

Behavioral insights to improve healthcare quality

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Overview

Applications of Behavioral Economics
to curtail inappropriate antibiotic
prescribing in primary care

Real World Evidence and
Randomized Pragmatic Trials

ex·ter·nal·i·ty

ˌɛkstərˈnælədē/

noun

ECONOMICS

1. (negative) a type of behavior that imposes costs on other parties that are not taken into account when first making a decision



in·ter·nal·i·ty

In'tər'nalədē/

noun

BEHAVIORAL ECONOMICS

1. (negative) a type of behavior that imposes costs on a person in the long-run that are not taken into account when first making a decision.



IN HEALTH CARE...

1/3



of health care expenditures—an estimated \$750 billion!—don't improve health.

IN OTHER INDUSTRIES...

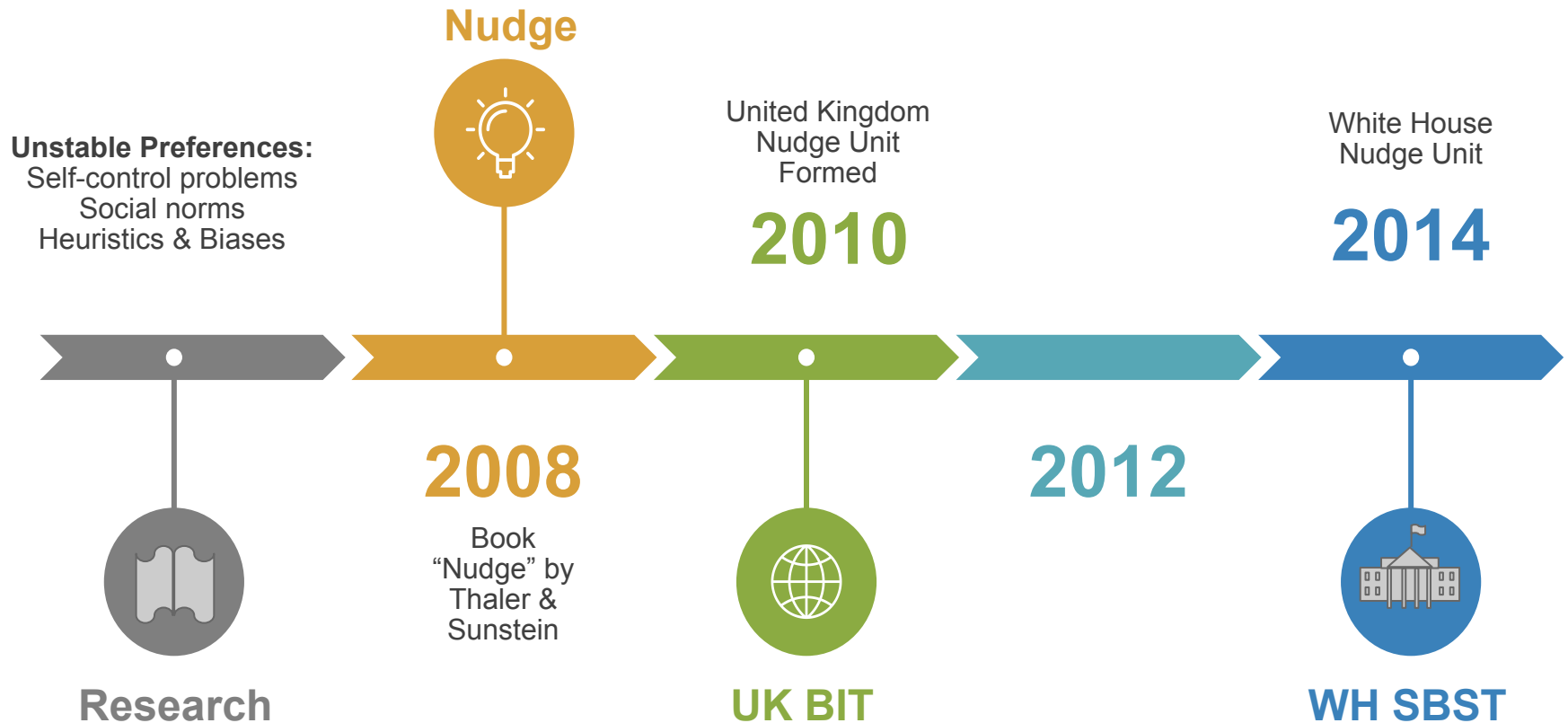


FACTORY ASSEMBLY LINES

are continually monitored to improve quality, identify inefficiencies, and remove waste.

What policies can improve the quality of decisions that are produced in healthcare?

Behavioral Science & Policy Timeline



Behavioral Insights



Decision Fatigue

Decision making gets worse with repeated decisions.



Choice Partitioning

We spread our choices over salient consumption options.



Public Commitments

Commitments bind our future self to desires our present self wants to fulfill.



Social Norms

We look to others for how we should act.



Justifications

We want others to approve of our behavior.



1.

Decision Fatigue

Decision making gets worse with repeated decisions



If you have to force yourself to do something you are less willing or able to exert self-control when the next challenge comes around. — Daniel Kahneman

Decision Fatigue: Judicial Decisions Revert to Path of Least Resistance

PNAS

Extraneous factors in judicial decisions

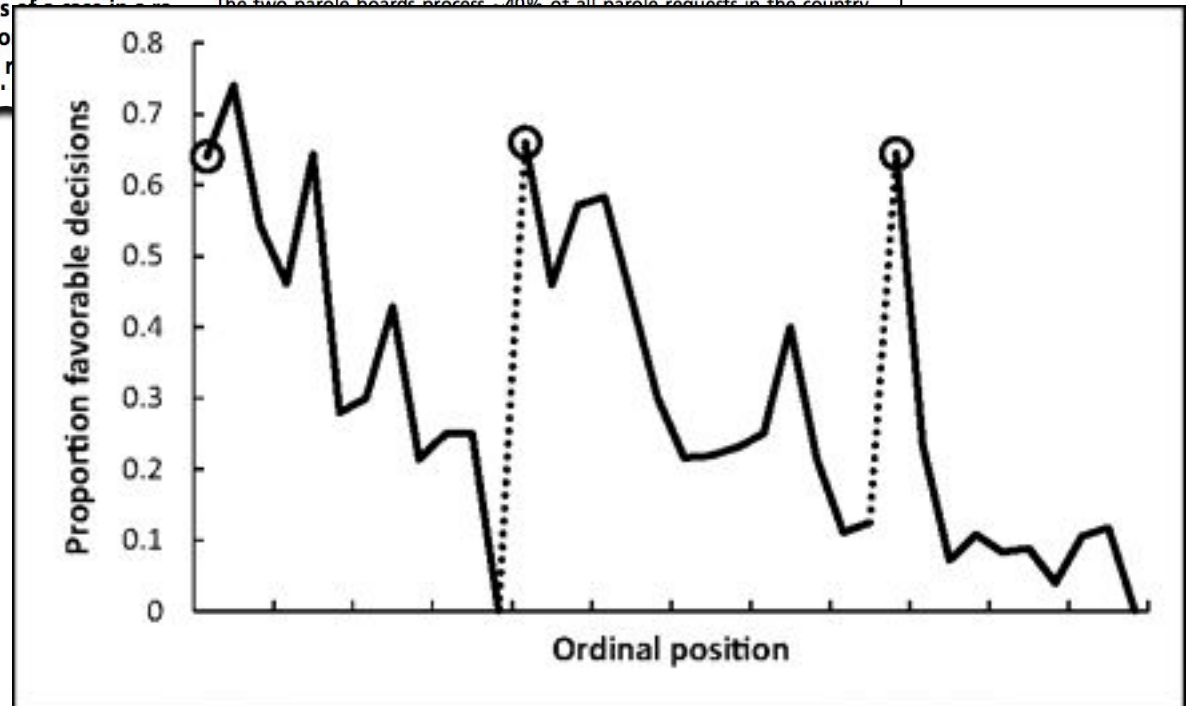
Shai Danziger^{a,1}, Jonathan Levav^{b,1,2}, and Liora Avnaim-Pesso^a

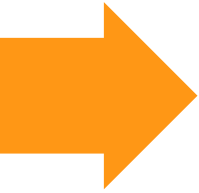
^aDepartment of Management, Ben Gurion University of the Negev, Beer Sheva 84105, Israel; and ^bColumbia Business School, Columbia University, New York, NY 10027

Edited* by Daniel Kahneman, Princeton University, Princeton, NJ, and approved February 25, 2011 (received for review December 8, 2010)

Are judicial rulings based solely on laws and facts? Legal formalism (29.3%), 50 Jewish-Israeli females (4.5%), and 9 Arab-Israeli females (0.9%). The two parole boards process ~40% of all parole requests in the country.

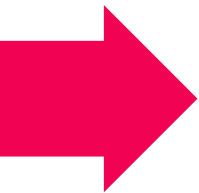
holds that judges apply legal reasons to the facts in a rational, mechanical, and deliberative manner. In contrast, legal realism argues that the rational application of legal principles is often replaced by extraneous factors such as emotions, fatigue, and the desire to avoid conflict.





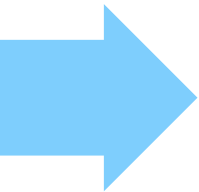
12.6%

of outpatient visits result in an antibiotic prescription



50%

of these are in appropriate



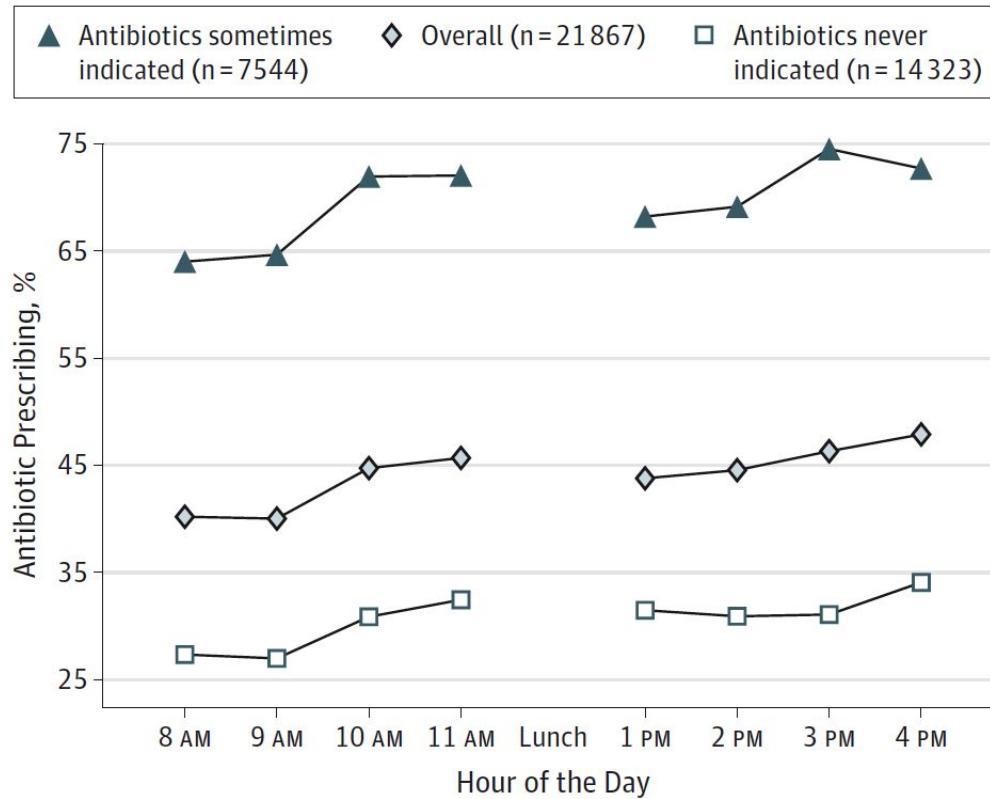
34,000,000

inappropriate outpatient prescriptions per year

JAMA Internal Medicine

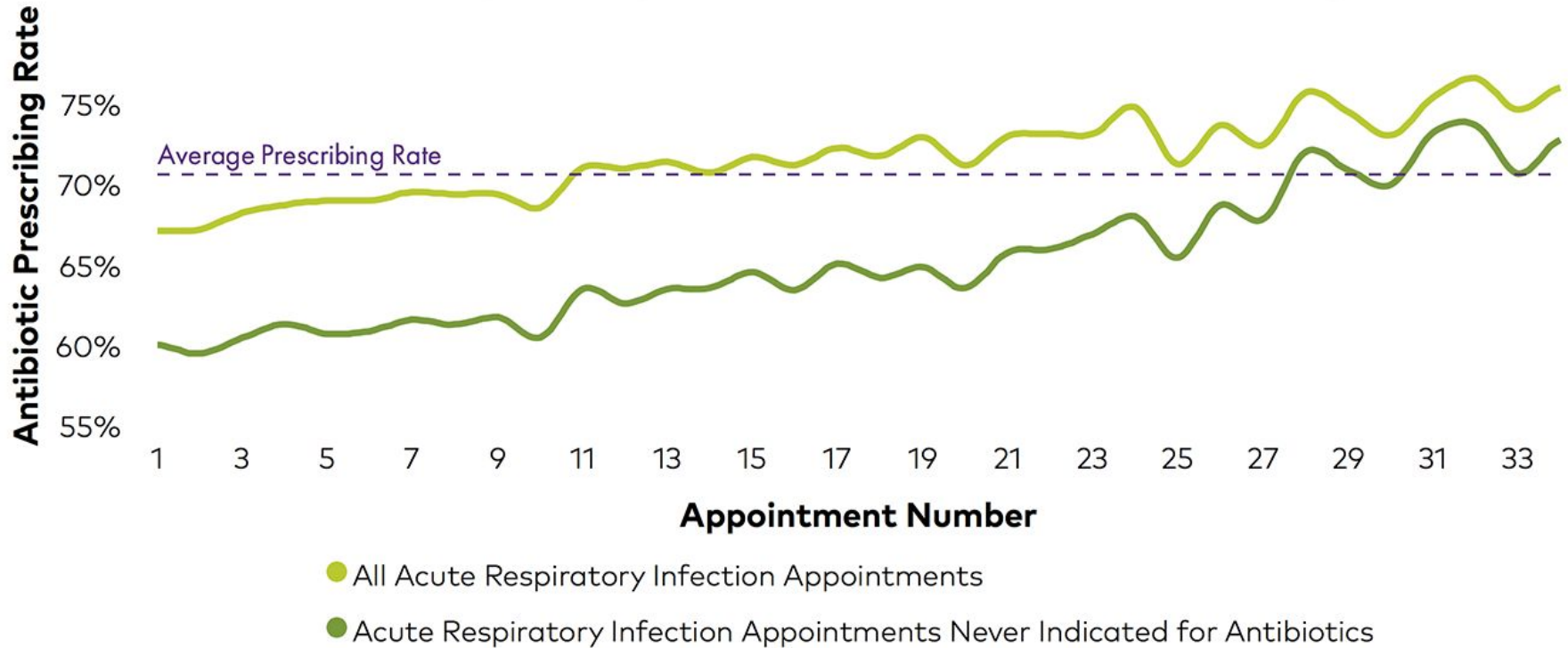
RESEARCH LETTER

Time of Day and the Decision to Prescribe Antibiotics



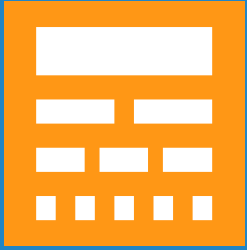
Replication: Athena Research

Antibiotic prescriptions over the course of a day



SOURCE: athenaResearch

<https://insight.athenahealth.com/expert-forum-decision-fatigue-antibiotics/>



2.

Choice Partitioning

People spread their choices over salient consumption options

Interface Design Effects in Wine Selection

Journal of Experimental Psychology: General
2005, Vol. 134, No. 4, 538–551

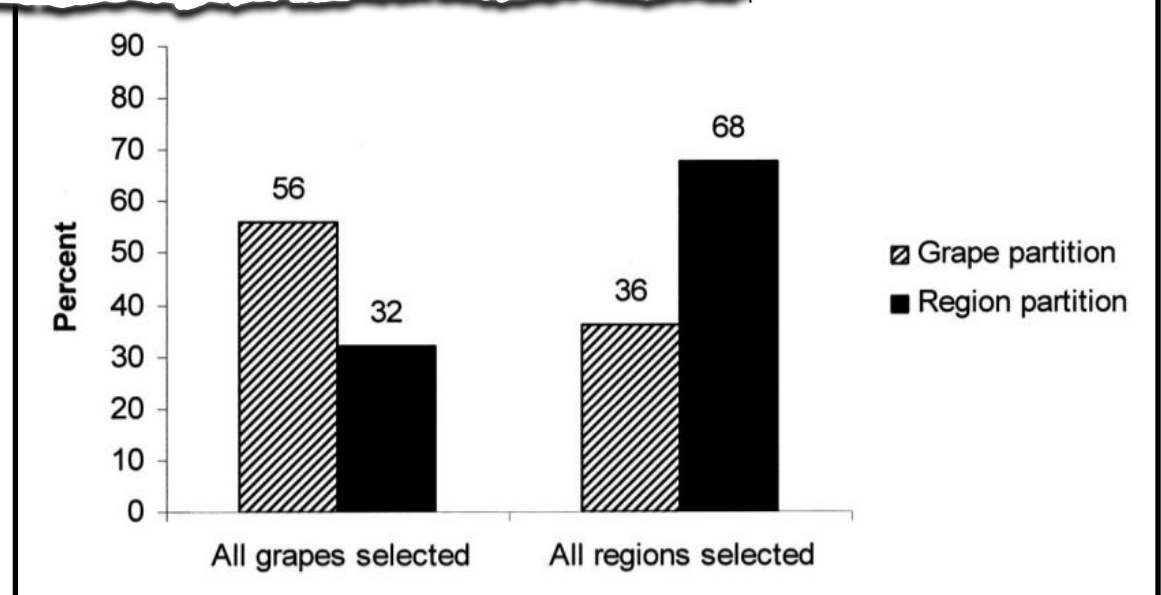
Copyright 2005 by the American Psychological Association
0096-3445/05/\$12.00 DOI: 10.1037/0096-3445.134.4.538

How Subjective Grouping of Options Influences Choice and Allocation: Diversification Bias and the Phenomenon of Partition Dependence

Craig R. Fox
University of California at Los Angeles

Rebecca K. Ratner
University of North Carolina at Chapel Hill

Daniel S. Lieb
Duke University



Nudging Physician Prescription Decisions by Partitioning the Order Set: Results of a Vignette-Based Study

David Tannenbaum, PhD¹, Jason N. Doctor, PhD², Stephen D. Persell, MD, MPH³, Mark W. Friedberg, MD, MPP^{4,5,8}, Daniella Meeker, PhD⁶, Elisha M. Friesema, BA³, Noah J. Goldstein, PhD⁷, Jeffrey A. Linder, MD, MPH^{5,8}, and Craig R. Fox, PhD⁷

¹UCLA Anderson School of Management, Los Angeles, CA, USA; ²Leonard D. Schaeffer Center for Health Policy and Economics, University of Southern California, Los Angeles, CA, USA; ³Division of General Internal Medicine and Geriatrics, Center for Healthcare Studies, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA; ⁴RAND, Boston, MA, USA; ⁵Harvard Medical School, Boston, MA, USA; ⁶Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA; ⁷UCLA Anderson School of Management, Department of Psychology, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA; ⁸Division of General Medicine and Primary Care, Brigham and Women's Hospital, Boston, MA, USA.

Interface Design: Partitioning

Acute Bronchitis

OTC medications visually grouped

Of the drug choices below, please indicate which drugs you would choose in treating this patient. You may select up to three options.

- albuterol inhaler
- an antibiotic of your choice
- robitussin with codeine
- tessalon perles

Over-the-counter drugs:

- cough lozenge
- cough spray
- cough syrup

Study

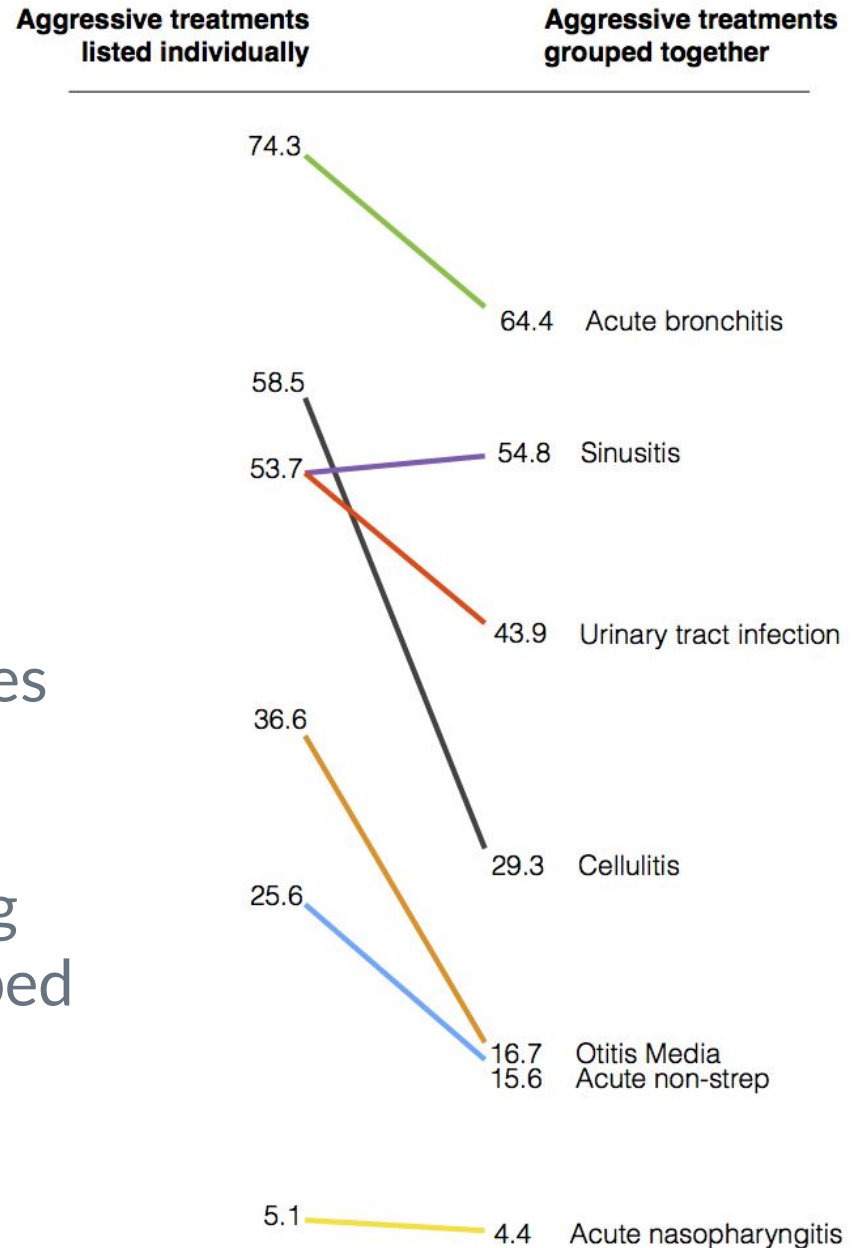
84 primary care clinicians

7 vignettes

Randomized (aggressive or nonaggressive grouped together)

Also randomized order of vignettes and positioning of grouped items

Overall, 12% decrease in choosing aggressive treatment when grouped ($p < .01$)





3.

Public Commitment

Commitments bind the future self to desires the present self wants to fulfill.

Public Commitment

Psychology
Marketing

Public Commitment as a Motivator for Weight Loss

Prashanth U. Nyer
Chapman University

Stephanie Dellande
University of New Orleans

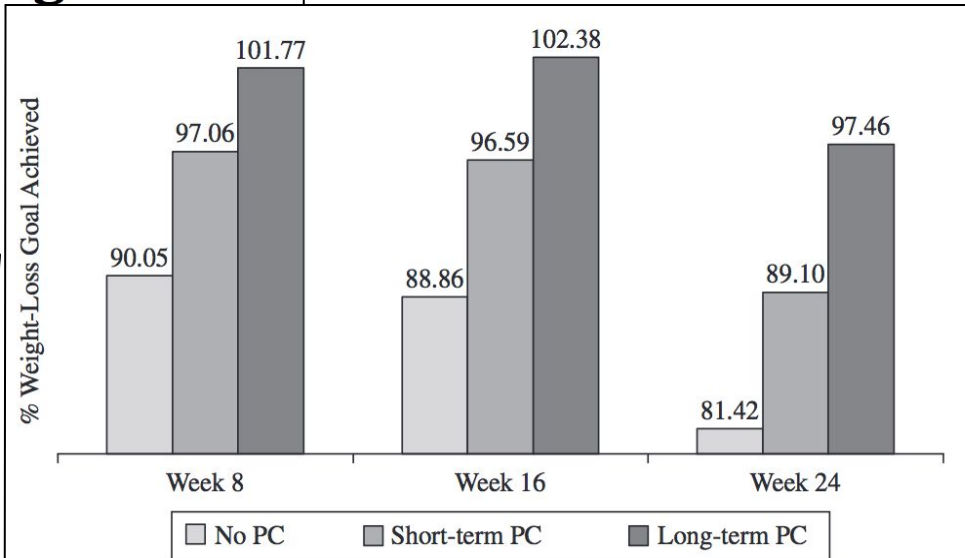


Figure 2. The effect of public commitment on weight loss.

Meals and Miles
Thursday

I'm running 8 miles on Saturday and riding my bike 50 miles on Monday. Hoping if I put these things out there, that they will actually happen. :)

State your own workout goals below. Let's help hold each other accountable through the holiday weekend.

Public Commitment

JAMA Internal Medicine

Original Investigation

Nudging Guideline-Concordant Antibiotic Prescribing A Randomized Clinical Trial

Daniella Meeker, PhD; Tara K. Knight, PhD; Mark W. Friedberg, MD, MPP; Jeffrey A. Linder, MD, MPH;
Noah J. Goldstein, PhD; Craig R. Fox, PhD; Alan Rothfeld, MD; Guillermo Diaz, MD; Jason N. Doctor, PhD

Safe Antibiotic Use: A Letter From Your Medical Group

Dear Patient,

We want to give you some important information about antibiotics.

Antibiotics, like penicillin, fight infections due to bacteria that can cause some serious illnesses. But these medicines can cause side effects like skin rashes, diarrhea, or yeast infections. If your symptoms are from a virus and not from bacteria, you won't get better with an antibiotic, and you could still get these bad side effects.

Antibiotics also make bacteria more resistant to them. This can make future infections harder to treat. This means that antibiotics might not work when you really need them. Because of this, it is important that you only use an antibiotic when it is necessary to treat your illness.

How can you help? Carefully follow your doctor's instructions on when you should or should not take antibiotics.

When you have a cough, sore throat, or other illness, ask your doctor for the best possible treatments. If an antibiotic is necessary, your doctor will explain this to you, and how to take it.

Your health is very important to us. As your doctors, we promise to treat your illness in the best way possible. We are also dedicated to avoid prescribing antibiotics when they are likely to do more harm than good.

If you have any questions, please feel free to ask your doctor, nurse, or pharmacist.

Sincerely,



El Uso Seguro de Antibióticos: Una Carta de su Grupo Médico

Estimado Paciente:

Queremos compartir información importante con usted sobre los antibióticos.

Los antibióticos como la penicilina ayudan a combatir infecciones debido a bacterias que pueden causar serias enfermedades. Pero estas medicinas también tienen efectos secundarios como erupciones de la piel, diarrea, o infecciones por hongos de levadura. Si sus síntomas son debidos a un virus y no por una bacteria, no se mejorará con un antibiótico, y usted aún puede obtener estos efectos secundarios no deseables.

Los antibióticos también pueden hacer la bacteria más resistente a ellas. Esto hará que infecciones en el futuro sean más difíciles de tratar. Eso significa que los antibióticos no trabajarán cuando ustedes en realidad necesitan que funcionen. Por eso es importante que los use solo cuando sea necesario.

Your health is very important to us. As your doctors, we promise to treat your illness in the best way possible. We are also dedicated to avoid prescribing antibiotics when they are likely to do more harm than good.

mejor para usted.

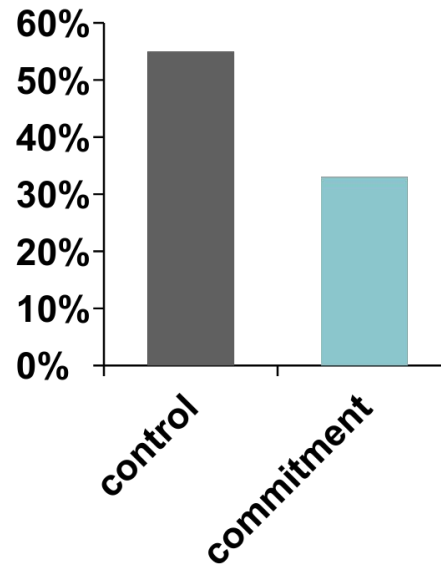
Su salud es importante para nosotros. Como sus doctores, nosotros prometemos tratar su enfermedad en la mejor manera posible. También nos comprometemos a evitar recetar antibióticos cuando sean probables de hacer más daño que bien.

Si tiene cualquier pregunta, pregúntele a su doctor, enfermera, o farmacéutico.

Atentamente,



Results: Public commitment



| Characteristic | Poster Condition | | Control Condition | |
|---|-------------------------------------|---------------------|---------------------|---------------------|
| | 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.

^b $P=.02$ for the difference.

^a Adjusted for demographic characteristics and insurance status.

JAMA – Internal Medicine, 174, 425-431, 2014.



4. & 5.

Social Norms & Justifications

We look to others for how we should act. We want others to approve of our behavior.

Effect of Behavioral Interventions on Inappropriate Antibiotic Prescribing Among Primary Care Practices A Randomized Clinical Trial

Daniella Meeker, PhD; Jeffrey A. Linder, MD, MPH; Craig R. Fox, PhD; Mark W. Friedberg, MD, MPP;
Stephen D. Persell, MD, MPH; Noah J. Goldstein, PhD; Tara K. Knight, PhD; Joel W. Hay, PhD; Jason N. Doctor, PhD

Specific Aim

- To evaluate 3 behavioral interventions to reduce inappropriate antibiotic prescribing for acute respiratory infections
 - 3 health systems using 3 different EHRs

Interventions

1. Suggested Alternatives
2. Accountable Justification
3. Peer Comparison

Intervention 1: Suggested Alternatives

20567913 (BWH) 01/01/1960 (54 yrs.) F BIMA

Home Select Desktop Pt Chart: Medications Custom Reports Admin Sign Results ? Resource Popup

Allergies: ACE Inhibitors - Angioedema, Rash / Morphine - Dystonia Unknown No Insurance Found

Patient Info As of 11/07/13 Refresh

Add New Medication

Medication: **Amoxicillin** Route: Search Favorites Cancel

Found in Practice Favorites

| | | | | |
|--------------------------|-------------------------|--|----|------------------------------|
| U Rx-Gen | Unknown | AMOXICILLIN 2000 MG PO X1 | PO | Alternatives |
| U Rx-Gen | Unknown | AMOXICILLIN 250 MG PO TID 7 day(s) | PO | Alternatives |
| U | | AMOXICILLIN 500MG, 1 PO TID | PO | |

Found in Medication Dictionary

| Type | Retail Copay | Medication | Route | Restrictions | Alternatives |
|--------------------------|-------------------------|--|-------|--------------|------------------------------|
| U Rx-Gen | Unknown | AMOXICILLIN | PO | | Alternatives |
| U Rx-Gen | Unknown | AMOXICILLIN EXTENDED RELEASE | PO | | Alternatives |
| U Rx-Gen | Unknown | AMOXICILLIN/CLAV. SUSP 400 MG/57 MG (5 ML) | PO | | Alternatives |
| U Rx-Gen | Unknown | AMOXICILLIN/CLAV.ACID 250/125 (AMOX./CLAV.ACID ... | PO | | Alternatives |
| U Rx-Gen | Unknown | AMOXICILLIN/CLAV.ACID 500/125 (AMOX./CLAV.ACID ... | PO | | Alternatives |
| U Rx-Gen | Unknown | AMOXICILLIN/CLAV.ACID 875/125 | PO | | Alternatives |

Intervention 1: Suggested Alternatives

The screenshot displays a medical software interface with a patient record for 20567913 (BWH), born 01/01/1960 (54 yrs.) F. The interface includes a navigation menu with options like Home, Select, Desktop, Pt Chart: Medications, Custom, Reports, Admin, Sign, Results, ?, Resource, and Popup. A red box highlights the 'Allergies' section, listing 'ACE Inhibitors - Angioedema, Rash / Morphine - Dystonia'. A dropdown menu shows 'Unknown' and 'No Insurance Found'. A dialog box titled 'BEARI Study -- Webpage Dialog' is open, asking: 'Are you prescribing this antibiotic for an acute respiratory infection (ARI)?'. The dialog box has three buttons: 'Yes', 'No', and 'Cancel'. The 'Yes' button is highlighted with a dotted border. The background shows a list of medications, including 'AMOXICILLIN/CLAV. ACID 875/125' and 'AMOXICILLIN/CLAV. ACID 875/125 (5 ML)'.

20567913 (BWH) 01/01/1960 (54 yrs.) F BIMA

Home Select Desktop Pt Chart: Medications Custom Reports Admin Sign Results ? Resource Popup

Allergies: ACE Inhibitors - Angioedema, Rash / Morphine - Dystonia Unknown No Insurance Found

BEARI Study -- Webpage Dialog

Are you prescribing this antibiotic for an acute respiratory infection (ARI)?

Yes No Cancel

U Rx- AMOXICILLIN/CLAV. ACID 875/125 PO Alternatives

U Rx- AMOXICILLIN/CLAV. ACID 875/125 (5 ML) Alternatives

Intervention 1: Suggested Alternatives

The screenshot displays a medical software interface with a patient record at the top: 20567913 (BWH), 01/01/1960 (54 yrs.) F, and BIMA. A navigation bar includes Home, Select, Desktop, Pt Chart: Medications, Custom, Reports, Admin, Sign, Results, ?, Resource, and Popup. A sidebar on the left contains sections for Allergies, Medications, and a list of Rx-Gen items. A central dialog box titled 'BEARI Study -- Webpage Dialog' prompts the user to 'Please select Principal ARI diagnosis:'. The options are: Non-specific upper respiratory infection, Sinusitis, Pharyngitis, Acute bronchitis, Otitis media, Influenza, Pneumonia, and Other with an adjacent text input field. 'Ok' and 'Cancel' buttons are at the bottom of the dialog. The background interface shows a medication entry for 'AMOXICILLIN/CLAV.ACID 875/125' with a 'PO' route and an 'Alternatives' dropdown menu.

Intervention 1: Suggested Alternatives

| | | | | | | | | | | | |
|--|------------------------|---------|-----------------------|--------|---------|-------|------|---------|---|----------|-------|
| 20567913 (BWH) | 01/01/1960 (54 yrs.) F | | | | | | | | | BIMA | |
| Home | Select | Desktop | Pt Chart: Medications | Custom | Reports | Admin | Sign | Results | ? | Resource | Popup |
| Warning | | | | | | | | | | | |
| You are ordering: AMOXICILLIN | | | | | | | | | | | |
| Alert Message: | | | | | | | | | | | |
| Antibiotics are not generally indicated for non-specific upper respiratory infections. Please consider the following alternative prescriptions, treatments, and materials to help your patient. | | | | | | | | | | | |
| Alternatives | | | | | | | | | | | |
| Over-the-counter medications | | | | | | | | | | | |
| Decongestants | | | | | | | | | | | |
| <input type="checkbox"/> Oxymetazoline HCL (0.05 % SPRAY) 2 SPRAY (0.05 % SPRAY) NAS BID or PRN but no more frequently than every 6 hours. Do not use more than 3 days. Dispense: 1 Bottle(s) Refills: 0 | | | | | | | | | | | |
| <input type="checkbox"/> Pseudoephedrine (30 MG TABLET) 60 MG (30 MG TABLET Take 2) PO Q6H PRN as needed for nasal congestion. Dispense: 50 Tablet(s) Refills: 0 | | | | | | | | | | | |
| Antihistamines | | | | | | | | | | | |
| <input type="checkbox"/> Diphenhydramine ORAL (25 MG TABLET) 25 MG (25 MG TABLET Take 1) PO Q6H PRN not to exceed 6 doses in 24 hours. Dispense: 24 Tablet(s) Refills: 0 | | | | | | | | | | | |
| <input type="checkbox"/> Loratadine (10 MG TABLET) 10 MG (10 MG TABLET Take 1) PO QD PRN Dispense: 30 Tablet(s) Refills: 0 | | | | | | | | | | | |

Intervention 1: Suggested Alternatives

| | | | | | | | | | | | |
|--|------------------------|---------|-----------------------|--------|---------|-------|------|---------|---|----------|-------|
| 20567913 (BWH) | 01/01/1960 (54 yrs.) F | | | | | BIMA | | | | | |
| Home | Select | Desktop | Pt Chart: Medications | Custom | Reports | Admin | Sign | Results | ? | Resource | Popup |
| fever. Dispense: 28 Tablet(s) Refills: 0 | | | | | | | | | | | |
| Cough suppressants and expectorants | | | | | | | | | | | |
| <input type="checkbox"/> Benzonatate (100 MG CAPSULE) 100 MG (100 MG CAPSULE Take 1) PO Q4H PRN for cough. Do not take more than 6 capsules in 1 day. Dispense: 30 Capsule(s) Refills: 0 | | | | | | | | | | | |
| <input type="checkbox"/> Guaifenesin AC (100-10MG/5 LIQUID) 5 ML (100-10MG/5 LIQUID) PO Q4H PRN for cough Dispense: 180 ML(s) Refills: 0 | | | | | | | | | | | |
| Bronchodilators | | | | | | | | | | | |
| <input type="checkbox"/> Albuterol INHALER HFA (90 MCG HFA AER AD) 2 PUFF (90 MCG HFA AER AD) INH Q6H PRN for cough Dispense: 1 Inhaler(s) Refills: 0 | | | | | | | | | | | |
| "Excuse from work" Patient Letter. | | | | | | | | | | | |
| Select patient's Days Off work <input type="text" value="4"/> | | | | | | | | | | | |
| <input type="checkbox"/> Save As Note | | | | | | | | | | | |
| <input type="button" value="Preview"/> <input type="button" value="Print"/> | | | | | | | | | | | |
| Print patient educational materials. | | | | | | | | | | | |
| <input type="button" value="Preview"/> <input type="button" value="Print"/> | | | | | | | | | | | |
| <input type="checkbox"/> If you still want to prescribe an antibiotic, please check the box | | | | | | | | | | | |

Intervention 2: Accountable Justification

BestPractice Advisory - Zztest,Bearistudyfive


▼ Text Alerts (1 Advisory)

Antibiotics are not generally indicated for acute bronchitis

▼ Justifications (1 Advisory)

You have prescribed antibiotics for a likely viral diagnosis. Please click the Enter Justification button below and write your justification for prescribing antibiotics in the comment box. This justification will be entered into the patient's record.

If you do not enter a justification into the comment box, the phrase "No justification for prescribing antibiotics was given." will appear in the patient's record. Click Accept when you are finished.

Acknowledge reason:  [Close](#)

[Click this box and enter ARI justificati...](#)

Interventions 1 and 2: Combined

BestPractice Advisory - Zztest ,Bearistudyfive

▼ Text Alerts (1 Advisory)

▼ Antibiotics are not generally indicated for acute bronchitis

▼ Justifications (2 Advisories)

▼ Please consider the symptomatic treatment options and patient instructions for this condition

Open SmartSet: VIRAL ACUTE RESPIRATORY INFECTION AP1 WITHOUT FLU [preview](#)

▼ You have prescribed antibiotics for a likely viral diagnosis. Please click the Enter Justification button below and write your justification for prescribing antibiotics in the comment box. This justification will be entered into the patient's record.

If you do not enter a justification into the comment box, the phrase "No justification for prescribing antibiotics was given." will appear in the patient's record. Click Accept when you are finished.

Acknowledge reason: [Close](#)

[Click this box and enter ARI justificati...](#)

Intervention 3: Peer Comparison

“You are a Top Performer”

You are in the top 10% of clinicians. You wrote 0 prescriptions out of 21 acute respiratory infection cases that did not warrant antibiotics.

“You are not a Top Performer”

Your inappropriate antibiotic prescribing rate is 15%. Top performers' rate is 0%. You wrote 3 prescriptions out of 20 acute respiratory infection cases that did not warrant antibiotics.

Interventions: Summary

***EHR-based
Nudges***

***Social
Motivation***

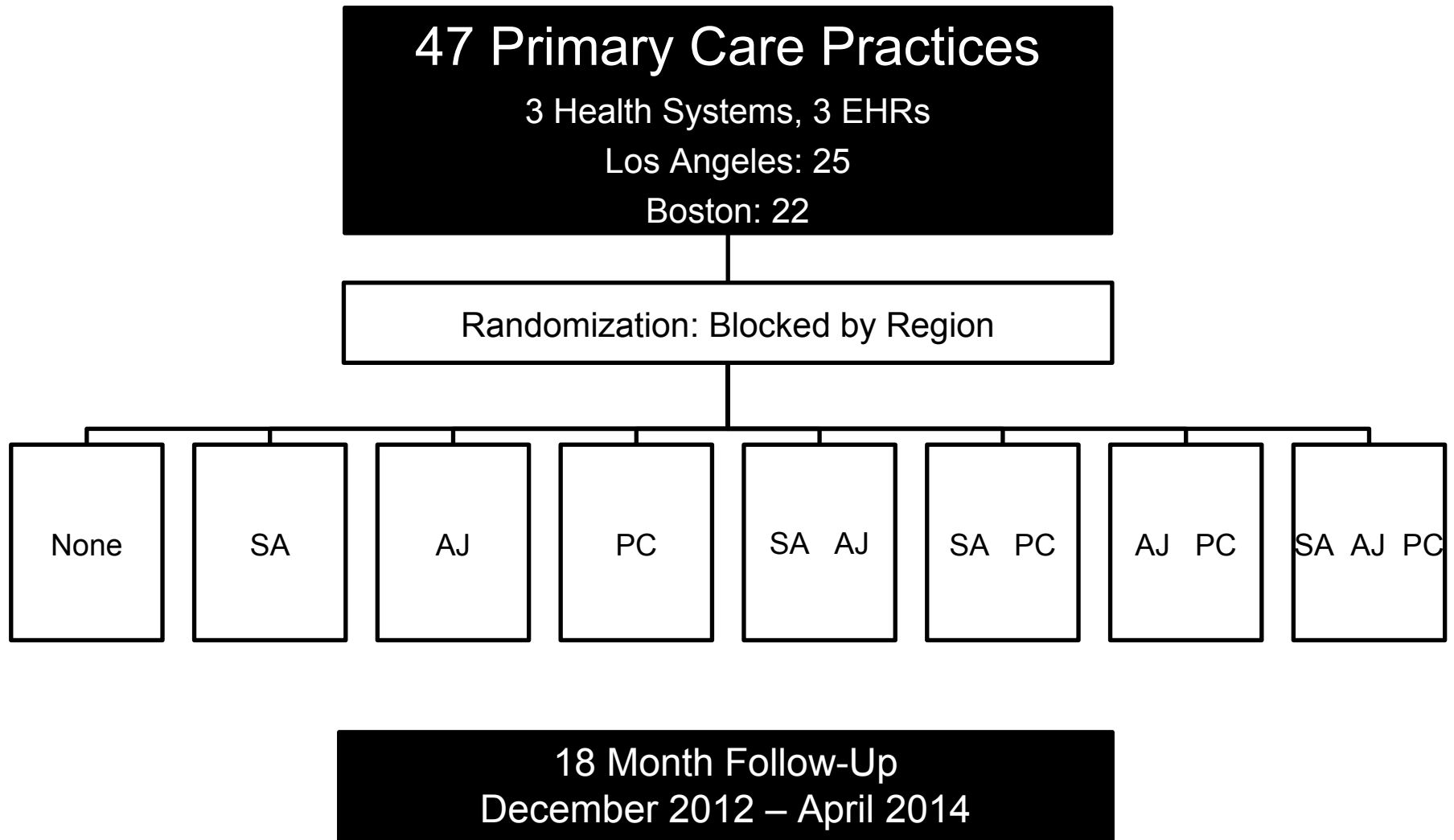
Suggested
Alternatives

Accountable
Justification

Peer
Comparison



Methods: Practices and Randomization



Methods: Enrollment

- ***Invited:*** 355 clinicians
- ***Enrolled:*** 248 (70%)
 - Consent
 - Education
 - Practice-specific orientation to intervention
 - Honorarium

Methods: Primary Outcome

- ***Antibiotic prescribing for non-antibiotic-appropriate diagnoses***
 - Non-specific upper respiratory infections
 - Acute bronchitis
 - Influenza
- ***Excluded:*** chronic lung disease, concomitant infection, immunosuppression
- ***Data Sources:*** EHR and billing data

Methods: Analysis

- **Trajectory Analysis: Piecewise generalized linear model with a knot at month 0**
 - 18-month baseline + 18-month intervention
 - Model testing to evaluate interaction effects
- ***Simple Difference in Differences (DD)***
 - Marginal probabilities predicted from DD

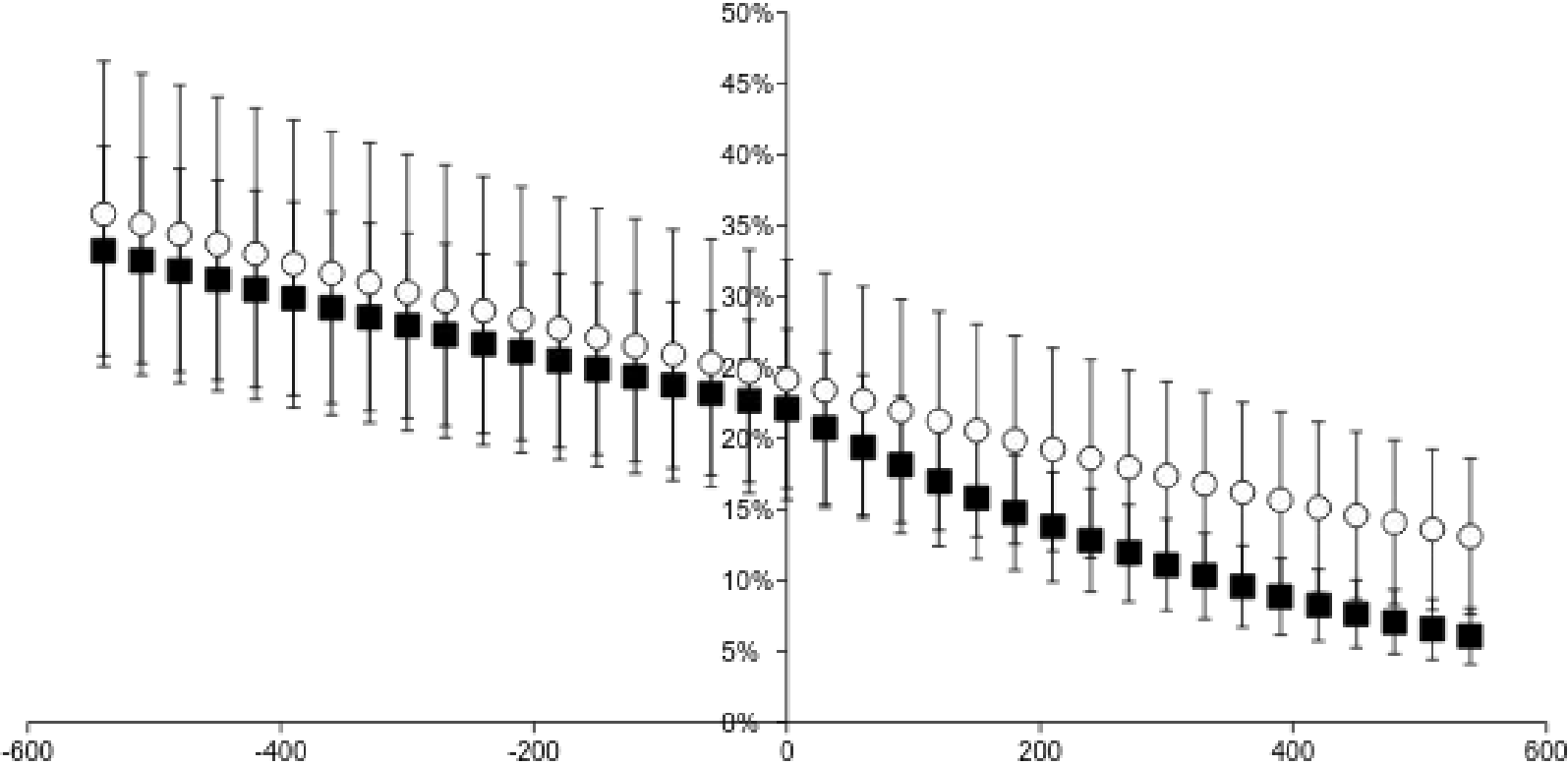
Results: Clinicians (N = 248)

| | Control | Suggested Alternatives | Accountable Justification | Peer Comparison |
|----------------|---------|------------------------|---------------------------|-----------------|
| Age, mean | 47 | 49 | 48 | 48 |
| | % | | | |
| Female | 48 | 68 | 61 | 61 |
| Clinician Type | | | | |
| Physician | 81 | 79 | 81 | 80 |
| PA or NP | 19 | 21 | 19 | 20 |

Results: Visits (N = 16,959)

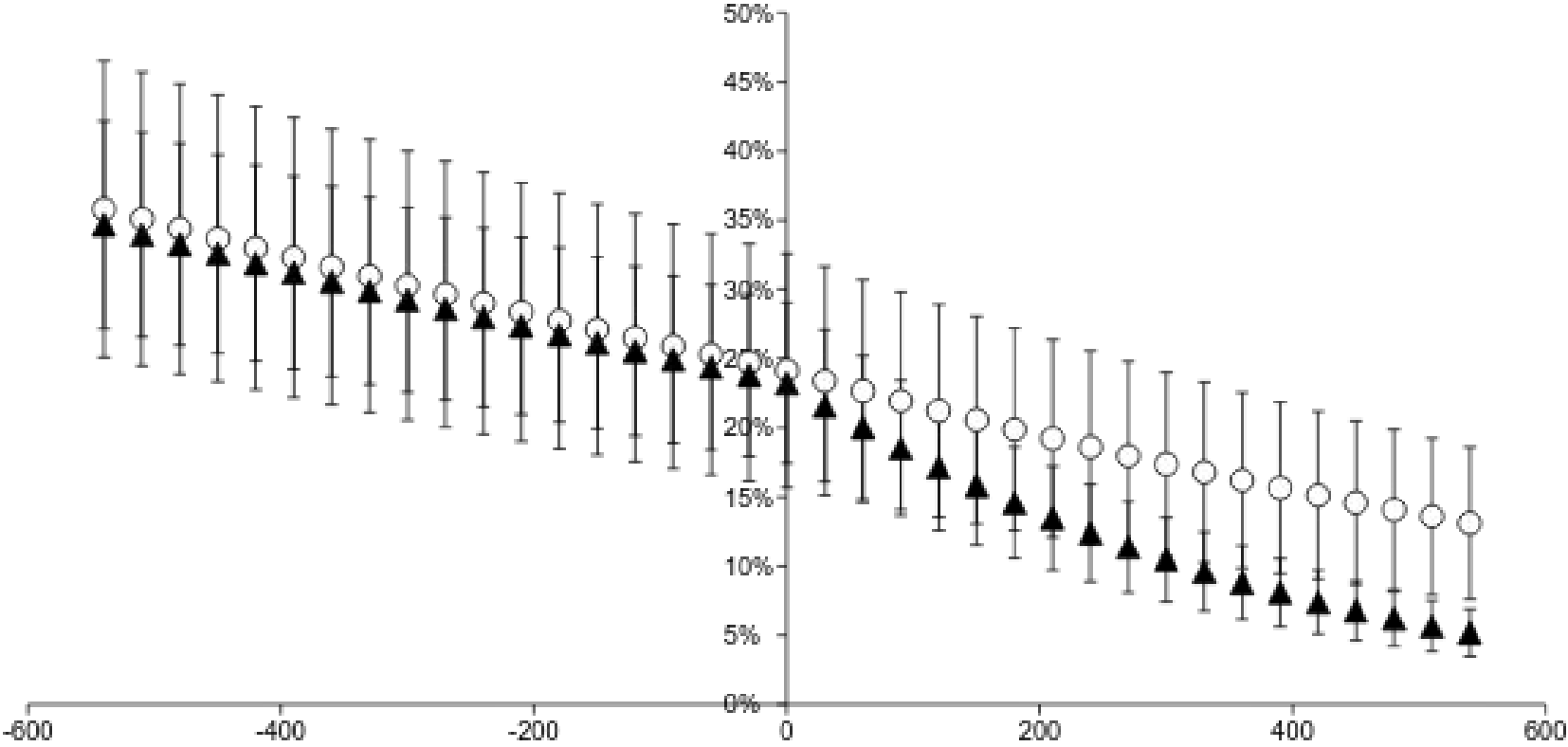
| | Control | Suggested Alternatives | Accountable Justification | Peer Comparison |
|-------------------|---------|------------------------|---------------------------|-----------------|
| Age, mean | 49 | 47 | 48 | 46 |
| | % | | | |
| Female | 65 | 70 | 66 | 68 |
| White | 88 | 86 | 88 | 87 |
| Latino | 35 | 32 | 30 | 36 |
| Private insurance | 60 | 59 | 58 | 58 |

Main Results: Suggested Alternatives



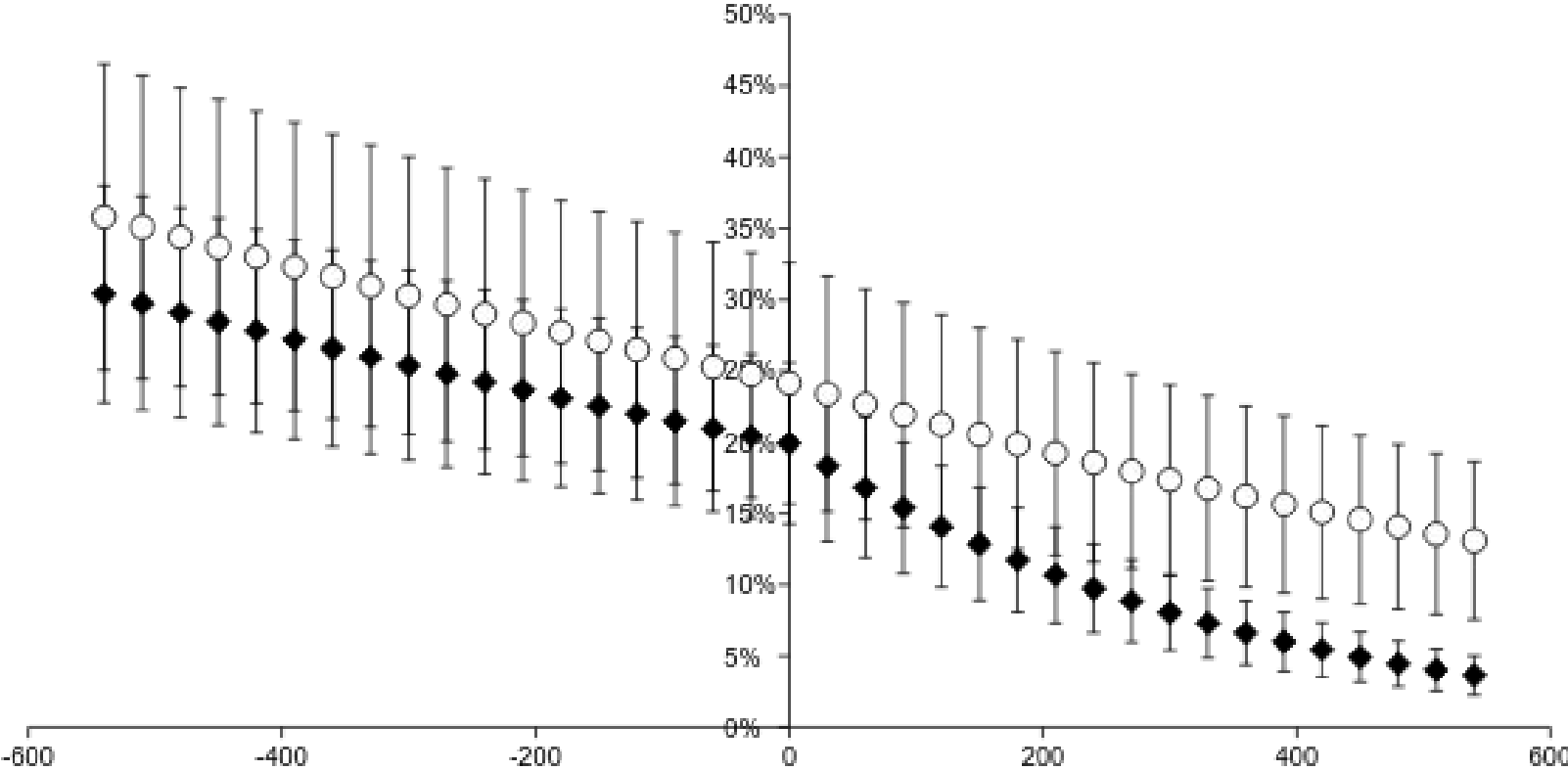
$p = 0.88$

Main Results: Accountable Justification



$p < .001$

Main Results: Peer Comparison



$p = <.001$

Persistence

- Evaluated prescribing for 12 months after interventions were turned off
- Difference of differences comparing 18-month treatment period to 12-month follow-up period

Intervention Persistence

| | Pre- intervention | Intervention | Post- intervention |
|---------------------------------------|---------------------------------|---------------------|-------------------------------|
| | % antibiotic prescribing | | |
| Suggested alternatives | 22 | 6 | 9 |
| Accountable justifications | 23 | 5 | 8 |
| Peer comparison | 20 | 4 | 5 |

Limitations

- Limited to enrollees
- Dependent on EHR and billing data

Strengths

- Randomized controlled trial
- Large size
- 3 different EHRs

Conclusions and Implications

- *Social motivation appears effective*
- *Interventions show durable effects post-intervention*

Future: Replication, Dissemination, and Scaling

CDC funded Replications: IDPH & NYSDH



Internal use only.
Do not distribute.

PDSB Campaign Goals

- Increase **provider and patient knowledge** & provide **resources** about antibiotic resistance and use

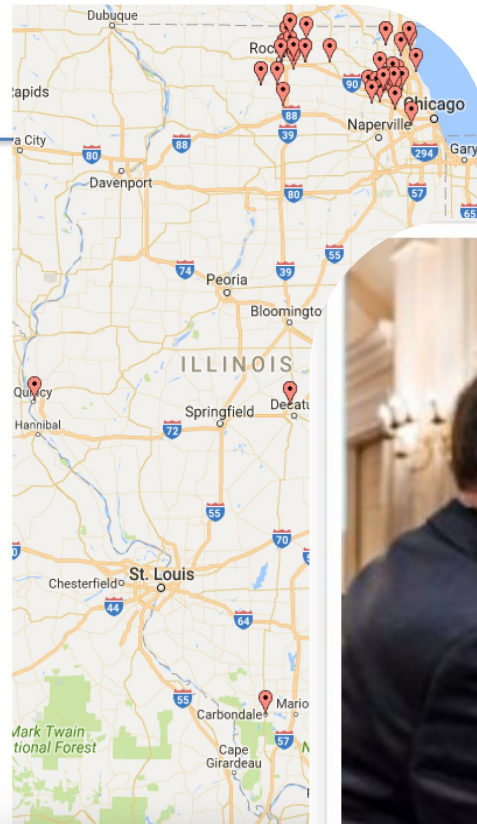
Phase I Participation

March 2015



Present

- 55 practices representing > 385 providers

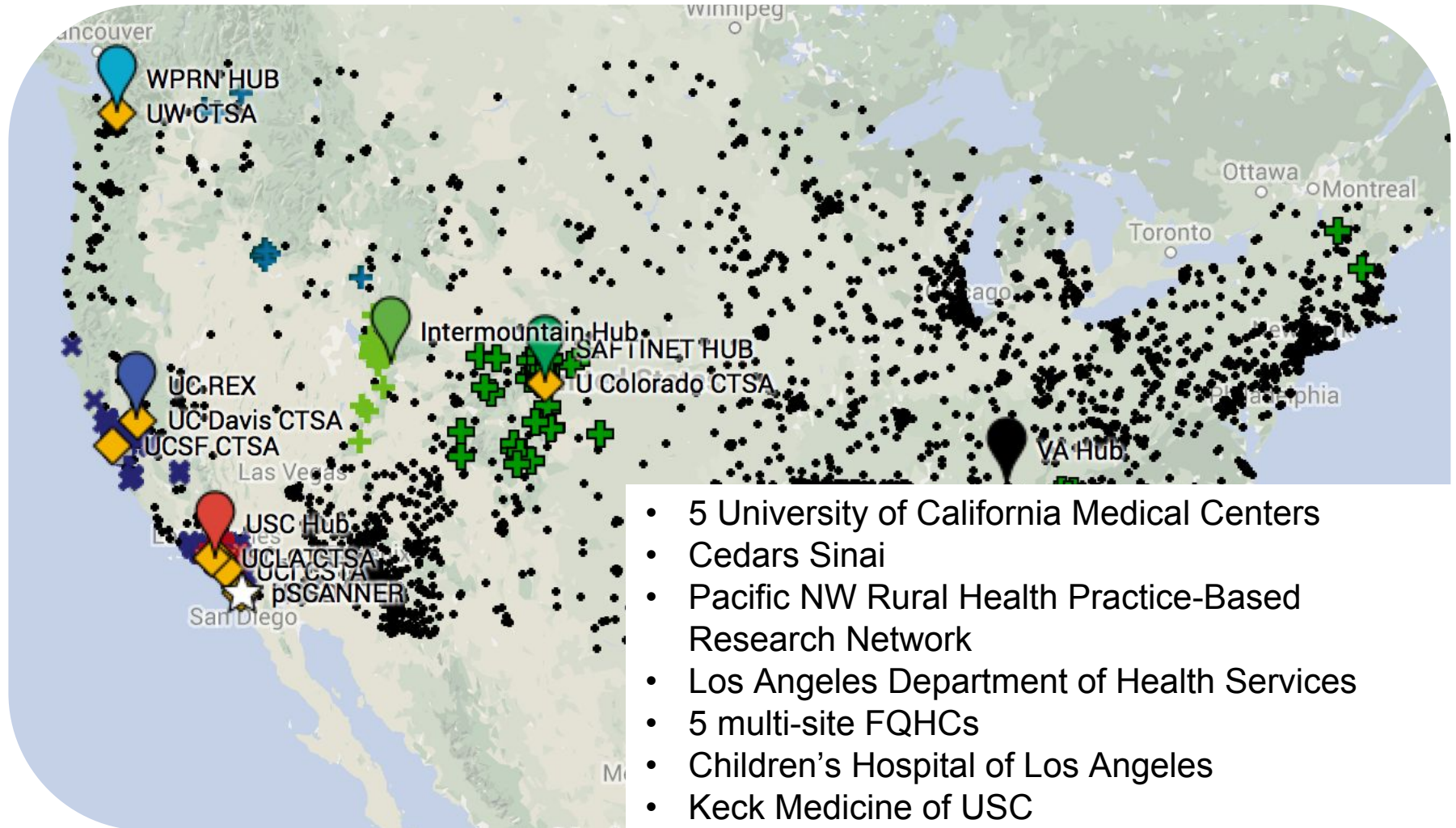


CDC Core Elements Outpatient Antibiotic Stewardship (2017)

EU Draft Guidelines for Antibiotic Stewardship

The NYS Department of Health recently rolled out a “Get Smart Guarantee” poster for healthcare providers to pledge to only prescribe antibiotics when they are needed.

pSCANNER Network - Connecting 21M patient's EHR Data with outcomes and health services researchers



What kind of data?

Electronic health records

Medical claims

Health information exchange

Patient reported outcomes

What are the data uses?

Quality measurement and reporting

Observational research

Clinical trials

Patient surveys

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Thank you!

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