Chapter 12
Spatial Patterns of Clandestine Methamphetamine Labs in Colorado Springs, Colorado

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Abstract Methamphetamine has become the most dangerous drug in the United States. More than half of the methamphetamine used is thought to be smuggled from Mexico, while the other half is manufactured domestically by clandestine methamphetamine labs that have sprung up all over the country. The ease of making the drug using over-the-counter medicines and household chemicals has encouraged many people to set up methamphetamine labs in their residences. In Colorado Springs, an urban area of about 360,000 people, the number of seized methamphetamine labs rose rapidly after the mid-1990s, from four labs in 1997 to 138 labs in the peak year of 2002. Altogether, 497 labs were seized between 1999 and 2005. Like other crimes, methamphetamine labs are not randomly distributed across space; rather, their distribution pattern is shaped by factors that may explain why an individual would want to start a methamphetamine lab and by those characteristics that make a neighborhood attractive as a place to produce methamphetamine. The spatial analysis of methamphetamine lab distribution in Colorado Springs shows that the methamphetamine labs are clustered roughly in and around the downtown area. They tend to be found in neighborhoods with a young and predominantly white population, small household size, and low educational levels. The distribution of methamphetamine labs also appears to have shifted northward over the 1999–2005 period. Such knowledge may assist law enforcement in their fight against the scourge.

Introduction

Methamphetamine is a highly addictive central nervous system stimulant with multiple street names such as “speed,” “chalk,” “crank,” “crystal,” and “ice.” The drug may be injected, snorted, smoked, or ingested orally, with its stimulant properties

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similar to adrenaline. One dose of methamphetamine (about 0.25 grams) lasts for 6 hours or more (KCI, n.d.; San Francisco AIDS Foundation 2007). Users initially experience feelings of increased alertness, well-being, exhilaration, or euphoria, high energy levels, loss of appetite, and a general sense of well-being. As the effects of the drug lessen, these intense and positive feelings will fade to extreme fatigue, depression, agitation, and violence. Feelings of panic, paranoia, hallucination, rage, seizures, and strokes can occur from extended methamphetamine use (NIDA 2007; ONDCP 2005). Since the drug alters the natural brain chemistry, addiction is very strong and hard to escape.

Once limited to specific segments of the population, methamphetamine has become the most dangerous drug in the United States. In 2002, 5.3% of the total US population reported having used methamphetamine in their lifetime (ONDCP 2005). About 1.5 million people regularly use this highly addictive narcotic. In 2000, law enforcement seized 7,436 pounds of methamphetamine nationwide. The drug has ruined many families and lives and has resulted in enormous social and economic costs.

Unlike other illicit drugs like cocaine and heroine, methamphetamine is easy to manufacture in make-shift labs. The ingredients are readily available household chemicals such as acetone, ether, iodine, lithium, methanol, muriatic acid, red phosphorus, lye (sodium hydroxide), drain cleaner (sulfuric acid), and brake cleaner (toluene), anhydrous ammonia (farm fertilizer), and over-the-counter cold and allergy medicines that contain pseudoephedrine. Producers can find recipes for "cooking" methamphetamine on the Internet. The ease of making methamphetamine has encouraged many users to establish labs in the United States in order to meet their own needs and sell for profits. The startup cost of a small lab is generally a few hundred dollars in chemicals and supplies, from which a producer can make thousands of dollars worth methamphetamine (KCI, n.d.; PDFA 2005). In the last decade or so, tens of thousands of methamphetamine labs have been seized by law enforcement in the United States. They come in various shapes and forms, from suitcase size labs in car trunks, to those in garages, basements, and warehouses. Labs have been found in many different places, but most of them were located in residential areas (KCI, n.d.). The clandestine nature of the labs makes it difficult for law enforcement agencies to track them. Often labs are uncovered when law enforcement officials go to homes that emit unusual or strong odors, have blacked out or foiled windows, generate excessive and odd trash, constant activity, and suspicious behavior, or when they investigate incidences of domestic violence, explosion and fire (KCI, n.d.).

The methamphetamine consumed in the United States comes from two sources: Mexico and domestic clandestine labs. By some estimate, about half to 80% of the drug is smuggled from Mexico. In the mid 1990s, Mexican drug traffickers started to dominate the production and distribution of methamphetamine in the United States. They operate "super labs" that are capable of producing at least 10 pounds of methamphetamine in a 24-hour period. Those labs are often located along the Mexican border with the United States and in California. Methamphetamine produced in Mexico enters the United States through ports of entry in California, especially San Ysidro (USDEA, n.d.; ONDCP 2005). Clandestine labs across the

United States (sometimes called "mom-and-pop" labs due to their small size) represent only a minor source of methamphetamine in the United States, but they pose a significant threat to public safety and environment (NDIC 2003). Many chemicals used to produce methamphetamine are highly flammable or toxic. The process of "cooking" methamphetamine also releases toxic and hazardous gases and waste. Usually for every pound of methamphetamine produced, five to seven pounds of toxic waste are produced (KCI, n.d.; Reinertson-Sand 2006). Exposure to these toxic substances may cause respiratory and eye irritations, headaches, dizziness, nausea, and shortness of breath among law enforcement officials and other first response personnel, not to mention people present in the homes with methamphetamine labs. Children in homes with labs are at extreme risk of serious illness, injury, or death due to toxic chemical exposure. Explosion and fire caused by botched operations are not uncommon, which sometimes result in fatalities. Methamphetamine lab operators may dump toxic waste down drains, onto the ground, along rural roads, and sometimes in other neighborhoods where it may be overlooked, which often contaminate soil, rivers and streams, groundwater, and public sewer systems (KCI, n.d.; NDIC 2003).

The purpose of this study is to analyze the spatial patterns of methamphetamine labs and the roles contextual socioeconomic characteristics play in their distribution in Colorado Springs, Colorado – a medium-sized city with just under 370,000 people. We selected Colorado Springs for this study for three reasons. First, after the mid 1990s, Colorado Springs experienced a rapid increase in seized methamphetamine labs, though the number has declined in recent years after reaching a peak in 2002. Understanding the distribution of the labs and the factors that may have affected their patterns may generate important insights into the social and demographic characteristics of individuals who engage in this dangerous and illegal activity and what characteristics make a place attractive to producing methamphetamine. Second, the Colorado Springs Police Department (CSPD) has made available on its website the addresses of seized clandestine methamphetamine labs from 1999 on. The data provide a unique opportunity for analyzing the spatial patterns of the methamphetamine labs in the city. Third, the second author of this paper is familiar with Colorado Springs, having lived there for 11 years. Local knowledge of the study area is very important in order to make sense of the patterns revealed by the data and to interpret the results properly.

The analysis uses the addresses of seized methamphetamine labs in Colorado Springs from 1999 to 2005, available on the CSPD website (www.springsgov.com). These addresses, as well as addresses for 11 superstores (Wal-Marts, Targets, and Sam's Clubs), 2 major universities (University of Colorado – Colorado Springs, and Colorado College), and 4 CSPD stations are geocoded in ArcGIS. Of the 497 lab addresses available, 398 addresses, or 80% of the total, geocoded successfully. Only large retail establishments such as Wal-Mart, Target, and Sam's Club stores are included as superstores because they carry large quantities of necessary supplies at attractive prices that may be used to manufacture methamphetamine. Their large size also provides the buyer a sense of anonymity. The ArcGIS Spatial Analyst distance-to-point (straight line) tool was used to calculate the distance from each census tract centroid to the nearest superstore, university, and police station. Socio-economic data for Colorado Springs census tracts are from the US Census.

In the remainder of the paper, we first provide a conceptual framework for understanding methamphetamine lab distribution. We then describe the spatial pattern of the methamphetamine labs seized in Colorado Springs during 1999–2005 period. Specifically, we will show using nearest neighbor analysis (NNA) that the methamphetamine labs are clustered. The study also analyzes by means of Poisson regression the effects of socioeconomic characteristics and the locations of police stations, superstores, and universities on the distribution of methamphetamine labs at the census tract level. Our hypotheses are that, just like other criminal activities, methamphetamine labs are not randomly distributed across the city, and their distribution pattern is shaped by various socioeconomic and geographic factors. The results show that several variables indeed have statistically significant effects on the distribution of the methamphetamine labs in Colorado Springs.

Conceptualizing the Spatial Distribution of Methamphetamine Labs

Geographic studies of crime have generally focused on identifying crime hotspots and the contextual socioeconomic and geographic variables that make some locations more prone to crime than others (Chainey and Ratcliffe 2005). These studies have used several conceptual frameworks to guide empirical analysis. Since domestic methamphetamine production is a relatively new phenomenon, little research has been done on their spatial distribution. Existing literature on methamphetamine has dealt with addiction (Knowles 1999; Maxwell and Spence 2005; Rawson et al. 2004), policy and policing (Boerl et al. 2006; Hohman et al. 2004), health and environment hazards (Brouwer et al. 2006; Colorado Department of Public Health and Environment 2003; Cunningham and Liu 2003), and the relation between methamphetamine use and other crimes (Bower 2003; Swartz 2005). Though little research has been done on the factors that may shape the geography of methamphetamine production, conceptual frameworks that have been developed to explain other types of crime are instructive.

For methamphetamine labs to appear, there needs to be a convergence of three elements: a demand for methamphetamine, motivated offenders, and an attractive environment in which to manufacture the drug. While there are many theories related to crime in society, such as routine activities theory (Malczewski and Poetz 2005), self-control theory and broken window theory (Doran and Lees 2005), social disorganization theory is the most relevant to this research, as it connects crime to socioeconomic variables. The social disorganization theory, developed in 1942 by Clifford Shaw and Henry McKay, suggests that crime is a result of the failure of community structure to recognize the shared values of its citizens and maintain effective social controls (Andresen 2006). The theory has notably impacted subsequent research (Cahill and Mulligan 2003; Browning 2002; Kelly 2000). Three primary factors may lead to social disorganization: economic status, ethnicity, and residential mobility. The assumption is that communities with lower incomes have less money for formal controls and community organizations; communities with greater heterogeneity and more diverse backgrounds are less likely to come together in groups; and communities with greater mobility are less likely to establish networks and community relations. The resulting breakdown of social structure increases the likelihood of crimes. The more immense the breakdown is the higher the expected crime. Methamphetamine production is hypothesized to be similarly influenced by social and community stability as a result of issues such as economic status, ethnicity, and transient population.

Crime has a geography (Andresen 2006; Chainey and Ratcliffe 2005). We must consider the place where crime occurs. The locations of crime often represent the communities most affected by social disorganization. Many studies have found crime rates to be higher in neighborhoods with low income and higher percentages of minority population (Ackerman 1998; Andresen 2006; Brown 1982; Buonanno and Montolio 2008). It is a common belief that criminal activity, like methamphetamine production, is concentrated in neighborhoods of low socioeconomic status, great ethnic diversity, and large proportion of temporary population (Ackerman 1998; Cahill and Mulligan 2003). Other studies have examined the relationship between crime and proximity variables, such as distances to major transportation routes, to downtown, to alcohol serving establishments (Brown 1982; Groff and La Vigne 2001; Kumar and Waylor 2003; Voltz 2000). Voltz's (2000) analysis of heroin and amphetamine markets shows a link between heroin suppliers, but not amphetamine suppliers, and major roads and railroads, which confirms previous findings that methamphetamine suppliers were less likely to be associated with major arterial roads (Eck 1995). Whether this finding holds for methamphetamine manufacturing is worth investigating.

Methamphetamine in Colorado Springs

Colorado Springs is located in central Colorado just east of the Rockies and at the base of Pikes Peak, encompassing an area of 186.1 mi^2 (481.8 km^2). With a population of 369,815 people in 2005, it is also the second largest city in the state, next only to Denver, which is approximately 60 miles to the north. As an amenity and recreation-rich medium-sized city, Colorado Springs holds many meanings to people. For some, it is a popular vacation destination. For others, it is an ideal location to raise a family. The amazing scenery, exciting activities, and supportive communities notwithstanding, Colorado Springs has its dark side, just like many other places. Sitting in the Garden of the Gods, you may not guess it. Looking down on the city from the top of Pikes Peak you would not suspect it. Driving around town you probably would not see it either. But methamphetamine production and addiction has become a serious problem in Colorado Springs, a growing plague hidden in the veins of the city.

Methamphetamine was once used mainly by specific subgroups of the U.S. population such as members of outlaw motorcycle gangs (OMGs) in the west coast. It entered Colorado in the 1990s, first hitting the streets of the Denver metro area in 1994. After that, methamphetamine rapidly overtook cocaine to become the drug of choice for many people in Colorado due to its more intense high at the same cost (KKTV 2005). The National Drug Intelligence Center (NDIC) reported in 2003 that methamphetamine has become the primary drug threat to Colorado (NDIC 2003).

Most of the methamphetamine available in Colorado is produced and distributed by Mexican drug traffickers in Mexico and in southwest states in the United States, particularly California and Arizona, but Caucasian criminal groups and OMGs also produce and distribute methamphetamine in the state (NDIC 2003). Colorado Springs has a reputation for the production of high-potency methamphetamine (ONDCP 2005) and is one of the regional distribution centers of methamphetamine for the west. Prices for methamphetamine in this region range from $90 to $125 per gram, $700 to $1,200 per ounce, and $9,000 to $15,000 per pound (ONDCP 2005). OMGs such as the Banditos and the Sons of Silence, which is the fifth largest OMG with its national headquarters in Colorado Springs, are active distributors of methamphetamine at the wholesale and retail level in Colorado Springs. Hispanic street gangs like Sureños and West Side Varrios, and African American Street gangs such as the Ruthless Ass Gangsters Crips also distribute methamphetamine at the retail level in Colorado Springs (NDIC 2003).

Although perhaps up to 80% of methamphetamine available in Colorado Springs is believed to be produced in Mexico, California, and Arizona, local methamphetamine labs also produce a significant amount of the drug. Law enforcement agencies report that locally produced methamphetamine generally has a higher purity (as high as 90% pure for crystal methamphetamine) than that brought in from outside (NDIC 2003). Methamphetamine labs were almost unheard of in the early 1990s. After the mid 1990s, the number of seized labs rose rapidly, from four labs in 1997 to 138 in the peak year of 2002 (Fig. 12.1). Since then, the number of methamphetamine lab seizures has been on the decline. In 2005, only 18 labs were seized. Most of the labs seized in Colorado Springs were small, capable of producing small quantities of methamphetamine. They were set up by addicts and local independent dealers to produce the narcotic to satisfy their own needs and to sell for a profit to fund their addiction. Repeat offenders are common because people cannot kick the habit.

The recent sharp decline in seized methamphetamine labs may be the result of several factors: an increased awareness among the general public that has deterred methamphetamine production; laws that restrict the sales of cold and allergy medicines containing pseudoephedrine – an important precursor to methamphetamine; and perhaps also the improved ability of methamphetamine lab operators to conceal their illegal activity. But the decline appears to have not made any dent in methamphetamine supply in the city. Whatever decrease in locally manufactured methamphetamine is being offset by Mexican sources. In 2003, the CSPD's Metro Vice, Narcotics and Intelligence (VNI) Division seized nearly

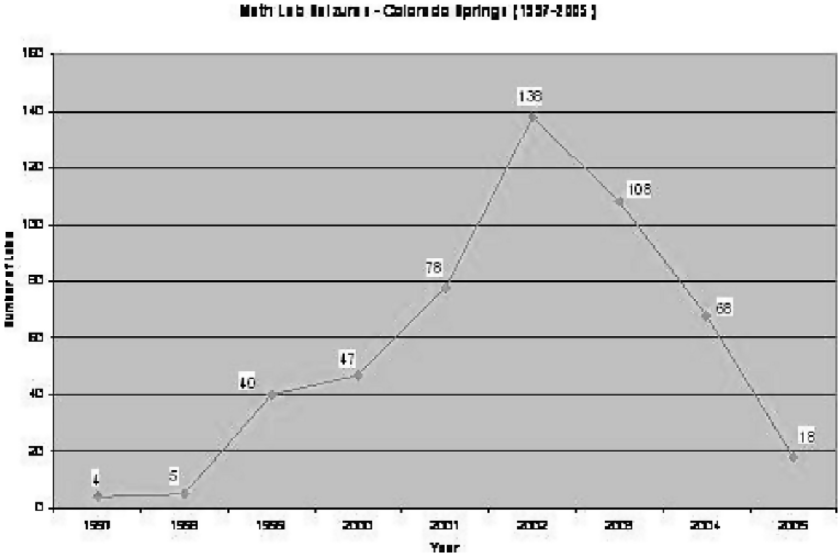

Fig. 12.1 Methamphetamine lab seizures in Colorado Springs, 1997–2005 [Source: Data are from the Colorado Springs Police Department website (www.springsgov.com)]

4,000 grams of methamphetamine. The number increased to 15,000 grams in 2005 and 25,000 grams in 2006, despite drastic declines in lab seizures (KKTV 2007).

An examination of the methamphetamine labs seized in each year from 1999 to 2005 shows that they are mostly located in and near central Colorado Springs, southeast of Colorado College and the central business district, close to the downtown (Fig. 12.2). The downtown area is a mixture of commercial and residential property. Many of the residential neighborhoods around downtown experience more crimes than other areas and are considered to be of low socioeconomic status. Additionally, Acacia Park, located in downtown between Nevada Avenue, Tejon Street, Platte Avenue and Bijou Street, is known for its criminal activity, including drug transactions in addition to being a popular location for concerts, fairs, and outdoor markets.

Methamphetamine is related to other criminal activities, particularly property crimes and identity theft, in Colorado Springs. The focus of methamphetamine users and producers is to obtain money and continue the cycle of addiction and production (KKTV 2005). The relationship between methamphetamine and identity theft is receiving national media attention (Schabner 2005). The majority of identity theft rings are related to methamphetamine and in some places, as many as 95% of identity theft cases are related to methamphetamine addiction. Drug user will steal mail and ID items from cars and purses in order to trade the information for more methamphetamine (Sullivan 2004). To increase public awareness of the problems caused by methamphetamine and help police combat the methamphetamine problem in Colorado Springs, the city produced a documentary – "Methamphetamine – A Social Plague." The documentary was aired

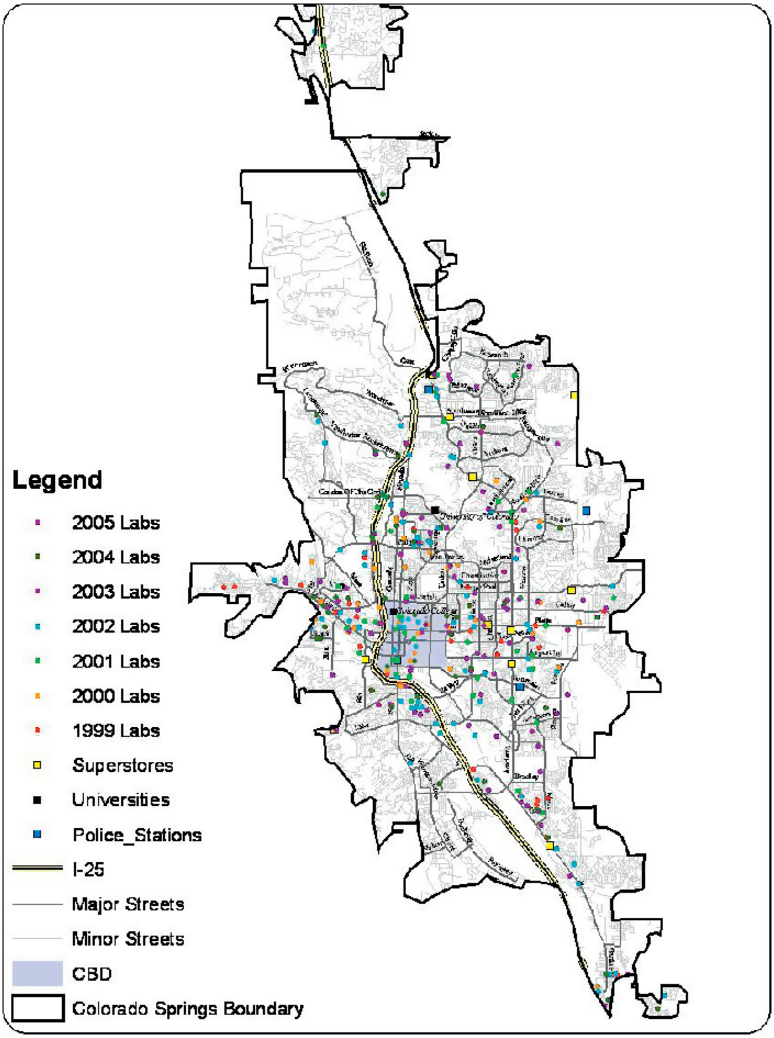

Fig. 12.2 Distribution of the seized methamphetamine labs in Colorado Springs, 1999–2005 (See also Plate 14 in the Colour Plate Section)

simultaneously on June 6, 2005 by all five commercial television stations in Colorado Springs.

Spatial Patterns of Methamphetamine Labs in Colorado Springs

To test if the seized methamphetamine labs are clustered in space or randomly distributed, NNA is carried out. NNA is a widely used technique for spatial pattern analysis, including crime patterns (Chainey and Ratcliffe 2005; Ratcliffe 2005). It calculates the expected mean distance between the locations of methamphetamine labs based on the assumption that the points are randomly distributed and compares that distance with the observed mean distance. If we use (x, y) to denote the coordinates of nearest neighbor labs i and j in a Cartesian space, then the distance between them, d_{ij}, is calculated using the formula:

$$d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$$

The observed mean nearest neighbor distance is simply $d_{\text{obs}} = \frac{\sum d_{ij}}{n}$, where n is the number of the methamphetamine labs in the study area. Given the size of the study area, A, the expected mean nearest neighbor distance under the assumption of random distribution is given by

$$\overline{d}_{\text{exp}} = \frac{1}{2}\sqrt{\frac{A}{n}}.$$

The ratio between the two (observed mean distance/expected mean distance), $\overline{d}_{\text{obs}}/\overline{d}_{\text{exp}}$, is called the nearest neighbor index (NNI). If NNI is <1, then the point pattern shows signs of clustering, and if the NNI is >1, the pattern is dispersed or random. The technique allows us to test if the clustering is statistically significant (Chainey and Ratcliffe 2005; Wong and Lee 2005).

The results of the NNA show that while the expected average distance between the methamphetamine labs is 810.2 m (about 0.5 miles), the actual average distance observed is 260.2 m (0.16 miles). The NNI is 0.32, which means that methamphetamine labs in Colorado Springs are clustered. Furthermore, the Z-score is -26 standard deviations, indicating that the clustering is statistically significant at the 0.01 significance level.

To examine the shift in the general distribution of the methamphetamine labs, we also calculated their mean center of distribution in each year. The mean center, or center of concentration, for a set of methamphetamine labs is their average coordinate values, that is, $\bar{\bar{x}} = \sum \frac{x}{n}$, $\bar{\bar{y}} = \sum \frac{y}{n}$ (Wong and Lee 2005). The mean center is useful to show the overall central focal point of the methamphetamine labs, but caution should be exercised in interpreting the results because different sets of locations may generate the same mean center and furthermore its location is very sensitive to outliers (Chainey and Ratcliffe 2005, p. 121).

The mean centers of the methamphetamine labs for the 1999–2005 period showed a northward shift over time with the exception of 2002, when the mean center moved south to nearly the same location as the mean center for 2000 (Fig. 12.3). Northern Colorado Springs consists of middle to upper class areas, not typically characterized by high levels of crime. The northward movement of the mean center may indicate the spread of methamphetamine labs into those areas.

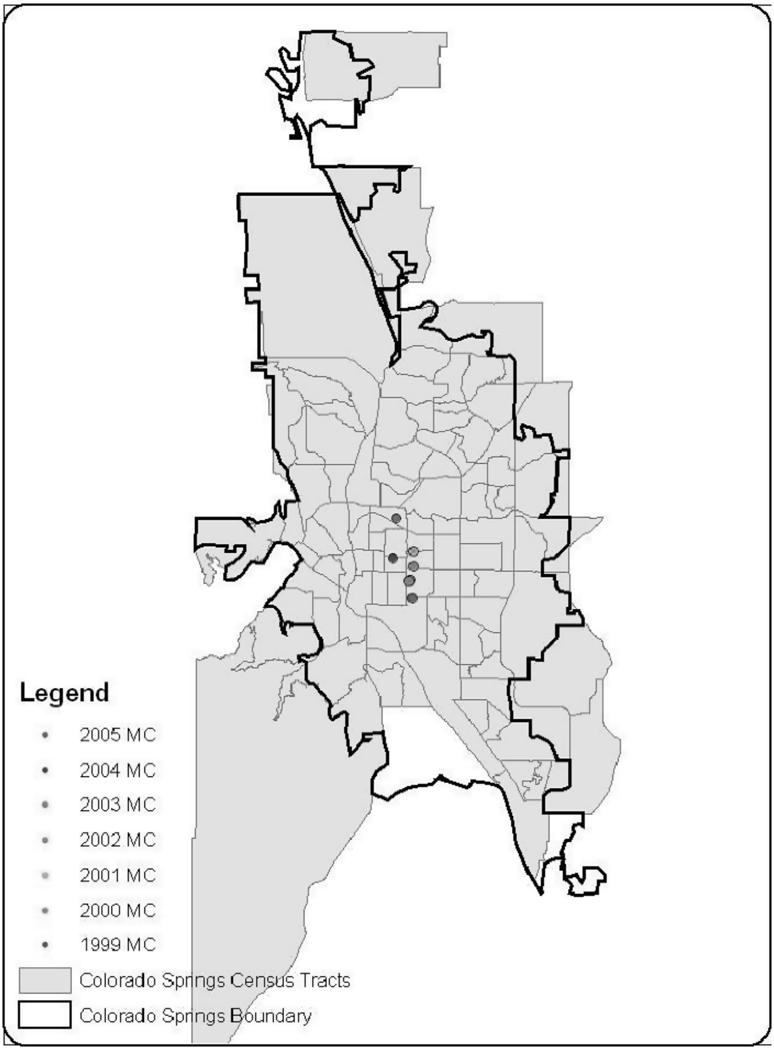

Fig. 12.3 Mean centers of the methamphetamine labs in Colorado Springs

Effects of Contextual Variables on Methamphetamine Lab Distribution

One objective of this study is to examine if there is a geography to clandestine methamphetamine manufacturing, in other words, whether methamphetamine labs are more likely to be established in certain neighborhoods due to their specific socioeconomic and geographic characteristics as implied in the social disorganization theory. Little research has been done on this topic. Anecdotal evidence seems to indicate that methamphetamine in Colorado Springs is a middle-class problem that knows no racial or gender-based boundaries. For example, Sgt. Terry Curry of the Colorado Springs Police Department's Metro VNI Division states that "We [have] busted labs in the Broadmoor, and the Briargate, and the B street area… and the inner city of Colorado Springs… some of the not more affluent areas. It doesn't matter. It could be anywhere…" (KKTV 2005). The Boradmoor area is one of the wealthiest neighborhoods in the city with large grand homes surrounding a five star golf resort. Briargate, located in northern Colorado Springs, is considered an upper middle class area with expensive homes, one of the best school districts, and many recreational amenities. Rundown housing, low-income neighborhoods, and high crime rates characterize the B street area and the inner city. What we wanted to do in this study is to examine if this is borne out in the data.

The spatial patterns of methamphetamine labs may be examined at the census tract level. Colorado Springs has 109 census tracts, most of which are located completely within the city boundaries but some census tracts on the fringes extend beyond. During the 1999–2005 period 79 census tracts had methamphetamine lab seizures though in most cases only a few labs were discovered (Figs. 12.4 and 12.5). The census tracts along I-25 and the downtown tend to have more methamphetamine labs than do those located elsewhere. Two census tracts, one located north of the downtown and the other south, had the greatest number of methamphetamine lab seizures, both at 15, during the study period. A cursory examination of their socioeconomic characteristics indicates that relatively low median household income levels seem to be their only common characteristic. The northern census tract has a population of 3,768 with 20% minority, a median age of 37.4 years, and an

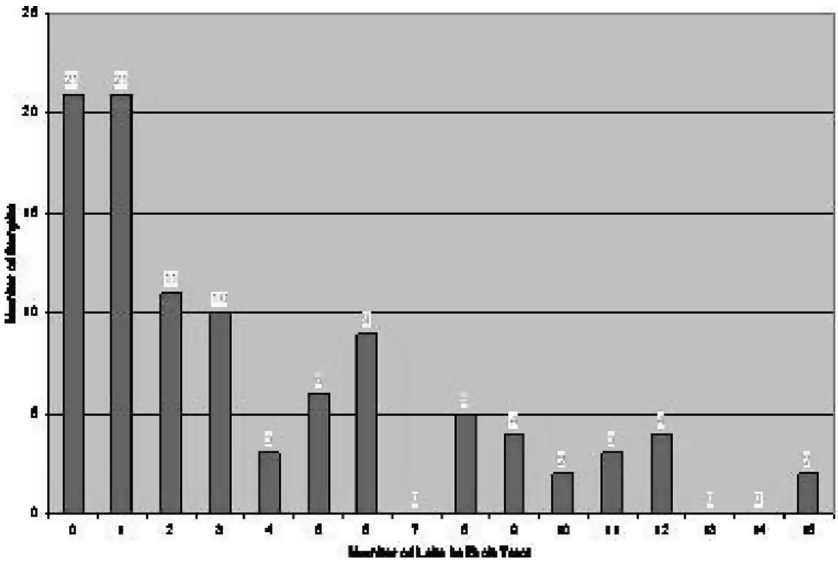

Fig. 12.4 Number of methamphetamine labs by census tract

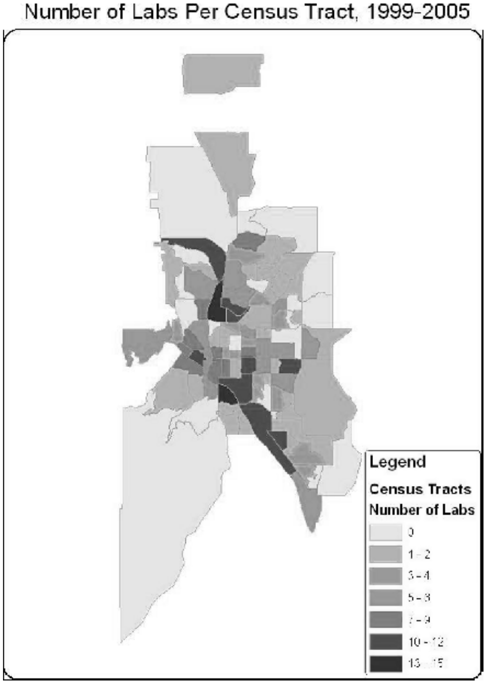

Fig. 12.5 Numbers of methamphetamine labs per census tract, 1999–2005

average household size of 1.99 persons. Its median household income is $26,848 (the number for the whole city is $50,667). The southern census tract has a similar median income ($26,250), but 38% of its 7,158 residents is minority. Its median age is much younger at 28.6 years with a larger average household size of 2.58. The neighborhoods of these census tracts are generally considered to be of low income, their properties are often not well-maintained, and they have a reputation for having more instances of crime.

Poisson regression is used to analyze statistically the effects of contextual variables on the distribution of methamphetamine labs at the census tract level. Poisson regression is preferred to the traditional regression technique because occurrences of methamphetamine labs amount to count data, and most census tracts have a small number of labs. Seven of the 109 census tracts were excluded due to incomplete data sets and two other tracts that do not have methamphetamine labs and are located on the outer limits of the city are also excluded from analysis. The dependent variable is the number of methamphetamine labs found in each census tract during 1999–2005, and the 11 independent variables included in the model are selected based on the social disorganization theory and the previous work on crime distribution (Chainey and Ratcliffe 2005).

Table 12.1 lists the variables included in the model and their summary statistics. The 2000 total population is included as an offset variable to control for the varying population sizes of the census tracts. The Poisson regression analysis was carried

Table 12.1 Summary Statistics of the Regression Variables

Variable	Mean	Minimum	Maximum
Number of methamphetamine labs (dependent variable)	3.8	0	15
Total population in 2000	4,498	1,411	8,743
Percent minority population	19.2	4.0	50.1
Median age	34.4	20.9	51.6
Average household size	2.6	1.7	3.6
Percent rental	37.7	4.0	98.0
Median household income	47,474	14,700	99,432
Percent with HS education or less	32.8	8.0	65.0
Median age of the structures	32.7	8.0	66.0
Median rent	754.3	423.0	2001.0
Distance to store (m)	3305.4	429.2	18020.2
Distance to university (m)	6431.6	214.6	24628.7
Distance to police (m)	4525.1	479.9	18673.6

out using a 2004 free trail version of the statistical and power analysis software, NCSS, downloaded from the NCSS website (www.nccs.com/poisreg.html).

The resulting model has a Pseudo R^2 value of 0.49, indicating that the model was effective in predicting 49% of the sample variations. Five of the eleven independent variables are statistically significant at either the 0.05 or 0.01 significance level (Table 12.2). Not surprisingly, the effect of the offset variable – 2000 total population – is positive because a census tract with a larger population will have more methamphetamine labs than one with a smaller population, *ceteris paribus*. Contrary to findings in other crime studies (e.g., Ackerman 1998; Brown 1982; Groff and La Vigne 2001), the proportion of minority population in a census tract affects the number of seized methamphetamine labs negatively, that is, census tracts with larger percentages of minority population are associated with fewer seized methamphetamine labs. Median age of population also has a negative relationship with the number of labs in a census tract. These findings are consistent with the observation that methamphetamine users and producers are generally young and white (ONDPC

Table 12.2 Regression Coefficient Estimates

Independent Variable	Coefficient	Standard Error	Probability
Intercept	4.78	1.45	0.00
1. 2000 Total population	0.00	0.00	0.00
2. Percent minority	−0.03	0.01	0.02
3. Median age	−0.08	0.02	0.00
4. Average HH size	−1.64	0.41	0.00
5. Percent rental	−0.01	0.01	0.16
6. Distance store	−0.00	0.00	0.85
7. Distance university	−0.00	0.00	0.16
8. Distance police	0.00	0.00	0.55
9. Median HH income	0.00	0.00	0.09
10. Percent no college	0.06	0.01	0.00
11. Structure age	0.01	0.01	0.11
Dispersion Phi	–	2.41	–

2003). The average household size and the number of methamphetamine labs are also negatively related. As average household size increases the number of labs tends to decrease. The percent of population with high school education or less has a positive effect. This may be because individuals with low educational attainment often have fewer employment opportunities and are more likely to engage in risky activities such as drug use and methamphetamine production.

Interestingly, the analysis shows that the relative location of census tracts to superstores (Wal-Marts, Targets, and Sam's Clubs), universities, and police stations, percent rental properties, median household income, and median structure age do not have statistically significant effects on methamphetamine lab activity at the census tract level. We can only speculate on the reasons for these results. Being a medium-sized city, different parts of Colorado Springs are all within a reasonable distance from a superstore; hence the store locations do not make much difference to where one decides to operate a lab. The distances to universities did not matter probably because most residential areas in Colorado Springs are not in proximity to the two college campuses included in the study. While students may be potential customers of methamphetamine producers, they are less likely to make the drug by themselves due to their usually shared or group living arrangements. Structure age does not have a significant effect probably because it may not imply a particular type of housing. For example, some of the older neighborhoods are rundown and less costly, other older neighborhoods, such as the Broadmoor area, are upper-class with large, expensive homes.

Conclusions

This study analyzed the spatial patterning of seized methamphetamine labs in Colorado Springs, Colorado by means of NNA, mean center, and Poisson regression. The results show that methamphetamine labs in Colorado Springs are clustered, roughly in and around the downtown area. Over the 1999–2005 period, the mean center of the labs experienced a northward shift, which may indicate that methamphetamine labs have gradually moved into the middle-class, more "respectable" neighborhoods. The distribution of the methamphetamine labs at the census tract level is affected by several socioeconomic variables such as proportion of minority population, median age of the population, household size, and educational attainment.

The findings of this study provide insights into the kind of people that are likely to engage in the dangerous and illegal activity and the characteristics that make a place more attractive for manufacturing methamphetamine. Generally speaking, methamphetamine labs tend to be found in neighborhoods with a young and predominantly white population, small household size, and low educational levels. Such knowledge may in turn assist law enforcement in their battle against methamphetamine and related crimes. Also, the distribution of methamphetamine labs changes over time. This may be a result of diffusion, or production displacement. In a study on methamphetamine use in Nebraska, for example, Herz (2000) points out that more intensive law enforcement in one area may displace methamphetamine to other areas. In Colorado Springs, the distribution has shifted northward over time. It would be interesting to see if the lab distribution shifts further as law enforcement forces become more active in relatively high risk areas.

One difficulty of analyzing the patterning of methamphetamine labs is that the individuals running methamphetamine labs try hard to hide them. The available data include only those labs that have been discovered and seized by law enforcement. It is not certain if the distribution of such seized methamphetamine labs represents that of all methamphetamine labs out there. A Colorado Springs Police Officer speculated that for every lab uncovered, ten more labs remain unknown (KKTV 2005). Also, the pattern of seized methamphetamine labs is likely affected by spatially differential levels of law enforcement. Further research may examine additional information regarding methamphetamine labs, such as the type of labs (large or small? in car trunks, warehouses, apartments, or single family homes?), the kind of individuals involved, primary reasons for production, how labs came to be seized, and so on, to better understand the variables affecting lab locations.