Building a Neighborhood-Level Risk Model for Homelessness, Mental Illness, and Addiction: A prospective study of the residential origins of the homeless in Dallas, Texas

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Mental illness, addiction, and homelessness are highly complex psycho-social diseases that are costly for governments but are often ignored in policy and planning. The US Department of Health and Human Services reports that in 2009, 19.9% of adult Americans had some type of mental illness, nearly 37,000 Americans committed suicide, and a shocking 8.4 million people seriously considered suicide (SAMHSA 2010). In 1977 Michael Dear published a call to arms stressing the importance of mental health geography. He writes, "Inner portions of North American cities may be becoming the location of an asylum without walls for psychiatric patients discharged from mental hospitals (Dear 1977)." However, Dear's prophetic warnings fell on deaf ears, and now nearly 40 years later we find ourselves with a broken, complicated, and deeply entrenched behavioral healthcare system offering help to the mentally ill and homeless. In 2013 we need to reassess the form and function of this system. Where are the homeless coming from and why? What environmental factors lead to the types of mental health and addiction problems that create homelessness?

I propose to study the interurban migration and neighborhood characteristics of homeless individuals in the City of Dallas, Texas, focusing specifically on those with severe mental illness (SMI). According to the Metro Dallas Homeless Alliance people with SMI are making up an increasingly larger percentage of the homeless population, comprising 42 percent of the surveyed homeless in 2012 (MDHA 2012). While studies have been done to show where the homeless are currently located, few have looked at where the homeless are actually coming from, which is crucial information for locating preventative and early-intervention services.

In the 1960's and 70's the American mental health system changed from an asylum based model to community based care. This approach was designed to allow the mentally ill to live and participate in supportive communities. However, implementation of the new system was not well

planned and underfunded. As a result most aftercare services were placed in poor, crime-ridden areas of the city where rent and resistance were low (Dear 1977). Now, clustered services for the mentally ill and homeless may create interurban migration, resulting in greater psychological trauma and less desirable addiction outcomes (Wolch et al., 1988; Rachlis et al. 2010; Pierce et al., 2012).

The greatest degree of homelessness related to the community-based healthcare shift was in states with either very little or extreme levels of deinstitutionalization. Texas fell into the latter category, decommissioning asylums as quickly as possible. As a result Texas still has the highest rates of need and the lowest rates of mental health service use in the United States (Hudson 2012). No thought was given to teaching people how to use the system and now Texas has the lowest per-capita mental health funding in the country, despite demonstrated need (NAMI 2011). Dallas, as the third largest city in Texas and the ninth largest city in the country, is an ideal place to study how the homeless and mentally ill interact with their environment where funding and support of social services are low. This political climate permeates the "Sun Belt" region of the U.S. stretching across the southern tier of the country from the Atlantic to the Pacific.

We know that supportive services offered to the homeless are not usually located in communities with a higher standard of living than where they were before (Tsai, Mares, and Rosenheck 2011). Furthermore, we know that very poor areas where need is highest often do not have any support for the homeless and mentally ill because there is no funding available (Joassart-Marcelli and Wolch 2003). The challenges facing the current system of behavioral and social healthcare are inherently geographic, yet no one has yet been able to map the small-scale geography of these populations-- their trips through shelters, hospitals, prisons, social services,

and the streets (DeVerteuil et al. 2009). My project proposes to fill that gap by studying the movement of homeless persons through the City of Dallas, TX.

Once we identify these vulnerable areas planners will be able to target services to smaller areas in space. Not only can clinics be located at the proper social and spatial distance, but supportive interventions beyond specialty mental healthcare can be implemented. These interventions include providing life skills classes, creating green space, establishing better access to fresh foods, employment training and placement, and housing stabilization schemes. In conjunction with appropriate methods of therapy and medication, these changes can significantly increase the happiness levels of people living in these areas in a very local way. However, as policy stands, these resources cannot be targeted, and therefore cannot be efficiently evaluated. Creating a map of need is the first step to ameliorating vulnerable places while reliving residents from some of that vulnerability.

Until relatively recently, questions related to homelessness and the behavioral healthcare system were the primary domain of urban geographers. For 50 years the built environment of the city reflected psychological and social issues requiring study and intervention. However, medical geographers have different skills and experience modeling disease. The World Health Organization defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (Meade and Emch 2010)". The need to expand our understanding of social and mental diseases is great, and the methods and technology now exist to revisit difficulties from the past.

Background

The vulnerable place theory is gaining traction in the medical geography field and is important to understanding the aims of this project (Oppong 1998). The vulnerable place theory

asserts that vulnerable people are attracted to vulnerable places, vulnerable places create vulnerable people, and displaced vulnerable people will recreate their vulnerable space in a new place. In most cases the area surrounding homeless shelters act as a hyper-vulnerable place with increased rates of victimization and harassment and a lack of social and economic comforts (Goodman, Saxe, and Harvey 1991, Hwang et al 2009). The people who come to the services most likely originated in a vulnerable place that creates homeless residents. The goal of this project is to find these spaces.

Place vulnerability is evident in the handful of mental-health geography studies conducted to date. Prisons are a vulnerable place for mental illness; over half of the inmates in the United States have a diagnosable mental illness. The epidemic of hyper-incarceration has made imprisonment more likely, prisons more crowded, and service providers less able to keep up with demand (Dumont et al 2012). Another study showed that group homes for the mentally ill and formerly addicted are sited in neighborhoods with high rates of drug related crime in Worchester, Massachusetts (Pierce et al 2012). The political system for placing services actually reinforces resident's vulnerability both in prison and out.

To understand how political, cultural, and historical systems influence health outcomes researchers use the political ecology framework. Political ecology asserts that our behavior and environment are inextricably influenced by history, law, and social context (Meade and Emch 2010). For example, the location of public facilities with negative externalities is often determined by leaders' perceptions of opposition (Dear, Taylor, and Hall 1980). Planners will not approach municipalities that are likely to have strong opposition to facilities such as a waste processing plants and homeless shelters. Meanwhile, depressed areas with low community cohesion will take on an uneven and unfair burden for these facilities (DeVerteuil 2000). A

political ecology approach is required to understand why the rate of mental illness and addiction is so high among the homeless population.

Prior to the second half of the 20th century mental healthcare primarily consisted of asylums. However, after World War II increasing interest in psychology led to a dramatic change to the behavioral healthcare system. In 1946 congress passed the National Mental Health Act establishing the National Institute for Mental Health, primarily for research. In 1961 a special congressional commission on mental health published the report "Action for Mental Health" that encourages funding small regional mental healthcare centers. This translated into the 1963 Community Mental Health Centers Act, which officially began the period of community-based care. Asylums lost support and most shut down by the end of the 1970's. Keeping people with mental illness out of society was hurting them more than helping them, so returning them to the community ideally would meet neglected social and personal needs. However, the transition to community-based care was unplanned, largely unfunded, unsupervised, and piecemeal (Dear 1977).

Quickly these newly discharged patients with no money or life skills found their way to available services and affordable housing. Since the services were grossly underfunded they often located in very low-rent areas to save money. Services began to cluster together as more and more people moved into these areas, creating what Michael Dear terms "psychiatric ghettoes" (Dear 1977). By 1980 twenty-five percent of the homeless population had been discharged from an asylum (Wolch, Dear, and Akita 1988). These newly homeless persons were in good company, as the 1960's and 1970's also created disproportionate economic hardship for urban blacks. Urban renewal projects destroyed the affordable housing available to black residents without replacing the units. In many places these citizens could not move to the suburbs

due to discriminatory housing practices. Deindustrialization in the 1970's also disproportionately affected blacks since forty-three percent held blue-collar jobs in 1969, compared with only thirty-six percent of whites (Johnson 2010). By the 1980's these social changes created a larger population of homeless persons, mostly comprised of poor blacks and the mentally ill. This was the volatile situation when crack cocaine first hit the streets. Vulnerable areas around shelters and clinics became even more dangerous as hard drug use drastically increased.

In the chaos following the sudden influx of homeless persons, few administrators had the luxury of considering the spatial arrangement of services. However, from a medical geography perspective the physical layout of the healthcare system in space is crucial to providing access, continuity of care, and choice. For example, one recent study showed that the probably of patients discharged from an inpatient psychiatric hospital attending their follow-up sessions depends on drive time and the relative crime rate of the neighborhood of their appointment (Mennis, Stahler, and Baron 2012). While it makes sense that no one would want to put themselves in danger for a therapy appointment, these factors are rarely addressed in mental health service planning, as if the populations most at risk no longer worry about their time or safety.

In the decades following deinstitutionalization the general culture of homeless policy became more punitive, focusing on how to punish and shame the homeless instead of supporting them, shifting focus from supporting the homeless to punishing and shaming them. The result is an incredibly complex built environment for the mentally ill and homeless. A single person may filter through inpatient rehab, outpatient counseling, emergency shelters, supportive housing, transitional housing, psychiatric hospitalization, prison, and single-residency hotels. This personal geography of the homeless has never been adequately traced (DeVerteuil et al 2009).

The 1980s and 1990s were a time of diversifying homeless demographics, to the point where it is impossible to identify one common experience of homelessness (DeVerteuil et al 2009). Gender, family status, race, age, and geographic location can all radically change how a person works through homelessness, or not (Alegria et al 2002). Suburban homelessness is particularly interesting because the suburbs carry a cache of privilege that appears to be crumbling. In 1998 Crane and Takahishi found that the suburban homeless were less transient and had fewer mental health needs than urban homeless populations (Crane and Takahishi 1998). Increasing homelessness in suburban areas is a concern currently in the metroplex, where the count of homeless persons has nearly quadrupled in wealthy suburban Collin County, just to the north of Dallas (MDHA 2012).

Early in the 21st century geographers turned their attention to the way services are placed in space. In California it was found that services are most common in racially and economically heterogeneous areas. The poorest areas have no resources and the richest areas are expected to significantly oppose the influx of social services (Jossart-Marcelli and Wolch 2003). My own previous research has found that a similar pattern exists in Dallas (Figure 1). The standard incidence ration (SIR) is a statistic designed to compare the expected number of homeless persons based on poverty to the observed number of homeless persons per district. We see many times the number of homeless persons we expect in districts offering services. However, by comparing the SIR map to the poverty map (Figure 2) it is clear that these services are not located in the poorest areas of the city. These findings may mean that people are moving towards services, but without better data I can neither confirm nor deny that assumption. However, if drift can be shown in Dallas (as it has in other cities) it means people seeking services are more likely to relocate into hyper-vulnerable areas and leave their jobs, schools, and support network behind

in their old neighborhoods. Along the same lines, scholars investigating service placement have wondered about the rising influence of non-profits and how they make their locational decisions (DeVerteuil 2000).
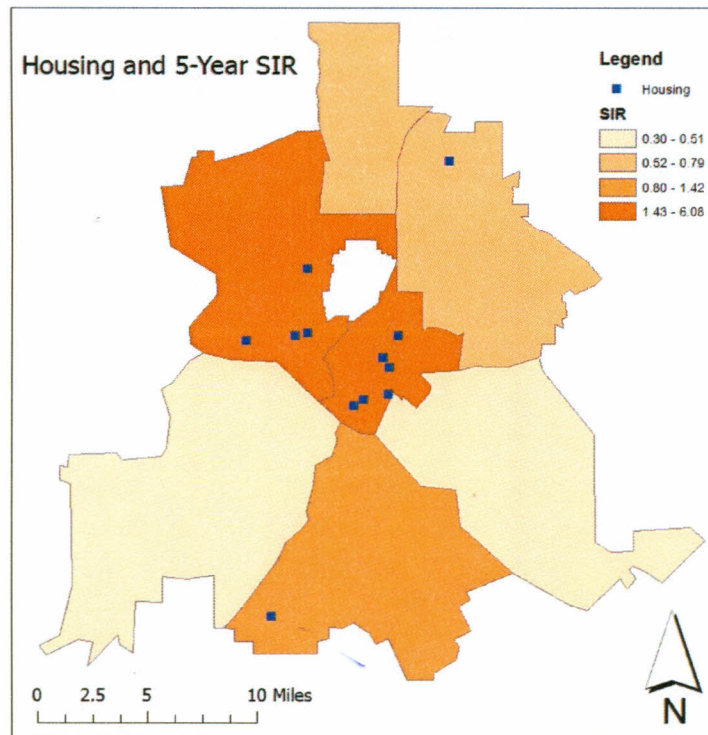

Figure 1: Homelessness in Dallas from 2008-2012. The central district averages 6 times the number of homeless persons we would expect there based on demographics alone.
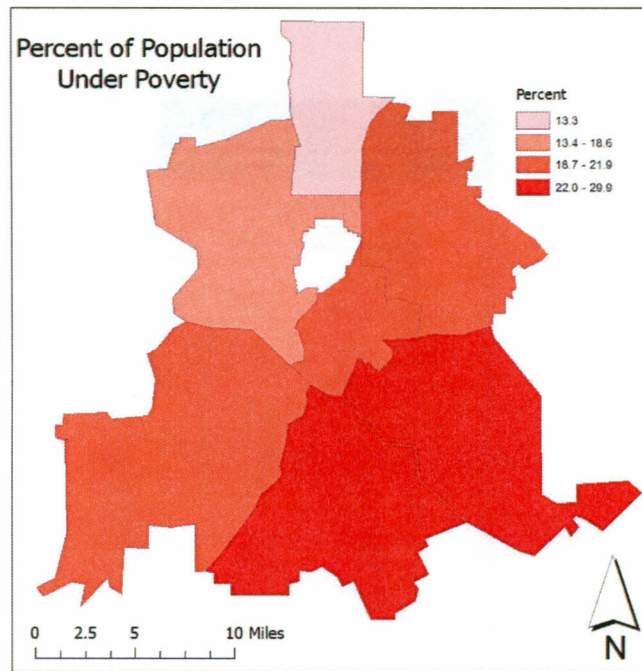
Figure 2: Percent of persons under the poverty level in Dallas TX, by police district

Recent studies have found that mental illness does not cause homelessness; economic deprivation causes homelessness (Montgomery, Metraux, and Culhane 2013). While mental illness creates the situation for extreme poverty, homelessness is an effect of that poverty. Mental illness prevalence among the very poor is the same as the prevalence among the homeless. However, the mentally ill sub-population requires different services for recovery and reintegration.

The newly discovered prevalence of severe mental illness among the very poor colors the conversation about the future of the behavioral healthcare system. Estimates show that 1 in 6 uninsured Americans has a severe mental illness, and we know that homelessness is expensive (Montgomery, Metraux, and Culhane 2013). Now the debate has turned to relative verses absolute poverty and which metric is most important in the development of mental illness (Curtis 2010). One thing is for certain; prevention is the cheapest option and will cause the least amount

of suffering. However, assessing where the mental health need is highest is no small feat and geographers have been wrestling with this question for decades.

Sarah Curtis, the leading expert in mental-health geography, defines two strategies for estimating local need for psychiatric services. The first is synthetic estimation, using some metric to estimate the number of people with psychiatric disorders in local populations. The second is using correlations between disease prevalence and demographic variables to create risk surfaces (Curtis 2010). Many of the traditional models used for location-allocation purposes are inappropriate for this context, since mental healthcare is a unique good. Its use is involuntary and unpredictable, patients must accept care, consumers rarely pay for services (in a public system), consumers have no way to evaluate the services offered, and mental healthcare has numerous positive external effects on society (Dear 1978). In addition, location of need can change depending on the location of services in a process known as drift (Rukmana 2011).

Two recent studies are good examples of using available data to interpolate risk. In 2007 Foley and Platzer mapped psychiatric need in London using acute admissions data in hospitals (Foley and Platzer 2007). This is a common way of trying to get at need (Curtis 2010). However, this method only estimates the most severe cases. In a single-payer system this could work with some limitations, but the American system is too large and diverse for hospital admissions to explain much but an ultra-local neighborhood need. The second study was conducted in Philadelphia using Medicaid data. Researchers mapped the residences of Medicaid recipients receiving services for SMI. However, to stabilize the data the only clients included had been on Medicaid without break for a year (Metraux et al 2012). Therefore, this study produced a fascinating neighborhood profile for poor, stable people coping with mental illness; however, it could not get at the most volatile and unstable populations.

Researchers in North America have also employed various methods of synthetic estimation using demographic variables (Curtis 2010). In a study funded by the state of North Carolina, a team of researchers attempted a needs/service analysis for mental healthcare workers across the entire state (Thomas et al 2012). Using census data at the county level they compared the expected need with the available workforce. However, results from such a large-scale study would be impossible to apply to neighborhood or even city-level planning. Another project studied access to mental healthcare in Washington D.C., using poverty as the primary variable for need (Ronzio et al 2006). However, both of these methods rely on the model to test accessibility, even though the model cannot be ground-truthed with actual data.

At the same, urban geographers have taken an interest in the origins of the homeless population. A handful of studies have recently emerged on the topic. Using data collected through the Collaborative Initiative to Help End Homelessness in several major American cities, Tsai, Mares, and Rosenheck calculated mobility statistics. They found that 16.3 percent of respondents traveled over 30 miles to services, and 12.3 percent traveled more than 100 miles, giving us a better idea of how much migration occurs among the homeless population (Tsai, Mares, and Rosenheck 2011). However, this study had no way of measuring where people came from or why. In Miami one study used geographic origin data collected through a Point-in-Time Homeless Census to map the origins of homeless families, and correlated these areas to census demographics (Rukmana 2011). The findings revealed that homeless families are more likely to drift to services while homeless individuals were more likely to "churn" within the service system. However, this study did not address other characteristics of the homeless population, such as mental illness, addiction, race, or self-reported cause.

A gap in knowledge exists between the mental health geographer's desire to accurately map need for accessibility studies and the urban geographer's desire to discover the neighborhood types that produce the most vulnerable people. By combining these parallel methodologies for uncovering vulnerable places we can find a way to map risk for homelessness in general, and homelessness due to mental illness and addiction in particular. This paper proposes building a risk model for mental illness, addiction, and homelessness using an origin study of the homeless to find vulnerable places on a neighborhood scale.

Methods

In order to better understand the residential origins, characteristics, and risk markers of persons experiencing homelessness I propose using individual level data to explore risk. In order to obtain this data I will work with the Metro Dallas Homeless Alliance (MDHA) to incorporate a geographic questionnaire on their annual Point-in-Time Homeless Count and Census (PITC). The PITC already gathers a wealth of information including age, gender, race/ethnicity, employment status, self-reported causes of homelessness, SMI diagnosis status, self-reported unmet need, and veteran status. However, it does not include geographic markers in the data beyond which police district the survey was completed in. Since we cannot extrapolate residential origins from where the survey was completed we are now without any information on the neighborhoods most at risk of producing homeless residents in Dallas.

The PITC collects responses from all participating municipalities in Dallas County, but for the purposes of this project the study area is the City of Dallas (Figure 3). Many municipalities in Dallas County do not participate and others have unreliable methods and results. Only responses from within the city limits will be incorporated into the analysis.
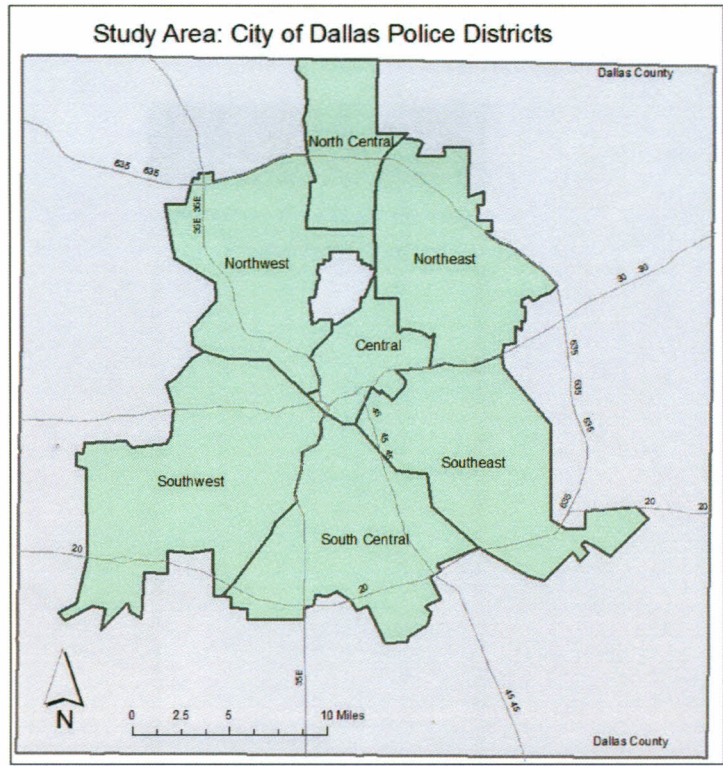
Figure 3: Proposed Study Area

After obtaining IRB approval from the University of North Texas, I will propose including the following section on the MDHA survey:

SECTION X: RESIDENTIAL HISTORY

Instruction to proctors: Try to get the most specific location possible. Street address, closest intersection, building name, or a nearby landmark is fine. If this is too specific or difficult to remember zip code or neighborhood will suffice. If the interviewee is from outside of Tarrant, Denton, Dallas, or Collin counties then city, town, or county will suffice. Please remind interviewee that this information will be kept strictly confidential.

1. Where did you sleep last night?

   - Did you consider this a permanent residence?

2. Where did you primarily sleep a year ago?

   - Did you consider this a permanent residence?

3. Where did you primarily sleep 5 years ago?

   - Did you consider this a permanent residence?

4. Where was your last permanent residence?

The PITC is administered by volunteers one night a year in January. Dallas, Tarrant, Denton, and Collin counties all coordinate their census for the same night to eliminate double-counting in the Metroplex. Volunteers assigned to count and survey people in the streets are given assistance by police officers who know where homeless people are likely to congregate. The PITC protocol is determined by the Housing and Urban Development Administration and is the most reliable homeless data available. This type of data has been used in the past to glean geographic information on the homeless in Miami (Rukmana 2011).

Once the raw data is collected and cleaned I will geocode the responses that allow for approximating individual level data (addresses, intersections, and nearby landmarks). The resulting set of data points can be queried by any question on the survey, but for this study it is most important that this data can be separated into sub-categories including homelessness due to mental illness and homelessness due to addiction. Using the kriging method of interpolation I will create smoothed risk maps using the points for all cases of homelessness, cases of homelessness caused by mental illness, and cases attributed to addiction. Kriging will allow for both smoothing and detecting hidden structures in the data, which often hint at "neighborhoods"

of risk. I will also run Ripley's K to determine if cases of homelessness cluster in certain areas or are more dispersed through space (Kuhn and Culhane 2010). These clusters and neighborhoods will be compared to determine if mentally ill and/or addicted people come from different areas than the general homeless population.

The process will be repeated for all four geographic markers (yesterday, 1 year ago, 5 years ago, last permanent residence). From this analysis we can determine if and when people at risk begin to cluster or arrive in the city (Figure 4). It is possible that people will show significant migration towards the service-rich hyper-vulnerable areas. It will also be possible to see how Michael Dear's psychiatric ghettos look in the 21st century. Are people who suffer mental illness more likely to cluster, even through time? Are people with addiction issues living in vulnerable places that reinforce their behavior?
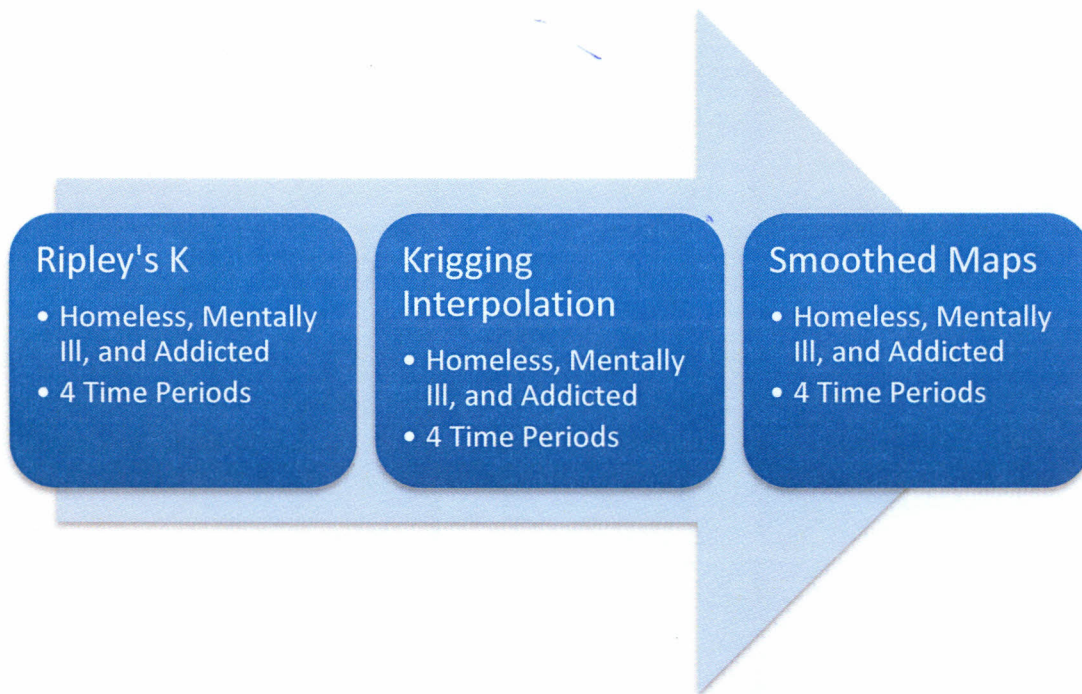
Ripley's K
- Homeless, Mentally Ill, and Addicted
- 4 Time Periods

Krigging Interpolation
- Homeless, Mentally Ill, and Addicted
- 4 Time Periods

Smoothed Maps
- Homeless, Mentally Ill, and Addicted
- 4 Time Periods

Figure 4: Mapping Methodology

The data will then be aggregated to the census tract level. The census tract was chosen to avoid meaningless and unstable rates produced by the small numbers problem. The spatial support with be scaled up to the zip code level if the numbers are unreasonably small. Tracts with fewer than 5 cases will be suppressed for confidentiality and instability reasons.

With the data at a census tract level local rates of homeless risk can be correlated to the characteristics of that piece of land. Variables selected to correlate with rate of homelessness, homelessness due to mental illness, and homelessness due to addiction can be found in Table 1. All variables will be taken from the most recent available American Community Survey 5-year estimates.

Table 1: Variables for Correlation

Variable	Indicator of:
Rent as a percentage of income	Economic deprivation
Median income	
Percent unemployed	
Percent under poverty	
Percent on food stamps	
Percent female householder, no husband present	Socio-economic status
Percent with less than 9th grade education	
Percent speaking a language other than English at home	
Percent of units that are renter-occupied	
Percent reliant on public transportation	
Percent with a bachelor's degree	
Percent of housing units are vacant	Environmental
Percent of homes built before 1960	
Percent of single family housing units	
Housing density	
Percent of homes with 1.51 occupants or more per room	
Percent of households with no vehicle available	Resident mobility
Percent living in the same place for >12 months	
Percent moved within the same county in the past 5 years	
Percent white	Demographic
Percent black	
Percent Hispanic	
Median age	

The variables fall into five main categories. First are the measures of economic deprivation. Economic deprivation has been found in previous studies to be the single most significant factor in becoming homeless. This category includes unemployment, median income, and percent of the population living under poverty. Socio-economic variables measure education, family type, and security. Environmental variables represent the built environment in which people live and function. Vacant buildings, dense living conditions, and aging housing have all been shown to negatively affect mental health (Van Zandt and Mhatre 2009). Resident mobility measures are to test the drift hypothesis that at-risk groups are more mobile. Finally, median age and percent black, white and Hispanic are included to account for possible demographic variation.

Using Pearson's r correlation the ACS indicators will be associated with the calculated crude rates of homelessness, mental illness, and addiction from the PITC data. Then, using the significant correlates I will build linear regression models to predict the risk of homelessness due to any cause, mental illness, or addiction by census tract. These three surfaces can be verified by the individual level point data using zonal statistics.

This project will use ArcGIS and SPSS, available already through the University of North Texas. No extra equipment budget is required at this time.

Hypotheses

1. Homelessness, mental illness, and addiction will show strong clustering one year prior to the interview and a more dispersed pattern five years prior.

2. Mental illness will show the strongest clustering pattern in every time frame.

3. Economic deprivation indicators will be more important predictors of homelessness than race.

4. Addiction and mental illness correlations will largely overlap.

Conclusion

For fifty years the United States has struggled to build a social safety net for its citizens, including mental healthcare and homelessness services. However, little attention has been paid to the importance of space. Geographers understand that it is impossible to truly evaluate a system "on the head of a pin," to borrow a favorite criticism of demographers. Some places are particularly vulnerable and others are more resilient. Without considering spatial variation we set the system up to fail, and in some cases, to do more damage than already existed.

Recently researchers from many disciplines have attempted to investigate this behemoth of a problem. Geographers rise to the top because we have the skills to model a three dimensional system in space without over-simplification. However, mental health geographers display great zeal in pursuing studies on access inequality without pausing to consider the necessity of reliable and specific information on need. Access studies can only be useful in the American context when based on such models of risk for mental health and homelessness. We cannot afford to give equal access to all citizens; we must target the available resources to those most in need.

This project proposes to build such a model. By borrowing bits and pieces from health and urban geographies I will determine census tract level risk for mental illness, addiction, and homelessness. This risk surface will allow planners (both public and non-profit) to target financial and capital resources to the most deprived and dangerous areas of the city. Service

planning can be improved once the providers know more about the population at risk. The environment of the neighborhood can change, saving people from developing these issues in the first place. Ultimately, this tool will help reduce homelessness, reduce America's collective psychological burden, and reverse some of the inequality that has become entrenched in a system that thrives on moving people from one vulnerable place to another.

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