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### Do adults with bacterial infections develop less of an antibiotic resistance with IV antibiotics than with oral antibiotics after a full course of treatment?

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# Do adults with bacterial infections develop less of an antibiotic resistance with IV antibiotics after a full course of treatment?

Taylor-Erin Evitts and Navy Stevens



## Abstract

This study was conducted in order to discover if patients develop less of an antibiotic resistance when going through intravenous antibiotics, compared to using oral antibiotics. This concept was created due to the fact that many people that are prescribed oral antibiotics, do not finish the entire prescribed amount. When this occurs, it gives the bacteria that the antibiotics were trying to get rid of, have the chance to adapt and become resistant to the particular antibiotic. By discovering the percentage of people who were prescribed antibiotics that never finished a round of them, it aids in narrowing down what the best course of action would be to aid in further preventing the spread of antibiotic resistance.

## Introduction

Antibiotics are used to help treat infections with an intravenous or oral route of administration. Intravenous antibiotics can be used for severe infections, like sepsis, in order to reach the tissues faster and with a higher concentration compared to oral antibiotics. It is also more penetrable in parts of the body such as in the bone and spinal fluid where oral methods are not as effective (Johnson, 2017).

Antibiotics are given to help treat the infection as quickly as possible, in which the health care provider may give more than one at a time or a "broad-spectrum" antibiotic to kill many types of bacteria ("Antibiotic Treatment in the Hospital", 2016). Unfortunately, the influence of antibiotics is now fading due to the progressive rise of resistance, and this phenomenon is observed among all antimicrobial drugs. The first sign of antibiotic resistance was discovered by Abraham and Chain in 1940 when they reported an *E. coli* strain was able to inactivate penicillin by producing penicillinase (Lobanovska & Pilla, 2017).

Antibiotic resistance is a dangerous problem rising to a high level in today's healthcare. New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases. Specific infections such as pneumonia, tuberculosis, blood poisoning, gonorrhoea, and foodborne diseases are proving to be becoming harder, and sometimes impossible, to treat as antibiotics become less effective. While there are specific bacteria that are resistant to antibiotics, many times people can be resistant to antibiotics over time if they are misused, especially with certain forms of administration such as intravenous ("Antibiotic Resistance", 2020).

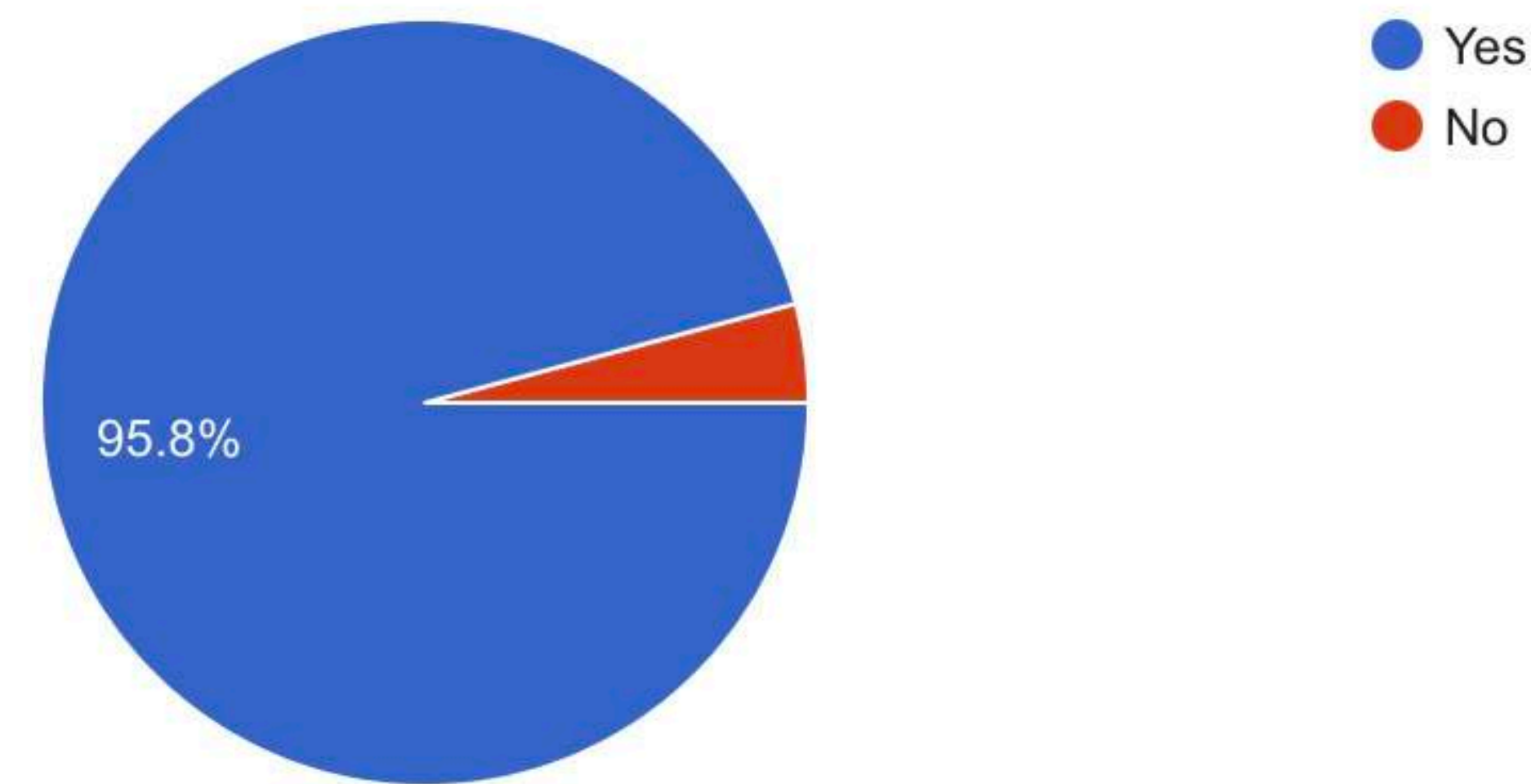
## Methods

A literature review involving relevant data to the research topic from scholarly articles and other sources was conducted. Five sources were peer-reviewed, primary articles from scholarly journals published within the last five years. The other three were educational sources from professional websites and other scientific literature.

A poll was created through "Google Forms" and shared on Facebook to get responses from a variety of individuals. There were three questions asked, only one being required because the other two questions were only for the individuals that answered "Yes" to the first question. The amount of responses received from the poll was 72, however only 69 people responded to all three questions. With the questions being "Have you ever been prescribed antibiotics?" being the first question asked, it set up a basis for the next two questions. If the individual answered "Yes" to the question of if they had ever been prescribed antibiotics, then they would answer the second question, that being "If you answered 'yes' to the previous questions, were the antibiotics oral or administered via IV?". If the individual answered "Oral" or "Both", they were directed to the third question of "If you have been prescribed ORAL antibiotics, have you always completely finished all of the prescribed amount?". These questions were prompted in this way in order to narrow down the answers for the data that was trying to be collected, that of what percentage of people in the sample have not finished all of their prescribed oral antibiotics at any given time.

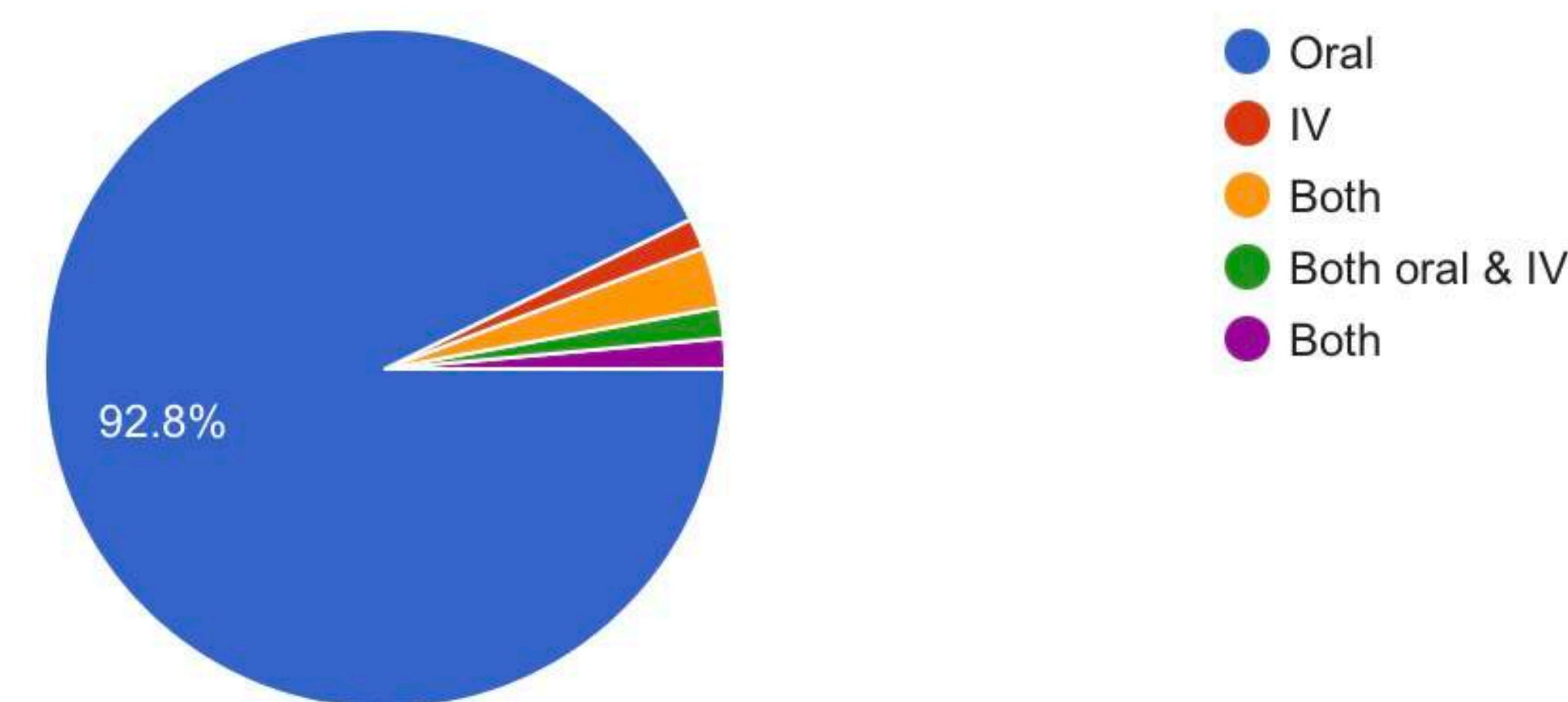
Have you ever been prescribed antibiotics?

72 responses



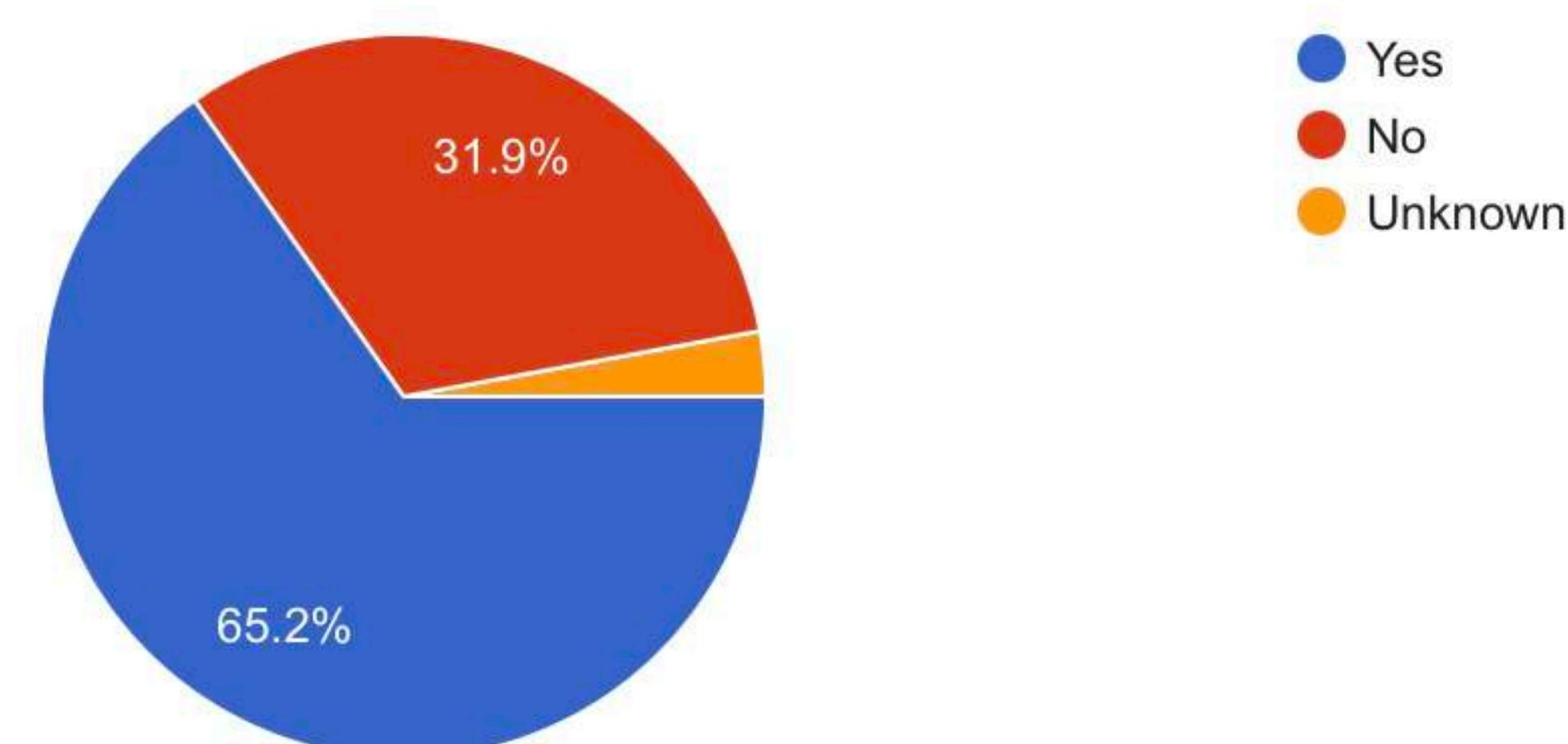
If you answered "yes" to the previous question, were that antibiotics oral or administered via IV?

69 responses



If you have been prescribed ORAL antibiotics, have you always completely finished all of the prescribed amount?

69 responses



## Evaluation & Analysis

McCarthy & Avent (2020) found that the overuse of antibiotics has contributed to the emergence and dissemination of antimicrobial-resistant nosocomial and community pathogens. Reducing intravenous antibiotic use and shortening the duration of antibiotic courses can contribute to less antibiotic use overall, reducing the development of antibiotic resistance. The appropriate use of oral antibiotics, especially those with good bioavailability, is also essential to maintain their usefulness.

Throughout the history of antibiotic use, recommendations on duration of therapy were based on fairly arbitrary extension of days of treatment such as 7, 10, or 14 days rather than on reliable evidence with the main aim to keep the risk of failures and undertreatment at a minimum. This concept, before the gradual increase in the incidence of antibiotic-resistant infections, was utilized to treat beyond clinical improvement to accomplish both the desire to reduce relapses and the belief that antimicrobial resistance could be prevented by a prolonged antibiotic course.

The use of IV antibiotics has shown correlation to a rise in antibiotic-resistant infections. As antibiotic resistance has increased, our ability to use oral antibiotics to treat infections has declined. Infections that generally would not require intravenous antibiotics now often do (Johnson, 2017). Broad-spectrum antibiotics are more likely to lead to bacteria that resist drugs. This leads to infections that last longer and cost more to treat. They can spread to family and friends. Reducing the dosage of antibiotics is called "de-escalation" used to improve treatment and help prevent antibiotic overuse ("Antibiotic Treatment in the Hospital", 2016).

There is also a belief among doctors and some patients that intravenous antibiotics can hold "additional potency" (Broom et al., 2016) is an important misunderstanding given that clinical evidence supports efficacy of oral formulations in many common clinical situations. This hesitation to use an oral route despite evidence of clinical efficacy has shown persistence over time and across different specialty areas, despite the preference of patients for outpatient management with oral antibiotics. This can impact the intravenous to oral switch method and also lead to intravenous overuse, a major factor in the development of antibiotic resistance.

From the data collected from the online poll, it was discovered that while 92.8% of the 69 people that completed the poll have been prescribed oral antibiotics at one point in their lives, only about 65.2% of people have actually completely finished taking the prescribed amount. While a good amount of antibiotic resistance comes from overuse of strong antibiotics that the bacteria can adapt to, it also comes from not taking the entire amount of the prescribed oral antibiotics. This is why it was believed that IV antibiotics may be a better way to administer antibiotics, to be able to fully ensure that the entire prescribed amount is taken.

## Conclusion & Implications for Future Research

McCarthy & Avent (2020) suggested shorter durations of intravenous antibiotic therapy and switching to oral therapy are important considerations in patient management. These interventions have the potential to improve outcomes for patients by avoiding the adverse effects of intravenous drugs and may facilitate early discharge from hospital.

The intravenous to oral switch method should to "demystify antibiotic efficacy, engage consumers around the negative effects of iv antibiotic overuse and examine strategies to streamline team decision-making" ("Antibiotic Resistance", 2020). Addressing these issues can effectively reduce inappropriate antibiotic use that can lead to resistance. If key limiting factors to early oral switch are identified, this modification can allow programs to develop a more widely applicable and accessible base.

Lobanovska & Pilla (2017) indicated a need for new techniques for rapid diagnostics of bacterial infection and better antibiotic surveillance schemes to be designed, as they are crucial for early identification of resistance and the implementation of appropriate interventions to combat the spread of antibiotic resistance. With more and more bacteria adapting to become resistant to antibiotics each year, the numbers for individuals getting antibiotic resistant infections raise greater and faster. If something is not done to adapt new antibiotic agents in the near future, the crisis will get worse.

It is also important as the healthcare professionals to help prevent and control the spread of antibiotic resistance with ensuring appropriate hand hygiene, only administering prescribed antibiotics as they are needed, report any antibiotic-resistant infections, and educating the patient on correct administration, antibiotic resistance, the dangers of misuse, and preventing infections ("Antibiotic Resistance", 2020).

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