

Allergies in Primary Care: A Study of the Allergy Management Evaluation Tool

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Allergic conditions are the most common life-altering, and sometimes life-threatening, disorders affecting millions of individuals worldwide. Oftentimes, people with allergies and their health care providers neglect to discuss the symptoms of allergy, and thus, proper diagnoses are not made and treatment is not initiated. The aim of this manuscript is to describe the development of a tool for improved management and treatment of allergies in the primary care setting.

Although multiple management and therapeutic strategies are available, allergies to environmental conditions, triggers, and medications are a major clinical and public health concern. Based on national data, more than 2 in 10 patients pre-

senting to general practice in the United States are expected to have a diagnosed allergic disease affecting their quality of life, daily performance, and productivity.¹ Several clinical guidelines are available to help clinicians in general practice prescribe generic approaches to allergy management.^{2,3} However, few simple and cost-effective clinical tools are available specifically for assessing allergies and subsequently prescribing medication without referring patients to allergy specialists.

Primary care physicians (PCPs), who usually are required to treat comorbidities instead of the cause of the allergic disease, are at the forefront of this pervasive problem. Managing allergies can be challenging, especially since the modern

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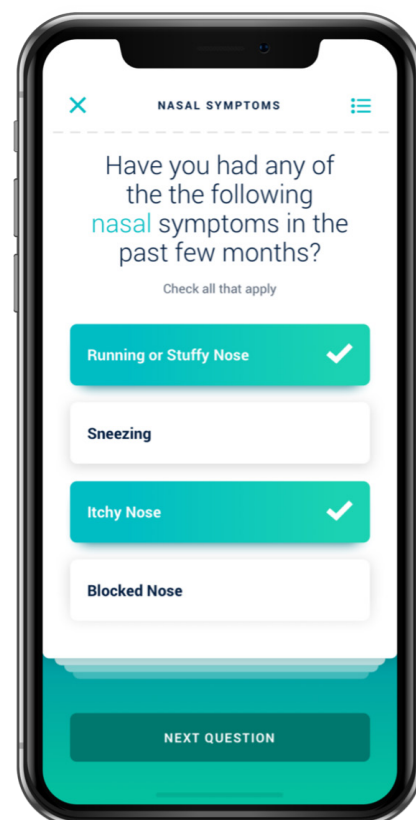


Figure 1. Sample Electronic Assessment, Patient View

lifestyle promotes less sleep, a less nutritious diet, and less physical activity. All of these lifestyle factors contribute to increased and worse allergic symptoms.⁴ The problem is exacerbated by a number of environmental, patient knowledge gaps, and behavioral conditions. PCPs have been given little guidance about customizing treatments to individual idiosyncrasies based on the aforementioned factors.^{5,6} To the authors' knowledge, there are few, if any, validated allergy

Table 1. Patient Health Literacy of Allergy History

PLEASE SELECT THE BEST RESPONSE IF YOU HAVE THE FOLLOWING MEDICAL CONDITIONS	I DO NOT KNOW IF I HAVE THIS CONDITION.	I KNOW I DO NOT HAVE THIS CONDITION.	I HAVE THIS CONDITION BUT HAVE NEVER BEEN TREATED.	I HAVE THIS CONDITION AND HAVE BEEN TREATED.	I AM TREATED AND MONITORED REGULARLY FOR THIS CONDITION.
Allergic rhinitis (hay fever)					
Asthma					
Allergic conjunctivitis (eye inflammation)					
Allergic urticaria (hives)					

management tools that can be completed online by a patient at home or in a waiting room prior to an office visit that have the ability to calculate and score a range of known and predictable items associated with allergy severity and triggers. Such a tool would allow clinicians to identify allergy triggers for each of their patients and enable them to create an individualized treatment regimen per patient, potentially increasing successful allergy management especially in nonallergy specialist settings.⁷

Background

It is well known that seasonality, environmental conditions and control, self-management, appropriate medication use, and health habits contribute to managing allergy symptoms. From a clinical perspective, patients are often unaware of their allergy triggers, allergic environments, and types of medications that best contribute to their overall symptom control.⁸ Clinicians are required to uncover specifically which environmental conditions, triggers, and medications relate to an individual patient's symptom severity—not a simple “one size fits all” scenario. Primary care visits are becoming shorter, and clinicians have to cover other, more-urgent patient concerns first, lowering the priority of asking about allergy symptoms.⁹ If patients' specific allergic factors could be identified early in the consultation, clinicians could customize

the encounter for the individual, potentially increasing the chances of successful allergy management in concert with other chronic and acute health care needs.^{10,11}

Methods

For these reasons, the authors developed the Allergy Management Evaluation (AME) tool, a custom digital clinician-driven tool developed to assist clinicians in identifying and managing common allergic conditions. The AME was adapted from new research findings and 3 existing validated allergy- and asthma-related questionnaires to identify patients' allergic disease and various contributing factors to their condition(s).^{12,13} The data was combined in a comprehensive single battery of questions with built-in computerized logic.

The assessment includes patient responses related to their allergy history (**Figure 1**), recent allergy and asthma symptoms, environmental impact and severity of these symptoms, use of allergy and asthma medication(s), and lifestyle habits. “Digital medicine” relates to computerized applications that are directed by physicians and other health care professionals. This assessment is not meant to be diagnostic or therapeutic but should be used as an adjunct to clinical decision-making.

Patients' health literacy about their condition(s) can benefit their approach to self-management and overall quality

of life (**Table 1**).¹⁴ Allergy triggers can be broadly categorized as outdoor, indoor, or food related. Different outdoor allergens pollinate at various times during the year and in various regions. Trees typically produce pollen in early to mid-spring, grass pollination occurs later in spring through summer, and weeds pollinate in the fall. Outdoor mold spores can also affect individuals with allergies year-round when conditions suit fungi or mold growth, such as after the winter frost melts in early spring or after heavy rain periods followed by warmer weather conditions. Perennial allergens such as dust mites, animal dander, insects, and mold allergens are likely to be found indoors in areas with high moisture or humid conditions and are very prevalent year-round.¹⁵ A patient's responses to questions regarding symptoms (**Table 2**), occurrence, and environment help determine the most likely trigger allergen and can be confirmed via a skin or blood test. Patients' responses also help the clinician prescribe or modify medications.

If the patient selects any symptoms within the various categories (ie, nasal, sinus, eye, throat, chest, ear, or skin), the algorithm built into the AME tool asks the following questions separately for each category:¹⁶

- What time of year do you have these symptoms?
- Are your symptoms worse at night, during the day, or both?

Table 2. Symptom Checklist

Have you had any of the following symptoms in the past few months? (Check all that apply)

NASAL & SINUS	EYES	THROAT
Runny or stuffy nose	Red eyes	Itchy throat
Sneezing	Itchy eyes	Throat clearing
Itchy nose	Watery eyes	Sore throat
Blocked nose	Dark circles	Excessive phlegm
Post-nasal drip/drainage	Swollen dry eyes	Hoarseness
Mouth breathing/snoring	Sore eyes	
Frequent sniffing		
Decreased smell		
Headaches		
Facial pressure/pain		
CHEST	EARS	SKIN
Wheezing	Full, stuffed, or clogged	Rash
Coughing	Painful	Hives
Tightness	ringing	Eczema
Shortness of breath	Hearing loss	Swelling
Chronic bronchitis	Itchy ears	Itchy skin

- Do your symptoms mostly occur indoors, outdoors, or both?
- Are your indoor symptoms worse at home, work, school or daycare, or other indoor locations?
- Are your symptoms mostly triggered by grass, other pollen, cats, dogs, other animals or insects, dust, mold, wind, perfume, smoke/pollution, cleaning products, or certain types of food? Or "I do not know."

Suppose a patient has reported that he does not know if he has allergic rhinitis, asthma, allergic conjunctivitis, or allergic

urticaria. This situation could provide an educational opportunity to explain the conditions, determine whether the patient has a condition, and explain proper management of the condition. If a patient has reported that she has an allergic condition and has been treated, this will provide insight into her expectation of the treatment to be prescribed. Both of these responses are opportunities to reinforce evidence-based approaches to allergy management.

Another example is if a patient has answered "yes" to having the condition,

he or she is then asked to consider how serious having such a condition is and at what stage of change they are in to receive medical supervision, participate in self-management, or potentially undertake allergen immunotherapy.¹⁷ If a patient self-identifies as being in the precontemplation, contemplation, or preparation stages of change, the computerized logic embedded into the assessment tool will ask the patient whether he or she would like help during their face-to-face or telemedicine visit. This has been reported to be a powerful method of identifying

Table 3. Respiratory Allergy Prediction Test Questions

1.	Do you have parents/relatives with allergic rhinitis (hay fever) and/or asthma?	Y	N
2.	Do your nasal/ocular (eye) issues usually start or worsen during the spring?	Y	N
3.	Have you ever had a cough or shortness of breath, even during exercise?	Y	N
4.	Do you use nasal sprays frequently?	Y	N

how important it is for patients to receive medical care for the identified condition.¹⁸

Moreover, paper-based patient history forms can be confusing for patients to complete, are prone to missing information, and can be challenging for nonallergy specialists to interpret at a quick glance. The digital AME computerized tool has the potential to minimize omissions of data by requiring responses in order to progress, highlight relevant patient responses accurately, and calcu-

late risk using previously validated scores. The goal of the tool is to help the clinician interpret patient self-reported information and easily see relevant allergy-related information.

Accordingly, the authors report herein the development of the AME tool and how it was implemented in clinical practice. Allergy and asthma questionnaires and items were piloted for internal validity with a small group of expert medical practitioners from allergy; ear, nose, and

throat; and family medicine specialties and 30 continuous adult patients at a family medicine practice in Florida on a single day. Depending on how many allergy symptoms patients had reported, the AME took approximately 8 to 12 minutes to complete.

Digital Assessment Tools Included in the AME

Respiratory Allergy Prediction Test

The Respiratory Allergy Prediction Test is a validated and straightforward 4-item assessment (**Table 3**). It is designed to confirm the clinical suspicion of respiratory allergies and the medical necessity of performing allergy testing by its high predictive value. Answering “yes” to Questions 2, 3, or 4 provides a high probability (85%) of a respiratory allergy diagnosis.¹⁶ It also suggests the need for allergy testing to confirm the allergen

QLAB Quality Health Score

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Allergy Management Report Test Date: 09/05/20

GENDER	Male	HEIGHT	5'10"
DATE OF BIRTH	02/23/1983	WEIGHT	198 lb.
WAIST	34"	HIP	N/A

GENERAL ALLERGY HEALTH

- Allergic Rhinitis: I have this condition but never treated for it
- Asthma: I know I do not have this condition
- Allergic Conjunctivitis: I have this condition and treated in the past
- Allergic Urticaria: I do not know if I have this condition
- Parents/ relatives suffering from allergic rhinitis (hay fever) and/ or asthma? YES
- In general, how would you say your health was? GOOD

ALLERGY SYMPTOM SEVERITY (SNOT 22)

- Need to blow your nose: Severe Problem
- Sneezing: Problem as bad as it can be
- Runny nose: Severe Problem

PHYSICIAN INTERPRETATION
Patient scored 52 to the SNOT 22 test indicating Severe allergy symptoms. Patient has family history of allergies, nasal/ ocular complaints that start or worsen during spring time, had cough or shortness of breath even during exercise, ...

NASAL SINUS EYES CHEST EARS SKIN

Do you have these nasal symptoms: All year round

Nasal complaints usually start or worsen during the spring? YES

Nasal symptoms worse: During the day

Nasal symptoms mostly occur: Outdoor

Nasal symptoms mostly triggered by:

- Grass: YES
- Other pollen (trees, weeds, flowers): YES
- Cats: NO
- Dogs: UNSURE
- Other animals or insects: NO

NEXT STEP
Export this test to a spreadsheet.
CONTINUE

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Figure 2. Sample Electronic Report, Physician View

Table 4. A Sample of SNOT-22 Questions and Response Types

	NO PROBLEM	VERY MILD PROBLEM	MILD OR SLIGHT PROBLEM	MODERATE PROBLEM	SEVERE PROBLEM	PROBLEM IS AS BAD AS IT CAN BE
1. Need to blow your nose	0	1	2	3	4	5
2. Sneezing	0	1	2	3	4	5
3. Runny nose	0	1	2	3	4	5
4. Nasal obstruction/blockage	0	1	2	3	4	5
5. Loss of smell or taste	0	1	2	3	4	5
6. Cough	0	1	2	3	4	5

trigger.¹⁶ If a patient answers “yes” to Questions 2, 3, or 4, the clinician’s digital interpretation report will indicate that the patient is highly likely to have confirmed environmental allergy triggers via blood or skin test (**Figure 2**).

Sinonasal Outcome Test-22

The Sinonasal Outcome Test-22 (SNOT-22) is a commonly used, disease-specific questionnaire involving 22 symptoms that combine rhinologic issues with general health issues.¹⁹ A sampling of 6 of the 22 questions is provided in **Table 4**. SNOT-22 has been validated and is easy to use in clinical practice and research. Physicians can use this test to facilitate routine clinical examinations to highlight the impact of chronic rhinosinusitis on patients’ quality of life. This test is also frequently used to measure the outcome of surgical intervention and specific allergen immunotherapy treatment.^{19,20}

Overall severity scores are summed with a total score max of 110 and are categorized in the following severity levels:

- Mild: Score less than 20
- Moderate: Score between 20 and 50
- Severe: Score greater than 50

As previously described, a baseline SNOT-22 score is an objective record before commencing specific allergy treatment or after nasal-related surgeries to monitor a patient’s recovery progress.

Asthma Control Test

Chronic rhinosinusitis is an inflammatory disorder of the paranasal sinuses and linings of the nasal passages, which can last 12 weeks or longer and is strongly associated with comorbid asthma. The Asthma Control Test (ACT) quickly provides a numerical score to assess asthma control (**Table 5**). The test has been recognized by the National Institutes of Health in their 2007 asthma guidelines,²¹ and has been clinically validated against spirometry and specialist assessment.²² Patients who indicate they have asthma via their general asthma history, as outlined above, are then presented with the ACT questions during their assessment. Patients who do not indicate they have asthma will not be presented with the ACT questions, which is a customized feature that is lacking on paper-based questionnaires (ie, the algorithm adds or removes certain questions that are obviously not required during the patients’ responses, making the process more pleasant and relevant to each patient). An asthma control score of 19 or less indicates that the patient’s asthma might not be under control.

Allergy Medication Use

Research shows that as many as two-thirds of individuals with allergies will not consult their PCP for a proper diagnosis.²³ As a result, patients often self-diagnose and self-medicate inappropriately. Patients also choose to alter their medication dose, discontinue it altogether,

or change it as they wish, for a variety of reasons. The most commonly devised strategies for allergy symptoms are related to adherence to medications. Patients who use over-the-counter medications without a clinician’s prescription are likely to have poor adherence rates, and incorrect medications may be taken without clinician or pharmacist oversight.²⁴ These patients often cite “concern of adverse effects for taking medications” as the reason for stopping medication.²⁴ Self-management strategies can be better implemented when patients’ medication type and use have been evaluated in combination with their symptom frequency and severity and environmental encounters.²³ An example of the medication use questions and the patient response selections incorporated in the AME tool are listed in **Table 6**. The complete medication-use questions contain the following medication categories: antihistamines, decongestants, cromolyn, leukotriene receptor antagonists, and combination long-acting and β_2 -adrenergic bronchodilators for patients who indicate they have asthma. Brand names are typically listed with each medication class/category for easy patient recognition, although they are not listed in **Table 6**.

Results

Patients rated the user interface “easy to navigate” and “easy to answer all the questions.” Clinicians indicated that the patient reports were “easy to interpret” and “useful additions to

Table 5. Asthma Control Test Questions**1. DURING THE LAST 4 WEEKS, HOW OFTEN DID YOUR ASTHMA KEEP YOU FROM BEING PRODUCTIVE AT WORK, SCHOOL, OR HOME?**

All of the time	Most of the time	Some of the time	A little of the time	None of the time	Score
1	2	3	4	5	

2. DURING THE LAST 4 WEEKS, HOW OFTEN HAVE YOU HAD SHORTNESS OF BREATH?

More than once a day	Once a day	3-6 times a week	Once or twice a week	Not at all	Score
1	2	3	4	5	

3. DURING THE LAST 4 WEEKS, HOW OFTEN DID YOUR ASTHMA SYMPTOMS (WHEEZING, COUGHING, SHORTNESS OF BREATH, CHEST TIGHTNESS, OR PAIN) WAKE YOU UP AT NIGHT OR EARLIER THAN USUAL IN THE MORNING?

4 or more nights a week	2 or 3 nights a week	Once a week	Once or twice	Not at all	Score
1	2	3	4	5	

4. DURING THE LAST 4 WEEKS, HOW OFTEN HAVE YOU USED YOUR RESCUE INHALER OR NEBULIZER MEDICATION (SUCH AS ALBUTEROL)?

3 or more times a day	1 or 2 times a day	2 or 3 times a week	Once a week or less	Not at all	Score
1	2	3	4	5	

5. HOW WOULD YOU RATE YOUR ASTHMA CONTROL IN THE PAST 4 WEEKS?

Not controlled at all	Poorly controlled	Somewhat controlled	Well controlled	Completely controlled	Score
1	2	3	4	5	

their patient encounter." Administrators requested the need for multiple languages, such as Spanish and Haitian because of the region of south Florida in which the pilot occurred.

Additional observations were also recorded, which suggested that future integration with electronic medical records would be advantageous for managing workflow efficiency. We believe that by employing the AME tool presented herein to initially assess patients' allergy symptoms, health care providers will be better able to evaluate and address allergies in the clinic. The usefulness of this tool in clinical settings will be fully gauged in another study, and the results will be presented in a future report.

Discussion

We sought to develop an easily accessible allergy management tool for clinicians to better understand the source and root causes of allergic disorders. The AME tool has been developed to capture the patient self-report information accurately, reliably, and with simplicity. The AME tool can be used to improve the management of allergic disorders with a more holistic approach.

It is well known that a lifestyle that includes regular physical activity, weight control, good sleep hygiene, a healthy diet rich in fruits and vegetables, not using tobacco (and eliminating exposure to secondhand smoke), and psychological well-being can help improve allergy symptoms.²⁵ Many patients know they need to make lifestyle changes, but they often

do not take it seriously until they hear it from a trusted medical professional.²⁶ The AME tool also presents patients with questions related to their health behaviors and provides clinicians with patients' physical activity levels, fruit and vegetable consumption, and tobacco use, as these health behaviors have obvious impacts on patients' general well-being, weight management, and psychosocial health.

When patients are asymptomatic or have their allergy triggers under control, physicians should encourage patients with allergies and/or asthma to achieve the recommended 150 hours of physical activity goal each week. Also, encouraging patients to spend time outdoors when possible, especially at parks, forests, lakes, and beaches, to attract some good "bugs" into their microbiota is also

Table 6. A Sampling of Responses to Allergy Medication Use

MEDICATION TYPE	UNSURE	NEVER	OCCASIONALLY	WEEKLY	MORE THAN ONCE A WEEK	DAILY
Oral antihistamines such as diphenhydramine, loratadine, fexofenadine, clemastine, cetirizine, levocetirizine, or pharmacy branded allergy tablets or liquids						
Nasal steroid sprays such as beclomethasone, beclomethasone dipropionate, budesonide, fluticasone, avamys, mometasone, triamcinolone acetate						

beneficial for allergic disease management.¹⁴ Safe exposure to direct sunlight to increase natural vitamin D while exercising outdoors can also be helpful.¹⁴

Consuming a diet high in fermentable fiber—with fruits and vegetables such as garlic, onion, leek, chicory root, and asparagus, as well as regular prebiotic intake—is highly beneficial. Probiotic-rich foods such as fermented cabbage, sauerkraut or kimchi, pickles, butter-milk, and live-cultured yogurts are also recommended. A healthy diet combined with prebiotics and probiotics may aid in allergy protection for your patients.²⁷

It should be noted, however, that while internal validity of the AME tool has been tested, external validity that tests the potential predictive value of the tool has not been completed yet. Items selected for each of the tests are essentially American/English and will need to be modified for different languages and cultures. Similarly, separate items could be developed for use among children and adolescents. Possible limitations to this study include language barrier for group of participants (until it becomes available in languages other than English), unwillingness of the patients to participate in the survey (sample size), and lack of interest from the primary health care providers to adopt this digital tool.

Conclusions

This article describes the development and internal validation of a simple, convenient, online testing tool for identifying

and prioritizing the main factors influencing allergy symptoms and severity in an individual. The AME provides a digital medicine tool for clinicians to quickly assess patients' likely allergy triggers and environmental conditions that affect their symptom severity and quality of life. With this simple test, clinicians can determine whether further blood or skin tests are needed to confirm the triggers and whether the patient would benefit from consulting an allergy specialist and/or allergen immunotherapy treatment approach.

The AME tool was implemented into approximately 150 primary care practices in early 2021. External validation of the finalized tool will involve assessing the long-term outcomes, such as patient self-reported allergy symptom control and satisfaction with treatment, after the baseline AME is undertaken and advice or prescriptions are provided. Physicians and patients will evaluate the digital assessment tool in a functional manner, and the results will be described in a future publication.

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