Operations Management
Final Project
3/10/2019

Analyzing the Demand of Social Service Centers in Barcelona

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1. Introduction

One of the most critical goals of a modern government is to improve the lives of its most disadvantaged citizens. There are many avenues through which the government can accomplish this goal, but perhaps the most effective method is to establish a robust and efficient social service system. Social services are a range of public services provided by the government with the aim of increasing the standards of living of its needy citizens. These services include activities such as counseling and training, home care for the elderly and disabled, and food and clothes donations. The quantity and quality of social services offered vary tremendously across countries, regions, and even cities.

Barcelona's government prides itself in its commitment to continuously expanding its social service offerings. Throughout the years the government has developed a range of policies to make sure that there is a minimum life quality in the city. By offering different services to individuals and families in precarious situations that require assistance. The services these people are entitled to are determined through an assessment of their situation by a social worker staffed at one of the social centers. These social workers then develop a work plan and serve as guidance on the resources, benefits and services most appropriate to their specific needs.

In this paper we will be analyzing the supply and demand for social services in Barcelona by analyzing the location of Barcelona's social service centers in regards to much of its population. We will then provide recommendations on how we believe resources should be distributed and how we believe the system could be improved to address inefficiencies today and in the future.

2. Data, Variables and Methods

We have compiled data on the 42 social service centers and their locations within Barcelona as well as a comprehensive database of Barcelona's demographics through combining several datasets from Open Data BCN. This provided us with fundamental information regarding the distribution of social service centers within Barcelona, as well as the demographic characteristics of Barcelona's population segmented by districts and neighborhoods in 2017.

The demand for social services is not equally distributed among society, the typical users of social services are the elderly, people with disabilities, and the poor. Therefore, in order to

analyze the distribution of these people in Barcelona. Table 1 provides a brief overview of the variables we collected for Barcelona's demographics by district. By analyzing this table we can begin to see the differences in the demographics between the Barcelona´s districts, which in turn affects the demand for social services for each district. In terms of age the oldest district is Les Corts with the youngest being Ciutat Vella. In terms of disability the district with the highest percentage of disabled people is Nou Barris with 10.15% and the district with the lowest percentage of disabled is Sarria with 5.40%. Finally, the population with the highest RFID index was Sarria with a score of 182.8 indicating they on average have 82.8% more disposable income than the Barcelona median, and the district with the smallest score was Nou Barris with a score of 74.60 meaning that on average they have 74.60% of the mean disposable income.

	Total	Ciutat Vella	Eixample	Sants Montjuïc	Les Corts	Sarrià	Gràcia	Horta-Guinardo	Nou Barris	Sant Andreu	Sant Martí
Pop	1,620M	101,387	266,416	181,910	82,033	149,279	121,347	168,751	166,579	147,594	235,513
%	100%	6.3%	16.4%	11.2%	5.1%	9.2%	7.5%	10.4%	10.3%	9.1%	14.5%
Avg Age	43.95	39.97	44.71	43.77	45.60	42.81	44.16	45.23	44.64	44.11	43.49
60+ Years	439,698	18,075	74,551	47,275	26,360	40,078	33,100	49,792	48,013	41,058	61,396
%	27.12%	17.70%	27.90%	25.90%	32.10%	26.80%	27.20%	29.40%	28.80%	27.80%	26.00%
Disabled	132,133	8,300	19,637	16,489	6,028	8,084	9,049	14,355	17,560	13,056	19,575
%	8.15%	8.20%	7.40%	9.10%	7.30%	5.40%	7.50%	8.50%	10.50%	8.80%	8.30%
Median Income (2017)	€30,623	€29,998	€33,959	€26,983	€27,018	€46,022	€31,214	€28,342	€22,247	€27,038	€29,998
RFD Index Barcelona (2017)	100.00	84.30	122.40	84.60	137.30	182.80	105.30	78.00	55.00	74.60	88.10
Surface Area (HA)	10215.9	436.8	747.6	2294.2	601.8	2009.2	418.6	1194.7	804.1	656.5	1052.4
Pop Density	158.66	232.11	356.36	79.29	136.31	74.30	289.89	141.25	207.16	224.82	223.79
60+ Density	43.04	41.38	99.72	20.61	43.80	19.95	79.07	41.68	59.71	62.54	58.34
Dis Density	12.93	19.00	26.27	7.19	10.02	4.02	21.62	12.02	21.84	19.89	18.60
Social Service Centers	42	5	6	4	2	4	3	5	5	3	5

Table 1. Demographic summary of Barcelona's population.

In order to precisely analyze and visualize the locations of the social service centers and the distribution of the different demographic characteristics in Barcelona we used R Studio. We made use of the packages *ggmap* and *tmap* which allow the user to visualize spatial data on top

of static maps from online sources such as Google Maps. To generate a static underlying map of Barcelona we used Google's Cloud Platform and Barcelona's geoportal which provided us with the spatial data of Barcelona's districts and neighborhoods. To further develop our visualizations we merged the spatial data with our data from BCN Open Data to help us create the maps in this report.

3. Findings

3.1 Location of social service centers

As a proxy to determine the supply of social services in a given region of Barcelona we use the number of social service centers. On the Barcelona government website we found the address of all of the social service centers in the city. We then took these addresses and used a geolocation function in R to derive the geocoordinates. With these coordinates we were able to plot the location of social service as points on a map of Barcelona.
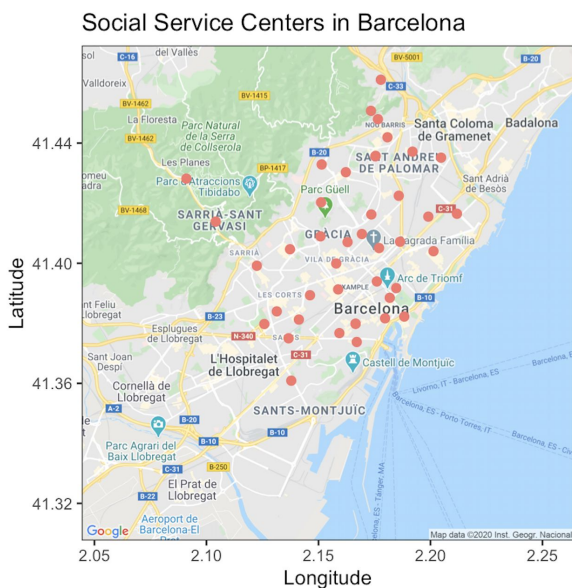

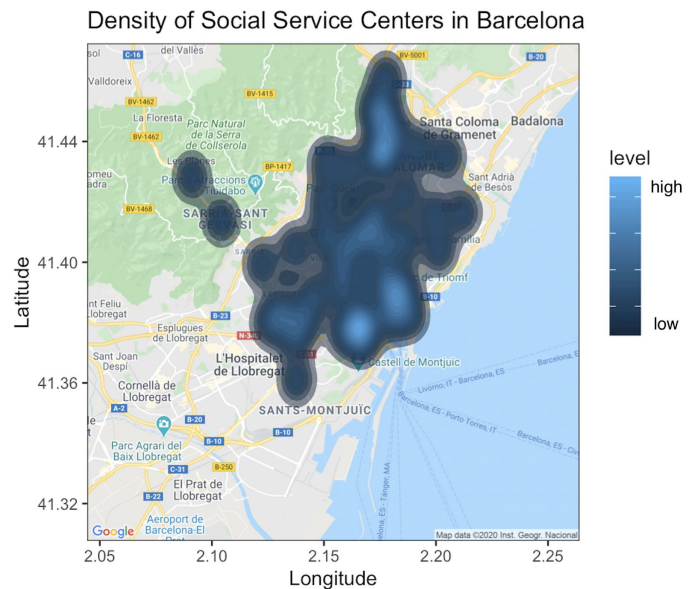
Figure 2. Social Service Centers in Barcelona. *Figure 3. Density of Social Service Center*

Figure 2 allows us to visualize the location of the social service centers which are marked in red on a static underlying map of Barcelona. Soley using this graphical representation, it appears that the social service centers are evenly distributed around the city. Figure 3 provides additional context showing the density of the social service centers' distribution. The lighter areas represent a high density of centers, while the darker areas illustrate a low density. With this

added context it becomes clear that there is a higher density of social service centers in the districts Ciutat Vella and Nou Barris than in the other areas. Knowing the location and general distribution of social service centers we can now build on this to gain a better understanding of the demand and supply of social services in the city.

3.2 Analysis of The Positioning of Social Service Centers by Distribution of Population

Next we proceed to analyze the locations of the social service centers in relation to Barcelona's general population distribution. By taking into account this generic variable we wanted to determine if there were any obvious inefficiencies in the distribution of social care in terms of the number of people served in Barcelona. Figure 4 and 5 demonstrate Barcelona's population by district and by neighborhood respectively while visualizing the locations of the 42 social service centers. The level of population is illustrated by a choropleth map that shades the map in terms of population. The darker the shade of blue in a region the larger the population.
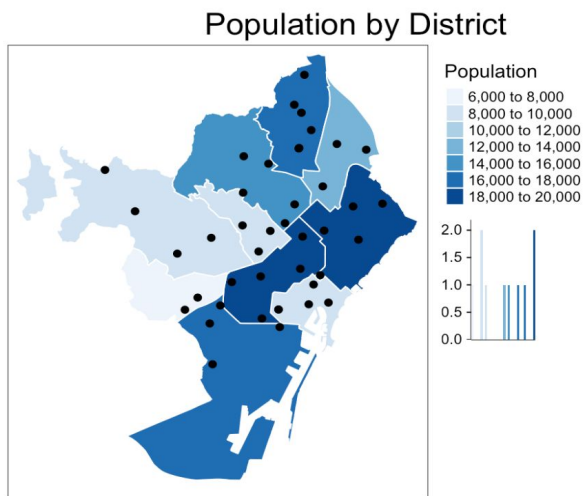

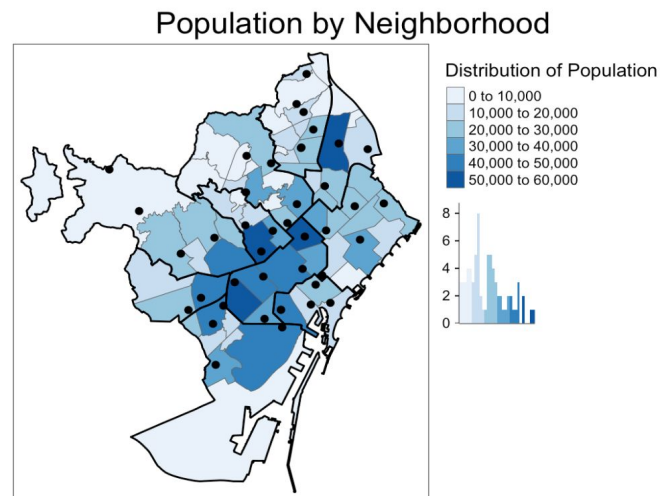**Figure 4.** *Population by district in Barcelona.*   **Figure 5**. *Population by neighborhood in Barcelona.*

Looking at Figure 4 and Figure 5, it can be seen that there are significant differences in the population between the 10 districts and the 73 neighborhoods. The districts Eixample and Sant Martí register the highest total population with 266.416 and 235.513 habitants. While Eixample's neighborhoods are generally quite dense (e.g. 58.180 inhabitants in La Nova Esquerra de l'Eixample) the high number of habitants in Sant Martí is mainly due the sheer

amount of neighborhoods it contains. The lowest population records the district Les Corts with 82.003 inhabitants followed by Ciutat Vella with 101.387 habitants, which although having small sizes are not substantially more dense than other regions.

These visualizations provide us with insights on possible inefficiencies with the distribution of the social service centers. One of the most obvious aspects is that Ciutat Vella has among the highest density of social service centers while having one of the smallest population. In other words, Ciutat Vella with a total population of 101.387 habitants contains 5 social services meaning they have 20 thousand people per center while Eixample, Sants Montjuïc, Les Corts, Gràcia, Sant Andreu and Sant Martí all have over 40 thousand people per center. Additionally, looking at the neighborhood level, we observe that for the most part the social service centers are well distributed near populated areas. However, Sant Andreu in the upper right corner seems as though it may be under supported with only one center in the immediate vicinity for the most populous neighborhood in Barcelona (57,183 people)

3.3 *Analysis of The Positioning of Social Service Centers by Distribution of Disabilities*

After analyzing the population we wanted to dig deeper and see if any additional inefficiencies exist within the groups that typically make use of social care. The first user segment we explored is the disabled population. We collected data on the total disabled population, the severely disabled, and the physically and mentally disabled and mapped the distribution on these cases in the choropleth maps below.
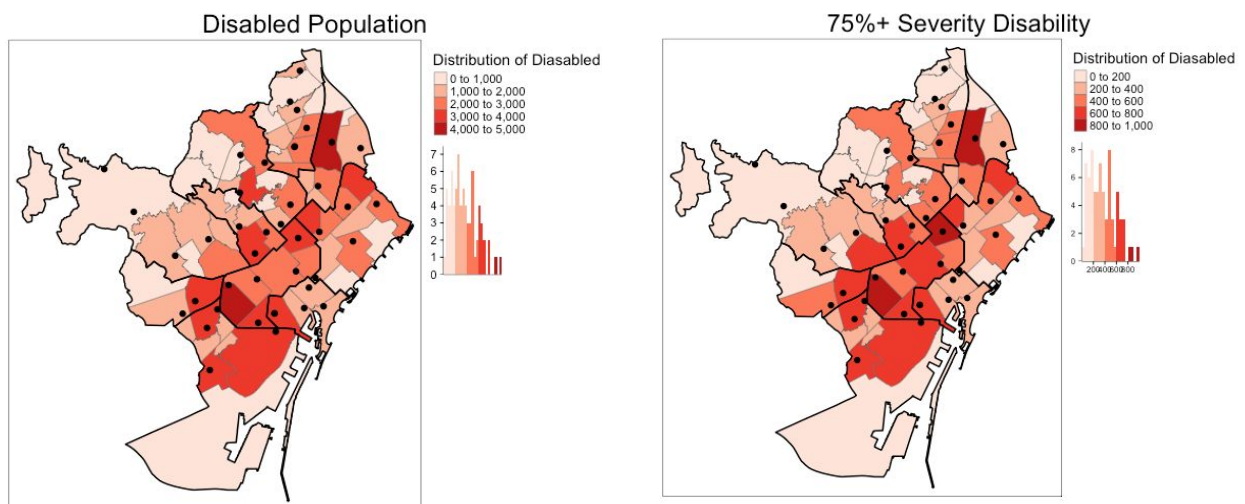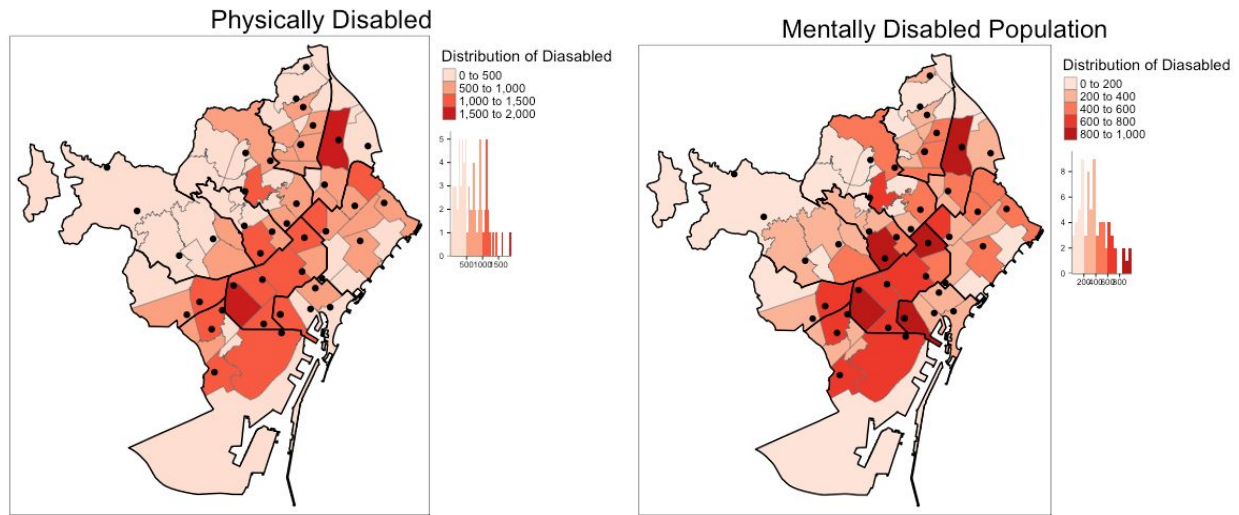
Figures 6,7,8,& 9 Disabilities in Barcelona characterized by frequency, severity and type

It is clear that these 4 maps are very similar to one another. This indicates that all of the factors of disability are correlated with one another and regions with high numbers of disabled people also have a higher number of severely disabled individuals and more physically and mentally disabled individuals. These maps provide us with interesting information on how resources should be distributed. Regions with a darker shade of red should get a higher percentage of resources than lighter regions for dealing with the particular category of disabilities.

In terms of severity "La Nova Esquerra de Eixample", "Sagrada Familia", and "Sant Andreu" have the highest degree of severity. Therefore, they should be provided with the most experienced social workers whose experience will be invaluable in dealing with these severe cases. As for the physically disabled Eixample and its surrounding neighborhoods as well as "Sant Andreu" have the highest proportion of this group. Consequently, these regions should be provided with more home care workers and nurses that can go to the homes of the individuals and help them with cooking, cleaning, bathing, and living all around more independent lives. Finally, for the mentally disabled "Raval", "La Nova Esquerra de Eixample", "Sagrada Familia", "Vila de Gracia", and "Sant Andreu" have a high percentage of this segment. This indicates that the government should provide these regions with more psychologists, therapists, and mental health specialists, while additionally providing adult day care services. Analyzing

possible inefficiencies in the system once again the center of the city seems to be well covered in terms of facilities while "Sant Andreu" has a very high percentage of all types of disabled but only has one social center serving all of these individuals.

3.4 Analysis of The Positioning of Social Service Centers by Distribution of Income

The next segment we analyzed is the poor in Barcelona. We collected data on the average income per district and the RFD index Barcelona (renta familiar disponible) per neighborhood. Like we did in the previous sections we then took the data and mapped it onto the Barcelona map creating informative choropleth maps. However in this case we are interested in the lighter regions which represent the poorer parts of the city.
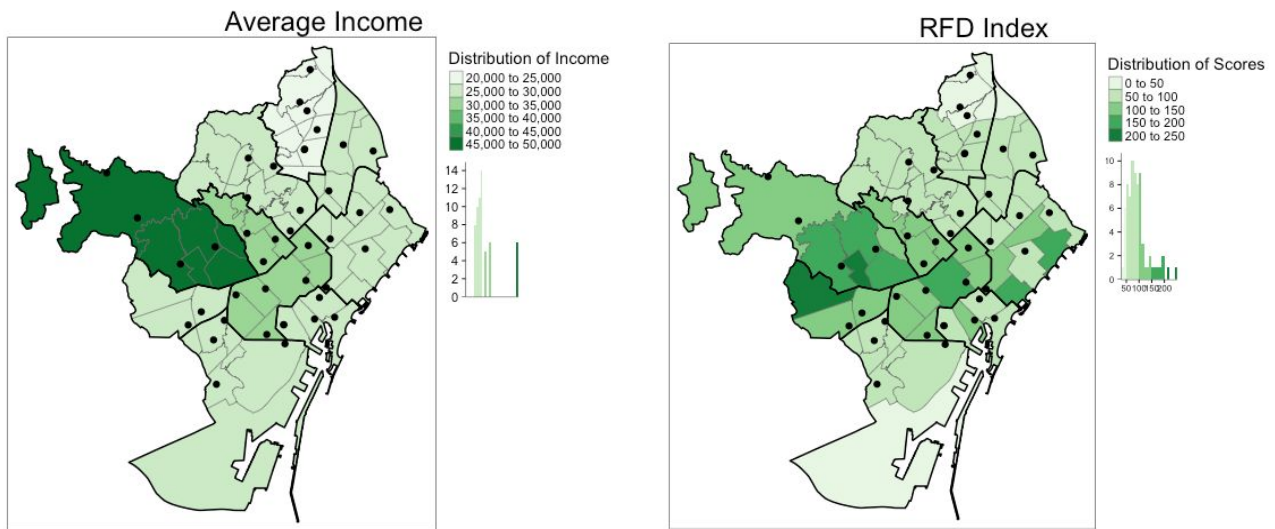
Figures 10 & 11: *Average wage in the city and RFD by neighborhood (inequality metric based on household disposable income)*

Through these maps and analyzing the data we have found that the central and the top left regions tend to be the wealthiest, while the outskirts on the bottom left and top right tend to be the poorest. On average. We have found that the areas with high disposable income have less social centres. For instance, the map shows that seven regions with high and medium incomes (Pedralbes, Les Tres Torres, Les Cortes, Sarria, Sant Gervasi - La Bonanova, Sant Gervasi - Galvany and El Putget i Farró) only have four social services combined. Pedralbes registers the highest RFD score of 248.80 and has 0 social service center. On the other hand, we see that the low-income regions have more social service centers - La Trinitat Nova records an RFD of 48.2

but contains two centers. This information again can be used to determine the type of services provided by these centers and how resources should be allocated. Regions with lower incomes should have more centers that focus on providing financial services and subsidies to the poor such as providing donations, buying groceries, providing cheap childcare, and offering personal finance trainings. In terms of inefficiencies we do not see any new issues with the distribution of the centers in this case.

3.5 *Analysis of The Positioning of Social Service Centers by Distribution of Elderly*

Finally, the last possible user segment we analyzed are the elderly (65<). Similar to the previous cases we collected data on the distribution of the elderly population and mapped it on a choropleth map. Additionally, we found data on the age distribution of the city and created a population pyramid to see how the demographics are projected to change in the future.
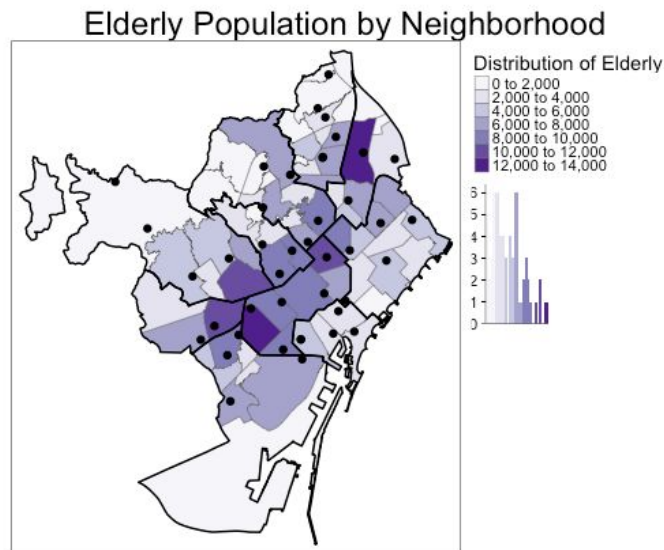

Figure 12: *Distribution of Elderly*

The elderly map has a very similar distribution to the disability maps. This makes sense because as people get older they tend to develop more disabilities both mentally (i.e dementia) and physically (i.e broken bones, difficulty walking). We can see that the areas La Nova Esquerra de l'Eixample and Sant Andreu have the highest elderly population with 17.066 and 16.166 people. The same two regions also register the highest number of disabled people with

4.530 respectively 4.889. On the other hand, the lowest population of elderly and disabled people can be found in areas such as "La Marina del Prat Vermell", "La Clota", and "Vallbona" with 281,105 and 306 of older people as well as 229, 42 respectively 198 disabled people. In both figures we can clearly see that the districts Ciutat Vella and Nou Barris have a comparatively low amount of disabled and elderly people. Considering the fact that Ciutat Vella is one of the areas with the highest density of social service centers this appears contradicting and inefficient..

The population pyramid gives us a glimpse into what the future demographic of Barcelona may look like in the future. Barcelona's population pyramid has a narrow base of younger people under 25 indicating a decline in the birthrate, that then dramatically widens out until the late 30`s which are the bulk of the working population, and then slowly narrows out every year. This type of tree indicates that Barcelona may face a demographic change in the near future and have a disproportionate elderly population as those in the middle age and the bulge slowly

Figure 13: Population Pyramid

works its way up the pyramid. Given this information Barcelona must invest in the social system now especially regarding services to elderly and disabled to be ready to meet the changing demand in the future.
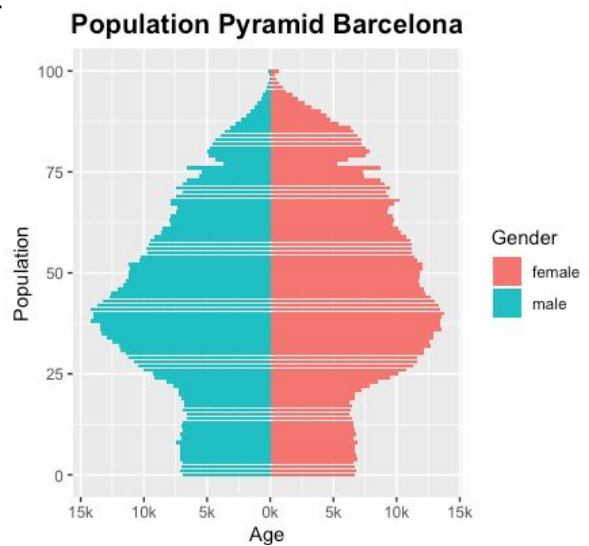
4. Conclusions, Recommendations, and Further Research

Putting it all together, we do not believe that there are any glaring problems with the system in which large percentages of the population do not have access to the services they need. However, we do have some recommendations regarding how resources should be allocated and some minor inefficiencies we see in the system.

In general, we see several trends in the current system. The first is that Eixample and in particular "La Nova Esquerra de l'Eixample" has a large number of eldery and disabled people but are middle income areas. This suggests that these social centers specialize in dealing with

elderly and disabled cases instead of income related cases. This region is fairly central and has adequate centers to cover the demand. In the Ciutat Vella district there is a lot of facilities but a relatively small and young population, and although it is not the richest area it is by no means the poorest and we believe that one of the 5 social service centers in this neighborhood could be of better use in another part of the city. At a glance Sarria seems understaffed given the size of the region but due to the regions wealthy demographic they have a lower demand for these centers than other places in the city. Nou Barris has a significant amount of social centers, but they are well spread out and justified due to the higher poverty levels present in this district. One of the most notable observations we made was that the Sant Andreu neighborhood has the largest population, with a high density of older and disabled people yet it only has one center serving it's people.

Furthermore, we anticipate that given the general demographics trends of the city we should expect Barcelona's population to become increasingly older. In the next decades this will lead to general strain across the board for social services as the aging population will demand access to services such as home care. This has the possibility to put a massive strain on the social system if measures aren't taken to prepare for this projected increase in demand.

Additional research the government can do is determining the best location to place new facilities. This can be done by using a covering location style linear programming approach with the help of a more indepth dataset with household level data. In this model the city can outline possible locations to place new facilities with different specializations and use the household demographic as a proxy for demand. They then will create a list of constraints and run an objective function that maximizes the demand covered. This can be done continuously, with each iteration decreasing the distance from the center that is considered covered. Eventually, this can lead to a scenario where the majority of people in the city have access to the social services they need in order to improve their situation.

5. Sources

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Tennekes M (2018). "tmap: Thematic Maps in R." *Journal of Statistical Software*, **84**(6), 1–39. doi: 10.18637/jss.v084.i06.

Data From: Barcelona Open Data