# User Centered Design for Drug Side Effects app
# (SideEffects.Agileana.com)

**Goal:** Create a simple and intuitive website where users (able or disabled) can search for a drug and view their side effects in a graph for quick and easy comprehension.

**Process:** Sharing a strong commitment to human centered design and allowing potential end user feedback to shape our development, we worked closely with representative users, using their feedback throughout the design process to reach a solution that is accessible, easy to use, and aligned with their goals and expectations. The method and techniques used for this process are as follows:

1. Research for gathering requirements (Interviews and Persona creation)

As a team we decided to use the adverse drugs reaction dataset, as we believe it has the broadest applicability to a variety of individuals and populations. Before beginning development, our team wanted to interview potential end users to ask about the information that would be useful to them. To do this, Father's Day weekend our team spent time asking friends and family to share their thoughts, feelings, and ideas regarding information related to drug reactions.

At this point the questions we were asking were not bound by limitations of the dataset as we were still exploring potential integrations with non-Open FDA data.

Here are five personas created using the information gathered from various individuals who helped shape our choice to create Drug Side Effects app. These fictional characters are constructed to understand their goals, desires, needs, behaviors and preferences.

1. Potential user one, 62, female, physician and health IT professional: noted that as a physician she would like to see how reactions from specific drugs in the same drug class stacked up against each other. She also recalled having patients frequently ask questions regarding side effects and where to find more information. Frequently the text on pill bottles or drug warnings is too small to read, the warning voice at the end of a commercial is too difficult to understand.
2. Potential user two, 54, female, nurse and former health IT/ EHR trainer: suggested a visualization of potential side effects for health care consumers. Specifically referencing her older father who was on a large amount of medications but was not always aware which medicines had which side effects. For instance if he takes three meds before bedtime, and experiences insomnia, which one is more likely to cause this?
3. Potential user number three, 24, male, agricultural equipment sales: mentioned struggling with understanding the weight of various side effects for drugs. Referenced the "warnings" at the end of drug commercials that all end in death. Said specifically that

without understanding which side effects actually occurred more often he felt he couldn't make an educated decision on taking medication and accepting risk.

4. Potential user number four, 45, male, IT professional: Recently diagnosed with multiple conditions that required medication. Was experiencing some side effects but was unsure if they were related to medication or just aging. Would like to be able to validate this by understanding which side effects are the most common for which drugs.
5. Potential user number five, 65, female, retired retail worker: Enjoys spending time on the internet, partially blind, accesses sites through VoiceOver on her MacBook. Mentioned taking various medications, had some concern about side effects but more concerns about being able to access information - pill bottle labels and other printed information cannot be accessed without the help of others. Would like independence to ask questions and consume data related to adverse reactions but felt that most sites currently available had too much information and were difficult for her to navigate.

During this initial research we determined that the greatest need sat with creating a simple, usable, accessible site that aging populations (or anyone) could easily access and consume information from. We then consulted as a team to determine technical feasibility and viability of creating a solution for the user stories that we gathered. In this process we began to examine the information supplied in the data set. We also researched the strengths and weaknesses of existing solutions on the market (benchmarking) using Heuristic Evaluation.

## 2. Benchmarking via Heuristic Evaluation

For this Heuristic Evaluation, three team members with significant experience in UX (User Experience) tested three popular websites that allow users to search for the adverse reactions to a drug. These websites are: Drugs.com, WebMD, and RxList. The heuristics used for this evaluation and the results obtained can be observed in Table 1. The score for each heuristic ranges from 1-3, where 1= Doesn't comply with heuristic; and 3= Completely complies with heuristic.

| **Heuristics** | **Websites Evaluated** | | |
|---|---|---|---|
| | **WebMD** | **Drugs.com** | **RxList** |
| **Perceptible Information** (Communication of necessary information to the user) | Clear path to search drugs. Labels are clear. Information is understandable but not quickly scannable. | Clear path to search drugs. Labels are clear. Complete information but is very long to read. | Search is clearly labelled. But lots of unnecessary surrounding text. Most of which is very technical. |
| **Score** | 2 | 2 | 1 |

| | | | |
|---|---|---|---|
| **Simple, Intuitive use** (Ease of use to achieve user goals regardless of their technical skills) | Few clicks are needed to reach information. Includes autocomplete. | Easy to search with autocomplete, can also use alternative phonetic search. | Very cluttered. Lots of text and different elements grouped together. |
| **Score** | 3 | 3 | 1 |
| **Error Prevention** (User mistakes are minimized or shown if committed) | Does not prevent errors but does show error message and suggestions. | Shows error message before confirming query. | Does not prevent errors but does show error message. |
| **Score** | 2 | 3 | 2 |
| **Accessibility** (Accommodation for a wide range of users, with or without sensory/cognitive impairments) | Sufficient contrast, but lots of surrounding text complicates use of screen readers. | Good contrast, compatible with screen readers. | Abundance of different texts makes it confusing for screen readers. |
| **Score** | 2 | 3 | 1 |
| **Flexibility** (Design adapts to multiple platforms) | Not responsive. Is limited to use on a computer. | Website is responsive and can be used on a computer, tablet, or phone. | Not responsive. Is limited to use on a computer. |
| **Score** | 1 | 3 | 1 |

Table 1. Heuristic evaluation of three (3) existing solutions.

According to the previous table, we highlighted the importance of presenting the user with a simple and intuitive interface where they could type their search and visualize the most relevant information in a way they could easily understand. Also, the content provided should be accessible for the majority of users (i.e., 508 Compliance) and also be accessed from various devices.

## 3. Participatory Design

From here we began to develop potential designs within the team. The initial intention was to show drug interactions as well as reactions, but due to time constraints this was not possible. So a simpler version was produced and shown to users for feedback. See Image 1.

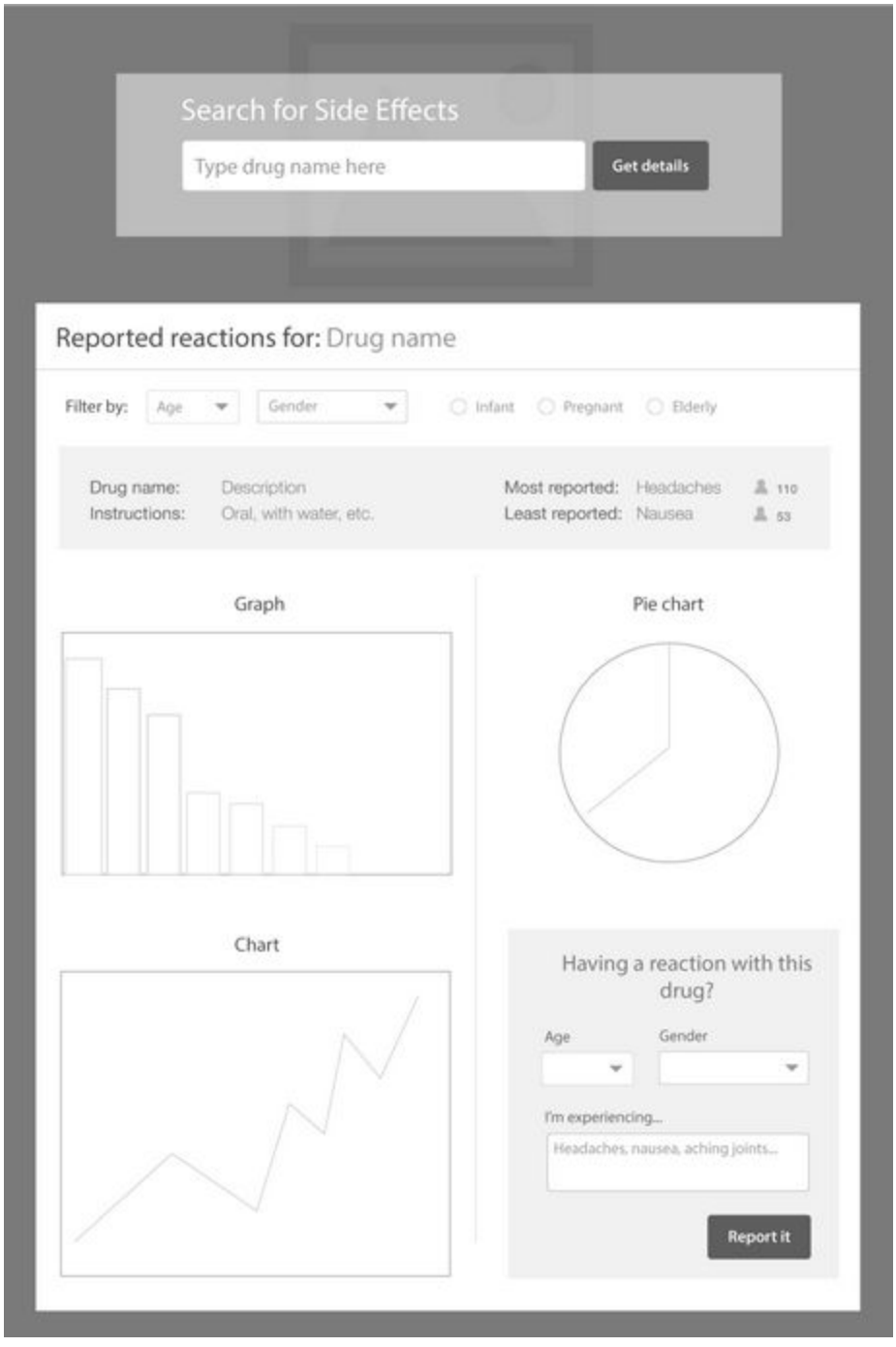


Image 1. Initial design of solution.

Various suggestions were made, such as dividing the search into two separate screens instead of just one. Also, showing the reactions in only one graph, limited to the top 10 - 20 for a more concise result. To better comply with user expectations, a Participatory Design Workshop was organized in which designers and users worked together to design an improved prototype. The results can be shown in Images 2 and 3.

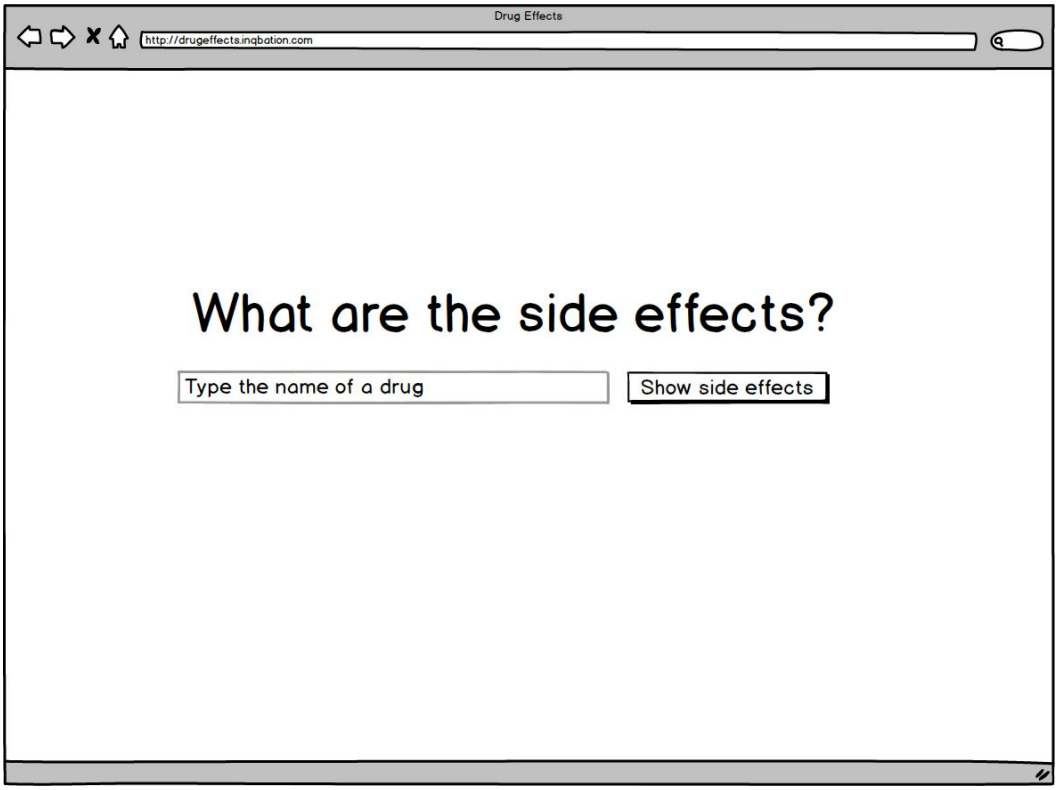


Image 2. Homepage.

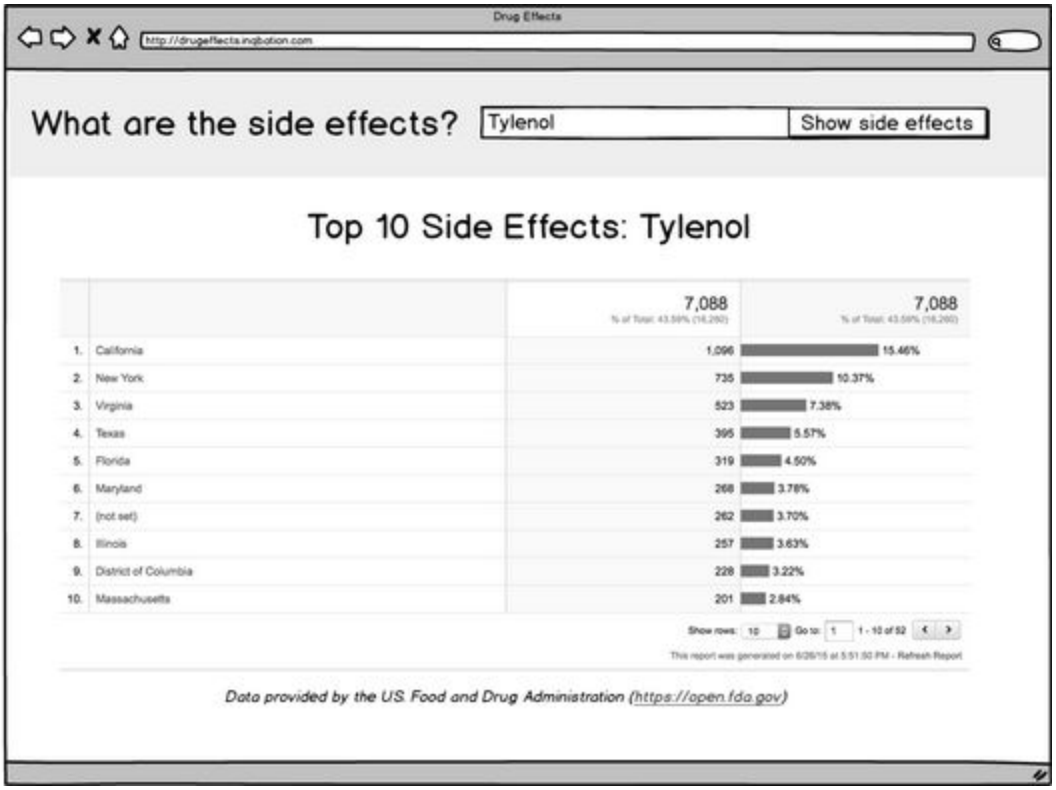


Image 3. Results page.

4. Initial Usability Testing

This design was then converted into an interactive prototype using Invisionapp where 3-5 users interacted with it in a “Think Aloud” usability test. Comments were generally positive and the main task of searching for a drug’s side effects was completed without hesitation. There were a few suggestions that were taken into consideration, such as adding an option to quickly clear the search bar after typing in a long drug name that is shown as incorrect.

These design measures were shown in a new prototype. See image 4. Which the users tested again successfully.

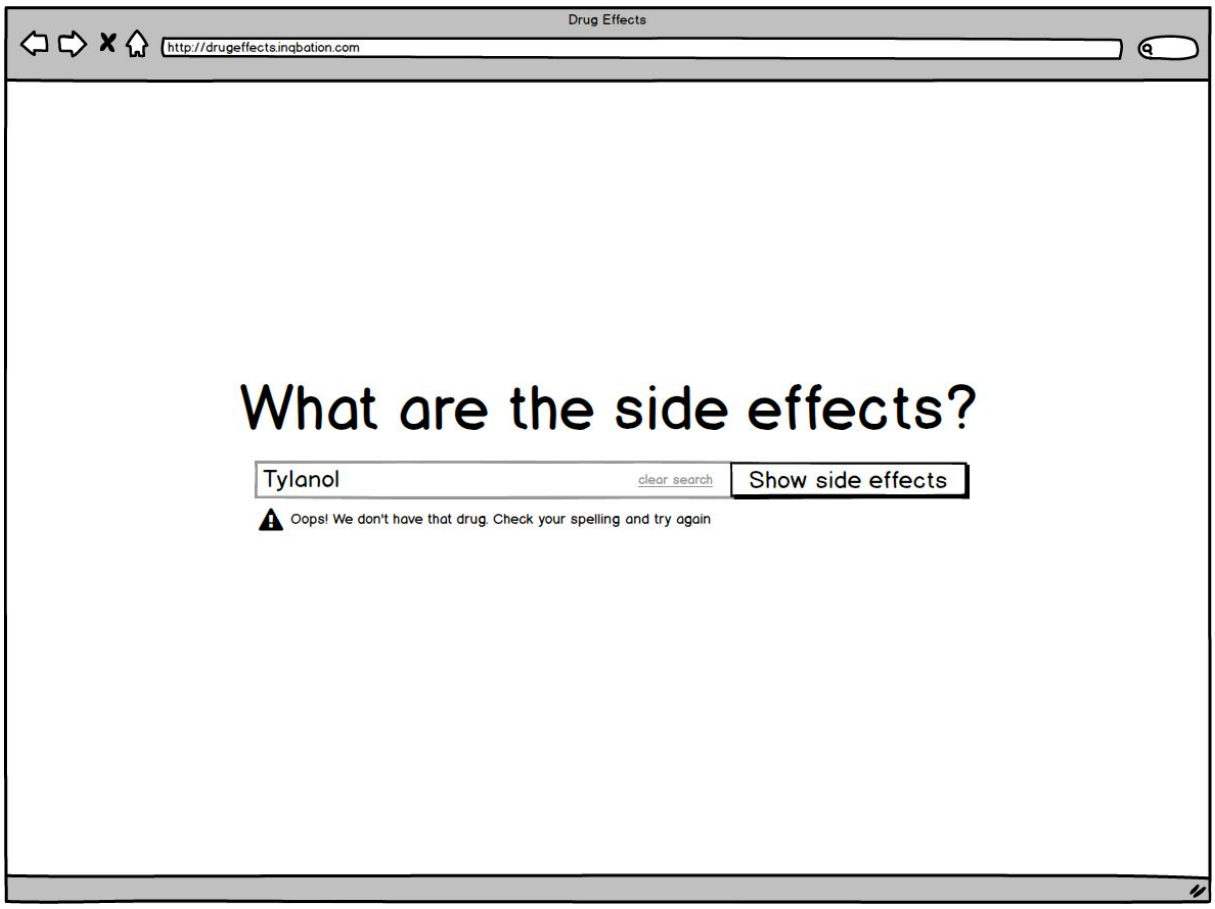


Image 4. Corrected search (when incorrect input)

## 5. Reiteration and Final Usability Testing

Once the interactive prototype was tested and approved, it was converted into a functional software prototype for final user testing. See Images 5, and 6.

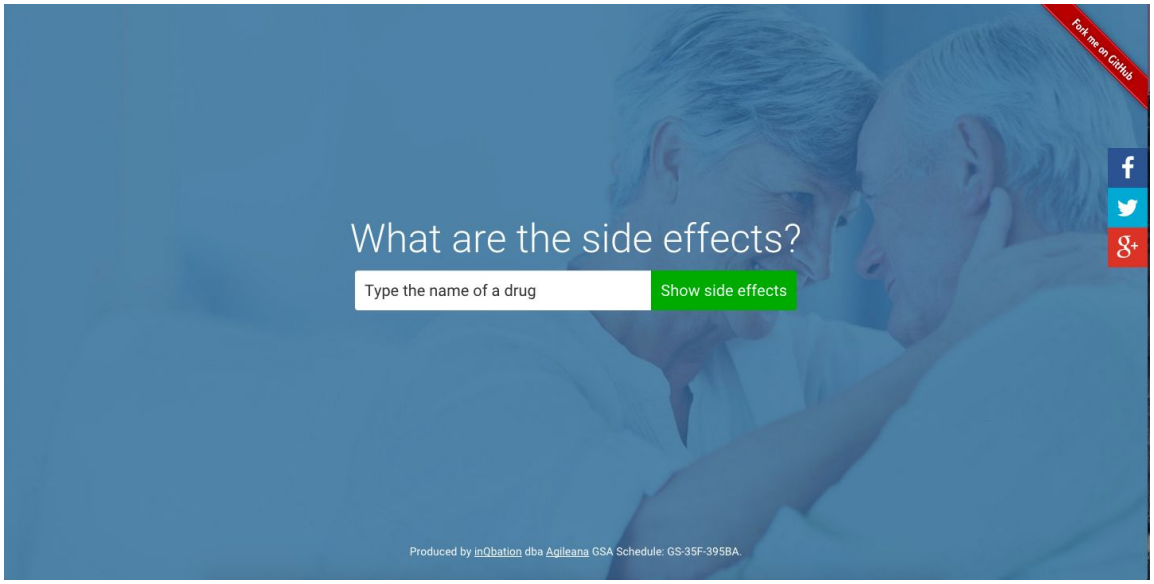


Image 5. Working prototype of homepage.

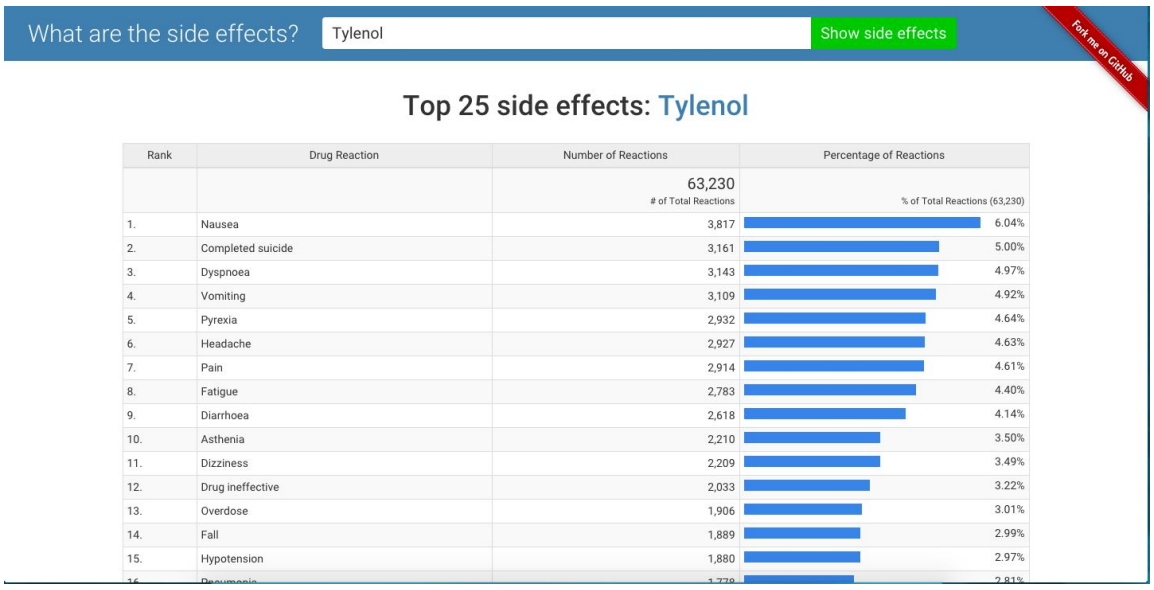


Image 6. Working prototype of results page.

In usability tests run with friends or family who fit the user profile, one participant reported an issue with the screen reader due to mislabeled elements; and two participants reported visualization problems on iPhone 4. These issues were immediately corrected by the team's developers before being re-tested.

As an extra measure, the website was also tested using the remote, online usability testing tool: Loop11.com, where up to 10 users who fit the profile tested it (on their personal computer or cell phone) and left their feedback. In this case, 90% succeeded on first try. See Image 7. The remaining 10% reported they typed in the name wrong (and received the immediate error message suggesting they check their spelling) or typed in a drug that was not in the database.

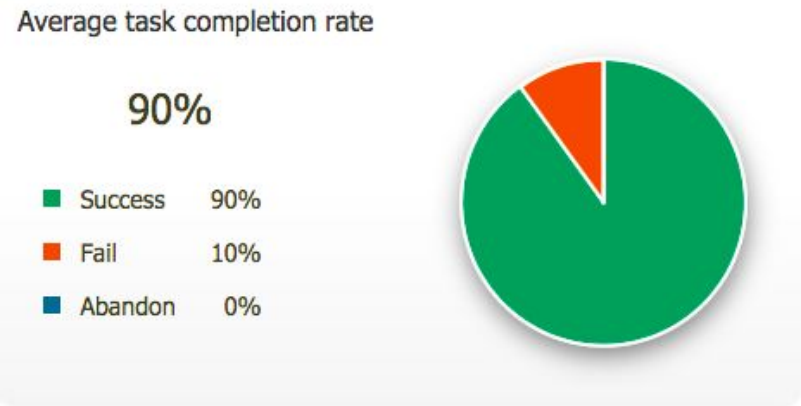


Image 7. Task completion rate using Loop11.com

In the final usability tests, the interaction and functionality were successful and the website was deemed 100% responsive on Firefox, Chrome, and Safari, as well as on mobile devices. At the conclusion of each usability test, a few questions were asked regarding the satisfaction, efficiency, and general ease of use of the website. The questions and answers are as shown in Image 8.

Did you find it easy to search for a drug's side effects?

| | % | Response Count |
|---|---|---|
| Yes | 100.0% | 10 |
| No | 0.0% | 0 |
| More or less | 0.0% | 0 |
| Answered Question | | 10 |
| Skipped Question | | 0 |

Which of the following statements accurately describe this website?

| | % | Response Count |
|---|---|---|
| Simple and intuitive | 60.0% | 6 |
| Easy to use | 80.0% | 8 |
| Results are clearly presented | 70.0% | 7 |
| Aesthetically pleasing | 50.0% | 5 |
| Unhelpful | 0.0% | 0 |
| Confusing | 0.0% | 0 |
| Ugly | 0.0% | 0 |
| | 0.0% | 0 |
| | 0.0% | 0 |
| Other, please specify | 0.0% | 0 |
| Answered Question | | 10 |
| Skipped Question | | 0 |

Image 8. Questions and answers of final usability tests.

Thanks to these results, we can safely confirm that Drug Side Effects app, in its most basic form, complies with essential usability principles and has accomplished what it was created for, which was to be a simple, intuitive, and accessible platform to search for a drug's top side effects.