

## ORIGINAL RESEARCH

# Risk of Redocumenting Penicillin Allergy in a Cohort of Patients With Negative Penicillin Skin Tests

Ramzy H. Rimawi, MD<sup>1,2\*</sup>, Kaushal B. Shah, MD<sup>1</sup>, Paul P. Cook, MD<sup>1</sup><sup>1</sup>Department of Internal Medicine, Division of Infectious Diseases, Brody School of Medicine—East Carolina University, Greenville, North Carolina;<sup>2</sup>Department of Internal Medicine, Division of Critical Care Medicine, Brody School of Medicine—East Carolina University, Greenville, North Carolina.

**BACKGROUND:** Even though electronic documentation of allergies is critical to patient safety, inaccuracies in documentation can potentiate serious problems. Prior studies have not evaluated factors associated with redocumenting penicillin allergy in the medical record despite a proven tolerance with a penicillin skin test (PST).

**OBJECTIVE:** Assess the prevalence of reinstating inaccurate allergy information and associated factors thereof.

**DESIGN:** We conducted a retrospective observational study from August 1, 2012 to July 31, 2013 of patients who previously had a negative PST. We reviewed records from the hospital, long-term care facilities (LTCF), and primary doctors' offices.

**SETTING:** Vidant Health, a system of 10 hospitals in North Carolina.

**SUBJECTS:** Patients with proven penicillin tolerance rehospitalized within a year period from the PST.

**MEASUREMENTS:** We gauged hospital reappearances, penicillin allergy redocumentation, residence, antimicrobial use, and presence of dementia or altered mentation.

**RESULTS:** Of the 150 patients with negative PST, 55 (37%) revisited a Vidant system hospital within a 1-year period, of whom 21 were LTCF residents. Twenty (36%) of the 55 patients had penicillin allergy redocumented without apparent reason. Factors associated with penicillin allergy redocumentation included age >65 years ( $P = 0.011$ ), LTCF residence ( $P = 0.0001$ ), acutely altered mentation ( $P < 0.0001$ ), and dementia ( $P < 0.0001$ ). Penicillin allergy was still listed in all 21 (100%) of the LTCF records.

**CONCLUSIONS:** At our hospital system, penicillin allergies are often redocumented into the medical record despite proven tolerance. The benefits of PST may be limited by inadequately removing the allergy from different electronic/paper hospital, LTCF, primary physician, and community pharmacy records. *Journal of Hospital Medicine* 2013;8:615–618. © 2013 Society of Hospital Medicine

Patient safety is a healthcare provider's top priority. Drug allergies are instated into an electronic medical record (EMR) to avoid potential adverse events in the future. Despite the intention to provide safety, healthcare providers frequently document antimicrobial allergies incorrectly.<sup>1</sup> In turn, this may lead to decreased antibiotic choices, increased healthcare costs, potential adverse reactions, and unnecessary avoidance of optimal, first-line agents.

Several strategies have been developed to help improve the accuracy of allergy documentation, including pharmacy-based interventions, but the persistence of corrections, once performed, is unknown.<sup>2</sup> Although most antibiotic allergy errors are identified upon review of prior medication history (eg, penicillin allergy listed in a patient who previously received piperacillin–tazobactam), no prior studies have evaluated penicillin allergy errors

directly after a proven tolerance with a penicillin skin testing (PST) and penicillin confirmatory challenge.<sup>3–5</sup> We hereby assess factors for erroneous allergy documentation in a cohort of patients with a negative PST.

## METHODS

We retrospectively reviewed charts under a protocol approved by the university and medical center institutional review board. Following a PST intervention we have previously described, penicillin was removed from the patients' EMR (Epic, Verona, WI) allergy list from March 2012 through July 2012.<sup>6</sup> We then invested a brief procedure note into the allergy section describing the negative PST and subsequent tolerance of a penicillin agent. During the PST intervention, there was no attempt to convey the result of the PST and corrected allergy information to the outpatient clinicians.

As a follow-up to our previous study, we reviewed the charts of the 150 subjects who represented the entire population of patients who underwent PST in the March 2012 through July 2012 intervention time period. From August 2012 through July 2013, charts were reviewed to gauge reappearances at Vidant Health, a system of 10 hospitals in eastern North Carolina. Collected data also included demographics, drug allergy or intolerance, penicillin allergy redocumentation, residence, antimicrobial use, and presence of dementia or altered mentation.

\*Address for correspondence and reprint requests: Ramzy Husam Rimawi, MD, Department of Internal Medicine, Division of Infectious Diseases and Division of Critical Care Medicine, The Brody School of Medicine at East Carolina University, Doctor's Park 6A—Mail Stop 715, Greenville, NC 27834; Telephone: 252-744-4500; Fax: 252-744-3472; E-mail: ramzyrimawi@hotmail.com

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**TABLE 1.** Data Comparing Patients Who Had Penicillin Allergy Erroneously Reinstated Into the Medical Record Versus Those Who Did Not

Category	Variables	Penicillin Allergy Not Reinstated, n = 35	Penicillin Allergy Reinstated, n = 20	P Value
Age, y	18–30	5 (14%)	0 (0%)	0.011
	31–64	17 (49%)	5 (37%)	
Gender	>65	13 (37%)	15 (75%)	0.19
	Male	12 (34%)	10 (50%)	
	Female	23 (66%)	10 (50%)	
Race	White	20 (57%)	11 (55%)	0.36
	Black	14 (40%)	8 (40%)	
	Hispanic	1 (3%)	1 (5%)	
Residence	Home	28 (80%)	5 (25%)	0.0001
	LTCF	7 (20%)	15 (75%)	
Acutely altered mentation	Yes	8 (23%)	16 (80%)	<0.0001
	No	27 (77%)	4 (20%)	
Dementia	Yes	1 (3%)	10 (50%)	<0.0001
	No	34 (97%)	10 (50%)	
Primary service	Resident*	18 (51%)	5 (25%)	0.18
	Hospitalist	8 (23%)	10 (50%)	
	Surgery	3 (9%)	3 (15%)	
	Emergency medicine	6 (17%)	2 (10%)	
Primary language	English	34 (97%)	19 (95%)	0.59
	Spanish	1 (3%)	1 (5%)	
Hospital diagnosis	Infectious	19 (54%)	14 (70%)	0.20
	Noninfectious	16 (46%)	6 (30%)	
Antibiotic received	β-lactam†	22 (63%)	0 (0%)	0.07
	Non-β-lactam‡	4 (11%)	12 (60%)	
	None	9 (26%)	8 (40%)	

NOTE: Abbreviations: LTCF, long-term care facility. Fisher exact testing was used for all the valuables.

\*Internal medicine or family practice resident service (under supervision by an attending physician).

†β-lactams, not including aztreonam.

‡Aztreonam and non-β-lactams.

Outpatient physician and long-term care facility (LTCF) allergy records were obtained via EMR records, patient or family inquiry, and referring

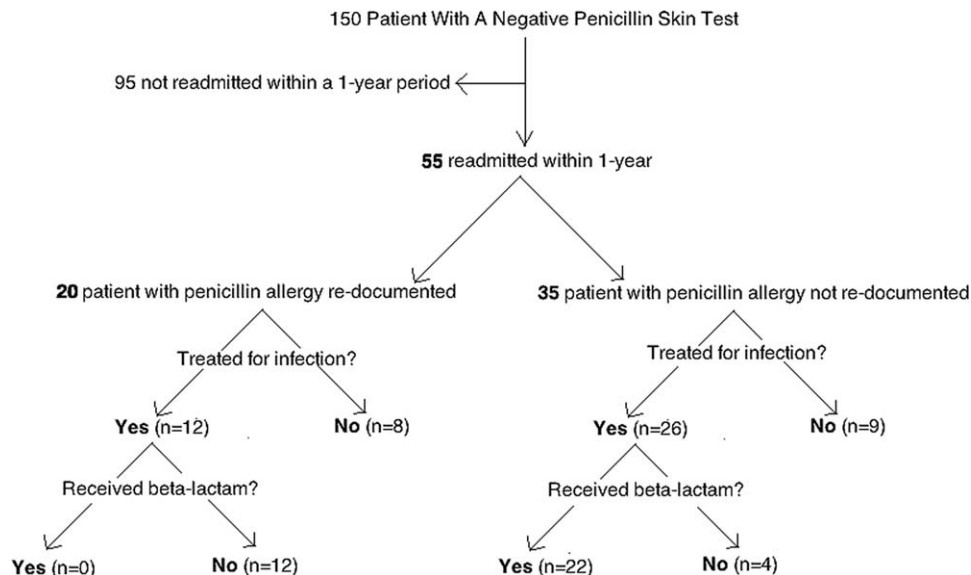
documents that accompanied the patient upon arrival. In addition to reviewing the LTCF and/or outpatient physician referring documents, the outpatient physician(s) and LTCFs were contacted and asked to review other electronic or paper records that may not have been delivered with the referring documents. Inpatient and outpatient records were reviewed for penicillin allergy, as defined by the drug allergy practice parameters.<sup>7</sup> Fischer exact tests were used to identify significant associated factors.

**RESULTS**

Of the 150 patients with proven penicillin tolerance, 55 (37%) revisited a Vidant Health hospital within a year period, of which 22 (40%) received a β-lactam agent once again without adverse effects (Table 1). Twenty (36%) of the 55 patients had penicillin allergy redocumented (Figure 1). There was no description of any allergy after the PST in any of the 20 EMR, LTCF records, or outpatient primary care physician records. Factors associated with penicillin allergy redocumentation (vs those not redocumented) included age >65 years ( $P = 0.011$ ), residence in a LTCF ( $P = 0.0001$ ), acutely altered mentation ( $P < 0.0001$ ), and dementia ( $P < 0.0001$ ). Penicillin allergy was still reported in all 21 (100%) of the LTCF patient records.

**CONCLUSION**

Errors in medication documentation are a major cause of potential harm and death.<sup>8</sup> In the United States, up to 14% of patient harm is due to a preventable medication error, a rate that exceeds death related to breast cancer, vehicular accidents, and AIDS.<sup>9,10</sup> Inaccurate drug allergy reporting can result in a cascade of consequential medical errors, including medication prescribing (eg, use of less effective, potentially more toxic and/or more expensive agents), and diagnostic



**FIG. 1.** Flow chart of the 150 patients with a negative penicillin skin test.

errors (eg, repeat PST, unnecessary medication desensitization).

Although EMR systems are designed to improve allergy documentation, they may also increase the risk of inaccurate or out-of-date data. Providers may be reluctant to permanently alter the electronic record by removing an allergy from the EMR. “Chart lore,” the persistence of inaccurate or out-dated information, may contribute to error, particularly when the patient is unable to provide information directly. We found, for example, that dementia and acutely altered mentation were associated with allergy reporting errors, likely related to the inability of the patient to give a reliable history. Finally, the EMR does not typically include a function for noting that an allergy does not exist, making it easier to reinstate incorrect allergies. To address this problem, we subsequently began listing a negative PST as an “other allergy” in the EMR allergy section to improve visibility.

We also found that residence in an LTCF was associated with allergy reporting error, in part perhaps because all LTCF records still included penicillin as an allergy. This finding highlights the need for direct communication of a proven PST tolerance with the primary care physician or LTCF provider, which was not part of our initial intervention. Previous studies have described the benefit of removing incorrectly reported allergies from community pharmacy records as well.<sup>2,11</sup> Simply recording it into a transfer summary may not suffice, as LTCF providers may not read, or misread, the PST result. Healthcare providers performing PST should attempt to maintain consistent inpatient and outpatient drug allergy reports to avoid drug allergies.

Another possible modality to reduce inaccurate drug allergy documentation is repetitive review of the allergy list. In the Epic EMR system, the allergy list will illustrate when the healthcare provider(s) reviewed the patients’ allergies last. At Vidant Health, the allergy list is generally only reviewed during nursing triage in the emergency department. Healthcare providers should avoid chart lore or relying on nursing notes and routinely review allergies directly with the patient. Obtaining allergy information only during routine nursing triage assessment is substandard.<sup>12</sup> This should not substitute acquisition of allergy information from the patient using a structured, direct interview. Supervision and repeated EMR review may help to avoid overlooking an inaccurate history acquisition.<sup>13</sup> This may help not only help to remove drug allergies that were erroneously added to the patient’s list, but also to possibly add agents that may have been missed by the triaging team.

Another means by which inaccurate redocumentation of drug allergies can be avoided is avoidance of placing nonallergic drug reactions in the allergy section of the EMR. Antimicrobial agents are often

added to the allergy list because of a drug intolerance (eg, gastrointestinal symptoms), and/or pharmacologic effect (eg, electrolyte abnormality). Although these are not true reactions, healthcare providers often avoid rechallenging these agents. These adverse reactions should be placed within the “problem list” or “past medical history” section of the EMR, and not within the allergy section. Therefore, healthcare providers should accurately describe the behavior of the allergic reaction(s).<sup>14</sup>

A limitation of our study is our small sample size and single-site design. This may have limited the ability to analyze the data in a multivariable way and the ability to learn about risk factors across a variety of EMR and workflow settings. Furthermore, we reviewed only the 55 patients who were readmitted, and therefore do not know how accurate records were for the other 95 patients.

In summary, this work highlights the challenges of successful implementation of quality improvement projects in an electronic health record-based world. Although PST can expand antimicrobial choices and reduce healthcare costs, the benefits may be limited by inadequately removing the allergy from the hospital and outpatient record(s). From the novel data gathered from our study, primary care physicians and LTCFs are now promptly notified of a negative PST to reduce these medical errors, and we believe this process should become a standard of care.

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