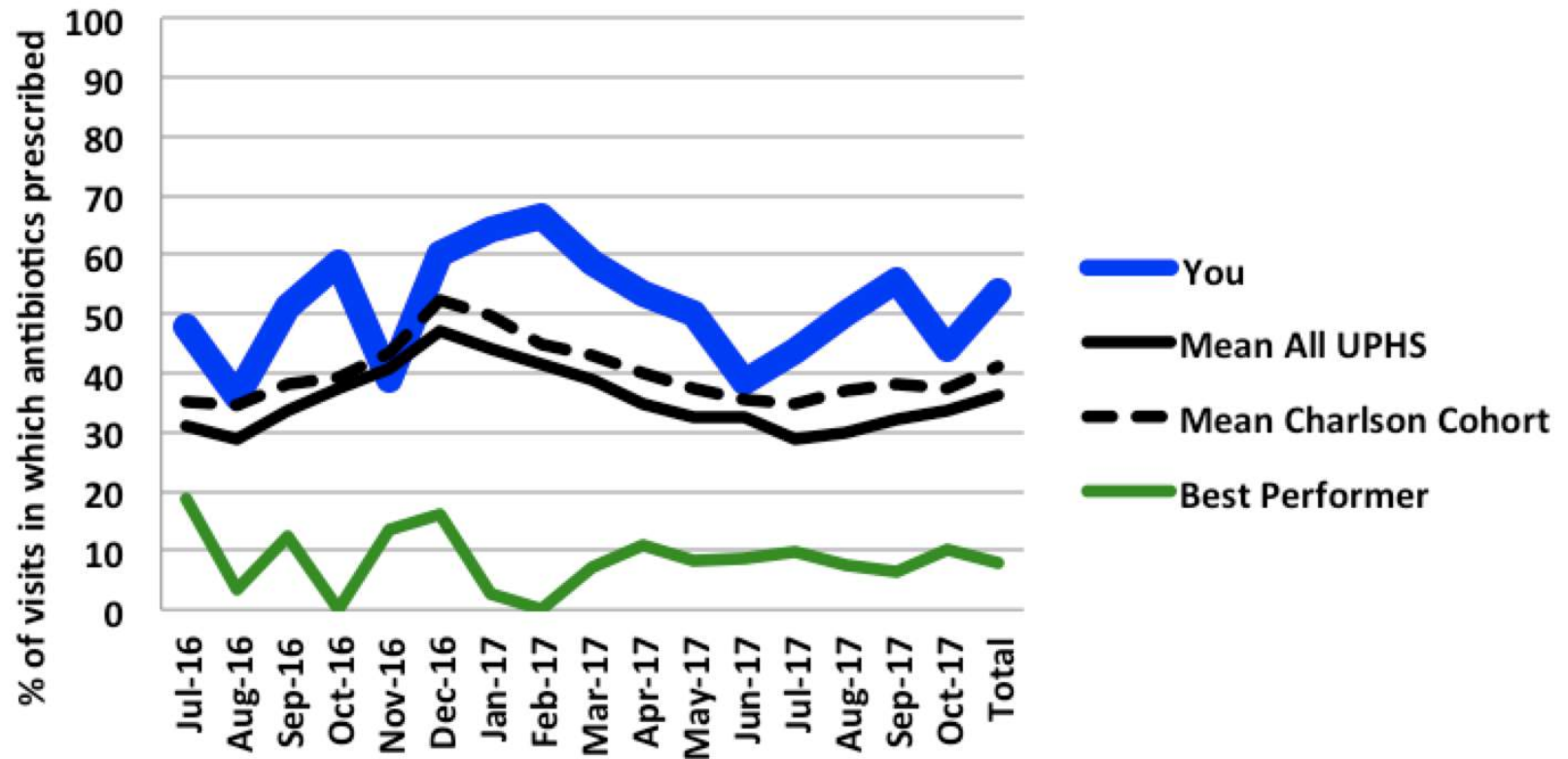


Prescriber

CMO/CEO

Feedback

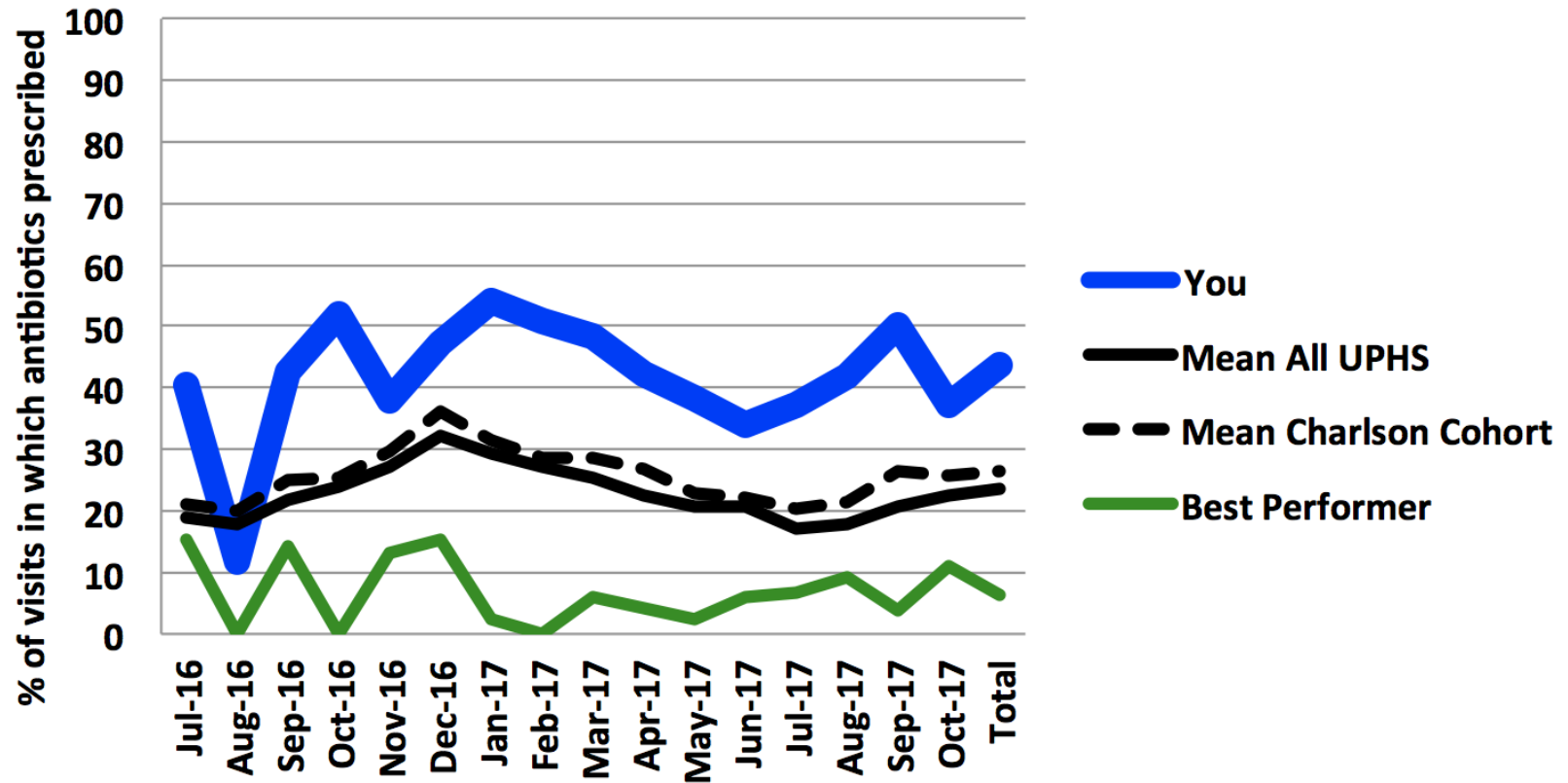
% Prescribing in Respiratory Tract Infection Visits



You are in the **lowest performing** (4th) quartile of all prescribers for this metric.

Feedback

% Prescribing for Diagnoses that Almost Never Require Antibiotics



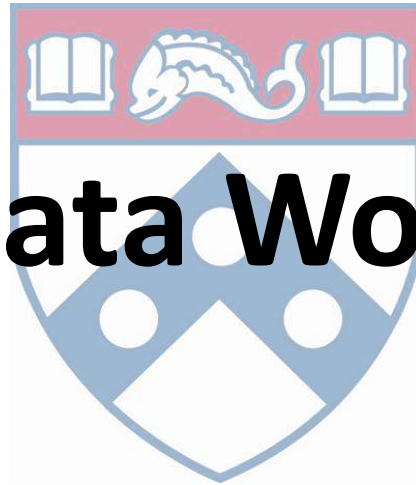
You are in the **lowest performing** (4th) quartile of all prescribers for this metric.

Feedback

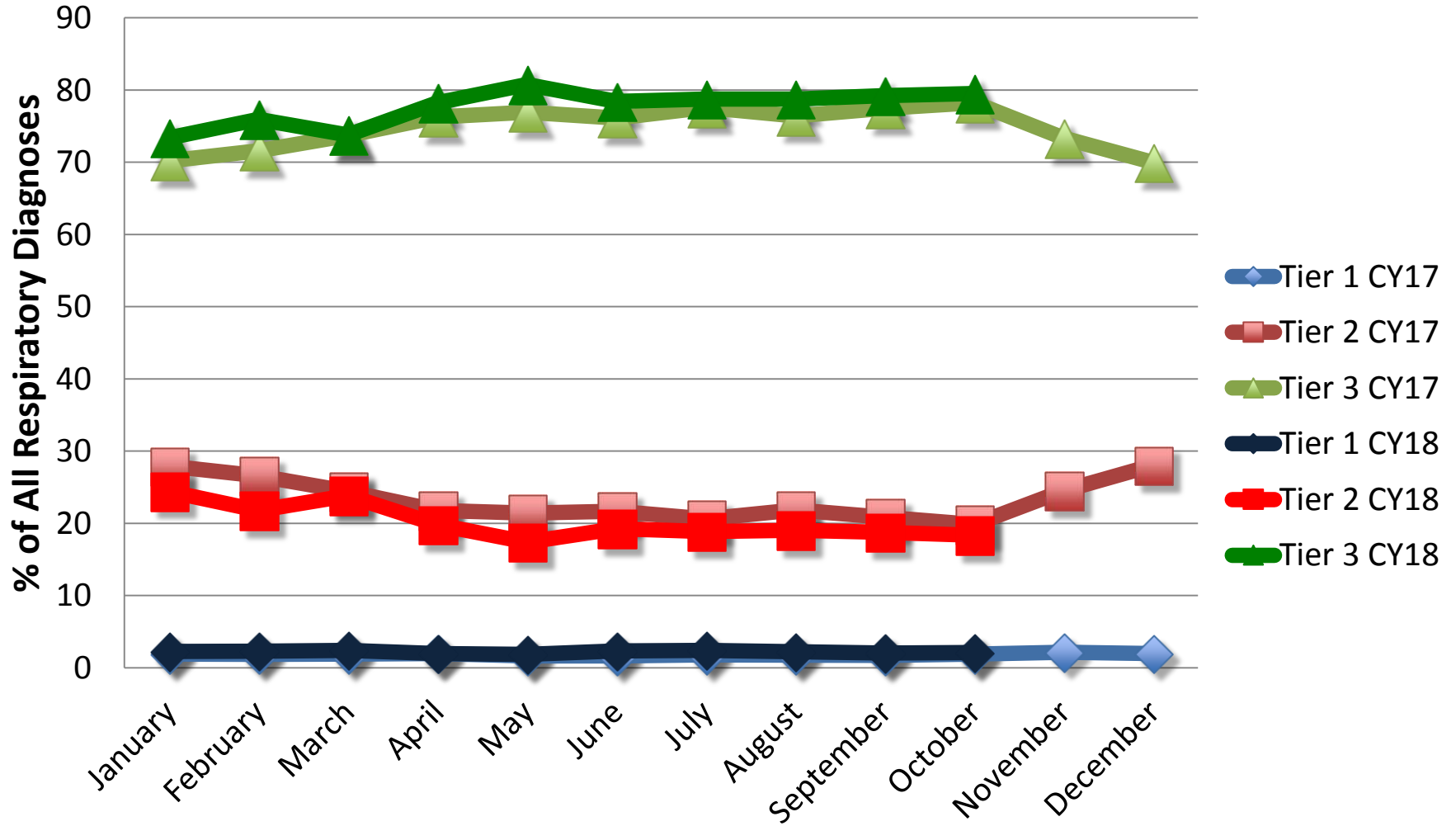
The following metrics may help you to target areas of improvement for specific diagnoses:

Diagnosis	Your % Antibiotic Prescribing	Mean % Antibiotic Prescribing for UPHS primary care providers	Best Performer % Antibiotic Prescribing*
Bronchitis	82.64	70.40	8.20
Sinusitis	98.02	89.65	15.00
Pharyngitis	85.29	51.73	4.55
Non-specific respiratory syndromes	35.56	19.12	3.69

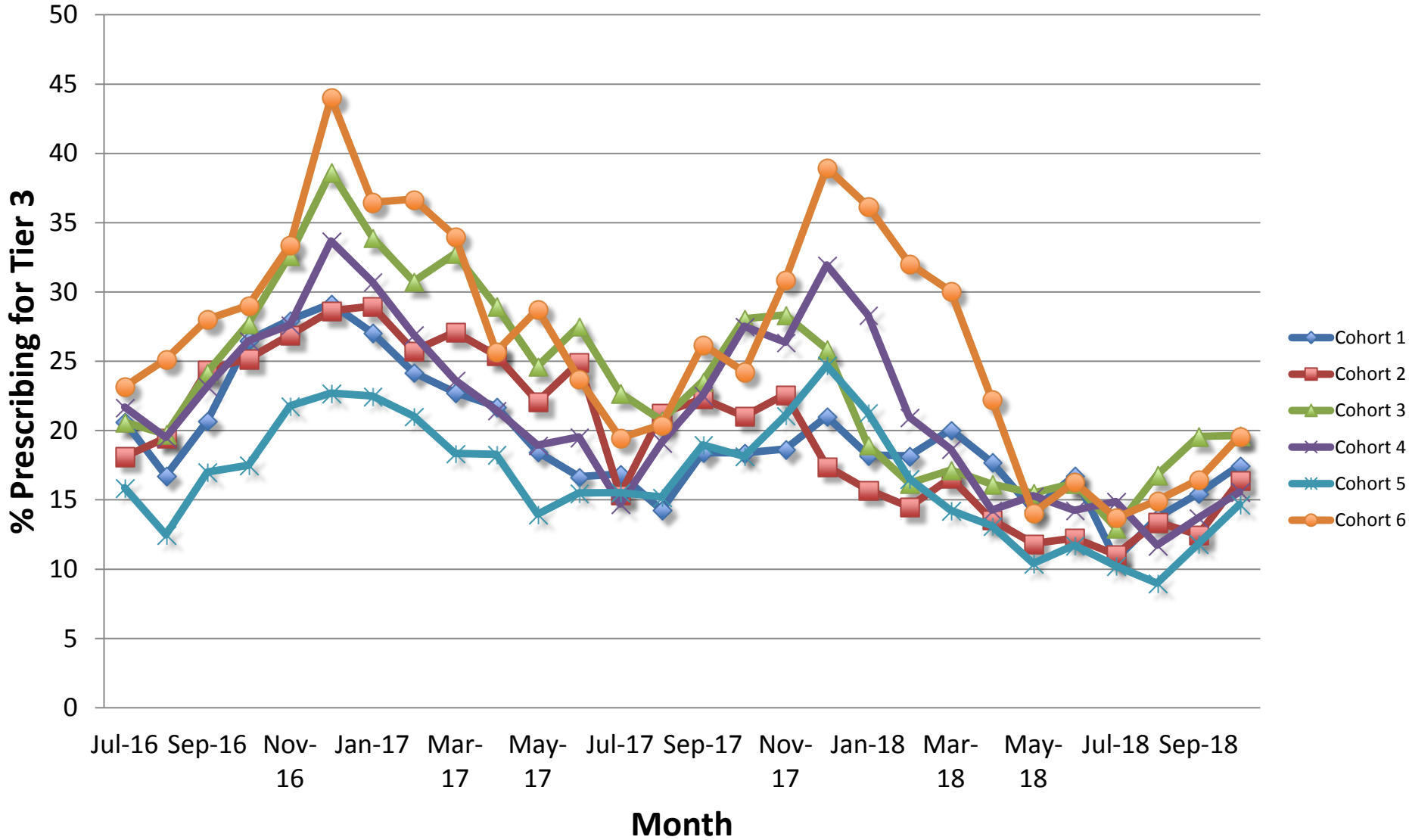
Did the Data Work for Us?



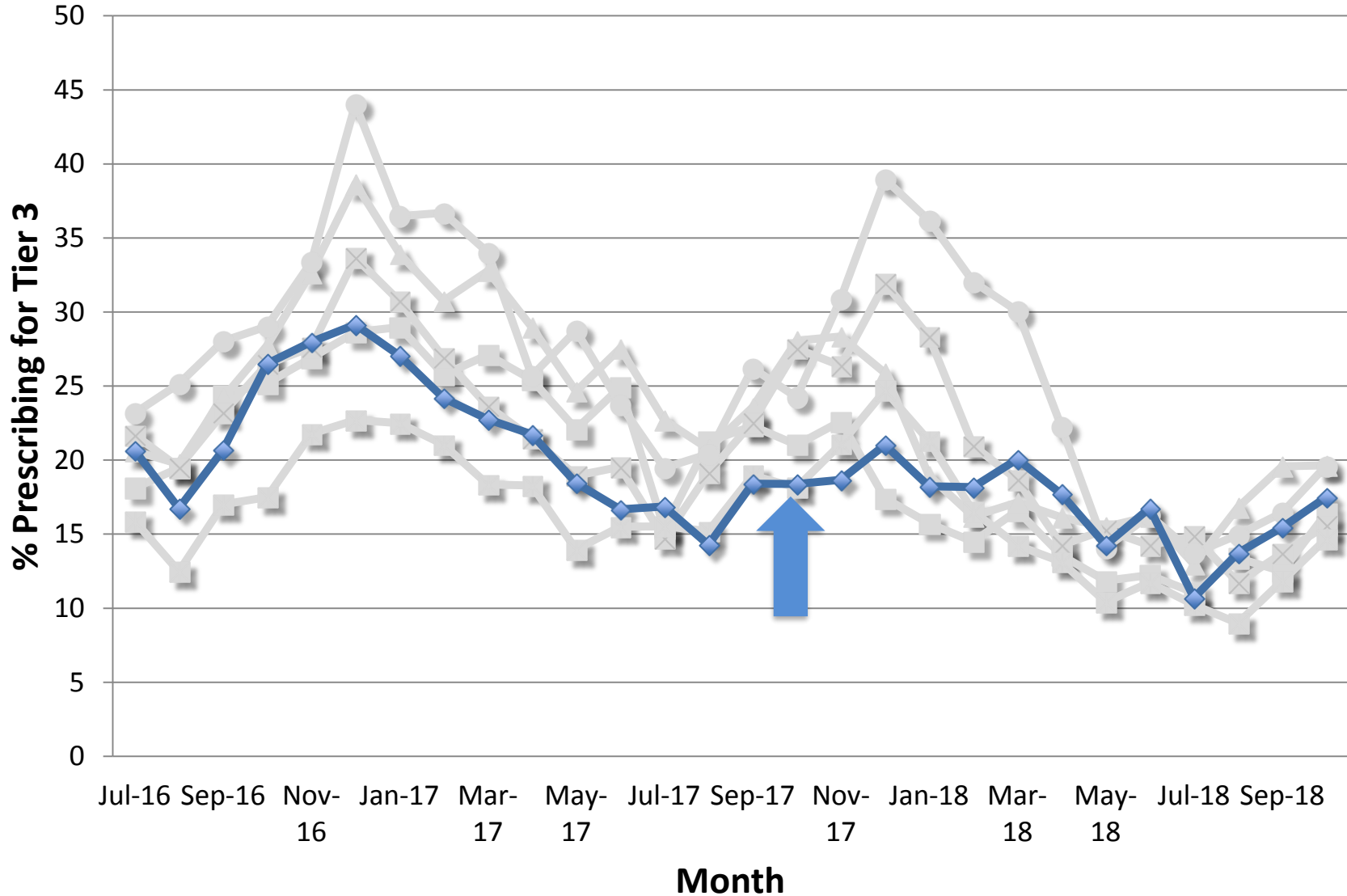
Diagnostic Tiers



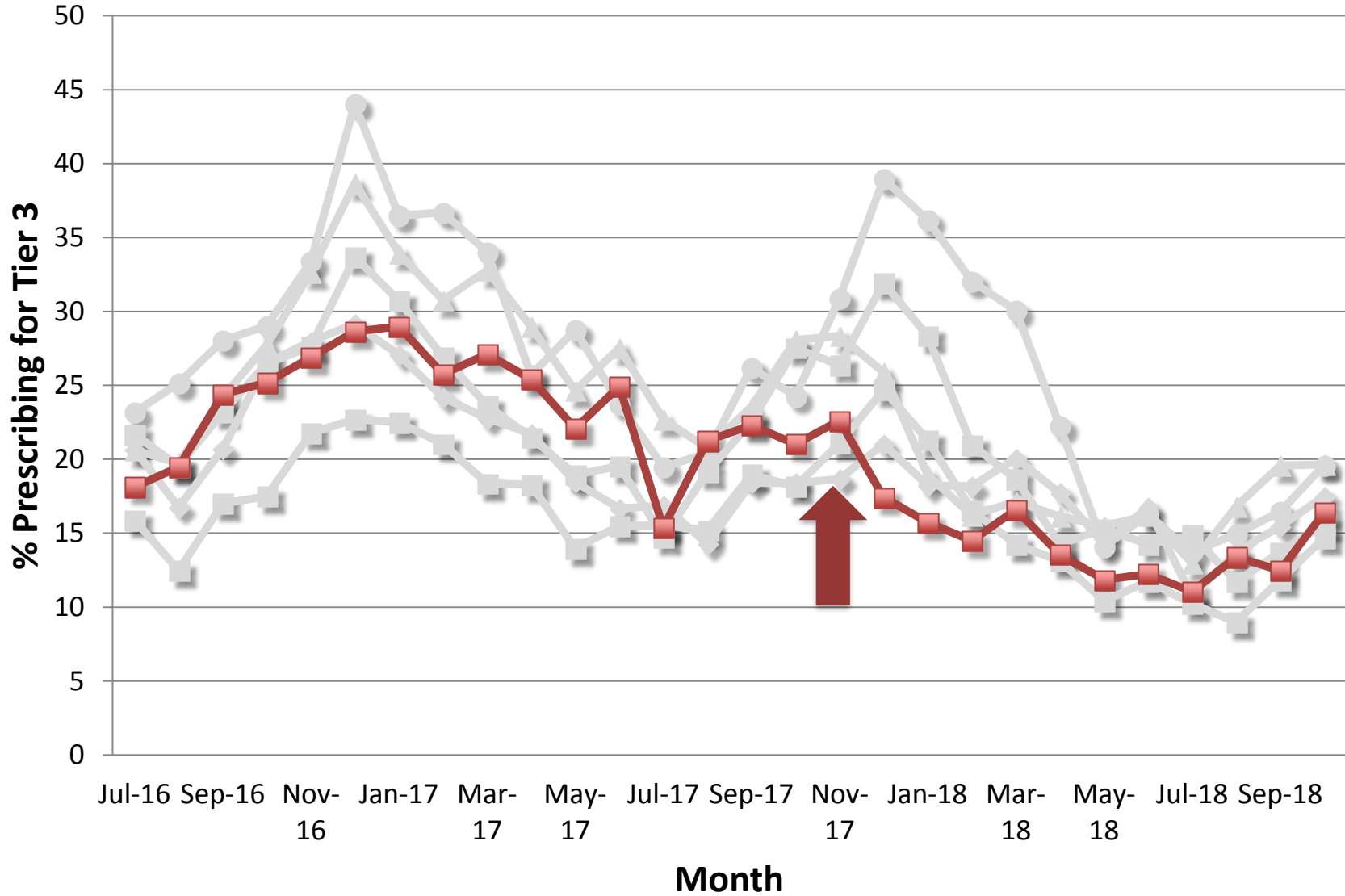
Prescribing by Cohort



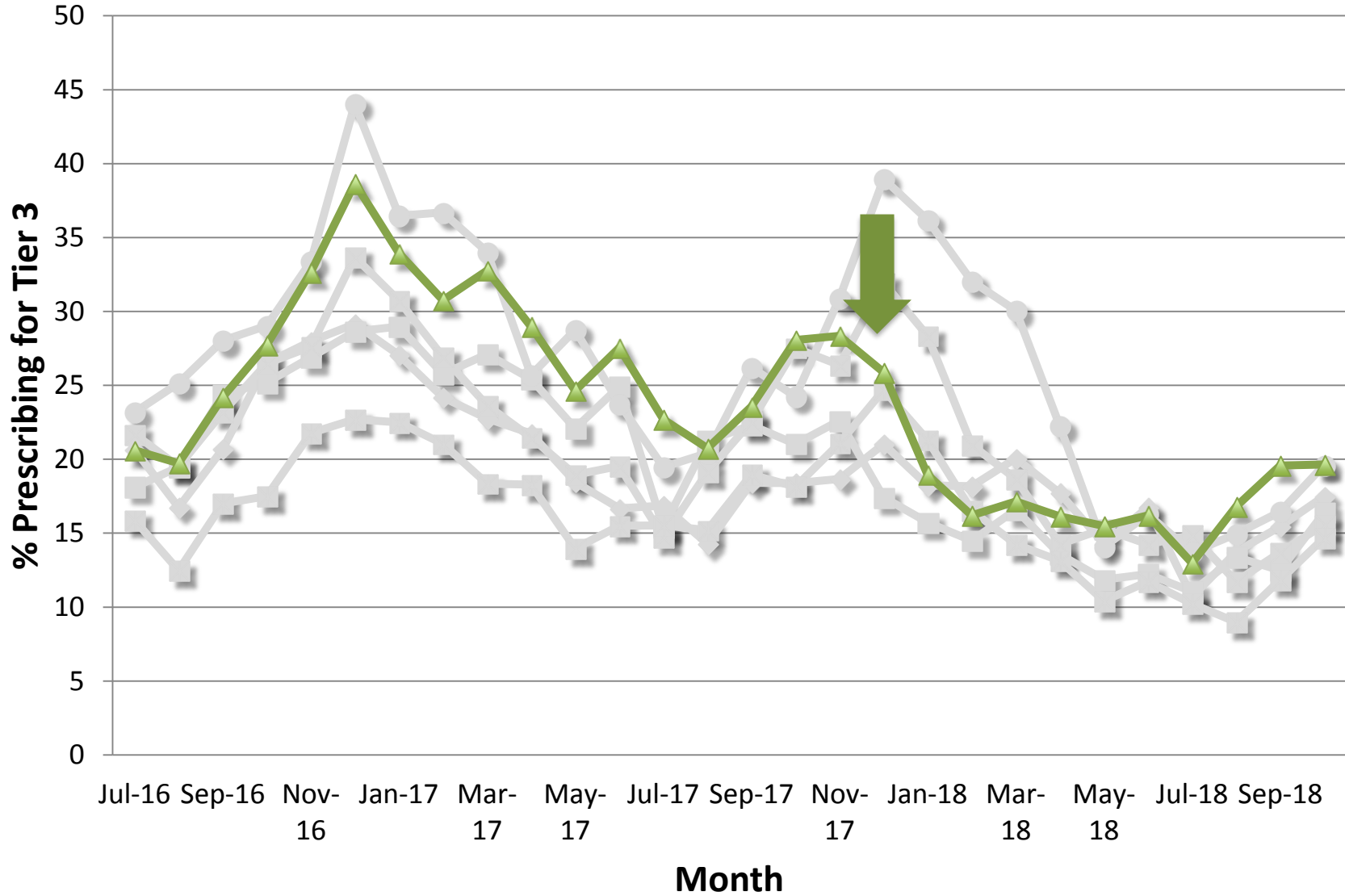
Prescribing by Cohort



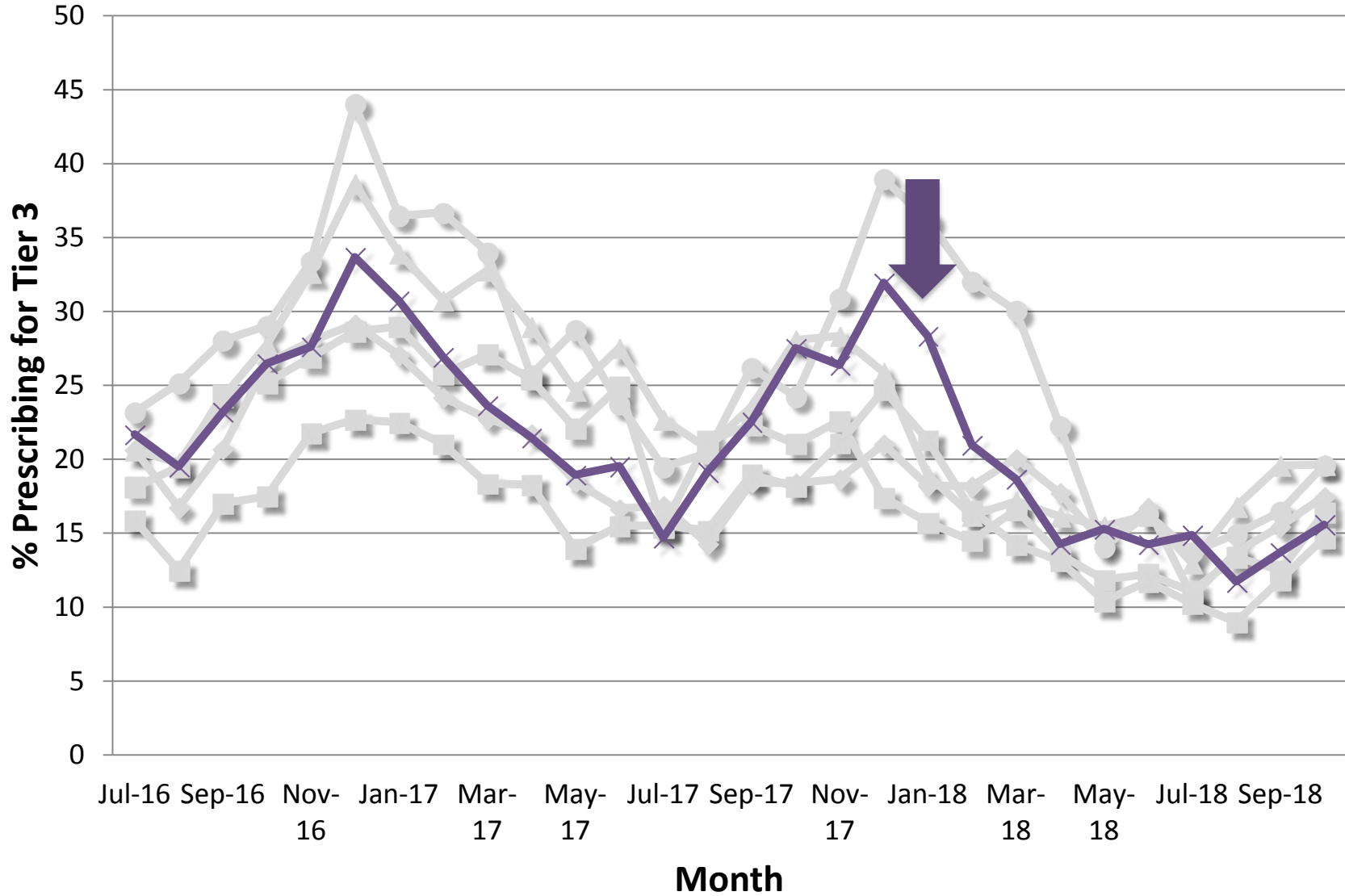
Prescribing by Cohort



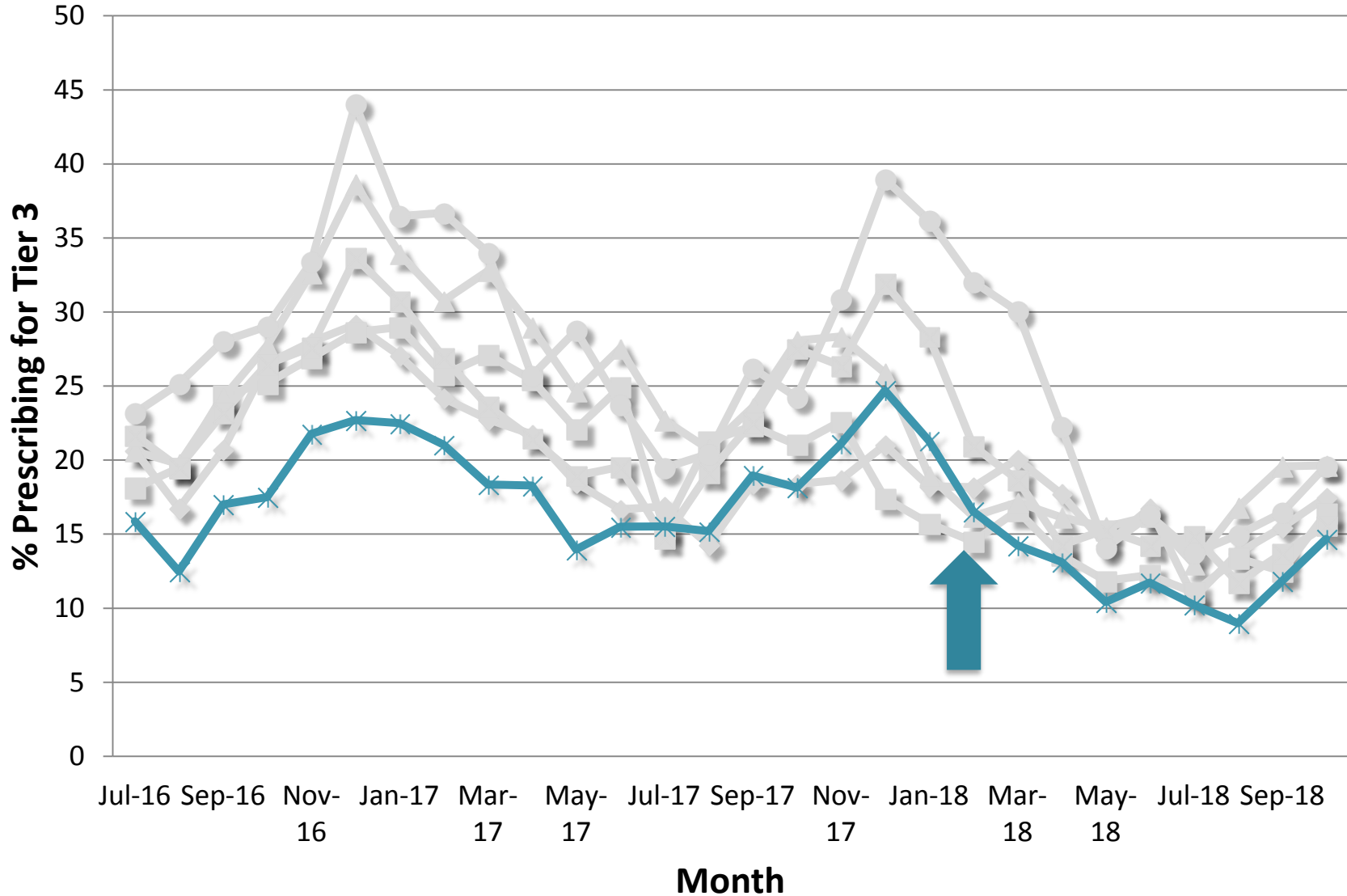
Prescribing by Cohort



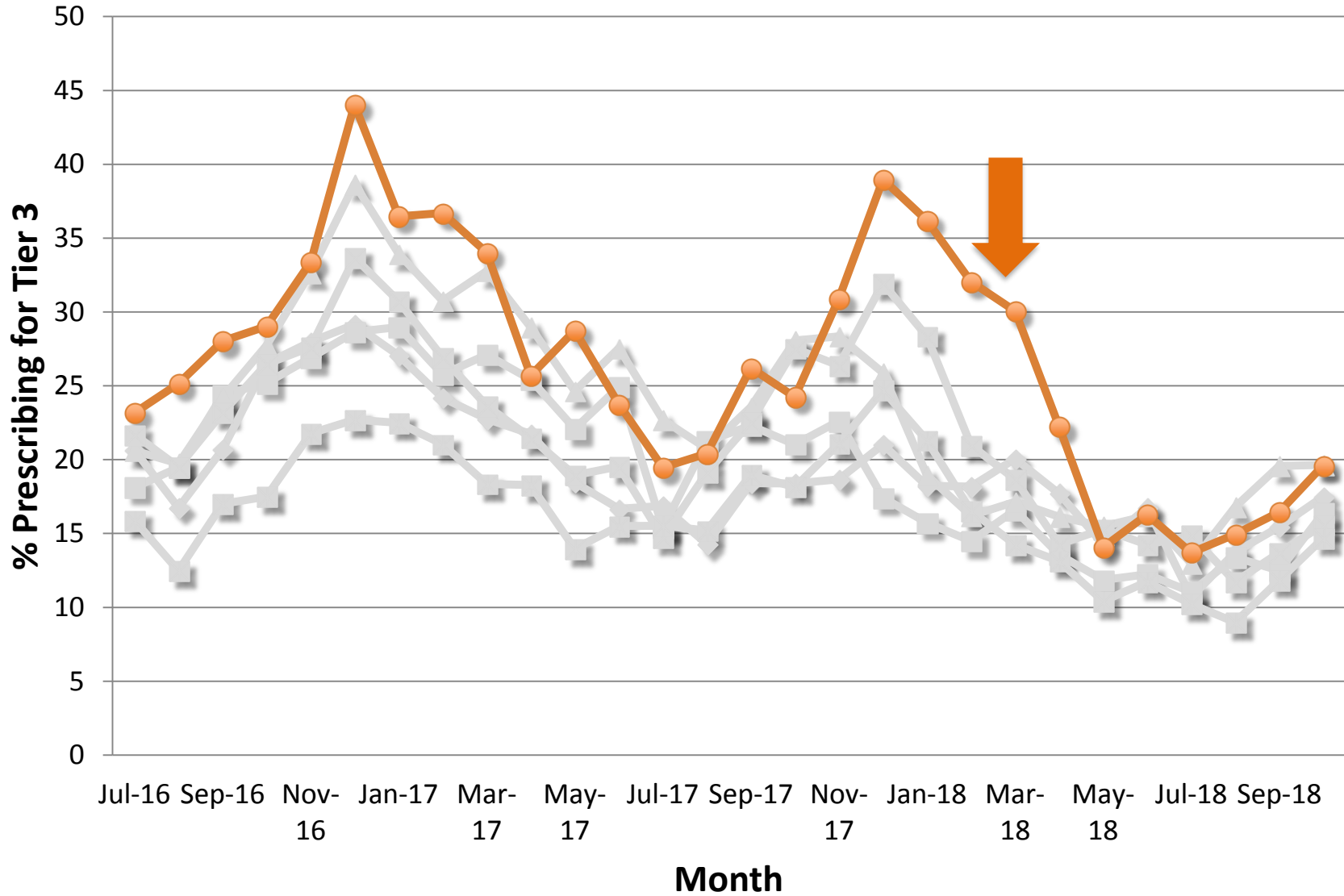
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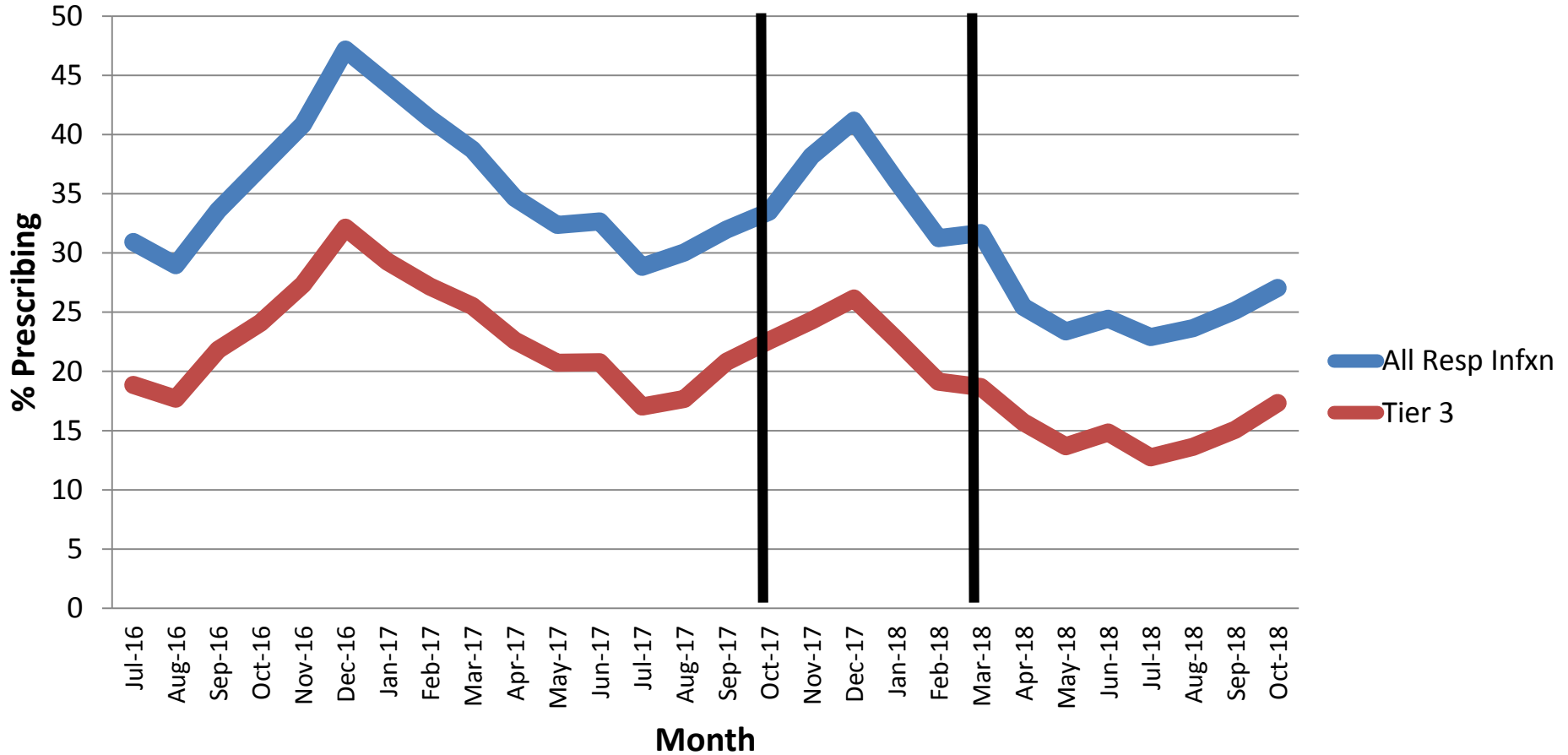
Prescribing by Cohort



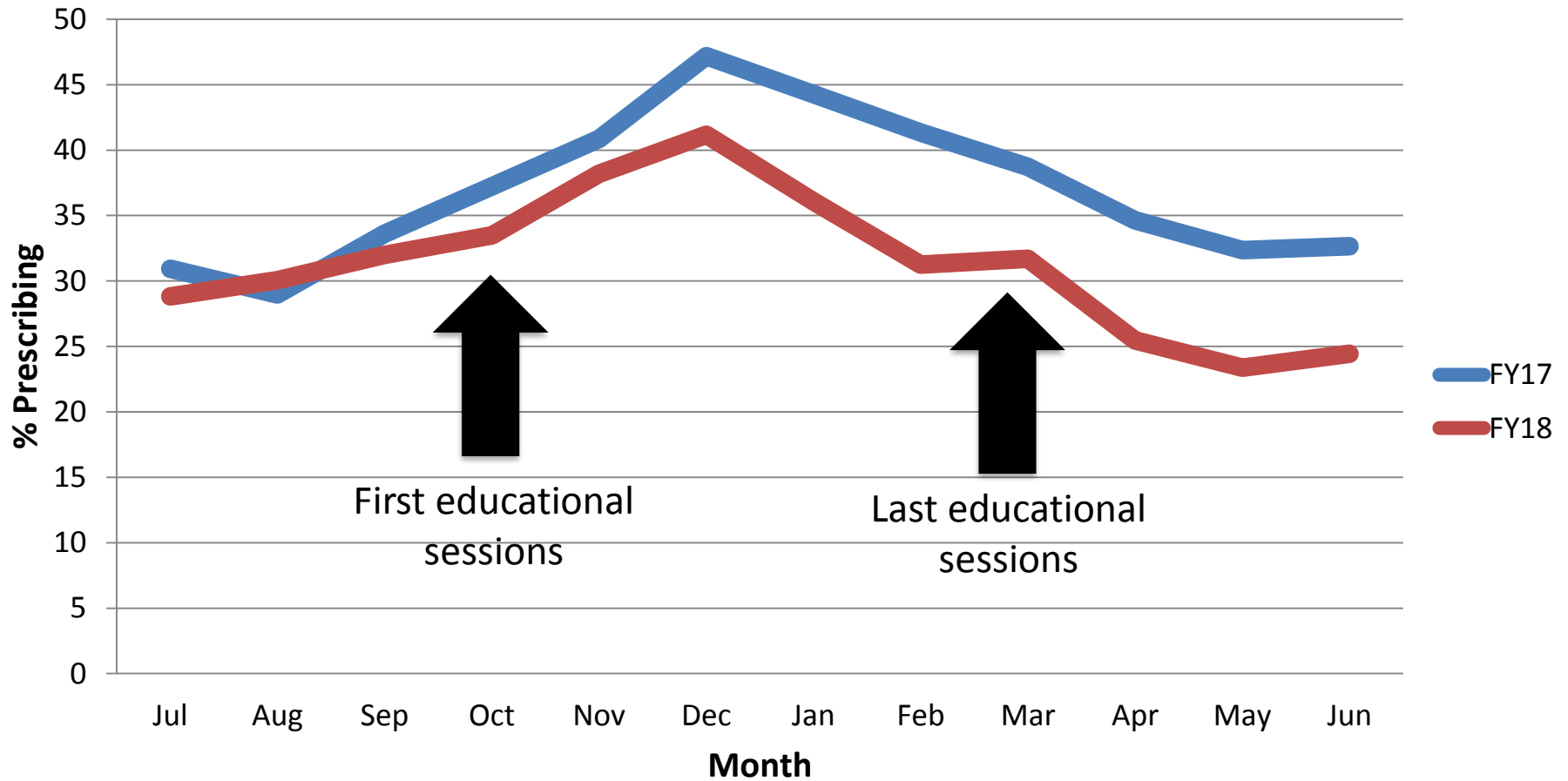
Prescribing by Cohort



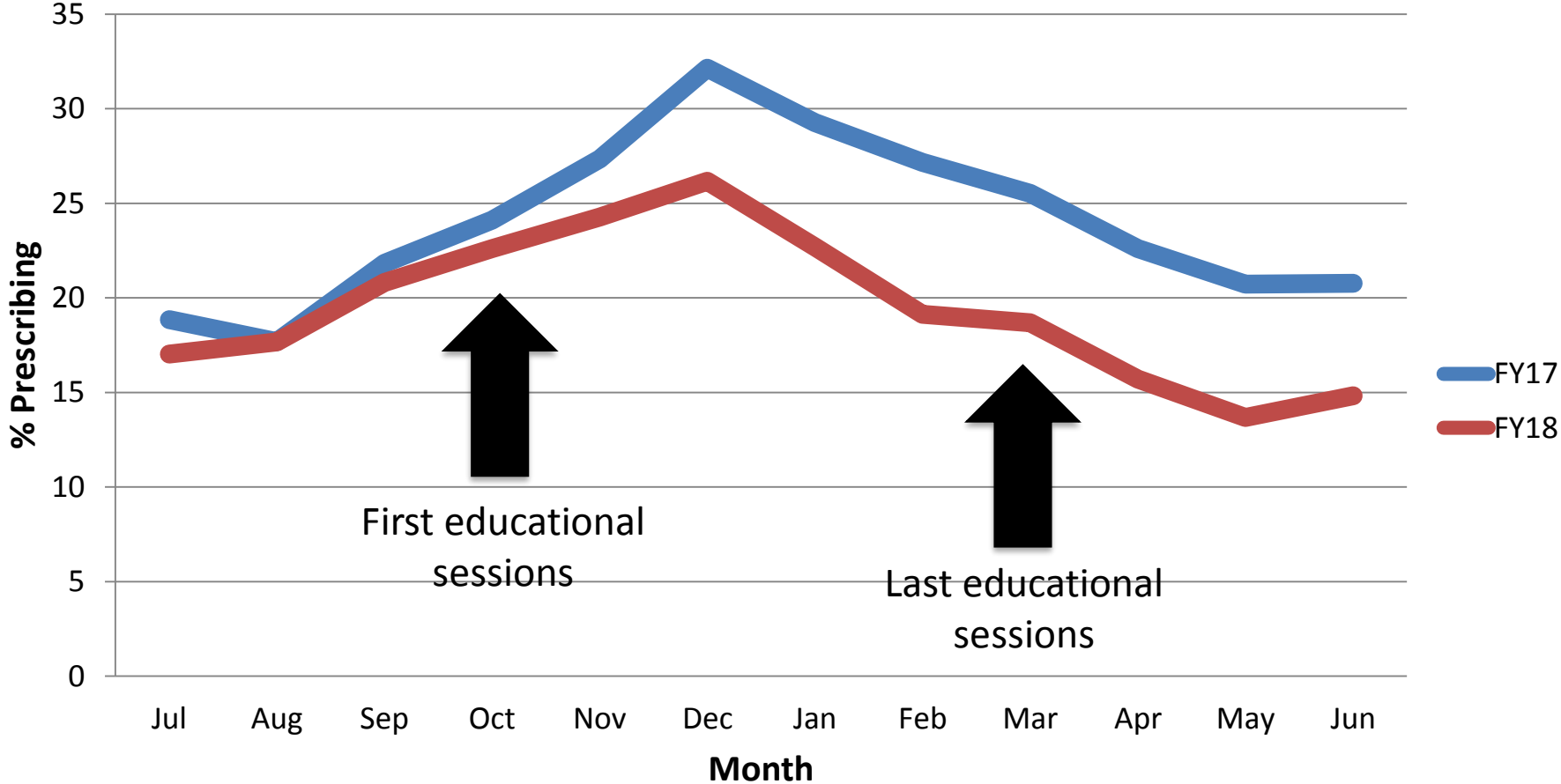
Antibiotic Prescribing



All Respiratory Infections



Tier 3 Infections



Specific Aim 1: Metrics

23% ↓

in prescribing for

All Respiratory

diagnosis visits

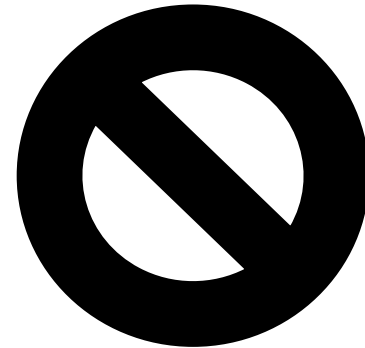


27% ↓

in prescribing for

Tier 3

diagnosis visits



Next Steps

- Qualitative study on mental models of prescribing compared to provider performance
- Association of intervention with patient satisfaction scores

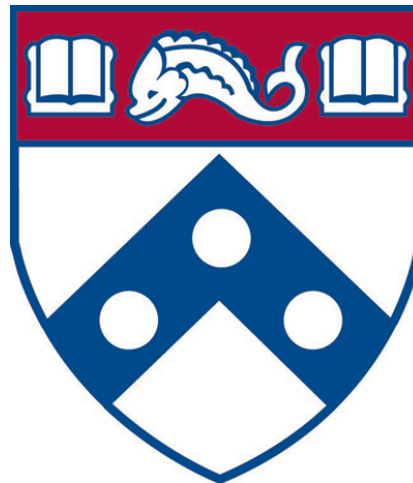
Conclusions

- Aggregate metrics can be created that correlate with appropriate antibiotic prescribing
- Educating prescribers and providing benchmarking using these metrics shows promise in decreasing antibiotic prescribing for respiratory infections
- Additional studies must identify why some providers respond to the intervention and others do not

Thank You!

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Delayed Prescribing



93%
used antibiotics



32%
used antibiotics



14%
used antibiotics

Antibiotic Use

