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PROJECT REPORT

HCDE 511



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Table of Contents

1. Abstract.....	2
2. Introduction	2
3. Related work.....	2
4. The Data	5
5. Personas and Scenarios	8
Initial Personas.....	8
Final Personas	9
6. Early Brainstorming.....	9
Initial Iterations of Sketches	10
7. Prototyping and User Evaluation	11
Task List:.....	11
Iteration I – PowerPoint Prototype.....	12
Usability Study I	14
Iteration II –Tableau.....	15
Map Explorations	15
Auxiliary Chart Explorations.....	18
Usability Testing II.....	21
Iteration III	22
Usability Study III	24
8. Final visualization.....	25
9. Evaluation	26
Shneidermans mantra of “Overview first, zoom and filter, then details on-demand”	26
Principle of effective navigation	27
Basic and advanced interaction techniques	27
Tufte’s principles of Graphical Excellence and Integrity.....	27
10. Discussion and Further Work.....	28
The Map	28
Improving Interaction and User Experience	28
Storytelling and Final Thoughts	28
11. Acknowledgments.....	29
12. References	29

Abstract

This paper explores the different methods used to analyze the calls received by the Crisis Clinic across geography and time in order to find useful insights in terms of discovering important trends, correlations and possible causations. We analyze the call trends of 4 different lines: Crisis Line, Teen Link, Recovery Line, and 211, and specifically focus on the most common problem areas and needs, which we have analyzed with respect to geography in terms of ZIP codes and cities, and with respect to time from January 2010 to May 2014. Our exploration with the data shows that it is possible to extract useful information on the call behavior of the callers across geography and time through visual analysis. Based on these results, we explain how managerial decisions specifically relevant funding of the Crisis Clinic can be enhanced, and also focus on the aspect of increasing public awareness through hosting the final set of visualizations as a dashboard on Tableau Public.

Introduction

Crisis Clinic is at the heart of the Seattle-King County safety net providing a broad array of telephone-based crisis intervention and information and referral services. For many people in emotional distress or needing community services assistance, they are their “first call for help.” Every year, the Crisis Clinic receives a huge number of phone calls from King County residents in need of emotional support and community services. It has four main programs through which it provides its services:

1. The **24 Hour Crisis Line** offers emotional support to those in crisis or considering suicide;
2. **King County 2-1-1** offers information and referrals to community services based on its database of more than 5000 services;
3. **WA Recovery Help Line** provides a state wide service offering emotional support and linkage to substance abuse, problem gambling and mental health services to anyone in Washington State;
4. **Teen Link** offers emotional support and assistance to teens by providing a teen-answered help line.

As a nonprofit organization, Crisis Clinic depends on the financial support of local government, United Way of King County, corporations and foundations, and the generosity of donors to keep its doors open and provide services. In addition, it also serves as a central point for crisis resources that includes training, outreach, and a bridge to other organizations that may provide specialized support.

In this paper we investigate the different ways of making interactive visualizations of the callers’ dataset to gain insights into its presence in the King County area, and also explore and understand patterns and trends in the calls they receive across geography and time. We envision that these visualizations and insights will allow the staff at Crisis Clinic to better allocate resources in a targeted way, more effectively communicate the impact of Crisis Clinic to current and prospective funders, and allow the general public to better understand and appreciate its work in the King County area.

Related work

Early in our process, we interviewed the Crisis Clinic staff to get an overview of their needs; based on their requirements, we investigated related visualizations that would be a source of inspiration and best practices. We were drawn to these visualization as they resonated with us as having similar missions to the Crisis Clinic to provide information on how their services were impacting different areas, primarily featuring a map to communicate distributions of services. Across these visualizations, we also noticed a

consistent trend of the use of Shneiderman's mantra: "Overview first, Zoom and Filter, Then Details-on-Demand," which became an important component of our visualization (2012). Visualizations that resonated with us included:

1. [Interactive data visualization for global road safety data by Pulitzer Center \(McCarey, 2013\).](#)

This was an example of a spatial overview with additional data visualization summaries revealed on mouse-over. In this example, by clicking on a country one can access an assortment of road safety data, ranging from trend lines on highway fatalities to statistics on the types of vehicles most likely to be involved in fatal crashes. We were impressed by the use of details-on-demand to quickly provide summary statistics for individual regions.

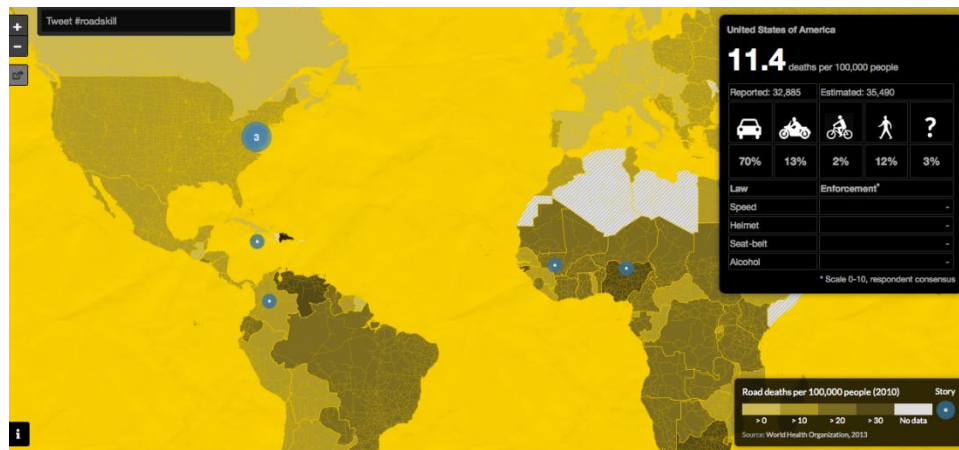


Fig.1

(Source: <http://www.pbs.org/mediashift/2013/09/visualizing-the-global-road-safety-crisis/>)

2. ["How fast is LAFD where you live?" - A map to compare the LAFD's performance across LA \(Welsh, 2014\).](#)

In this example, the spatial map shows a block-by-block analysis of how long it takes LAFD units to reach victims after the agency picks up a 911 call. A pop up displaying further data is revealed on mouse-over with statistics on average response time, the total number of responses over five years, the breakup of medical and fire related responses, and average arrival and dispatch times. Filters on the side further enable scanning the information based on neighborhoods as well as type of need (e.g. cardiac). This analysis helps reveal "simultaneous incidents" as a vexing issue and difficult to manage in some parts of the city with current staffing levels.

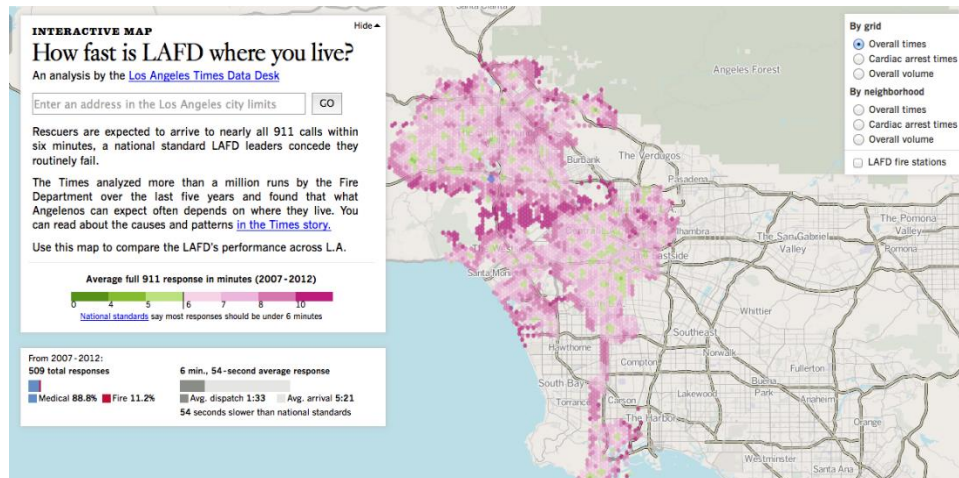


Fig. 2

(Source: <http://graphics.latimes.com/how-fast-is-lafd/#10/34.0288/-118.5109>)

3. *San Francisco Crimespotting*, designed by Stamen Design is an interactive map of crimes in San Francisco (*San Francisco crimespotting*, 2014).

This spatial visualization overlays crime events on a block by block basis. The users can filter by crime type, date and time of the day and find out individual crime event by clicking on each point. In addition to information about the happenings in neighborhoods, this visualization helps answer questions about patterns like: is there more number of crimes this week than last week, more this month than last, etc. This provided a unique way of exploring crime volume during different times of the day, a trend that we believed may be interesting to explore in the Crisis Clinic's data set.

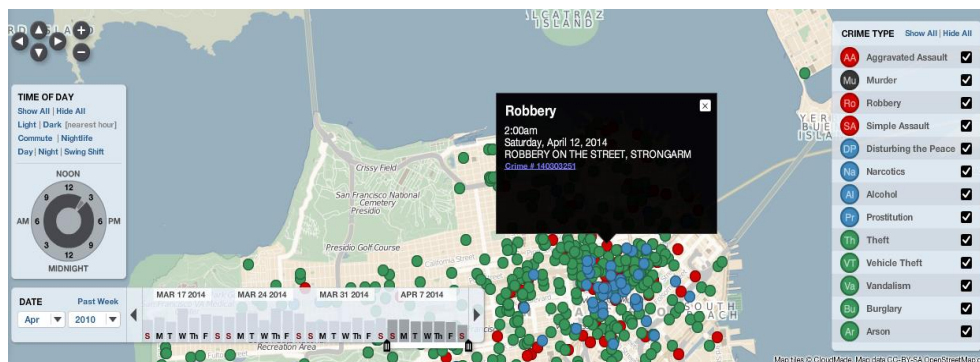


Fig. 3

(Source: <http://sanfrancisco.crimespotting.org>)

4. *The INdigital Real time Activity* (InDigital Live 911 Tracker, 2014).

This visualization displays 911 emergency calls from cell phones in Indiana in real time as they happen, and presents them on a map and timeline. Entries in the timeline are visually linked with counties, and the sparkline at the bottom summarizes total call volume per hour. The density of points on the timeline graph makes it easy to identify “crisis times”—or times when the system was handling a very high volume of calls.

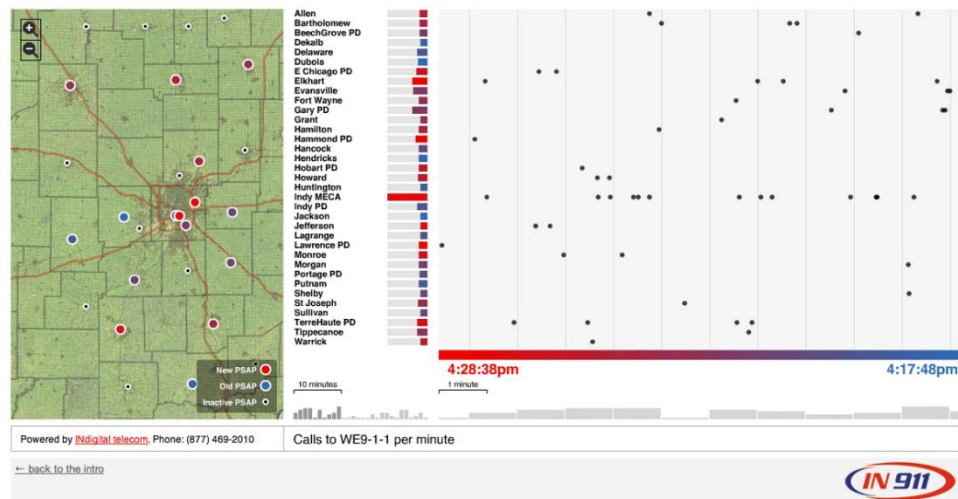


Fig. 4

(Source: <http://stamen.com/clients/indigital/>)

The Data

The Crisis Clinic logs all of its calls into a 2009 SQL server database. Mike Maloy and Terry Morgan, part of the IT Staff, generously granted us access to a server owned by the Crisis Clinic that provided a snapshot of the current database. This snapshot was used to create the interactive visualization which was presented to the Crisis Clinic staff during the user studies and evaluations, with the assumption that they could later connect Tableau to their live database if desired after project completion.

As the data set contained private information about the callers that was HIPPA protected, we set out to create a SQL query that would remove all private information before copying data off of the Crisis Clinic's servers. During this time, we began data exploration by installing Tableau on Crisis Clinic's remote server. As this was made possible through virtual desktop mode and we were dealing with large amount of data (1.5 million rows), the process had considerable latency, especially for team members who were Apple Macintosh users. Once we obtained staff approval and were able to download the stripped data from the Crisis Clinic servers, we worked locally laptop and surface machines. This considerably sped up the process, but with respect to using Tableau on Mac machines, the process was still slower as it had to be carried out over a virtual machine. For collaboration purposes, we used OneDrive, OneNote and Drop Box extensively.

During the process of creating a query and exploring the data, we encountered several issues with the data that necessitated additional "cleaning". Some of these included:

- City and State were contained in a single field (i.e. "Seattle, WA").
- Some city names were misspelled, and had inconsistent casing.
- When ZIP code was unknown it was assigned the value 22222.
- The database had one table for the calls received by each program, as well as one table for the problem/needs reported to each program, for a total of eight tables with pertinent data.

Initially, we created two Tableau extracts that consolidated the tables; one extract contained one row for each call logged, and one extract contained a row for each problem/need reported (multiple problem/needs per call). In addition, city and state were split into separate columns, inconsistent spellings were corrected, unknown ZIP code values were set to NULL instead of 22222 (which happens to be a ZIP code in Virginia), and a separate column was created to identify the “Program”. Later, after exploring data blending and filtering limitations across different data sources, we decided to use the extract that consolidated all tables and had one problem/need per row. This final extract was larger than 1.5 million rows, which exceeded the default maximum upload limit for Tableau public. Hence, in order to successively publish our final dashboard/ visualization to Tableau Public, we had to coordinate with Jock Mackinlay (Vice President of Visual Analysis, Tableau Software), who generously helped us get an exception for the row limit for our account.

To provide “Calls Per Capita” information, we also obtained a CSV file from the US Census Bureau that provided a mapping between ZIP code and population (as collected in the 2010 census). This data source was also later used to provide “City” information for each of the ZIP codes in details-on-demand on the map.

We were engaged with the process of data processing throughout the project as we were uncovering new requirements through our usability studies (described below). To incorporate these, we had to consider defining new variables that the users were interested in and manipulate and clean data accordingly.

Key Dimensions that were finally explored and visualized:

Field	Description	Use in visualization
City	City name, scoped to cities in Washington state	Filtering provided with a single value dropdown filter; displayed in details on demand when hovering over the map.
ZIP code	5 digit ZIP code, scoped to ZIP codes in Washington state	Filtering provided with a multi-value dropdown filter; displayed in details on demand when hovering over the map.
Consumer Group	Sub-groups of the population that are often eligible for special services: Active Military, Dependents of V/AM (Veterans/Active Military), Disabled, ESL, Immigrant/Refugee, Veteran	Filtering provided with a single value dropdown filter.
Number of Calls	Number of calls	Displayed as summary information for all values selected in upper-left region, and in details on demand for all charts.

Calls Per Capita (over selected time period)	Calls per Capita over time period selected, for selected ZIP code.	Displayed in details on demand in the map, for a selected ZIP code.
Month and Year	Month and year when calls were received	Filtering down to granularity of a month provided in slider; displayed in details on demand in “Calls Over Time” chart.
Calls Per Day	Calls per day, calculated over selected time period.	Displayed as summary data for all charts in upper-left region, and in details on demand on the “Calls Over Time” chart.
Program Type	Crisis Line, Lifeline, Recovery Line, 211, Teen Link	Distinguished with color and displayed in details on demand in “Calls Over Time” and “Problems and Needs Reported” charts; filter provided via legend.
Problem/Need	Specific problem/need reported.	Searchable using filter on “Problem and Needs Reported” chart.
Problem Area	Parent category for a specific problem/need, including: Animals, Basic Needs, Communicate, Community, Disaster, Emotional Health, Employment/Education, Financial, Legal, Physical Health, Relationships, Substance Abuse, Threat/Abuse/Violence	Searchable using filter on “Problem and Needs Reported” chart; provided in details on demand on “Problems and Needs Reported” chart.
% of Callers Reporting	% of callers that reported a particular problem or need, for calls selected.	Displayed in details on demand in the “Problems and Needs Reported” chart

Personas and Scenarios

Initial Personas

After we went over the related work, we started off our design process by zeroing in on our key personas for our project – the primary stakeholders. We settled down to three main personas for our project over two iterations:

1. Hannah, the IT Staffer



As a member of the IT staff, one of Hannah's responsibilities is to create annual reports that showcase critical statistics about the Crisis Clinic, including call volumes, demographics, and problems/needs reported. This report is used by the program directors, as well as local funders, to understand the current state of affairs and decide how to allocate resources. Hannah will be able to use the interactive dashboard to quickly add visual elements to her reports that highlight key trends and statistics throughout the year.

2. Susan, the Program Director



As the director of 211 (The Community Information Line), Susan needs to be able to quickly answer inquiries from stakeholders about Crisis Clinic's operations; she recently received an inquiry asking how many Veterans have accessed services in Snohomish. Using the interactive dashboard, she is able to quickly use filters to scope down to this demographic and answer the question. If she is too busy, she will ask Hannah to help out.

3. Tom the Fund Raiser



Tom is responsible for talking to a local legislature in Bellevue about getting more funding for the Crisis Clinic. He goes to the interactive dashboard and can quickly zoom in on data revolving around call volumes from Bellevue residents. He captures a visualization that will help him communicate community needs to the legislature, and convince him that the Crisis Clinic is providing his town with an invaluable service. He also shares the dashboard to the public to increase the visibility of Crisis Clinic work and provides information about community needs and trends.

As we continued with our design process and went through our usability studies, we realized that our first persona, Hannah – the IT Staffer, didn't feel that our eventual value proposition consisting of interactive visualization was of much utility to her (and all the people who came under the persona of the IT staff). They subtly indicated their preference for using direct queries in the databases to harvest the required information and the freedom it provided them in terms of manipulating and accessing the required data, and were hesitant in learning, installing and managing the "overhead" of adding a new technology to their system (Tableau to their servers), as they also felt that for their purposes visualization wasn't a core requirement.

During our usability studies and contextual inquiries, we found that the Management/ Leadership teams at the Crisis Clinic were the ones who were most interested in our value proposition. They laid specific emphasis on its ability to communicate the presence and reach of the Crisis Clinic in the King County area, and were intrigued by the different types of problems and needs of the people who were calling. Further, they also expressed that they would like to employ the interactive visualization to communicate with the general public about the different aspects and significance of the Clinic through a web portal.

Final Personas

1. Susan, the Program Director,
2. Tom, the Fund Raiser, and
3. Mary, the Curious Student



Mary heard from a friend who called Crisis Line Clinic. This peaks her interest and she would like to find out more about what type of Calls are most prominent for the area where she lives. She opens the dashboard on the public website and notices that for the city she live in – Sammamish, Mental Disorders are the largest problems category. This makes her aware of the issues she hasn't thought before and makes her find out even more about the clinic.

Early Brainstorming

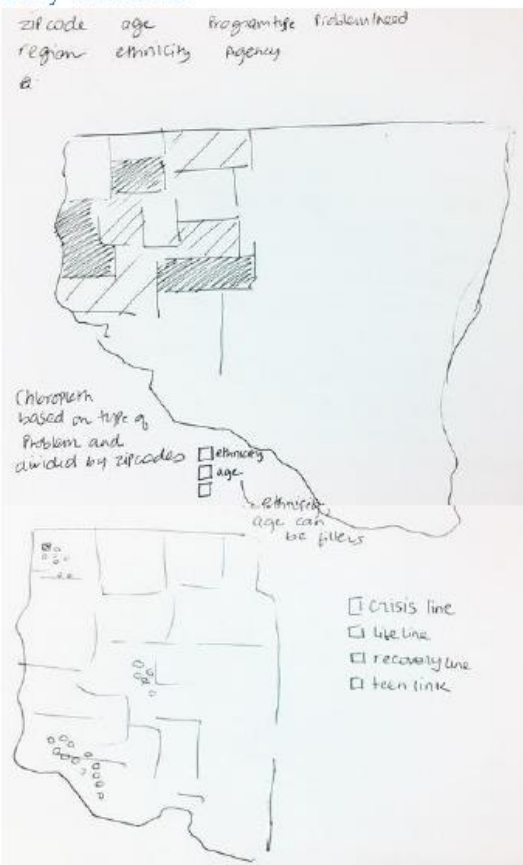
Upon deciding on the topic of the visualization and the personas we would be catering to, we had a brainstorming ideation session, where we individually came up with sketches for answering our initial set of main questions based on initial interviews with the Crisis Clinic:

The main questions that we started off with were the following:

- Distribution of calls by region (ZIP code). Do certain regions have more types of calls than others?
- Are there peaks in call volume during certain times of the year or special times of the year?
- Distributions of callers by other demographics; i.e. age, ethnicity, gender, veteran-status.

Initial Iterations of Sketches

Early sketches:



Number of Calls By Region

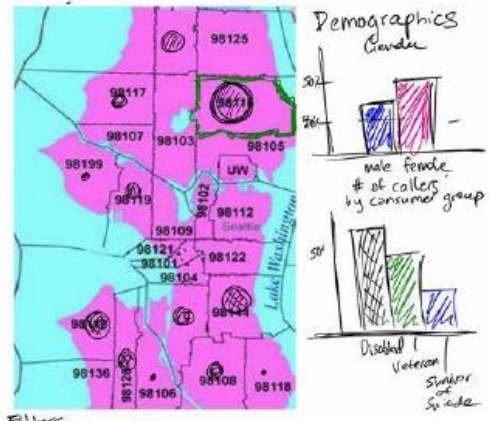


Fig. 5

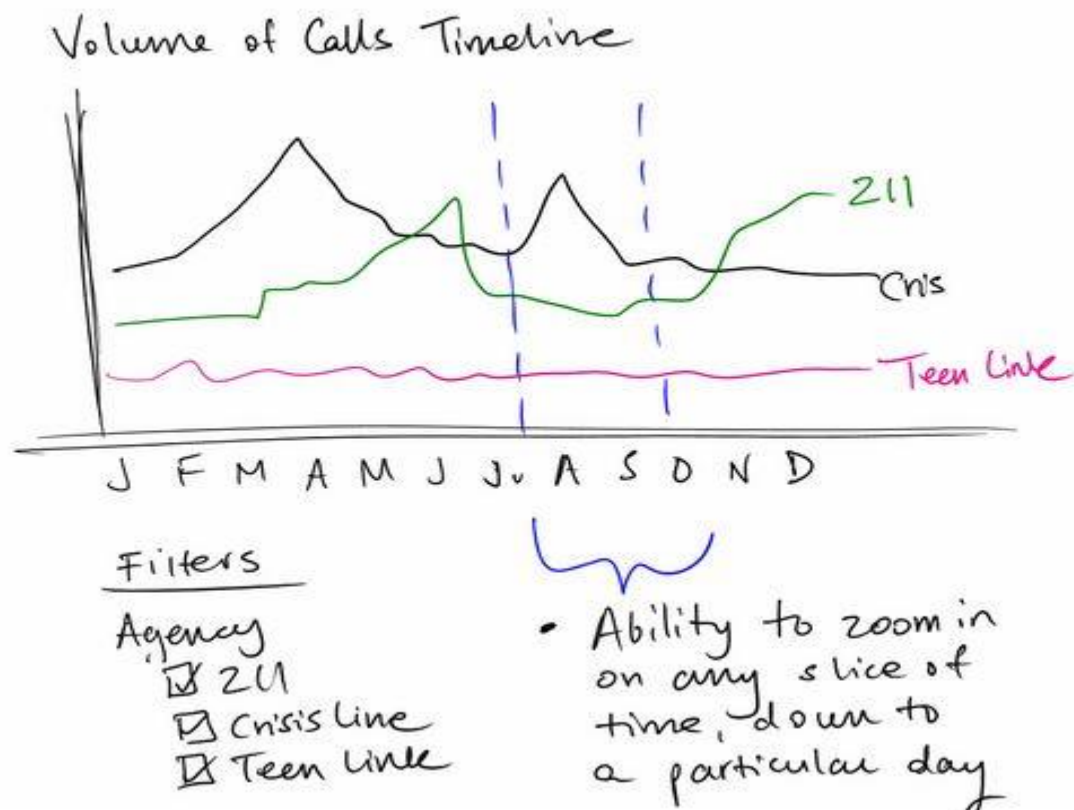


Fig. 6

Prototyping and User Evaluation

After brainstorming through various sketches, we consolidated them into creating an early mid-fidelity PowerPoint prototype to test it with our prospective users. This prototype evolved into an interactive implementation in Tableau, which was further refined based on usability testing. We went through three rounds of iterations and usability testing. During these iterations, the users were asked to complete tasks using progressive iterations of the visualization, and the visualization in turn was improved accordingly.

Task List:

1. What is this visualization broadly about?
2. What does the size of the bubbles indicate?
3. How many types of programs are there?
4. Find the top 10 problems and needs of the King County area. What about all of the problems and needs of the King County area.
5. Find the details (ZIP code, city name, number of callers, calls per capita) that any random bubble represents.
6. Select a random ZIP code. Can you tell once you have a selected it (is there adequate feedback)?

7. Select a random city. Can you tell once you have a selected it (is there adequate feedback)?
8. Find the details (number of callers, calls per capita, city name) of a ZIP code of your interest.
9. Find the top 10 problems pertaining to any ZIP code.
10. Find the top 10 problems pertaining to any ZIP code with reference to a specific program.
11. Find all problems/ needs pertaining to any ZIP code.
12. Find the calls over time pertaining to a specific program.
13. Find the details (number of callers, calls per capita) of a city of your interest.
14. Find the top 10 problems pertaining to a city of your interest.
15. Find the top 10 problems pertaining to a city of your interest with reference to a specific program.
16. Zoom in to a specific area on the map. Try to pan around
17. Find the calls over time pertaining to a particular program, and the problem needs associated with them.
18. Select a particular time interval to find the corresponding problems/needs and details (number of calls, calls per capita) of a ZIP code and city of your interest during that interval.
19. Are the labels, titles and symbols clear and legible?
20. Is the vocabulary used comprehensible?
21. Is the feedback of the actions you perform adequate?
22. Is there anything that you would expect to see, or would like to see, that you didn't?

Iteration I – PowerPoint Prototype

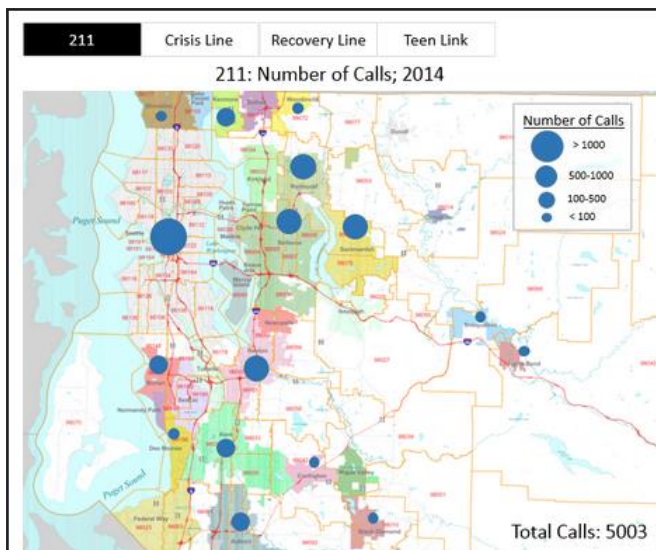


Fig. 7 Slide 1

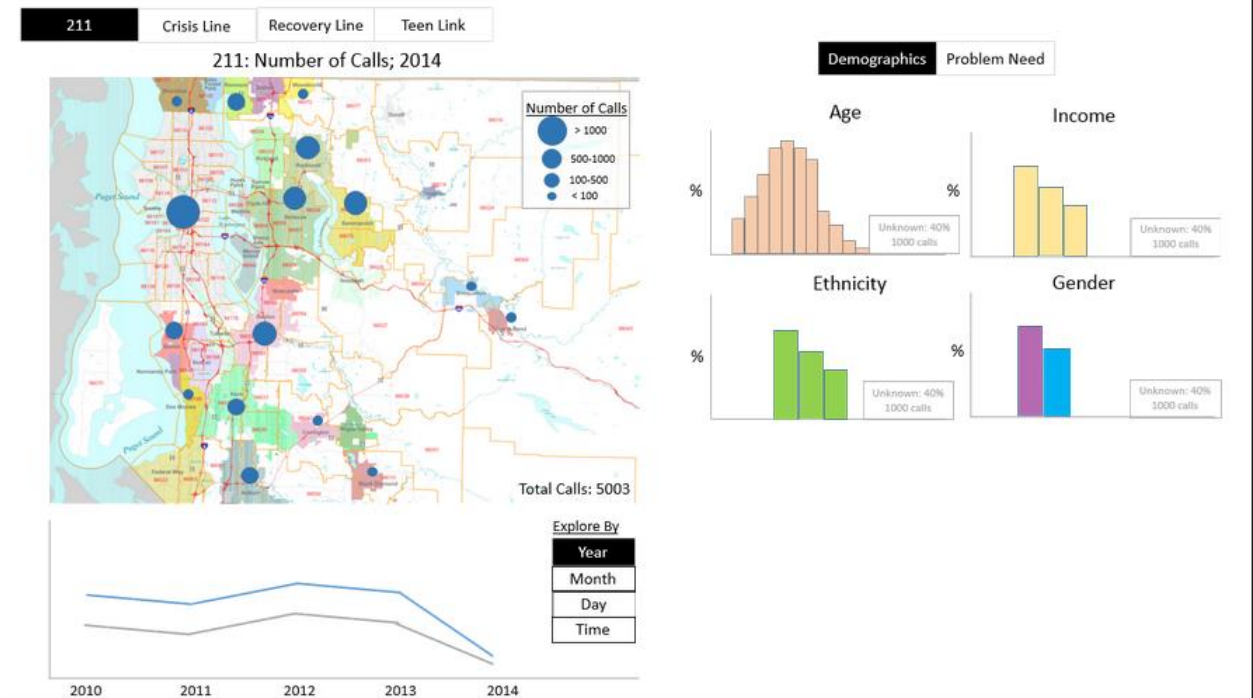


Fig. 8 Slide 2

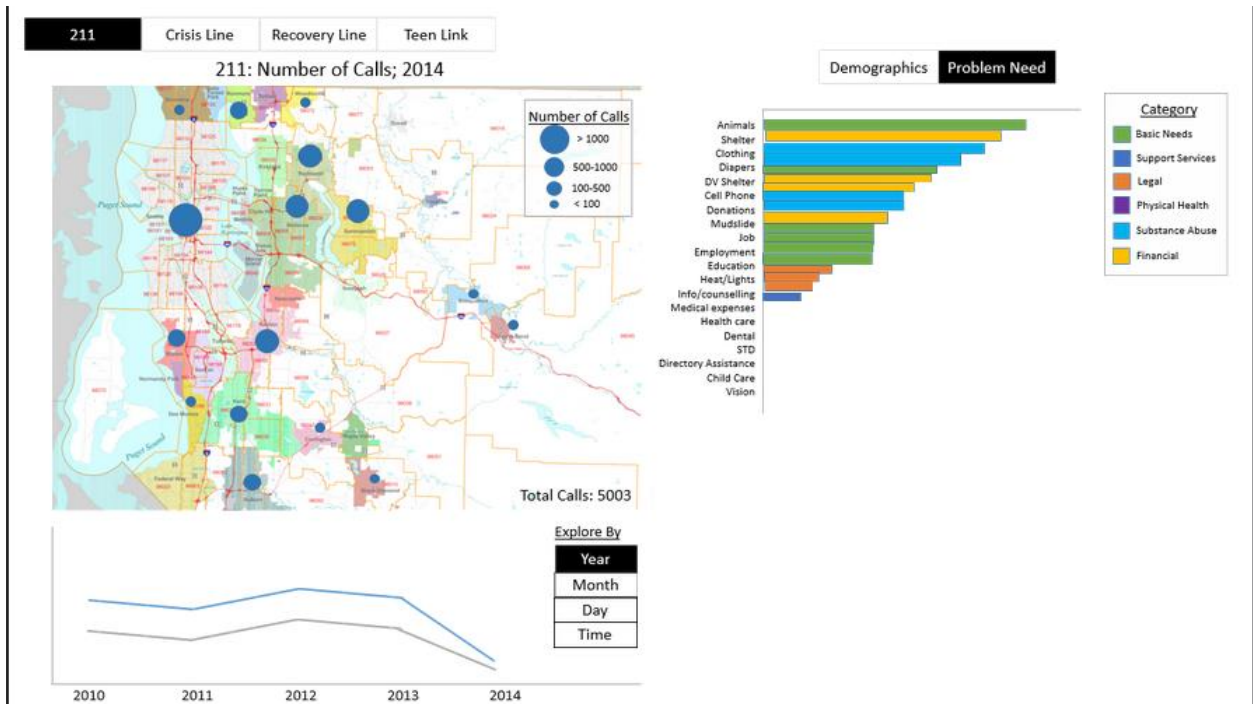


Fig. 9 Slide 3

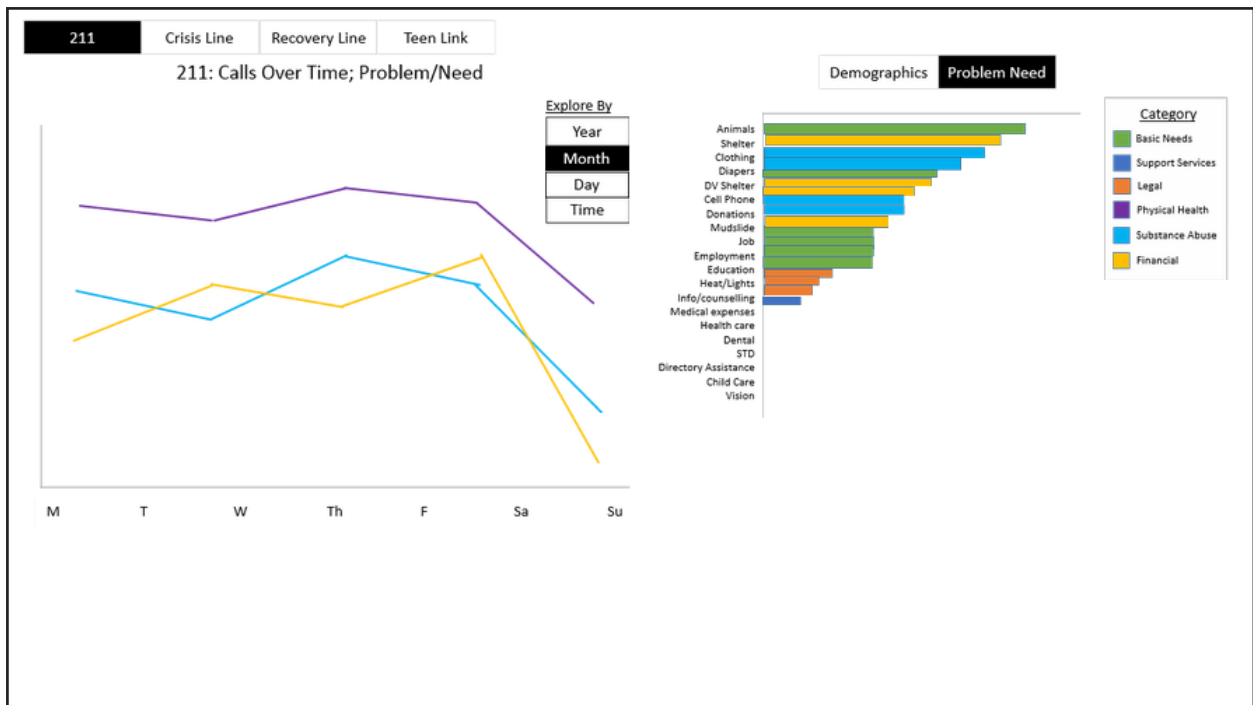


Fig. 10 Slide 4

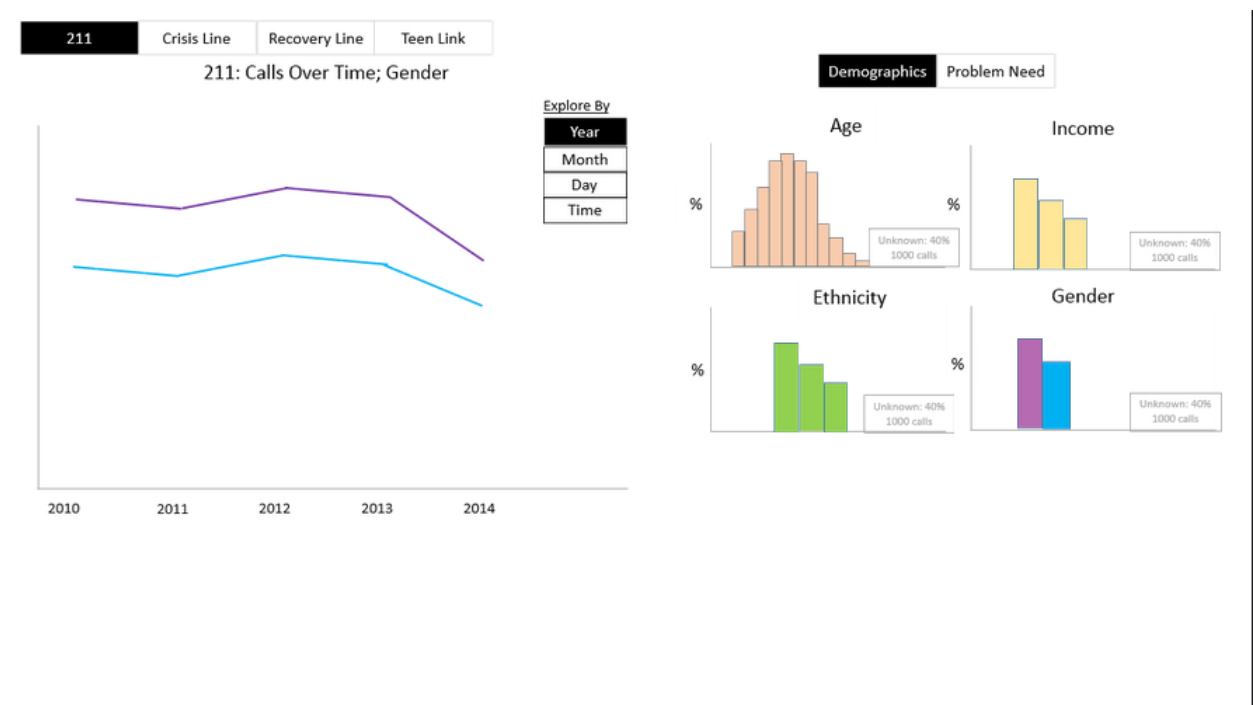


Fig. 11 Slide 5

Usability Study I

The first round of the usability testing was done using the above PowerPoint prototype. We showed it to four people at the Crisis Clinic, who were from our initial set of personas, and collected their feedback.

As the visualization was not fully interactive at this point, as the users were asked to complete tasks we asked them to describe what they were thinking, and we described what changes would occur in the visualization based on particular actions.

Our key insights from this early study were:

- Make the visualization simpler and easier to use.
- Incorporate proper labelling, which was not present on the prototype. Our rationale for not doing this initially was because we had crafted the slides as a low-fidelity prototype. The users, though, interpreted it as a high-fidelity prototype and felt that that is how it would be actually incorporated. Also, as we had abbreviated a few things because of its low-fidelity nature, the users didn't find all of it comprehensible, which caused some distraction from the main point.
- People loved the map feature and wanted it to be “pretty”, “colorful”, and legible.
- The test users indicated their preference to be able to browse by ZIP code and by city.

In the next phase, we used this feedback to move on to creating an interactive visualization in Tableau 8.1 client. The next round used real data and incorporated findings from the first usability test.

Iteration II –Tableau

For our second usability study, we progressed through a great deal of exploration in Tableau. Some of our explorations are depicted below:

Map Explorations

Based on feedback that it was important to view data based on both city and ZIP code, our map visualizations focused on different approaches to display information based on both dimensions.

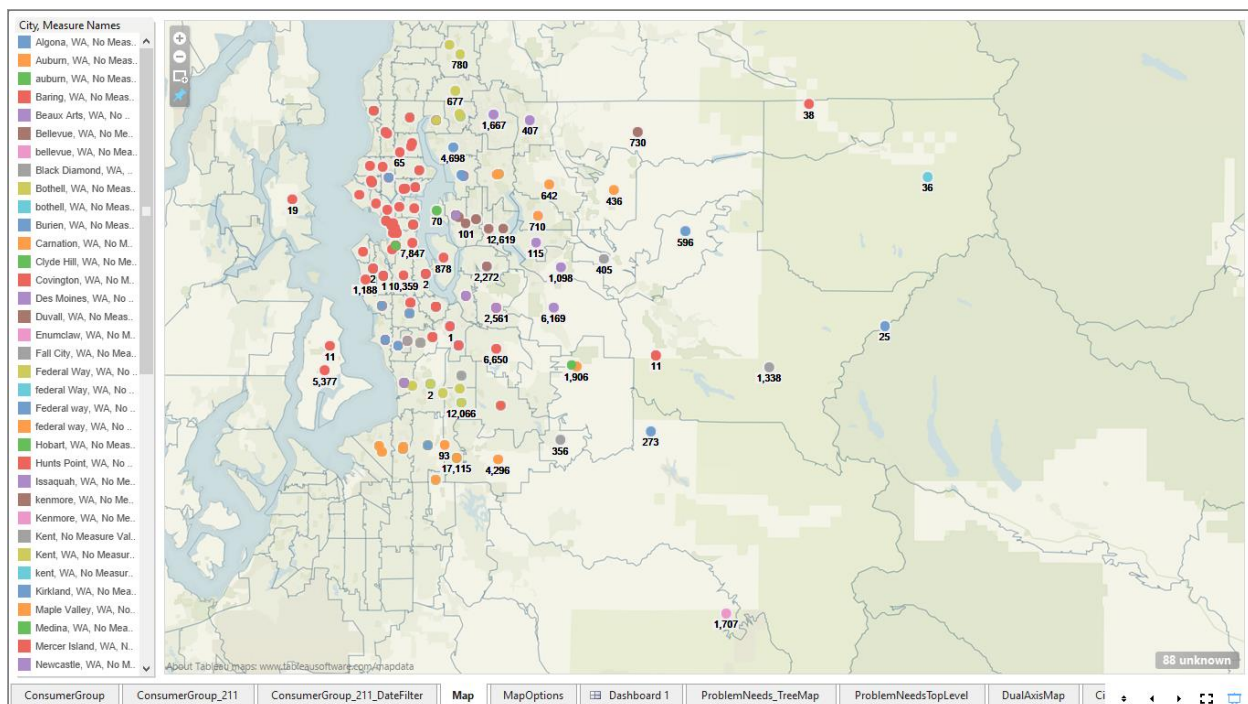


Fig. 12 Simple Dot Plot. Color corresponds to cities.

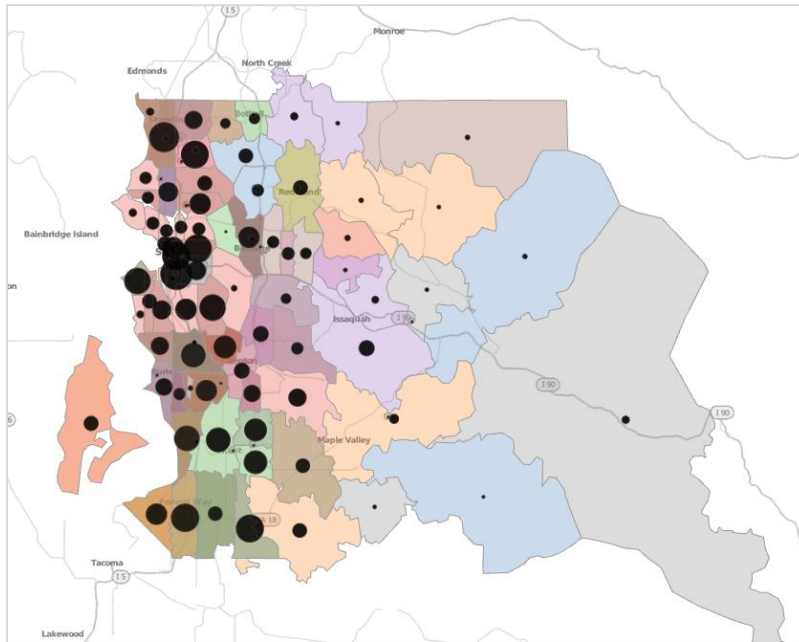


Fig. 13 Exploration of dual-axis maps in Tableau, using bubble sizes to depict the number of calls from different ZIP codes.

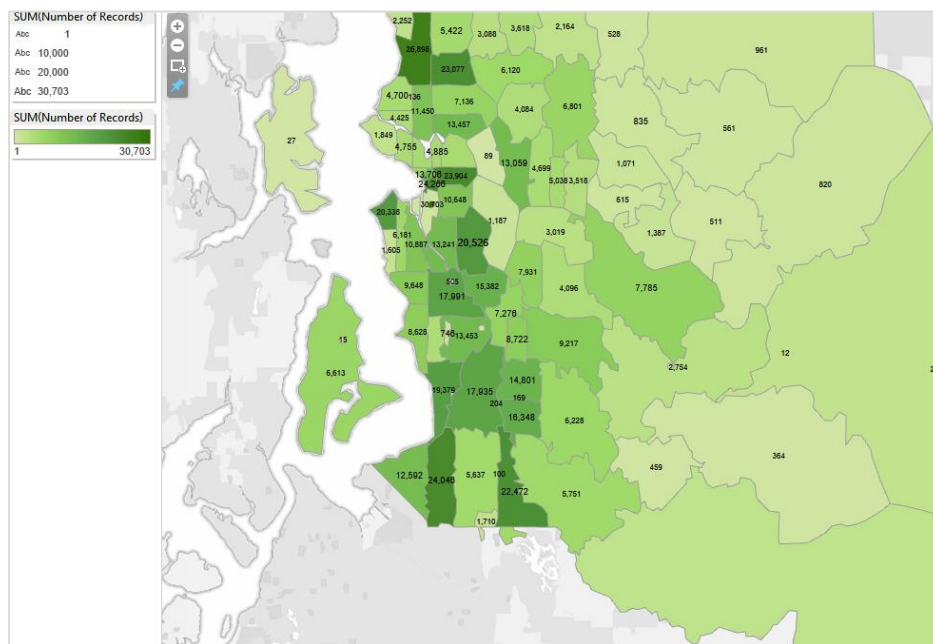


Fig. 14 Choropleth, using color gradient on the ZIP code area map

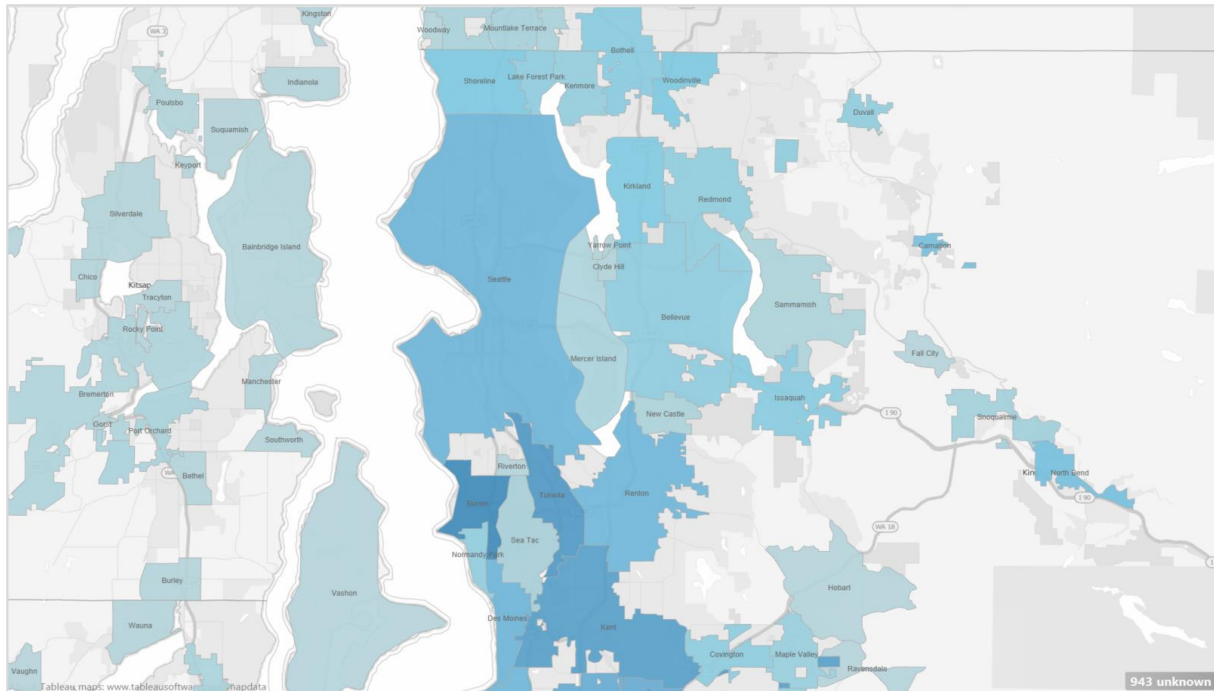


Fig. 15 Choropleth map of cities; polygon data for city borders was obtained from the US Census Bureau website, and imported into Tableau using Richard Leeke's TabGeoHack extension (Mundigl, 2012).

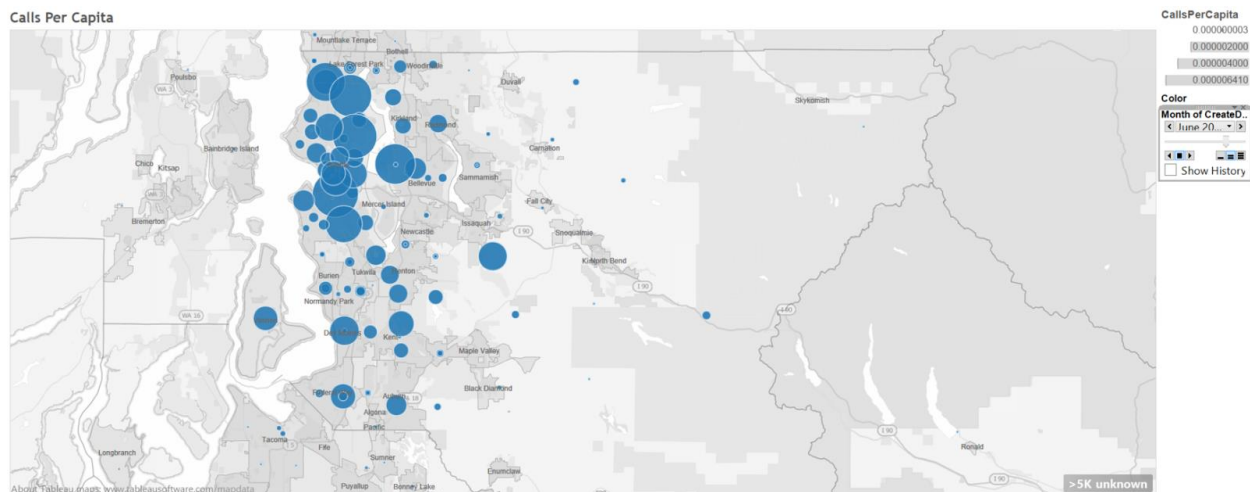


Fig. 16. Exploration of analyzing trends through animation, using the "Pages" feature to play changes through time (box on the right). ZIP code data is overlaid on top of city borders using bubbles.

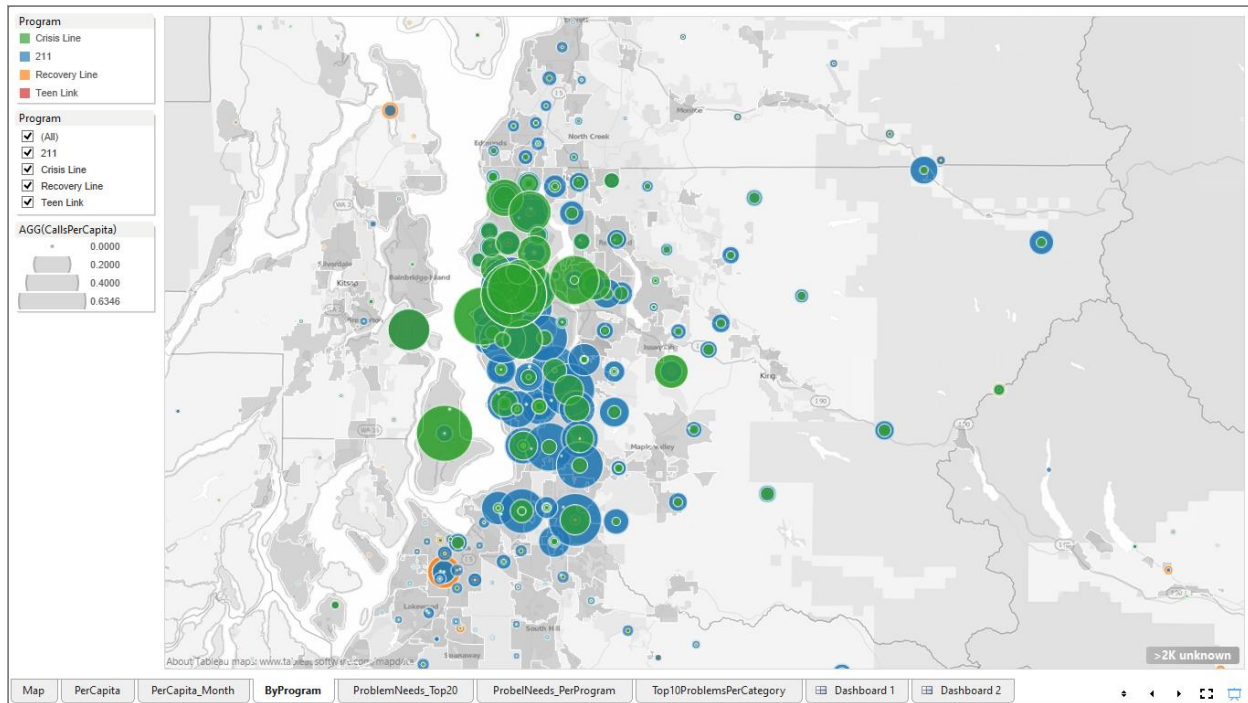


Fig. 17. Experimenting with color coding the bubbles as per services.

Auxiliary Chart Explorations

We also explored different types of visualizations for representing problem/needs and other program data that would be linked to the map view, some of which are depicted below.

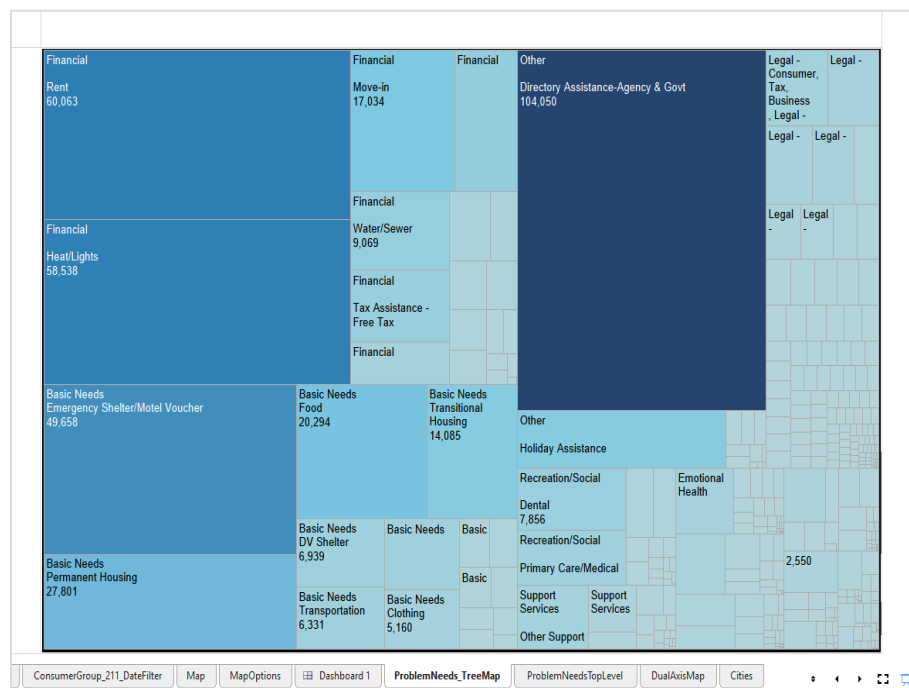


Fig. 18 Exploration of tree maps in an attempt to make prominent data points stand out in Problems/Needs

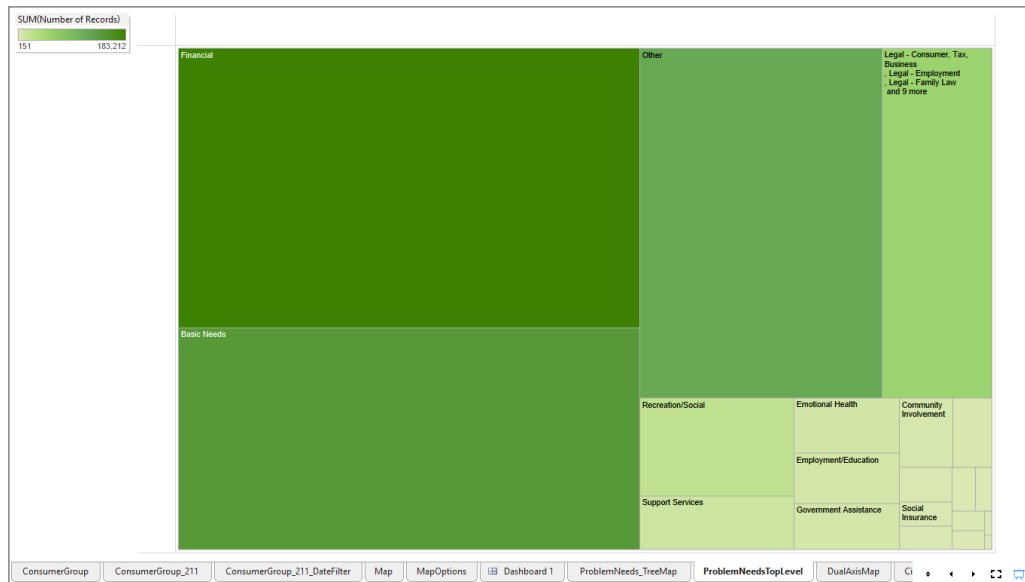


Fig. 19 Exploration of tree maps for top-level categories of Problem/Needs

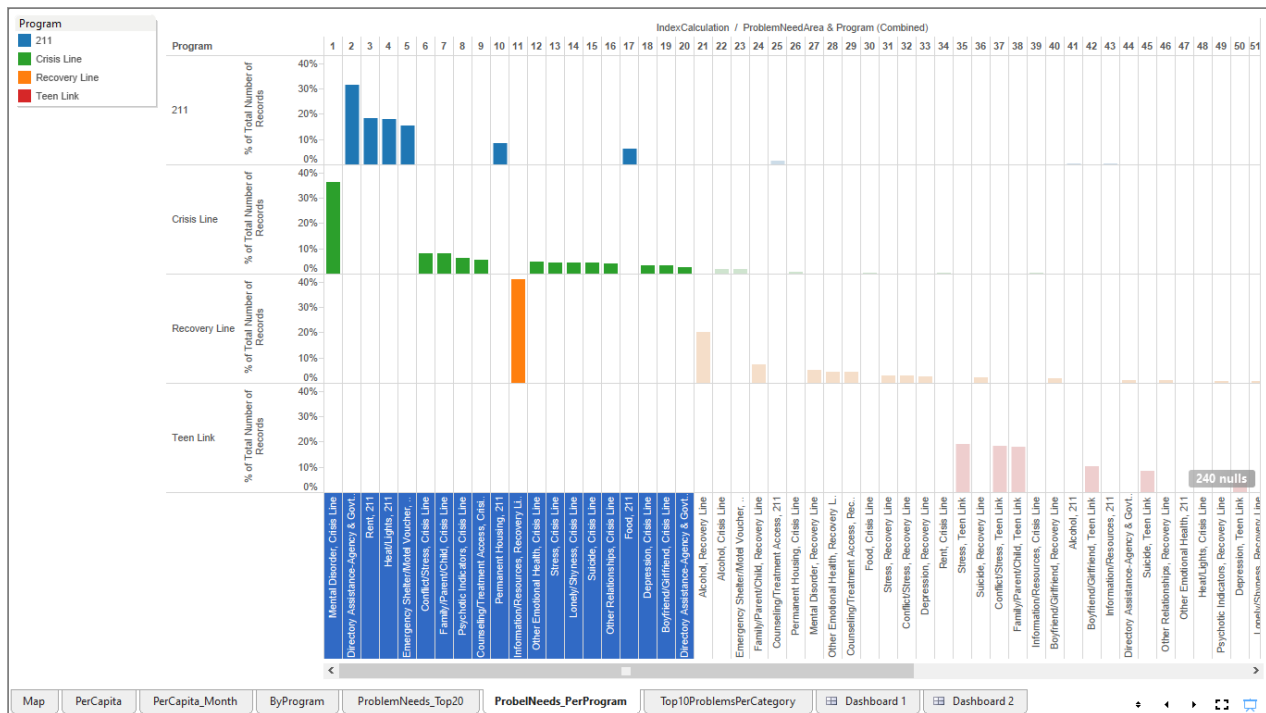


Fig. 20. Small multiples of Problem Needs per Program

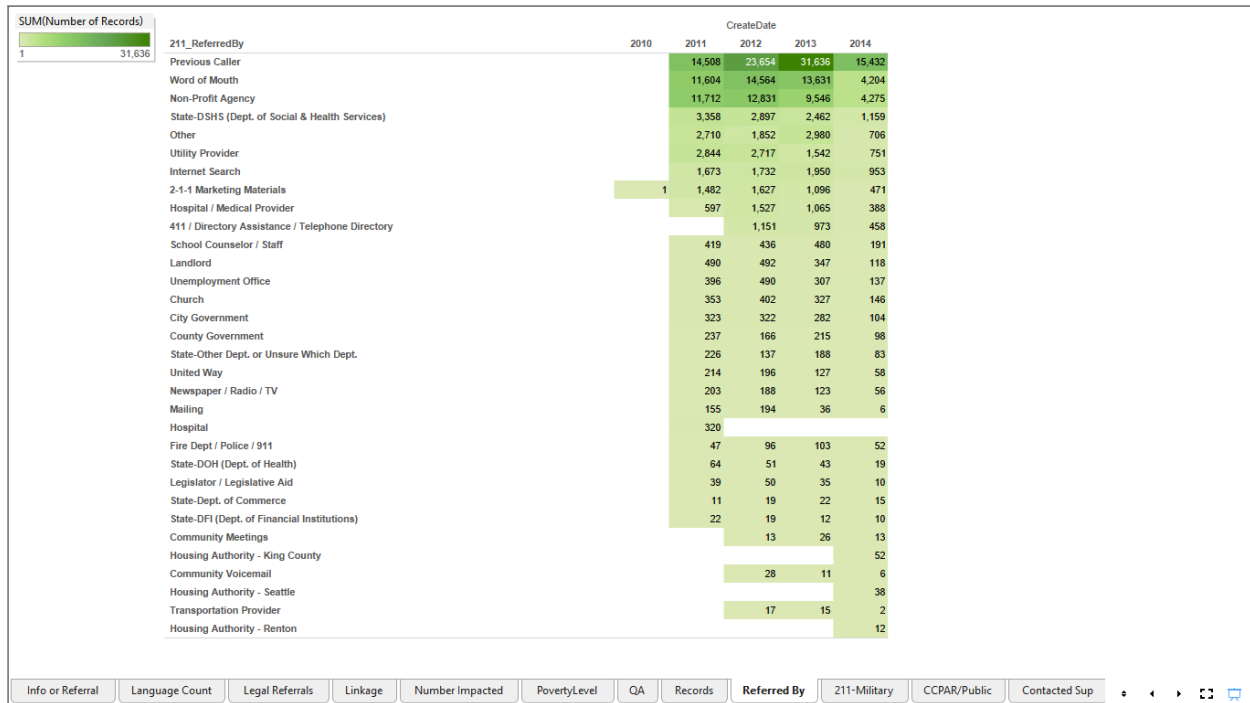


Fig. 21. Heat map of how different callers learned about 211, by year.

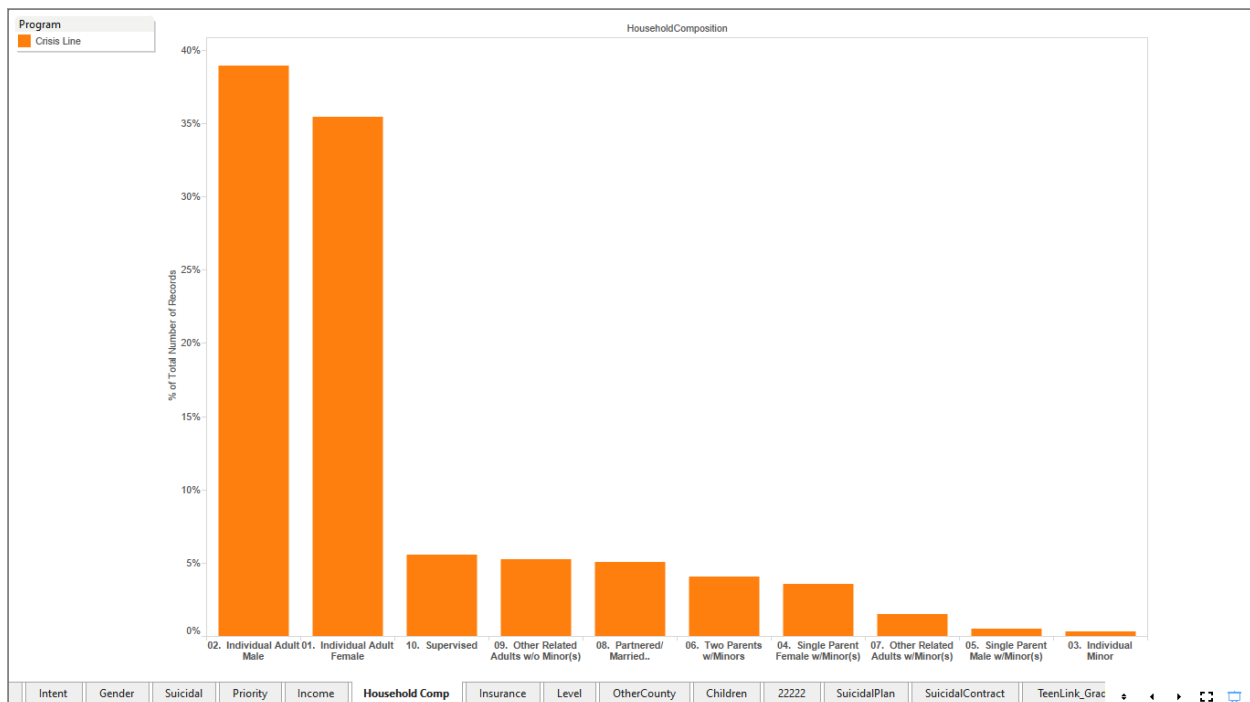


Fig. 22 Bar chart showing different distributions of household composition.

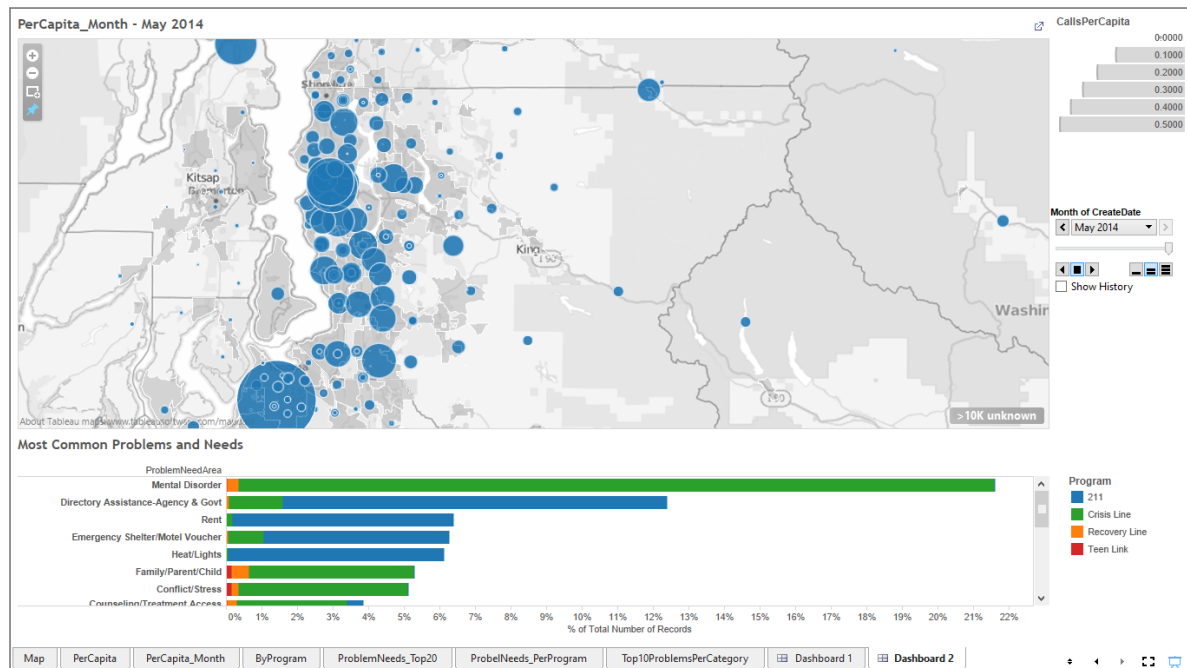


Fig. 24. Dashboard that combines a map, linked bar chart for problem/needs, and our animation exploration.

Usability Testing II

For our second round of usability testing, we wanted to get feedback on both the latest version of our dashboard, as well as our Tableau explorations. Because we were limited to a half hour session to get feedback from a large group of Crisis Clinic staff members who represented the first iteration of personas (Hannah – IT Staff, Susan – the Program Manager), the above visualizations were projected using a projector on a wall for display purposes, which was tried in both light and dark ambient conditions. While the visualizations were projected, we asked them questions about how they would expect to complete tasks; they were free to ask us questions about the visualizations, provide feedback, and explain what was important to them. Although the format was not ideal, as one person's opinions and answers were likely to bias the group, we did come away with some key takeaways, including:

Key takeaways:

- Great excitement about the map view and desire to find trends over time.
- Managers wished to see top 10 problems or needs for a particular area/city or ZIP code.
- The Tree map view of the problem need wasn't as intuitive to the people as we had suspected. Particularly asked question regarding its relation to the map – some didn't think that they were related at all, and one person asked "why is this better than a bar chart?"
- Although a novelty, the animation wasn't successful in showing trends as the older data points were replaced by the newer ones.
- Suggestions to correlate call and problems/needs with population density (calls per capita) of a city/ZIP code.
- The Program Director was excited to show this on the website and share it with the public to create more awareness.

- The people in leadership were appreciative of using such a visualization during funding events to deliver relevant pertinent information effectively to prospective funders.
- The people comprising of the IT Task persona – Hannah, were “meh” about it, and described the way they work as described in the Persona section.

The aforementioned three aspects eventually resulted us to pivot to a new set of personas, which was formed by adding the persona Hannah-the curious student, and removing the persona Hannah- the IT Staff.

Taking all these points into account, we progressed to our next iteration of visualization:

Iteration III

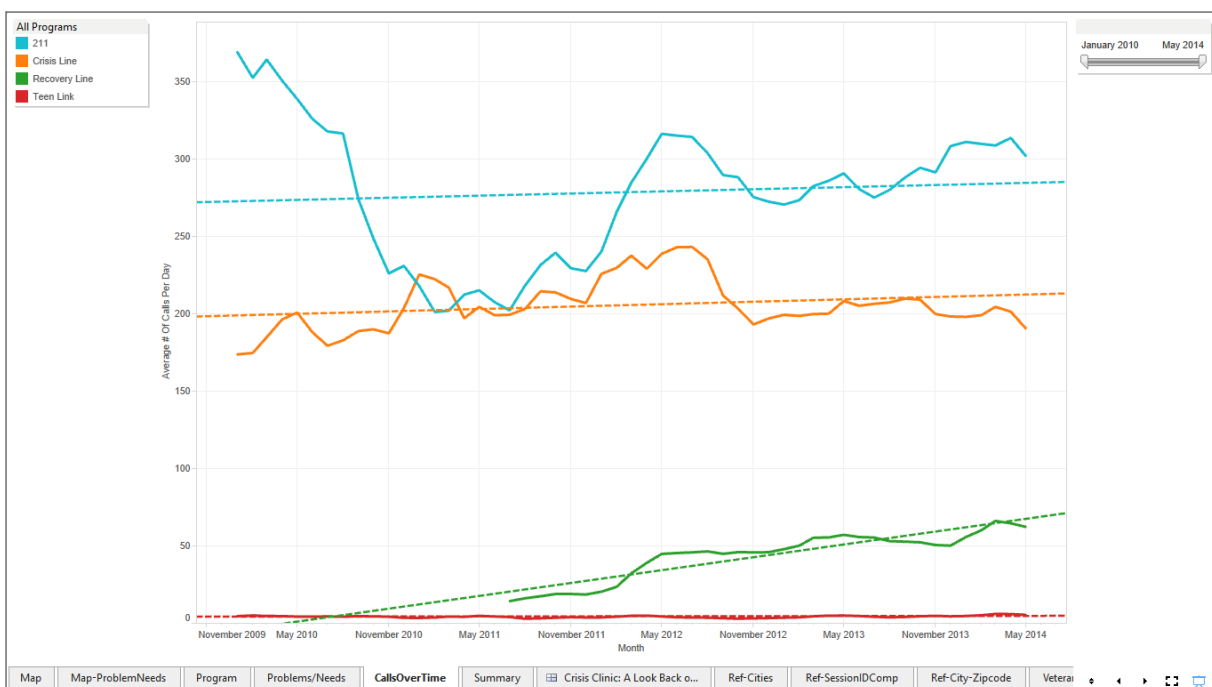


Fig. 25. More exploration of ways depicting trends in data.

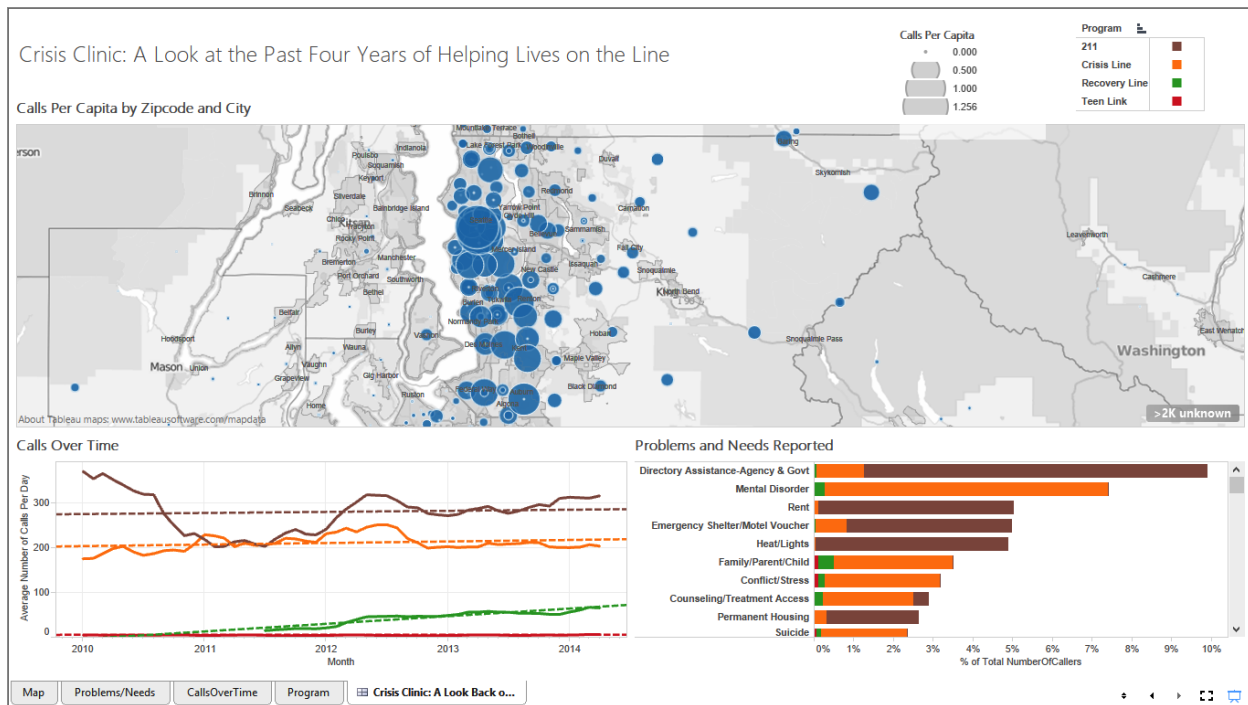


Fig. 26 Updated version of the dashboard, including top problem/needs and calls over time.

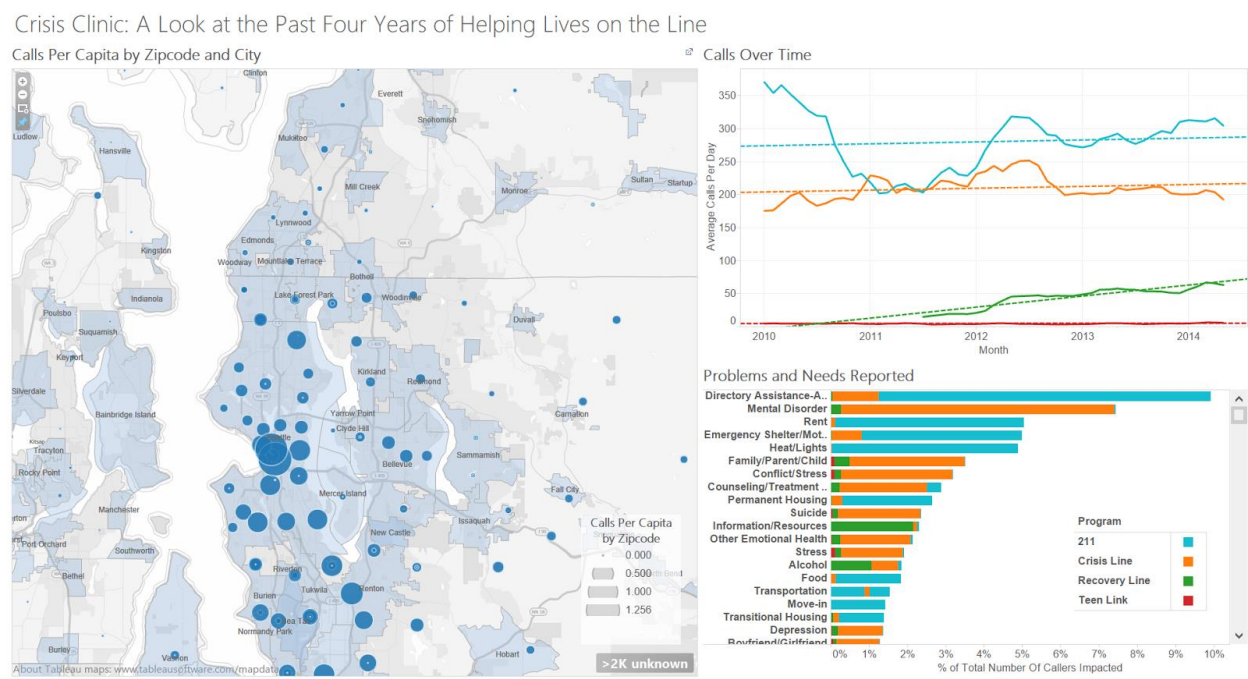


Fig. 27. Dashboard reformatted.

Usability Study III

The 3rd round of the testing was done individually by the project team members using *Fig. 27* above, which consisted of informal usability sessions with four Crisis Clinic employees, coworkers (who were UX Designers) and friends, the latter to gauge the needs and perspective of the new persona – Mary, the Curious Student. Here we incorporated feedback from previous tests and added third persona – Mary. In case when people were not familiar with the Call Center we had brief introduction and explanation of what is about.

Summarizing across participants, the key challenges that the users faced were:

- Users were consistently frustrated around de-selection in Tableau - people consistently had problems figuring out how to do it, and how to get back to a "baseline" view.
- Many users were frustrated with the map controls - two people double-clicked on everything and kept zooming in (Tableau issue).
- People did not realize they could select or filter by dates.
- People did not immediately realize that the programs were clickable.
- People wanted a search field to search by ZIP code and city on the map.
- Users were confused about bubbles over the cities. Although most people eventually figured out that bubbles represented calls per ZIP code, it was not immediately obvious, and took some prompting for them to explore and understand.
- Although some users thought that being able to select cities was a good feature, it was difficult to deselect a city to get to another ZIP code and the interaction felt awkward.
- For users unfamiliar with the data set, there was a common desire to know more about each program. Many questions were around what 211 does.

Barring the negative elements above, users were generally able to complete the remainder to tasks; once they realized that regions were clickable they actively engaged with the visualization and began to explore. Furthermore, the Crisis Clinic staff members thought that it would be a useful tool in communicating with partner organizations and funders. For example, one staff member stated:

"I think it would be really useful for fundraising or for recruiting, especially to show people who may be ... clueless about what's going on in their area. It's also useful for partners, to be able to tell them who is calling about what in their area."

One of the Program Directors was very excited about seeing this type of visualization for a particular consumer group (i.e. Veteran, ESL, etc.), which prompted a discussion about adding this as a filter. Based on this usability study, we were able to get a distilled set of features, which we accommodated in the final interactive visualization. This included:

- Removing city borders, and replacing ZIP code bubbles with a choropleth.
- Adding filters to select city, ZIP code, time period, and consumer group.
- Adding borders around the program legend, to make them appear as clickable as possible, as well as a text prompt to encourage people to interact.
- Addition of summary data.

Although we did not have time to complete another full study with the Crisis Clinic staff, we used friends and family (representing Mary, the Curious Student) to ensure that our updates facilitated successful completion of key tasks.

Final visualization

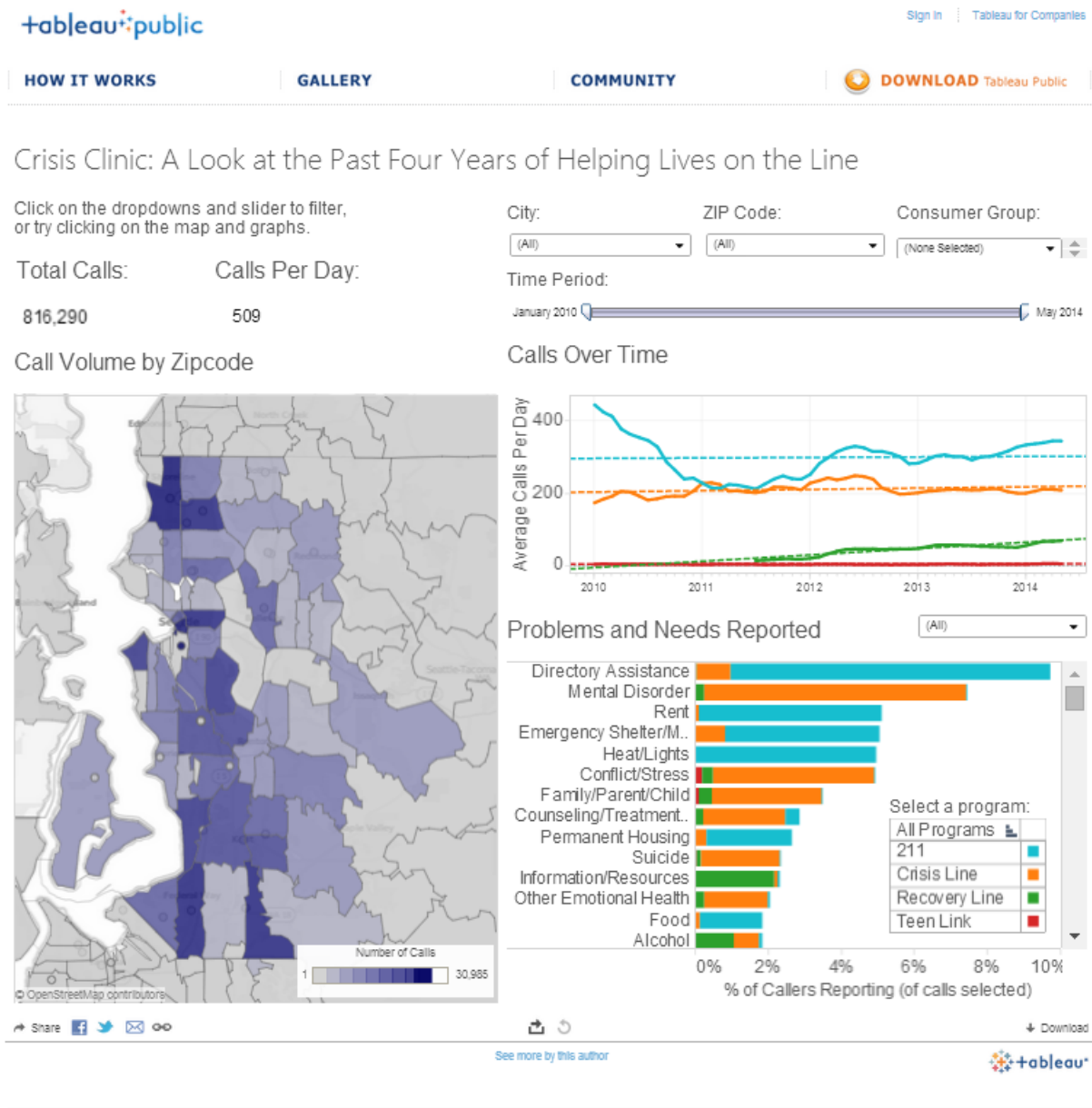


Fig. 28 Final Visualization in Tableau Public

Link: http://public.tableausoftware.com/profile/emilygre#!/vizhome/CrisisClinic_v2/CrisisClinic

Our final deliverable consists of an interactive dashboard that allows Susan, the Program Director, Tom, the Fundraiser, and Mary, the Curious Student, answer the following kinds of questions:

- What is the distribution of calls by ZIP code? Do certain regions have more types of calls than others?
- What is the distribution of calls per special needs consumer groups (i.e. ESL, homeless, veteran)
- What are top 20 program needs per ZIP code? Per City?
- How do call volumes change over time, both in general and for specific problems/needs, programs, and groups.

There are four categories of visualizations that we used to accomplish these tasks:

1. An interactive visualization of a choropleth map that shows distribution of calls per region encoded by color intensity. Selecting a region will allow the user to view related graphs that show distributions of types of calls as per different problems/needs category.
2. A time series visualization that shows the number of calls reported over a period of four years from 2010 to 2014. The visualization shows trends based on calls per day. Filters are provided for key properties, such as call volumes to different service lines (i.e. 211, Teen Link, Crisis Line, and Recovery Line). Each service type is color-coded.
3. A bar chart that ranks Problem/Needs reported. A dropdown is list added as a filter that allows multi-selection of the problems. Selecting the problem will reflect on the view on the map as well as on the time series chart accordingly. The histogram also shows color-coded program type. Selecting particular bar provides detail on demand information about the problem area, program, % of calls, and number of calls
4. We provide overview information by showing “Total Number of Calls” and “Calls Per Day” for the calls selected.

Evaluation

We believe our visualization is successful in meeting the needs in terms of answering the questions important to our three key personas. Furthermore, our visualization affords easy exploration of patterns and stories of different consumer groups of special interests (Active Military, Dependents of V/AM, Disabled, ESL, Immigrant/ Refugee and Veteran) in the King County and the WA area.

In this section we evaluate our final visualization against some of the seminal thoughts on data visualization from books and papers from experts.

Shneidermans mantra of “Overview first, zoom and filter, then details on-demand”

(Referenced in UW HCDE 511 lecture from April 15, 2014, slide 33)

The final visualization thus produced effectively incorporates this mantra, which is illustrated as follows:

Overview: The choropleth map provides an overview of distribution of calls per ZIP code. The auxiliary charts provide an overview of calls over time and the top problems and needs across all calls.

Zoom: Map portion of the dashboard allows panning and zooming in/out of any area of interest.

Filter: The visualization allows filtering based on the city, ZIP code, type of Crisis Clinic program, time frame, problem needs as well as special interest groups.

Details on Demand: Hovering/clicking on ZIP code areas for example shows details that are pertinent to that chart, such as calls per capita, total number of calls, city name and ZIP code. This is true for all three sections of the visualization.

Principle of effective navigation

(UW HCDE 511 Lecture, April 15, 2014, slide 47)

The visualization also allows the progressive technique of **step by step exploration, fine tuning as we go**. For example, we can start with an overview and decide to check for call trends for a specific city, say, Seattle. Then if we want to further see the call trends for the city of Seattle during a particular time frame, we can fine tune the filters to show that. A process like this allows certain interesting trends and facts to emerge, which might explain some of the anomalies seen in the overview. The visualization thus satisfies the principle of successfully showing **from pattern to investigation of cause**.

Basic and advanced interaction techniques

(UW HCDE 511 Lecture, April 22, 2014, slide 23 + Stephen Few 'Now you see it' chapter 4)

The visualization demonstrates some of interaction techniques that Stephen Few mentions in his book 'Now You See it'. For example, it allows the users to filter, sort, highlight, zoom, pan and access details on demand. In addition to this, it also allows the users to perceive what things in different ways, and enables them to see relationships and compare trends. For example, we can see number of calls in several different ways by time, by region, by need, etc., and also compare to get a sense of trends, correlations, outliers and anomalies. Further, it allows sorting the problem needs automatically when the user performs a selection or filters out cities or areas. The visualization also supports basic interaction techniques like selecting (mouse click), hovering and details on demand. Furthermore, it supports advanced interaction techniques like panning and zooming, and brushing and linking, which enables the user to perceive the "connectivity" and possible inter-dependence/causation between different aspects.

Tufte's principles of Graphical Excellence and Integrity

(Referenced in UW HCDE 511 lecture April 8, 2014, slide 65)

The visualization follows the following principles of graphical excellence and integrity:

- It is easily understandable.
- Visualizing this data reveals trends and patterns that might have been hard to grasp through visually examining textual forms of the data.
- It presents data in context. For example, the distribution of calls by ZIP code is shown in the form of a choropleth, i.e. geographical representation. When it highlights information, it does so in context, changing other related views to reflect data specific to that selection.
- It uses visual components appropriately. We use lines for trends over time, length of bars for number of calls in different categories, gradation of color for volume of calls, and color for program. These fall along the ideals of effective encodings for intuitive data visualization. Color is also used consistently through the visualization, allowing users to make connections across the different parts of the visualization.
- It uses labels and legends where necessary, keeping the user in context through the exploration.

Discussion and Further Work

Given the limited scope of time, we have tried to demonstrate what an ideal visualization would be to help the Crisis Clinic answer some key questions. However, from various rounds of evaluative testing we recognize that there are areas that we can further work on to improve. These possible areas of improvement are discussed below.

The Map

We explored a great deal with adding different data points on the choropleth, such as “calls per capita” or “number of callers”; ultimately, we found that neither of these were as effective as providing the raw call numbers. “Calls Per Capita” tended to be confusing because of the ability to change the date range, and we were unable to express this in a way that was easy for users to understand. We did decide to keep “calls per capita” as an element of details on demand, because we found that it still provided useful comparison information between ZIP codes. We also experimented with using “number of callers” as a dimension; although this tended to remove some outliers in the call data, it also tended to flatten the data and remove a lot of the stories that are familiar to the staff. We were also concerned that we could not accurately calculate “number of callers” since a great deal of the calls are anonymous. Nevertheless, it may be interesting to explore some alternative map views in the future.

Furthermore, although we chose to prioritize ZIP code in our final visualization because this was the most useful data for the Crisis Clinic, we would like to incorporate a way to show the most ideal view and breakdown based on context, and believe that semantic zoom may be helpful. For example, at a zoomed out level of detail, such as the entire state, calls could be aggregated by county; on zooming in, city boundaries could start to show up, following by ZIP codes. This would be particularly useful for the Recovery Line, which operates across the entire state. It would also be useful to have more ability to control map details, such as the ability to toggle on or off city boundaries or ZIP codes.

Improving Interaction and User Experience

Better de-selection and filter control would be a good improvement. For example, users expected filters to be reset when clicking off of selected regions on the map, and they also expected the city and ZIP code filters to stay in sync with their selections. Although we investigated some workaround for filter resetting, we were unable to accommodate this request within the framework of Tableau.

We are also interested in exploring ways of restructuring the data to improve performance, which is important for delightful interaction. Although we have found the performance on Tableau Public to be acceptable, performance on our laptops in Tableau desktop tends to be poor when using the “consumer group” filter. We suspect that any performance problems encountered are due to the user of the “count distinct” operation to count number of calls across the visualization, as well as the user of a parameter for “consumer group” that depends on the text searching. We were unable to figure out a way to restructure the data that would still allow us to keep the “consumer group” filter as a single dropdown.

Storytelling and Final Thoughts

One of the things that came up during our evaluations with Crisis Clinic staff was the idea that this would be an interesting addition to their website for anyone in the general public to explore. It would be a good way for them to look for patterns in their area of interest, or in general just explore what Crisis Clinic does. However, people that are unfamiliar with the call data may benefit from more guidance and a “walkthrough” of some key data points in the visualization. For this particular purpose, we believe it may

be beneficial to incorporate a story format with the data to convey the information to the public. We also think that it would be beneficial to provide more context information such as a description of each of the programs does. Although we chose not to include this in the visualization because its primary users are familiar with the programs, we believe that contextual information could be provided by the website where it is embedded; ideally, this would be hosted by Crisis Clinic.

We do believe that this data set has many stories to tell, both to the Crisis Clinic staff, potential funders, and well as the general public. During one of our usability tests, while exploring the data one of the Crisis Clinic staff members quoted:

"I'm having an emotional reaction... it really makes our work real and affirms what we do... I think a lot of the staff and volunteers would like to see this."

Ultimately, we hope that this visualization will be able to provide some useful insights to the Crisis Clinic, as well as expose them to the power and potential of interactive data visualization.

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