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Allergy Entry and Deletion in the Electronic Health Record

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Between 20–35% of the United States population has one or more medication allergy listed in their electronic health record (EHR).^{1,2} However, prescribers override over 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 providers 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 provider 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 provider for three or more visits during

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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 determined age, sex, self-reported race, and drug allergy history for cohort patients. We calculated total allergies entered, deleted, and accumulated in each year. We used PHS credentials and internally available provider lists to identify healthcare team members entering and deleting allergies. We determined the frequency of allergy deletion by mechanism, distinguishing side effects, immune-mediated reactions, and unknown reactions. While the majority of 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 chi-squared tests in SAS version 9.4 (Cary, NC). The Partners Institutional Review Board approved this study.

During the study period, a total of 533,790 PHS patients met visit criteria. Patients had a median age 45.0 years [IQR 28.0 years, 58.0 years] and were 66.9% female. Self-reported race included Caucasian (75.3%), Black (4.0%), Hispanic (4.0%), Asian (2.3%), other (10.2%), and unknown (4.2%). Most patients had one drug allergy (59.7%), but the cohort also included patients who had two drug allergies (22.4%), three to five drug allergies (15.5%), and six 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 (Figure 1).

We were able to identify provider type for 696,644 (80.9%) of allergies entered and 119,335 (86.3%) of allergies deleted. Among the allergies entered with a discernible provider type, entry was performed by non-allergist medical doctors (82.8%), nurse practitioners or physician assistants (7.6%), registered nurses (6.7%), and pharmacists (0.6%). Other known providers, including social workers, physical therapists, nutritionists, dentists and medical students, entered 2.1% of allergies. Allergy specialists entered 0.2% of allergies. Among the allergies deleted with a discernible provider type, deletion was performed by non-allergist medical doctors (82.8%), nurse practitioners or physician assistants (8.2%), registered nurses (6.3%), and pharmacists (0.7%). Other known providers 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 side effect reactions. Unavailable or unknown reactions comprised 32.2% of all allergies entered or deleted. Overall, side effects reactions were more likely to be deleted than immune-mediated reactions (15.5% vs 10.8%, $p<0.001$). Allergy specialists were more likely to delete immune-mediated reactions than other providers (68.7% vs. 46.8%, $p<0.001$).

Our review of seven years of EHR allergies demonstrated that allergies tend to accumulate over time with comparatively few allergy deletions. The underuse of allergy deletion, while not previously reported, is consistent with a prior study that identified over 50% of drug allergy alerts were triggered for medications patients had have 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 most common providers interfacing with the EHR allergy module were non-allergist physicians, a variety of other healthcare team members edit allergy data, and most of these providers lack drug allergy knowledge.^{7,8} We found that those most capable of discerning allergy mechanisms—allergy specialists—rarely interfaced with the allergy module, even in a health system with over 40 allergy specialists and robust drug allergy programs. In order to improve the quality and usefulness of the EHR allergy module, more allergy education, and dissemination of best practices for allergy documentation is required.

We found that immune-mediated reactions were less frequently deleted than side 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. In order 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 healthcare team members interacting with allergies; however, we identified a majority of provider 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, and therefore data may not be generalizable to other healthcare systems.

We found that allergy deletions were infrequent and that the EHR allergy module was used by a variety of healthcare team members. While side effect reactions were more commonly deleted than immune-mediated reactions overall, allergy specialists deleted immune-mediated reactions more frequently than other providers. Additional data are needed to more fully understand allergy entry and deletion, with an eye towards improving the usefulness of the EHR allergy module for optimal patient care.

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Abbreviations

EHR	electronic health record
PHS	Partners HealthCare System

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