

## AAAAI Work Group Report



# Allergy Electronic Health Record Documentation: A 2022 Work Group Report of the AAAAI Adverse Reactions to Drugs, Biologicals, and Latex Committee

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The allergy section of the electronic health record (EHR) is ideally reviewed and updated by health care workers during routine outpatient visits, emergency room visits, inpatient hospitalizations, and surgical procedures. This EHR section has the potential to help proactively and comprehensively avoid exposures to drugs, contact irritants, foods, and other agents for which, based on an individual's medical history and/or genetics, there is increased risk for adverse outcomes with future exposures. Because clinical decisions are made and clinical decision support is triggered based on allergy details from the EHR, the allergy module needs to provide meaningful, accurate, timely, and comprehensive allergy information. Although the allergy section of the EHR must meet these requirements to guide appropriate clinical decisions and treatment plans, current EHR

allergy modules have not achieved this standard. We urge EHR vendors to collaborate with allergists to optimize and modernize allergy documentation. A work group within the Adverse Reactions to Drugs, Biologicals, and Latex Committee of the American Academy of Allergy, Asthma & Immunology was formed to create recommendations for allergy documentation in the EHR. Whereas it is recognized that the term "allergy" is often used incorrectly because most adverse drug reactions (ADRs) are not true immune-mediated hypersensitivity reactions, "allergy" in this article includes allergies and hypersensitivities as well as side effects and intolerances. Our primary objective is to provide guidance for the current state of allergy documentation in the EHR. This guidance includes clarification of the definition of specific ADR types, reconciliation of

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*Abbreviations used*

<i>ADR</i> - Adverse drug reaction
<i>AR</i> - Adverse reaction
<i>CDS</i> - Clinical decision support
<i>DRESS</i> - Drug reaction eosinophilia and systemic symptoms
<i>EHR</i> - Electronic health record
<i>HSR</i> - Immune-mediated hypersensitivity reactions
<i>NLP</i> - natural language processing
<i>NSAID</i> - nonsteroidal anti-inflammatory drug
<i>RCM</i> - Radiographic contrast media
<i>SCAR</i> - Serious cutaneous adverse reaction
<i>SJS</i> - Stevens–Johnson syndrome
<i>TEN</i> - toxic epidermal necrolysis

**confirmed ADRs, and removal of disproved or erroneous ADRs. This document includes a proposal for the creation, education, and implementation of a drug allergy labeling system that may allow for more accurate EHR documentation for improved patient safety.** © 2022 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2022;■:■-■)

**Key words:** Documentation; Drug allergy; Adverse drug reaction; Anaphylaxis; Intolerance; Hypersensitivity; Electronic Health Record

## INTRODUCTION

The complete and accurate documentation of an allergy in the electronic health record (EHR), also known as the electronic medical record, is an important but often overlooked task for health care workers. Consensus documentation guidelines are lacking and previously published guidance from informatics societies and specialist-recommended approaches have not reached widespread use.<sup>1-6</sup>

A work group within the Adverse Reactions to Drugs, Biologicals, and Latex Committee of the American Academy of Allergy, Asthma & Immunology was formed to create specific recommendations for allergy documentation in the EHR. Whereas a high rate of EHR adoption by hospitals and offices has improved medical communication,<sup>7</sup> limitations exist in EHR documentation specific to allergy. We begin this work group report with a discussion on the current state of EHR allergy documentation. Although we focus our discussion mainly on documenting drug allergies, our general recommendations may also be applicable to foods, contact allergens, and other agents such as excipients (inactive drug ingredients) and vaccines.

Next, we recognize that many health care workers who routinely access and document drug allergies within the allergy section of the EHR have minimal formal knowledge about adverse drug reactions (ADRs) and allergic reaction types, which limits documentation accuracy and completeness. Various nonstandard terms are used throughout the medical, allergy, dermatology, and informatics literatures to characterize ADRs, and many health care workers have limited experience with true immunologically-mediated drug allergy. In addition, the mechanism of reaction is not proven in most cases of ADR, even with available diagnostic testing. Our committee recommends using standard terminology to discuss different reaction types and proposes a precise labeling system to address the current

EHR limitations and best practices for documenting reactions with common drug examples.

This work group report then discusses the indications for referral to a drug allergy specialist for further evaluation. Specifically, this involves appropriate drug allergy inactivation and deleting, now known as delabeling, when an evaluation disproves the presence of an allergy, the need for routine screening, and reconciliation of the allergy section by the health care team.

Finally, although we recognize that there are inherent limitations for health care workers when documenting allergies that are often EHR vendor-specific, we discuss how existing technology can be used to standardize EHR allergy documentation and the importance of standard EHR training for health care workers to ensure routine adoption of documenting best practices.

## THE CURRENT STATE OF EHR ALLERGY DOCUMENTATION

In most EHRs, the section where ADRs are documented is referred to as the allergy section. Several different ADR types can be entered into this section, including both confirmed and self-reported reactions of all types to any allergen type. Overuse of the term “allergy” for benign symptoms such as an intolerance or patient preference contributes to the unnecessary avoidance of essential drugs.<sup>1</sup> Allergists previously recommended that the EHR allergy module be renamed to reflect the variety of information populating this section more accurately, including patient preference, contraindications, adverse effects, and immunologic reactions.<sup>1</sup> The primary challenge to improving the accuracy and completeness of allergy documentation<sup>8</sup> is that this requires improved knowledge of ADR nomenclature and application of standard definitions and documentation procedures by all health care workers with access to editing the EHR allergy section.

Currently, various health care professionals and team members use and document in the EHR allergy module, and these individuals have different knowledge bases. One study that looked at health care roles and EHR allergy entry found that allergy entry was common by non-allergist medical doctors (83%), nurse practitioners or physician assistants (8%), registered nurses (7%), and pharmacists (<1%). Other health care workers, including social workers, physical therapists, nutritionists, dentists, and medical students, entered 2% of allergies. In contrast, allergy specialists entered only 0.2% of allergies.<sup>9</sup> Nearly all documenters may have limited knowledge about classification and mechanisms of allergic reactions and inadequate training on best practices for entering EHR allergies, which makes accurate documentation challenging.<sup>10</sup>

How clinicians document allergies depends on factors including institutional guidelines and limitations from EHRs using quick pick lists or free text. The EHR may limit detailed or appropriate documentation, and there are many EHR systems from different vendors.<sup>1</sup> For example, EHR allergy sections do not contain a field for test results or reaction photos, data that are critical for immunologically-mediated drug allergy and phenotype adjudication. A prior study that considered the quality of documentation of radiographic contrast media reactions in the EHR demonstrated that the records were imprecise and incomplete; more than one-fifth of reactions were entered as free text.<sup>8</sup> More specifically, shellfish allergy, iodine allergy, and RCM allergy are sometimes inappropriately documented and linked in EHRs. There are no actual links among iodine, shellfish, and RCM reactions.<sup>11</sup> In addition, allergies are

Questions	Responses
Practice type	<input type="radio"/> Academic medical center practice <input type="radio"/> Community hospital practice <input type="radio"/> Private practice with academic affiliation <input type="radio"/> Private allergy practice <input type="radio"/> Private multi-specialty practice <input type="radio"/> Other
Practice specialty	<input type="radio"/> Allergy and immunology <input type="radio"/> Dermatology <input type="radio"/> Infectious diseases <input type="radio"/> Other
Does your institution have an Electronic Health Record (EHR) System?	<input type="radio"/> Yes <input type="radio"/> No
Which company provides your EHR system? (Check all that apply)	<input type="radio"/> Cerner <input type="radio"/> Epic <input type="radio"/> Athena <input type="radio"/> Meditech <input type="radio"/> Allscripts <input type="radio"/> EClinicalWorks <input type="radio"/> Siemens medical <input type="radio"/> McKesson <input type="radio"/> GE Healthcare <input type="radio"/> Practice Fusion <input type="radio"/> NextGen Healthcare <input type="radio"/> MEDHOST <input type="radio"/> Evident <input type="radio"/> Other
What types of allergies can be entered into the allergy section of your electronic health record? (Check all that apply)	<input type="radio"/> Medication allergies <input type="radio"/> Medication intolerances <input type="radio"/> Food allergies <input type="radio"/> Food intolerances (e.g., lactose intolerance) <input type="radio"/> Environmental allergies (e.g., dust, mold) <input type="radio"/> Environmental intolerances (e.g., perfume) <input type="radio"/> Contact allergens <input type="radio"/> Latex allergy <input type="radio"/> Patient preferences (e.g., vegetarian, keto diet)
In your opinion, which allergies do you think should be entered into the electronic health record allergy section? (Check all that apply)	<input type="radio"/> Medication allergies <input type="radio"/> Medication intolerances <input type="radio"/> Food allergies <input type="radio"/> Food intolerances (e.g., lactose intolerance) <input type="radio"/> Environmental allergies (e.g., dust, mold) <input type="radio"/> Environmental intolerances (e.g., perfume) <input type="radio"/> Contact allergens <input type="radio"/> Latex allergy <input type="radio"/> Patient preferences (e.g., vegetarian, keto diet)

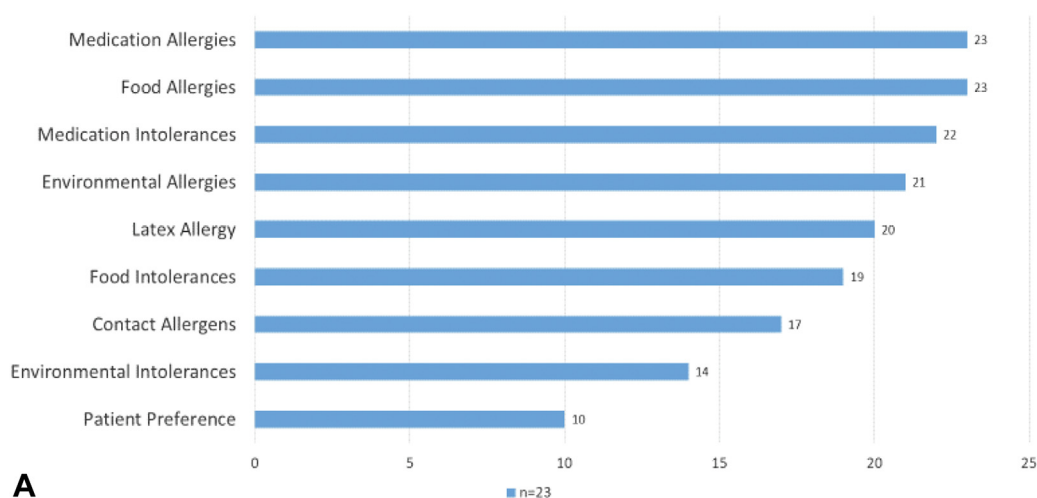
**FIGURE 1.** Pre-meeting survey sent to allergy and immunology specialists who were part of the Adverse Reactions to Drugs, Biologics, and Latex Committee of the American Academy of Allergy, Asthma & Immunology. *EHR*, electronic health record.

routinely entered in the EHR by those who did not directly observe the reaction.<sup>12</sup> Studies have identified substantial errors and discrepancies in patient self-reported allergies and EHR allergy documentation.<sup>13,14</sup> For example, a study demonstrated that penicillin allergy documentation was accurate in less than 50% of 100 charts reviewed and was poor across all levels of training.<sup>15</sup>

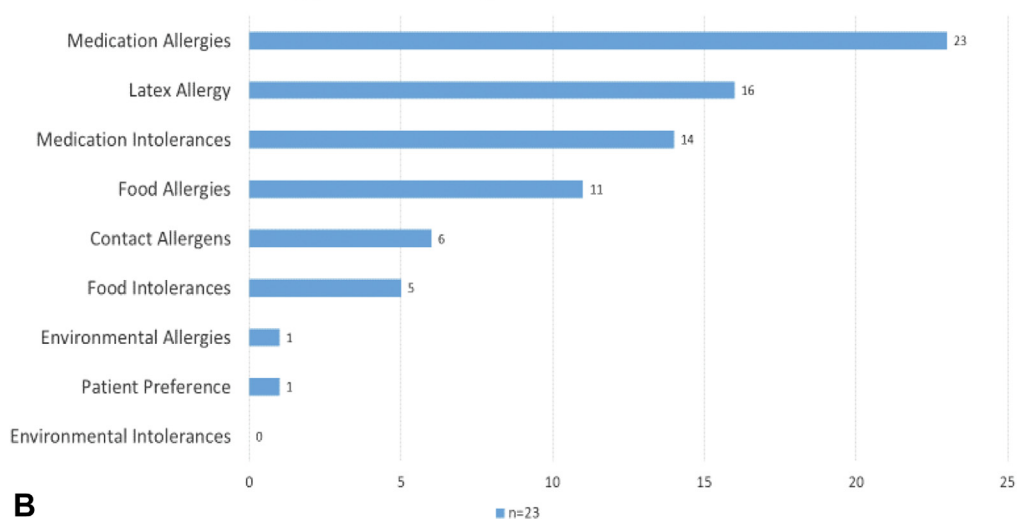
Accurate allergy documentation is essential for future management of patients because improperly documented allergies may lead to unnecessary use of alternative agents. Ambiguities

and missing data in the patient history can complicate accurate allergy and ADR documentation, and may contribute to patients being labeled as allergic to medications that they already or would tolerate.<sup>16</sup> In addition, overreporting of some allergies, such as penicillin allergy, will lead to inferior clinical outcomes and other adverse sequelae.<sup>17</sup> Although any drug can cause a hypersensitivity reaction, a relatively limited number of medication classes account for most allergy entries. The most frequently reported drug allergies are to antibiotics, opiates, and nonsteroidal anti-inflammatory drugs (NSAIDs).<sup>18,19</sup>

## What types of allergies can be entered in your EHR?



## What types of allergies should be entered in the EHR?



**FIGURE 2.** Adverse Reactions to Drugs, Biologicals, and Latex Committee survey responses ( $n = 23$ ). **(A)** Bar graph demonstrating responses to what allergies can be entered into the allergy section of the electronic health record (EHR). **(B)** Bar graph demonstrating responses to what allergies should be entered into allergy section. *EHR*, electronic health record.

Even among allergy and immunology specialists, there is disagreement about what warrants entry in the EHR allergy list. Allergy and immunology physicians who were active members of the Adverse Reactions to Drugs, Biologicals, and Latex Committee of the American Academy of Allergy, Asthma & Immunology were e-mailed a survey (REDCap, hosted by Partners HealthCare, Boston, Mass) in January 2019, regarding EHR allergy documentation (Figure 1). The response rate was 26% ( $n = 23$  of 89). Most respondents were part of an academic allergy and

immunology practice ( $n = 21$  of 23; 91%) using Epic (Epic Systems Corporation, Verona, Wis) ( $n = 16$  of 23; 70%). Most respondents thought that all medication and latex reactions should be entered into the allergy section of the EHR (70%,  $n = 16$  of 23; and 61%,  $n = 14$  of 23, respectively). In addition, most ( $n = 22$  of 23; 96%) thought that patient preferences and environmental allergies should not be included in the allergy section. Less than half of members believed that food allergies ( $n = 11$  of 23; 48%), contact allergens ( $n = 6$  of 23; 26%), and food intolerances



**FIGURE 3.** Proposed hierarchical menu and standardized terminology for the adverse reaction section in electronic health records. *ARs*, adverse reactions; *ADRs*, adverse drug reactions; *EOE*, eosinophilic esophagitis; *FPIES*, food protein–induced enterocolitis syndrome; *HLA*, human leukocyte antigen; *DRESS*, drug reaction with eosinophilia and systemic symptoms; *SJS*, Stevens–Johnson syndrome; *TEN*, toxic epidermal necrolysis.

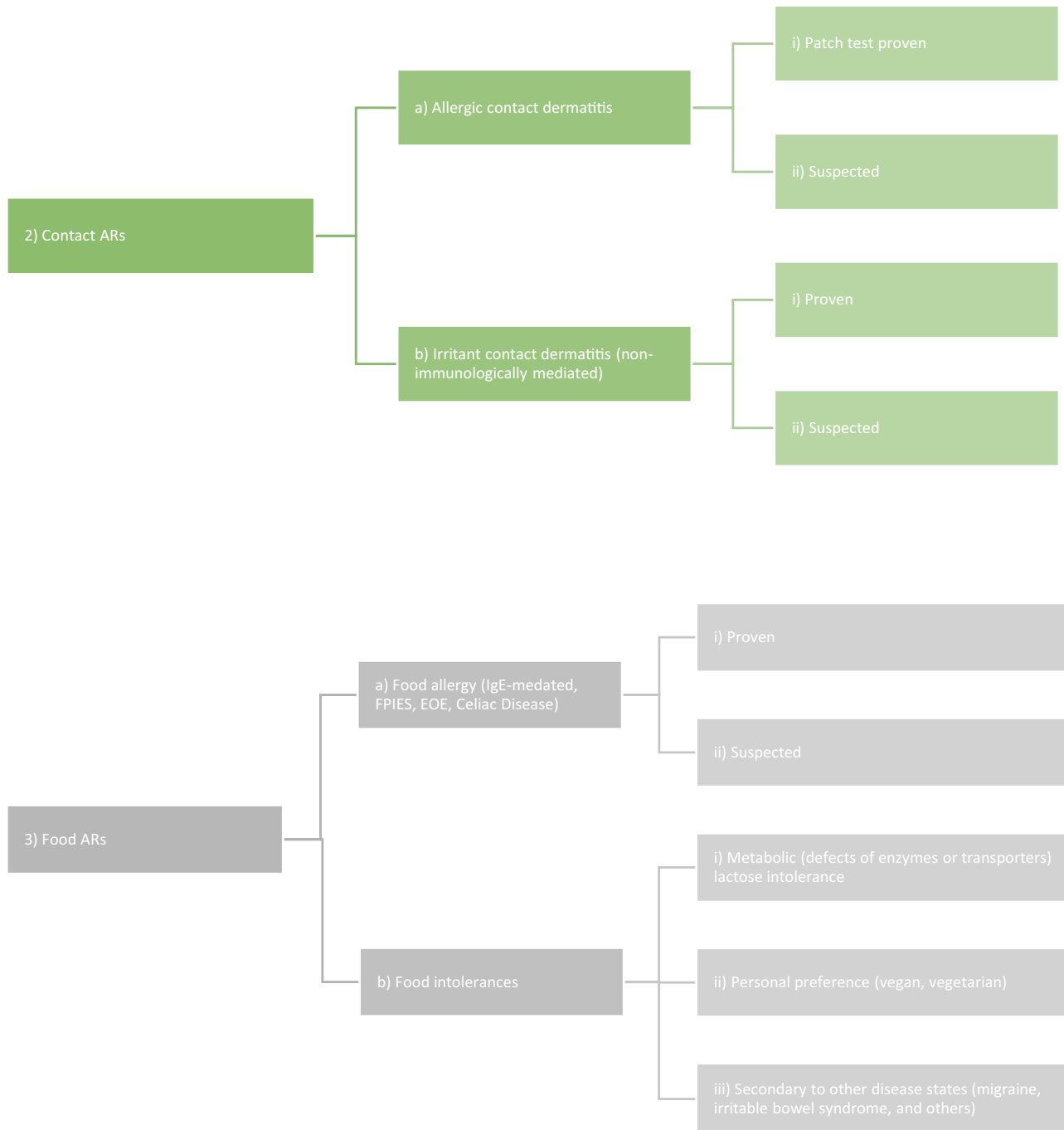


FIGURE 3. Continued

( $n = 5$  of 23; 22%) should be entered into the allergy section of the EHR (Figure 2, *A* and *B*).

Prior protocols to improve drug allergy documentation in the inpatient hospital setting demonstrate feasibility;<sup>20</sup> however, a multidisciplinary collaboration approach is needed to advance accurate and complete allergy documentation efforts. In some cases, allergy specialist referral should be made for patients with multiple drug allergies for whom specific testing approaches may be beneficial. Until terminology is standardized and EHR allergy

documentation options are improved by national EHR vendors, allergy and immunology specialists with training and understanding of complex ADRs should be leaders of allergy documentation and reconciliation in the EHR. Ideally, allergy and immunology specialists would collaborate with pharmacists and information technology specialists within their hospital or health care setting to facilitate local EHR allergy reform. On a national level, our work group would like to collaborate with national EHR vendors to implement these recommended changes.

## STANDARD TERMINOLOGY AND DEFINITIONS ARE NEEDED

The first step to improving EHR allergy documentation is to adopt standard language when labeling ADR types. Although we subsequently propose an improved labeling system that could enhance allergy documentation, we recognize the current limitations and constraints of most EHRs. Different EHRs have different ADR options from pull-down menus and different reaction type options; reaction types may be different in the same EHR based on specific health care system modifications. Currently available ADR types in EHRs are broad and use imprecise terminology, which is confusing and difficult to define. For example, the Epic implementation at Mass General Brigham has four reaction types that can apply to drugs, foods, and other substances: Intolerance, Allergy/Hypersensitivity (changed from its original form "Allergy"), Contraindication, and Unspecified. We next define these reaction types and other terms used to describe adverse and allergic reactions.

"Adverse reaction" (AR) is an umbrella term that includes all unintended effects of drugs, foods, chemicals, or other agents, such as inactive ingredients or vaccines.

"Adverse drug reaction" is an umbrella term defined as an unintended effect of a drug that occurs owing to the inherent pharmacologic properties of that drug.<sup>21</sup> Adverse drug reactions include non-immune-mediated intolerances and side effects and immune-mediated hypersensitivity reactions (HSRs), typically from varied antibody-mediated or cell-mediated mechanisms. They are frequently reported by patients and included in the EHR allergy module without complete history documentation and rarely with confirmation of clinical findings. In addition, clinical features alone do not always correlate with specific immune mechanisms. For example, patients have drug-induced anaphylaxis that may be caused by a drug-specific IgE-mediated mechanism or activation of mast cells through receptors independent of IgE. Delayed urticaria or benign exanthems, although likely to be T cell-mediated, can be due to other mechanisms.

"Intolerances" are defined broadly as materials that are not tolerated by specific individuals. Although intolerances are classically defined as non-immune mediated, we recognize that it is sometimes difficult or even impossible for clinicians to make this distinction from the clinical history alone. Following further evaluation by a drug allergy specialist, there may be recategorization of these labels in the EHR. When entered in the EHR allergy module, patient aversions or preferences for avoidance of specific foods, drugs, and other agents should be coded as intolerances.

"Drug intolerances" are non-immune mediated ADRs that do not carry the same predictability and risk as immune-mediated reactions.<sup>21</sup> Intolerances include reactions such as nausea, headache, and fatigue.<sup>22</sup>

"Drug HSRs" are immune-mediated ADRs that can be immediate or delayed in onset. Prior studies identified hives, itching, and angioedema as the most common symptoms and signs of immediate drug HSRs. Delayed drug HSRs were most frequently documented as causing rash, but delayed drug HSRs include severe cutaneous adverse reactions (SCARs) such as Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis, and drug reaction eosinophilia and systemic symptoms.<sup>10</sup>

"Drug allergy" was historically reserved for drug HSRs with an IgE-mediated mechanism.<sup>23</sup> Currently, drug allergy is considered

synonymous with drug HSRs and includes all immune-mediated drug reactions.

"Contraindication" is a specific situation in which a drug, material, substance, or food should not be used because it may be harmful. An example of this would be the use of NSAIDs in a patient with a solitary kidney or use of QT-prolonging medications in a patient with long QT syndrome.

"Unknown" reaction types should be used when the reaction type cannot be specified given the information known (eg, when a reaction occurs that may be an intolerance or HSR). Unknown can also be used when the person entering the allergy does not feel comfortable choosing a reaction type, although overuse of this reaction type will lead to missing data and will not improve EHR allergy module quality. Unknown is also appropriate when patients are unaware of historical details related to the adverse drug effect.

## RECONFIGURATION OF THE EHR

Although many EHRs use the allergy terminology defined earlier, we propose an improved reconfiguration of the current allergy section in EHR systems to allow more accurate labeling and delabeling. In an ideal EHR, properly entered drug hypersensitivity information should trigger clinical decision support (CDS) to facilitate management, as would be the case with anaphylaxis or SCARs. This CDS is not currently possible because of the need to rely on free text in the EHR allergy module.

In this newly proposed system, "AR" would be used as the new highest-level name for the historical allergy section. A proposed hierarchical menu and standardized terminology for the new AR section in EHRs is described subsequently and outlined in [Figure 3](#).

### Adverse reactions

In our proposed system, a clinician would place an order for the AR and the system would automatically enter it into one of these classes (drug ARs, contact ARs, food ARs, and other ARs). As we discuss later, documentation would not include environmental allergens and hymenoptera. Ideally, entry of materials unable to cause a reaction, such as chemicals essential to human life or endogenously produced by humans (eg, iodine, epinephrine, glucose), would not be permitted as allergy entries.

### Drug ARs

Drug ARs will typically be populated by patient-reported medications associated with adverse effects after previous exposures. Drug ARs include patient-reported ARs, patient preferences (eg, religious preferences not to be exposed to materials with certain origins or associations), and additional patient-specific factors including (1) genetic factors (eg, enzymatic or human leukocyte antigen types), (2) mechanical factors (eg, gastric bypass), (3) drug-drug interactions (eg, clinically significant drug-drug interactions, some with potentially catastrophic outcomes, which could be divided into low- and high-risk warnings), and (4) disease state-specific factors or contraindications to using a specific drug (eg, avoid using high-dose NSAIDs in renal insufficiency, or avoid using angiotensin-converting enzyme inhibitors in individuals with acquired or hereditary bradykinin-mediated angioedema).

**TABLE 1.** Common documentation examples for penicillin antibiotic reactions and for an unknown reaction to an unknown penicillin antibiotic

Penicillin antibiotic	
Drug	Ampicillin—sulbactam
Date noted	02/04/2010
Reaction	Hives, swelling, hypotension, anaphylaxis
Type	Allergy/hypersensitivity reaction
Severity	Severe
Free text	“Witnessed reaction on 02/04/2010. Began 15 min after start of intravenous infusion. Systolic blood pressure was 80 mm Hg and swelling involved oropharynx, requiring intramuscular epinephrine treatment. Referral to allergy placed on 1/10/2022.”
Unknown penicillin, unknown reaction	
Drug	Penicillins
Date noted	1970
Reaction	Unknown
Type	Unknown
Severity	Unknown
Free text	“Unknown childhood reaction to a penicillin drug more than 50 y ago. Referral to allergy placed on 1/10/2022.”

Finally, there are immunologically mediated drug ARs, which are among the most feared reactions but account for only a small minority of entries in current drug allergy fields. Unfortunately, the current EHR limits the use of such descriptive terms except via free text. Major subcategories of immunologically mediated hypersensitivity/allergy include (1) IgE-mediated drug allergy (eg, cefazolin anaphylaxis), (2) T cell-mediated drug hypersensitivity (eg, amoxicillin morbilliform rash), (3) direct mast cell activation (eg, MRGPRX2, which has been shown to be activated by neuromuscular blocking agents, vancomycin, and fluoroquinolones<sup>24</sup>), (4) nanoparticle complement activation (eg, parenteral iron preparation reactions<sup>25-27</sup>), (5) IgG- and complement-mediated hypersensitivity (eg, serum sickness reaction), and (6) cytokine release (eg, chimeric antigen receptor-T cell therapy, rituximab).

Acute onset IgE-mediated allergy may be present when the clinical history of the index AR meets the 1-1-1 criterion recently outlined by Sabato and colleagues<sup>28</sup>: onset of symptoms within 1 hour of the first dose and resolution within 1 day. A true IgE-mediated drug allergy is rarely confirmed in individuals with penicillin allergy labels. Clinical symptoms associated with full-dose therapeutic reexposures in individuals with confirmed IgE-mediated drug allergy can range from benign hives to potentially life-threatening anaphylaxis. A feature of IgE-mediated drug allergy is the ability to desensitize (or induce temporary drug tolerance), permitting the safe use of a therapeutic course.<sup>29</sup>

Delayed-onset T cell-mediated hypersensitivity can range from benign rashes, which might be possible to continue treatment through, to life-threatening reactions including drug reaction eosinophilia and systemic symptoms, SJS, and toxic epidermal necrolysis with both systemic and cutaneous manifestations. These SCARs may be the immunologically-mediated reactions least likely to wane with time, and currently appear to warrant lifelong avoidance. It is not possible to desensitize individuals with T cell-mediated hypersensitivities, although

continuing treatment through a benign morbilliform rash is possible.<sup>30</sup>

Although the clinical features and timing of reactions may suggest a specific mechanism, most mechanisms are not known for drug ARs.

### Contact ARs

This class would be populated with agents causing allergic or irritant contact dermatitis determined by clinical history and/or confirmed with patch testing. Specific materials commonly implicated in causing delayed-onset T cell-mediated contact dermatitis include medical adhesives, topical antibacterial agents, metals, methacrylates, and rubber accelerants. The documentation of some contact ARs is critical to ensure the safety of patients in health care settings, especially before prosthetic or medical device implantation.

### Food ARs

Food ARs would include IgE-mediated food allergies; foods avoided owing to eosinophilic esophagitis, lactose intolerance, or gluten intolerance; gluten allergy owing to celiac disease; dietary preferences (eg, religious, ethical, or moral reasons); and dietary needs resulting from disease states (eg, phenylketonuria, homocystinuria).<sup>31</sup>

## RECOMMENDATIONS FOR ALLERGY DOCUMENTATION IN THE CURRENT EHR

Several medical practitioners in emergency departments, urgent care offices, primary care practices, and specialist offices will evaluate patients for whom a clinically significant immunologically-mediated HSR has occurred. After completing the evaluation, the clinician will need to determine how to document this reaction in the EHR allergy module in addition to the clinical note. More commonly, clinician documentation of historical reactions is necessary (eg, through patient self-report).

Many EHRs allow categorization of the allergy severity into mild, moderate, and severe or low, medium, and high. In this situation, a patient with a significant but benign maculopapular drug eruption might be rated as severe or high with the reaction rash. A similar categorization might be given to a patient who developed SJS. Therefore, additional specific information needs to be entered into the allergy record for treating physicians to reference and discriminate among distinct types of reactions. If there are known drug-drug interactions or genetic reasons for a patient to avoid a specific drug, these details should be included. Although we hope that in the future there will be less need to use free text and an increased ability to enter these key details as coded information, currently, we recommend that the free-text field of the allergy section, often termed “comments,” include an accurate diagnosis for all hypersensitivity/allergy reaction types regardless of whether the diagnosis exists as a coded reaction. For example, “rash” as a reaction should be further clarified in the free-text field (eg, as SJS or benign maculopapular eruption). Other information that should be included in the free-text field is clinical context, clinical details, diagnostic certainty, treatment detail, reference to the date of the clinical note and photos, source of the information (eg, reported by patient vs observed by specific health care professional vs documented in other medical records), suggested alternative medications considered to be safe, and date and results of any allergy evaluations, if applicable.



**TABLE II.** Specific examples of allergy documentation for allergists

<b>Cephalosporin antibiotic</b>	
Drug	Cefaclor
Date noted	1994
Reaction	Rash, arthralgia, joint swelling
Type	Allergy/HSR
Severity	Moderate
Free text	“Serum sickness like reaction in childhood that started 7 d after first dose and resolved with antihistamines/NSAIDs. Has tolerated cephalixin and ceftriaxone as well as penicillins as an adult.”
<b>Sulfonamide antibiotic</b>	
Drug	Sulfamethoxazole–trimethoprim
Date noted	2015
Reaction	Rash
Type	Allergy/HSR
Severity	Mild
Free text	“Delayed exanthem started 2 d after completion of 10-d course with flat red rash and raised areas over torso and extremities. Resolved with antihistamines. This reaction is not a contraindication to receiving sulfonamide antibiotics in the future. No concern for similar rash with sulfonamide nonantimicrobials (eg, furosemide, glipizide, celecoxib).”
<b>Vancomycin antibiotic</b>	
Drug	Vancomycin
Date noted	2015
Reaction	Flushing, pruritis
Type	Allergy/HSR
Severity	Mild
Free text	“Flushing and pruritis of the head, neck, and chest 5 min into infusion. Resolved with antihistamines. May be readministered with slower infusion rate or antihistamine pretreatment.”
<b>NSAIDs/ibuprofen</b>	
Drug	Ibuprofen
Date noted	2010
Reaction	Hives, swelling
Type	Allergy/HSR
Severity	Moderate
Free text	“Reaction occurred 1 h after ingestion. Tolerates celecoxib and aspirin (81 mg) without reaction. May have been an underlying idiopathic urticaria vs single NSAID allergy. Consult allergy if high-dose NSAID is needed.”
<b>Radiographic contrast media</b>	
Drug	Iohexol
Date noted	2019
Reaction	Infusion reaction
Type	Allergy/HSR
Severity	Mild
Free text	“Hives over chest and extremities 15 min after infusion. Resolved with antihistamines. Recommend use of iodixanol or any other nonionic contrast in the future and consider use of antihistamine premedication.”
<b>Opioids</b>	
Drug	Morphine
Date noted	2002

(continued)

**TABLE II.** (Continued)

Reaction	Non–IgE mediated mast cell activation, itching
Type	Allergy/HSR
Severity	Mild
Free text	“Generalized pruritus started 60 min after dose. Resolved with antihistamines. Tolerates oxycodone. May use morphine again in the future if needed and use antihistamines to control itching.”
<b>Food</b>	
Drug	Gluten
Date noted	2020
Reaction	Migraine headache
Type	Intolerance/preference
Severity	Mild
Free text	“Patient prefers strictly to avoid gluten-containing foods and products given history of migraine headaches.”
<b>Chemical agent: adhesive tape</b>	
Drug	Adhesive tape
Date noted	1998
Reaction	Contact dermatitis
Type	Allergy/HSR
Severity	Mild
Free text	“Developed contact dermatitis at site of adhesive tape 7 d after skin biopsy. Tolerates paper tape.”

d, days; HSR, hypersensitivity reaction; m, minutes; NSAIDs, nonsteroidal anti-inflammatory drugs.

We recommend that all health care workers (eg, medical assistants, registered nurses, pharmacists, physicians) routinely review the allergy profile in the EHR for all patients they evaluate regardless of the chief problem or reason for the visit. In certain cases, the clinician may have limited time to review a complex allergy history owing to a more urgent diagnosis or symptom, so a follow-up visit can be scheduled in the near future to review the drug allergy history and formulate an appropriate plan more completely. Allergy and immunology specialists should lead these efforts through their own practices. In this situation, the clinician can clarify and improve allergy documentation and consider evaluations that could take place in the future if necessary (ie, referral to a drug allergy specialist for further evaluation or for a graded dose challenge to amoxicillin to evaluate a childhood penicillin allergy). Feng and colleagues<sup>32</sup> reported on a large series of patients with a documented history of coronary artery disease, who also had an aspirin allergy label on their charts. In 23% of cases, there was no information in the EHR allergy section to guide decision-making, and even on detailed chart review, no information was available regarding this allergy that impeded the use of this inexpensive first-line antiplatelet therapy. This situation is a notable example of a patient who might be seeing an allergist for an unrelated issue, but for whom, upon discovery of the aspirin allergy label, every attempt should be made to give precise characterization, cross-reactive tolerance patterns, and even risk assessment and suggestions for future administration. These steps can and should be done even when the medication allergy is not the reason for the visit. Another example in the allergy specialist domain might be patients presenting for chronic sinusitis with antibiotic allergy labels that would immediately complicate the treatment of a bacterial sinusitis.<sup>33</sup>

## BEST PRACTICES FOR ALLERGY DOCUMENTATION

Next, we highlight how clinicians should document drug HSRs using coded text and free text, followed by two specific examples for penicillin in Table I. In Table II, we provide specific examples for allergy specialists regarding how to document other reactions. All clinically significant intolerances to drugs, foods, chemicals, and other agents in addition to patient preferences or contraindications should be included in the current allergy section.

### Drug, food, chemical, or other agent

Enter the specific generic name of the drug, food, chemical, or other agent (eg, additive or vaccine). This means being as specific as possible regarding the product and its formulation. For example, entering “ampicillin” would be preferred to entering “penicillins,” “sulfamethoxazole” is preferred to “sulfa,” and “ibuprofen” is preferred to “Advil.” A rare exception to using the generic name is when there is a known reaction to a specific formulation of a drug or vaccine that is suggestive of an excipient reaction. However, when there is a known excipient allergy, the excipient should be added as its own entry.

### Date noted (onset)

Document the date of the reported reaction or onset. The date when each potential culprit drug was started should also be available such that a time line can be constructed.

### Reaction

Include details of the reaction(s). These details can be symptoms or signs. Choose coded reaction(s) and enter additional details in the free text. Expanded upon the specific details of the reaction. Because anaphylaxis is a clinical diagnosis and may be used inappropriately, we encourage the use of detailed and specific signs and symptoms in addition to adding “anaphylaxis” when anaphylaxis criteria are met.

### Reaction type

Label the type of reaction depending on the EHR coded list. Examples of coded reactions may include intolerance, allergy/HSR, contraindication, unspecified, and other. We recognize that there are limitations to current EHR systems, and many of these coded reaction types may be limited or inadequate to code the reaction appropriately. We therefore do not suggest that health care systems make this a required field, and encourage using “unspecified” when needed. In addition, we recognize that many reactions are not IgE-mediated (eg, vancomycin infusion reactions, urticaria after RCM) and are currently coded as allergy/HSR-type reactions. Some of these might be best described as “infusion reaction.” In the future, suggested reaction types linked to common drugs and reactions in the EHR will allow for more appropriate reaction labeling. For example, an entry of anaphylaxis could default to “allergy/HSR” whereas an entry of “headache” could default to “intolerance.” In some EHRs, the reaction type will affect the order and categorization with which the allergies are displayed.

### Severity

We recognize that some health care team members will have limited knowledge about severity grading, so this field should be reserved for clinicians who are comfortable with this documentation. Health care systems can use reactions to auto-designate

severity at a system level so that it does not need individual-level entry. Documentation should include the severity: mild, moderate, or severe (or low, medium, or high). For allergy/HSR reaction types, we recommend grading the severity based on signs and symptoms; for example, maculopapular rashes are low severity, urticaria is medium severity, and SCARs and anaphylaxis are high severity. For intolerance reaction types, we recommend grading severity based on interference with daily life.

### Additional details

Add free text to include details about the reaction, timing of the reaction (eg, maculopapular rash began day 10 of a 14-day course), if or when the drug was last tolerated, the date of allergist evaluation (particularly when testing was performed), management recommendations (safe alternatives or consideration for desensitization), and links to photographs when available. Include the results of any testing that may already have been performed. If the patient has tolerated any related drug or drug in the same class, this should also be documented (eg, anaphylaxis to cefazolin, but tolerates all other penicillins and cephalosporins).

Items that should specifically be excluded from the allergy section of the EHR include diagnoses that should be entered into the problem list or active diagnosis list. Specifically, if a patient has allergic rhinitis caused by pollens, animal dander, or molds, these environmental allergens should not be included in the allergy section of the EHR. Instead, an allergic rhinitis diagnosis should be listed under the medical history and documented in the active problem list. If clinicians encounter these allergens in the allergy module, we recommend removing them from the allergy list and adding them to the problem list, adding specific details under this problem (eg, skin test—positive to dust mite, receiving allergen immunotherapy). In addition, if a patient has known hypersensitivity to hymenoptera (eg, yellow jacket, wasp, fire ant), we recommend that this diagnosis be entered in the problem list rather than the allergy list.<sup>1</sup>

## REFERRAL TO A DRUG ALLERGY SPECIALIST

There are specific situations in which referral to a drug allergy specialist should occur. A prominent reason for referral to an allergy specialist is the documentation of an allergy to a drug that is essential for treatment, which cannot be resolved through history or reconciliation. Allergy specialists have shown that many patients can safely take medications to which they are considered to be allergic. This includes penicillins and other antibiotics (to which most are proven tolerant) and drugs such as NSAIDs, corticosteroids, and anesthetics,<sup>34</sup> for which there is a high accuracy of diagnosis from specialist assessment. Allergy specialists can also give indicated drugs despite proven IgE-mediated allergy through desensitization procedures.<sup>29</sup>

Prior studies identified that high-cost, medically complex patients have a high burden of reported drug allergies.<sup>19,35</sup> Multiple drug intolerances are associated with significantly more health care use.<sup>36</sup> Patients with multiple drug allergies documented in their chart are most likely to have multiple drug intolerance syndrome,<sup>37</sup> which warrants a referral to an allergist to improve the overall documentation of drug reactions and discriminate true HSRs. Patients with similar reactions to multiple chemically unrelated drugs need to be evaluated by an allergist to assess for chronic spontaneous urticaria<sup>38</sup> and multiple

Prior to Allergy Evaluation	Following Allergy Evaluation
<ul style="list-style-type: none"> <li>•Drug: Amoxicillin</li> <li>•Date Noted: 1990</li> <li>•Reaction: Hives</li> <li>•Type: Allergy/HSR</li> <li>•Severity: Moderate</li> <li>•Free text: "Hives occurred 48 hours after start of 10 day course treated with antihistamines at age 5, reported by patient's mother. Has avoided all beta-lactams since that time."</li> </ul>	<ul style="list-style-type: none"> <li>•Drug: Amoxicillin</li> <li>•Date Noted: 1990</li> <li>•Reaction: Hives</li> <li>•Type: Allergy/HSR</li> <li>•Severity: Moderate</li> <li>•Free text: "Hives occurred 48 hours after start of 10 day course treated with antihistamines at age 5, reported by patient's mother. Has avoided all beta-lactams since that time. <b>Negative skin testing and drug challenge 03/10/2020, see Dr. Lisban's Allergy note</b>"</li> </ul>

**FIGURE 4.** Sample electronic health record documentation after penicillin allergy evaluation. After the reason for deletion has been documented in the free text, the allergy may be deleted. *HSR*, hypersensitivity reaction.

drug intolerance syndrome.<sup>37</sup> Systematic drug allergy evaluations can optimize medication use in these complicated patients.

Specific populations may also benefit from allergy referral, including those with high antibiotic needs such as cystic fibrosis patients; surgery patients; transplant patients; hematology and oncology patients, particularly before immunosuppressive treatment; and pregnant patients with penicillin allergy (given optimal antibiotics for group B streptococcal prophylaxis and caesarean delivery).<sup>39,40</sup> Other common reasons for referral to an allergy specialist include childhood or remote reaction history occurring more than 10 years earlier, reactions that patients cannot remember, incomplete EHR entry, or when a patient desires a referral because of a concern that the condition was mislabeled or overlabeled (one reaction of rash resulting in an allergy label to multiple different antibiotics).

## REVIEW AND RECONCILIATION OF THE ALLERGY SECTION

No evidence-based guidance exists to inform how often allergy module review and reconciliation should occur. General guidance advises that the allergy list should be checked and updated at all patient contacts with health care professionals. However, this typically occurs through an attestation that allergies were reviewed rather than any meaningful interaction with the allergy section of the EHR. As before, we recommend that allergy and immunology specialists routinely perform a comprehensive allergy module review as an example to other clinicians.

Upon each review, it is important to remove or inactivate any medications in the allergy list that have since been tolerated by the patient. No long-term ongoing medication taken by the patient should be present in the allergy list. Items discussed previously that are inappropriate for inclusion in the allergy list of the EHR (eg, seasonal allergies) should also be removed if identified during the review. In most commercial EHRs, inactivating allergies changes the display and linked CDS, but a record of the allergy remains for clinician viewing.

Although a patient may undergo testing and challenge to a medication to delabel the drug allergy, many studies have confirmed that the process of delabeling does not always lead to the removal of the allergy in the EHR. After penicillin allergy is disproved, the penicillin allergy label remained in the EHR of up

to 38% of patients.<sup>41</sup> If an allergist considers the historical reaction to be potentially IgE-mediated, and therefore performs skin testing or drug challenge testing, the allergy should be removed after tolerance of a single therapeutic dose of the medication. Although it may be possible for a benign T cell-mediated response to occur to the medication upon subsequent or prolonged exposure, the allergy must be removed to ensure its future use. This nuance should be discussed with the patient so that there is a shared understanding.

Relabeling or reacquisition of a previously cleared allergy can also occur.<sup>42</sup> In one study, 45% of delabeled patients had the allergy added back upon hospital readmission; relabeling was prominent in the emergency department.<sup>43</sup> Relabeling can occur even within the same health care system; 36% of patients who had been delabeled of a penicillin allergy were relabeled upon revisiting the same hospital system.<sup>44</sup> Age greater than 65 years, living in a long-term care facility, altered mental status, and dementia were factors associated with relabeling.<sup>44</sup> Clear communication and documentation may help to address erroneous relabeling.

The most common cause of allergy relabeling after penicillin allergy delabeling is simply that the drug is erroneously added back to the allergy list.<sup>45</sup> Allergist error has also been cited as a contributor to relabeling.<sup>41,46</sup> Because allergies can easily be reactivated by those assessing the EHR, it is necessary to provide EHR clarification before deleting the allergy. Figure 4 illustrates how this can be performed in a manner that may prevent future reactivation.

After the reason for deletion has been documented in the free text, the allergy may then be deleted. If the EHR has a field in which to choose a reason with extra free text, we recommend choosing "entry determined to be clinically insignificant," "resolution of allergy," or similar. The free text can include the text "Negative skin testing and drug challenge 03/10/2020," for example.

Because up to 50% of penicillin allergy delabeled patients may tell a new clinician they are still allergic to penicillin, it is necessary to educate the patient at the time of delabeling.<sup>41</sup> Additional interventions implemented after negative penicillin testing have been studied, such as a follow-up phone call to patients from a pharmacist, providing a pocket card, and implementing an EHR best practice alert notifying clinicians of the negative testing results when an attempt occurs to add the allergy. These efforts led to a reduction of relabeling from 12.9%

to 2.5% at one Texas-based hospital.<sup>47</sup> Recently, a clinical informatics study employing natural language processing (NLP) was used to assist clinicians with reconciling drug allergies after challenge procedures.<sup>48</sup>

### **ALL HEALTH CARE WORKERS WITH ACCESS TO EHRs SHOULD RECEIVE TRAINING ON ALLERGY ENTRY**

The diverse members of the health care team who can edit the EHR allergy module include physicians, physician assistants, nurse practitioners, pharmacists, medical students, registered nurses, licensed practical nurses, dentists, nutritionists, physical and occupational therapists, and students, with varying levels of training.<sup>9</sup> Multiple studies demonstrate a lack of basic knowledge regarding drug allergy in physicians<sup>33,49</sup> and a lack of drug allergy training generally.<sup>33</sup> Most free text entries in the drug allergy section were entered by nurses and medical assistants in one health care system analysis.<sup>50</sup> Given the current state of the EHR allergy section and the knowledge gaps across health care workers, we recommend that all members of the health care team with access to the drug allergy module receive the following training:

1. Terminology, including definitions and types of ARs.
2. Allergy EHR module sections, documentation expectations, and examples.

This would include an opportunity to practice entering information in a standardized way into the drug allergy module in the EHR. There would be an emphasis on avoiding the use of free text—only entries and reducing duplicate entries. Specific uniform practice examples of common drugs and symptoms would be created for training purposes, and all those interacting with the allergy EHR module would need to demonstrate proficiency.

This proposed training can be short and effective. This mandatory training could be instituted at the time of EHR training for new health system employees and as part of ongoing learning modules typically required by health care systems for existing employees. This training should be revisited annually, much like other health care—required training, such as patient confidentiality and blood-borne pathogen training.

### **USING TECHNOLOGY TO SUPPORT ACCURATE INFORMATION ENTRY INTO THE ALLERGY SECTION**

Although training is necessary, it is unlikely to be sufficient. We strongly encourage EHR vendors to collaborate with drug allergy specialists from our field to implement these critical changes. We propose the following technological advancements to support optimal EHR allergy modules.

#### **Coded Drug And Reaction Entries With A Quick-Pick List Of Common Drugs, Foods, Chemicals, Or Other Agents And Their Reactions To Optimize CDS**

Coded allergy entries, rather than free-text entries, are necessary for CDS functionality.<sup>2</sup> To this end, a quick-pick list of commonly encountered medication classes including antibiotics, RCM, NSAIDs, opioids, antiepileptics, antidepressants, and antihypertensives should be created, rather than the current alphabetical lists. Similarly, common and severe reactions (even when rare such as SJS) should be easily accessible in such a pick list of reactions.<sup>1</sup> If drugs and reactions are entered in a coded

manner, more specific CDS can be employed to prompt data input to enhance reaction detail in the module and potentially help with diagnosis and management recommendations. CDS alerts could then be silenced if a coded drug and reaction type does not necessitate drug avoidance (eg, amoxicillin—clavulanic acid causing the intolerance diarrhea).<sup>42</sup> This would result in more meaningful allergy alerts and a reduction in alert fatigue. The same coded lists can be created for the most commonly encountered food allergens, chemicals, and other agents. Ideally, clinicians could not easily override these alerts.

#### **Use of CDS alerts once a patient has tolerated a drug, food, chemical, or other agent**

CDS alerts should be deployed to update the allergy module once an allergy has been delabeled, whether through a formal evaluation or inadvertently. For example, a CDS alert designed to fire 24 to 72 hours after a  $\beta$ -lactam drug challenge improved drug allergy module updates.<sup>51</sup> A similar alert should exist in the EHR when patients are listed as allergic to medications they are taking (eg, a patient with a sulfa allergy taking trimethoprim—sulfamethoxazole). Furthermore, such a CDS alert could be deployed when a recorded suspected IgE-mediated allergy could be revisited, such as when 5 to 10 years have elapsed since a patient experienced hives with penicillin. Conversely, CDS could ideally be trained to prompt clinicians to add serious allergic reactions into the allergy module based on EHR data combinations of medications administered, laboratory findings, pathology results and medication discontinuations. For example, after epinephrine is administered and ceftriaxone is discontinued in an inpatient who experienced anaphylaxis, CDS could ensure complete and accurate allergy documentation.

#### **Revisiting evolving technology for use in the EHR allergy module**

Evolving advances should be used to enhance the EHR allergy section once proven safe and effective. Natural language processing algorithms have been shown to be useful to the epidemiologic study of drug allergy<sup>52</sup> and effective in converting free-text entries in a perioperative information management system<sup>53</sup> and emergency department clinical notes.<sup>5</sup> A combination of manual and automated review remediated free-text entries in the drug allergy module.<sup>50</sup> Natural language processing has also assisted in ensuring that delabeled patients were not relabeled.<sup>48</sup> Once refined, NLP algorithms could be employed both to codify existing EHR free-text entries and to identify and modify free-text entries into coded forms as they occur. Optimally, NLP algorithms would be able to identify new ARs from patient care documentation in notes and recognize when patients are tolerating a drug (or food, chemical, or other agent) listed in the EHR allergy module and prompt automatic removal.

#### **Encouraging patient use of allergy tracking technology**

Patients should also be empowered to maintain their own allergy lists, given the inaccuracies of the EHR and incomplete communication among systems. One example of this is a mobile app, Allergy Passport, which is available free of charge in the Apple (Cupertino, Calif) app store. Although there are no data regarding this app to date, it permits food and drug allergy entries and may enhance patient-provided information and communication with health care clinicians regarding intolerance and

hypersensitivity.<sup>42</sup> We encourage additional apps or data storage options such as blockchain to maintain allergy lists.

## SUMMARY

Improvements in EHR allergy documentation are critically needed for improved patient safety, clinical care, and public health. Allergists should encourage thorough documentation of reaction histories across diverse health care clinicians and welcome referrals when indicated. Allergy and immunology specialists with training and understanding of complex drug reactions can lead allergy reconciliation, which includes new documentation, edits to existing documentation, and removal of inaccurate, erroneous, or inconsequential entries. However, a multidisciplinary approach with training and improved technologies from EHR vendors is needed for optimal use of EHR allergy modules.

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