General Information

Title: Can "The Expanding Circle" Reduce Patients' Interest In Unnecessary Antibiotics? Educational Nudges Designed To Reduce The Global Risk Of Antimicrobial Resistance

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Estimated Budget: We expect $200,000 in annual direct costs with $125,000 of annual indirect costs, for a total annual cost of about $325,000.

Research Strategy

Description And Significance

Evidence suggests that over 1,000,000 annual deaths are attributable to antibiotic resistance, globally.[1,2] Affordable and widely available antibiotics may be one of humanity's greatest medical achievements, drastically increasing peoples' life spans.[3] However, antibiotics are becoming less effective against even simple bacterial infections, such as methicillin-resistant Staphylococcus aureus, Clostridium difficile, and Neisseria gonorrhoeae.[4] Although antibiotic resistance is a natural process, humans can accelerate it by overusing or misusing antibiotics. Currently, the pace of antibiotic resistance is outpacing the development of new antibiotics.[5]

Although researchers have proposed various protocols to slow or reverse antibiotic resistance, most have proven difficult in practice.[6] Retraining clinicians is expensive and may not overcome pressure from patients or parents to prescribe unnecessary antibiotics.[4]

We will target this patient side of antibiotic overuse by testing the expectation that patients will care more about the global health risk of antibiotic resistance as the "moral circle" is expanded.[10,11]

Proposed Intervention (theoretical underpinnings and hypothesized mechanism of behavior):

One low-cost and potentially high-reward mechanism for aligning patients' expectations with appropriate antibiotic prescribing involves repurposing existing healthcare communication systems such as on-premise television broadcasts and posters as well as mobile messaging systems (Figure 1). Patients' expectations of receiving antibiotics may be somewhat attenuated if they learn the risks of antibiotic misuse *before* discussing their chief complaint with a provider, especially if they comprehend that the risk is *global* rather than merely *local* or *personal*.[12]

And providers who are pressured by patients to prescribe unnecessary antibiotics[9] may be better prepared when a text message or examination room poster reminds patients of antibiotic guidelines[13] — especially if the reminder highlights the *global* scope of the risk. After all, reminders increase the rate at which people seek recommended medical treatment.[14]

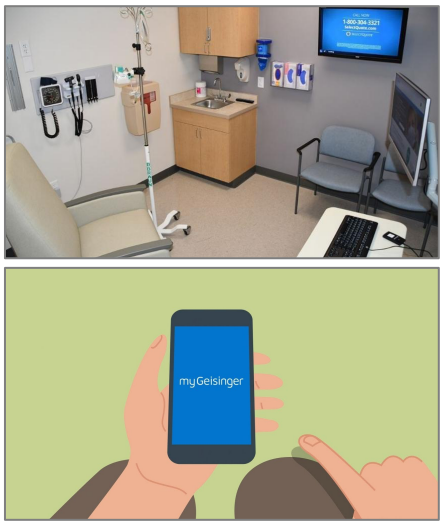


Figure 1. Examples of messaging systems in Geisinger's Health System: in-room graphics and in-app messages.

Brief description of research design (study design, subject eligibility criteria, intervention description, primary outcomes and method to test mechanism of behavior change):

A 2×2 factorial randomized controlled trial will assess the effectiveness of educational infographics (antimicrobial resistance vs. control image) and messages (antibiotic guidelines vs. control text) on antibiotic prescription to adult patients (or parents) visiting Geisinger's facilities during cold and flu season.

Primary outcomes are CDC-recommended antimicrobial stewardship metrics[15] like antibiotic prescriptions and assigned diagnosis. Mechanisms are patients' (or parents') perspectives on appropriate antibiotic use. Physician transcriptions and electronic health records can be supplemented by surveys (distributed by in-app reminders). A difference-in-difference analysis will compare outcomes among messaged and control participants.

Given our evidence-based hypotheses, our research questions are as follows:

i. Can we improve patients' concern about and understanding of antibiotics (mechanisms) and thereby reduce counter-guideline antibiotic prescribing and consumption (outcomes) using A/B tests that vary the geographic scope of antimicrobial resistance risk (intervention) in our health system messaging?

ii. Will a *combination* of our healthcare educational interventions (i.e., the combination of *both* examination room infographic *and* in-app reminders) significantly improve the effectiveness of *singular* healthcare communications?

iii. Independent of our interventions, what measured variables predict variance in our outcomes and mechanisms?

Proposed Setting and Timelines:

Before cold and flu season, evidence-based communication will be refined based on nationally representative samples of adults that participate in remote smartphone-friendly experiments. The best performing pre-season communications will be randomly selected clinics and pharmacies during cold and flu season. Data will be analyzed and reported after cold and flu season.

Goal	Anticipated date
Secure IRB approval for the protocol	August 1, 2024
Refine materials with Antimicrobial Stewardship Committee and online pre-tests	September 30, 2024
Begin messaging, clinical measures, patient surveys	October 1, 2024
Conclude data collection	April 1, 2024
Complete initial report, presentation	May 1, 2024
Complete final report	May 31, 2024

Patients will be seen by clinicians at one of 40 clinics or 12 pharmacies in our health system, with messages delivered by our existing systems and data collected from our existing survey and health record systems.

Power Calculations

To ensure at least 90% power to detect non-negligible effect sizes (Cohen's $d > 0.1$) *pragmatic experiments* will sample nearly 8500 patients seeking healthcare for non-bacterial infections during cold and flu season(s).[16] The `pwr` package in R estimates a required sample size of approximately 2100 participants per treatment group.

Summary of qualifications of the investigative team:

Our preliminary test and replication proved the concept of improving antibiotic decisions via infographics and text messages in two online experiments with adults from the United States (Figure 2).[17] Our results refined and extended results from a smaller sample in New Zealand.[13]

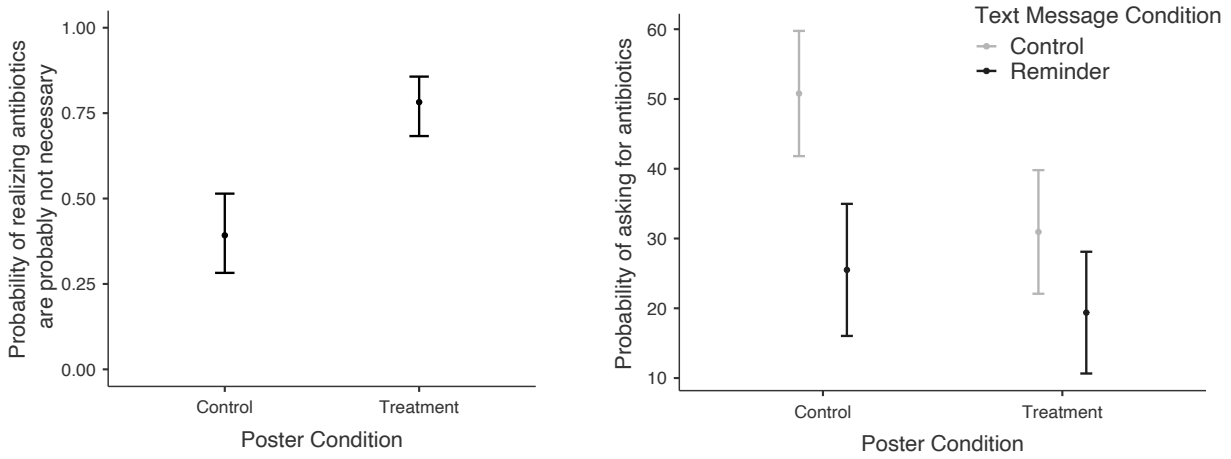


Figure 2. Large improvements (Cohen's $d > 0.8$) in(from left to right) people's understanding that antibiotics will not treat symptoms of a common non-bacterial infection (cold or flu), and intentions to ask for such needless antibiotics, compared to control group(s), $p \leq 0.005$. Error bars represent 95% confidence intervals. Total $N = 999$.

Geisinger has been refining its system-wide health communication platform (including on-premise televisions, remote messaging, and other mediums) for about a decade, making our proposed interventions optimally available, feasible, and acceptable for our patients, clinicians, and other stakeholders.

Geisinger was among the first to adopt electronic health records, becoming a leader in using health and pharmacy data to improve care, add value, and advance research.

Geisinger's clinicians, staff, and medical students serve over three million patients in 45 rural counties,[17] allowing us to address antibiotic resistance with unprecedented scale, and with an under-studied, often overlooked population.

Disclaimer

An NBER Roybal PI advised us to propose *separate* antibiotic prescription interventions to Brigham and Women's and USC-Yale Roybal Centers, in case different centers want to fund different interventions or centers want to share the cost of testing a subset of the interventions. Because each proposal contains distinct interventions, there is no risk double funding for any set of interventions (even if all our Roybal proposals are funded).

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