A Mental Health Tracking System for the State of California

A Project of the
Center for Reducing Health Disparities
UC Davis School of Medicine

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Executive Summary

A mental health tracking system for the State of California should employ a variety of approaches, including:

- careful assessment of current state-funded mental health services,
- improved understanding of population-level mental health care need (please see our report on the assessment of need using the California Health Interview Survey),
- and enhanced use of existing databases such as the Medi-Cal billing and pharmacy databases.

The goals of this project are to:

1. Demonstrate how existing data can be used to track mental health services access and utilization and examine possible disparities at the local level (census tracts within counties).

2. Show how modern spatial and statistical methodologies (using a geographic information system or GIS) can be used to illustrate meaningful patterns of mental health services access and utilization in an understandable way.

With these goals in mind, this report focuses on the mental health problems of serious emotional disturbance (SED) and serious mental illness (SMI) in the following ways:

1. We discuss the prevalence of SED and SMI in California.
2. We analyze access to mental health care services and utilization of these services for beneficiaries within the Medi-Cal database.
    a. We report outcomes separately for different target populations (by age group, gender, and race/ethnicity) in order to increase knowledge about possible disparities in mental health services in the state.
    b. We employ a geographic approach to facilitate targeted interventions that may effectively allocate limited resources.
    c. We comment on information systems needs in order to track and improve mental health in the State of California.

Introduction

The Mental Health Services Act (MHSA) provides an unparalleled opportunity to serve children, youth, adults, older adults, and families with mental health needs. It also conveys an expectation to monitor progress toward statewide goals of improving access to and enhancing the quality of mental health care, especially for those with mental health needs that are currently un-served or underserved.

> *"To provide state and local funds to adequately meet the needs of all children and adults who can be identified and enrolled in programs under this measure. State funds shall be available to provide services that are not already covered by federally sponsored programs or by individuals' or families' insurance programs."* ***– Mental Health Services Act: Purpose and Intent***

A critical component involved in monitoring and evaluating service provision, use, and the success of the Mental Health Services Act is the availability of a robust information system that is capable of providing an accurate assessment of the progress of California's mental health programs toward its goals at the state level.

Any effective information system must be carefully designed. It must be scientifically sound (that is, have sufficient statistical precision and provide accurate estimates on which policy decisions can be based), and the information system itself must be cost effective. Cost effectiveness can be measured by the value of the information collected (important variables included and unimportant ones excluded) versus the personnel and maintenance costs for the system. Analytic strategies must be used to efficiently and effectively track access to mental health services and utilization of those services.

Any effective mental health tracking system should incorporate the following:

1. **Analyze patterns and trends over time:** There should be regular and systematic analyses of the data, so that temporal trends and patterns can be identified and acted upon.
2. **Understandability and usability of data analyses:** Data analyses must be presented in a way that the public, public administrators, policy-makers, and other stakeholders can understand and use. In this project, we use maps to provide a powerful and user-friendly way to convey analytic results.
3. **Public health policy:** The mental health tracking system should be tied to mechanisms for effecting public health actions.

4. **Timely in its operation:** Data collection and analyses must be timely. For the three items listed above to be effectual, policy-makers, stakeholders, and the public need to see results from recently collected data, not from data collected several years earlier.
5. **Scientifically sound:** Data collection, quality control procedures, and statistical analyses should be methodologically sound, reflect modern scientific approaches, and be subject to independent scientific review.

In the following sections of the report we will discuss the prevalence of SED and SMI in California and our approach to measuring access and utilization of mental health services for this population. We review the spatial and statistical methods used in mapping the data and summarize our findings, including noted disparities among different geographies and subpopulations. We will draw some final conclusions and summarize our recommendations from this project. In addition, an in-color atlas of maps for the State of California is provided at the end.

Serious emotional disturbance (SED) and serious mental illness (SMI) in California: Estimating prevalence

Serious emotional disturbance (SED) and serious mental illness (SMI) are defined as having a diagnosable mental, behavioral, or emotional disorder that meets the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria and results in functional impairment that substantially interferes with or limits one or more major life activities. This definition describes a population with explicit need for mental health care specialty services, providing an appropriate focus for our analysis that remains consistent with the tenor of the Mental Health Services Act.

> *"Mental illnesses are extremely common; they affect almost every family in California. They affect people from every background and occur at any age. In any year, between 5% and 7% of adults have a serious mental illness as do a similar percentage of children—between 5% and 9%. Therefore, more than two million children, adults and seniors in California are affected by a potentially disabling mental illness every year. People who become disabled by mental illness deserve the same guarantee of care already extended to those who face other kinds of disabilities."* ***– Mental Health Services Act: Findings and Declarations***

The gold standard for a definitive diagnosis of SED or SMI is usually made by a trained clinician using semi-structured interviews in a one-on-one clinical assessment [1]. However, in order to take advantage

of the large state-level Medi-Cal dataset, we employed an algorithm (developed by Jen Associates), already used at the Department of Health Care Services (DHCS), identifying qualifying ICD-9 code diagnoses associated with having SED or SMI (see Appendix A for a list of SED and SMI diagnoses).

We collected 3 years of data (1/1/2007 to 12/31/2009) from DHCS including Medi-Cal data from the fee-for-service, managed care and Short Doyle programs (Figure 1).

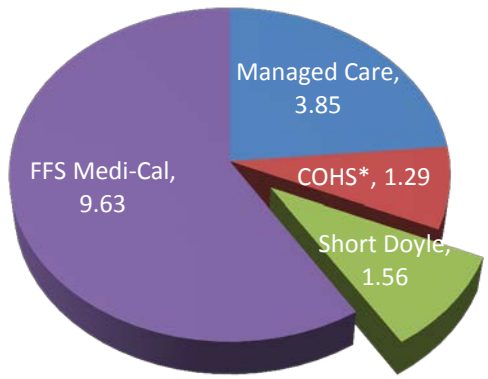

Figure 1. The number of Medi-Cal visits (ages 12-64), by program type, in the Medi-Cal billing database from 2007-2009.

*COHS = County Operated Health Systems

The characteristics of clients existing in these data are shown in Table 1. We initially explored the possibility of merging Medi-Cal data with the county-level Client and Service Information (CSI) database. This has been a continued interest among the Department of Mental Health, DHCS/CalMEND and Ingenix, a health information technology company. However, the project has been stalled by budget issues and personnel changes. This is unfortunate since the ability to analyze mental health from a variety of payers would improve the understanding of service access and use.

Table 1: Socio Demographic Characteristics for California Medi-Cal Beneficiaries with SED or SMI, 2007-2009, Compared to the State of California's Demographic Profile

	Youth age 12-17 with SED	Adults age 18-64 with SMI	U.S. Census: CA Demographics 2009
Total	**N = 179,131 (22.0%)**	**N = 636,765 (78.0%)**	**N = 36,961,664**
Gender			
Male	56.6%	36.8%	50.1%
Female	43.4%	63.2%	49.9%
Age*			
12-17	22.0%		
18-24		10.8%	
25-44		31.6%	
45-54		20.1%	
55-64		15.7%	
Ethnicity/Race**			
White	29.1%	43.2%	76.4%
African-American	14.6%	14.4%	6.6%
Hispanic	45.4%	26.7%	37.0%
Asian/Pacific Islander	3.1%	6.9%	13.1%
American Indian/Alaskan Native	0.8%	1.0%	1.2%
Other	1.5%	2.2%	2.6%
Invalid/Decline to State	5.5%	5.6%	

*We excluded populations under the age of 12 since the criteria for diagnosing SED requires the child to be at least 12 years of age. Our analysis also stopped after age 64 since we were concerned that we would miss a significant portion of the 65 years and older population covered by Medicare and thus provide skewed results for this population.

**The Medi-Cal database does not specifically separate race and ethnicity, but the U.S. Census does. Thus the total percentage in the census column is greater than 100%. In addition, several sub-populations of Asian and Pacific Islander racial origins were combined to create the "Asian/Pacific Islander" category including: Filipino, Amerasian, Chinese, Cambodian, Japanese, Korean, Samoan, Asian Indian, Hawaiian, Guamanian, Laotian, Vietnamese, and Other Asian or Pacific Islander.

Measuring Access to Mental Health Care Services

The issue of access to mental health care services can be defined in a number of ways and from a number of perspectives. For example, access may refer having health insurance or a usual source of care (overall accessibility), ease of contacting providers for appointments (contact accessibility), length of

time it takes to get an appointment (appointment accessibility) and the proximity of providers to patients (geographic accessibility) [2]. It might also be related to an individual's perception that they are getting the services they need. In our analyses we have defined the access to mental health services as the penetration rate in the Medi-Cal beneficiary population. The **penetration rate** is a frequently used measure that in this case provides information about the amount of mental health services consumed among those eligible to obtain mental health services (i.e. those already enrolled in the Medi-Cal program). The penetration rate was constructed as a ratio with the number of individuals with a diagnosis of SED or SMI in the numerator and the total number of Medi-Cal beneficiaries in the denominator (or subpopulations of interest thereof).

We aggregated our analyses of the penetration rate to the census tract level. Census tracts have often been considered the spatial equivalent of a 'neighborhood' since populations within census tracts tend to be relatively homogeneous. The census tract also has the advantage of containing a fairly consistent number of individuals, estimated at an average of 4,000 people (range 1,500 to 8,000). To perform the analysis at the census tract level we required a fully geocoded dataset for both the numerator and the denominator described above. Geocoding, or assigning spatial coordinates to an address, is not a trivial task for such a large dataset. The Department of Health Care Services (DHCS) was able to provide a fully geocoded numerator for this project. However, since the denominator is much larger (all Medi-Cal beneficiaries in California over three years time), the computing power required to geocode would have tied up DHCS computing resources for several days. For this reason, a 10% sample was used for the denominator. Although the distribution of the 10% sample dataset has been shown to have a high level of precision at the census tract level, this compromise will no doubt lead to some errors in our estimates, particularly in the census tracts with small numbers of beneficiaries.

Maps showing both the distribution of access to care in the state and clusters of high and low access areas are included in the atlas at the end of this report.

Measuring Mental Health Care Services Utilization

The utilization of mental health care services was analyzed using a measure of the number of mental health visits per Medi-Cal beneficiary with SED or SMI, per year, by census tract. For this analysis, we used the presumed outpatient population. This was derived from claim types (see Figure 2) of 'outpatient' and 'medical/physician.' This allowed us to display utilization rates in a more meaningful

way. For example, one might consider it reasonable for individuals with SED or SMI to access outpatient mental health care services at a rate of once per quarter or even once per month. However it might be considered a failure of the system if those with serious mental illness saw a mental health provider fewer than two times per year. In other words, thresholds of appropriate utilization could be assessed based on current standards of care. On the other hand, if inpatient visits were included, those patients who spend weeks to months to years in such a setting would skew the utilization rate to very high numbers that would not be amenable to a rational interpretation. Our selection of these service types was inclusive of 79% of the overall dataset.

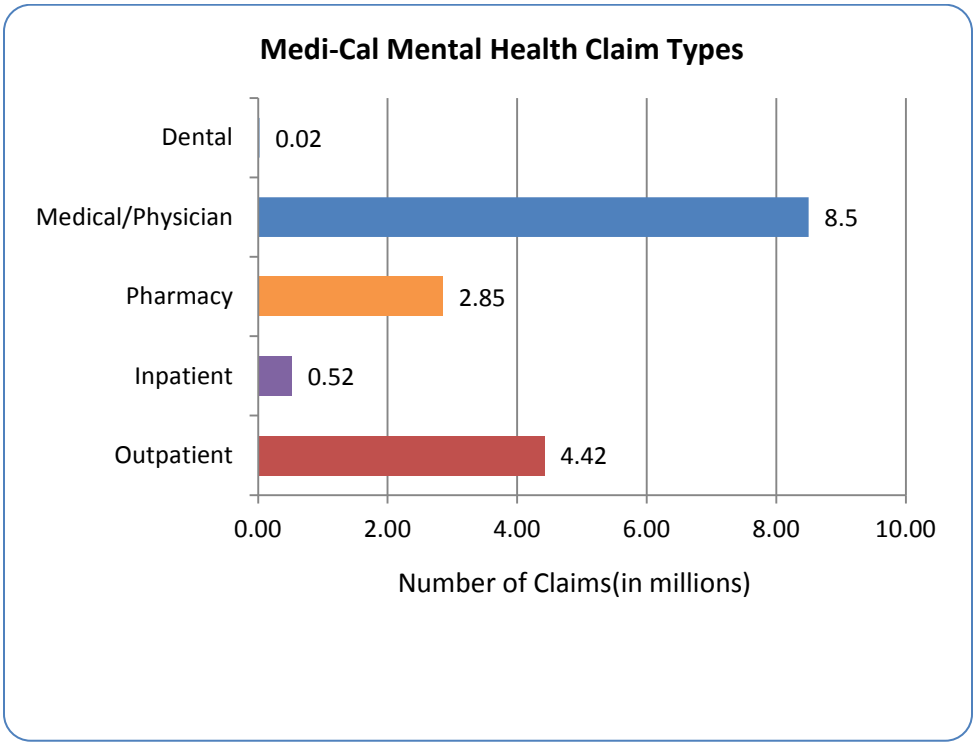

Figure 2. Different claim types for Medi-Cal mental health patients.

Please see the atlas for maps showing utilization rates by census tract as well as the clusters of high and low utilization in the state.

Spatial and Statistical Methods

When working with geographic information, careful attention is required to ensure that the message being presented is indeed the one intended. Spatial data violates one of the basic tenets of traditional statistics, that each observation is independent. That means that when looking at two events, the occurrence of one event provides no information on the occurrence of the second. But this is not true in geography. We know that in this field, two events are related based on their proximity to one another. In other words, near events are more alike than those separated by greater distances. Because of this, spatial methods are inherently different. The section that follows is intended to provide detailed information about the mapping techniques used in this project which will facilitate the reader's interpretation of the enclosed maps.

An overview of hot spot analysis

Hot spot analysis is a method for testing the statistically significant clustering of a value (such as the penetration rate or utilization rate) geographically. The technique brings meaningful patterns to light and provides the reader with an easy to read outcome map.

The statistic used in hot spot analysis is called the Getis-Ord Gi* (pronounced Getis-Ord G-i-star). This statistic is used to evaluate each census tract in the state and produce a related z-score and p-value indicating where high and low values (i.e. penetration rates or utilization rates) cluster spatially. According to the spatial statisticians at ESRI (Redlands, CA), a leading GIS software company, "This tool works by looking at each feature [census tract] within the context of neighboring features. A feature with a high value is interesting but may not be a statistically significant hot spot. To be a statistically significant hot spot, a feature will have a high value and be surrounded by other features with high values as well[3]."

As one might interpret from the paragraph above, looking at a map that shows a single census tract with a high value may or may not be important (more on that in the section, "Why perform hot spot analysis?"). Hot spot analysis focuses on 'neighbors.' When performing a hot spot analysis, an *a priori* decision must be made about how many contiguous neighbors should be considered in the analysis (refer to the section "How was hot spot analysis done for this project?"). Whatever the number of

contiguous neighbors, each group of neighbors would be analyzed by its penetration or utilization rate to create a 'local' mean for the analysis.

That local mean can then be compared the mean for all of the census tracts in California (i.e. a 'global' mean). This comparison creates a z-score. When the local mean is very different from the global mean and that difference is too large to be the result of random chance, a statistically significant z-score results (indicated by a p-value of < 0.05). To re-state, if the census tract and its designated neighbors have penetration or utilization rates that are significantly different from the overall penetration or utilization rate for the state of California, then a hot or a cold spot results.

A hot spot indicates an area of intense clustering of high values (penetration rates are higher, indicating greater access to care). A cold spot is an area where there is intense clustering of low values (thus less access to care).

Why perform hot spot analysis?

Using the above information, we can employ hot spot analysis to answer the question, "Where is the access to mental health care in California greater or lesser than expected, given the overall Medi-Cal beneficiary population? Stated another way, we are asking where mental health care services are consumed to a greater or lesser extent among those eligible to receive such services through the Medi-Cal program. We believe that this will provide the most useful information available for geographically based allocation of resources over traditional mapping techniques because:

- it answers the question of interest,
- maps are comparable,
- hot spot maps decrease concerns about missing important information in small, difficult to see census tracts,
- statistical significance provides meaningful information.

Choropleth maps

We also provide a compendium of choropleth maps. These kinds of maps display the raw data values for penetration and utilization rates in categories. Different colors are used to distinguish the relative magnitudes of these rates in each census tract. Since there are so many census tracts in the state (7,049), it can be difficult to see patterns in the data. We propose that the choropleth maps be used for more detailed understanding of socio-demographic and geographic areas of disparity noted in the hot spot maps (See Figure 3).

[redacted] [redacted]

Figure 3. Yolo County. The hot spot map on the left shows an area of significantly increased access to mental health care services in Davis (red area). By looking at the choropleth map on the right, we can see that the Davis census tracts (teal blue) appear to be strongly influenced by the high penetration rate (dark blue) at the University of California, Davis. The top map is provided for reference.

An important concern for any map reader, particularly with the choropleth style map is the issue of bias related to the census tract size. We caution the reader to note that the penetration and utilization rates in larger census tracts are no more important than the penetration and utilization rates in very small census tracts. As previously noted, despite the large variation in the geographic size of census tracts, they were meant to be homogeneous areas with respect to population characteristics, economic status, and living conditions[4].

How was hot spot analysis done for this project?

The methods used in setting up a hot spot analysis can change the results, so careful attention to detail is required. To fully understand the methods behind hot spot analysis, they will be described here, with specific details relating to this project.

As mentioned above, spatial methods differ from traditional statistics because each value considered is dependent on the values of nearby things. This is important because if things near one another were not more likely to be similar (and thus dependent), there would be no purpose in studying problems spatially. That said, there are many ways to conceptualize spatial relationships and this must be determined early in the hot spot process. It turns out that choosing a fixed distance band works best when analyzing data using polygons (like census tracts) of varying sizes. Think of the distance band as a 'sphere of influence' or a moving window over a map that settles on top of each census tract and looks at that census tract within the context of its neighbors. Anything lying outside of that sphere of influence has no influence in the calculations. Therefore it is critical to choose a distance that makes sense for the problem being analyzed[5]. The selection of the distance band, then, is one way to identify the number of neighbors needed to create the local mean described above.

If we knew the spatial processes that promote clustering of mental health services access or lack of access, we could use that distance in our calculation. Unfortunately, there is no empirical distance for this topic. Therefore, we must choose a distance band that reflects maximum spatial autocorrelation (a statistical measure of the degree to which a set of spatial features and their associated data values tend to be clustered together or dispersed in space). Moran's I is that statistical measure.

Before we ran Moran's I on our data, we first had to understand the spatial arrangement of census tracts in California. In 2008, there were 7049 census tracts in the state. However, the sizes of census tracts are quite varied (see Figure 4). In Figure 4, we show the calculated and mapped area of each census tract and then used colors to signify which census tracts are significantly larger than the mean census tract size for the state. Table 2 summarizes our findings indicating that here were 118 very large census tracts (in a teal green color) occupying a significant area of the state. To find a distance band that will enable our 'sphere of influence' to encompass at least three census tracts (a reasonable number of neighbors), we would have to choose a very wide distance band for these large areas. This might be appropriate for a regional analysis, but since our focus is on representing community patterns we needed a method to allow for smaller distance bands.

Figure 4. State of California census tracts symbolized by the area of each census tracts. The teal blue color shows the 118 larges census tracts in the state (total = 7,049).

Table 2 Analysis of California Census Tracts

Number of Census Tracts	Range (sqmi)	Mean (sqmi)	Std Dev (sqmi)
Entire State (7049)	0.02 to 7,992.51	22.44	173.79
Largest census tracts (118)	285.72 to 7,992.51	909.83	980.29
Remaining census tracts (6931)	0.02 to 282.74	7.33	26.85

To do this, we focused on the 6,931 smaller census tracts. Using just those areas, we calculated the minimum, average and maximum distance it would take to get from the center of one census tract to another (the results were 0.16, 1.49 and 76.48 miles respectively). This gives us some important information about our data which we can now use to perform Moran's I at several different 'test' distance bands. Our goal is to find the distance at which clustering for the data being analyzed is most intense. Our initial test distance should be somewhere between the minimum and maximum distances noted above (we chose 9.3 miles or 15,000 meters). Then we tested 25 different distances using an increment that was approximately the same as the average distance shown above (about 1000 meters). That means that we tested the following distances (in meters): 15,000, 16,000, 17,000 …. 39,000, 40,000. The result of the Moran's I test includes both a z-score and a p-value for each distance tested. By looking at the z-scores graphically (see Figure 5), we can easily find the shortest distance at which clustering is most intense (the first peak among the charted z-scores).

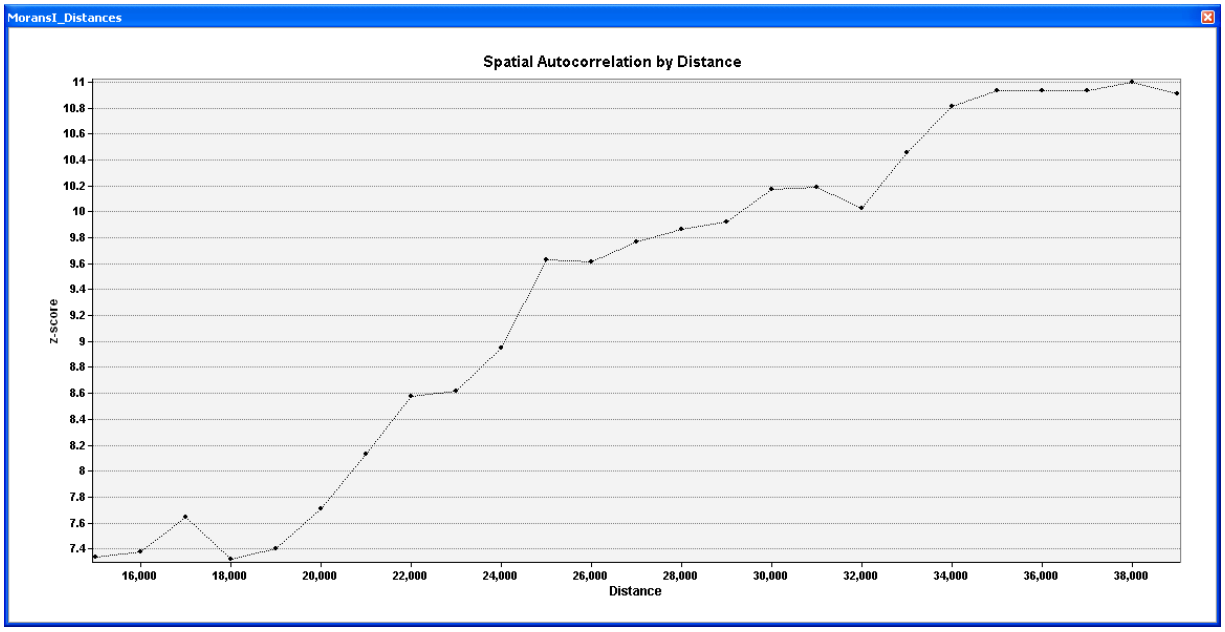

Figure 5. Plotting the distance on the x-axis (in meters) against the resulting z-score from the incremental Moran's I test. The first peak is seen at a distance of 17,000 meters. This is the shortest distance at which clustering is most intense for this dataset. One should then check that z-score against the output table to ensure that the p-value is statistically significant.

Having chosen 17,000 meters (just over 10 miles) as our sphere of influence or distance band for the hot spot analysis, the next step is to account for those large census tracts that have so far been left out of

the analysis. To do this, we create a file called a spatial weights matrix. This file records our conceptualization of spatial relationships (the fixed distance band approach) our calculated distance (17,000 meters) and a mandatory number of 'forced' neighbors (two). This last part pertains to the larger census tracts. The spatial weights matrix ensures is that when hot spot analysis is running, if the fixed distance of 17,000 meters does not provide for at least 2 neighbors for each census tract, then we will force the nearest two neighbors to be included in the assignment of a local mean for the analysis.

Finally, we are ready to perform hot spot analysis, using the 'rules' defined in the spatial weights matrix. The resulting map is specific to the underlying data and the way in which it clusters spatially. The example below (Figure 6) shows where in California clusters of high and low access to mental health care services among all adult Medi-Cal mental health beneficiaries exist.

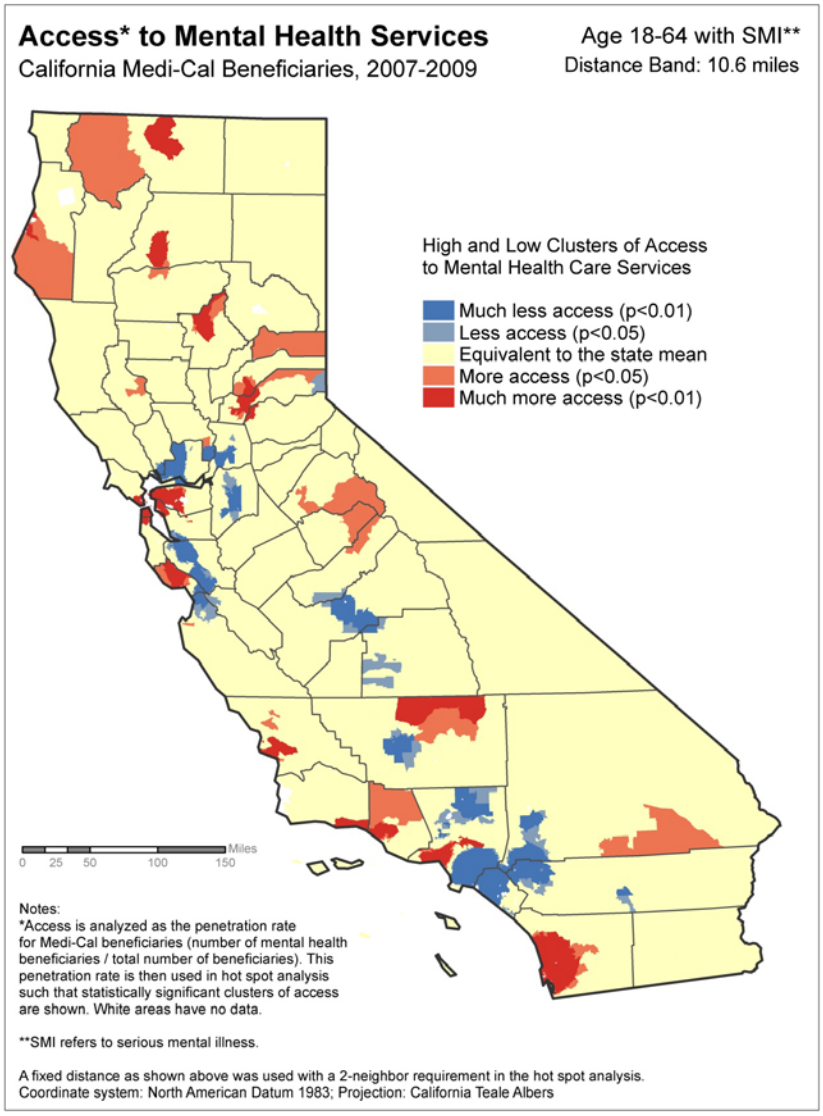

Figure 6. Hot Spot map showing high and low clusters of access to mental health services care among Medi-Cal beneficiaries ages 18-64 with a diagnosis of SMI, using a distance band of 17,000 meters or 10.6 miles.

Findings

The bulk of mental health care services provided by Medi-Cal (Fee for Service and Managed Care) are not provided by psychiatrists (see Table 2). According to the table below, psychiatrists rank 20th among care providers with regard to the number of mental health visits they provide via the Medi-Cal program. If one were to combine the primary care specialties (General Practice, Family Practice, Internal Medicine and Pediatrics), these specialists provide just over 25% of all mental health services. Emergency Medicine doctors are also significant providers of service. What appears concerning in viewing the table below is the number of services provided by specialties like: Radiology-Pedodontist (Dentists Only),

Pathologists (M.D. only) and Anesthesiologists for example. It is possible that these specialists are not offering the kind of mental health services that studies like this one are meant to address. We recommend that a review be conducted to provide insight regarding what services are included in this database for patients with SED or SMI that might be billed by specialists.

Table 2. Providers of mental health services as per the Medi-Cal billing database (Fee for Service and Managed Care claim types only), 2007-2009. The frequency noted in the table refers to the number of line-items per patient in the database, which is roughly equivalent to the number of visits.

Frequency	Percent	Provider Type
851,920	13.70%	Emergency Medicine
832,036	13.38%	Radiology, Pedodontist (Dentists Only)
654,142	10.52%	Unknown
573,933	9.23%	General Practice
507,131	8.15%	Family Practice
501,045	8.06%	Internal Medicine
312,892	5.03%	Pathology (M.D. only)
236,874	3.81%	Pediatrics, Periodontist (Dentists Only)
214,815	3.45%	OB-Gynecology (M.D. only)
194,507	3.13%	Clinic (mixed specialty), Public Health (Dentists Only)
187,479	3.01%	Cardiovascular Disease (M.D. only)
140,526	2.26%	Anesthesiology
116,760	1.88%	Ophthalmology
85,901	1.38%	General Surgery
79,769	1.28%	Roentgenology, Radiology (M.D. only)
73,520	1.18%	Gastroenterology (M.D. only), Oral Surgeon (Dentists Only)
68,971	1.11%	Neurology (M.D. only)
66,951	1.08%	Pathologic Anatomy: Clinical Pathology (D.O. only)
63,082	1.01%	Orthopedic Surgery, Orthodontist (Dentists Only)
55,725	0.90%	Psychiatry
42,079	0.68%	Physical Medicine and Rehabilitation, Certified Orthodontist (Dentists Only)
34,103	0.55%	Pulmonary Diseases (M.D. only)
29,613	0.48%	Otology, Laryngology, Rhinology
29,005	0.47%	General Practitioner (Dentists Only)
27,304	0.44%	Urology and Urological Surgery
25,111	0.40%	Dermatology
17,412	0.28%	Nephrology
17,183	0.28%	Pediatric Cardiology (M.D. only)
16,902	0.27%	Neurological Surgery
16,708	0.27%	Pharmacology-Clinical
16,431	0.26%	Pediatric Allergy
16,319	0.26%	Nuclear Medicine
15,983	0.26%	Hematology
15,394	0.25%	Other
11,214	0.18%	Infectious Disease
10,589	0.17%	Allergy
8,218	0.13%	Endocrinology
6,932	0.11%	Ophthalmology, Ototolaryngology, Rhinology (D.O.only)

6,850	0.11%	Rheumatology
6,537	0.11%	Aviation (M.D. only)
6,165	0.10%	Thoracic Surgery
5,903	0.09%	Plastic Surgery
4,018	0.06%	Obstetrics (D.O. only), Endodontist (Dentists Only)
3,559	0.06%	Psychiatry Neurology (D.O. only)
3,398	0.05%	Neoplastic Diseases/Oncology
3,014	0.05%	Neurology-Child
2,970	0.05%	Psychiatry (child)
2,599	0.04%	Geriatrics
6,219,492	**100.00%**	**Totals**

While it is well known that mental health disparities exist among diverse populations, especially individuals of different racial and ethnic groups, geographic differences are less well known. In order to better understand differences in access to and utilization of mental health care services, we chose to analyze subpopulations of Medi-Cal beneficiaries by: age group, sex, and racial/ethnic group.

We have provided a number of hot spot maps (see Atlas) that will aid in identifying patterns in service access and utilization in California. However, we realize that trying to 'digest' the information presented in so many maps can be challenging. Therefore, we have created a summary sheet to improve interpretation of the maps (see the map comparison matrices within the atlas). A sample of the matrix is shown below (Figure 7).

SMI	Female		White		Black		Hispanic		Asian/Pacific Islander	
County Name	A	U	A	U	A	U	A	U	A	U
Plumas	100						75			nd
Riverside	55		51		12	1	31		20	9
Sacramento	8	1	97	2	97	1	5	7	68	
San Benito										
San Bernardino	72	11	41		9	6	29	3	3	1
San Diego	84	57	90	52	51	44	70	63	63	24
San Francisco	100	100	100	37	100	7	100	1	74	91

Figure 7. Map comparison matrix sample. This section of the matrix shows dyads of access (A) and utilization (U) by county and by analytic subgroup. Yellow areas indicate that the county had no hot or cold spots. Red areas indicate that the county had census tracts with one or more hot spots as the predominant effect direction and similarly the blue areas refer to cold spots (less access or utilization). Numbers inside the cells represent the percentage of census tracts in that analytic subgroup, for the county that were hot or cold compared to the total number of census tracts containing Medi-Cal beneficiaries of that population type. The reference 'nd' means that there were no Medi-Cal beneficiaries in that subgroup in the county.

Within the matrix, the reader is meant to look at dyads of information within a county and within an analytic subgroup. The dyads consist of summary level information (from the maps) regarding access (denoted with an 'A') and utilization (denoted with a 'U') of mental health services. Note that yellow boxes in the matrix mean that the county had no hot or cold spots. This means that the rate of access or utilization for that county was roughly equivalent to the state mean. On the other hand, if there was even one hot (red) or cold (blue) spot on the map, then the predominant color within that county is used in the matrix. To better understand the relative amounts of that predominant effect, a number is placed inside the box which indicates the percentage of census tracts (for that county and population subgroup) that were hot or cold. Some areas had no Medi-Cal beneficiaries for the population subgroup being analyzed and were left as white space in the map and described as 'nd' (meaning no data) in the matrix. In the rare case when the percentage of hot and cold spots for a county were the same, the matrix cell was colored yellow and a notation is made at the bottom of the chart describing the relevant data distribution.

How each dyad is then interpreted may vary since different interpretations are possible. However, we have created a legend with one potential interpretation for the matrix dyads (Figure 8).

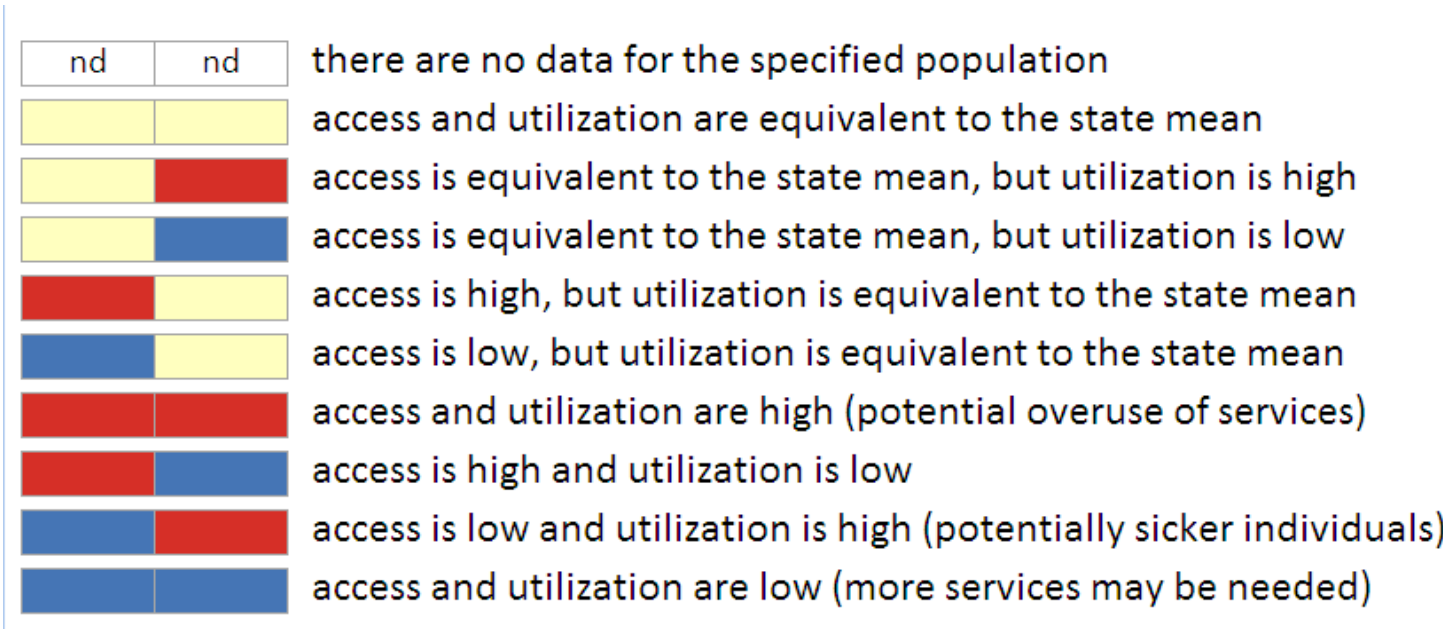

Figure 8. Map comparison matrix legend. Each dyad is shown with its potential interpretation. Special attention should be paid to both the 'blue/blue' dyads and the 'blue/red' dyads which may indicate areas where more services are needed.

On a more global level, one should remember that each census tract is being compared to the mean for the state. So if the assumption is that the state is doing relatively well with respect to providing mental health services, than one should regard the cold spots cautiously, since although they are significantly less than the state mean, they may be doing relatively well compared to other places that do not provide high levels of service. On the other hand, if the assumption is that California is doing poorly in its provision of mental health care services, then the hot spots, where access and/or utilization is high, may not reach a threshold of desired service levels, despite having higher than average levels.

Some findings to highlight (using the above interpretation method) include:

- Counties demonstrating a high need for more services: Kern, Los Angeles, Riverside, Sacramento, San Bernardino, Santa Clara and Solano.
- Counties that may demonstrate an overuse of services: Monterey, San Diego, San Luis Obispo and Santa Barbara
- Groups for which disparities are highest (in order): Age 18-24, women, Age 55-64, Hispanics and blacks.

Conclusions and Recommendations

In the State of California, there are statistically different levels of access to and utilization of mental health care services. Census tract level data allows for a community level analysis to be performed. This

might be considered an ideal geographic level for understanding health disparities in this population since it is said that census tracts mimic neighborhoods in their homogeneity. The "hot spot" maps provide an opportunity to look at patterns within the state (still analyzed at the community level) in which statistically significant clusters of high and low access and utilization of mental health care services exits. Reviewing the enclosed choropleth/distribution maps allow a census tract by census tract review of service access and utilization that may further facilitate decision-making and policy initiatives.

In order to facilitate continued tracking of mental health care in California, we make the following recommendations:

- Merging of the Medi-Cal and CSI data will provide a more complete picture of mental health services in California.
- Medi-Cal should change its definition of Hispanic to classify it as an ethnicity and not as a race. This will be consistent with the U.S. Census Bureau's definition and will facilitate data comparisons to socio-demographic indicators drawn from census data.
- Older adults (65 and over) should be also included in the analysis. Such an analysis would be most useful if it included Medicare patients as well as Medi-Cal.
- To facilitate geographic analyses, data should be geocoded at the source. Recently the Office of the State Chief Information Office (OCIO) issued a policy statement on 12/15/2010 requiring all state datasets, where an address exists, to have latitude and longitude coordinates included. This will be very helpful. However, it will not improve geocoding for specific populations in need, such as the homeless and incarcerated populations. Policies should be instituted to collect geocodable data at the initial source of patient contact with the system (eg. nearest cross-streets where a homeless individual spends a lot of time or the address of a regularly used shelter).
- Attention should be paid to new policies planned for release by the California State Geographic Information Officer, Scott Gregory. These policies will be focused on increasing data integrity through stewardship so that users can rely on authoritative content. Mr. Gregory is also building a statewide spatial data infrastructure. These new policies will help state agencies to perform geospatial analyses with trusted data and methods. The measure of access to care should include a component of population level mental health need. Please see our Deliverable #3 for a recommended calculation of need within the California Health Interview Survey dataset, which is a geocoded dataset.

- To evaluate the effect of the mental health services Act, data should be similarly analyzed before the time the act was implemented. In addition, temporal trends should be reviewed with ongoing data analysis.
- Access to care should be revised to include a component of 'need' as defined in Deliverable #3.
- The Medi-Cal database should be reviewed to better understand why there is a large population of specialists providing mental health care services that seem to be generally unrelated to the practice.

In addition to the above recommendations, it is worthwhile to note that we see at least two additional ways in which the geographic data could be enhanced with further work:

- The hot spot and choropleth maps could be provided in a digital format, potentially with the ability to interact with the different map layers. This would allow policy makers to visualize not only the data, but the underlying base map and demographics associated with a geography.
- The next step in understanding disparities geographically is with regression analysis. There is a model, called geographically weighted regression, than can help decision-makers to understand 'why' a hot or cold spot exists in an area by including the relevant predictors (eg. need, insurance, income, etc).

Resources Cited

1. Zimmerman, M. & Mattia, J.I. (1999). Psychiatric diagnosis in clinical practice: Is comorbidity being missed? *Comprehensive Psychiatry,* 40 (3): 182-191.

2. Hall AG, Lemak CH, Steingraber H, Schaffer S. Expanding the definition of access: it isn't just about health insurance. *J Health Care Poor Underserved*. 19(2):625-38.

3. Esri. How Hot Spot Analysis (Getis-Ord Gi*) works. 2010 11/17/2010 [cited 2010 12/19/2010]; Available from: http://help.arcgis.com/en/arcgisdesktop/10.0/help/#/How Hot Spot Analysis Getis Ord Gi works/005p00000011000000/.

4. U.S. Census Bureau-Geography Division. Census Tracts and Block Numbering Areas. 2000 04/19/2000 [cited 12/19/2010]; Available from: http://webcache.googleusercontent.com/search?q=cache:Kk3Xz495V18J:www.census.gov/geo/www/cen tract.html+census+tract+population+characteristics&cd=2&hl=en&ct=clnk&gl=us.

5. Esri. Conceptualization of spatial relationships. 2010 [cited 12/19/2010]; Available from: http://help.arcgis.com/en/arcgisdesktop/10.0/help/#/Modeling spatial relationships/005p00000005000000/.