Review

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Antibiotic Allergy Labeling in Primary Care: Challenges, Consequences and a Path Forward

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Abstract

Approximately 10% of the general population reports a penicillin allergy, making it one of the most commonly documented drug allergies in clinical practice. Yet formal evaluation confirms true hypersensitivity in fewer than 10% of these cases. This gap has practical consequences. Patients who carry an inaccurate allergy label are more likely to receive broader-spectrum alternative antibiotics, with downstream effects on cost, adverse drug events, and antimicrobial resistance. Although primary care physicians are often the first to record these labels and the ones who face their consequences most often in daily prescribing, they have remained peripheral to most systematic de-labeling efforts. In this narrative review, we examine how antibiotic allergy labels arise, why they persist, and what they cost—clinically, economically, and from a stewardship perspective. We also discuss emerging approaches to reassessment in primary care, along with the possible role of digital health tools and patient education in improving the accuracy of allergy documentation.

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1. Introduction

Antibiotic allergy is one of the most frequently reported adverse drug reactions worldwide. Penicillin allergy, in particular, is commonly documented: about 10% of the general population carries this label [1]. But when patients undergo formal evaluation—typically with skin testing and, where appropriate, oral challenge—more than 90% are found not to have a true immunoglobulin E (IgE)-mediated allergy [1]. That mismatch between label and reality is not a minor documentation issue. It is a widespread and underrecognized clinical problem.

Its consequences extend well beyond the individual patient. Once an unverified allergy label enters the record, clinicians often avoid first-line beta-lactam therapy and instead prescribe broader-spectrum alternatives. The result is familiar: higher costs, more adverse drug events, and greater selective pressure for antimicrobial resistance [3]. Even so, verification and de-labeling still remain largely concentrated within allergy subspecialty care. Most patients who carry questionable labels never reach formal reassessment.

Primary care sits at the center of this problem. It is usually the first setting in which allergy information is reported, recorded, and acted upon. Primary care physicians are therefore not only the initial recipients of these labels but also the clinicians most likely to see their downstream effects in routine prescribing decisions [7]. Yet structured approaches to antibiotic allergy assessment in generalist practice remain uncommon, and many clinicians have neither the training nor the system support to revisit labels that have long been taken as fact.

In this narrative review, we consider antibiotic allergy mislabeling from the primary care perspective. We discuss how inaccurate labels are created and sustained, what clinical and economic

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harm they cause, and why primary care should play a larger role in reassessment. We also consider how digital health tools and patient education might help improve allergy documentation in everyday practice.

2. The Problem with Self-Reported Antibiotic Allergy

Self-reported antibiotic allergy is inherently unreliable because patients and caregivers often use the word "allergy" to describe very different kinds of experiences. In practice, the term may refer to true IgE-mediated hypersensitivity, predictable adverse effects such as gastrointestinal upset, or symptoms that simply happened to appear during antibiotic treatment but were unrelated to the drug itself [2]. Once these distinct phenomena are collapsed into a single label, clinical confusion becomes almost inevitable.

This problem is especially common in children. Antibiotics are frequently prescribed during acute infections, and those same illnesses—particularly viral ones—can produce rashes that are then attributed to the medication [4]. A child receiving amoxicillin for pharyngitis may develop a diffuse maculopapular rash that is actually viral in origin, not drug-related. Still, in the absence of formal evaluation, the antibiotic is often blamed, and the label remains in place for years [5]. Standardized testing has shown that most parent-reported penicillin allergies in children do not reflect true hypersensitivity [6].

We have seen this pattern repeatedly in our own digital health setting. Through a pediatric health guidance mobile application with more than three million downloads in South Korea, caregivers frequently upload photographs of rashes that appear during antibiotic treatment and ask whether the child has developed a drug allergy. The submissions follow a consistent pattern: a rash occurs while the child is taking an antibiotic, and the drug is assumed to be the cause. That reasoning is understandable. It is also one of the main ways inaccurate labels become established [4].

Several factors then make those labels difficult to undo. Patients and caregivers rarely seek reassessment once an allergy has been documented, in part because the label is perceived as protective rather than limiting. Many do not realize that carrying an unverified allergy label can lead to worse treatment options later [15]. Clinicians, meanwhile, often accept reported allergies without verification, especially in busy settings shaped by time pressure and medicolegal caution. Electronic medical records do not help much. In many systems, the allergy section is little more than a free-text field or checkbox, with no clear distinction between confirmed hypersensitivity and unverified patient report [7]. Over time, a single uncertain story can harden into a durable clinical fact.

3. Consequences of Inaccurate Labeling

The effects of an unverified antibiotic allergy label are broad and clinically important. Once penicillin allergy is listed in the chart, clinicians often turn to alternative agents that are broader in spectrum, more costly, and sometimes less safe than the drugs they replace [9]. Patients labeled as penicillin-allergic are more likely to receive substitutes such as fluoroquinolones, clindamycin, or vancomycin instead of first-line beta-lactam therapy [3]. These alternatives are not benign. Depending on the agent, they may carry risks such as Clostridioides difficile infection, QT prolongation, or nephrotoxicity—harms that may be avoidable if the allergy label is inaccurate to begin with.

The stewardship implications are serious. When second-line or broad-spectrum antibiotics are used unnecessarily, the cumulative effect is greater antimicrobial selection pressure [1]. At the population level, millions of patients with unverified allergy labels can meaningfully shape prescribing patterns and, in turn, resistance patterns in both community and hospital settings [8,10]. It is not surprising, then, that antibiotic allergy de-labeling has become a priority within national antimicrobial stewardship efforts.

The financial burden also deserves attention. A systematic review found that self-reported penicillin allergy is associated with substantially higher antibiotic-related and hospitalization costs

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compared with the absence of such a label [11]. Labeled patients may experience longer hospital stays, higher rates of treatment failure [12], and a greater risk of surgical site infection [9]. These are not isolated inefficiencies. They accumulate across healthcare systems and make the case for de-labeling stronger not only clinically, but economically.

There is also a less measurable cost. Patients who believe they are allergic to penicillin or other common antibiotics may approach future treatment decisions with considerable anxiety, especially when a clinician questions the label or suggests allergy testing [15]. For parents, the concern is often more emotionally charged. They may feel responsible for protecting their child from a medication they believe once caused harm, even if that belief rests on uncertain evidence. This part of the problem is easy to overlook, but it matters. De-labeling is not only about correcting the chart. It is also about changing a belief that may have been reinforced for years.

4. The Role of Primary Care Physicians

Primary care physicians are well positioned to address antibiotic allergy mislabeling, but in most systems their role remains underdeveloped. They are often the clinicians who first record the label, who encounter it repeatedly during routine prescribing, and who maintain the longest relationship with the patient over time [7]. That continuity matters. It creates opportunities to revisit labels that were assigned years earlier, often on the basis of limited or uncertain information.

Importantly, reassessment in primary care does not always require complex testing. A careful history alone can often identify patients whose reported reactions are unlikely to reflect true hypersensitivity [1]. The essential questions are straightforward: What exactly happened? When did it happen relative to drug exposure? How long ago was the event? Has the patient tolerated the same antibiotic, or a related one, since then [13]? In many cases, that conversation reveals a different story from the one implied by the word “allergy.” The original event may have been a side effect, a viral rash, or an episode so remote that the details are no longer reliable.

For patients with clearly low-risk histories, direct oral provocation testing has emerged as a practical option outside specialist settings. Several studies suggest that oral amoxicillin challenge can be performed safely in selected low-risk patients in primary care or comparable outpatient environments, with serious reactions reported rarely and mild adverse reactions occurring in only a small proportion of cases [14,16]. This shift matters because reliance on allergy subspecialists alone is unlikely to address the scale of mislabeling. Some national guidance has already begun to reflect that reality by supporting the idea of primary care-led de-labeling pathways [2].

Still, the barriers are real. Many primary care physicians feel they have not been adequately trained in drug allergy assessment and are uncertain about which patients can be safely challenged without specialist input [15]. Routine consultations are already crowded. Standardized protocols are often missing from electronic health record systems. Medicolegal concerns remain a deterrent. In some settings, reimbursement structures also work against primary care involvement, especially when formal allergy testing is tied to specialist billing codes [7].

Those barriers will not disappear on their own. Addressing them will likely require targeted education during residency and continuing professional development, practical risk stratification tools designed for generalist use, and institutional support for structured allergy reassessment in primary care [7,17]. Because primary care accounts for such a large share of antibiotic prescribing in most countries, even modest progress at this level could have substantial effects.

5. Digital Health and Patient Education

Digital health may offer one of the more practical ways to intervene earlier in the labeling process. Mobile health applications are already used widely by caregivers of young children, a group in which antibiotic allergy mislabeling is particularly common [18]. These tools capture what happens outside the clinic: symptoms as they appear, how families interpret them, and what kinds of decisions follow.

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Our experience with a pediatric health guidance application used by more than 250,000 monthly active users in South Korea suggests how useful that moment may be. Caregivers frequently upload photographs of rashes that develop during antibiotic treatment and document symptoms through in-app logs. Again and again, the same pattern appears. A rash occurs while the child is taking an antibiotic, and the drug is assumed to be the cause [4]. This is precisely the point at which education may matter most. If families receive timely, context-specific guidance before an inaccurate label is entered into the medical record, some of that misattribution may be prevented at the source.

Education, however, is not a secondary issue. It is central to de-labeling. Qualitative studies suggest that even after successful allergy testing, some patients remain reluctant to take penicillin-class antibiotics and may continue reporting the allergy in later clinical encounters [15]. In other words, a negative test result does not automatically correct the patient's internal model of what happened. Effective education must therefore do more than announce that testing was negative. It has to explain what a true drug allergy is, why the earlier event may not fit that definition, and why accurate labeling matters for future treatment [2].

Artificial intelligence-assisted triage may eventually add another layer to this process. Natural language processing systems could, in principle, help distinguish histories that sound compatible with IgE-mediated reactions from those that more likely reflect benign adverse effects or coincidental symptoms [19]. Such tools are still early in development, and their clinical role remains uncertain. Even so, the direction is clear. As digital platforms become more embedded in everyday health behavior, they may help identify which reports warrant formal evaluation and which may be better addressed through reassurance and education.

6. Conclusions

Most self-reported antibiotic allergy labels do not reflect true hypersensitivity, yet they remain embedded in medical records and continue to shape prescribing in ways that are clinically suboptimal and systemically costly. The consequences include avoidable use of broader-spectrum antibiotics, greater risk of adverse events, increased healthcare spending, and added pressure on antimicrobial resistance.

Primary care should have a larger role in addressing this problem. It is the setting in which these labels are often first recorded, repeatedly encountered, and most plausibly revisited. Careful history-taking can identify many low-risk cases, and selected patients may be appropriate for structured de-labeling pathways that do not depend entirely on subspecialty referral.

But de-labeling is not only a technical process. It is also a communication task. Patients and caregivers need to understand why an old label is being questioned and what is at stake if it remains unchallenged. Digital health tools may be especially helpful here, not because they replace clinical judgment, but because they create opportunities to intervene earlier—before uncertainty becomes permanent documentation.

A more coordinated strategy, combining primary care-led reassessment, patient education, and thoughtful use of digital tools, could substantially reduce the burden of antibiotic allergy mislabeling and strengthen antibiotic stewardship at the same time.

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