

Tackling Antimicrobial Resistance: Changing Patient Behaviour in US Primary Care Facilities

London School of Economics and Political Science
PB403 Psychology of Economic Life Summative coursework

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Background

1.1 The Global Threat of Antimicrobial Resistance

The development of antibiotics represents one of the most transformative technological accomplishments in medical history. The ability to prevent bacterial diseases has significantly improved the health and mortality of people worldwide. Healthcare systems currently face one of the most critical and life-threatening crises — Antimicrobial Resistance (AMR) (Ahmed, 2024). This global epidemic is responsible for approximately 50,000 deaths annually in Europe and the U.S. and could result in up to 10 million deaths per year by 2050 (Salam et al., 2023). The economic burden of AMR is equally alarming, with infections linked to resistant pathogens reducing GDP by between 2% and 3.5%, potentially costing the world up to \$100 trillion (Pantea et al., 2023). In the U.S. alone, AMR contributes to 29,000 deaths annually, with an estimated cost of \$27,160 per case (Dadgostar, 2019). This threat is not just a medical crisis but an economic and societal catastrophe that threatens modern healthcare and social and economic cohesion. Despite attempts by the World Health Organization (WHO, 2015) to coordinate an international plan to contain AMR, there is still significant variation in how antibiotics are accessed, conceived, and used in medical practice worldwide (Shrivastava et al., 2018).

1.2 How Antimicrobial resistance develops and spreads

Antimicrobial resistance occurs when bacteria evolve and develop resistance to antibiotics, rendering standard treatments ineffective (National Foundation for Infectious Diseases, 2024). Resistance develops through genetic mutations or the acquisition of resistance genes from other microbes. The primary driver of AMR is the *misuse of antibiotics in human medicine, agriculture, and animal health*, which increases opportunities for resistant strains to

develop (Salam et al., 2023). Misuse pertains to overuse, use of leftover antibiotics when not recently prescribed, failing to complete a full dosage, and not following medical professionals' instructions. When antibiotic misuse occurs, it increases the potential for resistance to develop. Resistant bacteria then multiply and spread between humans, animals, and the environment. Such channels are illustrated in *Figure 1*. This pathological phenomenon threatens to undermine modern medicine, making previously treatable infections deadly. WHO (2022) warns that without immediate intervention, standard medical procedures and infections could become life-threatening due to the lack of efficacy of antibiotics.

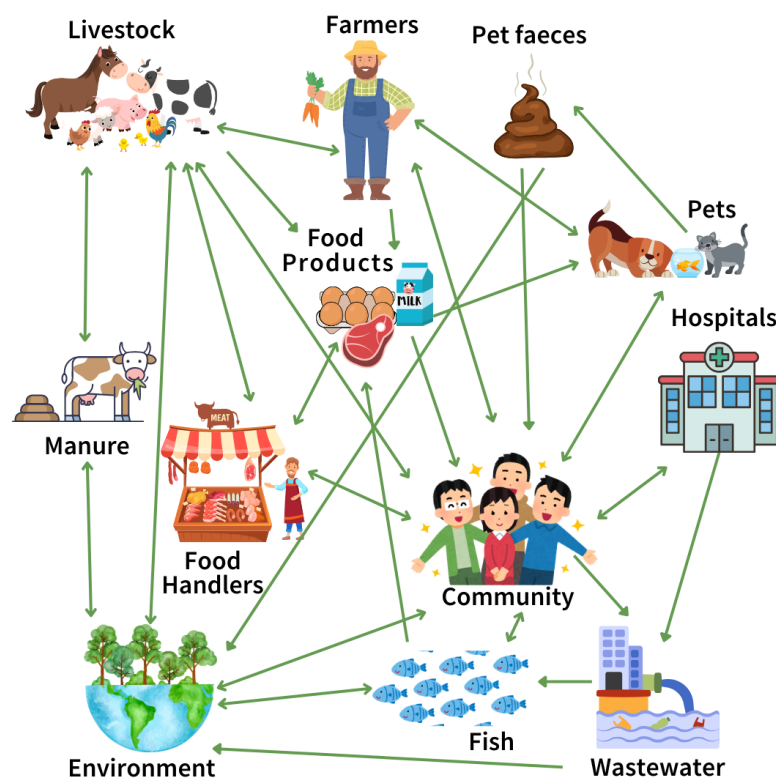


Figure 1: Channels of potential AMR spread

1.3 The United States: Current Interventions and Challenges

The spread of AMR in the U.S. is particularly concerning. With more than 2.8 million AMR-related infections occurring each year (CDC, 2024), there has been increasing pressure

for the U.S. government to take a more proactive approach. The political visibility behind AMR has generated funding for research into new antibiotic development and diagnostic tests, as well as interventions to prevent the misuse of antibiotics (CDC, 2024). The current U.S. National Action Plan (2020-2025) (USNAP) outlines broader, system-wide guidelines to prevent and control antimicrobial resistance (HHS, 2020). Given the widespread interconnection between human, animal, and environmental health sectors, the U.S. has adopted a one-health approach, recognising the need to address antimicrobial resistance in all sectors through widespread collaboration and coordination (Meza et al., 2022).

The U.S. plan is composed of 5 key goals (CDC, 2024):

1. Slow the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections
2. Strengthen National One Health Surveillance Efforts to Combat Resistance
3. Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria
4. Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines
5. Improve International Collaboration and Capacities for Antibiotic Resistance Prevention, Surveillance, Control and Antibiotic Research and Development.

While the U.S. has sought to prioritise the emerging threat of AMR, these attempts have proved insufficient as the country continues grappling with a fragmented healthcare system constrained by historical practices, patient expectations, structural inflexibility, and economic incentives (Sutton & Ashley, 2024). The USNAP remains loosely enforced and fragmented, with inadequate coordination between federal agencies, state, and local health authorities. Meanwhile, political instability may further exacerbate the problem. Concern is growing over

the return of the Trump administration and the temporary blockage of public health funds. Experts consider these budget cuts an “apocalypse”, weakening the limited resources allocated to AMR research, surveillance, and education (Green, 2025). Trump’s administration has previously cut scientific funding, and similar actions could derail the progress of combating AMR. The weakening of public health institutions and reduced oversight of pharmaceutical regulations could lead to increased overprescription and antibiotic-resistant bacteria. In fact, in 2023, tuberculosis was the leading infectious disease, resulting in 8.1 million new cases (WHO, 2023). Meanwhile, Trump’s executive order froze foreign aid, freezing funding for tuberculosis, HIV, and AIDS programs such as PEDFAR and USAID (USAIDS, 2025). These cuts severely impact and threaten global efforts to tackle antimicrobial resistance, increasing the risk of drug-resistant tuberculosis, which is more complex and costly to treat (Cegielski, 2021).

American healthcare clinics can be separated into two sectors – inpatient and outpatient. Inpatient care occurs when patients stay overnight at a healthcare facility, determined by their state of symptoms concerning clinical guidelines (Woolf et al., 1999). Outpatient facilities cover single-day care where the patient does not need to stay overnight. Outpatient care not only covers primary care and urgent care facilities, but also dentistry, diagnostic imaging, physical therapy, and some surgery centres (Sanchez, 2016). Due to the broadness of ‘outpatient’ we chose to focus on primary care facilities (PCFs), as most patients will use these first before going to an inpatient facility (depending on severity of symptoms) (Deloitte Insights, 2018). Outpatient facilities account for 60% of antibiotic use, far exceeding inpatient facilities prescriptions (Dumkow, 2024). The CDC implemented an outpatient stewardship program in 2016, which was aimed to “help health systems, stewardship leaders, and outpatient practitioners develop effective outpatient programs,” yet even with the presence of this program, there has been little progress made (Dumkow, 2024). Physician Assistants, Nurse Practitioners,

and Primary Care Physicians, who all work in PCFs, prescribe the highest number of antibiotics annually according to the CDC (2024).

Introduction

The rise of Antimicrobial Resistance (AMR) represents an urgent and devastating threat to humanity. In 2019, AMR was directly responsible for 1.27 million deaths worldwide (WHO, 2023). Without urgent action, AMR could lead us into a pre-antibiotic era, where bacteria that is currently considered treatable could become deadly. While AMR is a significant threat worldwide, it is particularly pervasive in the U.S., with attempts to tackle the issue inhibited by a complex and structurally inflexible healthcare system (CDC, 2025). The widespread transmission of AMR represents a systemic threat and highlights the multitude of stakeholders within many sectors that bear responsibility for containing the crisis. While accelerating research, the development of new antibiotics, expansion of diagnostic tests, and surveillance measures have become a priority, the core of the problem remains the misuse of antibiotics in animal health, agriculture, and healthcare (Willemsen, 2022). Thus, safeguarding both human and animal health is essential (Sudenkaarne & Sariola, 2024).

Evidence indicates inappropriate use of antibiotics within U.S. human medicine (Rahman et al., 2023). It is estimated that around 30% of antibiotics in the U.S. are unnecessarily prescribed in medical settings (CDC, 2024). Whilst antibiotics are indicated for many conditions and are prescribed in various institutions, 60% are prescribed in outpatient settings (Dumkow, 2024). Interventions to improve antibiotic prescribing have proved difficult to implement in outpatient facilities, due to heterogeneous prescribers, resource constraints and a fast-paced transactional nature (Dumkow, 2024). Over 40% of the U.S. public still believe that antibiotics are the best choice to treat common viral illnesses, and even more of the public are unaware of the personal risk of antibiotics and the collective risk posed by AMR (Carter et

al., 2016). The content of this essay explores the misuse of antibiotics in outpatient facilities in the U.S. healthcare system, with a specific focus on Primary Care Facilities (PCFs). After conducting an analysis of the key stakeholders involved, we will apply Installation Theory to propose actionable interventions that promote the appropriate use of antibiotics through changing patient behaviour.

Stakeholder Overview

PCFs are outpatient centres where patients receive routine, preventive, and ongoing medical care (Shi, 2012). They serve as the first point of contact in the healthcare system and address a wide range of health needs (Deloitte Insights, 2018). Most PCFs are privately owned, leaving them beholden to market forces (GAO, 2024). They receive revenue from a variety of sources, including government-sponsored programs like Medicare and Medicaid, which operate predetermined fee schedules; private insurance companies, in which fees are often negotiated through contractual arrangements; and fees for individual services (GAO, 2024). The terms of these arrangements can vary based on regional market dynamics and the nature of the services provided. This privatised nature produces an economic undertone to healthcare, as physicians often feel compelled to provide value to patients, by meeting their expectations (GAO, 2024). The web of stakeholders involved in antibiotic prescription in U.S. outpatient settings is complex, with varying layers of influence and involvement in the process (*Figure 2*). These stakeholders can broadly be categorised as either *internal* or *external*.

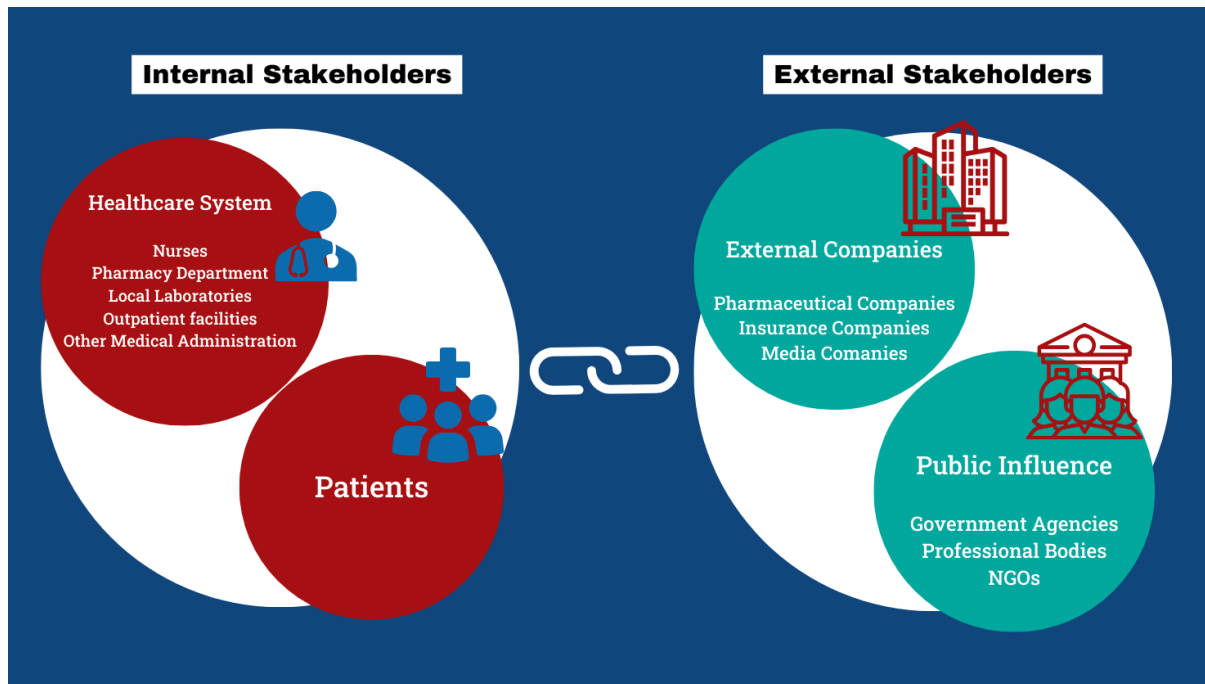


Figure 2: Internal and External Stakeholders

External stakeholders

The activities of the government as a stakeholder are dispersed at various levels. The federal government directs the Health and Human Services, which in turn directs federal agencies. The Center for Disease Control and Prevention (CDC) plays a significant role in AMR stewardship guidelines, along with education and awareness through campaigns such as “Be Antibiotics Aware.” While these have been useful, much of this educational material is located on the CDC’s website which requires the public to actively search for and engage with it. State health departments are responsible for the enforcement and regulation of guidelines created by federal agencies. They are also accountable to citizens within their constituency and will often seek to satisfy them directly. State medical boards oversee physician licensing and prescribing practices, investigating any cases of inappropriate or excessive prescribing. Pharmaceutical companies may attempt to influence outpatient antibiotic prescribing through marketing and promotion (NIH, 2017). Insurance companies also have preferences over antibiotic prescription, which may filter through to prescription behaviour (Li et al., 2025).

They negotiate prices with the outpatient administration and may encourage the use of low-cost alternatives (Ghamat et al., 2024).

Internal Stakeholders

At the centre of the internal stakeholders is the prescriber – often the primary physician but can be resident physicians or nurse practitioners. Their obligation is ensuring antibiotics are prescribed appropriately and are responsible for communicating the diagnoses and instructions on the use of antibiotics. They often face competing pressures, symbolising the conflict between the collective threat of AMR and personal expectations of a quick fix (Blaser et al., 2021). Beyond the primary decision maker, there is a web of key internal stakeholders, such as nurses, other physicians, pharmacists, and local labs that are involved in the antibiotic prescription process. Nurses play a critical role in patient triage, education, and follow up. They also communicate with patients about personal basic medical information. Pharmacists serve as gatekeepers that verify prescriptions, ensure appropriate dosing, and monitoring for potential drug interactions. Additionally, local laboratories provide diagnostic data, based on samples taken from patients. However, this can often take days, especially if the lab is located outside of the facility, placing additional pressure on practitioners to make quick decisions (Wang et al., 2021). Finally, the patient plays an active role; their expectations, health literacy, behaviours, and financial considerations may influence prescribing decisions.

Problem Analysis

Activity Theory

Activity Theory traces the movement of a subject through reality by analysing the steps they take to achieve their perceived goal. Their activity is separated into subgoals that are

reached by accomplishing tasks. As the subject travels from subgoal to subgoal, they eventually reach their overall goal, which in turn serves their overall motive (*Figure 3*). The path to serve their motive can be completed by various goals which can cause the subject's overall activity trajectory to adjust to serve their new goal (Lahlou, 2017). By looking at the activity of key stakeholders, we can identify the pain points that represent intervention opportunities.

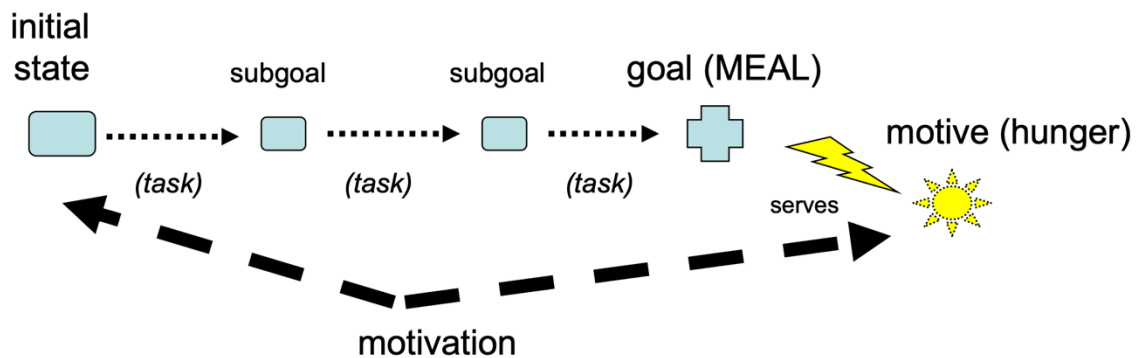


Figure 3: Activity Trajectory (Lahlou, 2024)

Installation Theory

Installation Theory describes the patterns of behaviour that occur within installations by taking the actor's perspective and analysing how their activity is shaped by three distributed layers: the material environment, the embodied competencies of the actor, and the social regulation (*figure 4*) (Lahlou, 2017). The theory serves as a tool to restructure behaviour by reorganising the layers to produce alternative and more desirable patterns of behaviour. The material environment presents different physical affordances – objects that facilitate action – which inform, support and limit behaviour. Whilst the physical environment displays the possibilities for action, the embodied competencies of the actor represent innate processes that encompass the architecture of interpretation, such as knowledge, experience, dispositions, and habits. The influence of the physical environment thus depends on the process through which

it is translated into a perception. Social regulation constitutes the rules and norms that govern an acceptable standard of behaviour.

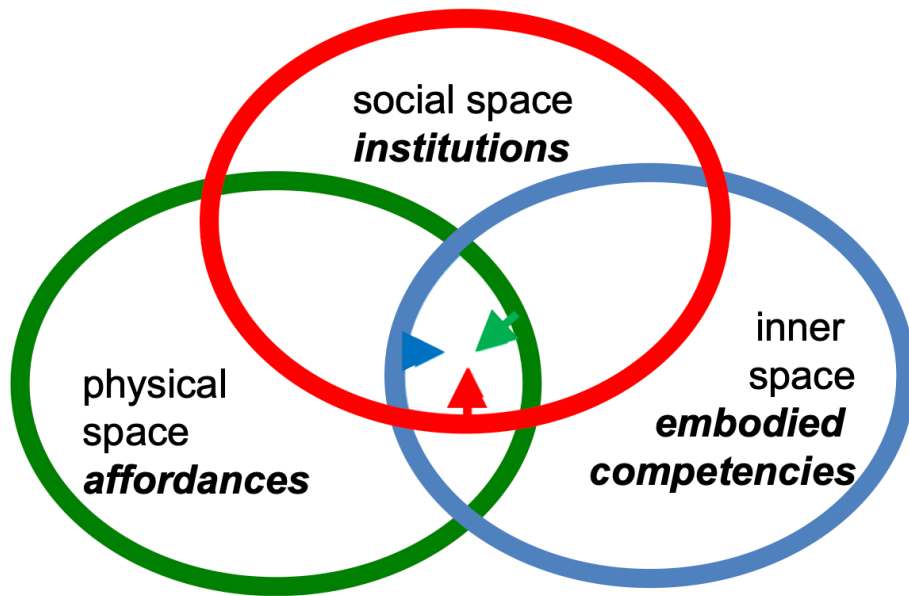


Figure 4: Installation Theory (Lahlou, 2024)

Approach

To conduct our analysis, we used Activity Theory to dissect the steps taken by key stakeholders involved in antibiotic prescription in PCFs. We separated activity into phases - pre-examination, during examination and post-examination. Based on a detailed analysis of the activities of stakeholders, we identified three key pain point. In many cases patients were unaware and unconcerned about the threat of antibiotics. While educational material is available online, via the CDC website, this information does not convey a clear message and is absent at salient points within the patient's activity trajectory. Secondly, whilst instructions (social regulation) regarding the use of antibiotics, including when not to take them, are given by medical professionals, it is not enforced through values shared by others. Finally, due to

time constraints, the prescriber is not able to communicate a clear recovery guide to patients post diagnosis. In our analysis, we explore these points in detail by situating them within their respective activity trajectories. We then utilise Installation Theory to further analyse the physical, embodied and social components at the identified pain points to devise intervention opportunities that reshape the behaviour of patients, encouraging the appropriate use of antibiotics.

Patient Activity Analysis

To look at the movement through patient's activity trajectory, we applied Activity Theory to get an in-depth analysis (*figure 5*). The patient's initial state is to enter the PCF with the overall motive to alleviate the distress caused by their current symptoms and to visualise a clear path to recovery. The final goal attached to this motive is receiving diagnoses and medication, underpinned by the patient's 'quick fix' expectation. Patients often possess expectations that antibiotics will solve problems - that if they do not receive antibiotics symptoms will worsen, so there is no harm in taking them (Cziner et al., 2023). These expectations arise from a heightened awareness of personal distress, from symptoms of an illness, in contrast to a lack of awareness of the risk of AMR.

As the patient arrives at the PCF, they check in at the front desk, giving their personal and insurance information to the receptionist. The patient moves to the waiting area until they are called by a medical assistant for their examination. During the beginning of this examination, the patient describes current symptoms and provides basic health information, like medical history and current medication. The patient next receives a basic assessment from the medical assistant, including height, weight, blood oxygen levels, and blood pressure. Once

completed, the medical assistant leaves, and the patient stays in the examination room until the doctor arrives, waiting to discuss symptoms in more depth.

A second examination is performed, this time from the doctor, which is more targeted to understand the patient's current symptoms and determines the overall diagnosis or continued plan for care. At this stage patients may exert pressure on practitioners to prescribe antibiotics if they remain wedded to medication as a final goal (Stivers & Timmermans, 2021). They will likely converse with medical professionals about their options. For example, patients may prefer whether they call back if symptoms persist or are instead prescribed antibiotics immediately. If antibiotics are prescribed, the patient will be informed about their prescription and receive guidance and instructions. In cases of diagnostic uncertainty, the default option is often a prescription (APA, 2017), so the patient often retains significant autonomy to decide whether antibiotics will be necessary for them. They will also maintain responsibility for adhering to the instructions given by the medical professional that accompany the use of antibiotics.

Based on the patient's Activity Theory, we have identified potential areas of intervention. We uncovered several points in the activity trajectory of patients that provided a window of opportunity to both accentuate and emotionally pronounce the risks of AMR prior to examination. These include while the patient is at the reception desk - when perceptive orientation is heightened, and while they are in the waiting area - where they possess time to reflect on their expectations for the appointment. We observed a lack of value reinforcing social regulation, prior to the consultation with a medical professional. Instead, social regulation is given in the form of instructions and guidance, after the patient has discussed their options and an antibiotic has been prescribed. Given the patient maintains a significant amount of autonomy over their options and may apply pressure for antibiotics it is important that they are aware of the risks of AMR before considering their options.

Medical Professionals Activity Analysis

Based on our understanding of the activity trajectory for medical professionals when prescribing antibiotics, we have organised them using Activity Theory to view their goals, steps, and identify the ideal location for interventions (*figure 5*) (Lahlou, 2017). We view medical professionals solely as prescribers, which includes medical doctors (MD), osteopathic doctors (DO), physician assistants (PA), and nurse practitioners (NP) (Zhang & Patel, 2023). The motive of medical professionals is to ensure the best health outcomes for patients, but they are also concerned about providing value for patients, particularly due to financial incentives. The final goal of medical professionals is to accurately and efficiently diagnose patients with an appropriate treatment plan.

We determined the initial state of medical professionals to be facing patient pressure for ‘quick fixes’. Prior to the patient examination, the medical professional reviews patient information, and converses with the medical assistant who documented the patient’s vitals and current symptoms. The medical professional then enters the examination room to assess the patient and determine their diagnosis. Once a diagnosis is determined - or the next steps of care (e.g., more tests or lab work), proper medication to alleviate symptoms is prescribed, which in the case of a bacterial infection, would be antibiotics. Even in cases where a diagnosis is uncertain, antibiotics are often prescribed as diagnostic tests can take too long (Wang et al., 2021). The medical professional may discuss this with the patient, along with the available options. After the patient is made clear of the prescription that will be available at their pharmacy, the medical professional shares what they believe to be the next best steps in care for the patient. This could consist of more appointments or referrals to specialist medical professionals.

We identified a pain point restricting the practitioner’s capacity to substitute the expectations of antibiotics (as a goal), with an alternative set of feasible expectations

surrounding recovery. Practitioners often prescribe antibiotics in cases that are difficult to distinguish between viral illnesses, such as the flu, and bacterial illnesses, such as bacterial pneumonia, which have similar symptoms (Polianciuc et al., 2020). When they briefly explain the antibiotic dosage to the patient, they lack the time to communicate the signs and symptoms to expect on their recovery path, leaving patients with the burden to educate themselves.

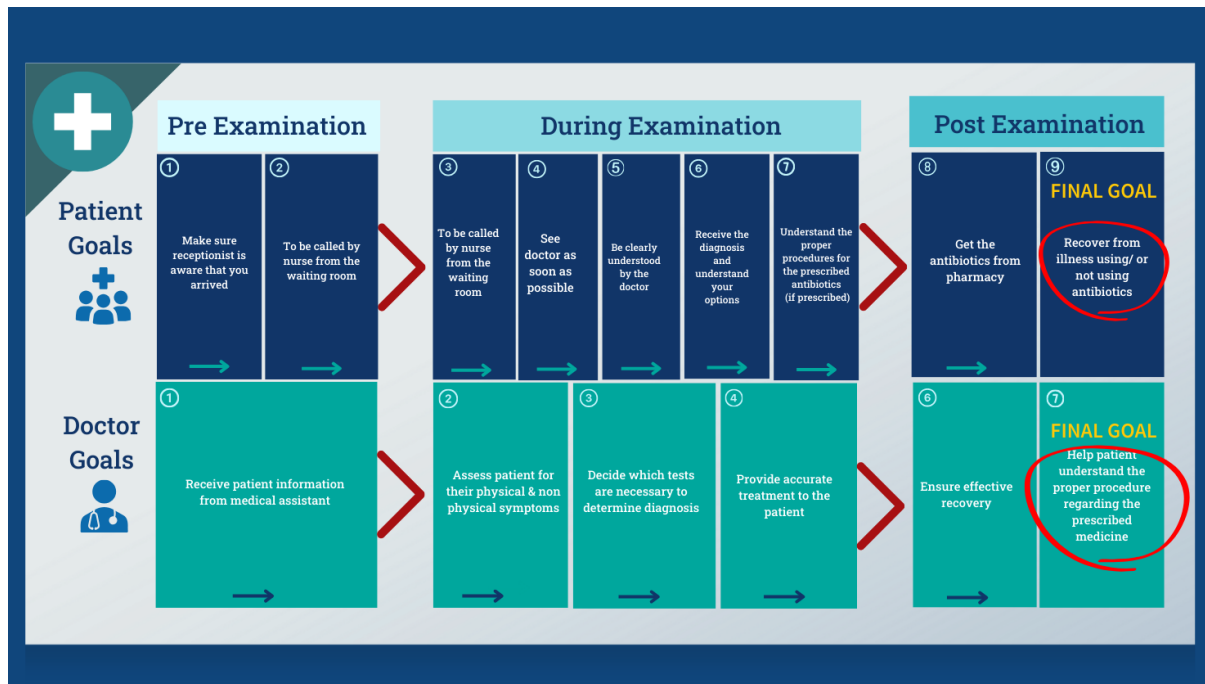


Figure 5: Patient and Medical Professionals activity trajectory highlighting subgoals

Solution

As a result of their expectations, patients often maintain a final goal of receiving antibiotics and subsequently apply pressure on medical professionals to prescribe antibiotics and misuse antibiotics when they are prescribed (Stivers, 2021; Stivers & Timmermans, 2021). Our intervention will shift patient expectations, encouraging goals that prioritise recovery without antibiotics, while still addressing their underlying motives. It is imperative that expectations are changed before a final goal is realised. We will use key points in the activity trajectory of the patient to change their expectations prior to a consultation, and reinforce those expectations post consultation.

Our intervention will leverage the three layers of Installation Theory (Lahlou, 2017):

- Patients use embodied competencies to form goals
- Patients embed goals in social norms and values
- Patients use what is physically available to inform and support goals

Derived from our analysis of the activity trajectories of patients and medical professionals, we identified several layers in which to distribute the cognition necessary to change patient goals (*figure 6*). We first propose a poster, badge and sticker system that promotes new embodied competencies, by associating antibiotics with social representations of caution. Secondly, we propose a community engagement wall. This wall will consist of narratives from members of the local community, as well as dynamic norms that emphasise the growing number of people prioritising recovery without antibiotics, embedding expectations in social norms and values that highlight the risk of AMR. Finally, we propose a recovery and symptom guide, for common viruses that are often mistaken for bacterial, to provide a more salient affordance, directly informing realistic expectations surrounding the patient's recovery after their appointment. This will be accompanied by a website that displays information about antibiotics, and alternative functional medicine, which can be accessed through QR codes located on posters, the community wall, and the recovery guide cards.

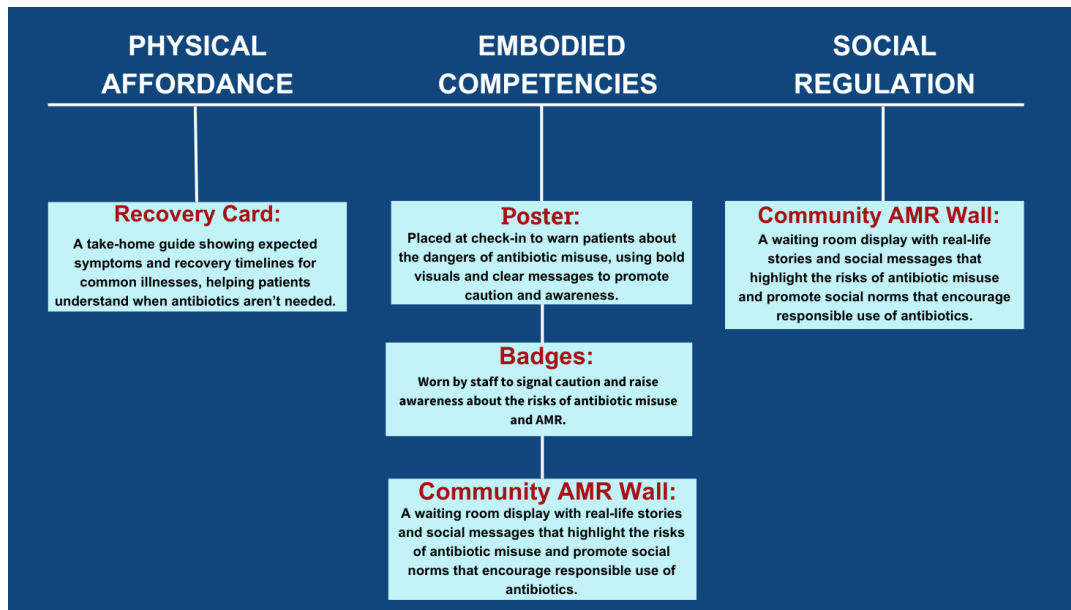


Figure 6: Installation Theory Analysis

Poster and Badge System

The first intervention we propose are posters that display the risk of antibiotics (Figure 7). This will be an extension of the CDCs “Be Antibiotics Aware” campaign (*Be Antibiotics Aware Partner Toolkit*, 2024). We plan for patients to encounter the posters at the first point of heightened awareness identified in the activity analysis - while checking in at the reception desk (figure 8). At the desk patients are more cognitively perceptive, as they must navigate the environment whilst engaging with the receptionist. The posters will be placed behind the desk, directly in the patient’s field of vision. This will have to be adjusted depending on the physical make-up of different facilities. To maximise visual awareness, we designed the posters with a bold caption that reads “Misuse of antibiotics puts us all at risk.” The poster will also appeal to the social nature of patients by using collective language - “we go hand in hand” - displaying a picture that represents a joint effort to use antibiotics wisely. The posters aim to amplify the risk of antibiotics through a clear message, forming new embodied competencies that retrieve a more emotionally relevant association with AMR. This is crucial, as patients use embodied

competencies to represent the choices available to them during and after the consultation, including whether to ask for antibiotics and how to use them if they are prescribed.



Figure 7: Main Campaign Poster (other poster options visible in the appendix)



Figure 8: Proposed poster placement at reception desk

Additionally, all medical staff will wear small badges with a diamond symbol that constitutes a social representation of ‘caution’ due to its widespread use in road systems (*Figure 9*). The slogan of “Don’t Misuse Antibiotics” will accompany the symbol to ensure its association with AMR. The warning label will also be featured on posters to maintain consistent messaging. The cue has been designed to reduce the cognitive demand of traditional awareness campaigns and send a coherent message. With repeated exposure to the yellow warning symbol, awareness and perception of AMR risk will subconsciously increase. This strategy works by embedding these messages into everyday healthcare interactions, rather than relying on descriptive educational materials. Repeated subconscious messaging is essential to our interventions as it continuously reinforces the risk of AMR throughout the patient's activity trajectory.



Figure 9: Badge Design

Additionally, the sticker will be placed on the top of the prescription bottle, acting as the final reinforcement. Unlike posters and badges, which are encountered during the clinical visit, the prescription bottle remains with the patient at home and acts as a constant reminder of the risk of AMR.

The Community AMR Wall

The second intervention we propose is the implementation of 'The Community AMR Wall' in waiting rooms. The time spent waiting is a pivotal point of possible reflection prior to examination. This wall will serve as a dedicated space for thought-provoking, engaging and emotionally compelling narratives that highlight the dangers of AMR. The content will be composed of narratives of vulnerable populations in the local community that have suffered the consequences of AMR. The goal of narratives is to add emotional resonance to the message - the threat of AMR - fostering empathy and identification (Polletta & Redman, 2020;

Alejandro et al., 2023). In doing so, narratives that directly target patients could impact their attitudes, knowledge, and beliefs regarding their expectations of antibiotics (Antwi et al., 2020). By shifting the focus from scientific concepts to personal and emotionally compelling stories, we can bridge the psychological gap and make AMR feel more relevant to individuals.

A key finding in AMR research is that as parents' risk perceptions increase, their willingness to request antibiotics for their children decreases significantly (Alejandro et al., 2022). Studies show that parents' perceptions of their child's future health risks are a strong predictor of their likelihood of changing their behaviour (Alejandro et al., 2023).

The wall will also contain dynamic norms tailored to the community, indicating that societal trends are changing, encouraging individuals to adapt their behaviour accordingly. This is important as the main form of social regulation that dictates the expectations and behaviour of patients arise from the actions, advice and instructions of medical professionals. We unearthed the need to design more powerful social regulations prior to the examination, where they can influence perceptions of antibiotics before the patient interacts with the prescriber. Moreover, in order for social norms to foster and sustain behavioural change, they need to adjust the patient's values and beliefs (Sparkman et al., 2021). Combined with the stories from the local community, dynamic norms will introduce social values that showcase the importance of using antibiotics appropriately - appealing to patients through the voice of the community. Additionally, a working together normative appeal will be showcased at the top of the board – 'How you can join in and help your community.' This will help avoid psychological reactance by framing personal decisions to use antibiotics appropriately as a contribution to a shared sense of purpose, rather than it being expected (Sparkman, et, al, 2021).



Figure 10: Proposed Community AMR Wall

The Recovery Guide

Finally, we propose the implementation of a Recovery Guide (RG) - a structured card that provides clear expectations of the progression of an illness (OpenAI, 2023; see Appendix E for the full transcript). Initially, this card will be designed for patients with symptoms that resemble either viral or bacterial sinusitis, as this is a common cause of visits to PCFs (Smith, et, al, 2013). In this instance, when the doctor prescribes antibiotics, the RG will be provided, including the main symptoms to expect at each stage (days 1-3, days 4-6 and days 7-10), distinguishing between viral and bacterial symptoms (*Figure 11*). The card will be standardised but to add a personalised touch, the practitioner will mark the date and the patient's current stage of recovery. The back of the card will display the same sign from the badges introduced in PCFs (*Figure 12*), further reinforcing the embodied competencies that associate antibiotics with risk. It will also have a QR code directing to a website with information about antibiotics and functional medicine alternatives. As the primary agency involved in antibiotic stewardship,

the CDC will create and distribute these cards to local clinics. After the initial card is introduced, additional cards can be added to include other types of viruses that are often mistaken for bacterial.

Date of visit:

YOUR PERSONALISED RECOVERY GUIDE

Day 1-3

Symptom	Description
Nasal congestion	Stuffy or runny nose
Mucus Colour	Clear or slightly yellow
Other symptoms	Mild, dull pressure in forehead or cheeks
Facial Pain & Pressure	Sneezing, mild fatigue, postnasal drip, sore throat
Fever	low grade (below 100.4°F) or none

Symptoms may worsen slightly before improving

Day 4-5

Symptom	Description
Mucus Colour	Thicker, may turn yellow but starts clearing
Congestion	Improves slightly, still present
Cough	Nighttime cough due to postnasal drip
Facial Pain & Pressure	Decreasing or mild
Fever	Usually gone or mild

Symptoms peak at Days 3-5, then improve. No need for antibiotics

Day 7-10

Symptom	Description
Mucus Colour	Lighter, back to clear or gone
Congestion	Much better or gone
Cough	May linger but improving
Facial Pain & Pressure	Almost gone or mild
Fever	No fever or very mild

Viral sinusitis improves on its own. No antibiotics needed!!

VIRUS SINUSITIS

Symptom	Description
Nasal congestion	Stuffy or runny nose
Mucus Colour	Clear or slightly yellow
Other symptoms	Mild, dull pressure in forehead or cheeks
Facial Pain & Pressure	Sneezing, mild fatigue, postnasal drip, sore throat
Fever	low grade (below 100.4°F) or none

Symptoms may worsen slightly before improving

BACTERIAL SINUSITIS

Symptom	Description
Nasal congestion	Stuffy or runny nose
Mucus Colour	May already be thick and yellow/green
Fever	Possible, but mild
Facial Pain & Pressure	Mild but may feel fuller than usual
Other symptoms	Similar to viral, but mucus may be thicker

Similar to viral at first, but mucus might already be thick.

Day 4-5

Symptom	Description
Mucus Colour	Thick yellow/green, persists with no improvement
Congestion	Worsens—severe stuffiness
Fever	Often above 100.4°F
Facial Pain & Pressure	Increasing—worse on one side of the face
Cough	Persistent, may worsen

Symptoms worsen instead of improving. Possible bacterial infection

Day 7-10

Symptom	Description
Mucus Colour	Thick yellow/green, not improving
Congestion	Still severe, no signs of clearing
Fever	High fever (above 100.4°F/38°C) persists
Facial Pain & Pressure	Severe, persistent pain/swelling
Cough	Persistent, worsening

Bacterial sinusitis may require antibiotics. See a doctor if symptoms persist.

Figure 11: Front of RG

Here's what you can do to feel better.

Figure 12: Back of RG

As mentioned, in the case of viral versus bacterial sinusitis, antibiotics are often prescribed to be used at the patient's discretion if symptoms persist. In such cases, patients leave with recovery expectations that are only briefly communicated by the medical professional. Given the patients' discomfort, if this information is not easily accessible, they may opportunistically resort to antibiotics. Whilst our first two interventions aim to prevent this decision by emphasising the threat of AMR, in the risk assessment of the patient, the purpose of the RG is to serve as an affordance to better understand recovery progression that can be accessed and used post appointment. To change behaviour around antibiotic use, patients need to visualise a recovery without antibiotics. A bacterial sinus infection is commonly distinguished from a viral one through the duration and severity of symptoms, as well as the colour of nasal discharge (Piccirillo, 2004). While this information is available online, it will need to be directly supported in the most convenient way possible – a physical card. It is important to note that the RG will serve as a guide, and not a method of self-diagnosis. Thus, it is designed to help reassure patients and should be accompanied by explicit instructions for patients to coordinate their actions with the clinic.

Antibiotic Database Website

It's unlikely that patients will fully absorb the information that is briefly communicated during their examination regarding their prescribed antibiotics. This is why we propose a government-backed website to act as an all-in-one database for antibiotic and AMR-related information. When the user opens the website, a pop-up will appear on the screen, informing them about the importance of minimising antibiotic use and the threats of AMR. If this pop-up is clicked, it will bring them to a section where they can read easily digestible information regarding antibiotics. This website should also act as a tool to increase awareness and

education. Within the database, users should be able to easily search for antibiotics which once found, will have a streamlined list of the side effects for the specific antibiotic.

To complement the information in the antibiotics database, this website will also include advice on holistic and functional medicine. Pushing for functional medicine can help address antibiotic misuse and AMR (Murugaiyan et al., 2022). Functional medicine focuses on identifying and treating the cause of illness in a natural and comprehensive way, often reducing or eliminating the need for powerful drugs such as antibiotics (Jamal, 2023). In cases where antibiotics are not necessary, alternative approaches - such as the use of herbal antimicrobials like turmeric, ginger, garlic and thyme - along with probiotics and immune-boosting nutrition, are presented as effective options to support recovery (Parham et al., 2020). For patients who do require antibiotics, the website offers holistic strategies to protect and restore gut health. This includes tips on how to maintain a healthy microbiome through the use of probiotics and prebiotic-rich foods, helping to minimise the potential negative effects of antibiotics (Els, 2024). By integrating conventional and alternative methods, this resource informs responsible decision making and will aid in supporting recovery without antibiotics.

Discussions and Limitations

This paper aimed to find the best ways to improve AMR awareness and reduce the misuse of antibiotics by patients in PCFs. Whilst AMR represents a systemic issue with large scale institutional reform becoming increasingly necessary, given our potential agency within a complex and fragmented healthcare system, we focused on the behaviour of patients in our attempt to improve antibiotic misuse. Our analysis could have been structured in many ways, but we chose to utilise Activity Theory and Installation Theory. We used these theories to break down the steps of the relevant stakeholders and find pain points where interventions would be

best implemented. We then considered how to address these pain points by leveraging the three layers of an installation that channel the behaviour of patients.

We proposed a three-part solution that will shape perceptions of antibiotics by:

- a)** displaying posters, badges, stickers and narratives that foster new embodied competencies by associating antibiotics with risk and emotional resonance.
- b)** drawing attention to a community wall that highlights social values reinforcing the need to use of antibiotics appropriately.
- c)** providing a clear path to recovery after the appointment through a physical affordance, and a QR link to a website with additional information on antibiotics and functional alternatives.

Together, these interventions will encourage appropriate use of antibiotics by adjusting patient expectations across the physical, embodied and social layers that drive behaviour. These layers will converge towards an overarching narrative that shapes how patients perceive and use antibiotics.

The main limitation of our analysis is that it does not address the agricultural sector when discussing solutions to AMR. Farming in the U.S., specifically in relation to meat and dairy production, is the highest contributor to national AMR, but it is the hardest to combat, given the number of animals to control over the number of humans. As discussed earlier in this analysis, we chose to look at the medical sector as we believed that we would see better results when targeting humans and that the first step to combating AMR is increasing awareness. Once most of the U.S. population recognises the threat of AMR, it will be easier to push for tighter regulations in the agricultural sector.

Another key limitation of our analysis is that the effectiveness of posters, badges, and the community wall relies on patients' attention. While these interventions are designed to be

visible and engaging, patients experiencing discomfort may be less likely to notice or absorb the information presented. In this case the information will not change the perception of antibiotics. We considered communicating the risk of AMR verbally through medical staff. However, this would add pressure to their duties and is less likely to be sustainable as it requires additional training. Moreover, the RG issued to patients, whilst convenient, may be lost. This would undermine its purpose as a convenient affordance. While the medical professional should emphasise the importance of referring to the card, there is no guarantee that patients will use it as intended. Additionally, the QR code requires digital literacy and active engagement, however this solution is primarily designed to offer additional information after attention has already been caught.

Finally, our intervention may face several implementation difficulties. Firstly, the CDC can develop and introduce posters, badges and cards, but they have little power to enforce that they are used in practice. It may be useful to identify local champions to spearhead the intervention, which has previously encouraged the adoption of interventions at a local level. It was not possible to include a detailed implementation strategy. While we designed our interventions to work alongside the motives of key stakeholders, resistance may be encountered at a local level due to default practices that are deeply intertwined within institutional norms.

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Appendix:

A: Poster Option 1



B: Poster Option 2



C: Poster Option 3



D: Chat GPT Use

Prompt: We are looking to design a personalised recovery guide for patients that enter outpatient facilities in the US. This card needs to be designed to offer patients the ability to distinguish between the symptoms of bacterial and viral sinusitis. We know from research that - "In most patients, rhinoviral illness improves in 7 to 10 days 6; therefore, a diagnosis of acute bacterial sinusitis requires the persistence of symptoms for longer than 10 days or a worsening of symptoms after 5 to 7 days. Symptoms of viral sinusitis, including fever, mimic those of bacterial sinusitis, although the colour and quality of nasal discharge — classically, clear and thin during viral sinusitis and yellow-green and thick during bacterial sinusitis — may help to differentiate the two" Can you develop and formalise how this card would look.

Response: Viral vs. Bacterial Sinusitis: Know the Difference

Most sinus infections are caused by **viruses** and will improve on their own within **7-10 days**. Bacterial sinus infections are less common and may require antibiotics. Use this guide to help determine what type of infection you may have:

- **Viral Sinusitis (Common Cold):** Symptoms improve within **7-10 days**. You may have a **low-grade fever**, clear or thin nasal discharge, and mild facial pressure that gradually gets better.
- **Bacterial Sinusitis:** Symptoms **persist for more than 10 days** or **worsen after 5-7 days**. You may experience **thick, yellow-green nasal discharge**, **high fever (above 102°F)**, **severe facial pain**, and **congestion that does not improve**.

When to Seek Medical Attention

- Your symptoms **worsen after 5-7 days** instead of improving.
- You have **severe facial pain, swelling, or difficulty breathing**.
- You have a **high fever over 102°F** lasting more than **3 days**.
- Your symptoms **last more than 10 days without improvement**.

Managing Your Symptoms at Home

If you have **viral sinusitis**, antibiotics **will not help**. Instead, try the following to relieve your symptoms:

- ✓ **Rest and hydration:** Drink plenty of fluids.
- ✓ **Nasal care:** Use a saline spray or humidifier to ease congestion.
- ✓ **Pain relief:** Take over-the-counter medications like ibuprofen or acetaminophen.
- ✓ **Steam therapy:** Use warm compresses on your face or take hot showers to relieve sinus pressure.

If you have **bacterial sinusitis**, your doctor will decide if antibiotics are necessary. If prescribed, **always take the full course of antibiotics** to prevent antibiotic resistance.

Continue using home remedies to ease symptoms.