DETERMINING HIGH-RISK CANDIDATES FOR DEMAND-SIDE COUNTER-METHAMPHETAMINE POLICY MEASURES

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By

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DETERMINING HIGH-RISK CANDIDATES FOR DEMAND-SIDE COUNTER-METHAMPHETAMINE POLICY MEASURES

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ABSTRACT

This thesis models methamphetamine consumption in the United States based on theories of habit formation using various demographic, economic and geographic factors contributing to usage. Using data from the 2005 National Survey on Drug Use and Health ("NSDUH"), a logit regression is employed to measure the impact of multiple variables on methamphetamine use. The results indicate that methamphetamine use is particularly prevalent among rural whites. Additionally, methamphetamine users frequently admitted to using other drugs including marijuana and cocaine. Based on these results, this paper proposes a number of demand-side policy interventions to prevent the first-time use of methamphetamine among high-risk individuals. These include educational programs, stiffer penalties for possession of methamphetamine and initiatives to limit the access of potential consumers to methamphetamine suppliers and dealers.
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INTRODUCTION

During the past decade, the United States has been dealing with an explosion in methamphetamine use. This highly addictive stimulant, often called “speed”, “crystal meth”, “crank”, or “ice”, can be “smoked, snorted, injected or orally ingested” (Volkow, 2002, 3). Methamphetamine is easily produced in both small and large scale operations using widely available pharmaceutical and chemical ingredients. Originally prevalent only in the Western United States, it has more recently spread across the entire country (Dobkin and Nicosia, 2007). In 2002, it was reported that around 10 million people admitted to having used some form of methamphetamine at least one time during their lives (Volkow, 2002).

Methamphetamine is not the first serious drug epidemic faced by US policymakers. During the mid-1980s, the emergence of crack cocaine as a street drug stretched the resources of law enforcement officials, health service providers and policymakers across the United States. In 1985, nearly six million individuals admitted to having used the drug during the past twelve months (Lawn, 2010). Additionally, crack cocaine-related hospitalizations increased over 400% between 1984 and 1987 (Lawn, 2010). This included admissions for not only overdoses

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1 Crack cocaine is a cheap, highly-addictive stimulant derived from powdered cocaine using a relatively “simple conversion process” (“Crack Cocaine”, 2010, 1).
and other health complications, but also an increasing number of victims of violent crime.

The popularity of crack cocaine fueled the growth of a vibrant drug trade, which led to huge jumps in murder and other violent crime rates as dealers battled for market share. In New York, for example, it was reported that over 30% of all homicides and 60% of drug-related homicides were connected to the crack cocaine trade (Lawn, 2010). Further, the use of crack cocaine by pregnant women was causing added strain on the health system in the United States. In 1985, it was reported that nearly 10% of pregnant mothers were using crack cocaine or other illicit substances (Okie, 2009).

The human toll of the crack epidemic caused widespread public outrage and led to calls for the government to combat the cocaine trade both domestically and abroad. The Drug Enforcement Administration (“DEA”) and other federal law enforcement agencies began to implement measures to combat the growing strength and influence of drug cartels throughout South America (Lawn, 2010). In addition, dramatic new domestic initiatives were implemented to reduce the use and sale of crack cocaine in the United States. Among these measures was the “Anti-Drug Abuse Act of 1987”, which mandated a number of new enforcement measures, including stiffer penalties for both users and dealers of crack cocaine (Lawn, 2010). Additionally,
policymakers created a number of new task forces and established law enforcement positions dedicated to fighting the spread of crack cocaine in the United States. In hindsight, the effectiveness of many of these anti-drug initiatives has been debatable (Caulkins, et. al., 2005). Nonetheless, it is clear that the government used its resources in a manner commensurate with the magnitude of the threat posed by crack cocaine.

Despite its similarity to the crack cocaine epidemic, neither the media nor policymakers have given methamphetamine the same amount of attention. A number of factors may help to explain this development. First, the impression is that methamphetamine has disproportionately affected small towns throughout the United States (Berkes and Hawke, 2004). Since it is primarily confined to rural areas, policymakers may not necessarily see the damage caused by methamphetamine on a daily basis. Second, the crack cocaine trade led to higher increases in violent crime rates than has the methamphetamine trade ("Methamphetamine: A Growing Threat", 2010). Since many methamphetamine operations are conducted in sparsely populated areas, there is less competitive pressure on dealers from other producers. While crime rates in these areas have increased, these spikes have been significantly smaller than the increases in violent crime rates in urban areas attributed to the crack cocaine epidemic during the 1980s ("FBI", 2010).
Despite the relative lack of attention given to the methamphetamine epidemic, it is clear that it poses a serious threat to communities throughout the United States. The DEA reports that methamphetamine trails only alcohol and marijuana as the substance most frequently seized in the Midwestern and Western United States ("Methamphetamine", 2010). In recent years, large scale sting operations have resulted in thousands of arrests related to the trafficking of methamphetamine.\(^2\) While smaller scale labs continue to exist throughout the country, an increasingly large amount of methamphetamine is manufactured in Mexican labs ("Drugs", 2010). As a result of the increased demand in the United States, methamphetamine and other drug-related violence in Mexico has exploded during the past few years (Hanson, 2008).

The increase in usage also has the potential to put further strain on the health system in the United States. According to the Drug Abuse Warning Network ("DAWN"), emergency room visits related to methamphetamine increased by 50% between 1995 and 2002 (Volkow, 2002). The habitual use of methamphetamine also poses significant long-term health risks including "memory loss, aggression, psychotic behavior, heart damage, malnutrition, and

\(^2\) Drug-related sting operations can involve any number of actions, but typically includes the use of undercover officers to purchase drugs (Newman and Socia, 2007). In the case of methamphetamine, stings often include efforts to buy large quantities of the chemicals and pharmaceutical products used in the manufacturing process.
severe dental problems” (Volkow, 2002, 1). Although some of these adverse health outcomes can be mitigated through extensive therapy and rehabilitation regimes, researchers have noted that abuse can also lead to irreversible brain damage (Volkow, 2002).

The production of methamphetamine also poses significant health risks for members of the local community. The DEA estimates that the creation of one pound of methamphetamine generates five to six pounds of hazardous waste (Hunt, et. al., 2006). This waste represents a serious threat to individuals residing in areas near the manufacturing operation. First, hazardous materials can leak into ground water and absent a thorough and costly cleanup effort can render local land unusable (Hunt, et. al., 2006). Second, individuals who purchase and attempt to reside in homes formerly used for the manufacture of methamphetamine can become seriously ill as a result of exposure to residual chemicals (Hunt, et. al., 2006). Since it is often impossible for subsequent homebuyers to determine whether previous owners were involved in the manufacture of the drug, this continues to pose a significant threat to communities affected by methamphetamine.

POLICY RESPONSES

In order to limit the prevalence of methamphetamine, a number of states and the federal government have implemented
various policy measures. In 1996, the US Government passed the Comprehensive Methamphetamine Control Act ("MCA") to help restrict the spread of methamphetamine. Specifically, this legislation tightened restrictions on the purchase of some of the chemicals used in the production process ("MCA", 1996). While products containing pseudoephedrine were still available over-the-counter, strict record keeping requirements were enacted for individuals attempting to purchase large quantities ("MCA", 1996). In addition, the law increased penalties for manufacturing and trafficking methamphetamine ("MCA", 1996).

More recently, a number of states throughout the country have imposed even tighter restrictions on the purchase of products containing "ephedrine, pseudoephedrine, and phenylpropanolamine" (Dobkin and Nicosia, 2009). These disparate measures were ultimately codified into federal law with the passage of the Combat Methamphetamine Epidemic Act of 2005. This law placed even tighter restrictions on the purchase of chemical and pharmaceutical products used in the manufacture of methamphetamine. Additionally, the law imposed strict penalties for individuals whose methamphetamine laboratories subsequently caused other people to become ill (Dobkin and Nicosia, 2009).

As this discussion illustrates, the counter-methamphetamine policy response since 1996 has been dominated by supply-side
measures to reduce manufacturing and trafficking of the drug. However, these initiatives have not led to the desired decreases in methamphetamine usage over the past few years (Dobkin and Nicosia, 2009). This has potentially occurred for a number of key reasons. First, many of the products used in the methamphetamine manufacturing process are very common household items. Unlike other narcotics including marijuana, cocaine and heroin, methamphetamine can be created from easily-acquired chemicals. It is difficult to regulate these products without overly burdening law-abiding American citizens.

Second, the pharmaceutical products involved in the manufacture of methamphetamine are not uniform. Faced with increasing restrictions on ephedrine and other similar products, manufacturers of methamphetamine have been able to use other products as substitutes (Hunt, 2006). Accordingly, regulators and law enforcement agencies are constantly chasing ever-changing methamphetamine manufacturing operations. Third, the growth of domestic use combined with restrictions on US producers has enabled Mexican suppliers to satisfy excess demand for methamphetamine (“Methamphetamine”, 2010). In addition, the relatively porous Southwest border has enabled Mexican producers to supply much of the United States (Dobkin and Nicosia, 2009).

These challenges illustrate that supply-side counter-methamphetamine measures alone are not sufficient to handle the
extent of the epidemic. In order to tailor a proper response, policymakers must develop a better understanding of the individuals most likely to engage in methamphetamine use. For example, a policy to educate people about the dangers of drug use would likely enable potential users to make more informed decisions about methamphetamine usage. However, this approach might be even more effective if it was delivered directly to individuals most likely to be exposed to methamphetamine during their lifetimes. Faced with resource limitations for counternarcotics measures, a more targeted approach to preventing methamphetamine use would also provide the most efficient use of public funds.

This thesis employs econometric techniques to develop a picture of the typical methamphetamine user. It is intended to help policymakers identify and target “high risk” individuals for demand-side policy interventions. Section 3 illustrates how this thesis builds on the relevant literature. In sections 4 and 5, a theoretical model of methamphetamine use is developed through consultation with “habit formation” literature. A discussion of the survey data and its potential problems is included in sections 6 and 7. A subsequent examination of the regression results in section 8 allows comparison between the effects of the different variables on methamphetamine use. This paper proposes a number of demand-side policy measures to help
reduce demand for methamphetamine in section 9. Finally, section 10 discusses some areas of interest for future research on the subject.

**REVIEW OF RELEVANT LITERATURE**

While many researchers have analyzed patterns of methamphetamine use in the United States, none have employed regression analysis to empirically measure the effect of different variables on usage rates. The vast majority of literature is instead focused on analyzing the impact of supply-side interventions, particularly measures designed to raise the price of methamphetamine and other drugs. Research indicates that this theoretical research may indeed have some merit. Desimone and Farrelly (2003) develop a model of household demand for cocaine and marijuana and find that individuals respond to price changes, which supports the validity of measures aimed at increasing drug prices. Similarly, Rhodes et. al. (2001) finds that methamphetamine consumption decreases when potential users encounter higher street-level prices.

While the theoretical benefits of supply-side interventions are clear, researchers have struggled to illustrate empirically that any policy can effectively raise the price of street drugs over the long term. Dobkin and Nicosia (2009) studied the impact of policies designed to disrupt the methamphetamine
production process. The authors found that methamphetamine prices initially increased, but returned to their previous levels within a few months. Freeborn (2009) analyzed the extent to which cocaine prices varied depending on the severity of punishment for drug dealers. He found that stiffer penalties may actually decrease the street price of cocaine. Similarly, DiNardo (1993) was unable to establish a significant relationship between supply-side enforcement measures and drug prices. Although Levitt and Kuziemko (2003) found that many supply-side approaches successfully increased the price of street drugs, they argued that the costs associated with such measures may exceed the benefits.

Given the relative dearth of articles supporting the effectiveness of supply-side policy interventions, this thesis proposes a demand-side policy focused on prevention. There has been significant empirical evidence supporting the effectiveness of such policies. Rydell and Everingham (1994) studied the impact of various drug enforcement programs. Although supply-side interventions are allocated the most resources, the authors find that demand-side approaches are both cost-effective and more likely to reduce long-term consumption. Similarly, Chang, Coulson and Wang (2002) found that demand-side measures are more likely to reduce usage rates among communities dealing with widespread drug abuse. Given the extent of methamphetamine
abuse in many rural communities, demand-side approaches offer the most potential to reduce drug consumption.

THEORETICAL MODEL

The theoretical model was developed based on the “habit formation” framework proposed by Pollak (1970). The author’s model assumes that “past consumption influences current preferences” (Pollak, 1970, 751). Therefore, a “higher level of past consumption of a good implies, ceteris paribus, a higher level of present consumption of that good” (Pollak, 1970, 751). In addition to past consumption, current preferences are also assumed to be a function of income and prices. In the case of methamphetamine consumption, it is assumed that the decision to use methamphetamine is a function of its cost and whether an individual had used other drugs in the past. This model also references the work of Dobkin and Nicosia (2009) which argues that methamphetamine use is also a function of demographic, geographic and social factors. By combining these effects, we propose that:

\[ \text{Methamphetamine Use} = f \left( \text{Initial Conditions, Environment, Demographics, Price} \right) \]

VARIABLES

The specific variables included in the regression equation were selected to reflect the impact of the initial conditions,
environmental factors, demographics and cost curve faced by the survey participant. These variables were selected based on review of relevant social, criminal, health and drug literature. Given restrictions on the available survey information, however, a number of proxies were selected for variables that were not included in the data set. For example, participants in the survey were not asked about how much they paid to acquire narcotics. Since this information is pertinent to the theoretical model, relevant (and available) information was substituted for the missing data. The model is as follows:

\[ \text{METHEVER} = a + b\text{RURAL} + c\text{COKEVER} + d\text{MJEVER} + e\text{CIGS30} + f\text{MALE} + g\text{WHITE} + h\text{MARRIED} + i\text{HSGRAD} + u \]

where

- METHEVER=1 if used methamphetamine during lifetime, 0 otherwise
- RURAL=1 if from an area with less than 1 million people, 0 otherwise
- COKEVER=1 if used cocaine during lifetime, 0 otherwise
- POTEVER=1 if used marijuana during lifetime, 0 otherwise
- CIGS30=1 if smoked cigarette during the past month, 0 otherwise
- MALE=1 if male, 0 otherwise
- WHITE=1 if white, 0 otherwise
- MARRIED=1 if married, 0 otherwise
- HSGRAD=1 if completed high school, 0 otherwise
As mentioned previously, methamphetamine use is among the greatest drug-related threats currently facing the United States. It is imperative that policymakers develop a better understanding of the patterns of methamphetamine use emerging in the United States. While drug-related hospitalizations or arrests could have been used to measure the prevalence of the drug, not all methamphetamine usage results in these outcomes. As a result, these statistics can misrepresent the actual level of acceptance and usage of methamphetamine by the American public. While self-reported rates of methamphetamine use must still be interpreted with caution, they appear to offer the best insight into patterns of use in the United States. Therefore, the dependent variable for this study, METEVER, measures whether the respondent admitted to having used methamphetamine during their lifetime.

Although some policymakers might be more concerned with current or past-year usage, determining the profile of anyone who has ever elected to use methamphetamine is imperative to developing a demand-side policy approach. The primary goal of this type of intervention is to prevent individuals from ever electing to use methamphetamine. Individuals that admit to having used methamphetamine recently are likely to be among the heaviest users of the drug. While these individuals should
clearly be targeted for treatment, the appropriate policy interventions for heavy users are not addressed in this thesis. In such cases, programs designed to reduce demand for methamphetamine are unlikely to have any meaningful effect on usage rates.

The independent variables were selected in order to develop an understanding of the factors contributing to methamphetamine use in the United States. The variable RURAL was included to measure whether the respondent lived in an area with less than one million people. This variable was chosen to measure whether methamphetamine disproportionately affects rural communities. While the DEA has reported that methamphetamine use has become increasingly popular in urban areas, it still is the most prevalent drug in many rural communities ("Methamphetamine", 2010). In addition, the majority of so-called "Super Lab" seizures by the DEA occurred primarily in rural areas throughout the Western part of the country ("Map", 2010). As a result, RURAL is expected to have a positive effect on methamphetamine use (See Table 1 for expected signs).

The variable RURAL was also included as a proxy for the inverse of price. Since no variable for price was included in the survey, RURAL was chosen to measure the relationship between methamphetamine usage and cost. The ease with which methamphetamine can be produced and acquired in many rural
communities somewhat mitigates the effect of supply shocks caused by anti-drug policies. This analysis also assumes that methamphetamine is much more difficult to produce in urban communities given limitations on space. As a result, users in urban communities are more reliant on outside producers to purchase and consume methamphetamine. Faced with a more extensive supply chain, prices in urban communities are thus assumed to be higher than in rural communities. Therefore, RURAL as a proxy for the inverse of price is expected to have a positive effect on methamphetamine use.

The other independent variables were selected to help control for the other factors outside of the criminal justice system that influence the likelihood of an individual deciding to use methamphetamine. The variable CIGS30 measures whether or not the person smoked a cigarette in the past month. According to Gatch, Flores and Forster (2007) methamphetamine and tobacco use have similar neurological effects on the brain. In studies on laboratory rats, the authors were able to almost seamlessly substitute the products between animals with very few noticeable changes in behavior (Gatch, et. al., 2007). In addition, the authors noted the prevalence of tobacco use among human methamphetamine users and speculate that the effects of nicotine may complement the effects of methamphetamine (Gatch, et. al., 2007). Given this connection, it is reasonable to assume that
individuals addicted to nicotine are more likely to engage in
methamphetamine use. Therefore, CIGS30 is expected to have a
positive effect on methamphetamine use.

The variable POTEVER measures whether the respondent
admitted to using marijuana in their lifetime. The variable was
included as a proxy for the willingness of the individual to
experiment with drugs. At a fundamental level, it is clear that
marijuana and methamphetamine are not perfect substitutes.
Methamphetamine is an addictive stimulant, while marijuana is
typically classified as a non-habit forming depressant (Boyum
and Keliman, 2010). Despite their differences, it is illegal to
consume either product in the United States. Individuals who
elect to use marijuana demonstrate a somewhat permissive
attitude towards drug use and might be more willing to
experiment with other drugs. Consequently, POTEVER is expected
to have a positive effect methamphetamine use.

The variable COKEVER measures whether the respondent
admitted to using cocaine in their lifetime. Similar to
POTEVER, this variable was included to gauge participants’
willingness to engage in illegal drug consumption. However,
cocaine and methamphetamine are much more similar than marijuana
and methamphetamine. In fact, researchers have found similar
behavioral responses between rats dosed with cocaine and those
given methamphetamine (Schechter and Glennon, 1984). In
addition, Zohra and ten Bensel (2010) found that cocaine and methamphetamine are frequently abused simultaneously by users. Given similarities between the effects of methamphetamine and cocaine and overlap between users, it is reasonable to assume that cocaine users are more likely to engage in methamphetamine use. Therefore, COKEVER is anticipated to have a positive effect on methamphetamine use.

The demographic variables WHITE and MALE control for the race and sex of the respondent. Historically, the typical user of methamphetamine has been described as a “blue collar, lower middle class white male between the ages of 18 and 34” (“The Meth Epidemic”, 2007, 5). However, the spread of the drug throughout the country has somewhat changed the profile of a typical user. First, the National Association of Counties (“NACO”) reports that a number of sheriffs have noted a significant increase in the number of Hispanics and American Indians arrested for methamphetamine-related offenses (“The Meth Epidemic”, 2007). Additionally, sheriffs across the country have also reported noticeable increases in methamphetamine abuse among women (“The Meth Epidemic”, 2007). In spite of this information, Caucasian males are still widely assumed to be the primary consumers of the drug. Therefore, both MALE and WHITE are expected to have positive effects on methamphetamine use.
The final independent variables included in the model, MARRIED and HSGRAD, were included to measure whether the individual has accomplished traditional socialization objectives. According to Becker and Murphy (1988), negative life cycle events can significantly decrease the marginal cost of engaging in self-destructive drug abuse. This rationale applies to positive life cycle events as well. Graduating high school represents a major accomplishment and demonstrates one’s willingness to embrace societal norms. Similarly, individuals electing to marry exhibit a desire to participate in an important American cultural institution. These individuals, therefore, should be less likely to engage in antisocial activities such as methamphetamine use. Consequently, both MARRIED and HSGRAD are expected to have a negative effect on METEVER.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>RURAL</td>
<td>Positive</td>
</tr>
<tr>
<td>COKEVER</td>
<td>Positive</td>
</tr>
<tr>
<td>POTEVER</td>
<td>Positive</td>
</tr>
<tr>
<td>CIGS30</td>
<td>Positive</td>
</tr>
<tr>
<td>MALE</td>
<td>Positive</td>
</tr>
<tr>
<td>WHITE</td>
<td>Positive</td>
</tr>
<tr>
<td>MARRIED</td>
<td>Negative</td>
</tr>
</tbody>
</table>
The data from this project was collected from the “2005 National Survey on Drug Use and Health” (“NSDUH”) archive. This study, which is administered yearly by the United States Department of Health and Human Services, attempts to gauge national attitudes towards drug use among members of US households. The survey targets the “civilian, noninstitutionalized [sic] population aged 12 years or older living in the United States or the District of Columbia” (Morton, et. al., 2005, 1). These randomly-selected individuals live in both single-family housing units and group quarters including “shelters, rooming houses, dormitories, and group homes” (Morton, et. al., 2005, 1). While “civilians living on military bases” are included in the survey universe, active duty military personnel living on base are excluded from participation in the survey (Morton, et. al., 2005, 1).

The survey is administered by specially trained personnel using a computer-based system at the residence of the individual. In order to improve the number of completed surveys, respondents were given a $30 stipend for their participation in the process. The survey attempts to evenly divide respondents between geographic regions, which facilitates
collection of accurate demographic information without having to “oversample specifically targeted demographics” (Morton, et. al., 2005, 1). In addition, the survey aims to gather responses equally from individuals aged “12 to 17, 18 to 25 and 26 and older” (Morton, et. al., 2005, 1).

The “2005 National Survey on Drug Use and Health” contained a broad array of questions on tobacco, alcohol and drug use during the respondent’s lifetime. In the event that a respondent affirmatively answered any question, they were subsequently asked further clarifying questions. For example, respondents who admitted to having used marijuana in their lifetime were later asked about their number of uses, their last date of use and so forth. Participants were also asked questions about their mental health, including the number of visits to mental health professionals and any prescriptions taken for various mental ailments. In addition, respondents were required to provide demographic information, including questions related to their ethnicity, job status and history of military service.

In 2005, the data set included over 55,000 participants (See Table 1.1). Since many of the questions allowed for multiple responses, dichotomous variables were created in order to simplify interpretation of the regression results. A “1” indicates that the respondent falls into the listed category or
answered affirmatively to the specific question about drug or tobacco use. A “0” indicates that the respondent did not fall into the category, answered the specific question negatively or that their response could be inferred to be “no” based on a previous response in the survey. “Missing” indicates that the respondent chose not to answer the question or that the data was corrupt or unusable for a variety of reasons. The following chart illustrates the breakdown of responses:

Table 2: Responses to Included Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>0</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>METHEVER</td>
<td>2184</td>
<td>53672</td>
<td>49</td>
<td>55905</td>
</tr>
<tr>
<td>RURAL</td>
<td>27331</td>
<td>23448</td>
<td>5126</td>
<td>55905</td>
</tr>
<tr>
<td>COKEVER</td>
<td>6537</td>
<td>49354</td>
<td>14</td>
<td>55905</td>
</tr>
<tr>
<td>POTEVER</td>
<td>21986</td>
<td>33894</td>
<td>25</td>
<td>55905</td>
</tr>
<tr>
<td>SMOKE30</td>
<td>14919</td>
<td>40986</td>
<td>0</td>
<td>55905</td>
</tr>
<tr>
<td>MALE</td>
<td>26539</td>
<td>29366</td>
<td>0</td>
<td>55905</td>
</tr>
<tr>
<td>WHITE</td>
<td>36014</td>
<td>19891</td>
<td>0</td>
<td>55905</td>
</tr>
<tr>
<td>MARRIED</td>
<td>14178</td>
<td>41727</td>
<td>0</td>
<td>55905</td>
</tr>
<tr>
<td>HSGRAD</td>
<td>4296</td>
<td>2967</td>
<td>48642</td>
<td>55905</td>
</tr>
</tbody>
</table>

POTENTIAL DATA PROBLEMS

While survey data offers many potential benefits for researchers, several factors could influence the accuracy of the
responses. Methamphetamine and other drugs are illegal to consume in the United States. In addition, narcotics users carry a significant stigma among the American public. Despite the anonymity of the surveys, respondents could be reluctant to admit to having engaged in illicit activities out of embarrassment or for fear of prosecution. As a result, the survey might underreport the actual amount of drug use in the United States. A number of researchers have empirically demonstrated evidence of these effects. Makkai and McGregor (2003) compared self-reported narcotic usage rates with the results of simultaneously administered drug tests. The authors found that some users, including methamphetamine and cocaine addicts, underreported their actual use of the drugs (Makkai and McGregor, 2003). Similarly, Hser, Magione and Boyle (1999) found that arrestees, individuals with sexually-transmitted diseases and those admitted to emergency rooms often underreported their actual drug use.

These effects, however, were unlikely to significantly bias the results of the 2005 NSDUH variables chosen for this study. First, the NSDUH survey is completely random. Those administering the survey go to great lengths to assure those taking the survey that their identity is protected by law. As a result, survey takers can honestly respond to the questions without embarrassment. By contrast, individuals questioned
about their drug use at hospitals were granted no such anonymity. Since drug use carries a negative stigma, users are incentivized to underreport their actual usage to medical personnel. As a result, the “embarrassment” effect is likely to more negatively affect the results of these individuals than those participating in the NSDUH.

Second, the “fear of prosecution” effect is likely to be greater for individuals dealing with the consequences of their drug use. In both the Makkai and McGregor (2003) and Hser, Magione and Boyle (1999) studies, the survey universe included both recently arrested prisoners and individuals in emergency rooms. These individuals were asked about their current drug use or use during the past year (Makkai and McGregor, 2003; Hser, et. al., 1999). Since many of them were likely to face further legal punishment for having recently taken drugs, the “fear of prosecution” effect may have strongly influenced their results. Those participating in the NSDUH, however, faced no such fear of prosecution and would have less incentive to be dishonest about the lifetime use of methamphetamine.

It is possible, however, that some individuals may simply overlook their past drug use and fail to accurately report their history. In Mikkai and McGregor (2003) the authors noted that “casual” users were less likely than “heavy” users to accurately report their drug history. However, this is unlikely to
significantly affect the results of the survey. Since respondents are simply asked whether they have ever done methamphetamine, cocaine or marijuana, they are not required to recollect specific details of their past drug use. While individuals may not remember how many times they have done methamphetamine during their lifetime, they should be able to recall whether they have done it on at least one occasion. As a result, this effect is unlikely to significantly bias the 2005 NSDUH results.

REGRESSION RESULTS

Since the dependent variable METHEVER is dichotomous, this study utilized a logistic (“logit”) regression model to estimate the effect of the included independent variables on the likelihood of engaging in methamphetamine use. Specifically, logit models “generate coefficients in the form of log-relative odds” (Miller, 2005, 220). These coefficients, however, can be difficult to interpret. A logit coefficient estimate measures the extent to which a one unit increase in an independent variable changes the log odds of having used methamphetamine during one’s lifetime (versus never having used methamphetamine) (“SAS Data Analysis”, 2010). Therefore, the odds ratio estimates are included to facilitate ease of interpretation. These estimates simply indicate the extent to which the
independent variables affect the odds of having admitted to using methamphetamine during one’s lifetime. The results of the regression are included in the appendices.

The likelihood ratio chi-square for the equation was 950.6989 with a probability of <.0001. This indicates that one or more of the independent regression coefficients is not equal to zero (“SAS Annotated Output”, 2010). Similarly, the score and Wald chi-squares of 1165.7695 and 604.5915, respectively, mirror the results of the likelihood ratio test. Simply put, these test results indicate that the overall goodness-of-fit of the model was significantly better than an empty model. Therefore, it is appropriate to proceed and interpret the individual variable results. Please see “Appendix A” for the specific test results details.

As expected, the independent variable POTEVER had a positive effect on methamphetamine use. The point estimate of 1.5558 was also significant at the 1% level. The odds ratio estimate indicates that individuals admitting to having used marijuana are 4.739 times more likely to have also used methamphetamine than those who have never used marijuana in their lifetime. While marijuana use was expected to be correlated with methamphetamine use, the strength of the correlation was surprising. Given differences in the effects of the drugs and profiles of typical users, admission of marijuana
use was not necessarily expected to be such a strong predictor of methamphetamine use.

As discussed in the variable section, this result is potentially attributable to a couple of factors. First, individuals who elect to use marijuana may be less concerned with the potential social, legal and health implications of their drug use. Thus, they might be more willing to experiment with other drugs like methamphetamine. The U.S. Department of Health and Human Services ("HHS") (2005) has noted the prevalence of antisocial behavior among individuals being treated for abuse of multiple drugs. Given this connection, it is plausible that marijuana users would be more likely to also use methamphetamine than those who have never used marijuana during their lifetime.

Second, individuals who initially use marijuana may eventually turn to harder drugs. The notion that marijuana is a "gateway drug" is debatable, but it is clear that many teenagers are often exposed to marijuana before any other drug ("Marijuana", 2010). While marijuana may in fact lead to other drug use (including methamphetamine), the data source did not provide the requisite information to support this claim. Since respondents were not asked about the order in which they used different drugs, one cannot say with any measure of certainty
whether participants used marijuana before or after methamphetamine.

Similarly, the variable COKEVER had a positive effect on methamphetamine use. The estimate of 2.3679 was also significant at the 1% level. Compared to individuals who never used cocaine, individuals admitting to cocaine use were 10.675 times more likely to have also engaged in methamphetamine use. Given the similarities between the effects of methamphetamine and cocaine, these results were somewhat expected. Users may substitute cocaine for methamphetamine or vice versa when faced with limitations on availability or increases in cost. As with marijuana, however, these results also need to be interpreted with caution. Since it cannot be determined which drug was used first by the participant, one cannot assume that cocaine use leads to methamphetamine use or vice versa. Nonetheless, the regression results clearly indicate a significant correlation between methamphetamine and cocaine use.

The variable CIGS30 was also estimated to have a positive effect on methamphetamine use. In addition, the point estimate of .4354 was significant at the 1% level. The odds ratio estimate revealed that an individual that smoked in the past thirty days was 1.546 times more likely to have used methamphetamine in their lifetime versus someone who had not smoked in the past thirty days. As mentioned in the variable
discussion section, this result may be attributable to a number of key factors. First, nicotine and methamphetamine may be used as substitutes and/or compliments for one another. Although methamphetamine has a far more pronounced impact on the human body, nicotine also produces a similarly stimulating effect. Therefore, individuals may use nicotine in between or during methamphetamine use sessions to achieve similar feelings.

Second, individuals biologically prone to addiction may be more likely to use other habit-forming substances, including tobacco. Johnson (2003) notes neurological similarities between individuals being treated for a variety of distinct addictions. Therefore, it follows logically that recent consumers of nicotine would be more likely to have consumed methamphetamine during their lifetimes.

The variable RURAL was estimated to have a positive effect on methamphetamine use. Moreover, the point estimate of .3185 was found to be significant at the 1% level. Compared to individuals that live in urban areas, residents of rural communities were 1.375 times more likely to have consumed methamphetamine during their lifetime. In these regions, producing methamphetamine is less costly and is consistent with the notion that methamphetamine is less popular in urban areas.

The variable WHITE was also found to have a positive effect on methamphetamine use. In addition, the point estimate of
.4252 was found to be significant at the 5% level. Compared to other races, white people in the sample were 1.530 times more likely to have used methamphetamine. While this result was anticipated, the magnitude of the effect was the weakest among the significant variables. This may vindicate reports that other races are increasingly using methamphetamine.

As expected, the variable HSGRAD had a negative effect on methamphetamine use. The point estimate of -.4647 was also significant at the 1% level. Relative to individuals who failed to graduate high school, high school graduates were only .628 times as likely to engage in methamphetamine use. In other words, individuals graduating from high school were 1.592 times less likely to use methamphetamine compared to individuals that failed to graduate from high school. This result appears to validate the proposition that individuals willing to apply themselves towards achieving traditional social objectives are less likely to engage in methamphetamine and other drug use.

The final variables, MALE and MARRIED were both insignificant at the 10% level. The variable MALE, however, was significant at the 20% level. While this is outside the range of significance for policy implications, a discussion of the results may still be instructive. Notably, MALE was found to be negatively correlated with methamphetamine use. Although research had indicated that women were increasingly using
methamphetamine, very little research has speculated that women were using methamphetamine at a higher rate than men. Undoubtedly, the insignificance of the variable should dissuade policymakers from overanalyzing this result. Nonetheless, it is clear that law enforcement officials should note the increased prevalence of use among women.

**POLICY RECOMMENDATIONS**

As mentioned previously, the United States has traditionally favored supply-side approaches to combating drug use (Dobkin and Nicosia, 2009). However, these measures have done little to slow the spread of drugs in the United States. Since drugs (including methamphetamine) are likely to be available for the foreseeable future, policy efforts should instead be focused on reducing demand. In particular, policymakers should focus on reducing demand amongst first-time users of methamphetamine. Statistics indicate that the overwhelming majority of drug use is done by addicts (Miron and Zweibel, 1995). Since demand among these individuals is unlikely to be affected by any policy, lawmakers should focus their efforts on prevention of first time use.

In order to better tailor anti-drug measures towards prevention, policymakers need to have a better understanding of the profile of a typical user. This approach, however, has
historically been ignored by many lawmakers. While understanding patterns of drug use is “important for both operational and strategic policy-making”, this information has often been omitted from the policymaking process (Makkai and McGregor, 2003, 1). This oversight represents a serious obstacle to the development of effective drug policies.

The regression results in my thesis help provide insight into some of the factors that influence one’s decision to engage in methamphetamine use. Based on this information, it is safe to assume that the typical methamphetamine user is white and from a rural area. Additionally, this individual is likely to be a smoker and may have engaged in marijuana and/or cocaine use during their lifetime. This individual is also unlikely to have attained education beyond high school. While other factors undoubtedly affect the decision to use methamphetamine, it is clear that policymakers should focus their legislative efforts on individuals with one or more of these characteristics.

In order to reduce demand among these individuals, governments should implement a two-pronged approach focused on preventing first-time use of methamphetamine. First, the approach should provide educational programs for “high-risk” individuals. For example, schoolchildren from rural areas should be given information about the dangers of methamphetamine use from a relatively early age. In addition, individuals from
“high-risk” communities arrested for other drug-related offenses should be required to complete stringent methamphetamine educational programs. Since marijuana and cocaine use is positively correlated with methamphetamine use, these individuals should be targeted for treatment. Completion of this program could be required for parole or probation and might reduce the likelihood that these individuals choose to subsequently use methamphetamine.

Second, penalties for the possession or use of methamphetamine should be strengthened to decrease demand in “high-risk” areas. In addition, individuals convicted of marijuana or cocaine use could face stricter punishments if they are subsequently found to be in possession of or test positive for methamphetamine. Furthermore, some seemingly supply-side policies could affect demand for methamphetamine. Moore (1988) proposes that tighter restrictions on dealers could also impose a “de facto tax on neophyte users”. Through harsh penalties and aggressive enforcement against dealers, suppliers would undoubtedly be forced to exercise greater discretion in the conduct of their operations (Passell, 1988). While heavy users could still utilize their services, first time users would have a much harder time finding someone to supply them with methamphetamine (Passell, 1988). This, ultimately, would equate
to higher costs for first-time and light methamphetamine users (Passell, 1988).

While the combination of these policies offers the potential to reduce demand for methamphetamine, it is also beneficial for a number of practical reasons. First, these common sense proposals are likely to generate broad, bi-partisan support amongst state legislators. It is unlikely that there will be much political opposition to programs designed to target “high-risk” youths for additional education about the threat of methamphetamine use. Additionally, programs to crack down on methamphetamine users are also likely to be popular among those segments of the population most concerned about increases in criminal activity and other law enforcement issues. Since many of these proposals will require a significant outlay of financial and human capital resources, it is important that they be able to garner widespread support among policymakers and the general public.

Second, it is easy to evaluate the effectiveness of the program. The benefits of the program, including the cost savings associated with fewer methamphetamine-related hospitalizations and imprisonments, can easily be compared with the costs of implementing the program. In addition, it would be simple to find other “control” municipalities with similar demographics to compare methamphetamine-related outcomes. Given
the increased focus on performance-based government, the ability to easily assess the value of the program is a strong asset.

**SUGGESTIONS FOR FUTURE RESEARCH**

Although this research offers some insight into the profile of a typical methamphetamine user, there is more research that needs to be conducted to develop a more complete profile. First, more information needs to be collected on the increase in use of methamphetamine by women. In some recent surveys, the number of women users of methamphetamine exceeds the number of male users ("Women and Meth", 2010). Since the number of male users of almost every other major drug exceeds that of female users, it is clear that the relationship between women and methamphetamine use warrants further investigation. In particular, anecdotal evidence suggests that women are "attracted to methamphetamine for weight loss and treatment of depression" ("Women and Meth", 2010, 1). If true, this could help to explain the growth in popularity among women and present significant new challenges for policymakers in the battle against methamphetamine proliferation.

Second, further research needs to be undertaken on the expanding use of methamphetamine by minorities. Recent statistics indicate that a number of groups, particularly Hispanics and American Indians, are increasingly using
methamphetamine ("The Meth Epidemic, 2007). This may be attributable to the prevalence of methamphetamine in the Western and Southern United States and the concentration of Hispanic and American Indian communities in this area. In addition, many Hispanic gangs are becoming increasingly involved in the manufacture and sale of methamphetamine ("Methamphetamine", 2010). This significantly complicates the federal law enforcement policy response and must be adequately addressed by policymakers.

Finally, researchers should further evaluate the notion that marijuana and cocaine use lead to methamphetamine use or vice versa. There has been significant research on the concept of “gateway drugs”. Nonetheless, there is little scientific research that confirms the existence of this effect. This thesis indicates an association between self-reported use of marijuana or cocaine and methamphetamine. While this does not prove that either is a “gateway drug”, it does indicate that further research should be conducted into the connection between the drugs. In particular, researchers should try to conduct a survey that asks participants about the order in which they used drugs. Given this valuable piece of information, researchers might be able to make a more informed judgment about whether marijuana or cocaine use ultimately leads to experimentation with “harder” drugs including methamphetamine.
### Appendix A: Testing Global Null Hypothesis: BETA=0

<table>
<thead>
<tr>
<th>Test</th>
<th>Chi-Square</th>
<th>DF</th>
<th>Pr&gt;ChiSq</th>
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<tbody>
<tr>
<td>Likelihood Ratio</td>
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<td>&lt;.0001</td>
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<tr>
<td>Score</td>
<td>1165.7695</td>
<td>9</td>
<td>&lt;.0001</td>
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<tr>
<td>Wald</td>
<td>604.5915</td>
<td>9</td>
<td>&lt;.0001</td>
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### Appendix B: Analysis of Maximum Likelihood Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>DF</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Wald Chi-Square</th>
<th>Pr&gt;ChiSq</th>
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<tr>
<td>POTEVER***</td>
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<td>.2617</td>
<td>35.3335</td>
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<td>WHITE**</td>
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<tr>
<td>SMOKE30***</td>
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<td>0.4354</td>
<td>0.1384</td>
<td>9.8931</td>
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<tr>
<td>COKEVER***</td>
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<td>2.3679</td>
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<tr>
<td>RURAL***</td>
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<td>0.1153</td>
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<td>MALE</td>
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<td>MARRIED</td>
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<td>HSGRAD***</td>
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<td>0.1103</td>
<td>17.7571</td>
<td>&lt;.0001</td>
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</tbody>
</table>

***Significant at the 1% level  
**Significant at the 5% level
### Appendix C: Odds Ratio Estimates

<table>
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<tr>
<th>Effect</th>
<th>Point Estimate</th>
<th>95% Wald Confidence Limits</th>
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<tbody>
<tr>
<td>POTEVER***</td>
<td>4.739</td>
<td>2.837 7.915</td>
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<tr>
<td>WHITE**</td>
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<td>SMOKE30***</td>
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<tr>
<td>COKEVER***</td>
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<td>RURAL***</td>
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<td>MALE</td>
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<td>1.097 1.724</td>
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<tr>
<td>MARRIED</td>
<td>0.901</td>
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<tr>
<td>HSGRAD***</td>
<td>0.628</td>
<td>0.506 0.780</td>
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***Significant at the 1% level  
**Significant at the 5% level
## Appendix D: Association of Predicted Probabilities

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<th>Metric</th>
<th>Value</th>
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<td>Percent Discordant</td>
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<td>Percent Tied</td>
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<tr>
<td>Pairs</td>
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<tr>
<td>Somers’ D</td>
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</tr>
<tr>
<td>Gamma</td>
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<tr>
<td>Tau-a</td>
<td>0.097</td>
</tr>
<tr>
<td>c</td>
<td>0.877</td>
</tr>
</tbody>
</table>


Hunt, Dana. 2006.  “Methamphetamine Abuse: Challenge for Law


“FBI Ties Crime Increase to Meth Use”. 2010. METH Awareness and Prevention Project of South Dakota. <www.mappsrd.org>


of Demand and Supply.” <www.ncjrs.gov>


