Allergy Screener

Prepared for the 2016 Startup Competition in Life Science (Boston)

Our Mission & Vision

We at Allergy Screener want to make lives easier for people with adverse sensitivities, which is defined as allergies, hypersensitivities, and intolerances by helping them identify, document, and manage reactions and causative agents. Patients with allergies often see an allergy specialist for care, and often need to remember what medications, foods, and environmental allergens they should avoid in everyday life. Occasionally, patients encounter a life-threatening allergic reaction, requiring them to immediately seek medical care from an emergency room or allergy specialist. Our app will provide information about users that self-identify quickly the signs and symptoms of a severe allergic reaction, nearby providers (e.g. hospitals, insurance companies) that have availability to see the patient, or wait times (i.e. skip to the prioritized queue track of a specific insurance company) at local emergency rooms to help a patient get back to a stable condition. This personalized treatment can exclude a potential fatal allergen, offer tips caution about foods or drugs, save patients’ time in searching a good doctor, and reduce expenses if linked to their health insurance network. Our product is a simple but intelligent mobile application that is based on continual analysis of vast amounts of available adverse sensitivity data.

Keywords: Big Data, Apps for Health, Allergy

Executive Summary

Healthcare services, from tracking patient health conditions to providing remote consultations, are continually being transformed by data innovations translated into mobile apps. Patient-provider communication is increasingly going digital. From our perspective, knowledge can be extracted from remote consultations and summarized by analyzing massive datasets, including clinical data and medical knowledge-based data to transform the nature of future interactions. Patients often research and discuss health-related information on the web both prior to and after visiting a clinician, often resulting in misleading and dangerous advice. Based on available data, an
association between patients’ description of symptoms and a physicians’ diagnosis and treatment plan can be discovered and applied to other similar clinical cases. Our solution is to create a disruptive data innovation utilizing clinical data from a large allergy repository, patient-provider communications, clinical knowledge bases, consumer data from social media, health plan network data, GPS data, and localized weather data to manage patients with adverse sensitivities.

Team Members

Joseph Plasek is our Chief Technology Officer. He is currently pursuing a Ph.D. in Biomedical Informatics at the University of Utah. He is a research assistant in the General Internal Medicine at Brigham and Women’s Hospital. Email: jplasek@partners.org.

Fuqin Yan is our Chief Marketing Officer and is responsible for the marketing plan. She has a Masters in Statistics and a Masters in Economics from the University of California, Santa Barbara. She is a data scientist working at a financial technology company, FinMason Inc. Email: fuqinyan@gmail.com.

Chunlei Tang is our Chief Executive Officer and team leader. She initialized this business plan with an idea of applying big data techniques to diagnosis tests, so as to reduce physicians’ daily workloads. She has a Ph.D. degree in Computer and Software Theory with interest in data mining and its application. Currently, she is a research fellow in the Department of Medicine at Harvard Medical School. Email: ctang5@partners.org.

Advisors

David W. Bates, MD, Msc, Senior Vice President for both Brigham and Women’s Hospital and the Brigham and Women's Physicians Organization. He is also a Professor of Medicine at Harvard Medical School and the Harvard T.H. Chan School of Public Health. Bates is Tang’s postdoctoral supervisor.

Li Zhou, MD, Ph.D., Senior Medical Informatician. She is an Assistant Professor in Medicine at Harvard School. Li is principal investigator of an NIH-funded allergy project focusing on extracting allergy information from clinical notes.

The Clinical Problem

Allergy has been recognized as a growing public health problem worldwide for its association with decreased occupational productivity. In the US, one in five patients have at least one adverse sensitivity. Allergic reactions result in over 1 million visits per year to emergency departments (ED) (1). Foods and antibiotics are among the most common causes of these visits with an estimated 525,600 and 112,116 visits annually (2, 3). International guidelines require food manufacturers to label products that contain common allergens to prevent fatal anaphylactic and other allergic reactions from hidden allergens (6-10). Environmental allergen exposures (e.g., plant, dust mite, animal dander, and mold) commonly cause a worsening of allergic rhinitis, sinusitis or asthma, and are mostly unavoidable, though they may be modified based on a patient’s
lifestyle or geographic location.

The asymmetric information problem between patients and doctors causes inefficiency and patient safety concerns for allergy. For example, adverse drug events (ADEs) due to a patient receiving a medication to which they were known to be allergic is present in both the inpatient (4) and outpatient (5) settings.

Our Market

The Centers for Disease Control and Prevention (CDC) lists allergy as the 6th leading cause of chronic illness in the US, with an annual cost in excess of $18 billion. Allergic rhinitis alone affects between 10-30% of adults with an annual cost of over $11 billion (11). More than 50 million Americans suffer from allergies each year. Healthcare organizations and health insurers are looking for ways to engage patients, gather real-time data about their symptoms, and transform the management of chronic diseases like allergy.

Although that is not so much relevant reports of allergic diseases as the US, Chinese people are really suffering due to their heavily polluted environment that presents in air, water, food and drugs. Specifically, relevant reports for low morbidity of allergies appear in being difficult to count based on the huge population of China with large regional differences, coupled with habitual endurance that is characterized most of the Chinese shows themselves in patience under various reactions occurring in the body.

On the basis of the above considerations, it is reasonable to design our marking plan: (1) the Test Phase: we will test our intelligence app in the US market based on hold data that we listed in the next section of solution, and (2) the Application Phase: we will promote the implementation and shift all available data from the China’s market.

Our Solution

A visual description of our solution is shown below:
We will create a disruptive data innovation utilizing clinical data from a large allergy repository, clinical knowledge bases, consumer data from social media, and localized weather data. The primary purpose of the Test Phase is to use the data from the Partners HealthCare System’s Enterprise-wide Allergy Repository (PEAR) that contains clinician entered allergens shared within a federated provider/hospital network (12). From our prior research on PEAR and emergency department notes, we have identified common allergens and common reactions using Natural Language Processing (NLP) techniques (13). We will use the algorithms of association analysis, more specifically refer to pattern mining, to identify recurring features in various reactions to generate frequent item sets of allergies. Consider the case of allergic rhinitis where a patient reports having a runny nose, itchy and watery eyes. We will call the pattern of the above three reactions a frequent item set, which has a strong correlation with a kind of allergy instead of catarrh.

We will further apply deep learning models to medical knowledge base data and social media data so as to improve our analysis. We will use data from MicroMedex, which provides scientific training for medical professionals related to diagnosing and treating adverse sensitivities. “Deep learning” on this data will help us to “translate” patients’ reaction descriptions to a clinical knowledge base and validate our frequent item sets created by association models. We will add in data from public health sources on epidemics, pandemics, and local outbreaks of disease, as symptoms from allergy may overlap with other illnesses present in the community. We will also look at data within patient-provider messages related to allergy information.

We plan to use data from Treato, a social health website, which has already collected and summarized clinical data and has made it available to researchers. Other social media data resources may include Facebook, Twitter, PatientsLikeMe, and similar social media networks that contain massive volumes of information that is shared publicly by patients. We will extract contents that contain a patients’ voice about their healthcare experiences related to allergy. For
example, patients may talk about allergic reactions, their current allergy symptoms, and about what they’re doing to treat or recover from an allergic reaction.

We will also use localized weather and climate data to a patients’ current location, as identified by mobile phone location. This dataset, obtained from the National Climate Data Center, includes temperature, precipitation, air quality, and wind data, which can help us to exclude unlikely allergens and identify likely causative agents. Air quality data contains information about pollution and seasonal allergens (e.g., pollens).

The following figure shows an example dialogue between the Allergy Screener app and a patient.

![Allergy Screener](image)

**Our Plan & Business Model**

We believe Allergy Screener can become a sustainable and profitable business that achieves high clinical impact with moderate funding. Based on prior research (from NIH as 1R01HS022728-01 with USD$2 million), an initial investment of seed funding (from InfinityData Investment Co., Ltd with USD$3,000) allowed us to develop a viable prototype of our mobile app.

There are three stages that are implementing as below. Stage 1 involves cleaning and analyzing all available data, developing data models, and creating symptom-allergy association maps. Stage 2 involves testing the app with volunteers affiliated with Harvard Medical School. During this phase, we will gather valuable feedback to enhance and refine our app and data models. During Stage 3, we will pitch our app to healthcare organizations or health insurers to integrate our data models into their patient registration and appointment making workflows to provide transformational functionality to patients that changes how they access healthcare services.

**Growth and Valuation**

We will derive growth at Allergy Screener by systematically increasing user adoption, targeting more markets, and bringing value to more stakeholders. Adoption of the tool by large health insurance companies or health care provider organizations would increase growth exponentially,
rather than simply targeting individual consumers, despite there is a common need of developing large-scale number of users in general mobile application.

Competitive Landscape

According to HealthLine, popular allergy-related apps include Zyrtec, Find Me Gluten Free, and AllergyManager. These apps are aimed at detecting and helping users avoid potential “threats” from foods, environmental conditions, or weather when an allergy has previously been diagnosed. Health websites like WebMD provide information to users about allergies and treatments, however their complicated symptom checklists and medical terminology make it difficult to follow and understand for patients. Compared to other health apps and websites, our solution is based on sophisticated data mining algorithms and large databases.

References