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Healthcare Facility Location: A Breast Cancer Alliance Case Study

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Healthcare Facility Location: A Breast Cancer Alliance Case Study

Alexandra Knopf

May 2016

A MASTERS RESEARCH PAPER

Submitted to the faculty of Clark University, Worcester, Massachusetts in partial fulfillment of the requirements for the degree of Master of Arts in Community Development and Planning in the department of International Development, Community and Environment.

And accepted on the recommendation of

Marianne Sarkis
Chief Instructor

Abstract

Community health is impacted by the location of a health advocacy agency. This commissioned report for the Breast Cancer Alliance of Greenwich, CT, consists of a location analysis to review potential cities in which they might locate expansion efforts. Such cities include Boston, MA, Chicago, IL, Greenwich, CT, Los Angeles, CA, San Francisco, CA, and Washington, D.C. This report will look at five ways (4 mathematical and one spatial) of conducting a location analysis that require specialized knowledge for interpretation. For this study, a Spatial Geographic Information System methodology is preferred because of the visualization component, which can ensure that all stakeholders understand proposed options. Using a spatial Weighted Linear Combination tool to account for BCA's preferred location criteria, hospital location, competitor location, breast cancer incidence rates, education attainment and median household income, this investigation will identify the best new city in which BCA can locate another office and make the greatest impact on its contribution to breast cancer related healthcare. The analysis suggests that Los Angeles, CA is the best option given the criteria used. The final section of this report suggests several factors that BCA and its Board of Directors should take into consideration before making a decision to relocate to a new city.

Marianne Sarkis, PhD.

Author's Background

Academic History

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Dedication

This practitioner report is dedicated to Yonni Wattenmaker for her encouragement, guidance, and ideas throughout this process.

“Just because expanding is a good idea does not mean it is going to work. Then again, you do not know unless you try.”

Looking forward to visiting you in Los Angeles!

Acknowledgements

I would like to thank Professor Marianne Sarkis for her support, dedication, and patience throughout this process.

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Chapter One: Statement of Purpose

This is a report commissioned by the Breast Cancer Alliance (BCA) Executive Director, Yonni Wattenmaker in September 2015. Wattenmaker requested a location analysis to review potential cities in which BCA might expand. This report looks at various ways of conducting a location analysis. I use GIS as the preferred model for location analysis to weight five variables in six proposed cities to find one city to recommend for locating a second office.

The significance of this professional report is twofold. First, the findings will directly benefit the case study organization, BCA, as they are looking to open a second office. BCA currently has one office. While speaking with the BCA Executive Director, Yonni Wattenmaker, on November 2, 2015, I learned that one of BCA's short-term operational goals is to open a second office. The hope is that the second office will provide expanded services, a new place to fundraise, and more hospitals with which to engage in collaborative activities.

Second, the findings will propose a general approach for other organizations to follow when trying to determine where to locate when expanding. This approach includes selecting criteria, a method, and an implementation strategy. When picking criteria to include in location analysis, organizations need to balance applicable theory with practical needs. While Spatial Geographic Information Systems is a specialize model, the interpretation of the visual results do not require any pre-existing knowledge and is accessible to a lay audience. Furthermore, the methodology employed should include a

spatial approach, which adds a visualization component to the analysis and ensures that all stakeholders are able to understand the proposed options. Lastly, because of the importance of the Board of Directors in organizational decision-making, a buy-in of the recommendations should be secured prior to relocation.

In this report, I will begin with exploring BCA as an organization, and illustrate my personal involvement with them. Second, I will review the extensive methodology and justify decisions and assumptions made to complete the location analysis. Third, I will analyze five variables in six cities to determine where BCA should locate its new facility. Lastly, I will conclude this paper with recommendations.

This report is rooted in the idea that community health outcomes and health promotion efforts are impacted by where a healthcare facility¹ is located. Facility location is a means to change health behavior. Researchers suggest a strong link between the location of healthcare facilities and the outcomes experienced by patients and their families (Laverack, 2000). A location that allows community involvement can improve patient competence and encourages empowerment so that individuals want to connect and take part in their health. A well-designed, supportive, and carefully located healthcare environment can prevent harm and injury and simultaneously provide psychological support and aid in the healing process (Reis, 2009).

Healthcare infrastructure provides the basic support for healthcare² operations and services. In addition to hospitals, facility location decisions are also a critical element in strategic planning for preventive health care programs or health advocacy organizations,

¹ For the purposes of this study, a healthcare facility is defined as any location where health care is provided.

² Health care is considered as medically related services, including procedures, education and advocacy.

such as BCA (Pons, 2005). With these facilities, the goal is to identify optimal locations so as to maximize participation. These organizations are often community based and rely on the support of locals (Gu, 2010). As illustrated below, BCA fits this profile, so a location analysis is critical for their success when expanding.

Chapter Two: Breast Cancer Alliance Case Study

The following background is based on research and personal observations from working as an intern from May 26, 2015 through August 7, 2015 and an interview with the Executive Director on November 2, 2015.

Mission and Background

BCA is a non-profit organization located in Greenwich, CT. BCA's mission is to improve survival rates and quality of life for those impacted by breast cancer. The main areas of work and expertise include fundraising, grant writing, and community outreach. BCA works with donors, both individuals and local stores, to provide grant money to achieve its mission. The organization also puts on several annual events to fundraise money.

BCA's goals are to improve prevention, early detection and treatment to ultimately find a cure for breast cancer. To do this, BCA engages in significant fundraising and then decides where to invest the money in the form of grants to fund research, surgical fellowships and trainings, community education initiatives, and breast cancer screenings. BCA provides funding to hospitals, researchers, community organizations and universities. The office most closely supports women and communities of varying races and cultures within a 200-mile funding radius, as determined by a board vote in 2010 (Wattenmaker, 2015). BCA has awarded over \$22 million in grants since opening in 1996.

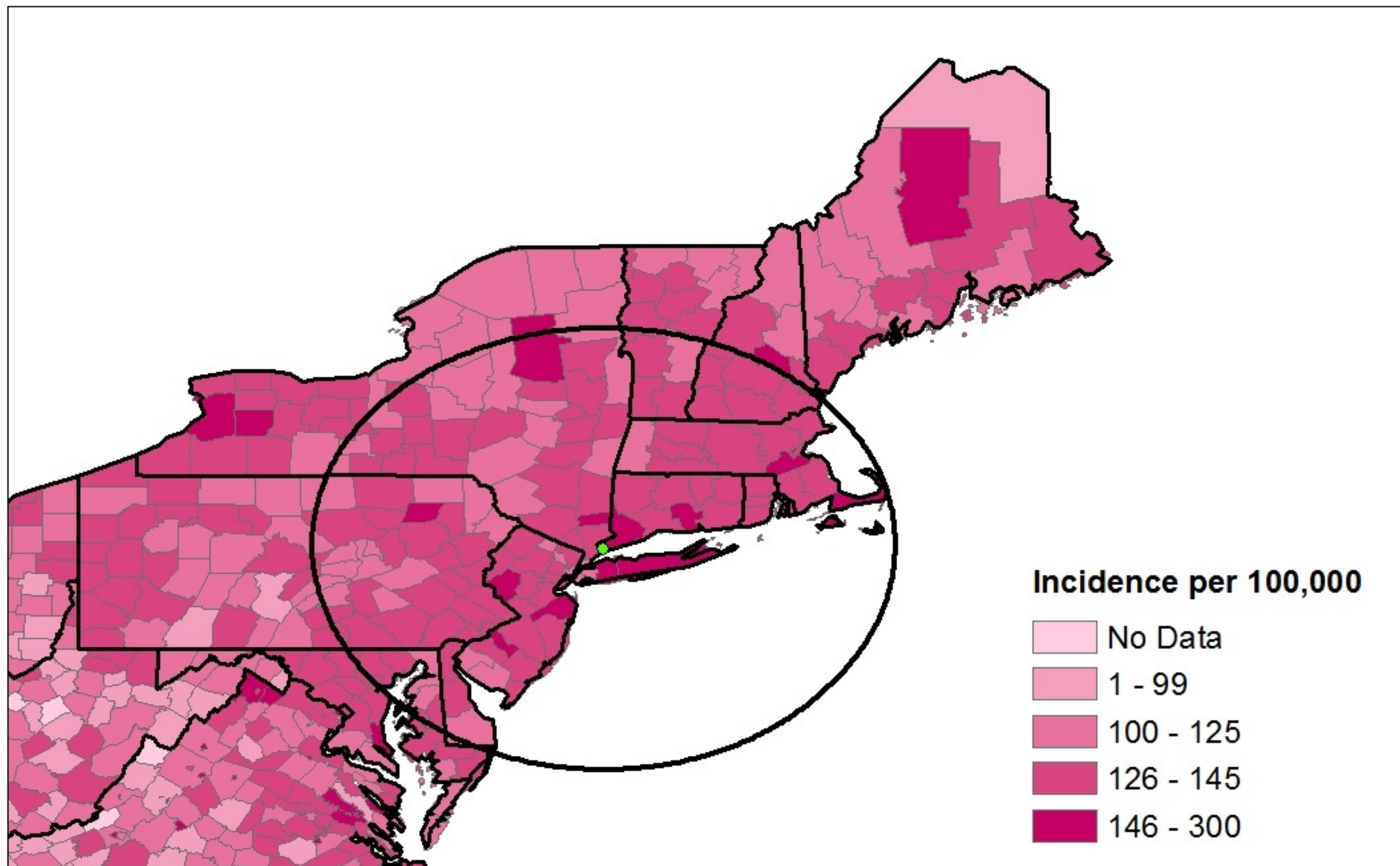


Figure One: Chart depicting service process from raising money to following up with recipients.

BCA donates 80 cents of every dollar earned. The remaining money funds two salaries, office supplies and other operating costs (Wattenmaker, 2015). In 2015 the organization raised 1.6 million dollars, which supported 24 grants. There are four different styles of grants BCA provides. The first is an Exceptional Project Grant for \$100,000, awarded to creative and innovative researchers. The second grant is a Young Investigator Grant for \$125,000, awarded to researchers in the early stages of their careers. The third grant is an Education and Outreach Grant for varying amounts, awarded to cancer services for the underserved. The final grant is a Breast Surgical Fellowship for \$75,000, awarded to physicians interested in an additional, and specific, training for breast surgeries.

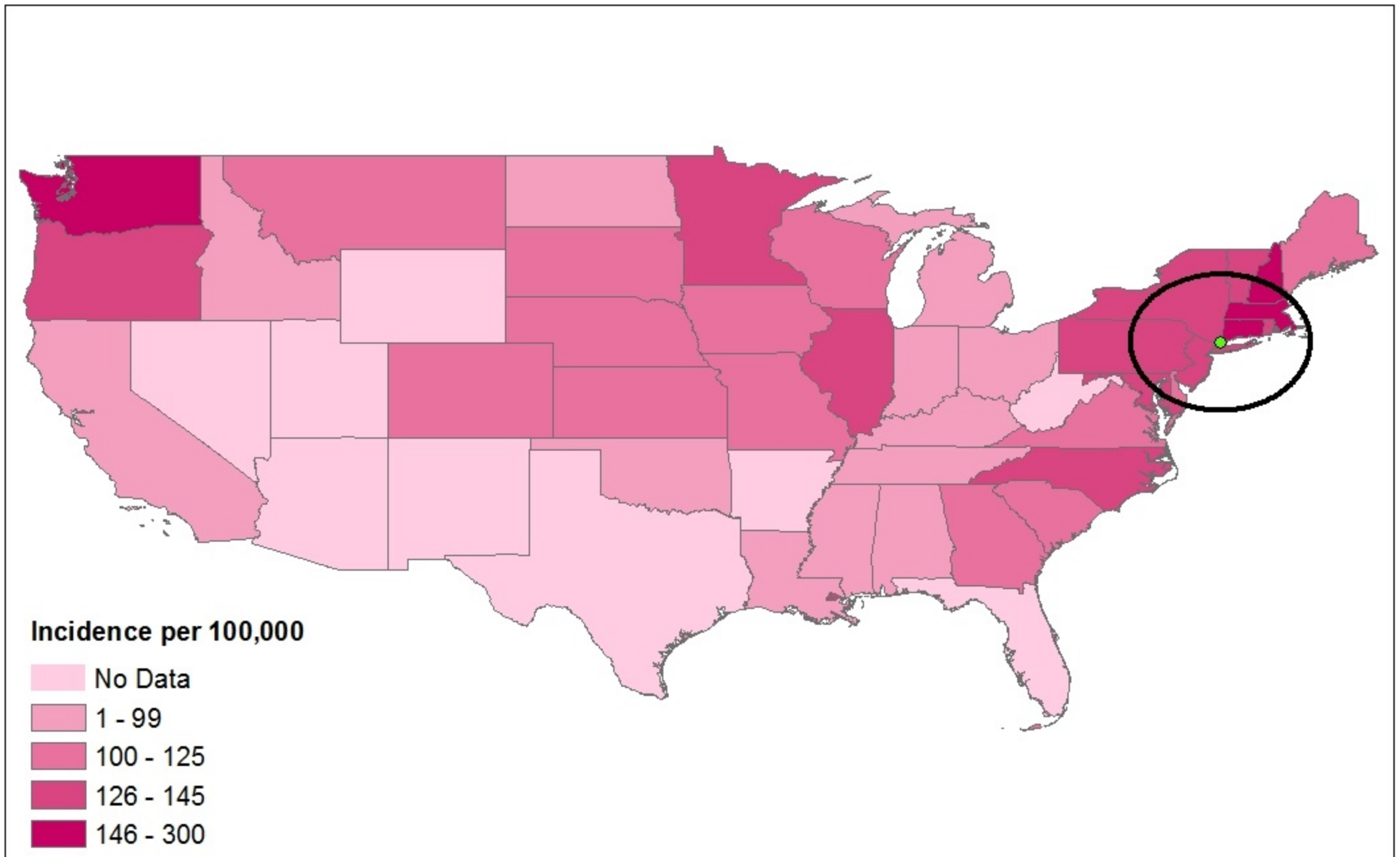
To accomplish its mission, BCA works in the United States and funds opportunities within a 200-mile radius of its office. BCA’s Executive Director (“ED”) says that its location is ideal because the organization is located in a high-need area. The breast cancer rate in Fairfield County, Connecticut is 146 per 100,000 people, which is among the highest in the country. This is even higher than the Connecticut state rate of 137 per 100,000 people and the national average of 123 per 100,000 people (figure two and three below).

Figure Two: New England Breast Cancer Incidence



Breast cancer incidence rates per 100,000 people by county.
Black circle represents BCA's 200-mile funding radius.

Figure Three: United States Breast Cancer Incidence



Breast cancer incidence rates per 100,000 people by state. Nevada is white because there is no data available. Black circle represents BCA's 200-mile funding radius. Green point represents BCA.

Two full-time paid staff manage the organization: ED and her Executive Assistant/secretary. BCA is also comprised of an advisory council, medical advisory board, founder’s board, leadership circle, junior committee of high school students, and event chairs for each fundraiser. All of the committees, councils and boards are volunteers.

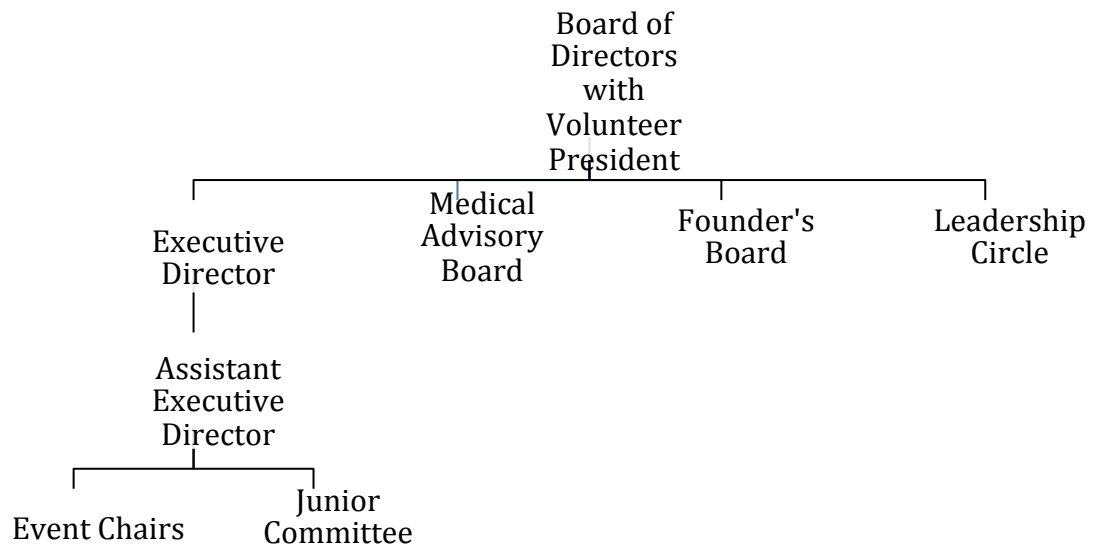


Figure Four: Organization hierarchy

Finally, BCA’s small size is advantageous for the work that they do. First, a small office allows the organization to have reputable due-diligence policies. BCA is transparent about their grant selection process and allow donors to participate in deciding where their money goes. BCA visits every site receiving money, and these visits are open to any board member, donor, or community participant who wants to attend. Finally, BCA requires quite stringent reporting from their grant recipients.

Second, a small office allows the organization to build relationships and a sense of community within their external interactions. Individuals who call or visit BCA feel connected immediately because of the small office. Whether people are looking to become involved in an event or they are calling for advice and to be connected to services, they are immediately welcomed. Many find comfort in the fact that they can work with or speak directly with the ED since it is just a two-person office.

Healthcare

Financially, the grants BCA award provides a multiplier effect of care. Although research grants and funding for breast fellowships training for surgeons might not directly fund patient treatment, the respective knowledge and skills developed do directly advance patient care (Boolbol, 2015). Separately, BCA's education and outreach grants fund self-breast exam information sessions, resource binders, mobile mammography vans, and bilingual providers for immigrant populations (Ward, 2015).

Patients and families call or email for recommendations to support groups for mental healthcare, general information on the average course of treatment and what to expect, wig and cosmetic suggestions, or for referrals to physicians and surgeons. BCA also provides educational care by sharing articles and related information on their social media pages to provide another voice for followers to consider regarding new topics, technology, and treatment regimens.

BCA has a unique relationship with grant recipients because unlike most other organizations, BCA conducts site visits with its grantees and obtains updates on their specific research efforts and related activities in the broader research community

(Wattenmaker, 2015). These meetings are impactful for assessing future grant requests and keeping up to date with the latest technical and scientific developments.

As previously noted, BCA has an External Review Panel and a Medical Advisory Board. The External Review Panel provides support and clarification when evaluating grant applications and deciding grant recipients. This relationship helps ensure that BCA fully understands the scope of proposed scientific topics. The Medical Advisory Board provides recommendations, second opinions and advice for patients who ask for support and diagnosis interpretations. These connections are critical and valuable resources, especially given the fact that the ED and the board members do not have a scientific background or medical training.

Vision and Expansion

BCA recently had their 20th anniversary. With such a milestone, it is a time to celebrate but also a time to reflect on a strategic plan for at least the next five years. Expanding is a large part of BCA's five-year plan to ensure BCA remains a relevant and worthwhile charity to support. The ED is faced with the challenge of how BCA should grow and evolve to stimulate excitement and attract new donors so that the organization can continue its good work, while simultaneously maintaining integrity (Wattenmaker, 2015). BCA is well positioned to expand based on a positive and strong reputation.

Decision Making

A potential challenge to growth is the decision-making structure. BCA has a volunteer president and Board of Directors. The ED is an active participant in board meetings, but ultimately, the collective board makes final decisions. This collective

approach can foster a ‘piggy-backing’ effect, where if one person strongly opposes something, the rest of the board members sometimes follow in opinion. Furthermore, when the ED meets with the president to set the agenda for meetings, the president can block topics from being discussed with the board at large.

During one particular meeting, the board discussed expanding BCA by opening another office in either California or Washington D.C. The board did not consult any data when suggesting California or Washington D.C. Rather, they based this discussion on whether or not the board members had wealthy and influential acquaintances in these areas.

Many board members were in favor of expanding. Those in favor agreed for several reasons. First, they thought the more office locations BCA has, the more money BCA can raise and the more it can contribute to breast cancer research. Second, they were conscious about over exploiting local commercial donors and residents in the Greenwich area, since money and goods are requested for raffle donations several times a year, often from the same people. And, third, another office would provide an opportunity to network and try hosting new events in other areas of the county.

The president was not in favor of expanding, however. She thought it would be too time and labor intensive. Furthermore, since the board plays a critical role in locally-based fundraising and organizational decision making, there is concern about how to replicate the board in the new location, such that it is integrated with the existing organization. Despite grave concerns, it is significant to note that benefits seemed to outweigh the potential setbacks. Questions surrounding exploiting the surrounding community, organizational sustainability and balance were debated. Expansion would be a proactive step, since BCA does not need to expand in order to maintain their financial profile.

Financial Consideration

The organization is flourishing with many interested donors, indicating BCA's long-term ability to succeed. Progress can be made without the pressure of bankruptcy. Currently, BCA's annual Benefit and Luncheon is the largest Greenwich town event, with over 900 people in attendance. This event raises approximately 80% of their annual income, or approximately 1.3 million dollars. Local Greenwich residents want to support and participate, however, each year's event has to be unique so that supporters will not lose interest. Balancing new event ideas with annual favorites is important to cultivate new interest and support while simultaneously maintaining interest, tradition and income.

Donor fatigue does not seem to be an issue. The ED has seen a growth in the donor base since she started her position in 2011. When she started, many donors were the same women who helped support the organization when it was founded. These individuals are older now, and the ED received feedback from local residents saying that BCA felt like their mother's charity. As such, the ED strived to find a balance of satisfying past donors, while simultaneously cultivating new interest. By adding a Junior Committee, work out events like SoulCycle rides, and a children's fashion show, the ED has slowly attracted another two generations of loyal supporters (Wattenmaker, 2015). With this success, expanding seems like the natural progression for BCA.

Chapter Three: Methodology

Variables Considered

Given the importance of deciding where to locate, many factors are considered by an organization's decision makers. Location is often determined based on price, competitors, and convenience. Planners try to minimize the distance between facility and demand points, or patients and consider the relationship between health advocate agencies and providers. Another factor is determining how many facilities are needed to cover all healthcare needs of the patients and the population the facility is looking to serve (Afshari, 2014). Additionally, labor costs influence a location decision (Crawford, 2012).

When meeting with the ED to decide criteria to consider, hospital location, breast cancer incidence rates, and competitors were recommended for the following reasons:

BCA is an advocacy agency, and works closely with providers to provide holistic and supportive patient care. Additionally, BCA funds research and fellowship opportunities at hospitals, so it would be advantageous if any new office were surrounded by recognized breast cancer hospitals. The breast cancer hospitals data is geocoded point data from the 2015 Annual US News and World Report article entitled "Top 50 Adult Cancer Hospitals."

Second, organizations have a greater impact in areas where there is a high need for their services. Additionally, BCA's mission is to improve survival rates and quality of life for those impacted by breast cancer. As such, it would be advantageous for any new office to be situated in an area with a high breast cancer incidence rate.

The breast cancer incidence rate data used in this study is county level data from the National Program of Cancer Registries Cancer Surveillance System under the Centers for

Disease Control and Prevention (CDC) and by the National Cancer Institute's Surveillance, Epidemiology, and End Results Program in 2012. The rate noted as 51 per 100,000 people in Apache County, Arizona was the lowest recorded. The highest was 364 per 100,000 people in Williamsburg County, Virginia.

Third, the location of competitors is important. BCA would want to be in an area with fewer breast cancer organizations to eliminate competition for financial support from similar donors. Identifying competitors is important to do before finalizing a business decision. It is helpful to identify other company's strengths and project their next moves in order to adequately plan for how the market will respond to your company's introduction. Organizations in areas with oversaturation of the same service struggle to maintain their funding and uniqueness. The competitor data is geocoded point data from the Internal Revenue Service database of all 501(c)3 charities that support breast cancer.

Interestingly, the ED requested to add a fourth and fifth variable to the analysis: education and income. The ED is interested in finding a place where the median income is high and residents are well educated, indicating a capacity to give. She mentioned that without donations, there was no possible way she could fund the grants to advance research and patient care.

These social variables were downloaded from the 2014 American Community Survey 5-year estimates on American Fact Finder at the county level. The "education" table includes educational attainment for the population 18 years and over. The specific field used is percentage of the population 18 years and older with a bachelor's degree or higher. The lowest percent of the population with a bachelor's degree or higher was 6.73% recorded in Greensville County, Virginia and the high was 66.47% in Arlington County, Virginia. The

“socioeconomic status” table includes median household income in the past twelve months. The lowest median income was \$31,996 in Surry County, Virginia and the highest income was \$90,803 in Santa Clara County, California.

The process of deciding on the five variables of consideration (hospital location, breast cancer incidence, competitor location, resident education and resident income) illustrates the gap between theory and practice. The first three variables recommended were suggested based on location theory, community development practice, and BCA’s mission and goals. The last two variables were added because BCA needs a way of funding the good work that they do.

Cities under Consideration

The following analysis is a top down, systematic approach to find a place for BCA to open an additional office. Instead of exploring the entire country looking for a suitable city, the ED purposely asked to consider Boston, Los Angeles, San Francisco, and Washington D.C. The ED requested comparison of these cities because they each offer something unique.

BCA is currently situated in Greenwich. Should BCA be interested in a expanding in the Northeast, Boston is of interest because many current partnerships already exist in the city (Wattenmaker, 2015). For example, in 2015, BCA awarded funding to three grant recipients in Boston. Furthermore, Massachusetts General Hospital recently nominated BCA as one of their top 100 honorees for outstanding contribution to patient hope in the cancer community.

The board of directors preferred California because the research on the West Coast is different than that which is explored around BCA's current location. On the West Coast, research focuses on holistic approaches to patient care, environmental influences, and genomic sequencing. BCA has not funded any such projects on the East Coast yet. Los Angeles was specifically recommended instead of other California cities because two of the current board members have supportive, and well connected, acquaintances that live here. Likewise, San Francisco was recommended because some of the past board members have since retired to the Bay Area.

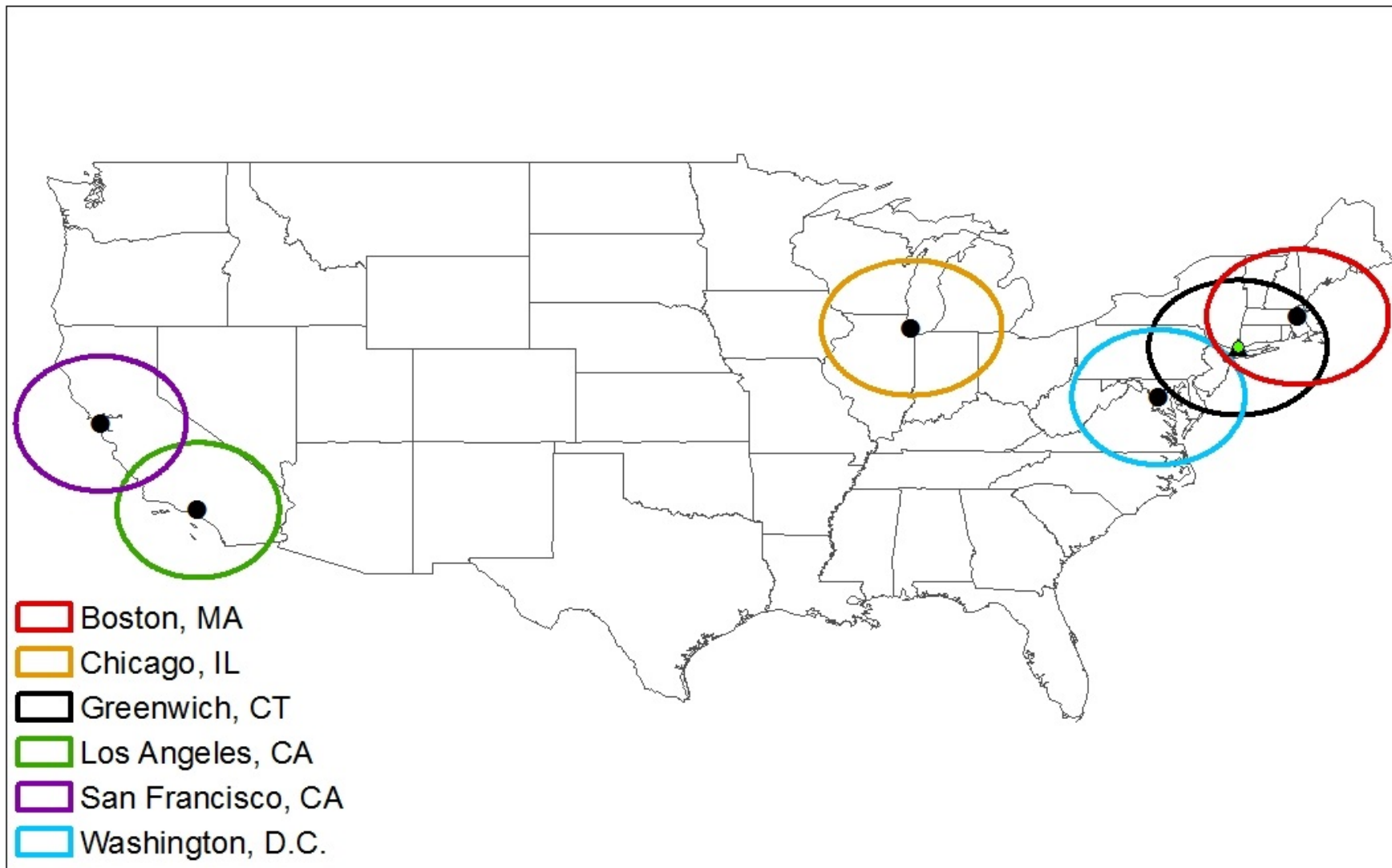
The ED also proposed Washington D.C. This city is appealing because it would provide a national presence to enhance legitimacy and perhaps give BCA a voice in national issues or the possibility of becoming involved in national lobbying efforts (Wattenmaker, 2015). Furthermore, BCA was recently approached by the National Breast Cancer Coalition in Washington DC who wants to collaborate and involve BCA in advocacy, lobbying, new guidelines, and government decisions around breast health. Locating in D.C. would make this partnership more feasible. Finally, the ED went to George Washington University and upholds relationships with former classmates in the area and sits on several university advisory committees. Thus, a partnership with George Washington University might be possible.

In addition to the four cities the ED requested, I chose to add Chicago and Greenwich to this analysis. Chicago has high breast cancer incidence rates (refer to figure three on page 6). Additionally, there are several hospitals, indicating potential partnerships, around the city (refer to figure seven on page 23). Furthermore, Chicago was recently ranked in the top ten cities for business relocation (Patel, 2015; Dill, 2014)

Expanding BCA's reach in the Greenwich area would not require a physical move, or even the need to open a new office. As such, Greenwich was added to the list of cities to consider because staying where BCA is currently located and building staff instead of opening a second office is also a way to expand. BCA is successful. An immediate growth strategy would be to host more events in Philadelphia, Boston and New York City. These cities fall within BCA's current 200-mile funding radius and researchers here already receive BCA funding that is raised in Greenwich. With a two-person office, expanding might prove difficult, unless they temporarily donate less of every dollar to accommodate the transition of adding another staff member to expand event reach.

The geographic scale of analysis in this study starts nationally, illustrating breast cancer incidence and top fifty breast cancer hospitals across the country. It then focuses on six cities of comparison: Boston, Chicago, Greenwich, Los Angeles, San Francisco, and Washington D.C. Given that BCA funds opportunities within a 200-mile radius of their office, this study also considers a 200-mile radius around the six cities listed above.

Figure Five: Areas of Consideration



Areas of Consideration with 200-mile buffer around target cities.

The extent around Boston is comprised of counties in Connecticut, Maine, Massachusetts, New Hampshire, parts of New York, Rhode Island, and Vermont. The extent around Chicago includes parts of Illinois, Indiana, Iowa, Michigan, Ohio, and Wisconsin. Greenwich includes counties in Connecticut, Delaware, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Los Angeles only encompasses counties in southern California. The San Francisco radius includes counties in northern California and parts of western Nevada. Finally, the Washington D.C. region is comprised of Delaware, Maryland, New Jersey, northern North Carolina, Pennsylvania, Virginia, and West Virginia. Given that these cities are continental, this study excludes Alaska and Hawaii.

Location Analysis Models

Location analyses typically use mathematical models to reach a decision. There are many models that can be used. The most popular are P-Median, optimization, decision trees and equity models.

One widely used model is the P-Median distance model. This is a linear integer program that determines the average distance traveled by visitors. The model finds a central point between all users as the suggested location for new facilities (Daskin, 2004). This is commonly used for location analyses that consider travel time and proximity problems.

A mathematical optimization model is also used in location analyses. In this approach, several selected criteria are optimized, or sorted based on preference. These criteria can even be structured based on social, economic, and political attributes or utility

theory (Calvo, 1973). This scoring method is used when several important characteristics need to be optimized simultaneously to determine the ideal location.

Decision trees are also commonly used in location decisions, too. This approach can be conducted in a excel document. Decision trees produce a tree-like graphic of decisions. This tool combines probability analysis to achieve optimal decisions in situations of uncertainty (Stevens, 2014). The technique in this model allows for comparison of multiple possible outcomes.

Lastly, another approach is to use an equity model. With an equity model, the criteria are equally distributed, where no one factor is more or less important than another. This is more of an exhaustive approach where everything can be considered without a heady negotiation to organize such factors (Schilling, 1994).

Geographic Information Systems

Although mathematical approaches are viable, a spatial representation is preferred for this client because of the ease when interpreting the output maps. The Board receiving these results is comprised of retired women with varying backgrounds. As such, a map is easiest for everyone to understand and relate to.

Spatial Geographic Information Systems (hereafter referred to as GIS), or cartographic map-making, can display the rich factors being considered over the landscape. This system is designed to store, manage, manipulate, analyze, interpret and present all types of spatial or geographical data. As a form of data visualization, or presentation of data in a pictorial format, GIS uncovers data traits that may not be obvious more easily and quickly (ESRI, 2016). This is especially useful when multiple parties are involved in the decision

making process and are looking to understand relationships, patterns, and trends (ESRI, 2016). It can even be used in conjunction with a numerical approach above.

GIS is essential when making decisions concerning location. GIS is described as the “go-to technology for making better decisions about location,” (ESRI, 2016). Understanding what is happening in geographic space is necessary in order to prescribe action. Mathematical models used for location that describe distance are not as effective as GIS because observers cannot visualize multiple factors at the same time.

GIS has been used to assess and quantify multiple values before. Specific Multi-Criteria Decision Analysis methods can be used in conjunction with GIS to offer data visualization and mathematical criteria weighting together (Ozturk, 2009). In a study by the US Geological Survey in Denver, Colorado, a team of researchers used this GIS approach to incorporate social values of information into the context of an ecosystem services assessment. This led to human dimensions and location jointly considered, yielding multiple areas in need of ecosystem services (Sherrouse, 2011).

A different group of researchers in Texas used a similar GIS process to perform an initial screening of an area to pick one location for a landfill. The purpose of this screening process was to eliminate unsuitable land to identify the most suitable site to locate the landfill. Here, researchers considered environmental, biophysical, ecological and socioeconomic variables to conduct a sensitivity analysis (Chang, 2008).

Another example of a GIS analysis is a vulnerability study. The concept of vulnerability has helped researchers consider the potential influence that biophysical factors have on human health (Cutter et al., 2008). The given value of vulnerability is considered specific and “place-based,” in that the degree of vulnerability depends on the characteristics,

exposures, sensitivity and spatial distribution in the place being influenced (Polsky et al., 2007). Using GIS, David Hattis and team assessed heat-related mortality and vulnerability in Massachusetts using GIS (2012). Without GIS, these researchers might miss the interconnectedness of variables or have trouble conveying results with the at risk communities.

For this study, GIS will be most useful. The spatial join functions allow for intersection visualization. This will be useful when considering breast cancer incidence data. Additionally, the boundary operations such as clip and buffer will be useful to contain the variables to the 200-mile funding radius BCA suggests (ESRI, 2016). Finally, GIS software allows for a multi-criteria decision analysis, which is key when considering multiple attributes and comparing the four cities. Indicators of interest are combined using a weighted linear combination (WLC) technique. WLC is used to derive composite maps in GIS by assigning a relative importance weight, or rank, to the variables of interest. Since the ED does not have a preference, all variables will be of equal importance, thus receiving the same assigned weight. This approach blends mathematical and spatial tools to provide a detailed story of the data (Malczewski et al., 2000; Drobne and Lisec, 2009).

Procedure

Using the aforementioned data, five variables and six cities, this comparative approach will help the client explore where to focus growth and expansion efforts. The first step was to select criterion to be evaluated for all six cities: Boston, Chicago, Greenwich, Los Angeles, San Francisco and Washington D.C. The indicators used include breast cancer

incidence rates, hospital location, competitor location, education, and income as previously detailed.

Cleaning the data involved deleting extra spaces and characters that cannot be read by the GIS software. Furthermore, cleaning the data ensured that all data points are similarly formatted and displayed using uniform units. For example, median household income data for the counties in Connecticut included cents, whereas the median household income data for the counties in Massachusetts rounded to the nearest dollar.

To process breast cancer incidence rates, a customized table was created from the CDC information. The customized Microsoft Excel table included two sheets. The first sheet contained incidence data for every single county in America. To create this sheet, each state was selected individually and added to the same sheet so that the data was in one place. The second sheet contained incidence data by state. This table was then joined to the state and county shapefile downloaded from the Census cartographic boundaries folder respectively (Figures two and three above).

Customized tables were also constructed for hospital and competitor location. After searching Top 50 Adult Cancer Hospitals on US News and World Report, a list of hospitals was generated. Searching for organizations that support breast cancer on the IRS database generated a list of competitors. The addresses and latitude and longitude coordinates were recorded for every site. This information was added to Arc Map, and the points were geocoded to display on the map.

Before analyzing the aforementioned criteria, a buffer of 200 miles was placed around Boston, Chicago, Greenwich, Los Angeles, San Francisco and Washington D.C. These are the cities BCA wants to consider.

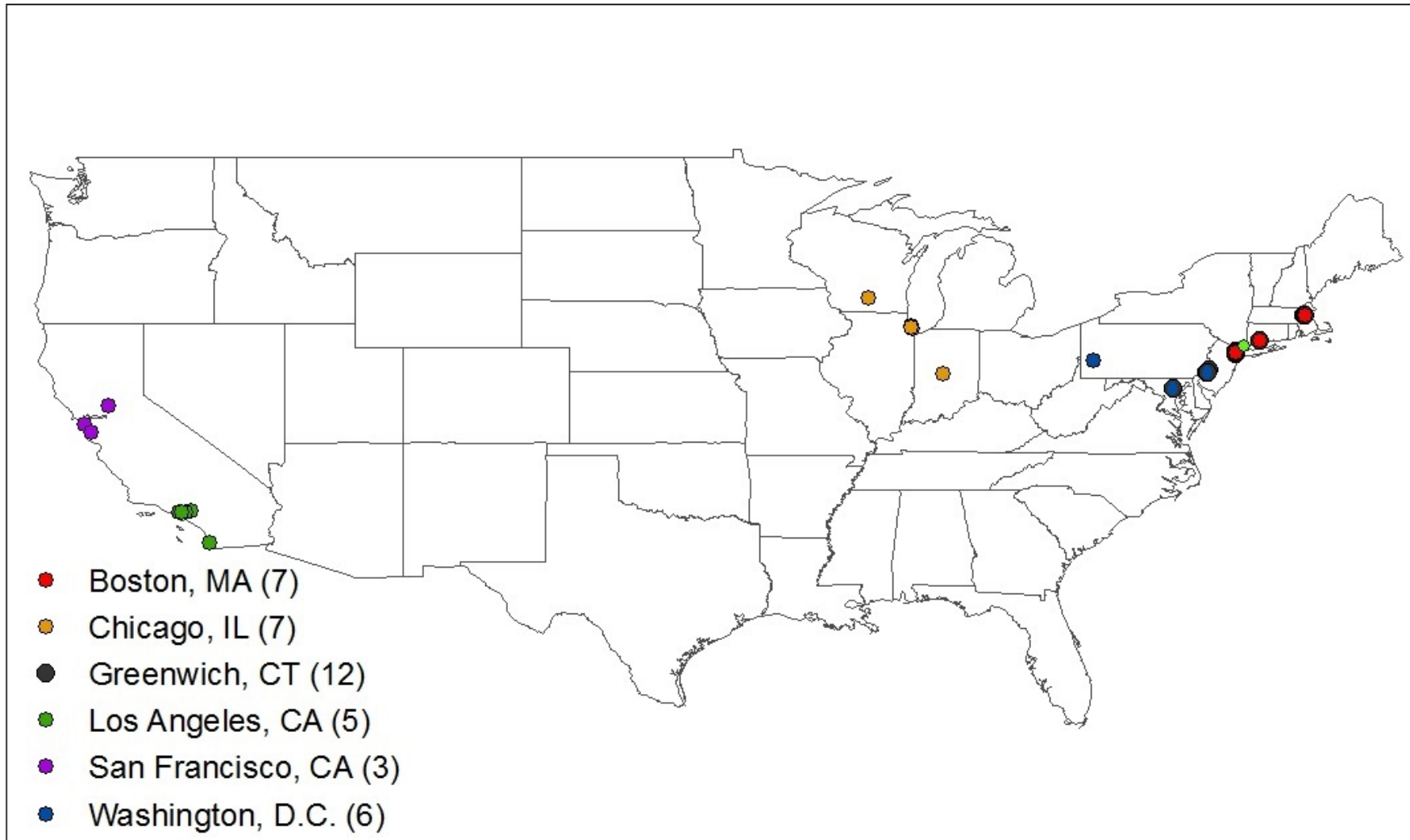
The education and median household income data were downloaded for the counties within the buffer zones. To create this sheet, each county was selected individually and added to the same sheet so that the data was in one place. The table was joined to the existing county shapefile.

Figure Six: Top 50 Adult Cancer Hospitals



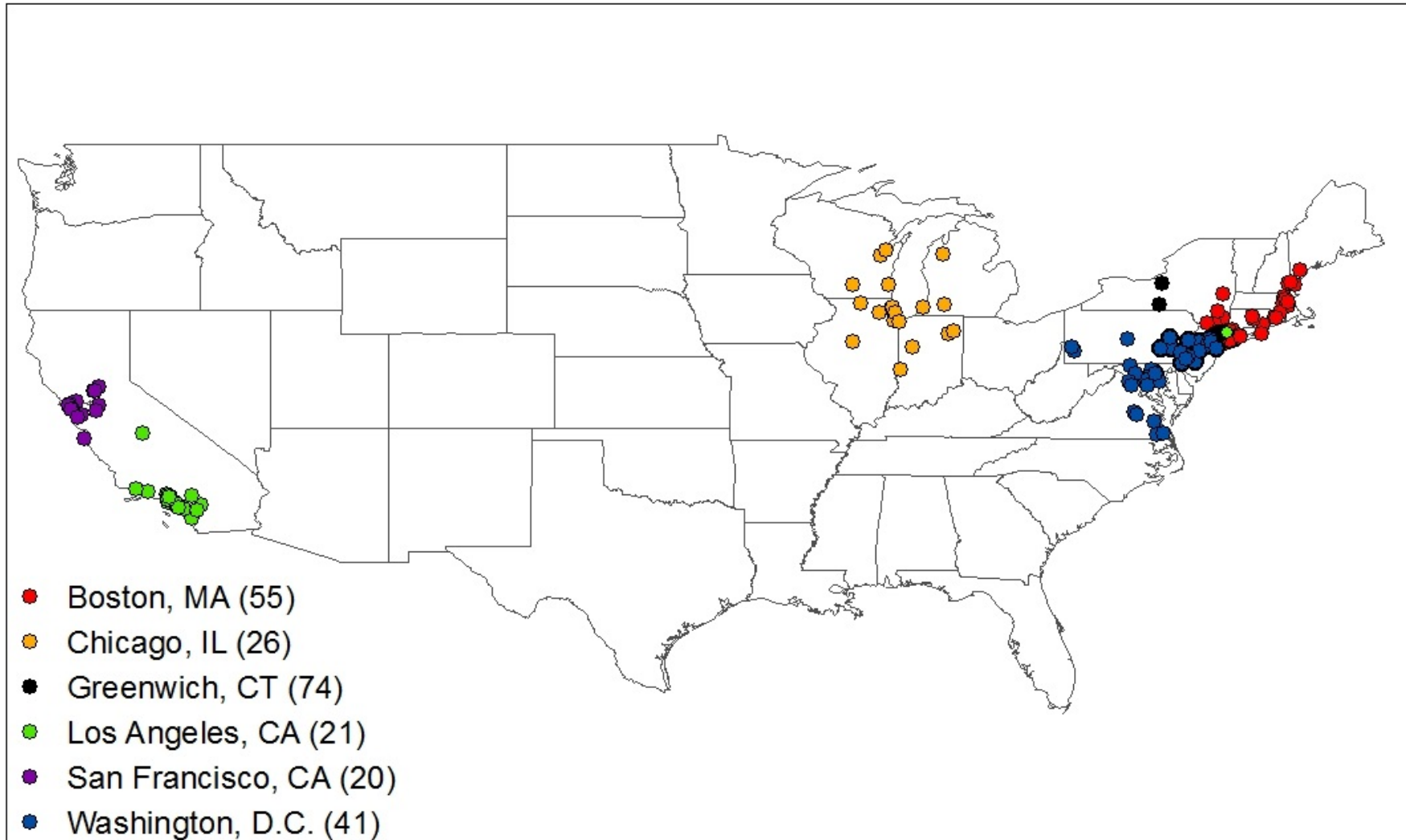
Top 50 Adult Cancer Hospitals ranked by US News and World Report

Figure Seven: Top 50 Adult Cancer Hospitals Considered



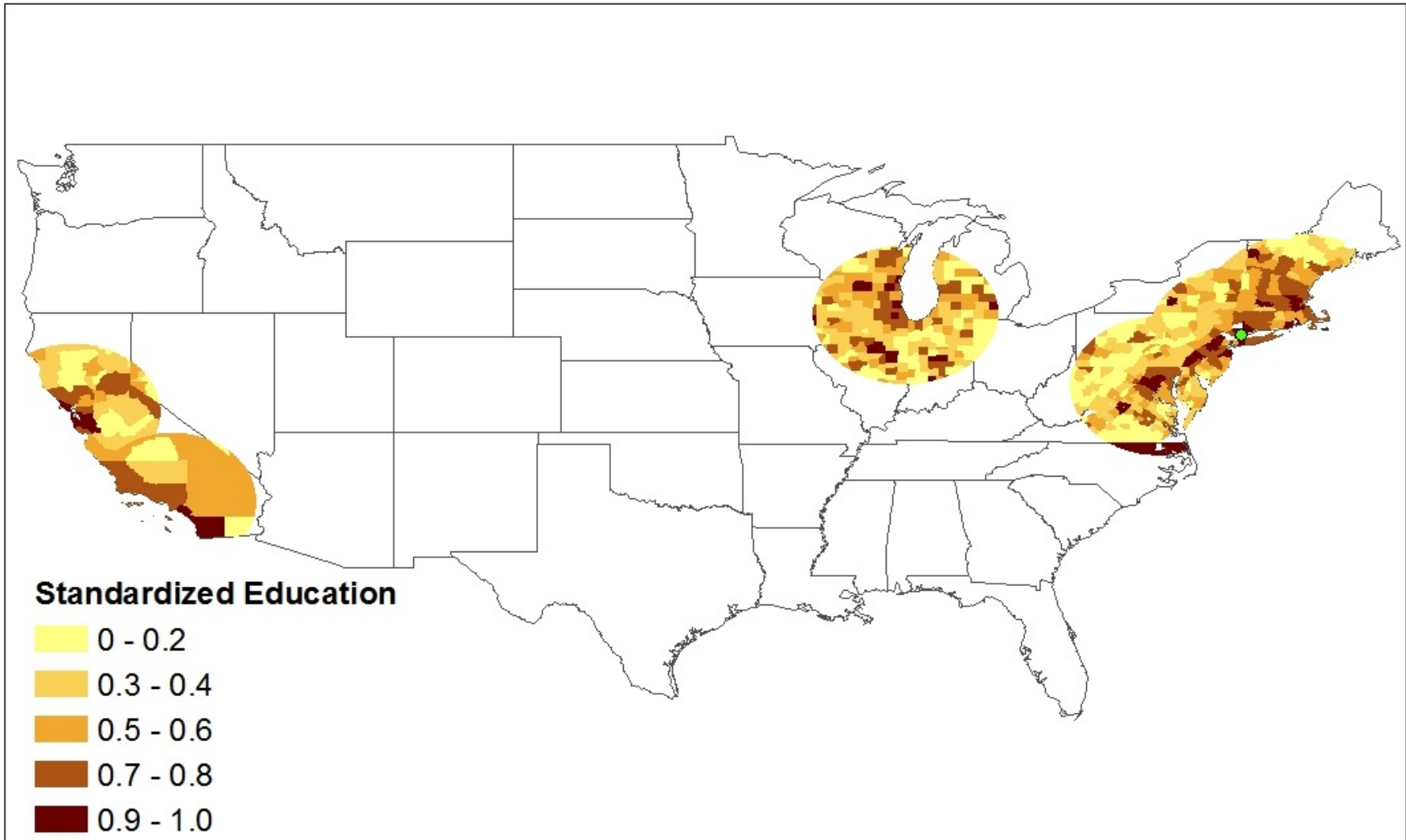
Top 50 adult cancer hospitals within 200-mile area of consideration around proposed cities. Red Boston points and blue Washington points on top of black points indicate Greenwich competitors, as the Greenwich area of consideration overlaps with Boston and Washington. The number in parenthesis indicates the number of competitors included in each city's buffer.

Figure Eight: Competitors



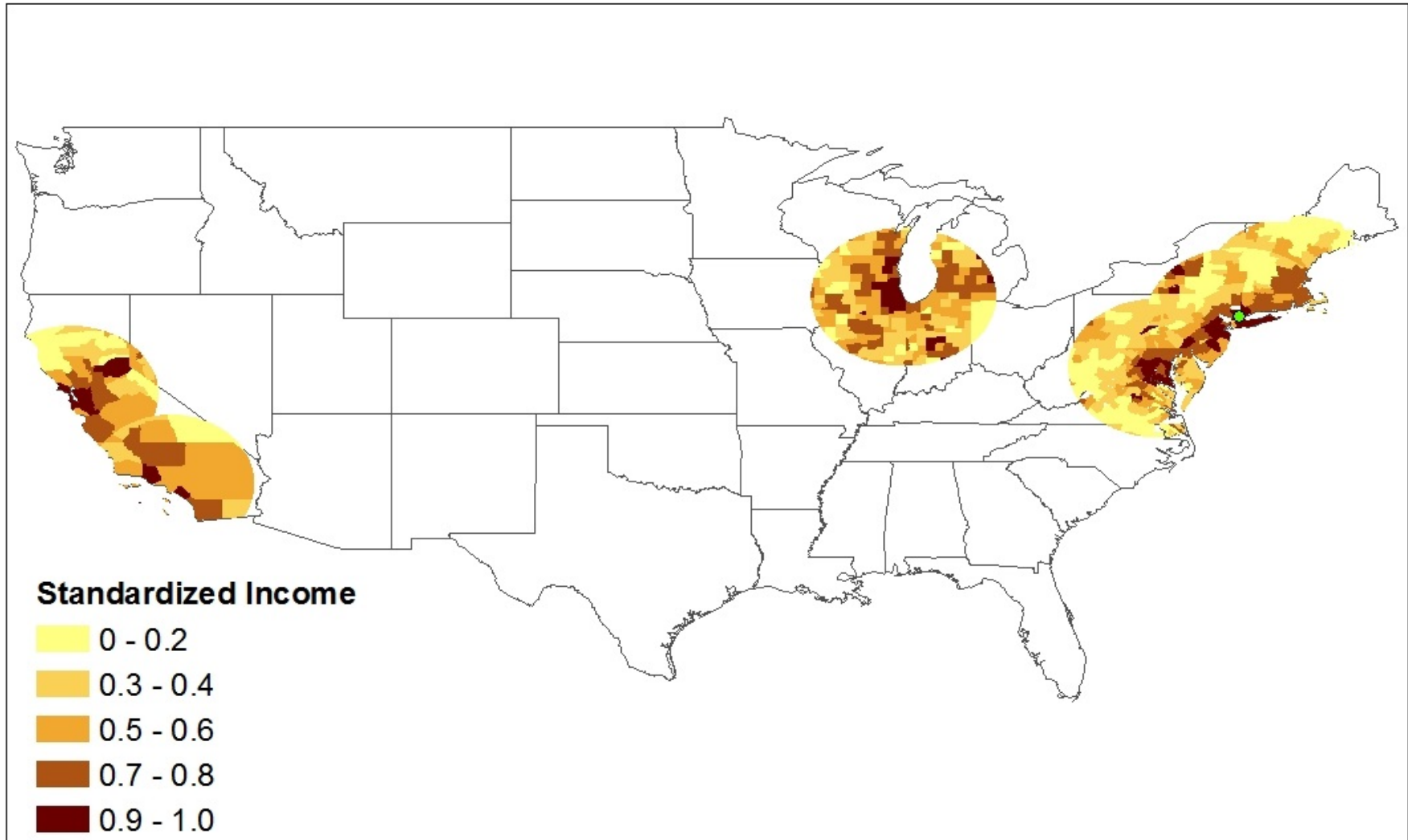
Potential competitors, 501(c)3 Breast Cancer charities, within 200-mile area of consideration around proposed cities. Red Boston points and blue Washington points on top of black points indicate Greenwich competitors, as the Greenwich area of consideration overlaps with Boston and Washington. The number in parenthesis indicates the number of competitors included in each city's buffer.

Figure Nine: Educational Attainment



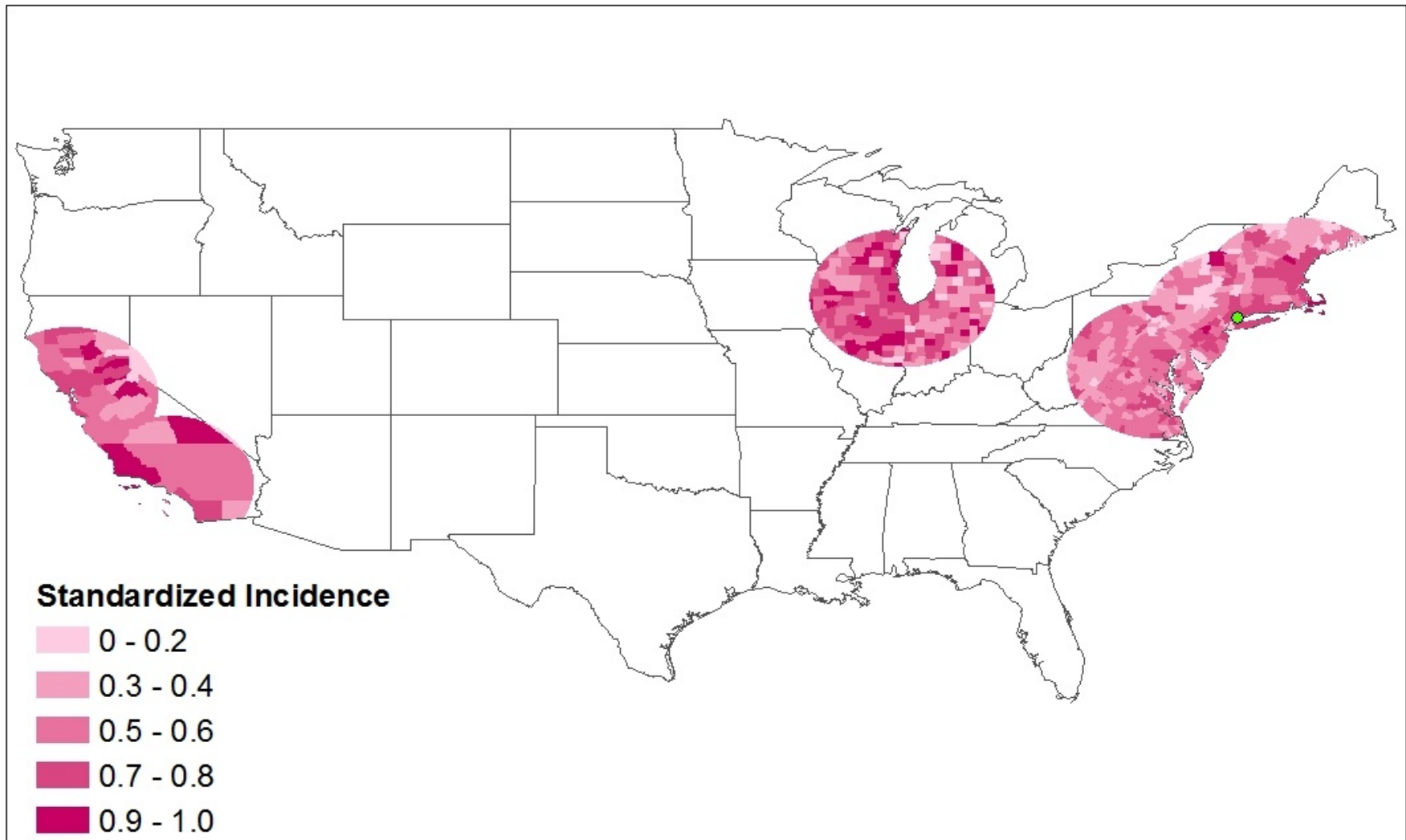
Percent of the population with a bachelors degree or higher standardized to a scale of 0-1.

Figure Ten: Median Household Income



Median household income standardized to a scale of 0-1.

Figure Eleven: Breast Cancer Incidence



Breast cancer incidence rates per 100,000 people standardized to a scale of 0-1.

All five indicators (breast cancer incidence rates, hospital location, competitor location, education, and income) were standardized to the same scale before they were aggregated. The following formula was used to change the variables from absolute value to a scale of 0-1: $\text{New Column} = (X_{\text{indicator}} - \text{min}_{\text{indicator}}) / \text{max}_{\text{indicator}} - \text{min}_{\text{indicator}}$. In this formula, the new column is the resulting column scaled 0-1; the X indicator is the particular input value being recalculated; the min indicator is the minimum absolute value for the entire indicator; and the maximum indicator is the maximum absolute value for the entire indicator. This process normalizes all variables and naturally accounts for differences in range.

The standardized score for the five indicators for each county within the city buffer zone were averaged to get a final weight for each city considered. This is the equivalent of assigning a preference weight of 0.20, or 20% of the total, to each variable. The new assigned “value” to each city is ranked highest to lowest. The highest number is the city recommended to BCA.

Chapter Four: Findings

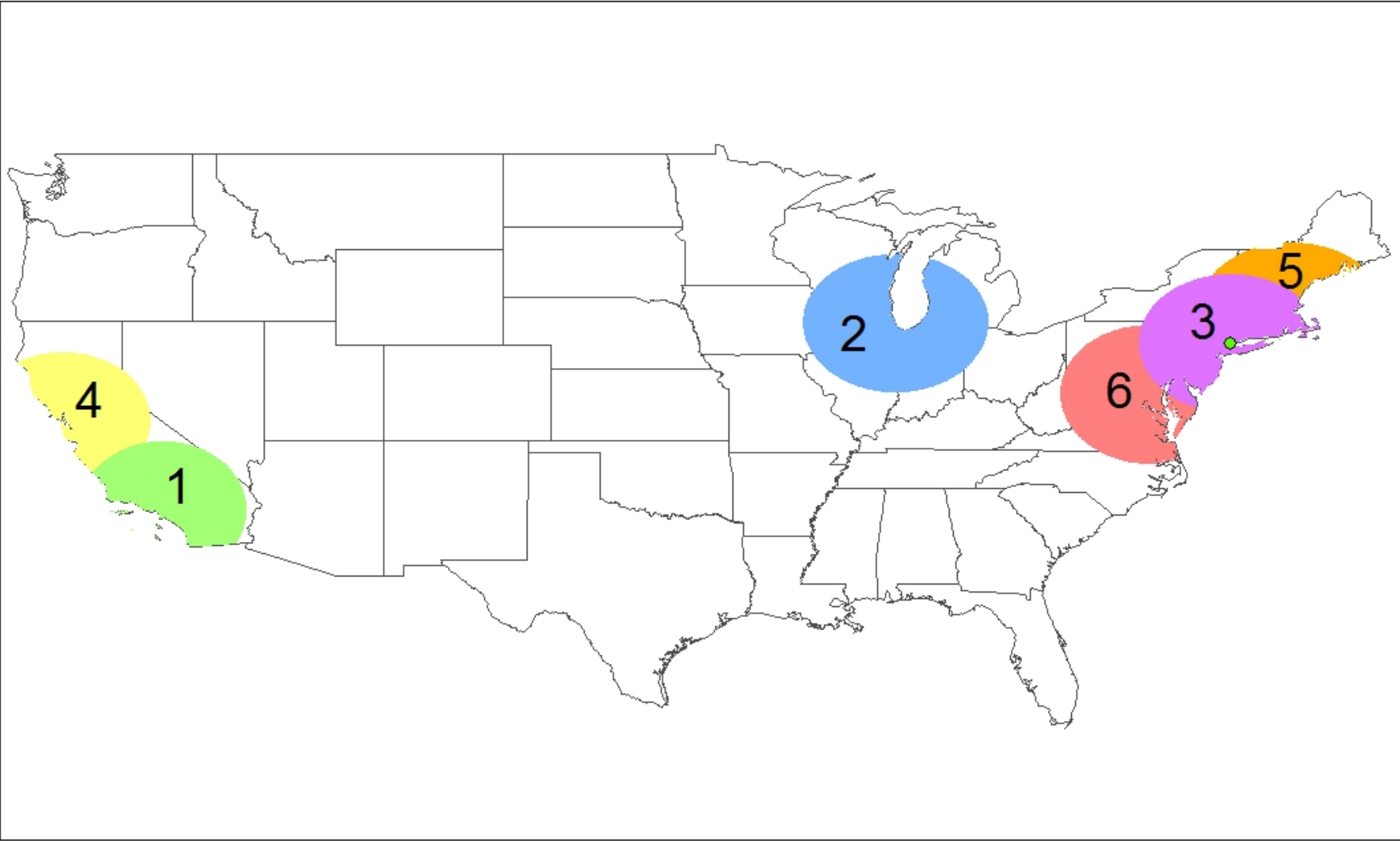
Results

While each factor, displayed spatially above, points to a favorable new location, upon aggregation, the highest ranked city is Los Angeles with a score of .43. The least highly ranked city is Washington, D.C with a score of 0.24, which was only a few points behind Boston at 0.29. Chicago, Greenwich, and San Francisco were closely ranked, comparable options with scores of 0.42, 0.41 and 0.38, respectively. These scores are relative and generated using averages. Table one highlights the variables used to determine the final ranking. Refer to figure eight below.

City	Number of Competitors	Number of Hospitals for Collaboration	Average Annual Breast Cancer Incidence (per 100,000)	Average Income (per year)	Average Percent of Population with Bachelors Degree or Higher	Normalized Awarded Score after Scaling (scale of 0-1)
Los Angeles, CA	21	5	105	\$61,422	20%	0.43
Chicago, IL	26	7	117	\$51,107	15%	0.42
Greenwich, CT	74	12	128	\$55,381	26%	0.41
San Francisco, CA	20	3	103	\$58,997	22%	0.38
Boston, MA	55	7	129	\$56,047	28%	0.29
Washington D.C	41	6	122	\$55,093	21%	0.24

Table One: Breakdown of variables used in analysis.

Figure Twelve: Final Recommendation



Discussion

The results of this study suggest that Los Angeles is the preferred city to open a second office. The second choice would be to move to Chicago. A close third choice would be to stay in Greenwich. Fourth would be moving to San Francisco. Fifth would be expanding to Boston. The final choice would be to move to Washington D.C., which was ranked last by a large margin.

The top three cities are very closely ranked. Each city offers clear advantages and disadvantages to relocating there.

If BCA is most interested in funding new opportunities and generating a large amount of money to accommodate more grants, I recommend Los Angeles. The two clear advantages to moving to Los Angeles are the low number of competitors and the high median income, indicating a great capacity to give. The primary component of BCA's identity is providing grant money to researchers.

The indicators used do not capture the feasibility of conducting business in Los Angeles, however. Having an office in Los Angeles and an office in Greenwich would require incurring added costs of flights, which average \$270 for a one-way ticket (Expedia, Inc, 2016). Additionally, BCA would need to upgrade technology to accommodate virtual collaboration and meetings. There is a three-hour time difference between Los Angeles and Greenwich, which can strain communication between offices. Furthermore, moving to Los Angeles might make it difficult to maintain same identity since they are opposite sides of country.

If BCA is most interested in maintaining their identity while expanding, I suggest Chicago. Expanding to Chicago, allows BCA to focus on hospital partnerships in a high need area. The collaboration BCA conducts with hospitals is meaningful as it is the cornerstone of BCA's current mission and goals. When considering Chicago, there is still a cost associated with flights, however, the average one-way ticket piece is \$100 (Expedia.com, 2016). Additionally, the time difference is only one hour. However, a technological upgrade would still be required. Lastly, the 200-mile area of consideration buffer zone around Chicago includes the most area, and thus might require the most BCA management. The other five cities are coastal, so part of their coverage includes the ocean.

If investing money is a constraint, staying in Greenwich would be preferable to opening a second office, as it will likely result in the cheapest expansion costs. In order to stay in Greenwich while maintaining relevance and increasing income, a third employee, and potentially a larger office, is needed to increase capacity. In busy seasons with a lot of events and site visits, BCA feels the stress of being a two-person operation. By having such detailed due-diligence policies, the ED spends a fair amount of time out of the office and on the road visiting grant recipients. Volunteers are helpful, but they do not provide the same kind of human power as having a third employee, for example. The drawback for staying in Greenwich is not being able to develop new partnerships with donors, researchers, and individuals affected by breast cancer.

The bottom three cities are not closely ranked. Each city presents an interesting contrast to the top three cities in that their rankings are not intuitive based on the initial reasons for selecting each option.

San Francisco was ranked fourth. This was a higher rank than expected due to mediocre values for all variables. Aside from the ability to invest in new research topics, I did not find this to be an overwhelmingly positive or negative option. Given the financial profile of both California cities, it is not surprising that Los Angeles was ranked above San Francisco.

Separately, it is interesting to take a closer look at Boston and Washington D.C. as viable options. The 200-mile radius around these cities overlaps with the 200-mile radius around Greenwich. BCA's credibility is rooted in their due-diligence policies, whereby the staff visits every site that is funded. BCA's Greenwich office has the ability to interact with 12 of the top 50 hospitals in their 200-mile radius restriction. As a result of overlapping buffers, or funding areas, opening an office in Boston would not include any new hospitals that are not included within the scope of the Greenwich office. Opening an office in D.C. would only introduce one new potential partnership.

The advantages to expanding to Boston would be the ability to exploit a different base of donors. Boston is the third most wealthy city considered with the highest percentage of the population holding a bachelors degree or higher. Beyond this however, Boston does not offer much that Greenwich does not already offer, except more competitors. Rather, it arguably offers the most feasible way to expand quickly, safely and close to home.

Washington D.C. was ranked last. If the funding area around D.C. was expanded to 250 miles, D.C. would only offer three new hospital partnerships—the same as opening in San Francisco. As such, it would be expected to rank more closely with San Francisco.

Recommendations for Future Analysis

The first recommendation when considering accepting the results of the report is to experiment with different preferential weighting based on the ultimate goal for expanding. Using a slightly different methodology, such as a spatial preference-weighting analysis, to re-evaluate the five cities might be beneficial. Using a preference weight would allow for ranking variables and assigning an importance “weight” to such variables. In the weighted linear combination decision rule, a low score of one indicator can be compensated by a high score in a difference indicator within the same polygon. In light of this trade-off, it might be useful to reconsider this analysis using a different ORness within the ordered weighted average (OWA) technique. The WLC is a style of OWA, using an ORness of 0.5. These different decision strategies indicate how much of a type two error they are willing to accept (Brobne and Liseć, 2009; Ratick and Osleeb, 2011). Future research can increase the ORness to 0.7 or 0.9 and compare what new areas become more vulnerable as a result of changing the ORness.

City	New Normalized Awarded Score after Scaling (scale of 0-1)	New Rank
Los Angeles, CA	0.43	1
Greenwich, CT	0.41	2
San Francisco, CA	0.40	3
Chicago, IL	0.39	4
Boston, MA	0.32	5
Washington, D.C.	0.29	6

Table Two: Goal to Maximize Income: The following weights were used for this table: income at 60%, education at 10%, breast cancer incidence at 10%, competition location at 10%, and hospital location at 10%.

City	New Normalized Awarded Score after Scaling (scale of 0-1)	New Rank
Chicago, IL	0.50	1
Greenwich, CT	0.49	2
Los Angeles, CA	0.35	3
Boston, MA	0.32	4
San Francisco, CA	0.25	5
Washington, D.C.	0.23	6

Table Three: Goal to Maximize Impact: The following weights were used for this table: income at 5%, education at 5%, breast cancer incidence at 50%, competition location at 5%, and hospital location at 30%.

A second recommendation would be to change the radius of feasibility around each city. This study uses 200 miles, since this is what BCA currently uses for their funding extent. Results may vary if this radius is expanded or limited. Reducing this radius may be more realistic when considering a new location since the new office will already be incurring opening and start up challenges. A smaller radius may be more manageable.

A third recommendation would be to consider additional variables. Perhaps it might be beneficial to consider locations of colleges and universities to suggest intern assistance and funding and event capacity. It is also important to note that these results do not take into consideration price of rent in the selected cities, availability of office space, or labor market, which could also be useful. Lastly, this analysis only considers the top 50 highly ranked breast cancer hospitals. As such, many meaningful programs, hospitals and impactful researchers were inadvertently excluded.

Lastly, when considering accepting the results of this report, BCA should ensure all Board members are on the same page and are supportive of expanding. Furthermore, the decision-makers at BCA should clearly define the goal of expanding. For example, if the

goal is to maximize donation income, BCA should move to Los Angeles, whereas if the goal is to maximize hospital partnerships, BCA should move to Chicago.

Limitations

A limitation in this study is the data. Given that this is a preliminary study, the data was sufficient. However, a deeper analysis would require a more holistic data set. For example, only the top 50 hospitals were considered, when there are many more hospitals that service breast cancer patients. Furthermore, the American Community Survey was used for the education and income rates. The survey collects a random sampling of responses annually, whereas a Census dataset, which is now slightly outdated, collects information from all residents.

Chapter Five: Conclusion

Planning is a critical component to community development and engagement. Where an organization is located can significantly impact the effectiveness of its work. Furthermore, facility location is critical to maintain the livelihood and relevance of an organization. There are many constraining factors that should be weighed in order to determine the most sustainable office initiation or relocation option. And, special consideration should be placed on the practical ability to move forward with a project, not just the best theoretical considerations. This report demonstrates the need for spatial GIS consideration when reaching a location decision involving multiple stakeholders, since unlike GIS, mathematical models used for location do not provide a way to visualize multiple factors at the same time.

Should the ED of BCA readily accept the results put forth in this report without further research, the next step would be to contact a real estate broker and consider office space in Los Angeles. Simultaneously, the board would need to discuss hiring, finances, and structure of BCA to truly accommodate opening an office across the country. These discussions could include a projection analysis to anticipate how much money would be generated from fundraising events hosted from the new location; generating a notice to send donors to let them know of the change; and lastly, an analysis of how much money of every dollar comparable competing charities donate, which could indicate an appropriate adjustment in order to sustain the expansion efforts.

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