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LOCAL TRENDS IN SUBSTANCE ABUSE

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Sneha Arjun

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APPROVED:

Edwin Boudreaux, Ph.D.
Dept of Emergency Medicine
UMASS Medical Center
MAJOR ADVISOR

David Adams, Ph.D.
Biology and Biotechnology
WPI Project Advisor

ABSTRACT

Drugs, alcohol, and tobacco are all substances of abuse in Massachusetts. Comparing their state trends to those found in a local hospital in Worcester provided information to better prevent and treat addiction. The results indicate that in this city, drug programs should increase their focus towards adult males, particularly with information about cocaine and marijuana. Similarly, teenagers and young adults should have the most benefit from education about alcoholism with emphasis on drunk driving. Finally, tobacco treatments need to be more widely available, and specially targeted towards a younger population. Thus, although substance abuse is prevalent in Worcester, more efficient means to treat and prevent addiction are possible.

ACKNOWLEDGEMENTS

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PROJECT PURPOSE

The purpose of this project is to investigate substance abuse trends in the state of Massachusetts, and to match the statewide trends against recent patient intakes in the Emergency Medicine department at the University of Massachusetts Medical School for the City of Worcester. This approach could provide a description of efforts needed in Worcester to help improve substance abuse behaviors.

Chapter 1: Background – Substance Abuse

1.1 Addiction and Its Many Faces

Merriam-Webster defines addiction as the "compulsive need for, and use of, a habit-forming substance characterized by tolerance and by well-defines physiological symptoms upon withdrawal"; or broadly, it is the "persistent compulsive use of a substance known by the user to be harmful". These substances have a wide range including alcohol, tobacco, and even prescription drugs. While addictive behavior likely has been around for millennia, scientific studies to explain and understand the behavior were initiated in the 1930s, when society labeled addiction primarily as a moral flaw and less as a health issue. Today, we view this behavior more as health condition, and are constantly making advances in understanding the effects of addictive substances on the brain (*"*Introduction*",* 2010).

Addiction studies in the United States are important because substance abuse continues to negatively impact the lifestyle of Americans. The National Institute on Drug Abuse reports approximately 440,000 deaths each year due to tobacco use and another 100,000 deaths from alcohol abuse. Moreover, the effects of addiction are not only seen in adults but also in babies and adolescents. The start of one's downward spiral with addiction can be the result of many different factors such as the lack of a stable home and supportive friends and family, or immense amounts of stress and peer pressure. While such details may cause a voluntary and conscientious decision to inhale, drink, inject, or ingest addictive substances, the addictive behavior itself results from the hijacking of the brain. When comparing images of a substance-addicted individual's brain to those of a control brain, it is seen that the affected areas include

the structures, such as the frontal lobe and cerebral cortex, that impact one's ability to make sound judgments and decisions, act rationally, and learn, which relate to the aforementioned addictive behaviors ("Introduction"). Although there is a very wide spectrum of addictive substances, for the purpose of this project, they will be divided into three major categories: drugs, tobacco, and alcohol.

1.1.1 Drug Addiction

The disease of addiction from drug abuse can lead to lowered self esteem, financial difficulties, and can jeopardize heath. Addictive drugs are not limited to illegal street substances, such as cocaine and heroin, but also include prescription medications. The voluntary and recreational use of drugs can soon become a habit, and one of most dangerous characteristics of addiction is that the user is often unable to realize their uncontrollable need for the drug. This disease cannot easily be overcome, and requires psychological and physical rehabilitation, as well as the rebuilding social relationships (Conditions, 2010).

Although there are a wide variety of addictive drugs, some of the most prevalent ones are cocaine, marijuana, and prescription drugs such as opioids. Cocaine is addictive due to its ability to provide the user with a very pleasurable effect by preventing the reuptake of the neurotransmitter dopamine. Researchers have shown that the areas of the brain stimulated with cocaine, such as regions of the midbrain known as the ventral tegmental area and the nucleus accumbens, include those areas affected by other positive stimuli, such as food and sex. The short term physiological effects of cocaine include dilated pupils, increased body temperature, and medical complications such as irregular heart rhythms and even death from respiratory arrest. Apart from the effects of the drug itself, those who inject cocaine also put

themselves at risk of contracting HIV and hepatitis from contaminated needles (Cocaine: Abuse and Addiction, 2010).

Marijuana, containing the neuro-active chemical delta-9-tetrahydrocannabinol (THC) provides the user with a "high" by acting on specific areas of the brain containing cannabinoid receptors. The most affected regions, such as the hippocampus, basal ganglia and cerebellum, are those that play a role in the feelings of pleasure, concentration, coordinated movements, and thought. When abused chronically, marijuana's adverse impacts on learning and memory can be felt for weeks after the drug has worn off. Such behavior has also been associated with depression and schizophrenia. Apart from the brain, the heart is negatively impacted as heart rate increases by 20-100% after smoking this drug, while the lung cells become dysfunctional due to carcinogenic hydrocarbons from marijuana smoke. Aside from its physical conditions, marijuana also lessens a person's potential by hindering social life and career status (NIDA InfoFacts: Marijuana, 2010).

Along with street drugs, prescription drugs are also used recreationally to alter the mind and body. The three most common types abused are opioids, central nervous system (CNS) depressants, and CNS stimulants. In a legal and safe dosage, opioids are most commonly prescribed to alleviate pain, depressants are used to aid in cases of anxiety and sleep disorders, and stimulants are given by doctors for attention-deficit hyperactivity disorder (ADHD). To begin, ppioids are used recreationally to induce feelings of pleasure, and can induce euphoria by attaching to specific brain receptors known as opioid receptors. Opioids such as OxyContin may also be snorted or injected to heighten the effects. When taken in quantities beyond a

clinical amount, long term opioid effects may include addiction leading to severe compromise of respiratory function that can result in death.

Next, CNS depressants act by increasing the neurotransmitter gamma-aminobutyric acid (GABA), which lowers brain activity. This produces the drowsy and calming effects that individuals addicted to drugs seek. When abused for a long period of time, depressants lead to physical dependence, and withdrawal from the drug may force the body into overdrive and lethal seizures. Finally, stimulants, as the name suggests, increase blood and heart pressure, opens the respiratory system, and increases dopamine by having a chemical structure that is similar to monoamine neurotransmitters such as norepinephrine and dopamine. While these are the short term effects, abusing stimulants for a long period of time leads to dependence that in turn can cause irregular heart functions, seizures, and feelings of paranoia (Prescription Drugs: Abuse and Addiction, 2005).

Overall, abusing any sort of drug can have very serious health risks, and often drug-addicted patients are unable to understand the impact until it is too late. For this reason, it has become crucial to not only prevent addiction, but to diagnose it early and provide feasible treatment.

1.1.2 Alcohol Addiction

Many people consume alcohol in moderation without experiencing any deteriorating effects. However, this level of safe alcohol consumption is lower than most people believe it to be. HelpGuide.org writes that for women, moderate drinking is approximately one drink a day, and for men about two drinks a day. However, not everyone can limit their drinking to a safe amount, and many consume in excess. Behavioral changes that occur when one begins to

move from moderate drinking to an abusive level include ignoring your responsibilities (whether at home, school, or work), endangering yourself physically, and consuming alcohol to reduce stress. In addition, two primary signs of someone who has transformed into an alcoholic are tolerance and withdrawal symptoms such as depression, insomnia, and the shakes (*"S*igns, symptoms, and help for drinking problems*", 2010*).

Once someone becomes an alcoholic and is addicted to consuming large amount of alcoholic beverages, many deteriorating effects occur in the body. Some significant organs that are devastatingly affected are the brain, liver, and lung. Research conducted by scientists at the Stanford University School of Medicine, the University of Texas, and SRI International has shown that brain size, specifically the frontal cortex, of a chronic drinker is smaller than for non drinkers, affecting the ability to complete tasks. The study also identified different inefficient pathways an alcoholics' brain uses to complete actions, and these pathways are thought to be related to someone's dependence to alcohol *(*Sullivan et al., 2010*).*

As the brain transforms from alcohol, the liver is also under attack by way of alcoholic liver disease (ALD). This liver condition is noted to be among the most widespread and serious consequence of drinking alcohol, and is a leading cause of death. Alcohol destroys the liver through its "toxic metabolites" that affect cells signaling pathways, such as those necessary for metabolizing glucose (Szabo and Mandrekar, 2010). Finally, the lung is another major organ to be negatively impacted in cases of alcoholism. Research has shown that alcohol in excess increases the chances of acute respiratory distress syndrome and death by 40-50%. Lung damage caused by alcohol can occur well before the liver is affected and before alcoholism is diagnosed (Kershaw and Guidot, 2010).

Apart from damaging their own bodies, those addicted to alcohol also negatively impact the lives of others. Negative consequences of alcoholism may be in their present relationships with loved ones, or at the workplace, and women can severely harm their own babies before birth. Researchers have shown that the most prevalent and preventable cause of mental retardation in babies is the abuse of alcohol by the mother. Such behavior can result most severely in fetal alcohol poisoning (FAS) and alcohol-related neurodevelopmental disorder (ARND) where the child is disabled both in cognition and behavior (Maier and West, 2010). In sum, alcohol dependence harms not only the individual but also harms others around them, thus underscoring the importance in controlling the number of people with alcoholism and treating this population.

1.1.3 Tobacco Addiction

Exposing the body to excessive amounts of tobacco through smoking cigarettes or pipes, or chewing tobacco, has detrimental effects on the body. Tobacco harms nearly all organs of the body while causing diseases in organs such as the bladder and reproductive organs. Even smoking cigarettes with a lower amount of nicotine and tar hurts the smoker ("Highlights: Four Major Conclusions of the 2004 Report"). Despite numerous dangerous side effects, tobacco mortality is a primary cause of preventable death in the United States, with half a million deaths annually. There are about 46 million smokers in the United States, and while 34% attempt to quit, only about 10% at the maximum are successful. Those who continue smoking are subject to many pathological consequences. For example, a year of smoking one cigarette per day is equivalent to pouring a cup filled with tar on one's respiratory tract. This can lead to

constant coughing, wheezing, bad breath, and infections such as pneumonia. More seriously, in the lungs, the tissues can be altered permanently, and this decrease in lung function can result in chronic bronchitis and emphysema, or Chronic Obstructive Pulmonary Disease (COPD) (Brodish, 1998).

Aside from the lung damage, the heart is also subject to deterioration from tobacco. Chronic tobacco use can cause coronary heart disease (CHD). This is an important consequence because often the first and only sign is death. In fact, men who smoke tobacco are four times more likely than a non smoker to suddenly pass away, and this likelihood increases to ten times with women (who also consume oral contraceptives). As with lung damage, studies have seen that the amount of fatty deposits blocking coronary arteries is directly related to the number of "pack years" (packs smoked per year). Tobacco also affects circulation in the body by narrowing the vessels and limiting the amount of blood that reaches the extremities (Brodish, 1998). Along with the decay of the lungs and heart, the eyes can also suffer from chronic tobacco use, including cataracts and blindness. In addition, the nose, throat, and gums also respond to tobacco by thickening their tissues, which may lead to various types of cancer (Brodish, 1998).

Thus, severe consequences of smoking tobacco are apparent, but what may be surprising are the serious health conditions in a non-smoker in contact with secondhand smoke, even if only briefly. A risk-free exposure does not exist ("Smoking & Tobacco Use", 2010). When children are exposed to secondhand smoke, they can suffer in several ways, such as ear infections, and the same respiratory symptoms of smokers. Infants who come into contact with smoke have a higher risk of sudden infant death syndrome (SIDS). In adult non-smokers, being

around the smoke from cigarettes can ruin the functioning of their heart and lungs, and their risk of cancer increases. Heart attacks become more likely, and data shows that each year 46,000 adults die from heart disease from secondhand smoke. In terms of the lung, the risk of lung cancer increases by about 30% in exposed individuals, and data shows that approximately 3,400 annual deaths result from lung cancer in non-smokers ("Smoking & Tobacco Use", 2010). In conclusion, tobacco is very harmful to the user and to bystanders, and it is important to prevent the increasing number of smokers by providing effective treatment.

1.2 Substance Abuse Trends in Massachusetts

Regardless of the wide range of harm caused by drinking alcohol, injecting drugs, or smoking tobacco, many people in the United States and in the state of Massachusetts continue to abuse these substances. The trend for each of these substances varies when looking at the results of several published surveys and the data reported by the citizens of Massachusetts. **Figure 1** shows the percentage of people, ages 18 and older, who reported being dependent or abusing alcohol, tobacco, or drugs in 2007-08 (State Estimates, 2007-08). It is seen that the lowest percentage of people, 2.97% (blue histobar), reported drug dependence or abuse, while a higher percentage of people, 8.46% (green histobar), reported dependence on alcohol. The highest percentage of people, 73.78% (red histobar), reported perception at great risk from tobacco. Thus, in 2007-08 in Massachusetts, the highest report of substance abuse was for tobacco.

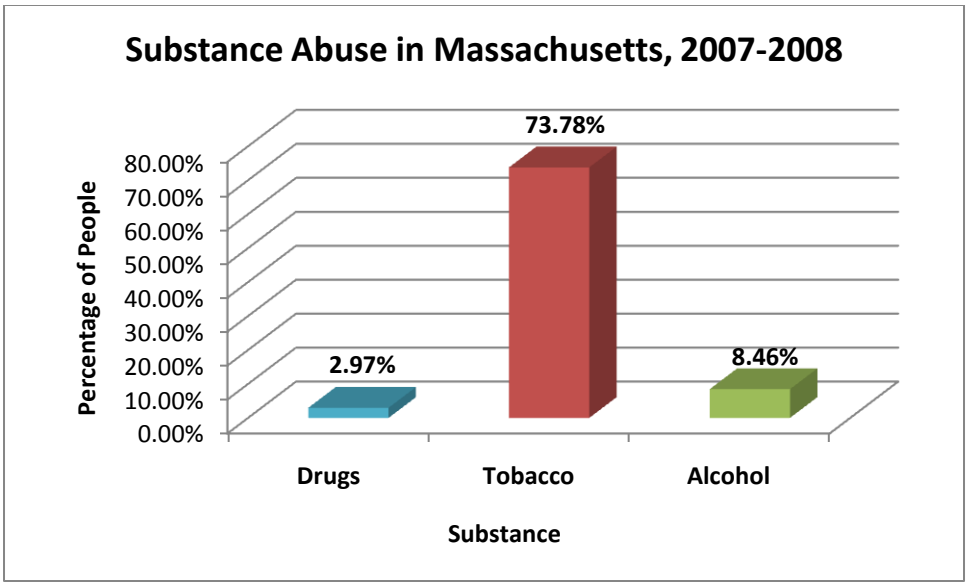


Figure 1: Substance Abuse in Massachusetts in 2007-08. Note that in this reporting period, tobacco was the most often reported abused substance (State Estimates, 2007-08).

1.2.1 Massachusetts' Trend of Drug Use

Apart from this overall portrait of substance abuse in Massachusetts, there are several unique components that accompany each substance. With a population of more than 6 million people, Massachusetts is a state where drugs abuse in both juveniles and adults outnumbers other crimes related to larceny and assault. Despite the deteriorative effects that result from the use of drugs, the instances of drug use has increased between the years 2003 and 2007. **Table 1** shows that the number of arrests made by the Massachusetts DEA was 431 in 2003, and was 540 in 2007. While a slight decrease was seen in 2006, an increase by more than 100 arrests was seen the following year in 2007 (Drug Policy Information Clearinghouse, 2008). These arrests were for all types of drugs, including marijuana, cocaine, and pain relievers.

Table 1: Number of DEA Drug Arrests in Massachusetts, 2003-2007

Year	Arrests
2003	431
2004	409
2005	451
2006	402
2007	540

(Drug Policy Information Clearinghouse, 2008)

Table 2 below shows various drug arrests for 2005 and 2006. The number of Massachusetts arrests was highest for people who used marijuana (696,000 people) compared to cocaine (183,000 people) and non-medical pain relievers (300,000 people).

Table 2: Massachusetts' Citizens Reporting Drug Use, 2005-2006.

Citizens (Ages 12 or Older) Reporting Drug Use, Massachusetts, 2005-2006 Data

Drug Type and Use	Number*	Percent
Past month illicit drug use	537	9.96%
Past year marijuana use	696	12.91
Past month marijuana use	429	7.96
Past month use of illicit drug other than marijuana	249	4.62
Past year cocaine use	183	3.40
Past year non-medical pain reliever use	300	5.56

* The number of users is in thousands

(Drug Policy Information Clearinghouse, 2008)

It may be ironic to note that while the majority of drug users reported marijuana as their substance of choice, around 1.6 million citizens of Massachusetts stated that even using marijuana as little as once a month puts a person at "great risk". The Office of National Drug Control Policy has reported that this drug can be easily obtained in all parts of the state (Drug Policy Information Clearinghouse, 2008). Although in 2009, marijuana possession was seen as a less serious problem than the use of illicit drugs such as heroin, cocaine, or prescription drugs,

the officials of Massachusetts deemed marijuana use a “major public health crisis” ("Judicial Attitudes toward Drug Abuse: Massachusetts", 2009).

One can also look at the damage caused by opioids in Massachusetts. Data from 1990 to 2005 for fatal opioid overdoses in Massachusetts shows that the percentage of deaths increased by 119%. In the year 2005, opioids played a role in 67% of all deaths that occurred due to poisoning ("Opioids-Related Events and Associated Risk Factors, 2010).

Another way to look at the abuse of illicit drugs is by separating the population by ages. In the period 2002-03, around 33,000 youths between the ages 12 and 17 were addicted to or abused drugs. Next, there were approximately 77,000 people for 18-25 year olds and 86,000 people for individuals 26 years or older. While these data were for 2002-03, the number of individuals for drug use increased for each age group in 2011, approximately 71,000 people 12-17 years old, 185,000 individuals 18-25 years old, and 244,000 adults 26 years or older (Massachusetts Illicit Drug Statistics, 2011).

Included in this subpopulation of the citizens of Massachusetts engaging in dangerous substances are those individuals who wish to recover from their habits by getting admitted into a treatment facility. Although the highest number of people abused marijuana between 2005 and 2006, the highest number of people who sought *treatment* for abuse was for heroin, with cocaine being the second highest. As seen in **Table 3**, of the total number of individuals addicted to substances in Massachusetts in treatment between 2005 and 2007, around 43% were abusing heroin, around 16% were smoking cocaine, and around 6% were addicted to marijuana. These individuals are supported by the state of Massachusetts because Massachusetts adheres to a legislation which requires state health insurance companies to

provide unlimited financial coverage to their customers who require treatment for substance abuse disorders. Such support might be a factor in the increasing number of drug-addicted patients entering treatment facilities between 2005 and 2007. However, additional improvements are still required as approximately 142,000 people of Massachusetts stated in a 2005-06 poll by the National Survey on Drug Use and Health (NSDUH) that they were in need of help but were not receiving treatment for drug use (Drug Policy Information Clearinghouse, 2008).

Table 3: Admissions to Treatment in Massachusetts by Drug Type, 2005-07.

Admissions to Treatment, Massachusetts, 2005-2007

	2005		2006		2007	
Drug Type	**#**	**%**	**#**	**%**	**#**	**%**
Alcohol only	11,398	19.7%	11,723	18.8%	12,029	18.7%
Alc. w/ second. drug	9,329	16.2	10,248	16.5	10,300	16.0
Cocaine – smoked	2,669	4.6	2,811	4.5	2,981	4.6
Cocaine – other route	1,554	2.7	1,736	2.8	1,876	2.9
Marijuana	3,372	5.8	3,724	6.0	3,536	5.5
Heroin	24,811	43.0	26,414	42.5	27,744	43.2
Other opiates	3,697	6.4	4,442	7.1	4,602	7.2
PCP	19	0.0	10	0.0	15	0.0
Hallucinogens	31	0.1	46	0.1	26	0.0
Amphetamines	151	0.3	148	0.2	157	0.2
Other stimulants	16	0.0	8	0.0	9	0.0
Tranquilizers	472	0.8	618	1.0	622	1.0
Sedatives	31	0.1	24	0.0	18	0.0
Inhalants	2	0.0	8	0.0	2	0.0
Other/none specified	208	0.4	251	0.4	263	0.4
Total	57,760	100.0	62,211	100.0	64,180	100.0

(Drug Policy Information Clearinghouse, 2008)

1.2.2 Massachusetts' Trend of Alcohol Consumption

The destruction to one's body and life caused by alcohol is well known, yet alcoholism is prevalent in the United States. Since the mid 1990's, the state of Massachusetts has data for the number of people engaging in binge and heavy drinking that are in line with the national averages. In 2007, the average number of people binge drinking was 15.3%, and 4.9% for heavy drinking in the United States, while in Massachusetts it was 17.5% and 6%, respectively. The number of people in this state who are drinking in excess appears to remain stable, as the percentage for binge drinking was 15.7% in 2005, slightly increased to 17.7% in 2006, and decreased to 17.5% in 2007 (Common Health for the Commonwealth, 2008).

When comparing the gender breakdown of the drinking population, it was seen that in 2006 in Massachusetts, 25% of adult males were involved in binge drinking, compared to 12% for females. This disparity is not as evident when comparing the population involved in heavy drinking, as data shows it to be 7% males and 5% females in Massachusetts. This indicates that

while the drinking behaviors of men and women may be different, there is little difference in the number of men and women who are drinking in excess.

This data can also be analyzed by different age groups. It is useful to group by different ages because the most reliable indicator of alcohol abuse in Massachusetts was the behavior of the younger population. Data shows that in 2006, the highest number of people who participated in binge drinking was in the 18-24 age group with 37% of individuals, and as the age increased, the percentage of people decreased: there were 25% of people in the 25-34 year age group, then a slightly lower 20% of people in the 35-44 year range, 16% in the 45-54 year group, and a mere 2% in the 75 year and older age group. The trend in Massachusetts for heavy drinking was more stable, a sign of a more dominant alcohol problem: the heaviest drinkers were in the 18-24 year age group with 8% of the population, but the percentages in the other groups did not vary by much (between 4-6%) (Common Health for the Commonwealth, 2008).

When looking at alcohol dependence or abuse in Massachusetts and the U.S., **Figure 2** segregates the population by 12-17 years, 18-25 years, and 26 years and older. For all age groups, the numbers for Massachusetts were slightly higher, as mentioned previously, and the age group with the most people was 18-25 year olds, for the country and the state. This age group also shows the highest disparity in the percentage of people abusing alcohol in the state (19.4%) versus the country (17.6%) (Common Health for the Commonwealth, 2008).

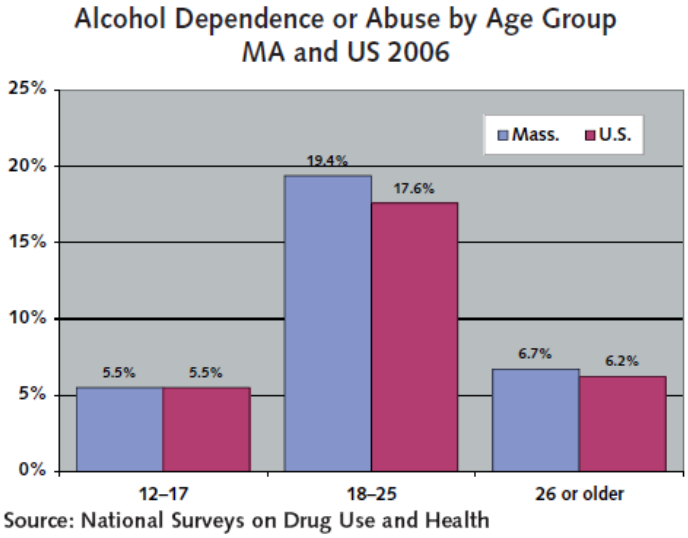


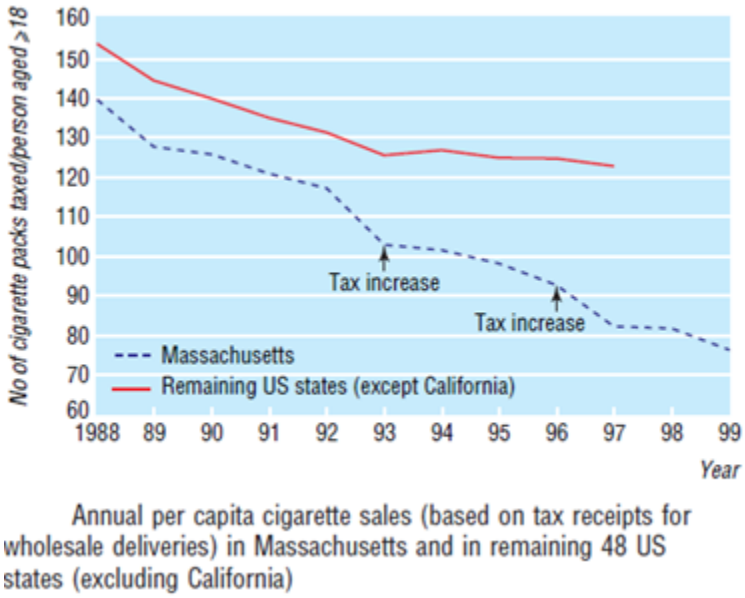
Figure 2: Alcohol Abuse Age Groups in Massachusetts and the United States, 2006. (Common Health for the Commonwealth, 2008)

Along with the individuals whose lives are harmed by the detrimental effects of alcohol abuse are those people hurt from the behaviors of this alcohol drinking population. Such people are the passengers that fall victim to drunk driving, and these accidents include both the sober and innocent individuals, along with those who mistakenly decide to drive under the influence. In 2006, around 422 people were killed in motor vehicle accidents in Massachusetts and of these 38% were due to alcohol. This is unfortunately very close to the data from the entire country, which reports that 37% of all traffic accidents are due to alcohol. It was seen in Figure 2 that the majority of those who are dependent or abusing alcohol are under the age 25, and in fact data from 2007 reported that 26% of Massachusetts' high school students had been driven by an intoxicated driver at least one time in the past month. Additional data reported 11% of high school students who have driven after drinking (Common Health for the Commonwealth, 2008). Consuming too much alcohol will indeed deteriorate the health and social aspects of an individual, and while that is in itself a reason to better control alcohol

abuse, the fact that it also leads to the violent destruction of others prompts an even stronger effort to prevent and treat alcohol dependence.

1.2.3 Massachusetts' Trend of Tobacco Use

While there has not been an obvious decrease in the number of people consuming drugs or alcohol in excess, data shows that the percentage of people consuming cigarettes in Massachusetts has been decreasing. **Figure 3** shows the number of cigarettes sold legally to people over the age of 18 between 1988 and 1999 in Massachusetts (dotted blue line) and between 1989 and 1997 for the United States (solid red line). Also seen in this figure are the years where there was a tax increase in Tobacco sales in Massachusetts. Before the first tax increase in 1993, the decrease in tobacco was 15% in Massachusetts, and around 14% in the country. However, after the tax increase, there was a 12% decline in sales in Massachusetts, while the rest of the country decreased by only 4%. In the following years, the sales in Massachusetts continued to drop each year by at least 4%, but the rest of the country leveled off with only about 1% decline (Biener et al., 2000).



Annual per capita cigarette sales (based on tax receipts for wholesale deliveries) in Massachusetts and in remaining 48 US states (excluding California)

Figure 3: Number of Cigarette Packs Taxed per Person in Massachusetts and the United States, 1988-99. (Biener, Harris, and Hamilton)

While Figure 3 shows a decrease in cigarette sales, it becomes important to research whether this results from a constant population buying fewer packs, or whether the total number of adults smoking is decreasing. To address this matter, **Figure 4** shows the percentage of adults who smoke as best-fit regression lines and single data points, separated by state and country, so the adults who smoke in Massachusetts are represented by a blue dotted line and blue triangles or circles, while the adults who smoke in the rest of the United States (excluding California and Massachusetts) are shown by a red solid line and by red squares. The Massachusetts triangles show the data from the Massachusetts Tobacco Surveys while the circles summarize data from the Massachusetts Behavior Risk Factor Surveillance. This graph depicts the adult smoking population between 1989 and 1999. The graph portrays visually that while the United States smokers declined only by 0.03%, Massachusetts had annual decreases of about 0.44%. Statistical analysis proved these differences to be significant (Biener et al.,

2000). This information thus links the decrease in cigarette sales to a decrease in the prevalence of adults smoking.

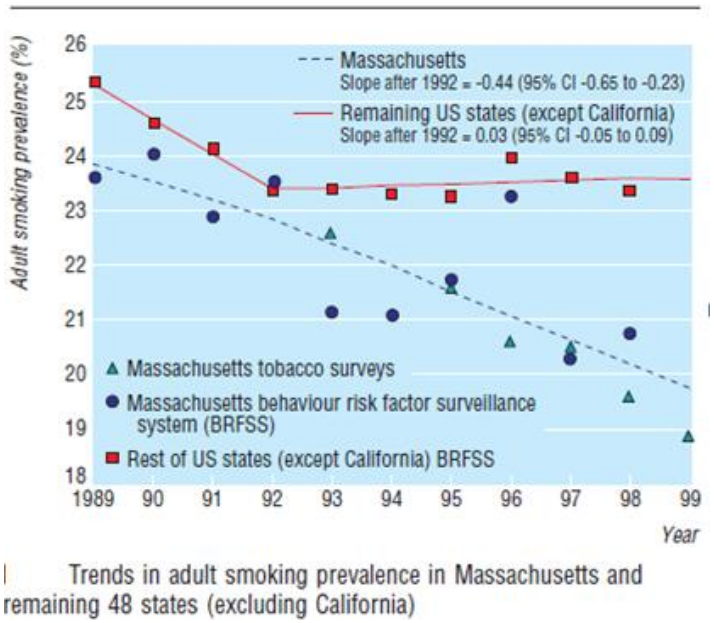
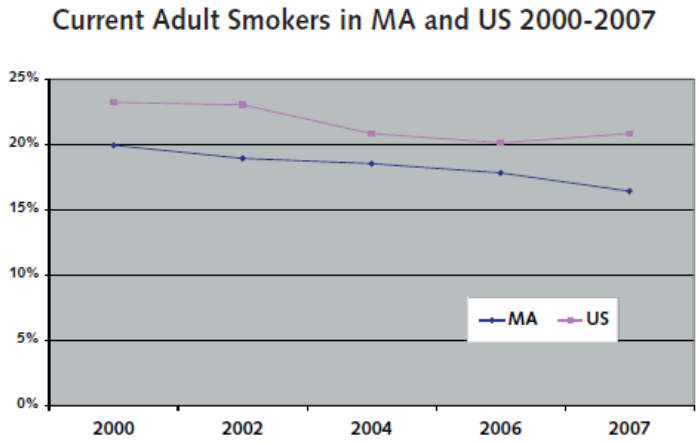


Figure 4: Percentage of Adults Smoking in Massachusetts and the United States, 1989-99. (Biener et al., 2000)

When looking at tobacco trends in Massachusetts in more recent years, 2000 to 2007, it is seen that the rate of adult smokers continues to decline (**Figure 5**). The most recent data for 2007 shows that the number of adult smokers dropped by 8%, and the number of adolescent smokers dropped to 17.7% from the previous years' 20.5%. In that 7 year period, the percentage of smokers in the United States continues to be higher than the percentages for the state. These improving numbers are beneficial because currently one in six deaths in the state is caused by cigarette smoking, and even if one does not smoke research shows that the inhalation of secondhand smoke is linked to serious health conditions including lung cancer and heart disease. Whereas the number of adult smokers, including heavy smokers, is decreasing, additional improvements are occurring in Massachusetts since around 60% of its smoking

population has reported performing actions to quit the habit in the past year, and another 41% anticipate participating in a rehabilitation program (Common Health for the Commonwealth, 2008).



Source: Behavioral Risk Factor Surveillance System – Trends Data; CDC

Figure 5: Percentage of Adults Smoking in Massachusetts versus the United States, 2000-07. (Common Health for the Commonwealth, 2008)

Chapter 2: Methodology

This project collected data from 786 patients who were registered into the emergency room of a local hospital in Worcester, Massachusetts. The patients had to be at least 18 years of age, fluent in English, residents of Massachusetts, mentally stable, and physically competent to fill out a survey on a tablet computer. They were approached with a request to fill out an initial questionnaire by the Dynamic Assessment and Referral System for Substance Abuse (DARSSA) software on the tablet that determined whether they were positive for substance abuse as per the American Association of Family Physicians guidelines. As stated previously, the substances were categorized into three groups: drugs, alcohol and tobacco.

Once a patient had screened positive for substance abuse behavior, they were asked to provide additional information to confirm their status as a resident of Massachusetts. They were then left alone with the tablet computer to fill out a second questionnaire that asked more in depth question about their behaviors, and these questions were targeted specifically for the substance category reported to be abused by the patient during the initial questionnaire. Their answers were collected in an electronic database.

The reported data from both the initial and secondary questionnaire was scrutinized to extract the relevant information using SPSS statistical software, and the graphs were created using Excel.

Chapter 3: Results of Substance Abuse Data from a Local Hospital

This section includes subsets of data from a complete set of all information given by the patients who were approached for this study at a local hospital's emergency room by the author of this report. This data selection was performed to compare the characteristics of substance use in Worcester (as per a local hospital) against those of Massachusetts. While over 700 patients were involved in the data collection for this student project, it is important to note that this is not the final set of data, as this project is part of an ongoing clinical study that will continue to collect data for additional months. The substances are categorized by drugs, alcohol, and tobacco.

3.1 Data Summary for a Local Hospital

The data begins by looking at information to get an overall image of risky substance use at this local hospital. **Figure 6** summarizes the population of patients that were a part of this study by separating those individuals who have a positive screen for substance use, those who did not indicate substance use in their survey, and those people who had data missing from their report. The patients who were positive may be abusing drugs, alcohol, or tobacco. It is seen that out of a total population of 771 patients providing complete data reports, most use was reported for tobacco with 279 cases, next highest was for alcohol consumption with 161 counts, and finally regular drug use with 129 people.

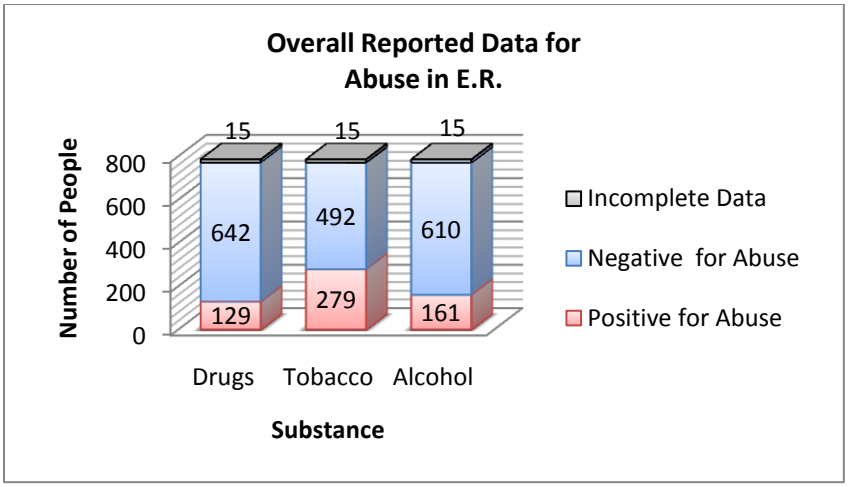


Figure 6: Overall Reported Data for Substance Abuse at a Local Hospital's Emergency Room.

Figure 7 below shows a pie chart of the data from Figure 6, showing the percent breakdown of the patients abusing each substance relative to the total number of positive cases. It is seen that almost half, 49.03%, are cases of patients using tobacco (red), while around 28% consume alcohol in excess (green), and almost 23% of positive cases were for drug abuse (blue).

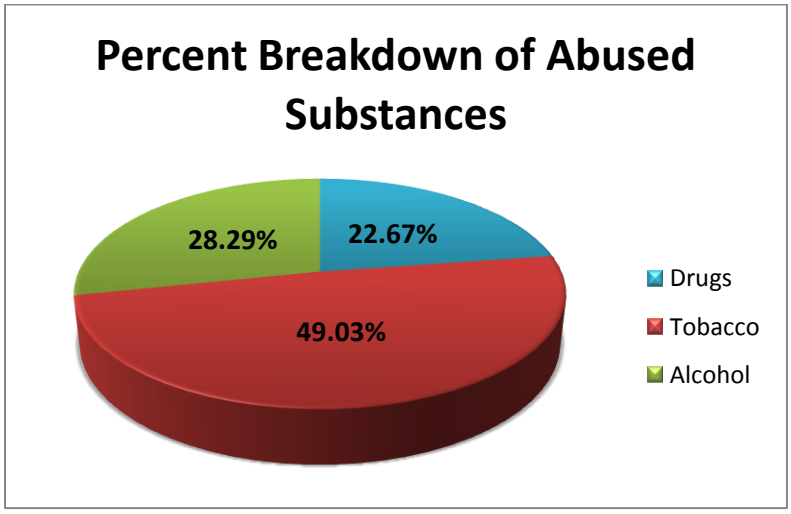


Figure 7: Percentage of Reported Substance Abuse.

Genders were also compared to notice any disparities. **Figure 8** below shows two sorts of graphs to achieve this goal. The pie chart on the left shows that from the total population seen in Figure 7, 45% were female and 55% were male. The bar graph on the right shows the gender separation within each substance group. It is seen that the percentage of female population reported using drugs (12.5%) is almost identical to that consuming too much alcohol (12.8%). The percentages of men using drugs and alcohol are also similar with 24.7% for drugs and 27.3% for alcohol. For both genders, the highest percentage of people reported substance use for tobacco where 31.7% females and 39.7% males regularly use tobacco. As the overall breakdown of the test population suggests, all substance groups showed a higher percentage for men than women.

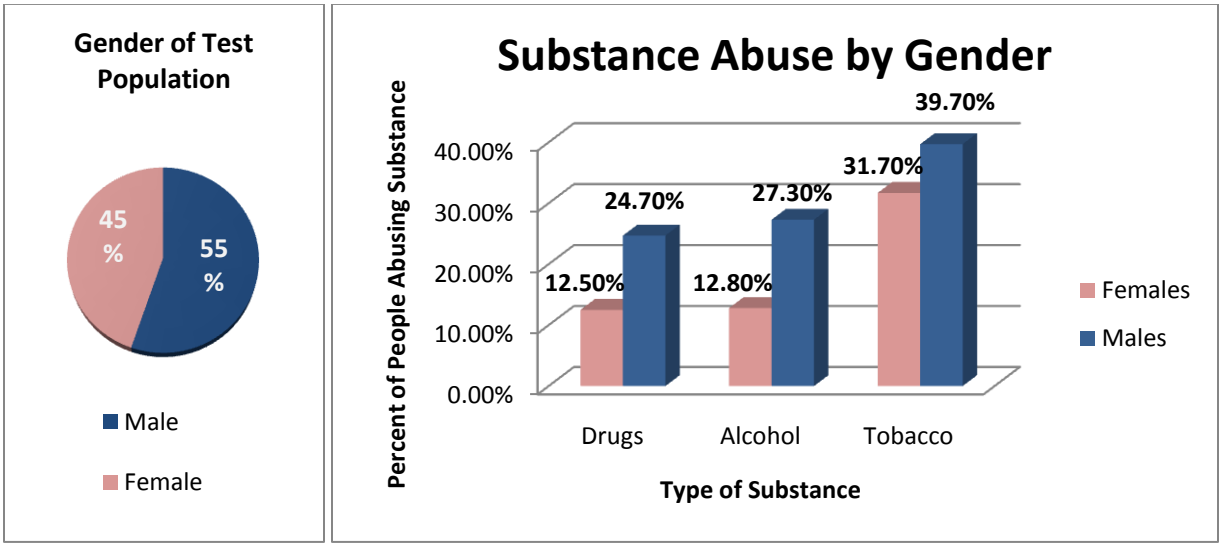


Figure 8: Gender Breakdown of All Patients in Study (Left). Gender Breakdown by Each Abused Substance (Right).

3.2 Local Trend of Drug Use

To go into more detail about the drug abuse characteristics at this local hospital, **Figure 9** below breaks down the population of people who screened positive for drug abuse by their current ages. They were grouped by the following ages: 18-44 years old, 45-65 years old, and older than 65 years. It is seen that at this local hospital the highest number of people, around 24%, who were recreationally using drugs were between the ages of 18 and 44. The remaining two age groups were similar in their breakdown, having 6.7% in the 45-65 range, and 5.5% in the older than 65 year category.

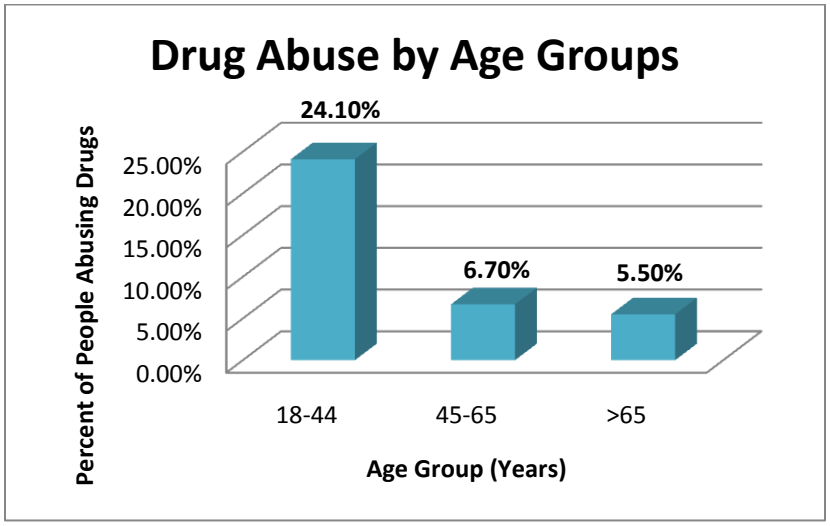


Figure 9: Breakdown of Drug Abuse by Age Groups.

Table 4 lists the drugs reported by the patients, used by those positive for drug abuse in the past 30 days. Marijuana was the most used substance with 7.1% of drug users using it in the past month at the time of their surveys. The next most abused drugs were painkillers and cocaine as they were both reported by 1.4% of the patients for use in the past month. The population that is not represented in Table 4 reported using drugs in the past year, not in the past 30 days.

Table 4: Percentage of People Who Abused Different Drugs in the Past 30 Days.

Type of Drugs	Percentage of People with Positive Screen in Past 30 Days
Marijuana	7.1%
Painkillers	1.4%
Cocaine	1.4%
Tranquilizers	0.6%
Stimulants	0.4%
Ecstasy	0.4%
Cold Medicine	0.4%
Hallucinogens	0.3%
Heroin	0.1%
Inhalants	0.1%
Sedatives	0.1%
Other Drugs	0.4%

3.3 Local Trend of Alcohol Consumption

Additional data about alcohol consumption at this local hospital is useful for understanding the behaviors of this population. **Figure 10** below separates the patients who screened positive for risky alcohol use by the following age groups: 18-44 years, 45-65 years, and older than 65 years. It is seen that the most number of people who over-consume alcohol were between the ages 18-44 years with a percentage of 25.2%, while 16.7% of the people were between the ages 45 and 65, and 8.3% of people who drank alcohol in excess were above 65 years in age.

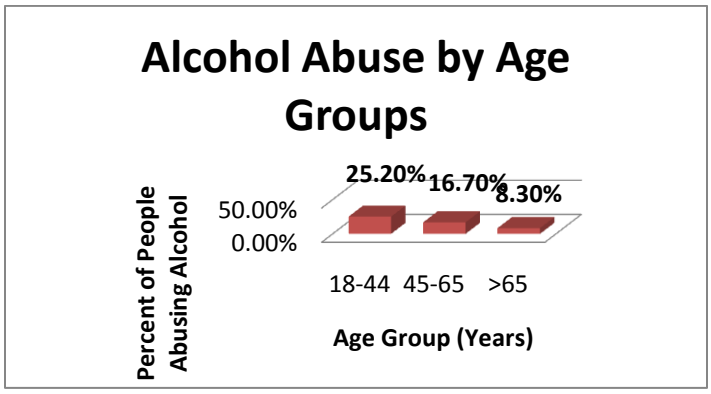


Figure 10: Breakdown of Alcohol Abuse by Age Group.

3.4 Local Trend of Tobacco Use

In order to learn additional details about tobacco use from patients at this Worcester hospital, **Figure 11** below breaks down the population who reported using tobacco by the follow age groups: 18-44 years, 45-65 years, and above 65 years. It is seen that the maximum percentage of people, 43.3%, were in the youngest age group, while 31% were between the ages 45 and 65 years, and 6.7% of people who used tobacco were above the age of 65 years at the time of the survey.

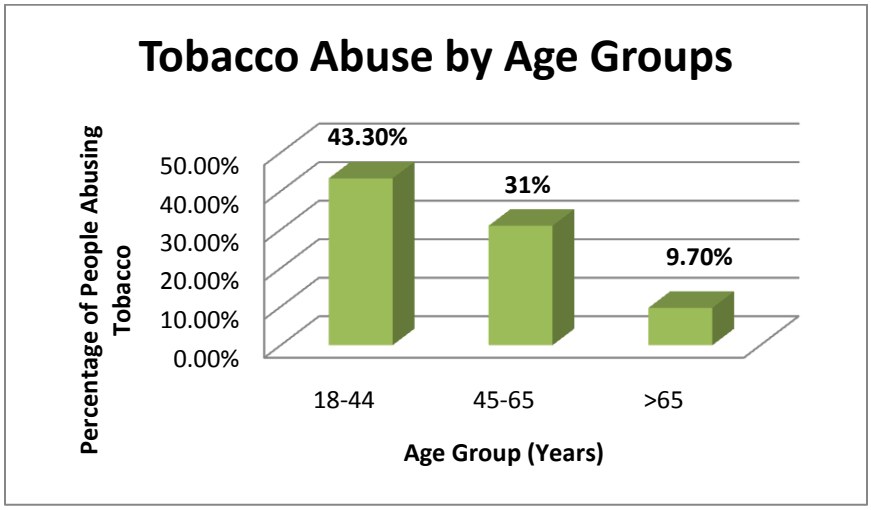


Figure 11: Breakdown of Tobacco Abuse by Age Group.

The left column in **Table 5** below shows different ranges of years and the right column list the percentage of smokers in this study who started smoking in a given age group. It is seen that most current smokers, around 55%, started using cigarettes when they were between the ages of 11 and 15, and the second highest percentage, 31.68%, belonged to the age group of 16 to 20 years.

Table 5: Age when People Started Smoking Cigarettes.

Age (Years)	Percentage of People
7 to 10	3.27%
11 to 15	55.19%
16 to 20	31.68%
21 to 25	9.29%
26 +	0.55%

Chapter 4: Discussion of State versus Local Trends in Substance Abuse

When comparing the risky substance use data from the state of Massachusetts (discussed in section 1.2) to those seen in Worcester (obtained as data for this project), several conclusions can be made about the characteristics of drug use, over-consumption of alcohol, and the smoking of tobacco. One can look at these behaviors in order to learn about the personality of the city of Worcester (from the viewpoint of a major local hospital) to evaluate and further plan reform with hope of making the city a healthier place.

The general division of the three major substance groups in Massachusetts (Figure 1) shows that the highest percent of population smokes tobacco, the second largest population consists of those people who drink alcohol in excess, and the smallest percentage of individuals in the state abuse illicit drugs. As seen in Figure 6, the statistics from the local hospital showed the breakdown of the substance abuse in Worcester to be the same, as most people reported tobacco abuse, while the least positive screens were for illicit drugs. Although this general property is similar between the city of Worcester and the state of Massachusetts, the proportions of each substance is distinct. Figure 7 shows that the while most of the patients used tobacco, this represents less than half of the total study population at this Worcester hospital, whereas Figure 1 shows tobacco use to be more 73.78% in Massachusetts. Next, the percentage of users abusing illicit drugs is 2.97% in Massachusetts, but this number is much higher at the local hospital. This study showed that of the people abusing any sort of substance around 23% were, for drugs, more than 5 times than the percentage for Massachusetts. This suggests that there are more people using drugs in Worcester needing the medical care of a

hospital emergency room (the survey did not measure non-hospital individuals) than one may expect based on the overall data of the state. This discrepancy also translates to the data for alcohol use, as data for Massachusetts showed 8.46% of people whereas it is increased to around 28% in this Worcester hospital. Although this study did not investigate non-hospital Worcester individuals, the overview comparison of substance abuse in Massachusetts versus Worcester brings light to the heightened use of illicit drugs and alcohol in this city. As a result, officials need to target their resources in decreasing the number of people who use these two major groups of substances by providing additional education and preventative care measures in order to stop individuals from such habits and also provide a more dynamic and assertive treatment programs for drugs and alcohol. In order to further detail these programs, it is important to look more in depth about the specific characteristics of the populations of Worcester that abuse each substance group.

Looking more explicitly at the data for drug abuse, it is seen that in Massachusetts the drug that is used by the most number of people is marijuana and as Table 2 shows, the second most abused drug is cocaine, followed by non-medical pain relievers. When comparing this to the data from the local hospital, Table 4 shows that the aforementioned ranking is also the case in Worcester. To be exact, 7.1% of the patients reported using marijuana, while cocaine and painkillers tied at 1.4% in the past month. While the people report using these classes of drugs the most, data from treatment centers report a different set of rankings. In Massachusetts, most people who entered treatment centers in 2007 were admitted for heroin. In fact, as Table 3 shows, they comprised 43.3% of the population in treatment centers. Based on the data of drugs used by the most people, one would expect this to be for marijuana or cocaine. Instead,

marijuana brought in 5.5% of the people and cocaine abuse (injected or otherwise) comprised 7.5% of the patients in treatment facilities. Moreover, while this discrepancy between the most abused versus the most treated drug is seen in the treatment facilities of the state as a whole, it is also seen in the treatment admission for Worcester. Data from substance abuse treatment programs in Worcester during 2007 showed that among drugs, heroin users were 51% of the total number of admissions. Moreover, cocaine was used by more patients in treatment centers in Worcester than marijuana. Specifically, cocaine users comprised 28% of patients whereas marijuana users made up 23% of the individuals in treatment programs (Description of Admissions to Massachusetts Substance Abuse Treatment Programs, 2007). Thus, although cocaine and marijuana have more users, treatment facilities are reporting more admissions for the drug heroin. This shows that the efforts to control the drug population of the state but more specifically for Worcester, calls for an increase in the policies related to marijuana and cocaine. These drugs report being used more commonly but this number does not correlate with the number of people recovering from these drugs' addictive qualities and harmful effects.

When looking at alcohol consumption, it is seen that although the trend of alcoholism has been a stable 17.5% in Massachusetts between the recent years 2001 and 2007, it is still above the national average (Common Health for the Commonwealth, 2008). When looking specifically at Worcester, as mentioned earlier, there are more instances of alcohol use in the city hospital ER visits than one may expect based on data from the state. To go into more detail, data shows that between the years 2002 and 2006, Massachusetts has actually always had higher rates of alcohol dependence for adults between the ages of 18 and 25 in the United States (Massachusetts Drug and Alcohol Abuse). When looking at Figure 2 it can be seen that

these seven years contain more alcohol dependent individuals than a range of ages that contain everyone who is 26 years and older. It is also interesting to note that the percentage of people who are abusing alcohol in the tender years of 12 and 17 is only about 1% lower than the vast age group of 26 years and older – suggesting more efforts be put into preventing alcoholism in the youth of Massachusetts. When looking only in Worcester, Figure 10 shows that most individuals abusing alcohol are in the 18-44 year age group, and if looking only at ages 18-25 years, the local hospital in Worcester also has the highest percentage of patients (26%) abusing alcohol (data not shown graphically). Next, in the same way that Massachusetts had many instances of drunk driving, the numbers for Worcester County are among the highest in the state. In 2008, Worcester County was tied with Plymouth County for having the highest number of fatalities from driving impaired by alcohol. Out of a total 124 deaths, 16-25 came from this county. In that year, Massachusetts had a state rate of 1.91 per 100,000 population traffic crashes caused by driving under the influence of alcohol, and Worcester County was among the counties with the highest rate of more than 2.75 crashes per 100,000 population (2008 Traffic Fatalities in Alcohol-Impaired-Driving Crashes* Massachusetts).

Lastly, the tobacco use data from Massachusetts, as seen in Figures 3 and 4, shows that the number of cigarette sales and the number of adults smoking has been declining since the 1990s. Moreover, the total percentage of Massachusetts' population that were smokers in the years 2000 to 2007 were consistently below the numbers for the United States, as evident by Figure 5. The percentage of people abusing tobacco in Worcester is also less when compared to the proportions of substance abuse for the state of Massachusetts. These properties of tobacco use show that the city's efforts to reduce tobacco reform is effective but regardless of

this decline, tobacco use remains the highest substance abuse seen in Massachusetts and in this local hospital. For this reason, with tobacco's associated health and social problems additional attention should continue to be allotted in reducing the number of smokers. Data collected from the Worcester hospital shows, as depicted by Figure 11, that the highest percentage of smokers (43.3%) is between the ages of 18 and 44 years, and in fact this age group contains the most tobacco users in the United States as a whole (Current Smoking, 2010). It is interesting to note that the highest number of people using tobacco belongs to the youngest age group in the study. In fact, it has been shown that abusing tobacco is a habit that starts early in life, around 15 years old, and this is the case not only the United States but also in countries such as India as China (Economics of Tobacco Control, 2010). When looking specifically at local data seen in Table 5, it can be seen that the highest percentage of people began smoking, 55.19%, between the ages of 11 and 15 years, and the second highest percentage was 31.68% between the ages 16 and 20 years. A young starting age for using tobacco combined with the negative social effects of smoking correlates with the data that most of the current smokers in Massachusetts have less than a high school degree, around 30%, and another 24.5% have only a high school degree (Smoking and Tobacco Use: State Highlights, 2010). Such pieces of information point to a need for a more efficient tobacco reform program that is designed towards the younger generations, because as of 2009, only 22% people who are in the younger age of 18-24 years have quit smoking, compared to the 69% of former smokers in the 45-65 years group and the 87% of former smokers in the above 65. More importantly, apart from age-appropriate smoking cessation methods, more dynamic treatment methods as a whole should be implanted. The reason for this is that in Massachusetts in 2009,

77% of the adult smoking population wish to quit smoking, and 61% have tried at least one quitting attempt in the past year (Who Quits Smoking, 2010).

In conclusion, a more assertive treatment campaign for drugs, alcohol, and tobacco is necessary in Worcester due to the fact that many individuals are abusing substances and treatment is necessary now more than ever. As seen in **Figure 12** below, data depicted graphically from the Bureau of Substance Abuse Services shows that the number of admissions in treatment facilities in Worcester decreased in 2010 when compared to the data from 2000, whether it is for alcohol, or drugs such as heroin or cocaine (Residents of the City of Worcester, 2010).

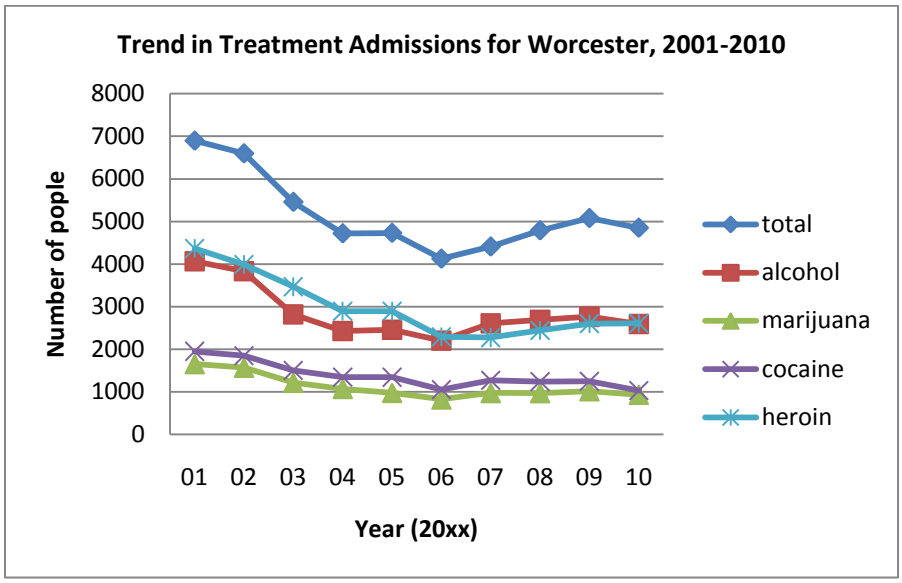


Figure 12: Trend in Treatment Admissions for Worcester, 2001-2010.
(Residents of the City of Worcester, 2010)

Regardless of the hundreds and even thousands of people who are receiving treatment for drugs and alcohol, there are still many who wish to improve their habits but are unable to receive the care they need. In 2007-08, 2.53% of Massachusetts residents above the age of 18

years needed treatment for illicit drug abuse but were not able to receive it. That year, the same was the case for 8.03% of people in Massachusetts for alcohol abuse (State Estimates of Substance Use from the 2007-2008 National Surveys on Drug Use and Health). With the downward trend seen in Figure 12 above, it can only be predicted that the number of people who require treatment but do not receive it will increase, pushing the need for additional and focused treatment campaigns. A treatment program in drugs should be focused on cocaine and marijuana, and as shown by Figure 9 should target adults between the ages of 18 and 44. More specifically, as seen in Figure 8, there is almost twice the number of males than female who reported abusing drugs, thus treatment options should keep the male audience in mind. Next, a target for alcohol treatment should tailor to a younger age group, such as teenagers and young adults, and actively educate about the dangers of driving under the influence. As was the case with drugs, alcohol abuse is also seen to be more common in males than females (Figure 8) and thus they should be a primary audience. Finally, tobacco programs in the Worcester area also need to begin reaching a much younger audience, and have more options available for treatment to provide recovery to all who require it. Substance abuse is certainly a modern day issue for Worcester, Massachusetts, but it can be improved with effective prevention and treatment strategies.

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