

Capstone Project:

ENDING HOMELESSNESS ONE COUNTY AT A TIME

Christopher Semkow

Pia Rahman

Georgetown University

Author Notes

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Introduction

Homelessness is a socially indiscriminate crisis affecting nearly half a million individuals in the US at any given time at a taxpayer cost of \$20 billion each year (Moorehead, 2012). The homeless head count varies and is sensitive to external factors such as socio-economic fluctuations (housing market and unemployment volatility), as well as individual factors (alcoholism and mental illness).

The difficulty in addressing homelessness is not without its challenges, as articulated in this Capstone Project. While our proposed approach in alleviating and preventing homelessness may sound simple, its implementation can be shadowed by nuanced deficiencies and systemic failures in addressing the problem from a governance and humanitarian standpoint. Before we attempt to address the problem of homelessness and proceed any further, we must first ask ourselves if the root cause and deficient resolution are based on ulterior motives in perpetuating homelessness, ignorance or indifference. We will demonstrate that the answer to this question is more complex, but in no way is the problem in addressing homelessness attributed to a lack of caring by many self-sacrificing individuals representing various industry sectors and walks of life.

Why does homelessness occur, what is its impact on society, and how do we prevent it? These three fundamental questions form the basis of our research and lay the groundwork in seeking answers. Our approach begins by gathering publicly available data from government, Non-Government Organizations (NGO), academic and other relevant sources. Although most published data come from similar sources, multiple disparate sources are necessary to account for variations in both homeless head count methodologies as well as data classification (e.g. defining chronic versus non-chronic homeless). Next, we will perform data analysis to better

understand homelessness cause and effect characteristics including risk factors and propose a mitigation strategy to prevent it. In doing so we will also expose the cost of homelessness on society and demonstrate that investing in preventative measures could provide significant cost savings to tax payers.

Problem Statement

Homelessness across the US has been on the rise since 2016, with over 500,000 individuals identified in 2017 alone (Johnson, 2015). Costing taxpayers as much as \$40,000 per homeless individual annually (Moorehead, 2012), certain causes are well documented using quantitative metrics such as inflation in housing market and unemployment (all of which are directly tied to the economy), whereas qualitative factors such as illness, substance and domestic abuse are less documented and understood.

The sobering truth is that homelessness rarely discriminates against race, religion or income, and in fact tends to be opportunistic in nature. It is not a disease or symptomatic of unmotivated individuals who can't follow society's rules. With rising health care costs, a volatile economic climate, a struggling middle class, high housing costs and drug epidemics, these are but a few of the risk factors that can lead otherwise productive members of society to become homeless. In addition, homelessness is not an isolated problem that impacts individuals and families only – social outcasts and 'non-citizens' to be ignored and forgotten by society. Like unemployment and other social problems, homelessness places a strain on the fabric of our society at varying levels and for different reasons. It requires substantial funding for social services (e.g. shelters, emergency rooms, law enforcement) which places an economic burden on our communities and nation.

Although any homeless event can be devastating, homeless individuals under the age of

18 such as runaways are statistically unlikely to recover and become productive members of society. According to Housing and Urban Development (HUD) statistics, \$2.38 billion was spent on homelessness assistance in 2016, but only \$134 million on youth services - only 5.6%. In addition, created in 1974, the Runaway and Homeless Youth Act created to assist underage and young homeless adults across the country is consistently underfunded by Congress by 28%, having reached a budget plateau of \$119 million (Kim, 2018).

With a nationwide HIV infection rate of 0.5% for the entire US population, and a 20.6% average HIV infection rate among homeless individuals, the resulting 4,000% increase could be considered a health crisis and a clear and imminent danger in both containing the disease and protecting the population (Fox, 2008).

While homelessness is acknowledged as a problem and addressed to some extent, its full scope and impact on society are not well documented, leading it to be managed in a reactive way as opposed to a proactive way. If statistical causes for homelessness were better understood and documented, most of which are related to social factors, preventative measures could be taken to mitigate risk factors – not just treat the problem but prevent it.

It is not a problem that can resolve itself without intervention given how most factors leading to homelessness are related to social factors as opposed to individualistic ones, thus causing the internal locus of control to shift away from that individual. In addition to the financial impact homelessness has on our economy through funding of social programs at tax payer expense, other factors such as drug waste, encampments and disease which are frequent outcomes of homelessness affect communities. Due to lack of health care, homeless individuals are less likely to practice personal hygiene and proactively maintain good health.

Homeless are susceptible to opportunistic and chronic illness resulting from their

exposure from the elements, malnourishment and drug abuse – all of which take a toll on hospitals, emergency rooms and law enforcement. In addition, they pose a health risk to the community by relieving themselves outside and discarding used drug paraphernalia in public or in unsafe places. According to a Center for Disease report published in 2008, epidemiologic studies of homeless individuals have demonstrated alarming prevalence rates for the following infectious diseases across the United States as summarized in Table 1 (Badiaga et al., 2008):

Condition	Homeless Rate of Infection
HIV	6.2%–35%
Hepatitis B (HBV)	17%–30%
Hepatitis C (HCV)	12%–30%
Active Tuberculosis	1.2%–6.8%
Scabies	3.8%–56%

Table 1 - Infections Affecting the Homeless

Defining the Problem

Methodologies for counting the homeless population differ amongst a spectrum of US Government agencies, NGO's, and academia for two primary reasons. First, there is no universally accepted definition of the term homeless. HUD defines chronic homelessness as someone having a disabling condition and without shelter (homeless) for more than a year or having experienced four episodes of temporary homelessness during a 3-year period (Nicholas et al., 2018). Other agencies and NGOs have their own definition based on arbitrary metrics required to address (or at a minimum discuss) the problem. However, no regulatory or governing body exists to oversee or provide a framework for defining and counting homeless individuals. From a non-scientific standpoint, while the term homeless translates to not having a place to stay (not having a home), it is only a noun used in a sentence and yet has a profound nuance in describing the condition which is often juxtaposed with an observer's personal experiences, bias and assumptions. For example, how can one differentiate between short term

(which subjectively only last days or weeks), chronic or long-term homelessness? If long-term, how does one quantify it, and in doing so, define its meaning?

Equally important is differentiating between sheltered (receiving help either through friends or social assistance such as shelters) and non-sheltered – living on the streets. Should an individual with or without a family who lost his or her home and staying with friends or relatives be counted as homeless, and on what merit and criteria should public assistance be given? The predicament leading to their homelessness could be equally as devastating as those living on the street. Therefore, is the definition of homelessness based on causation (what events lead to losing a home), outcome (being homeless), or both? Second, counting homeless individuals is challenging due to their removal and isolation from society which would otherwise capture metrics about them through digital fingerprints (e.g. bank and mobile phone accounts). Homelessness, regardless of which definition we adopt, does not possess the same metrics as non-homelessness, and cannot be tracked through organ donor or voter registration status for example. It is not stamped on our driver's license, and Governments and corporations will not declare us homeless because we dropped off society's radar. However, there are several methods used to count the homeless population.

Homeless Count Methodologies

One count methodology relies on Indirect Estimation which leverages shelters or other (indirect) sources to provide a homeless count at a specific location and point-in-time. Single-contact census relies on direct observation (and count) of homeless individuals at a specific location and time and extrapolates that information to derive a number for a larger area such as city or county (Cowan et al., 1988). Regardless of the methodology employed, challenges in obtaining a homeless head count revolve around a lack of consensus surrounding the definition

of the term, homeless individuals being counted multiple times due to their mobility and inclination to frequent multiple social services organization or single-contact location, or never being counted for various reasons such as isolation from others or social services.

When counting homeless individuals, differentiation must be made regarding the category they fall into which is divided into three general groups:

- **Chronic:** Individuals who are homeless for an extended period or in frequent bursts. While some agencies such as HUD have their own metrics, they tend to be nebulous and lack specificity and consistency in addressing duration and frequency.
- **Transitional:** Individuals who rely on shelters for short periods of time. This is the most common type, and usually involves younger individuals with temporary shelter needs due to catastrophic events such as natural disasters.
- **Episodic:** Individuals who show a pattern of cyclic homelessness, typically due to substance abuse, unemployment, or mental illness.

Unfortunately, there is a crossover between each group which is poorly differentiated, meaning that a certain percentage of homeless individuals may either transition between groups in a discrete manner which affects the count, or be counted multiple times based on the multiple groups they are a part of based on the count methodology and point in time. Unless specified in the data source, homeless numbers are assumed to include all three categories.

Research Methodology

Proper research requires a methodology which, for this project, involves identifying both a problem and an expected research outcome (what we are solving). Once identified, our research design approach includes the following steps in assessing risk factors, socio-economic trends, and cost benefit in mitigating homelessness:

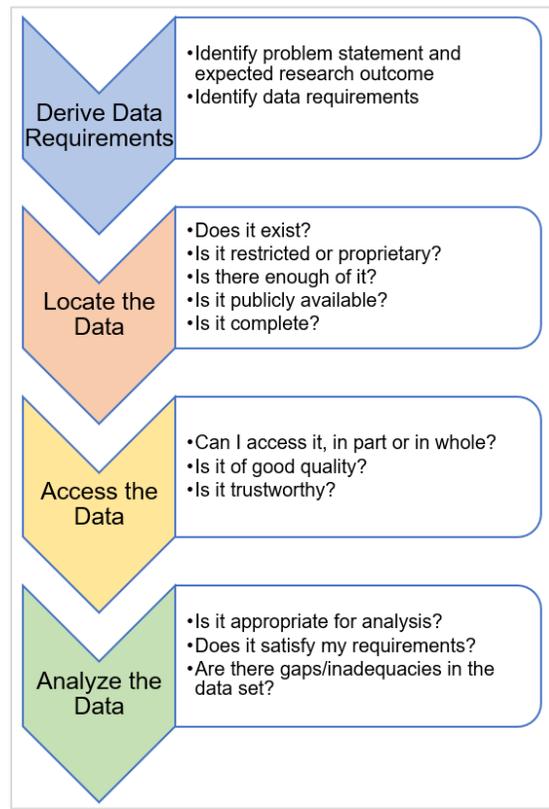


Figure 1 - Research Framework

Defining Areas of Research

The challenge in conducting research on homelessness has to do with the complexities associated with the problem from governance, social and individual (homeless) standpoints. Regardless of the abundance of data, a lack standardized system of identification and classification pertaining to homelessness makes extrapolation even more challenging. For this reason, our approach in conducting research is to compartmentalize homelessness into three components or data sets (not to be confused with the classification of homelessness):

- Risk factors leading to homelessness, such as unemployment and mental health. These factors are well documented and vary based on location, geographic-economic health and life situations unique to each individual.

- Socio-economic trends. Using data covering a 10-year period (or more), research existing socio-economic data in a specific location over a time period to expose trends (e.g. unemployment, housing market, substance abuse) and leverage as an indicator to predict future spikes in homelessness using risk factors.
- Cost benefit in mitigating homelessness Return on Investment (ROI). Research publicly available data demonstrating how the government can save money by funding social programs to prevent homelessness instead of focusing solely on programs to assist individuals who are already homeless.

Each area has its own challenges in terms of how well the problem is understood and documented. For example, financial benefits in ending homelessness can be measured accurately (albeit, using a small sample size) by differentiating between cost per homeless over a period of time and cost to remove that individual from a homeless state. While multiple variables come into play, such as category of homelessness and location, quantifying cost savings is achievable and discussed in the Simple and Multivariate Regression Testing Section.

In contrast, establishing a correlation between socio-economic factors such as housing market and unemployment which can lead to homelessness is more challenging. The Washington DC metro area which includes Fairfax County as the focus of research has some of the highest housing and living costs in the nation; 19.1% greater than the national average (Frohlich, 2018). In contrast, homelessness rates in Virginia and Washington DC stand at 1.08% and 1.25% respectively, which, while elevated, are not proportional to the high cost of living in that area (U.S. Interagency Council on Homelessness, 2018).

Another point to consider when performing research is determining a consistency in trend relationship. For example, when comparing the top 10 most affordable states ranked by

CNBC against their homeless population rates, we see a lack of correlation between the two (Cohn, 2018). We would expect the homeless rate to be linear with respect to the state ranking, which it isn't as demonstrated by the saw-tooth pattern in the graph (Figure 2). Michigan ranked fourth as most affordable state to live in, with a homeless percentage rate of 1.5%, which is 0.25% greater than Washington DC, one of the least affordable cities in the country. From this observation we can deduce there are other more complex causes and risk factors that come into play regarding homelessness (U.S. Interagency Council on Homelessness, 2018).

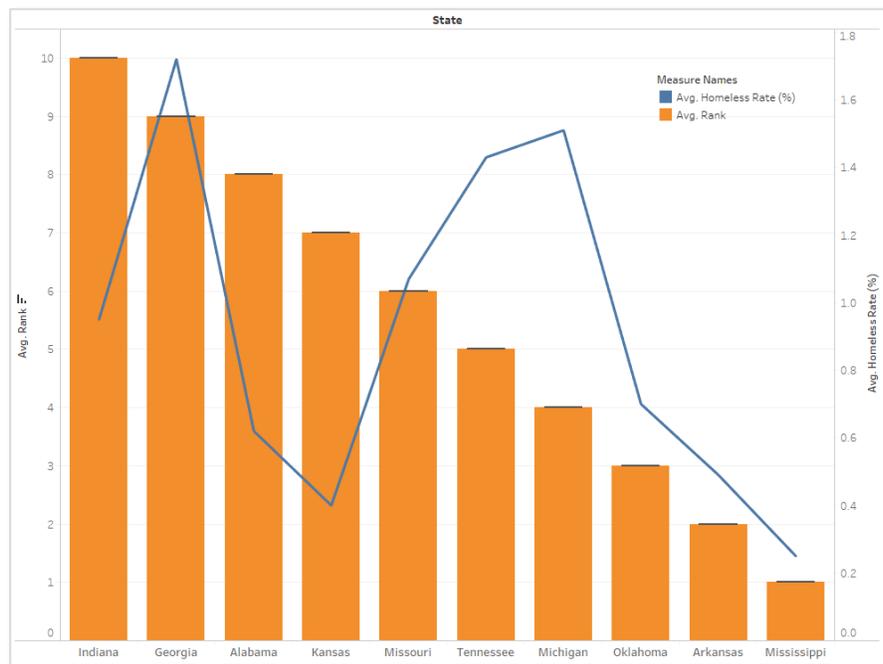


Figure 2 - State Affordability Ranking Versus Homelessness

These are important points of consideration given the less than conclusive relationship between cause and effect as demonstrated in this graph. There is no clearly defined single point of failure which leads to homelessness, and therefore our area of research and methodology must rely on more quantifiable risk factors and ROI in preventing homelessness in Fairfax County, Virginia.

Defining Sources of Data

Having identified our areas of focus for our research, the next step involves identifying each source as a point of data collection. Government agencies and NGOs that gather homeless statistics typically perform a variation of a point-in-time count which involves counting individuals in shelters and on the street on any given night (Homeless Count Methodologies). For this project homeless and other relevant data will be obtained through government sources, including NGOs, whose empirical data and statistics are available on public websites.

Based on abundant yet disparate data surrounding homelessness, key relevant data must carefully be collected from varying sources, including (but not limited to) the National Coalition for the Homeless, U.S. Interagency Council on Homelessness, and HUD. Table 2 breaks down homelessness into three distinct categories for better differentiation, data mining and analysis – location (where they sleep), socio-economic (why they became homeless) and duration (recurrence and length of homelessness). These data set for each category are important as they can be correlated to address risk factors leading to homelessness as well as mitigate risks.

Data Set	Purpose	Examples
Risk Factors	Establish statistical risk factors which could cause an individual to become homeless	Unemployment, housing costs, medical bankruptcy, substance abuse, mental & physical health, domestic violence
Federal Homeless Statistics	Establish a baseline when comparing national versus local statistics with similar criteria	Chronic and non-chronic homelessness across various socio-economic sectors with varying risk factors
State Statistics	Gather state statistics	Employment and unemployment rates, housing costs, substance abuse and crime rate
Continuums of Care (CoC) Statistics	Gather county level statistics	Employment and unemployment rates, housing costs, substance abuse and crime rate, factors unique to each county

Table 2 - Data Sources

Our approach is to use the Internet to conduct research involving homelessness (problem) and ways to reduce it (outcome). This involves searching for and collecting publicly available data whose sample size is sufficiently large (10 or more years) and possesses proper qualitative and quantitative properties (full data sets consistent with other sources) for effective analysis during the first project phase. Iterative steps will be taken to seek multiple sources of public Internet data if necessary until our data set is deemed satisfactory for analysis.

Site Data and Reputation

As previously mentioned our research will rely on data found on Government (Federal, State and County) sites that are reputable and serve as official sources for empirical data. Equally reputable, non-profit (NGO) and academic sites provide abundant and relevant data and tend to offer nuances and varying perspectives on the topic. These public websites provide

structured and unstructured data, reports and scholarly articles necessary for proper research and analysis. Sample sites include (but not limited to) National Coalition for the Homeless, U.S. Interagency Council on Homelessness, and HUD.

However, what constitutes a reputable site, and how do we distinguish them? The first step is to select well-established sources whose data is likely to be peer-reviewed. Validating the veracity of our data is critical, and leveraging credible sources including official government sites such as HUD or NGO sites such as National Coalition for the Homeless ensure our approach is sound. Data from smaller or lesser known organizations including NGOs and associations whose credibility is not fully established will not be considered due to their questionable trustworthiness. For example, are such organizations data sources and analysis tainted by funding or political affiliation (agenda)? Even if the data is accurate, the motivation behind it may be questionable and, in some cases, accurately present one side while leaving the other out.

Analysis

Given the broad definition of the term homeless, it is impractical to analyze data from multiple sources using unspecific search criteria and metrics without first narrowing the scope. General risk factors leading to homelessness must be understood, while also assessing correlations between unique socio-economic conditions and discrete geographic locations – all of which can either introduce new risk factors or aggravate existing ones.

From the Macro to the Micro: CoC VA-601

Present in major cities and counties throughout the US, HUD funded Continuums of Care (CoC) provide various services, including shelters, outreach and wellness programs. Each

geographic location poses unique challenges in determining root cause leading to homelessness.

For this project we will take a divide and conquer approach and address a specific location: Fairfax County, Virginia (CoC VA-601). This county presents a good starting point due to its size, population, cultural and economic diversity. Not meant to be a template for other counties and states, this first phase will serve as a framework to be applied at other locations at later stages. Behind each homeless statistic is an individual with a story to tell, and the same holds true for CoCs whose stories and mission revolve around socio-economic-cultural factors unique to their geographic location.

Homeless Risk Factors

Referring to Figure 3, regardless of the location homelessness can be caused by a single or combined risk factors. The purpose of our research is to analyze and understand factors unique to our location and leverage that information with published statistics (e.g. unemployment, substance abuse) to determine who is susceptible. The end goal for this analysis is to establish risk factor characteristics so that individuals seeking social assistance can be prioritized based on the severity of their risk factor(s) and likelihood of becoming homeless.

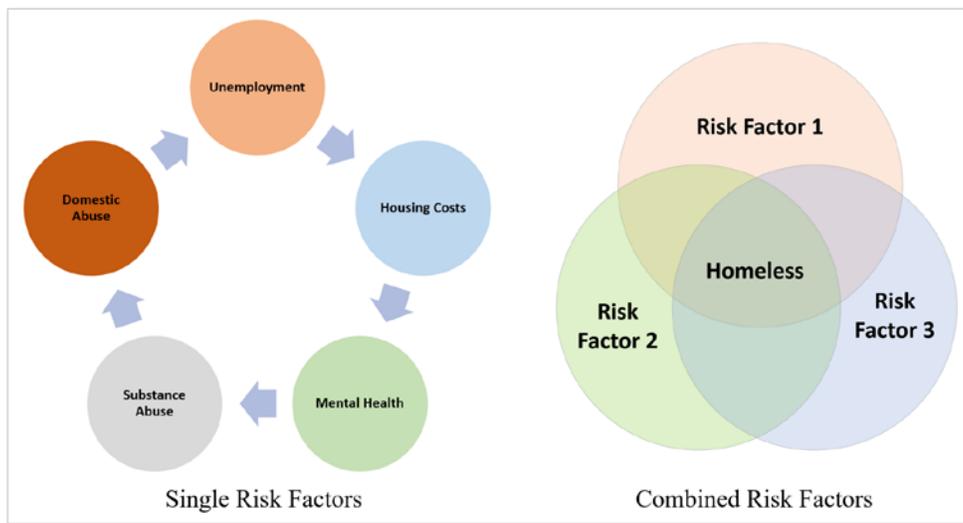


Figure 3 - Risk Factor Correlation

Additional Risk Factors

Risk factors can be categorized as internal (within one’s control) or external (outside one’s control), as summarized in the Table 3 (not all-inclusive and non-prioritized):

Internal Risk Factor	External Risk Factor
Substance abuse	Unemployment
Spending habits	Physical health
Fiscal responsibility	Affordable housing
Personal choices	Minimum wage/salaries
	Gender
	Domestic violence
	Poverty
	Ethnicity
	Age
	Mental health
	Weather (e.g. hurricanes, tornadoes)

Table 3 - Internal Versus External Risk factors

The table highlights how most risk factors are external in nature, which regrettably means homeless affliction tends to be beyond one’s control. Summarized in a 2013 HUD Annual Assessment Report submitted to Congress, the pie charts in Figure 4 provide a

statistical breakdown of risk factors leading to homelessness (National Law Center on Homelessness & Poverty, 2015).

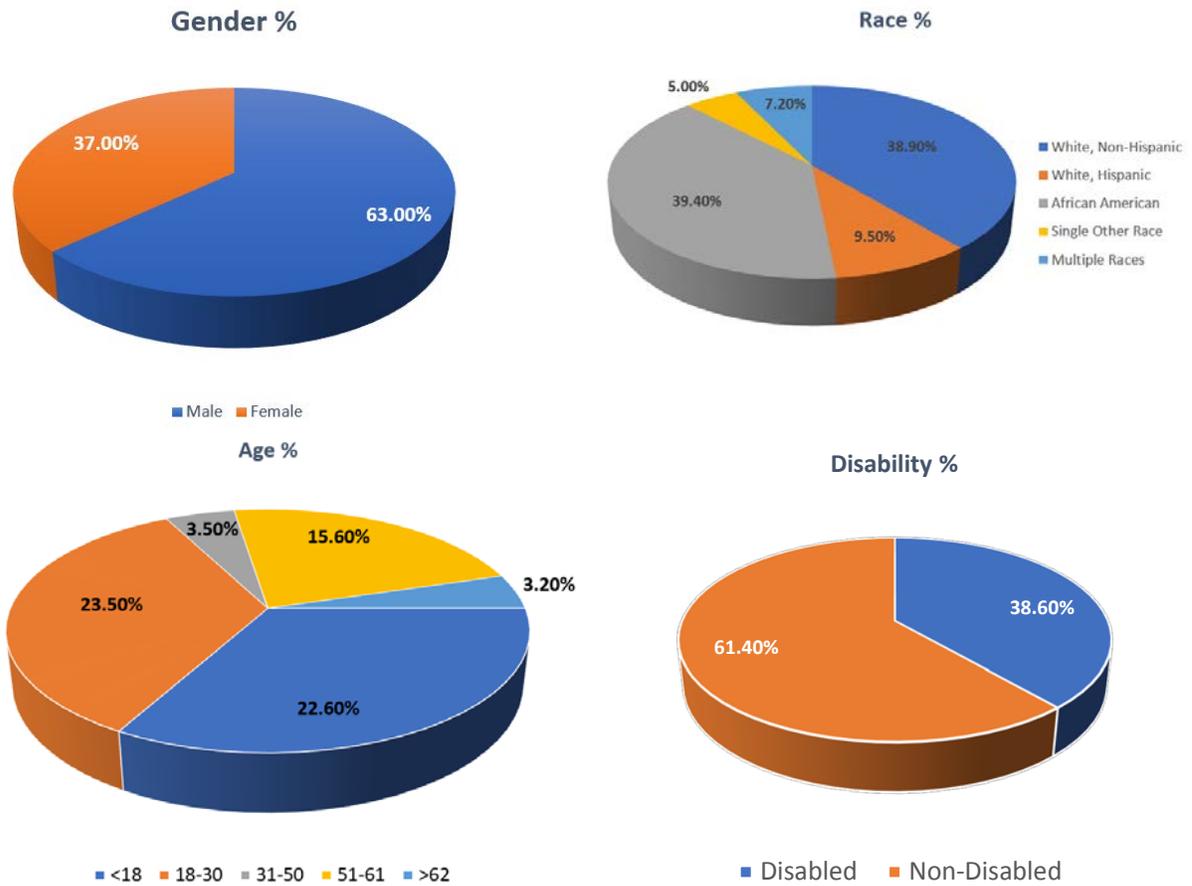


Figure 4 - Homeless Demographic Breakdown

Extrapolating the data, for example we can deduce that African American males between 18 and 30 years old and not disabled are the highest at risk of becoming homeless, as opposed to women of single race other than African American, White or Hispanic, over 62 years old and not disabled. Although these are nationwide statistics, we must adjust them for CoC VA-601. For example, Fairfax County’s homeless male percentage in 2018 was 76, or a +20% difference when compared to 2013 nationwide statistics; a clear illustration that seasonal, time, geographic and economic factors must be considered when establishing CoC

trends in preparation for a homeless mitigation plan.

Socio Economic Trends

Like risk factors, socio economic trends leading to homelessness are complex and vary based on (but not limited to) geographic location and individual (personal) circumstances. Understanding these trends can help establish a correlation between risks factors, geographic location and unique socio-economic factors impacting the population by either introducing risk factors or aggravating them. For example, according to a 2019 report by National Institute on Drug Abuse, West Virginia had the highest rate in the nation regarding opioid-related overdose deaths at 49.6 per 100K; a risk factor for homelessness (National Institute on Drug Abuse, 2019). In contrast, Hawaii has the lowest. However, each state possesses common and unique risk factors which must all be taken into consideration when establishing likelihood of an outcome, or in this case, homelessness.

Education and computer literacy also play a large part in preventing homelessness by allowing individuals to be viable computer literate candidates, as well as having the ability to search for employment. Referring to the graph in Figure 5, we clearly see a trend between households with high speed Internet enabled computers and education for CoCs in Virginia.

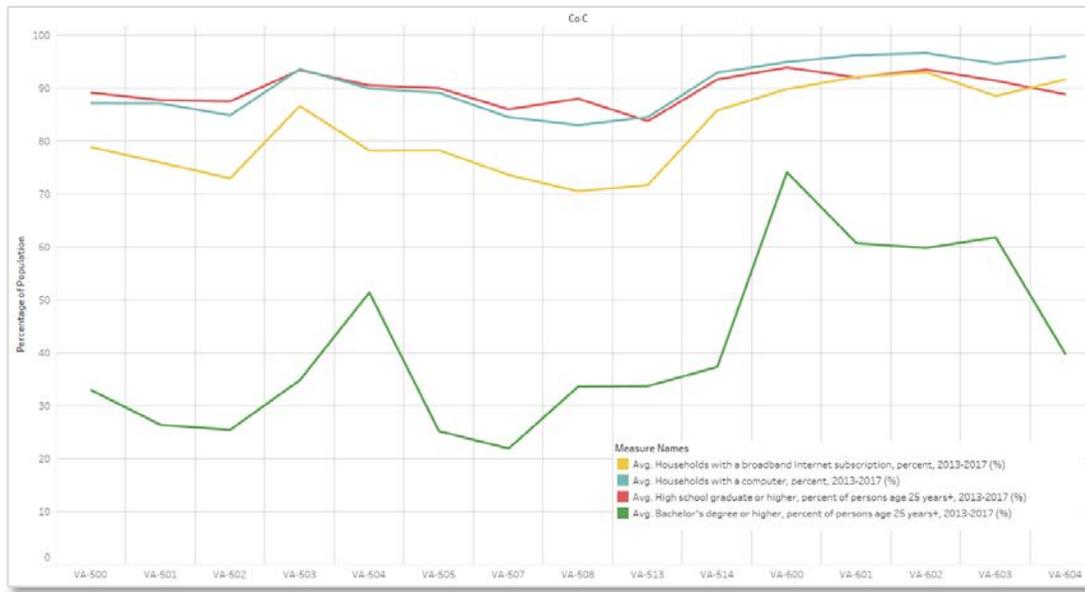


Figure 5 - Education and Computer Use Correlation

The next question requires establishing a correlation between unemployment and homelessness as it relates to education and access to Internet enabled computers. As described in the Simple and Multivariate Regression Testing Section, establishing a correlation may not be straightforward and the results may be counterintuitive.

Simple and Multivariate Regression Testing

There is a presumption of internal and external risk factors influencing homelessness - what we understand as being factors but don't understand how they become enough of a factor to cause homelessness, or how they interact with each other with specific geographic or social setting. In an abstract way we can reverse engineer the effect (homelessness) to determine if the cause (risk factor) was responsible but cannot accurately make that determination. It is not necessarily a one-to-one relationship and may work one way but not the other. Therein lies causation and dependencies.

Using a simple correlation coefficient model (single cause and single effect), we can

first determine if there is a linear relationship between a single risk factor and an outcome. The closer to zero the correlation coefficient the less of a linear relationship exists between the two. In contrast, coefficients close to range extremities -1 or 1 indicate a strong linear relationship meaning a risk factor is likely the cause of outcome (homelessness). In this case, implementing a simple correlation coefficient model to determine if substance abuse to unemployment would yield a value of $-1 \leq X \leq 1$.

Adding an additional risk factor (confounding variable), we want to determine if substance abuse *and* a specific age bracket yield a stronger correlation with the assumption that younger individuals are more likely to be homeless (as an example) and substance abusers as well. While substance abuse is a strong contributor to homelessness, results could indicate that age is the true factor. Unfortunately, this does not provide answers in terms of the true correlation between the two independent variables: age and substance abuse. The next step would be to leverage multivariate regression and create a model with dependent (homelessness) and independent variables (substance abuse and age), thus allowing us to estimate the relationship between substance abuse and homelessness while taking age into consideration.

Applying additional risk factors as independent variables to our model would allow us to achieve more accurate predictors of homelessness, albeit complex.

ROI – Cost Benefit in Mitigating Homelessness

The ROI (although we don't feel it is an appropriate term for this situation) in preventing homelessness does not generate corporate or personal profit, and while qualitative numbers in the form of social assistance (social responsibility) are difficult to measure or appreciate for some, we can demonstrate using published statistics how tax payers can save

money by preventing someone from becoming homeless. In line with the concept of the Affordable Care Act, prevention is cheaper than the problem as illustrated by a chronically homeless man in Reno, Nevada, who cost tax payers over \$1 million in social services and unpaid medical bills including ER visits and ambulance rides (“Study Data Show that Housing Chronically Homeless People Saves Money, Lives”, 2015).

According to a study published in *Science Magazine* in 2016, financial assistance provided to those at imminent risk of foreclosure reduced the likelihood they would end up in shelter by 76% within six months as opposed to those without assistance. According to the National Alliance to End Homelessness, chronically homeless individuals cost tax payers \$35,578 per year, which can be reduced by almost 50% by providing them with supportive housing which costs \$12,800, resulting in almost \$5,000 savings per year per homeless (“Ending Chronic Homelessness Saves Taxpayers Money”, 2017). Providing the US chronic homeless population estimated at 88,640 in January 2018 with supportive housing at a cost of \$12,800 per homeless could save tax payers \$443 million per year (“Chronically Homeless”, 2019). This significant cost savings only involves chronic homelessness and factoring in short-term and long-term homelessness would result in greater tax payer savings and a strong business case.

At the local level, Fairfax County VA-601 CoC cost were \$19 million in 2016, with 987 homeless in the Fairfax-Falls Church Community (Fairfax County, 2018). With 24% of those being chronically homeless, or 237 at an estimated cost of \$35,578 per year each, Fairfax County spends \$8,431,986 on them. By subsidizing them and reducing cost by 50%, \$8.2 million could be saved annually and re-invested in the community to further prevent or end homelessness. While funding for homeless social programs are in place, the focus currently lies

on managing the problem versus preventing it. Research demonstrates that social services costs can be reduced and save tax payers 49.5% per chronic homeless per year by transitioning them to supportive housing (“Ending Chronic Homelessness Saves Taxpayers Money”, 2017) – a clear indicator that a homeless cost reduction is possible and advantageous from a financial and humanitarian aspect. Our Capstone will take a preventative approach in reducing homelessness by leverage existing social programs along with analysis from this project to identify at-risk individuals and help steer them to a path of recovery before they become homeless.

Business Model for VA-601, Fairfax County

We shall establish a business model for VA-601, Fairfax County, and in doing so set expectations regarding metrics employed. We will start off with a homeless population of 964 based on 2017 figures (“2017 AHAR: Part 1 - PIT Estimates of Homelessness in the U.S.”, 2017), and use a set percentage (“Ending Chronic Homelessness Saves Taxpayers Money”, 2017) of the total cost of what it would cost to manage a new homeless individual towards preventing that at-risk individuals from becoming homeless (e.g. emergency funds to pay rent, subsidized housing). Our model assumes a random influx of 1 to 15 new homeless individuals each month, for a duration of ten years (January 2019 through December 2029), at a monthly cost of \$3,333 per homeless individual, based on an assumed \$40,000 per year per individual (Moorehead, 2012).

Fifty Percent Reduction Model

By investing 50% of what it would cost a new incoming homeless individual towards preventing one from becoming homeless (\$1,666.5), our analysis demonstrates a \$1.5 million savings over a 10-year period.

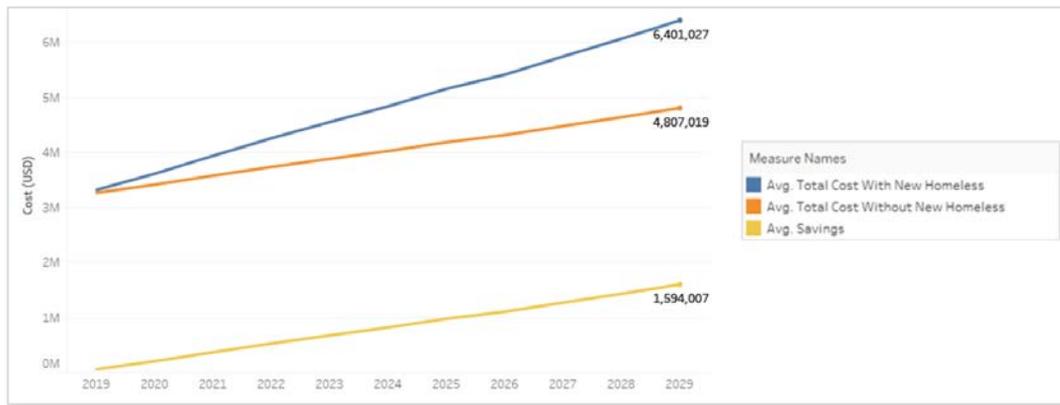


Figure 6 - VA-601 Projected Savings with 50% Fund Allocation

The implications in allocating 50% of operating costs per homeless individual to prevent at-risk individuals from becoming homeless as opposed to allowing them into the homeless pool are profound. For example, the Homelessness Prevention Call Center (HPCC) has a hotline to assist those in need of emergency funds to prevent becoming homeless (Weller, 2017). With limited resources and on a case by case basis, research has shown that people who receive emergency funds (typically in the \$1,000 range) are 88% less likely to become homeless within the next three months, and 76% less likely in six months; typically, enough time to allow them to get back on their feet and no longer be at-risk for homelessness. Our calculations demonstrate that CoC VA-601 will see no new homeless cases over that two-year period and save \$1,594,007. The reality is that there will always be a homeless population, and we realize there are more variables that come to play, including recessions which could drastically increase the number of homeless individuals and inflation which is not factored into our equation. However, our model clearly demonstrates cost-savings potential in preventing homelessness by leveraging a percentage of existing funds to prevent homelessness through programs such as HPCC. Furthermore, saved funding (in this case, \$1,594,007) could be used (re-invested) to assist existing

homeless individuals recover and no longer become homeless.

Technical Approach

Tableau and Excel are leveraged to analyze and visualize data for two reasons. First, Tableau is well suited to ingest data from numerous sources and formats, although we must first an ETL process before performing analytics: Extraction (data mining and/or retrieving data from various sources), Transformation (preparing semi-structured or structured data for reporting and analysis) and lastly Loading the transformed data into visual and analytical tools – in this case, Tableau. Doing so allows us to leverage Homelessness Intelligence (documented historical metrics, statistics and trends) and perform our own Homelessness Analytics by leveraging Tableau which generates meaningful and relevant data sets, facilitates analysis and provides Key Performance Indicators in establishing an approach in reducing or eliminating homelessness.

Second, the both Excel and Tableau tools have powerful data visualization capabilities which are critical in visualizing voluminous data sets and trends, making them easy to consume.

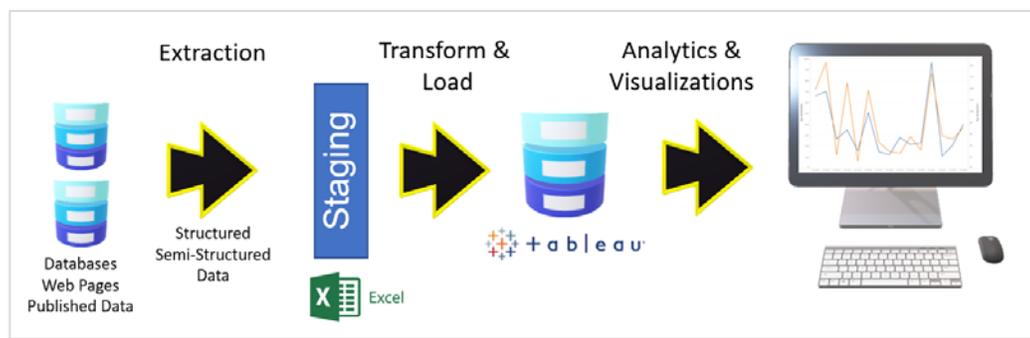


Figure 7 - ETL Process with Excel and Tableau

This project proposal will follow a medical research approach which (as an analogy)

determines and leverages statistical risk factors (frequency measures) associated with diseases based on researched data, and apply a methodology to evaluate at-risk individuals based on derived risk factors to mitigate the chances of disease setting in. As a result, and outcome of such research, our proposal will consist of graphs, sample data sets and descriptive elements of our statistical approach. We will use excel to maintain and prepare data sets, and Tableau to perform data analytics and visualizations which involves processing and displaying data for easy consumption.

As presented in our Additional Risk Factors Section, we can determine which individuals are at greater risk of becoming homeless based on the sum of their internal and external risk factors.

Technical Approach Risks and Challenges

With our technical approach, further research and analysis are not without risk which must be understood and analyzed to better ensure a successful project outcome. In doing so, we developed a risk matrix which allows us to quantify risks based on likelihood of occurrence and severity of consequences. Table 4 summarizes our risk analysis as it relates to Fairfax, Virginia (CoC-601).

Scenario	Risk Level	Comments
Lack of available data	Low	Government & NGO sources provide ample data
Inconsistent/Inadequate data	Medium	Data is abundant, but may contain inadequate or irrelevant components
Inability to Leverage Tableau	Medium	High learning curve but adequate resources for assistance
Ineffective Analytical Methodology (Regression Testing Results)	Medium	Independent variables may be too complex too inconsistent amongst locations to generate an accurate predictor model
Improper Data Differentiation	Medium	Data sources improperly differentiate between data types such as chronic versus non-chronic homelessness
Lack in Effective Data Correlation	Medium	Depends on qualitative/quantitative nature of data
Inconclusive Analysis	Medium	Data analysis may not provide answers or allow conclusions to be drawn which could affect success of project
Ethical Impact	Low	Data is obfuscated and does not contain PII components Triaging those in need objectively
Unidentified Risk(s)	Low	Risk creep is a possibility as we don't know what we don't know until later stages of Phase 1 or other phases

Table 4 - Research Risks and Challenges

Solution Development

We will take a preventative approach in addressing homelessness by analyzing social trends and leveraging them to prevent future occurrences while using, among varying methodologies, visualization and analytics tool Tableau. Socio-economic trends and statistics will be analyzed not only to understand the current state of homelessness, but potential leading causes and risk factors. Our approach involving social services will not be without cost (qualitative and quantitative), but our posture and research will demonstrate how preventing an individual from becoming homeless is potentially cheaper than treating that individual once homeless – thus reducing the (State and Federal) financial burden through a reduction in

homeless shelters.

First, we will leverage technology to maintain situational awareness regarding homelessness and associated statistics. Using a phased approach, a baseline will use existing data to understand the extent of the problem throughout the US. Second, our solution will be put into practice by identifying individuals at risk and taking necessary corrective action to prevent homelessness. This phase will begin as a proof of concept and focus at first on a specific geographic footprint identified during the first phase. Each geographic area at the county level, designated as a Continuum of Care (CoC), will likely be unique based on factors such as (but not limited to) geography, affluence and education. For example, County X in Florida may be undergoing an opioid crisis, whereas County Y in Nevada may be experiencing high unemployment rates. Both counties possess discrete risk factors which could lead to high rates of homelessness, and therefore CoCs will take these factors into consideration when designing social programs at each location. The third phase, maintenance, will monitor program success and determine if changes to the overall program are needed (not to be confused with changing CoC approaches to adapt to evolving socio-economic conditions for each geographic region).

Each shelter and CoC for example will need to maintain statistics regarding homeless and pre-homeless individuals, including associated costs. After a pre-homeless candidate asks for assistance, their lifestyle habits and social well-being will be monitored and documented for a customized program based on that individual's risk factor(s). In addition, candidates could be selected and assessed pre-emptively before help is asked to evaluate their level of assistance required. The program will also be measured and evaluated for effectiveness and adjusted as necessary. The project's tenet is to leverage community centers for at-risk

individuals who seek help early on and provide classes and programs to help such individuals in need from start to finish based on their requirements, risk factors and predicament.

Depending on the specific requirement, the community center for example will sign up a person in need with a counselor who will support them and guide them in the right path with the proper program and guidance.

In preventing homelessness, we must not lose sight of individuals who are already homeless and need assistance. Unfortunately, society views homeless individuals in a less than favorable way as opposed to those at risk (pre-homeless). CoCs and other social services are currently in place and funded to assist those in need. With such an infrastructure already in place, the goal is to modify the way they operate which is to assist existing homeless and assist those at risk. In following this approach, we must ask ourselves what resources and funding percentage to allocate for both prevention and management of existing homeless. To take it a step further, in coming up with an answer we must place emphasis on age groups and demographics to better understand what the homeless recovery level of effort would be, as well as chances for a full recovery.

When addressing existing homeless and at-risk individuals, should triage and certain decisions must be made when formulating a remediation approach. From an ethical standpoint should a homeless family or underage runaway skip at the head of the line for funding and assistance as opposed to self-destructive individuals? Agencies such as Community Solutions have a methodology in place to prioritizing resources and identifying gaps to match homeless individuals with housing alternatives (Gibbs, 2015).

To identify people at risk of becoming homeless we should consider risk factors and prioritize them. Social workers can work in understanding individual (or family) homeless risk

factors and decide what the best course of action is. For example, families with no computer and/or high-speed Internet are less likely to can't take online classes or apply for jobs; this lessens chance of getting a job and increases the chance of becoming homeless. Funding a \$500 new or used computer with Internet access for that family could put them in a better situation and increase the odds of not becoming homeless.

When examining pre and existing homeless individuals, certain problem/solution commonalities exist which can be leveraged. Table 5 illustrates an approach:

Risk Factor	Remediation Approach
Unaffordable housing	Subsidized housing
Substance abuse	Free rehabilitation clinics
Mental illness	Free psychiatric help
Deficient job skills	Free training
Domestic abuse	Alternate housing

Table 5 - Risk Remediation Approach

Business Case

A business case must present something of value to stakeholders while addressing a problem whose resolution establishes a positive outcome with qualitative and/or quantitative properties. The problem statement must be relevant, understandable, and provide some form of motivation towards a resolution. Our stakeholders include homeless individuals, taxpayers, and anyone who helps the homeless (including prevention) in various and any capacity.

Unfortunately, the problem statement and resolution may mean different things to various individuals, and while not necessarily mutually exclusive, they tend to be driven by ideology, greed or personal gain. When the problem statement is independent of a lucrative outcome which is not guaranteed (e.g. why cure cancer unless you become wealthy doing so), the outcome must be carefully justified with a demonstrable value – especially when there is no

obvious or well documented financial gain.

This project business case is developed by exposing qualitative and quantitative costs associated with homelessness; specifically, cost savings both in alleviating the homeless situation and preventing it. The term homeless has no official definition, and therefore addressing ways to prevent it becomes more challenging. Since it is difficult to prevent and measure outcomes quantitatively when you can't fully define or quantify the problem in the first place, certain assumptions must be made.

Unlike health care costs which are highly publicized and politicized due to their negative impact on our economy (which ironically results in financial gain for some), homelessness tends to be ignored due mostly to misunderstood negative financial consequences to tax payers. In a culture mostly driven by profit, we plan to capitalize on this by demonstrating that cost reduction is equally beneficial to financial gain as it relates to our business case.

We utilize published statistics measuring the difference in tax payer costs between funding homeless individuals (funding and perpetuating the problem with no planned resolution) through social services and shelters, and tangible financial savings achieved by preventing or alleviating the problem. Counterintuitive to capitalistic values and corporate greed, providing financial assistance to someone on the verge of being evicted from their home can save tax payers money. While mental health and substance abuse play a large part in homelessness, an important point to consider is that those with full time jobs and without health or substance abuse issues can also become homeless for many reasons including factors beyond their control. It can happen to anyone, and anyone can end up being a tax burden to others.

Analysis of Alternatives

Alternative solutions in addressing homelessness are difficult to assess due to the nebulous nature of the definition of the term as well as establishing success metrics in minimizing the problem. For an alternative to be considered it must have viable and equivalent benefits to stakeholders, including the homeless and taxpayers. However, it is difficult to quantify the effectiveness of alternatives when the proposed solution (including alternatives) do not provide enough data samples to accurately establish an expected outcome or best course of action. For example, it is difficult to allocate money from existing homeless shelters and social services to create a budget to prevent homelessness without understanding its impact on the existing homeless population. Money saved by preventing homelessness could be re-invested into services to help current homeless individuals, but at-risk individuals who were chronically homeless could require repetitive additional funding to avoid becoming homeless again. Unlike economic models which require large amounts of data over extended periods of time to demonstrate trends, in this case there are insufficient data samples over too short a period to provide quantitative metrics.

Roadmap

As illustrated in Figure 8, our timeline across an 8-week period is divided into weekly activities chronically arranged to identify and state a problem, gather the necessary data, generate expected outcome and success metrics, perform analysis and articulate next steps. As previously stated, this project proposal will only focus on the first of three phases. Phase 2 will extend beyond Fairfax County, Virginia, whereas Phase 3 will cover the rest of the United States.

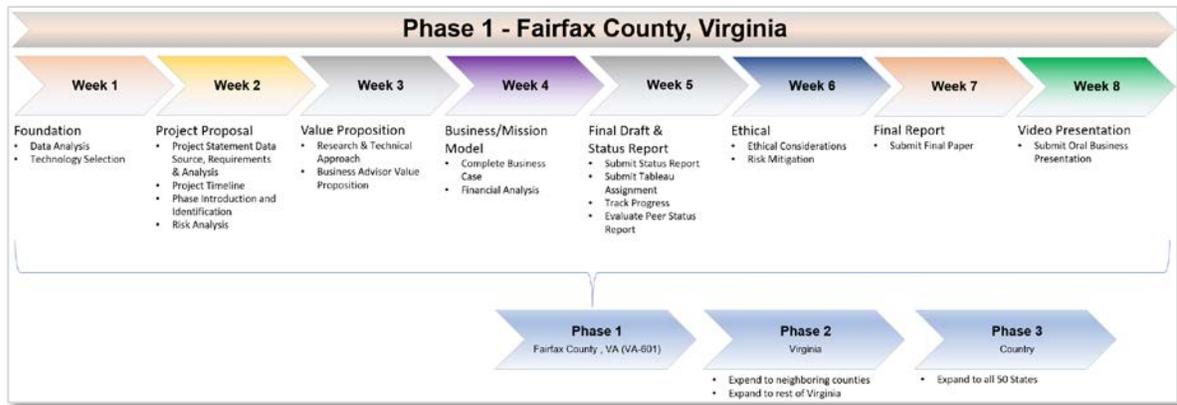


Figure 8 - Project Schedule & Timeline

Ethical Considerations

There is a paradox in our society which treats the sick and dying with care and dignity and yet ignores the homeless who are equally deserving of the same level of care and attention. While it is true that many individuals live and die with great pain and suffering due to lack of medical treatment, care, or neglect, nonetheless at the root of that statement lies, in theory and practice, the cornerstone of our society which affords us the ability to live in good health and dignity not as citizens of the United States, but of the human race. Doctors abide by the Hippocratic oath (do no harm), emergency rooms cannot deny admission to anyone with a life-threatening condition, and the Affordable Care Act was written specifically to provide everyone with the basic and fundamental right to affordable and ubiquitous medical care. We are sympathetic and empathetic towards cancer patients, and yet tend to fear homeless individuals and regard them as unworthy.

There is an inherent danger in conducting research on homelessness or providing a service to assist them - like the Hippocratic oath, one must do no harm. One ethical consideration is whether homeless individuals should be forcibly helped or studied without their consent. Drawing on a comparison between cancer research and homelessness, one must

take into consideration the purpose behind the research. In other words, does research on the homeless benefit them in the same way cancer research benefits current and future patients? In addition, will research serve a humanitarian purpose in helping those in need, or be mere talking points to assess the situation without taking further action?

Another ethical consideration when dealing with pre and existing homeless individuals is deciding who gets assistance and how it gets prioritized based on social prejudices, bias, or human emotions. For example, whether engrained in our DNA or driven by social norms, online dating site OKCupid performed data analysis on women with various looks and their popularity with men, and the results are far from surprising (Rudder, 2011). While beauty is subjective, 'attractive' women received four times the number of messages than 'lesser-attractive' ones did, and twenty-five times more messages than 'non-attractive' ones. Attractive individuals, both men and women, tend to be favored over less attractive individuals, and this trend could easily cross over into homeless prevention and assistance; placing an attractive underage runaway at the front of the assistance line in lieu of a physically less desirable and older individual. Following that reasoning and without delusions of morality, would that younger attractive runaway have a better chance for recovery based on the very same criteria we used to pick her out of the line?

The mere term 'homeless' desensitizes us to the fact we are dealing with a person who should be afforded the same protections, rights and level of privacy as patients under Health Insurance Portability and Accountability Act (HIPAA), for example. Being homeless does not strip you of your legal and constitution rights; researchers gathering statistics and social workers must consider the moral and ethical implications of their work. For example, when looking at homeless demographics one must take into consideration underage individuals who

became homeless for different reasons than adults. Homeless youths are the most vulnerable and exploitable, and qualitative research must be conducted in such a way as to minimally expose their identity.

As a voice against social injustice, social workers who help homeless and at-risk individuals not only must do so in such a way that puts their own self-interests aside but must do so with integrity. Researchers must treat homeless individuals objectively, with dignity and respect, as opposed to a missing link or data point for their transient research. No homeless individual should be embarrassed, disrespected, given false hope or misled.

Conclusion

Data analytics and visualization are powerful tools used to visually depict how non-homogenous data sets relate to one another. By leveraging Tableau, we can utilize various and disparate data sets (measures) to analyze trends in homelessness using aggregation which provides us with flexibility in chronology (past trends and future projections) and are able to sort and calculate according to socio-economic trends and risk factors. This level of manipulation allows us to visualize if certain time periods (e.g. recessions, housing market, opioid epidemics) are problematic, expose patterns and formulate conclusions. Ultimately, the goal is to determine a root cause which could lead at-risk (homeless) individuals to ultimately become homeless.

Having collected data sets for Virginia, Figure 9 visually represents the unemployment status (a leading risk for homelessness) for CoCs across Virginia. In this example, Fairfax County VA-601 has relatively low unemployment rate (2.65%), and other important homeless risk factor metrics are presented, including percentage of individuals with bachelor's degrees (60.7%), percentage of households with a computer (96.20%), and median household income

(\$117,515).

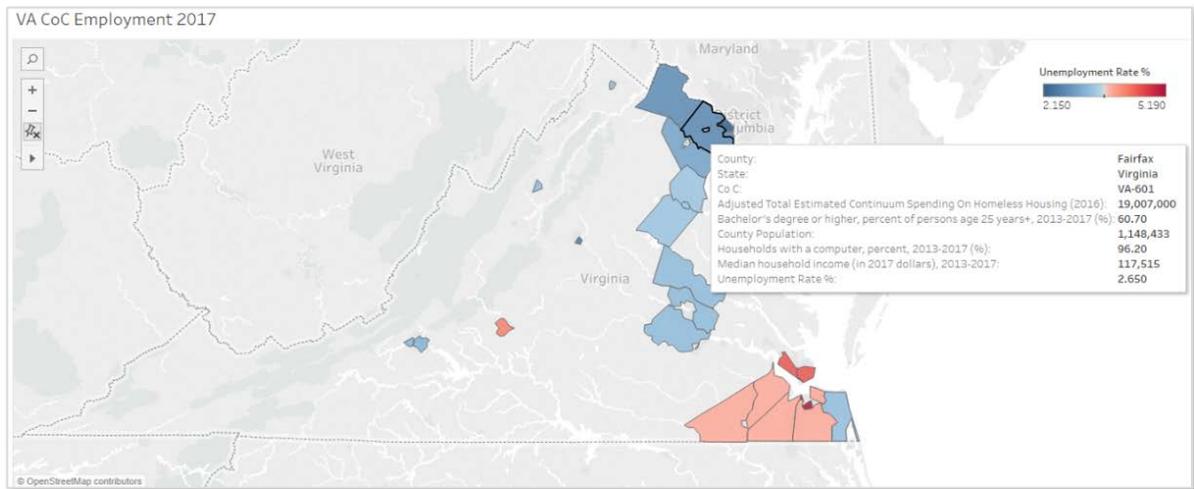


Figure 9 - CoCs in Virginia

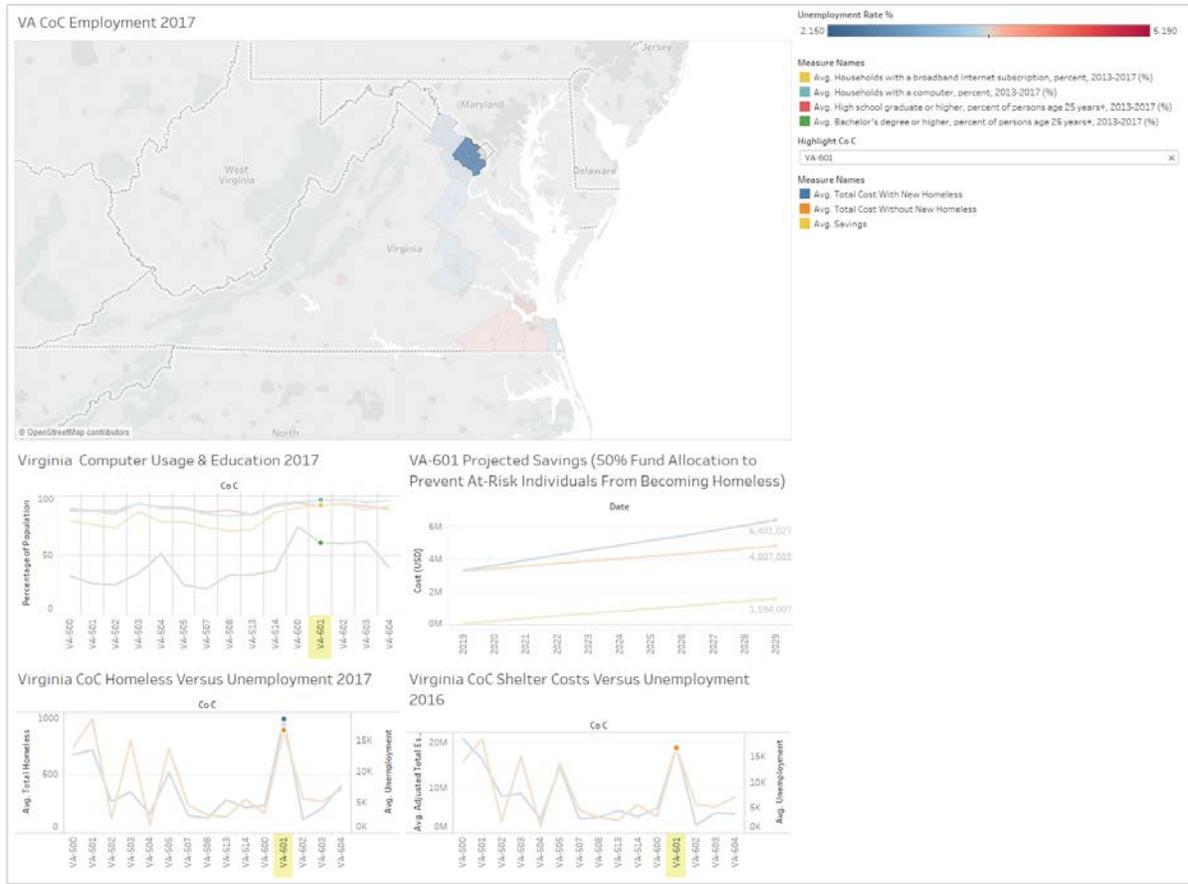


Figure 10 - Tableau Analysis for VA-601

In leveraging Tableau analytics and its visualization capabilities, Figure 10 provides important information pertaining to homelessness. Within the context of CoC VA-601, we can clearly see how that CoC has the second highest rate (after VA-600) of individuals with bachelor’s degrees (Virginia Computer Usage & Education 2017 graph). Additional graphs provide insightful information regarding CoC shelter costs and unemployment trends across Virginia (Virginia CoC Shelter Costs Versus Unemployment 2016 graph), including correlations between homelessness and unemployment (Virginia CoC Homeless Versus Unemployment 2017 graph).

While Figure 10 and other data present what could be depicted as anecdotal evidence regarding causes of homelessness (Homelessness Intelligence as defined in the Technical

Approach Section), this information is necessary in performing Homelessness Analytics and demonstrates how preventing homelessness is more cost effective than managing it. When considering variables and risk factors that lead to homelessness, the best approach is to quantify and prioritize risk factors as they relate to a specific location and apply them to individuals on a case by case basis. Allocating additional funds (Federal and private) to subsidize at risk (pre-homeless) individuals to mitigate risks that lead to homelessness has been demonstrated to be cost effective to taxpayers. Doing so also minimizes the homeless rate and allows individuals to return to society in a meaningful and productive way.

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