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Letter

Developing and pilot testing an electronic medical record–based allergen immunotherapy template

Decision support and health information technologies, such as electronic medical record (EMR) systems, have been reported to enhance the quality and efficiency of medical care.[1,2] EMR systems are increasingly being used by allergy/immunology physicians to facilitate clinical documentation surrounding office visits and allergen immunotherapy (AIT). Although distinct EMR programs are available, each platform typically enables customizable features to fit specialty-specific needs.[3] Allergy-specific EMR systems may be used to document skin test results and manage AIT schedules and administration.[3] Before the adoption of EMR systems, AIT schedules have typically been documented through paper-based records. However, no reported studies have compared paper-based and EMR-based AIT documentation with regard to process outcomes (patient satisfaction, time spent, efficiency) and adverse events. This report describes our experience in developing, pilot testing, and evaluating an EMR-based AIT program.

After our institution's adoption of the Centricity EMR system, we worked with our hospital's information technology team to develop an AIT template (Fig 1) for our Division of Allergy/Immunology clinical sites. Our major objective in transitioning to an EMR-based system was to minimize the potential for human error in ordering or administering the wrong concentrations while preserving the efficiency required in our AIT visits. The EMR template was designed based on our existing paper documentation form and included AIT-related information, such as ordering physician name, clinical site location, patient name, AIT indication, allergens per vial, extract lot numbers, vial expiration dates, injection administration date, extract concentration for each vial, physician-ordered dose for a given date, a signature field for physicians and nurses, and a free-text notes section for AIT adverse events and therapeutic interventions. The AIT form required 3 yes/no questions (increasing asthma symptoms during the past 1 week, increasing allergy symptoms during the past week, reactions after the previous AIT session) to be answered before the injections for a given patient could be administered and the AIT session signed and documented in the EMR for a given date. Any yes response triggered a prompt for the ordering physician to be notified. Only once the physician had been notified could the AIT session be signed and documented in the EMR.

We followed the plan-do-study-act method to ensure that we maximized the learning from our pilot study before implementing EMR-based AIT across our division's 4 clinical sites (there are a mean of 50 injection visits per site per week) that administer AIT. We initially concentrated our efforts on the development of the EMR template. After we developed the EMR-based AIT template, we pilot tested its use among patients receiving AIT at 1 of our Division of Allergy/Immunology clinical sites. Through pilot testing, we evaluated patients from 2 groups (EMR- and paper-based AIT schedules). The EMR-based template was used during AIT sessions on the same day of the week when the lead study author was available to enter AIT dosing orders into the EMR. The paper-based template was used on other days of the week when the same nurse as for the EMR-based group was administering injections. During pilot testing, we evaluated the actual time (patient entering treatment room to injection administration) for patients in both groups. After the injection was administered, all patients in both groups received a satisfaction survey that also asked about injection reactions. We compared results between the paper-based and EMR-based groups.

We observed 32 patients receiving AIT at our allergy clinic. There were 17 patients (6 men, 11 women; median age, 44 years) in the paper-based group and 15 patients (3 men, 12 women; median age, 42 years) in the EMR-based group. All patients in both groups reported satisfaction with all AIT-specific characteristics (time spent for treatment, clinician's preparedness for the treatment, AIT administration, clinician knowledge regarding AIT). Results were analyzed through the 2-sample t test. When asked to quantify (1- to 10-point scale, with 10 as extremely satisfied) their experience with the AIT encounter, patients in the paper-based and EMR-based groups had mean scores of 9.4 and 8.7, respectively ($P = .35$). Mean actual times in the paper-based and EMR groups were 4.86 minutes and 5.89 minutes, respectively ($P < .0001$). Injection reactions occurred in 3 individuals (18%) within the paper-based group and 5 patients (33%) within the EMR-based group ($P = .11$), and all symptoms were minor (local swelling, pruritus). Of note, 3 patients in the EMR group answered yes to at least 1 of the 3 warning questions.

This study assesses the development and pilot testing of an EMR-based template within our allergy/immunology clinical workflow. The feasibility and pilot testing of the EMR-based template have important implications to allergy/immunology physicians because recent data suggest that nearly 97% of acute care hospitals have certified EMR technology.[4] AIT has historically been documented through paper-based forms, and this study's findings indicate that EMR-based systems can be safely used in the clinical setting. Our AIT template included 3 yes/no questions, which aimed to identify patients at an increased risk for injection-related reactions. We also acknowledge several other alarm signals through which an EMR-based template can reduce AIT reactions: (1) rejecting a wrong (ie, too high) dose with an alarm to prevent its administration and (2) noting the time that has elapsed since the previous AIT injection and the present visit (if too many months

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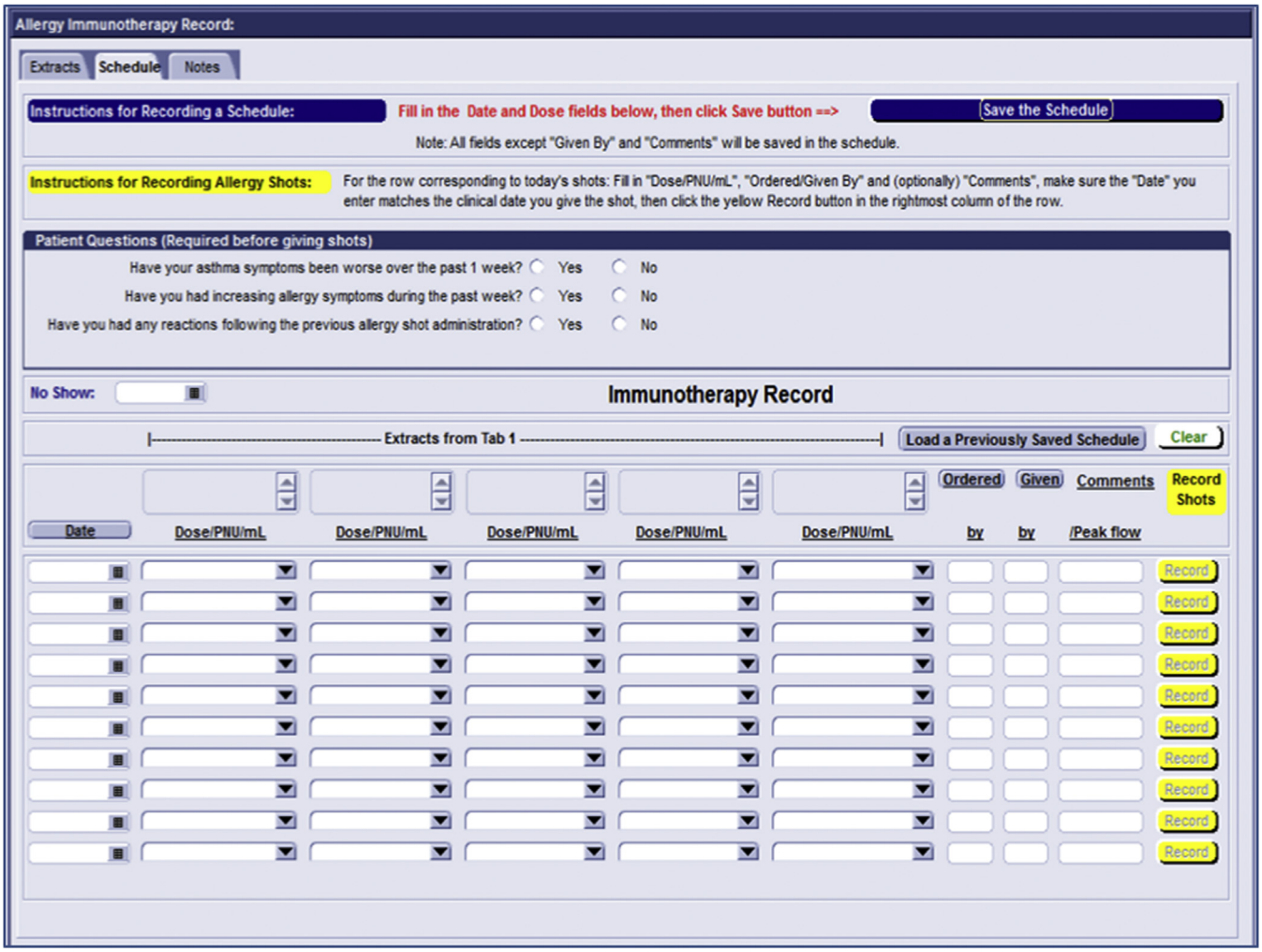


Figure 1. EMR-based AIT template.

had elapsed, the physician could consider reducing the dose). We recently asked our institution's information technology team to incorporate both these alarm signals into our EMR AIT form.

Our results suggest that the EMR-based AIT template is linked to high patient satisfaction but slightly longer visit times compared with a paper-based AIT form. Regarding patient satisfaction, Liu et al[5] similarly reported positive patient satisfaction with EMR systems. Regarding visit times, we collected data during a given AIT visit. However, EMR-related visit times may decrease as clinicians become used to the EMR system. Therefore, it would be of great interest to longitudinally collect data regarding visit times.

We acknowledge several limitations to our study design and results. Because this study was not a randomized clinical trial, the differences observed between the paper- and EMR-based groups might have been unrelated to the way in which AIT was administered. This study did not measure the effect (eg, physician and nurse satisfaction; physician time in entering the AIT dosing orders) of the EMR-based form on physicians or nurses administering the AIT injections. It would also be of interest to collect data regarding how comfortable physicians and nurses are with using computers and how this comfort influences visit efficiency and adverse reaction rates. We acknowledge that these results may not be generalizable because the EMT AIT template was pilot tested within a single clinical site. However, we are planning to clinically evaluate the EMR AIT form at each of our 4 site locations. We similarly hope that allergists may evaluate their EMR AIT forms to help determine best practices for different types of clinical sites.

To our knowledge, this is the first study that describes the transition between paper and EMR-based AIT. Further studies on a larger scale may indicate whether the EMR-based template can be made more time efficient in the setting of AIT without sacrificing safety, patient satisfaction, and clinical effectiveness.

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