



Letter

Allergy entry and deletion in the electronic health record

Between 20% and 35% of the US population has 1 or more medication allergy listed in their electronic health record (EHR).^{1,2} However, prescribers override more than 90% of allergy alerts intended to protect patients from adverse drug events,³ recognizing that many EHR drug allergies are incorrect and/or inconsequential to patient care. The EHR allergy section contains missing reaction details,⁴ discrepancies with patient interview,^{5,6} and data entered by health care professionals with limited drug allergy training and knowledge.^{7,8} Given that incomplete and inaccurate EHR allergy entries affect future prescribing,⁹ we aimed to assess drug allergy entry, deletion, and accumulation, to identify health care professional types recording allergy data, and to assess the reaction types that lead to allergy entry and deletion.

Drug allergy data were collected from the EHR allergy section of Partners HealthCare System (PHS). We used outpatient visit data to identify PHS cohorts each year from 2005 through 2012, with included patients seen by a PHS health care professional for 3 or more visits during the study period, including at least once in the year before and year of consideration. Visit criteria were specified to include only those patients for whom allergy list updating would be expected. We identified the age, sex, self-reported race, and drug allergy history for the cohort patients. We calculated the total number of allergies and allergies by drug class entered, deleted, and accumulated in each year. We used PHS credentials and internally available health care professional lists to identify health care team members entering and deleting allergies. We determined the frequency of allergy deletion by mechanism, distinguishing adverse effects, immune-mediated reactions, and unknown reactions. Although most allergy records were entered and stored in a coded format, the 6% in free-text required natural language processing techniques to map reactions to a coded form.² Immune-mediated reactions included reactions mapped to anaphylaxis, hives, urticaria, itching, bronchospasm, wheezing, shortness of breath, angioedema, swelling, or hypotension.^{2,3} We compared frequencies using χ^2 tests in SAS statistical software, version 9.4 (SAS Institute

Inc, Cary, North Carolina). The PHS Institutional Review Board approved this study.

During the study period, a total of 533,790 PHS patients met the visit criteria. Patients had a median age of 45.0 years (interquartile range, 28.0–58.0 years) and were 66.9% female. Self-reported race included white (75.3%), black (4.0%), Hispanic (4.0%), Asian (2.3%), other (10.2%), and unknown (4.2%). Most patients had 1 drug allergy (59.7%), but the cohort also included patients who had 2 drug allergies (22.4%), 3 to 5 drug allergies (15.5%), and 6 or more drug allergies (2.4%). From 2005 through 2012, there were 860,725 allergies added and 138,227 allergies deleted, resulting in 722,498 accumulated allergies (Fig 1).

We were able to identify health care professional type for 696,644 allergies entered (80.9%) and 119,335 allergies deleted (86.3%). Among the allergies entered with a discernible health care professional type, entry was performed by nonallergist physicians (82.8%), nurse practitioners or physician assistants (7.6%), registered nurses (6.7%), and pharmacists (0.6%). Other known health care professionals, including social workers, physical therapists, nutritionists, dentists, and medical students, entered 2.1% of allergies. Allergy specialists entered 0.2% of the allergies. Among the allergies deleted with a discernible health care professional type, deletion was performed by nonallergist physicians (82.8%), nurse practitioners or physician assistants (8.2%), registered nurses (6.3%), and pharmacists (0.7%). Other known health care professionals deleted 1.7% of allergies and allergy specialists deleted 0.3% of allergies.

Of all allergies, 38.2% were immune mediated; 29.6% included only adverse effect reactions. Unavailable or unknown reactions comprised 32.2% of all allergies entered or deleted. Overall, adverse effect reactions were more likely to be deleted than immune-mediated reactions (15.5% vs 10.8%, $P < .001$). Allergy specialists were more likely to delete immune-mediated reactions than other health care professionals (68.7% vs 46.8%, $P < .001$).

Our review of 7 years of EHR allergies revealed that allergies tend to accumulate over time with comparatively few allergy deletions. The underuse of allergy deletion, although not previously reported, is consistent with a prior study that identified more than 50% of drug allergy alerts were triggered for medications patients had previously tolerated.³ Regular allergy reconciliation, including deletion of inaccurate or outgrown allergies, would improve the EHR allergy module, thereby informing future prescribing and reducing unnecessary allergy alerts that can lead to alert fatigue and compromise patient safety.

Although the health care professionals most commonly interfacing with the EHR allergy module were nonallergist physicians, a variety of other health care team members edit allergy data, and most of these team members lack drug allergy knowledge.^{7,8} We found that those most capable of discerning allergy

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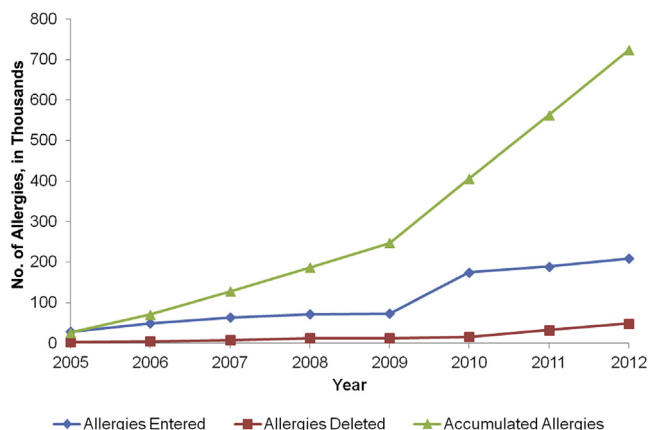


Figure 1. Allergies entered, deleted, and accumulated from 2005 through 2012 for a patient cohort at Partners HealthCare System.

mechanisms—allergy specialists—rarely interfaced with the allergy module, even in a health system with more than 40 allergy specialists and robust drug allergy programs. To improve the quality and usefulness of the EHR allergy module, more allergy education and dissemination of best practices for allergy documentation are required.

We found that immune-mediated reactions were less frequently deleted than adverse effect reactions. Reported drug allergies that are possibly immune mediated can be clarified by allergy specialist evaluation using clinical history and testing or challenge procedures. Given that the observed deletions occurred largely without allergy specialist involvement and that allergy specialists more frequently deleted immune-mediated reactions, this pattern of allergy deletion appears appropriate.

This analysis has limitations. To identify allergy entry, deletion, and accumulation, we created visit criteria defined in advance of data analysis but not previously used or validated. The retrospective study design limited identification of all health care team members who interacted with allergies; however, we identified most health care professional types entering and deleting allergies. Finally, these results represent the experience from one health system located in the northeastern United States that used a proprietary EHR; therefore, data may not be generalizable to other health care systems.

We found that allergy deletions were infrequent and that the EHR allergy module was used by a variety of health care team members. Although adverse effect reactions were more commonly deleted than immune-mediated reactions overall, allergy specialists deleted immune-mediated reactions more frequently than other health care professionals. Additional data are needed to more fully understand allergy entry and deletion, with an eye toward

improving the usefulness of the EHR allergy module for optimal patient care.

Kimberly G. Blumenthal, MD^{*,†,‡,§}
Warren W. Acker, MS^{||}
Yu Li, MS^{*,†}

Niki S. Holtzman, BA^{*}
Li Zhou, MD, PhD^{*,||,¶}

^{*}Division of Rheumatology, Allergy, and Immunology
Department of Medicine
Massachusetts General Hospital
Boston, Massachusetts

[†]Medical Practice Evaluation Center
Department of Medicine
Massachusetts General Hospital
Boston, Massachusetts

[‡]Harvard Medical School
Boston, Massachusetts

[§]Edward P. Lawrence Center for Quality and Safety
Massachusetts General Hospital
Boston, Massachusetts

^{||}Division of General Internal Medicine and Primary Care
Brigham and Women's Hospital
Boston, Massachusetts

[¶]Partners HealthCare System
Boston, Massachusetts
kblumenthal1@partners.org

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