



# Clarty – Transparent data of prescription drug adverse effects

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## Abstract

In the transactions among doctors, patients, and pharmaceutical firms each party has different amounts of information regarding the product quality of the drug prescribed and the risk entailed in the transactions. When the Food and Drug Administration (FDA) allowed Direct To Consumer Advertising (DTCA) in 1998, these advertisements were intended to reduce the level of information asymmetries between the drug manufacturer and the consumer.

Although the FDA publishes the AERS data every quarter on its Medwatch website, the data is largely considered a data dump and is in a format that allows for little sense making by the average consumer of these drugs. Given the limitations of the data presented on the FDA website, consumers, much less non-native speakers of the English language, are unable to make sense of the data and understand the risks involved in consuming a product.

The purpose of this research is to make this medical information on marketed drugs more transparent and accessible to consumers who want to understand the effects of the drug on others. The technical tools used to build this project also serve as a research segment regarding modern databases, servers, and UI design.

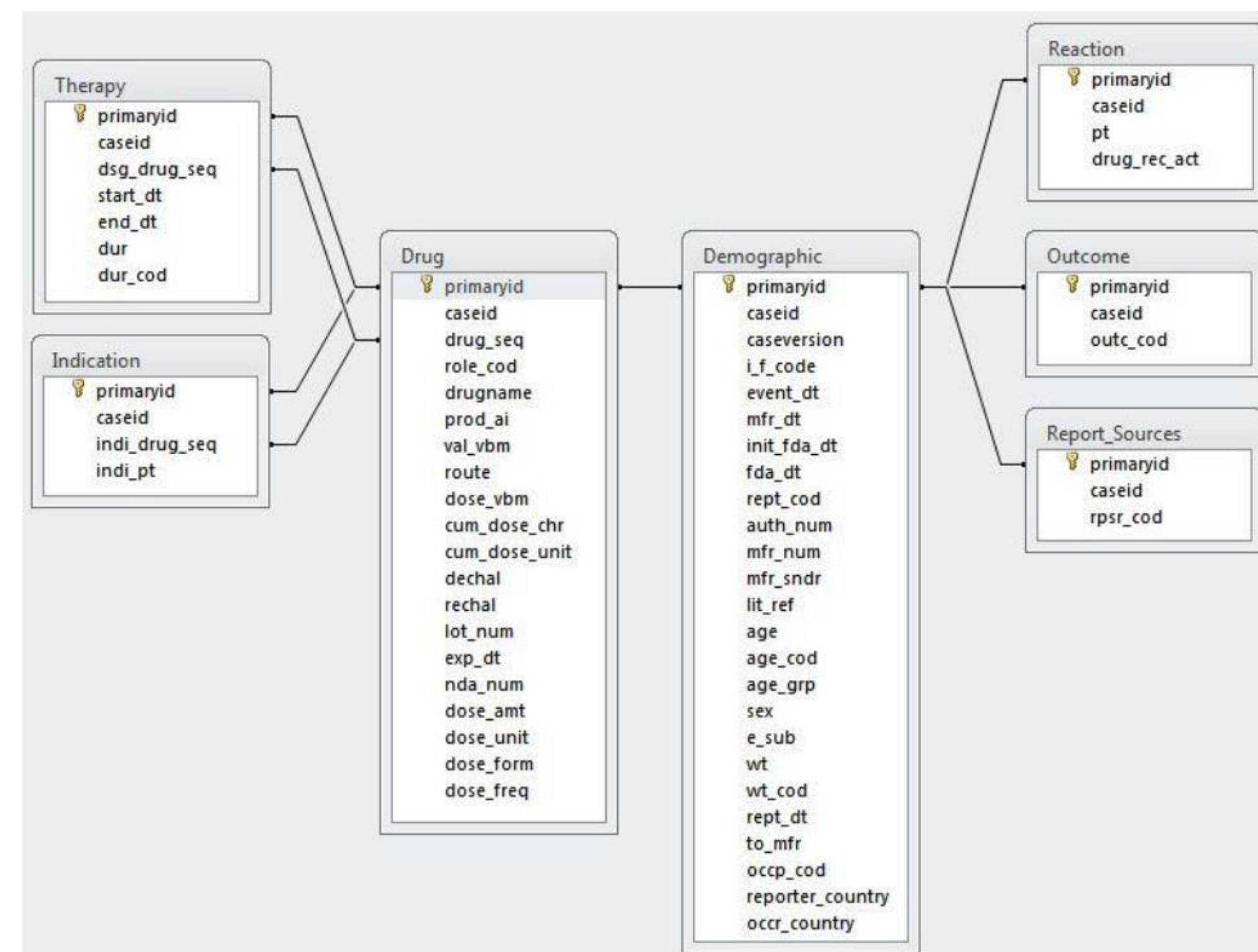


Figure 1: FDA AERS Entity Relationship Diagram

## Research Questions

- Which metrics do consumers of prescription drugs care about the most? (Ex: Adverse Effect Breakdown, Manufacturer Breakdown, Average Age, etc)
- How is the information that is presented to consumers going to affect their decisions when prescribed a new drug?
- Are there different effects when presenting numeric data through absolute values, percentages, or data visualization diagrams?
- Will these metrics also be useful for doctors or medical professionals who prescribe these drugs if they are aware of the unintended effects?
- What are the benefits of a modern technology stack versus a traditional monolithic one?
- What are the technical and UI challenges of presenting analytics data on a mobile device?

## Software Architecture

Given the breadth of tools being used today by start ups and fast-growing companies, the traditional monolithic application stack has been challenged by cloud technologies. On the FDA AERS website, it is stated that a RDMS or SQL database is required to visualize their data sets. This was tested by previous developers and showed inefficient search times on important drug metrics.

The software architecture we used involved Python scripting, NoSQL database, serverless stack, and React Native for cross mobile development. This software stack does not require database management, server maintenance, or proprietary programming languages for mobile development.

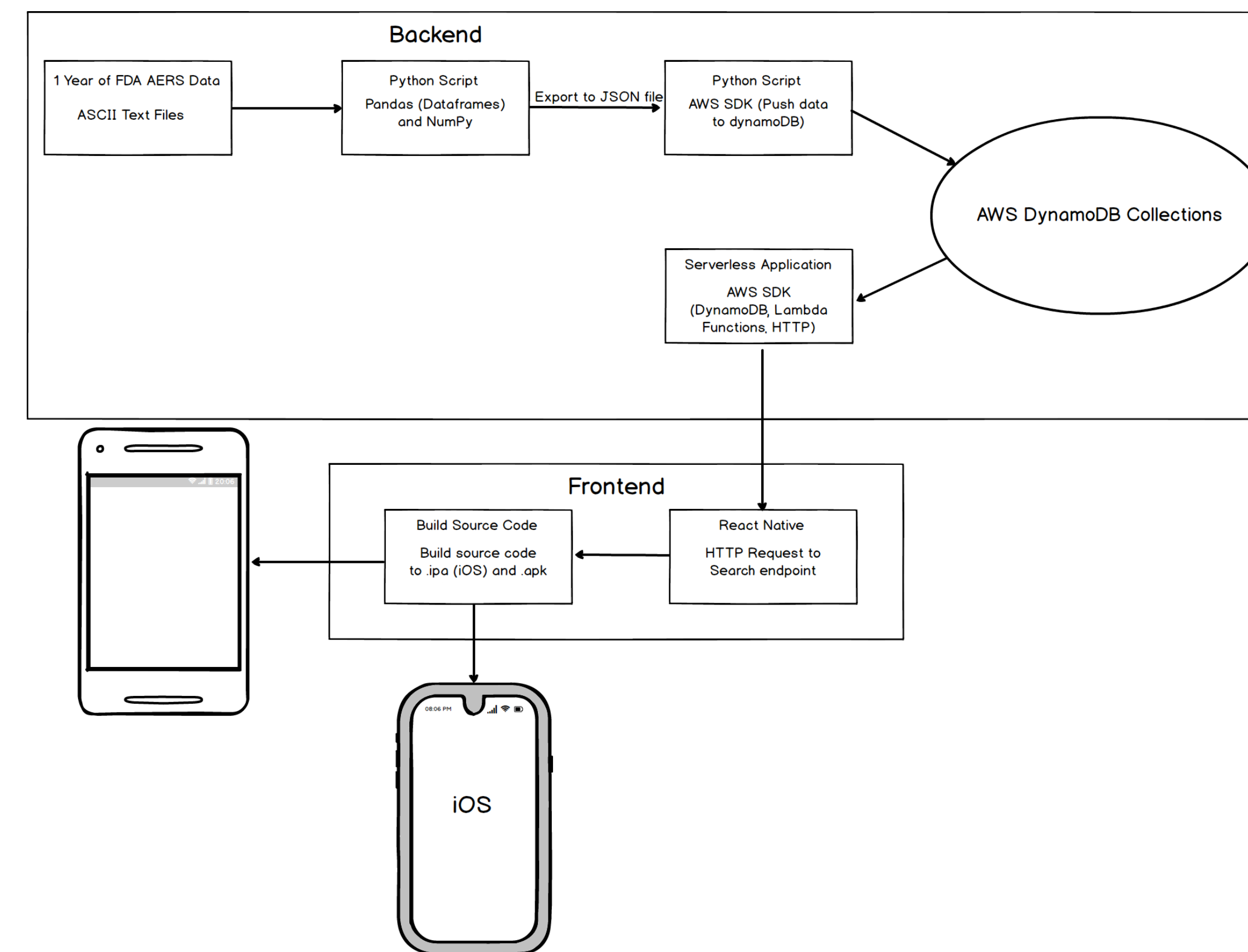


Figure 2: Clarty Software Architecture

## Consumer Use

With this application being geared more towards the average consumer of prescription drugs, we had to present the data in the most clear, transparent, and concise way as possible. Some immediate feedback that we received when holding focus groups on our Version 1 mockups was that the data did not capture the adverse effects clearly.

(Example: If there were 10,000 adverse effect reports for the drug Abilify, with 10,000 of those reports being linked to Anxiety, that does not necessarily mean that consumption of Abilify 100% causes Anxiety.)

Certainly, we needed to state this somewhere in our application to avoid any serious data validation issues. One way to aid the user in understanding the FDA AERS data was to present the figures as percentages and raw numbers. With percentages, users were able to understand the breakdown tables better without more data visualization. We are also observing the different effects of data visualization designs on how users' digest data.

## User Scenarios

- Adam was recently diagnosed with depression and prescribed by his doctor with Abilify. He noticed an increase in suicidal ideation when taking Abilify and does not suspect the drug to be the cause due to the manner aspects of his life and that drugs are supposed to be helping his emotions. Adam uses Clarty to see if others have reported this and consults his doctor on this adverse effect.
- Dr. Smith has been prescribing Metformin to his patients with diabetes for through his whole career. He observes that a noticeable amount of them have been experiencing muscle pain/weakness. Dr. Smith mentions to his future patients that are prescribed with Metformin of the known adverse effects after viewing all the data on Clarty.
- Marie is getting ready for chemotherapy and has a list of drugs she has to take during her therapy. She wants to know the adverse effects that others have experienced in the past 2 years. She uses Clarty to search for her drugs by the last 2 years and finds similar adverse effects for each drug.

## Application Screenshots

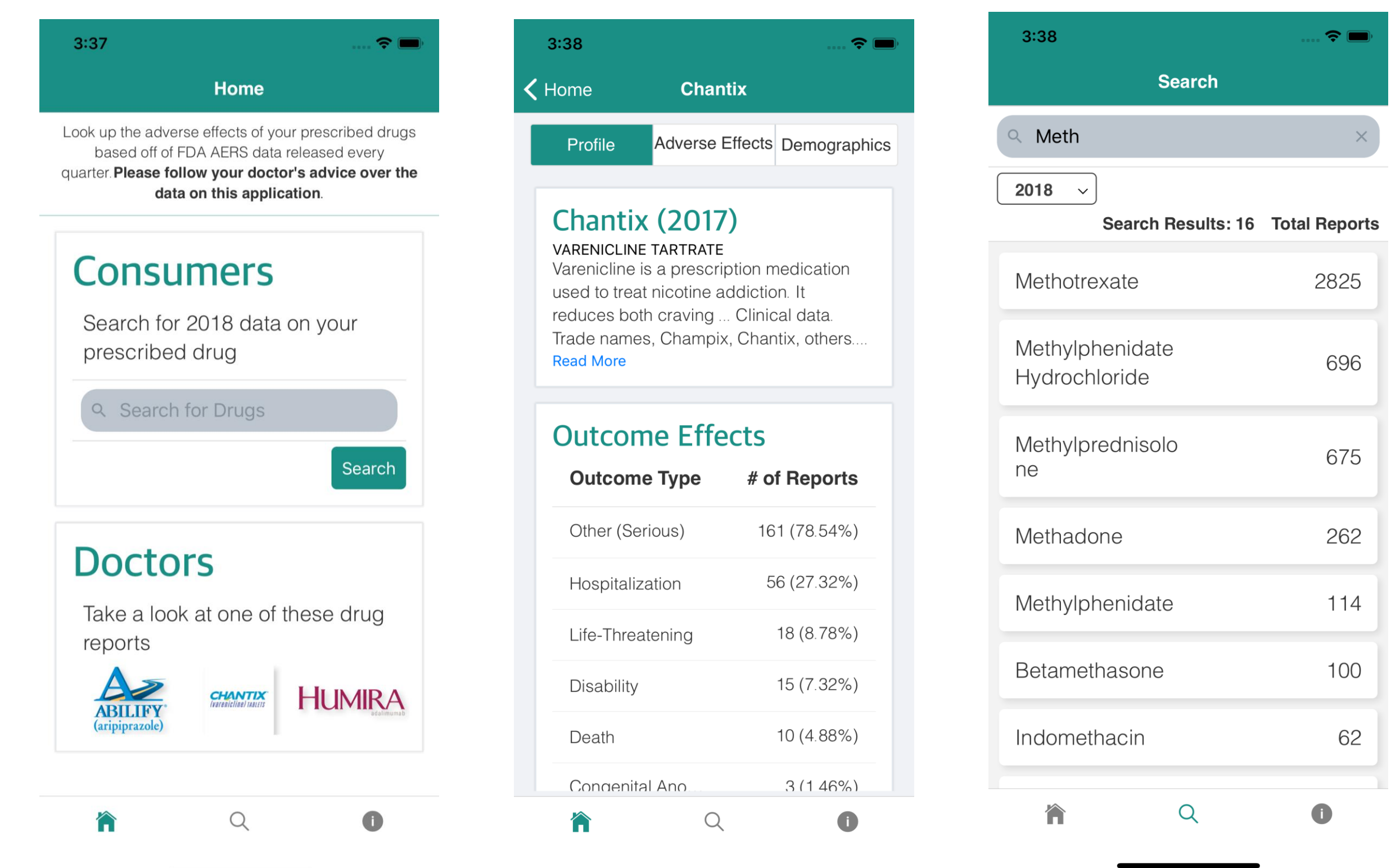


Figure 3: Clarty Screenshots (iPhone X Simulator)

## Related Resources

- Kirmani, Amna and Akshay R. Rao (2000), "No Pain, No Gain: A Critical Review of the Literature on Signaling Unobservable Product Quality," Journal of Marketing, 64 (2), 66-79.
- Holmer AF. (2002) "Direct-to-Consumer Advertising — Strengthening our health care system," *New England Journal of Medicine*, 346, 526-8.
- <https://fis.fda.gov/extensions/FPD-QDE-FAERS/FPD-QDE-FAERS.html>
- <https://github.com/ClartySFSU>
- Android: <https://play.google.com/store/apps/details?id=com.clarty.clarty>