Differences in amphetamine/dextroamphetamine prescriptions in areas with & without large universities

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Differences in Amphetamine/Dextroamphetamine Prescriptions in Areas With and Without Large Universities

Heather Bacon

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Abstract

This investigative study is examining trends in stimulant prescribing for several Michigan counties. An ex-post facto design was used to determine trends in the amount of amphetamine/dextroamphetamine dispensed in four Michigan counties containing large universities and two Michigan counties not containing large universities over the years 2007-2012. The study found suggestive evidence that there is an increasing trend of amphetamine/dextroamphetamine prescriptions filled in both counties with and without large universities. Suggestive evidence was also found that counties with large universities display a greater average amount of amphetamine/dextroamphetamine dispensed than counties without large universities for the years 2007-2012. Because the study consisted of data drawn from county populations and not university/non-university specific populations, the evidence presented is merely suggestive and in no way conclusive. Future research might include a similar project analyzing trends from all Michigan counties and/or a survey based study targeting university and non-university populations about actual amphetamine/dextroamphetamine usage.
Differences in Amphetamine/Dextroamphetamine Prescriptions in Areas With and Without Large Universities

Amphetamine/dextroamphetamine (brand name Adderall) has been shown to be efficacious in treating the symptoms of Attention Deficit Hyperactivity Disorder (ADHD) such as hyperactivity, aggression, and inattention (Manos, Short, & Findling, 1999; Pelham, Aronoff, et al., 1999). Additionally these drugs are well known to produce beneficial effects in academia such as improved concentration and stamina (Spencer et al., 2001). Because of the aforementioned reasons, stimulant drugs such as these have potential for abuse. Illicit use of prescription stimulants has been well studied in recent years, especially in college students. In many of these studies, it has been shown the most common motivation for use has been related to academic performance and Adderall and its generics has been the drug of choice (Arria, Caldeira, O'Grady, Vincent, Johnson, & Wish, 2008b; DeSantis, Webb, & Noar, 2008; Teter, McCabe, LaGrange, Cranford, & Boyd, 2006).

**Literature Review**

Advokat, Guidry, and Martino (2008) students found almost half of undergraduate used prescription stimulants illicitly. Advokat et al. (2008) studied prescription stimulant drug use at a southern public university. They found illicit stimulant use was prevalent in slightly fewer than half of the respondents. Of the 1,387 students without an ADHD diagnosis, 43% (n=591) reported using prescription stimulants without a prescription. In fact, of the 1,550 respondents, only 10.5% (n=163) reported having an ADHD diagnosis.

The illicit use of prescription stimulants is something that has been studied in students of all ages, but it is particularly common in college aged students (Arria, Caldiera, O'Grady,
Vincent, Fitzelle, Johnson, & Wish, 2008a). Arria et al. (2008a) conducted a longitudinal study of 1,253 first year students at a large, mid-Atlantic university. Findings indicate the prevalence of illicit prescription stimulant use increased 318.5% from precollege age students to 2nd year college students. This suggests a higher risk of illicit use once students go to college.

Amphetamine/dextroamphetamine combination is often the most common prescription stimulant abused among college students (Arria et al., 2008b; Teter et al., 2006). Teter et al. (2006) explored the illicit use of stimulants in a random sample of 4,580 college students using a web-based survey. The study found a life time prevalence of 8.3% (n=382) and a past year prevalence of 5.9% (n=269). It was determined that over the past year, a much greater percentage of abused stimulants consisted of the combination drug amphetamine/dextroamphetamine—a reported 75.8% (n=204), and this is a comparably larger proportion of use than methylphenidate (Ritalin), which was reported as 24.5% (n=66).

For students without an ADHD diagnosis and without having their own prescription, obtaining stimulants, such as Adderall, is often done by way of friends with such prescriptions (Bavarian, Flay Ketchum, & Smit, 2013). Bavarian et al. (2013) used simple random sampling for a classroom survey at a Pacific Northwest university to study the characteristics and the intrapersonal, interpersonal, and environmental correlates associated with illicit prescription stimulant use. Over ninety six percent (n=520) of the students participated in the study. The study found 25.6% (n=133) of participants ever used prescription stimulants illicitly. Of the 133 students, 70.6% (n=94) reported initiation of use during college. Furthermore, 87.1% (n=116) of students reported their drugs were obtained from friends and the majority reported academic motives for use. It was reported that improving focus (78.2%; n=104) and making studying more enjoyable (58%; n=77) were beliefs behind academic motives.
Similar findings were also reported by Arria et al. (2008b) found academic motives to be commonly reported when they examined illicit stimulant use among first year college students. It was found that 89.3% (n=201) of illicit users had used an amphetamine/dextroamphetamine combination agent (Adderall) compared to methylphenidate (Ritalin) at 25.8% (n=58). The study revealed the most common motivation for illicit stimulant use was for concentration during school work, (73.3%; n=165). In fact, 58.2% (n=131) of users reported schoolwork was their only reason for using stimulants. Only 6.7% (n=15) of users indicated their reason for use was to “get high”, and 8.9% (n=20) of users reported illicit use in order to stay awake and party.

Academic motivations were also found to be common by DeSantis et al. (2008) when they surveyed 1,811 students and conducted 175 in-depth interviews to study the illicit use of prescription stimulants and the causes associated with it. Of the 34% (n=585) of students who reported illicit use, the majority of students reported using for academic reasons. In fact, 72% (n=420) reported the motivation of staying up later to study, 66% (n=389) reported the motivation of having a concentration aid for homework, and 36% (n=213) reported using to help them memorize. Only 7% (n=39) reported using the stimulants to get high, and 12% (n=70) reported using to stay up later to have fun.

Diversion is the unauthorized sharing or selling of prescription medications to someone without a prescription. Garnier, Arria, Caldeira, Vincent, O’Grady, & Wish (2010) looked at the prevalence of prescription medication diversion. They used cross sectional analysis of personal interview data to examine 483 students with a prescribed medication. It was found ADHD medications had a diversion rate of 61.7%--this means that of the 81 students with a prescription for ADHD medication, 50 had ever diverted their medication. The study also concluded sharing
was the most popular mode of diversion, with 33.1% (n=160) of students sharing their medications and only 9.3% (n=45) selling.

Various studies have found the illicit use of prescription stimulants is prevalent in students, especially those in college (Advokat et al., 2008; Arria et al., 2008a; Arria et al., 2008b; Bavarian et al., 2013; DeSantis et al., 2008; Garnier et al., 2010; Teter et al., 2006). Amphetamine/dextroamphetamine appears to be a more popular, perhaps more accessible, choice over methylphenidate and students are obtaining these drugs most often from their friends (Arria et al., 2008b; Bavarian et al., 2013; Teter et al., 2006). It has also been found prescription stimulants have a high diversion rate, with students seeking them as an aid to increase their academic performance more than any other motivation (Arria et al., 2008b; Bavarian et al., 2013; DeSantis et al., 2008; Garnier et al., 2010). This information leads to the question: in Michigan, how does the rate of amphetamine/dextroamphetamine prescriptions filled in counties with large (student populations greater than 23,000) universities compare to counties without large universities?

In order to respond to this question, this study will compare dosages dispensed (mg) per capita for counties having large universities, and trends of dosages dispensed (mg) per capita in counties without large universities. After validating the previous trends present in medications, the dosages dispensed per capita will be compared between counties with and without large universities. For those comparisons, and using the state of Michigan as a sample of convenience, the following hypotheses are presented:
Hypotheses

I. There is no difference in the trend of prescriptions filled of Adderall (and its generics), per capita, in any of the Michigan counties of Kalamazoo, Isabella, Washtenaw, or Ingham for the years 2007-2012.

II. There is no difference in the amount of Adderall (and its generics) prescriptions filled, per capita, between the Michigan counties of Kalamazoo, Isabella, Washtenaw, and Ingham for the years 2007-2012.

III. There is no difference in the amount of prescriptions filled of Adderall (and its generics), per capita, in Berrien or Grand Traverse County in Michigan for the years 2007-2012.

IV. There is a greater amount of Adderall (and its generics) prescriptions filled in each Kalamazoo, Isabella, Washtenaw, and Ingham counties, per capita, than in Berrien and Grand Traverse County for the years 2007-2012.
Methodology

General Design

This study used an ex-post facto design of to analyze dosages (mg) dispensed of amphetamine/dextroamphetamine for the populations in six Michigan counties—Kalamazoo, Isabella, Washtenaw, Ingham, Berrien, and Grand Traverse. Counties were selected on the premise or lack thereof of large universities. Counties with large universities include Kalamazoo, Isabella, Washtenaw, and Ingham counties and counties without large universities include Berrien and Grand Traverse counties. The comparison of the counties containing large universities both individually between one another; as well as the comparison of the counties not containing large universities, both individually and between one another. A final comparison was conducted between all counties with large universities and the two counties without large universities to determine a difference in prescribing practices.

<table>
<thead>
<tr>
<th>Counties with Large Universities</th>
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<tr>
<td>Kalamazoo</td>
<td>Berrien</td>
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<td>Isabella</td>
<td>Grand Traverse</td>
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<td>Washtenaw</td>
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<td>Ingham</td>
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*Table 1 Michigan counties analyzed in this study.*

Population and Sample

Total county population values were taken from the United States Census Bureau’s records for the years 2007-2012. Prescription values were calculated per capita to eliminate the issue of extreme differences in population. Access to the Michigan Automated Prescription
System (MAPS) database was obtained through the Western Michigan University Sindecuse Pharmacy. Prescription data from the entire state of Michigan were pulled from the MAPS database, which included prescriptions for all drugs. Amphetamine/dextroamphetamine data from six counties was utilized in the study.

Data Analysis

The results for this study will be analyzed descriptively. Due to the data being based on reports to the MAPS database, as opposed to observations, an inferential analysis is not feasible. Barriers to an inferential analysis include a lack of normality, heterogeneity of the variances, and considerable outliers. A transformation of the data did not sufficiently correct the conditions necessary for an inferential analysis. As such, tables and graphs will be used to present the descriptive results with narrative statements to follow.

Results

Hypothesis I:

There is no difference in the trend of prescriptions filled of Adderall (and equivalent generics), per capita, in any of the Michigan counties Kalamazoo, Isabella, Washtenaw, Ingham, Berrien, or Grand Traverse.
Figure 1 demonstrates an overall increase in trend for dosages dispensed (mg) of amphetamine/dextroamphetamine between the years 2007 and 2012. There is a reduction in 2009 which will be expounded on in the discussion.

**Hypothesis II:**

There is no difference in the amount of Adderall (and its generics) prescriptions filled, per capita, between the Michigan counties of Kalamazoo, Isabella, Washtenaw, and Ingham for the years 2007-2012.
Figure 2 demonstrates an upward trend in the amount of amphetamine/dextroamphetamine dosages dispensed (mg) in counties with large universities throughout the years 2007-2012. There is a reduction in 2009 that will be expounded on in the discussion.
Figure 3 shows each county possesses a similar increasing trend in amphetamine/dextroamphetamine dispensed for the years 2007-2012. Each county also displays a reduction in milligrams dispensed in 2009 which will be expanded on in the discussion.
Hypothesis III:

There is no difference in the amount of prescriptions filled of Adderall (and its generics), per capita, in Berrien or Grand Traverse County in Michigan for the years 2007-2012.

Figure 4. Total mg per capita amphetamine/dextroamphetamine dispensed in counties analyzed without large universities for the years 2007-2012. This figure shows the amount of amphetamine/dextroamphetamine dispensed in Berrien and Grand Traverse counties per capita in mgs for 2007-2012.

Figure 4 displays an upward trend in the amount of amphetamine/dextroamphetamine dispensed in the counties analyzed without large universities for the years 2007-2012. There is no reduction in 2009 reports for these counties.
Hypothesis IV:

There is a greater amount of Adderall (and its generics) prescriptions filled in each Kalamazoo, Isabella, Washtenaw, and Ingham counties, per capita, than in Berrien and Grand Traverse County for the years 2007-2012.

Figure 5. Total mg amphetamine/dextroamphetamine dispensed per capita between 2007 and 2012 in counties with large universities and counties without large universities. This figure displays the comparison of total mgs amphetamine/dextroamphetamine dispensed in counties with large universities and counties without large universities.

Figure 5 demonstrates a greater percentage of amphetamine/dextroamphetamine dispensed for the years 2007-2012 in counties with large universities than in counties without large universities.
Figure 6. Distribution of mg per capita amphetamine/dextroamphetamine dispensed by county for the years 2007-2012. This figure displays the percent each county contributed to the total mg dispensed in counties with and without large universities.

Figure 6 shows counties with large universities presented a larger total value mg dispensed than counties without large universities. However, the percentage each county contributed to the total value are dissimilar.
Discussion

The study began with the intention of completing an inferential analysis; however, due to lack of normality, heterogeneity of the variances, and multiple outliers, a descriptive analysis was performed.

Conclusions

There is suggestive evidence to support for the hypotheses. Due to the lack of generalizability, broad populations, and changes to the MAPS reporting processes the evidence presented here is suggestive at best.
The data reveal there is no difference in the increasing trend of prescriptions filled of amphetamine/dextroamphetamine, per capita in counties with large universities for the years 2007-2012. Furthermore, the data show there is no difference in the increasing amount of amphetamine/dextroamphetamine dispensed, per capita, in counties with and without large universities for the years 2007-2012. In 2009 there is a notable reduction in the amount of Adderall dispensed which may be attributable to a change in the MAPS reporting system. All counties demonstrated similar anomalies, except for Berrien and Grand Traverse counties. This could be explained by a difference in the number of pharmacies present in each county due to the rural nature of the counties.

The data suggests there is a greater amount of amphetamine/dextroamphetamine dispensed, per capita, in counties with large universities than in counties without large universities. However, looking at individual findings per county, not all university counties contributed equally per capita. This calls into question any overall patterns that can be observed, given that the contributions are not equal at best and contraindicated at worst. For example, in counties of similar size, there is a discrepancy in contribution to the amount of mg dispensed per capita. Isabella county has an average population of 69,281 for the years 2007-2012 with a contribution of 12.58% of the total mg Adderall dispensed for counties with large universities for the years 2007-2012. Grand Traverse County has an average population of 87,354 for the years 2007-2012 and a contribution of 19.14% of total mg Adderall dispensed for the years 2007-2012. See Figures 6 and 7.

**Limitations**

The nature of the study is to provide initial evidence to support a more rigorous exploration of the relationships involved. As such, the study contains several limitations that
greatly reduce generalizability. First, the results are related only to Michigan and specifically the counties selected. The results cannot be generalized to any other region and accurate conclusions cannot be drawn due to differences in prescribing practices and state regulations. Second, the data is collected from counties rather than specific university/non-university populations; therefore the evidence presented here is merely suggestive and not conclusive. Third, the MAPS system was implemented in 2007, but not highly enforced until 2009 during which time a significant reduction in Adderall dispenses was observed, and demonstrated in Figures 1-4 thereby weakening conclusions concerning trends that can be drawn from the data. Interestingly, the same decline in prescriptions dispensed/reported was not observed in either non-university county, suggesting that due to the rural nature of the counties, the pharmacies may respond more efficiently to enforcement of the MAPS program. Given these limitations, the study accomplished what it set out to do, provide initial evidence to support more robust research.

**Implications for Future Research**

Based on the results of this study, beneficial future research may include a survey study targeting university populations and non-university populations about actual Adderall usage. This much more targeted population will facilitate inferential analysis as well as descriptive analysis and will allow for better conclusions to be drawn. A more robust study including all Michigan counties would provide more generalizability and conclusive findings but it will still limit findings to the state of Michigan.
References


