Penicillin Allergies Linked to Increased Likelihood of Other Antibiotic Allergies

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Key Findings:

- Patients with a documented penicillin allergy are more likely to also have allergies to other antibiotics than those without an allergy to penicillins. Patients with penicillin allergies were three times more likely to also have an allergy to cephalosporins or carbapenems.

Penicillin intolerances are common, reported by approximately 1 in 10 patients, though for many, a true penicillin allergy may not exist, or the allergy may resolve over time.[1] Those with the allergy may also have an allergy to other antibiotics, primarily those in the beta-lactams class, which includes cephalosporins and carbapenems.[2,3] It is suspected that having an allergy documented to a first-line antibiotic can lead to higher costs and antibiotic resistance as second-line antibiotics are used.[2]

To understand the relationship between having an allergy to penicillins and the presence of additional antibiotic class allergies, we studied 1,663,701 patients prescribed or administered penicillin and an additional antibiotic class. Patients were required to have at least one non-antibiotic allergy documented or an allergy documentation of no known allergies prior to receiving penicillin or in the year that followed. The 31,319 patients with a documented penicillin allergy were matched 1:4 with patients without a documented penicillin allergy based on antibiotic class, sex, race and ethnicity. We further adjusted for factors such as number of documented allergies, race, ethnicity, and age.

We found that patients who had a penicillin allergy were more likely to have additional antibiotic allergies than those without a penicillin allergy, as seen in Figure 1. Specifically, those with a penicillin allergy were 308% more likely to have an allergy to cephalosporins, 305% more likely to have an allergy to carbapenems, and 234% more likely to have an allergy to macrolides. Among all the studied antibiotic classes, patients had the least increased (152%) likelihood of having an aminoglycoside allergy. Of note, carbapenem antibiotics are less frequently used than other studied antibiotics as they are typically prescribed for less common infections with multidrug-resistant organisms, resulting in a smaller population with potential exposure.[4]

Change in Likelihood of Other Antibiotic Allergy for Patients with Penicillin Allergy

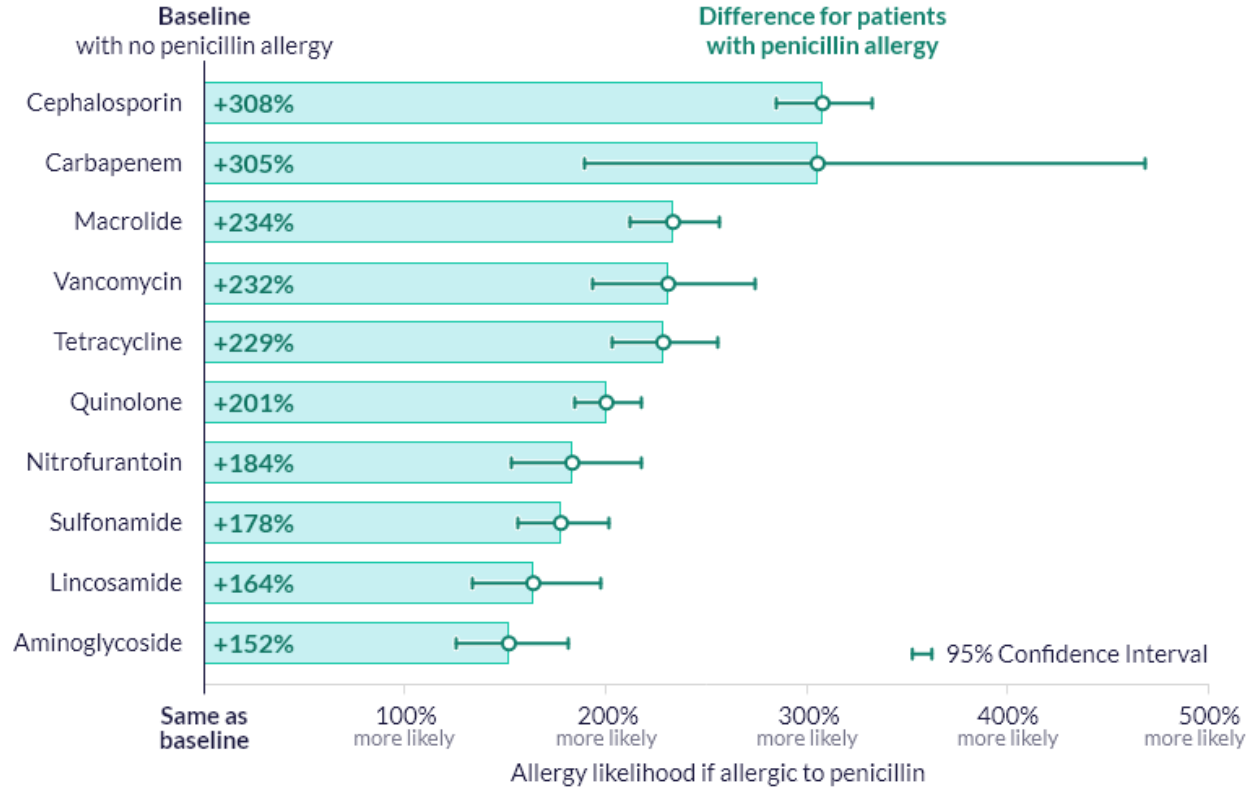

Figure 1. Likelihood of a patient having additional antibiotic allergies if they have a penicillin allergy.

These data come from Cosmos, a dataset created in collaboration with a community of Epic health systems representing more than 259 million patient records from 1,500 hospitals and more than 34,500 clinics from all 50 states and Lebanon. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

1. Solensky R. Patient education: Allergy to penicillin and related antibiotics (Beyond the Basics). UpToDate. Published January 11, 2023. https://www.uptodate.com/contents/allergy-to-penicillin-and-related-antibiotics-beyond-the-basics. Accessed July 9, 2024.
2. Lteif L, Eiland LS. The basics of penicillin allergy: What A clinician should know. Pharmacy (Basel). 2019;7(3):94. doi:10.3390/pharmacy7030094
3. Pandey N, Cascella M. Beta-Lactam Antibiotics. StatPearls Publishing; 2023.
4. Carbapenems. Drugs.com. List of Carbapenems - Drugs.com. Accessed July 29, 2024.

Data Definitions

Term	Definition
Study period	7/19/1984-12/31/2023
Study population	Patients over age 18 who have been prescribed penicillin and an **additional antibiotic type**.

	To ensure patients were evaluated for allergies, all patients were required to have one or more non-antibiotic allergies documented, or an allergy documentation of no known allergies, prior to receiving penicillin or in the year that followed.
Additional antibiotic types	Aminoglycoside Antitubercular Carbapenem Cephalosporin Lincosamide Macrolide Nitrofurantoin Quinolone Sulfonamide Tetracycline Vancomycin
Exposures	Documentation of penicillin allergy
Outcomes	Documentation of an allergy to an additional antibiotic type
Confounders	Sex: male/female Age: 18-39, 40-64, 65+ **Race and ethnicity** Number of non-antibiotic allergies
Race and ethnicity	We categorized patients based on their first listed race (Asian, American Indian, Black, Pacific Islander, or White) and by ethnicity (Hispanic or non-Hispanic).

Table 1: Change in Likelihood of Other Antibiotic Allergy for Patients with Penicillin Allergy

Antibiotic	Odds Ratio	95% CI Low	95% CI High
Cephalosporin	4.08	3.85	4.33
Carbapenem	4.05	2.89	5.68
Macrolide	3.34	3.12	3.57
Vancomycin	3.32	2.93	3.75
Tetracycline	3.29	3.03	3.56
Quinolone	3.01	2.84	3.17
Antiprotozoal	2.84	2.45	3.30
Nitrofurantoin	2.84	2.53	3.18
Sulfonamide	2.78	2.56	3.02
Lincosamide	2.64	2.34	2.98
Aminoglycoside	2.52	2.26	2.81