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A Chi-Square Analysis of the Fall 2013 Transportation Survey: Students at the University at Albany

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Abstract

There are over 6,500 students at the University at Albany who live off-campus and commute to school. In order to reduce their carbon footprint, the University at Albany must investigate what influences the students' transportation choices and their alternative transportation literacy. Therefore, the Office of Environmental Sustainability, Geography and Urban Planning Department and the Office of Institutional Research, Planning and Effectiveness conducted a survey in the fall of 2013 for the students at the University at Albany. After examining the results, the gender and minority distributions were not representative of the student population. The significant associations that were prominent were gender and driving alone, commute distance and CDTA bus and UAlbany shuttle bus usage, and commute distance and carpooling. Specific areas where the University at Albany can investigate and improve transportation efficiency are bus routes and schedules for student who commute less than 5 miles to school. Students that commute greater than 5 miles have expressed that they are unable to find carpooling partners and therefore the University at Albany should establish a carpooling database. Males are also more likely to commute alone and should be targeted to promote awareness and behavioral change.

Introduction

Over the last few years, the University at Albany has implemented various programs to improve alternative transportation options. To remain consistent with the University's commitment to environmental stewardship and sustainability, the Office of Environmental Sustainability is continually working to enhance transportation efficiency. With the help of the University at Albany's Parking and Mass Transit Services, Capital District Transportation Committee, Capital District Transportation Authority and the Albany Bike Coalition, the University is always striving to examine and decrease environmental impacts as a result from commuting to and from campus. As of 2013, the University at Albany had a total student enrollment of 14,398, with about 7,500 living in on-campus housing (ACUPCC 2013 Report). There are 1,125 faculty members and 3,639 staff members. There is an estimated 11,662 students, faculty and staff that commute to the campus, which contribute to the University at Albany's carbon footprint.

There are numerous alternative transportation options that the University at Albany provides and promotes. The UAlbany bus fleet consists of five electric-hybrid buses (Alternative Transportation, 2015). In order to become more convenient for riders to arrive at their destination, the UAlbany buses installed a GPS tracker that can be followed on the UAlbany App and various monitors around campus. University at Albany students, faculty and staff also have free access to all CDTA buses. There are several car share and ride share programs on campus and in the Albany area. The University at Albany had Hertz onDemand for three years before they brought Zipcar to the campus in the Fall of 2014. The iPool2 Carpool service provides students in the Capital Region with a guaranteed ride home service. The Office of Parking and Mass Transit Services provides discount parking for low-emitting and fuel efficient vehicles. They have also teamed up with the University at Albany Police Department to register personal bikes to prevent theft. Lastly, the Office of Environmental Sustainability and Residential Life operate a Bike Share in various Wellness Centers on quads for on-campus students to borrow bikes for free.

In order to reduce carbon emissions and promote social sustainability, the University at Albany must first understand what modes of transportation students take and the reasoning behind it. The Director of Office of Environmental Sustainability, Mary Ellen Mallia and the Director of the Geography and Urban Planning Department, Catherine Lawson, along with the Office of Institutional Research, Planning and Effectiveness, conducted a transportation survey to gather this information. The purpose of this paper is to use a chi-square statistical analysis to understand the associations between gender, minority, distance (in miles) and length of time (in minutes) of commute, mode of transportation, transportation problems at the University at Albany, factors influencing transportation choices, likelihood of using services if offered and the knowledge of availability of services offered.

With this information, we hope to gain a better understanding of the student population and their transportation choices at the University at Albany. We can also use this information to help make policy changes at the institutional level that can promote and facilitate behavioral changes at the student level.

Methods

Metadata

The Office of Environmental Sustainability, the Office of Institutional Research, Planning and Effectiveness and Urban Planning Directors created the "UAlbany Student Transportation Survey: Fall 2013 based off of a similar survey conducted in the 2006-2007 school year. Nelson/Nygaard Consulting Associates completed that study, which was conducted at the Harriman Campus. The 2013 survey was conducted in a similar manner, with additional questions added that were more up-to-date and tailored to the UAlbany population specifically.

There were 1036 students who completed the survey. Twenty-five percent of the students live in one of the four on-campus quads (Indian, Dutch, Colonial and State), 12% live in one of the campus apartments (Empire Commons, Liberty Terrace and Freedom Apartments), 4% live downtown on Alumni Quad and 58% live off-campus. The gender split within the survey is not representative of the UAlbany population because there were 65.3% females and 34.6% males who took the survey. In 2015, UAlbany enrolled 52% male and 48% female students (SUNY University at Albany). The same goes for the minority because 87.1% of the students answered that they were non-minority, 0% minority and 12.9% unknown.

Statistical Analyses

A chi-square (X^2) test is a statistical analysis the measures the significance to compare observed and expected frequencies. It is a test of the null hypothesis that the two variables are statistically independent. It uses frequencies of responses of various categorical data that are separated into mutually exclusive. It can be suggested that the larger the chi-square statistic, the more dependent the two variables are in the sample. Equation 1 displays the chi-square equation.

$$X^2 = \frac{(\sum \ observed\ frequency - expected\ frequency)^2}{expected\ frequency}$$ Equation 1. Chi-Square

A chi-square test produces a two dimensional contingency table that is defined by the levels of the two categorical tables. The intersecting cells contain the number of sampled individuals who fall into each category of one variable and each category of the other (Jaeger, 1990). The degrees of freedom (df) term distinguishes members of the family of t-distributions, members of the family of X^2 distributions and the members of the family of F-distributions. For example, when analyzing collected data, one df is gained for every independent observation and one df is lost for every population parameter that is estimated. I used SPSS to conduct chi-square analyses. With the assistance of Mary Ellen Mallia, we chose the variables that she though would be the most helpful to improve alternative transportation policies at the University at Albany. The survey questions and accompanying variables that were chosen are displayed in Table 1.

There were a few problems with the raw variables and their responses. Responses that included an "N/A" or "Unknown", had to be transformed into a dummy variable that includes a value for "missing". This way, there would not be an issue when I conducted the chi-square test. Another reason dummy variables were used in this analysis is because there were too many answer choices. Therefore, I transformed them into a maximum of three choices. I used SPSS to recode them into different variables. Table 2 shows the transformed dummy variables and their recoded answer choices.

I created frequency graphics for the variables chosen. Since the data I used was nominal, or categorical, I created bar charts in SPSS.

I ran several chi-square tests with the data. I used a confidence level of 95% to determine statistically significant values. First, I tested the association between gender and mode of transportation, gender and transportation issues in the UAlbany area, gender and factors influencing transportation choices, gender and the likelihood of using various services if offered at UAlbany, and gender and the knowledge of the availability of services offered at UAlbany. Second, I tested the association of commute distance (in miles) and mode of transportation, commute distance and factors influencing transportation choices, and commute distance and likelihood of using services if offered. Then, I tested the association between commute time (in minutes) and mode of transportation, commute time and factors influencing transportation choices, and commute time and likelihood of using services if offered. Finally, I tested the association between mode of transportation and knowledge of the availability of services offered.

Results

The chi-square results of the survey are displayed in Table 3.

Gender

There are a few significant associations between gender and various modes of transportation. There is a statistically significant association between gender and driving alone ($X^2 = 11.357$, 2, $p < 0.05$),

gender and being the driver of a carpool (X^2 = 8.347, 2, $p < 0.05$), and gender and walking (X^2 = 11.505, 2, $p < 0.05$).

When examining the associations between gender and original factors influencing transportation choices, there is a statistically significant association between gender and walking safety (X^2 = 18.487, 1, $p < 0.001$).

There is a statistically significant association between gender and likelihood of using bike amenities if offered at the University at Albany (X^2 = 15.904, 2, $p < 0.001$).

Minority

I found out that *none* of the individuals who took the survey answered that they were a minority. I was unable to test the association between the minority status and the selected independent variables. Therefore, the survey results cannot be generalized across the UAlbany population.

Commute Distance (in miles)

There are a many significant associations between commute distance and various modes of transportation. There are statistically significant associations between commute distance and driving alone (X^2 = 107.810, 2, $p < 0.001$), commute distance and carpool rider (X^2 = 23.211, 2, $p < 0.001$), commute distance and CDTA bus rider (X^2 = 99.207, 2, $p < 0.001$), commute distance and UAlbany shuttle bus rider (X^2 = 97.165, 2, $p < 0.001$), commute distance and bike rider (X^2 = 12.373, 2, $p < 0.05$) and commute distance and walker (X^2 = 83.091, 2, $p < 0.001$).

When examining the associations between commute distance and original factors influencing transportation choices at the University at Albany, there are statistically significant associations between commute distance and number of transfers of buses (X^2 = 5.499, 1, $p < 0.05$), commute distance and length of trip by bus (X^2 = 4.096, 1, $p < 0.05$), commute distance and bus stop frequency or time of stops (X^2 = 19.593, 1, $p < 0.001$), commute distance and familiarity with the bus routes and schedules (X^2 = 15.779, 1, $p < 0.001$), commute distance and living too far to bike (X^2 = 120.539, 1, $p < 0.001$), commute distance and living to far to walk (X^2 = 39.352, 1, $p < 0.001$), commute distance and finding a carpool partner (X^2 = 23.868, 1, $p < 0.001$), commute distance and needed to travel to other places besides school (X^2 = 29.935, 1, $p < 0.001$), and commute distance and convenience of driving (X^2 = 77.765, 1, $p < 0.001$).

There were a few significant associations between commute in miles and likelihood of using alternative transportation services if offered. There were statistically significant associations between commute distance and bike amenities such as racks, lockers, and showers (X^2 = 29.782, 2, $p < 0.001$), commute distance and ride sharing program (X^2 = 7.606, 2, $p < 0.05$), and commute distance and vanpooling program (X^2 =10.590, 2, $p < 0.05$).

There were some significant associations between commute distance and knowledge of the programs offered at the University of Albany. There were significantly significant associations between commute distance and the car-sharing program (X^2 = 8.570, 2, $p < 0.05$), commute distance and the bike

share program ($X^2 = 15.552, 2, p < 0.001$), commute distance and free access to CDTA buses ($X^2 = 171.393, 2, p < 0.001$), commute distance and bike registration ($X^2 = 6.452, 2, p < 0.05$), commute distance and the purple path ($X^2 = 22.210, 2, p < 0.001$) and commute distance the bus GPS system ($X^2 = 15.582, 2, p < 0.001$).

Commute Time (in minutes)

When observing the associations between commute time and mode of transportation, there were statistically significant associations between commute time and carpool driver ($X^2 = 12.182, 2, p < 0.05$), commute time and carpool rider ($X^2 = 15.925, 2, p < 0.001$), commute time and CDTA bus rider ($X^2 = 10.742, 2, p < 0.05$), commute time and UAlbany shuttle rider ($X^2 = 6.847\ 2, p < 0.05$), and commute time and walker ($X^2 = 47.164, 2, p < 0.001$).

There were many significant associations between commute time and original factors influencing transportation choices at the University at Albany. There were statistically significant associations between commute time and number of bus transfers ($X^2 = 10.218, 1, p < 0.001$), commute time and length of trip by bus ($X^2 = 7.894, 1, p < 0.05$), commute time and familiarity with bus routes and schedules ($X^2 = 4.010, 1, p < 0.05$), commute time and living too far to bike ($X^2 = 90.794, 1, p < 0.001$), commute time and living too far to walk ($X^2 = 43.072, 1, p < 0.001$), commute time and finding someone to carpool with ($X^2 = 27.933, 1, p < 0.001$), commute time and needing to travel to other places besides school ($X^2 = 18.889, 1, p < 0.001$), and commute time and convenience of driving ($X^2 = 8.585, 1, p < 0.003$).

When studying the associations between commute time and likelihood of using services if offered, there was a statistically significant association between commute time and bike amenities ($X^2 = 11.569, 2, p < 0.05$).

Mode of Transportation

There were many significant associations between various modes of transportation and associated problems they encounter at the University at Albany. There are statistically significant associations between automobile drivers who commute alone and the availability of bike lanes ($X^2 =7.542, 2, p < 0.05$), the availability of crosswalks ($X^2 = 9.387, 2, p < 0.05$), the availability of sidewalks ($X^2 = 8.180, 2, p < 0.05$), and the availability of bus service ($X^2 = 22.345, 2, p < 0.001$). There is statistically significant association between those who commute as a carpool driver and traffic congestion ($X^2 = 7.535, 2, 0.05$). There are statistically significant associations between CDTA bus riders and the availability of crosswalks ($X^2 = 7.110, 2, p < 0.05$), the availability of sidewalks ($X^2 = 17.152, 2, p < 0.001$), the availability of bike rakes ($X^2 = 6.931, 2, p < 0.05$), and the availability of bus service ($X^2 = 15.854, 2, p < 0.001$). There are statistically significant associations between UAlbany shuttle bus riders and safety when driving ($X^2 = 8.792, 2, p < 0.05$), and the availability of the bus service ($X^2 = 9.381, 2, p < 0.05$). There are statistically significant associations between commuting via bike and the availability of bike lanes ($X^2 = 15.781, 2, p < 0.001$) and the availability of bike racks ($X^2 = 7.699, 2, p < 0.05$). There is a statistically significant association between walking to campus and the availability of bus service ($X^2 = 10.919, 2, p < 0.05$).

There were many significant associations between various modes of transportation and knowledge of programs offered. There are statistically significant associations between those who drive alone to campus and the knowledge of free universal access to the CDTA bus ($X^2 = 140.480, 4, p < 0.001$), bike registration ($X^2 = 10.394, 4, p < 0.05$), and the GPS system on buses ($X^2 = 25.377, 4, p < 0.001$). There are statistically significant associations between those who commute as a carpool driver and the knowledge of the car share program on campus ($X^2 = 20.028, 4, p < 0.001$) and bike registration ($X^2 = 12.279, 4, p < 0.05$). There are statistically significant associations between those who commute to campus as a carpool rider and the knowledge of the bike share program ($X^2 = 12.513, 4, p < 0.05$), free universal access to CDTA buses ($X^2 = 28.117, 4, p < 0.001$), and the purple path ($X^2 = 19.676, 4, p < 0.05$). There are statistically significant associations between those who commute to school via the CDTA bus and the knowledge of the car share program ($X^2 = 15.148, 4, p < 0.05$), the bike share program ($X^2 = 37.930, 4, p < 0.05$), free universal access to CDTA buses ($X^2 = 179.802, 4, p < 0.001$), the purple path ($X^2 = 29.666, 4, p < 0.001$) and the bus GPS system ($X^2 = 31.081, 4, p < 0.001$). There are statistically significant associations between those who commute to campus on the UAlbany shuttle bus and knowledge of the car-pooling program ($X^2 = 15.789, 4, p < 0.05$), the car-sharing program ($X^2 = 16.082, 4, p < 0.05$), the bike share program ($X^2 = 20.365, 4, p < 0.001$), free universal access to CDTA buses ($X^2 = 117.708, 4, p < 0.001$), bike registration ($X^2 = 9.737, 4, p < 0.05$), the purple path ($X^2 = 11.974, 4, p < 0.05$), and the bus GPS system ($X^2 = 12.671, 4, p < 0.05$). There are statistically significant associations between those who commute to campus via bike and the knowledge of the bike share program ($X^2 = 22.152, 4, p < 0.001$), bike registration ($X^2 = 10.572, 4, p < 0.05$), the purple path ($X^2 = 24.255, 4, p < 0.001$), and the GPS system on the bus ($X^2 = 15.674, 4, p < 0.05$). There are statistically significant associations between those who walk to campus and the knowledge of the car-sharing program on campus ($X^2 = 13.591, 4, p < 0.05$), the bike share program ($X^2 = 30.035, 4, p < 0.001$), free universal access to the CDTA bus ($X^2 = 49.980, 4, p < 0.001$), the purple path ($X^2 = 42.893, 4, p < 0.001$), and the bus GPS system ($X^2 = 13. 746, 4, p < 0.05$).

Discussion

The majority of significant associations followed similar trends across the variables. However, there were some associations that showed major discrepancies between different variables and should be emphasized. The University at Albany should explore these associations further for possible policy changes and behavioral changes by students that can decrease the University's carbon footprint.

It is interesting to observe gender differences in transportation choices, although it must be noted that the survey cannot be generalized over the entire University at Albany population because of the disproportionate gender difference that completed the survey. When asked how frequent they drove alone to school, females where much more likely to answer "never or a few times a semester" than "daily" (Figure 1). This stands out because a similar frequency of males answered about the same for both answers. Therefore, the University should focus on changing the commuting behaviors of the male population from driving alone to carpooling. Females were also much more likely to answer that they "definitely would not or not likely" utilize bike amenities such as bike racks, lockers, and showers, when compared to males (Figure 2). Either female would not find it necessary to use the amenities because they are less likely to bike to school or they "perspire less" and therefore would not need a change of clothes.

There is also a large disparity in mode of transportation of students who commute less than and greater than five miles to school. Those who commute less than five miles are more than two times more likely to drive with someone in the car than driving alone daily. On the contrary, those who commute greater than five miles to school are more than two times more likely to drive alone daily. Therefore, the University should try and promote a carpooling service for students who live outside the range of five miles. Students who commute greater than fifteen minutes away also state that not knowing someone to carpool with keeps them from using alternative transportation choices, yet those who live less than fifteen minutes from school say it is not a factor (Figure 3). Therefore, for students who live further from school should be targeted for introducing carpooling services. The University at Albany can help set up a system where students can find others who live relatively close to them and they can arrange a carpooling system.

There is a relatively similar amount of students who commute less than five miles, that either rides the CDTA bus daily or never (Figure 4). This means that the CDTA bus is practical and being utilized and the University should market the bus system to the students who are not taking the bus within the five-mile range. They can increase awareness and promote behavioral changes. Although not as many students within this range are utilizing the UAlbany shuttle bus (Figure 5). There is also a large amount of students that commute less than 5 miles of school who say that the bus stop frequency and schedule keeps them from using alternative transportation. Therefore, the Parking and Mass Transit Services should further investigate the usage and feasibility of the CDTA and UAlbany bus routes and schedules.

Conclusion

The alternative transportation options that should be thoroughly examined by the University at Albany are the CDTA and UAlbany shuttle bus services and carpooling opportunities. Students have expressed concerns over CDTA and UAlbany shuttle bus schedules and routes, especially those who live within five miles of the school. They are also well aware that they have free universal access to the CDTA bus, so cost is not a concern. Updating and revamping schedules and routes that align with student's class start times can be a feasible solution. Students who live outside of the five-mile range and commute alone have indicated that do not carpool because they are unable to find carpooling partners in their area. Therefore, the University at Albany should establish a carpooling system for students to request and locate nearby drivers.

Figures

Question Number and Question	Responses
Q0_8. Sex	Male, Female, Unknown
Q0_14. Minority	Non-minority, Minority, Unknown
Q1a. Approximately how far is your one way commute in miles?	Less than ¼ mile, between ¼ and ½ mile, between ½ and 1 mile, between 1 and 2 miles, 2 to 3 miles, 3 to 5 miles, 5 to 10 miles, 10 to 15 miles, 15 to 20 miles, over 20 miles, N/A: I take only online classes.
Q1b. Approximately how long is your one way commute to school?	Less than 5 minutes, 6 to 10 minutes, 11 to 15 minutes, 16 to 20 minutes, over 20 minutes, NA: I only take online classes
Q2. In a typical semester, how often do you use the following modes of transportation to get to campus? *(Choices: never, a few times a semester, a few times a month, a few times a week and daily)*	Drive alone, carpool (driver), carpool (rider), take a CDTA bus, take a UAlbany bus, ride a bike, walk
Q11. In your opinion, do you think the following transportation issues are problems within the University at Albany area? *(Choices: not a problem, a minor problem, somewhat of a problem, a big problem, a severe problem, don't know/NA)*	Traffic congestion, safety when driving, safety when walking, safety when biking, availability of parking, availability of bike lanes, availability of crosswalks, availability of sidewalks, availability of bike racks, availability of bus service
Q12. Which of the following keep you from using alternative forms of transportation (e.g. walking, biking, carpooling or riding transit)? *(Choices: Yes – this keeps me from using alternative transportation or No – this is not a factor in my transportation choices)*	No bus runs between my home and school, number of transfers of buses, length of trip by bus, bus does not come frequently or a the right time, bus stops are not conveniently located, I am not familiar with the bus routes and schedules, I live too far from school to bike, I do not feel safe biking, I live to far from school to walk, I do not feel safe walking, I do not know a person with whom I can carpool, I have a to travel to other places on my way to or from school, Driving is the most convenient option for me, lake of ADA accessible transport, other
Q15. How likely would you be to use the following services or programs if they were offered to you? *(Choices: definitely would not, not very likely, as likely as not, very likely, definitely would)*	Assistance find carpool partners, bicycle amenities, preferred parking for carpoolers, preferred parking for hybrids or fuel efficient vehicles, rewards for taking transit, walking, biking or carpooling, ride sharing program and vanpooling program.
Q16. Below is a list of transportation services at UAlbany, of which you might or might not be aware. For each service, please choose the best response for you. *(Choices: I didn't know about it, I know about it but am not interested in using it, I know about it and am interested in using it, but haven't yet, I have used it, but not frequently, I have used it frequently)*	Carpooling program, car sharing program, bike sharing program, free access to all CDTA bus routes, bicycle registration, purple path, bus locator service (GPS)

Table 1. Survey questions and responses chosen to conduct chi-square analyses.

Question Number	Dummy Variable Responses
Q0_8	Male, Female, Missing
Q0_14	Non-minority, Minority, Missing
Q1a	Less than 5 miles, Greater than 5 miles, Missing
Q1b	Less than 15 minutes, Greater than 15 minutes, Missing
Q2	Drive alone, carpool (driver), carpool (rider), take a CDTA bus, take a UAlbany bus, ride a bike, walk *(New Choices: never or a few times a semester, many times a month, daily)*
Q11	Traffic congestion, safety when driving, safety when walking, safety when biking, availability of parking, availability of bike lanes, availability of crosswalks, availability of sidewalks, availability of bike racks, availability of bus service*(New Choices: a problem or a minor problem, a big problem missing)*
Q15	Assistance find carpool partners, bicycle amenities, preferred parking for carpoolers, preferred parking for hybrids or fuel efficient vehicles, rewards for taking transit, walking, biking or carpooling, ride sharing program and vanpooling program. *(New Choices: definitely would not or not very likely, as likely as not, likely or definitely would)*
Q16	Carpooling program, car sharing program, bike sharing program, free access to all CDTA bus routes, bicycle registration, purple path, bus locator service (GPS) *(New Choices: I didn't know about it, I know about it but haven't used it, I have used it)*

Table 2. Variables recoded and transformed in to dummy variables. Note that Q12 was not transformed into a dummy variable.

Association	Chi-Square
Gender	
-*Mode of Transportation*	
Driving alone	$X^2 = 11.357, 2, p < 0.05$
Driver of a carpool	$X^2 = 8.347, 2, p < 0.05$
Walking	$X^2 = 11.505, 2, p < 0.05$
-*Original factors influencing transportation choices*	
Walking safety	$X^2 = 18.487, 1, p < 0.001$
-*Likelihood of using alternate transportation service*	
Bike amenities	$X^2 = 15.904, 2, p < 0.001$
Commute Distance (in miles)	
-*Mode of Transportation*	
Driving alone	$X^2 = 107.810, 2, p < 0.001$
Carpool Driver	$X^2 = 23.211, 2, p < 0.001$
CDTA bus rider	$X^2 = 99.207, 2, p < 0.001$
UAlbany shuttle bus rider	$X^2 = 97.165, 2, p < 0.001$
Bike rider	$X^2 = 12.373, 2, p < 0.05$
Walker	$X^2 = 83.091, 2, p < 0.001$
-*Original factors influencing transportation choices*	
Number of bus transfers	$X^2 = 5.499, 1, p < 0.05$
Length of trip by bus	$X^2 = 4.096, 1, p < 0.05$
Stop frequency, time of stops	$X^2 = 19.593, 1, p < 0.001$
Familiarity of bus routes and schedules	$X^2 = 15.779, 1, p < 0.001$
Living too far to bike	$X^2 = 120.539, 1, p < 0.001$
Living too far to walk	$X^2 = 39.352, 1, p < 0.001$
Finding a carpool partner	$X^2 = 23.868, 1, p < 0.001$
Need to travel to other places besides school	$X^2 = 29.935, 1, p < 0.001$
Convenience of driving	$X^2 = 77.765, 1, p < 0.001$
-*Likelihood of using alternate transportation service*	
Bike amenities	$X^2 = 29.782, 2, p < 0.001$
Ride sharing program	$X^2 = 7.606, 2, p < 0.05$
Vanpooling program	$X^2 = 10.590, 2, p < 0.05$
-*Knowledge of programs offered at UAlbany*	
Car-sharing program	$X^2 = 8.570, 2, p < 0.05$
Bike sharing program	$X^2 = 15.552, 2, p < 0.001$
Free access to CDTA	$X^2 = 171.393, 2, p < 0.001$
Bike registration	$X^2 = 6.452, 2, p < 0.05$
Purple path	$X^2 = 22.210, 2, p < 0.001$
Bus GPS system	$X^2 = 15.582, 2, p < 0.001$
Commute Time (in minutes)	
-*Mode of transportation*	
Carpool driver	$X^2 = 12.182, 2, p < 0.05$
Carpool rider	$X^2 = 15.925, 2, p < 0.001$
CDTA bus rider	$X^2 = 10.742, 2, p < 0.05$
UAlbany shuttle rider	$X^2 = 6.847\ 2, p < 0.05$
Walking	$X^2 = 47.164, 2, p < 0.001$
-*Original factors influencing transportation choices*	
Number of bus transfers	$X^2 = 10.218, 1, p < 0.001$
Length of trip by bus	$X^2 = 7.894, 1, p < 0.05$
Familiarity with bus routes and schedules	$X^2 = 4.010, 1, p < 0.05$
Living too far to bike	$X^2 = 90.794, 1, p < 0.001$
Living too far to walk	$X^2 = 43.072, 1, p < 0.001$
Finding someone to carpool with	$X^2 = 27.933, 1, p < 0.001$
Need to travel to other places besides school	$X^2 = 18.889, 1, p < 0.001$
Convenience of driving	$X^2 = 8.585, 1, p < 0.003$
-*Likelihood of using services if offered*	
Bike amenities	$X^2 = 11.569, 2, p < 0.05$
Mode of Transportation	
-*Problems encountered at UAlbany*	
Drive alone & availability of bike lanes	$X^2 = 7.542, 2, p < 0.05$
Drive alone & availability of crosswalks	$X^2 = 9.387, 2, p < 0.05$
Drive alone & availability of sidewalks	$X^2 = 8.180, 2, p < 0.05$
Drive alone & availability of bus service	$X^2 = 22.345, 2, p < 0.001$

Carpool driver & traffic congestion	$X^2 = 7.535, 2, 0.05$
CDTA bus rider & availability of crosswalks	$X^2 = 7.110, 2, p < 0.05$
CDTA bus rider & availability of sidewalks	$X^2 = 17.152, 2, p < 0.001$
CDTA bus rider & availability of bike racks	$X^2 = 6.931, 2, p < 0.05$
CDTA bus rider & availability of bus service	$X^2 = 15.854, 2, p < 0.001$
UAlbany shuttle bus rider & safety when driving	$X^2 = 8.792, 2, p < 0.05$
UAlbany shuttle bus rider & availability of bus service	$X^2 = 9.381, 2, p < 0.05$
Biking & availability of bike lanes	$X^2 = 15.781, 2, p < 0.001$
Biking & availability of bike racks	$X^2 = 7.699, 2, p < 0.05$
Walking and availability of bus service	$X^2 = 10.919, 2, p < 0.05$
-*Knowledge of Programs Offered*	
Drive alone & free access to CDTA	$X^2 = 140.480, 4, p < 0.001$
Drive alone & bike registration	$X^2 = 10.394, 4, p < 0.05$
Drive alone & the bus GPS system	$X^2 = 25.377, 4, p < 0.001$
Carpool driver & care share program on campus	$X^2 = 20.028, 4, p < 0.001$
Carpool driver and bike registration	$X^2 = 12.279, 4, p < 0.05$
Carpool rider & bike share program	$X^2 = 12.513, 4, p < 0.05$
Carpool rider & free access to CDTA	$X^2 = 28.117, 4, p < 0.001$
Carpool rider & the purple path	$X^2 = 19.676, 4, p < 0.05$
CDTA bus & car share program	$X^2 = 15.148, 4, p < 0.05$
CDTA bus rider & bike share program	$X^2 = 37.930, 4, p < 0.05$
CDTA bus rider & free access to CDTA	$X^2 = 179.802, 4, p < 0.001$
CDTA bus rider & the purple path	$X^2 = 29.666, 4, p < 0.001$
CDTA bus rider & the bus GPS system	$X^2 = 31.081, 4, p < 0.001$
UAlbany shuttle bus & the carpool program	$X^2 = 15.789, 4, p < 0.05$
UAlbany shuttle bus & the car share program	$X^2 = 16.082, 4, p < 0.05$
UAlbany shuttle bus & the bike share program	$X^2 = 20.365, 4, p < 0.001$
UAlbany shuttle bus & free access to CDTA	$X^2 = 117.708, 4, p < 0.001$
UAlbany shuttle bus & bike registration	$X^2 = 9.737, 4, p < 0.05$
UAlbany shuttle bus & the purple path	$X^2 = 11.974, 4, p < 0.05$
UAlbany shuttle bus & the bus GPS system	$X^2 = 12.671, 4, p < 0.05$
Bike rider & the bike share program	$X^2 = 22.152, 4, p < 0.001$
Bike rider & bike registration	$X^2 = 10.572, 4, p < 0.05$
Bike rider & the purple path	$X^2 = 24.255, 4, p < 0.001$
Bike rider & the bus GPS system	$X^2 = 15.674, 4, p < 0.05$
Walk & the car share program	$X^2 = 13.591, 4, p < 0.05$
Walk & the bike share program	$X^2 = 30.035, 4, p < 0.001$
Walk & the free access to CDTA bus	$X^2 = 49.980, 4, p < 0.001$
Walk & the purple path	$X^2 = 42.893, 4, p < 0.001$
Walk & the bus GPS system	$X^2 = 13. 746, 4, p < 0.05$

Table 3. Associations and their chi-square values.

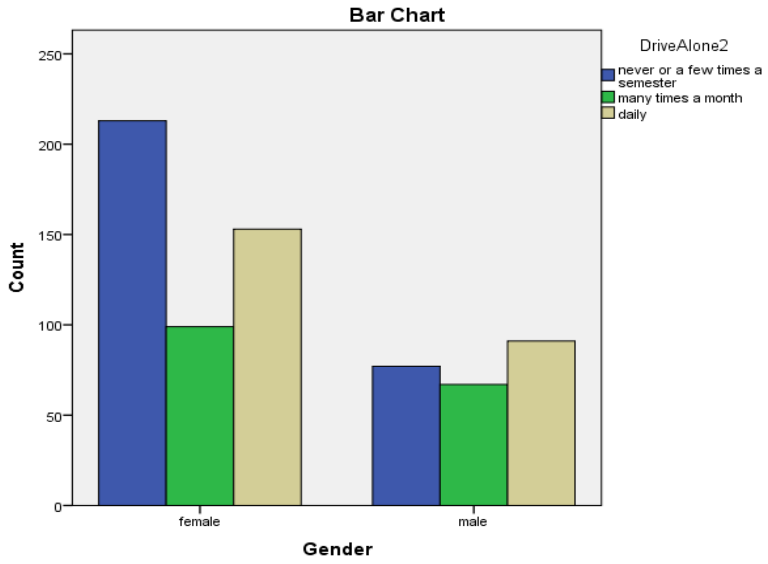

Figure 1. Association between gender and drive alone ($X^2 = 11.357, 2, p < 0.05$)

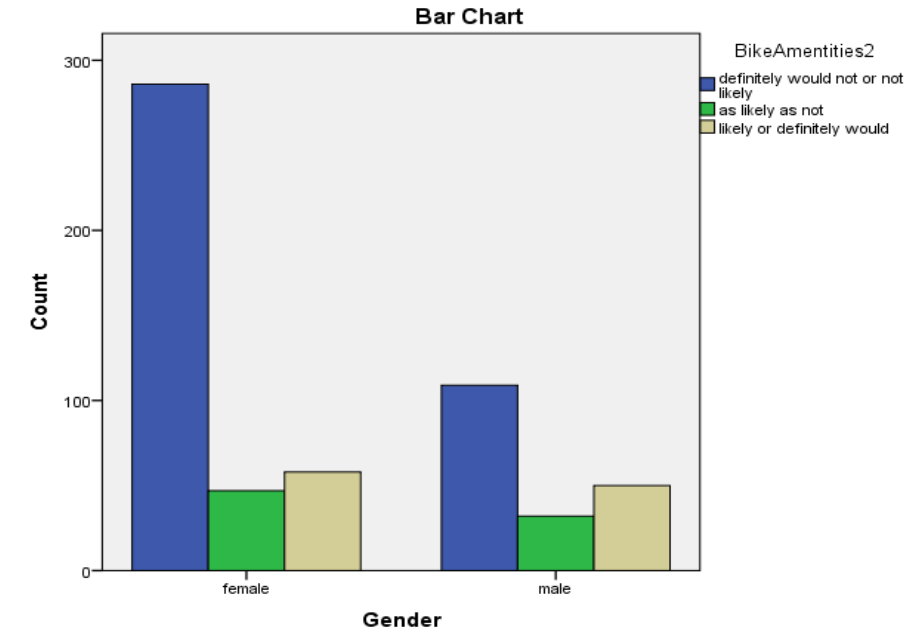

Figure 2. Association between gender and bike amenities (X^2 = 15.904, 2, p < 0.001)

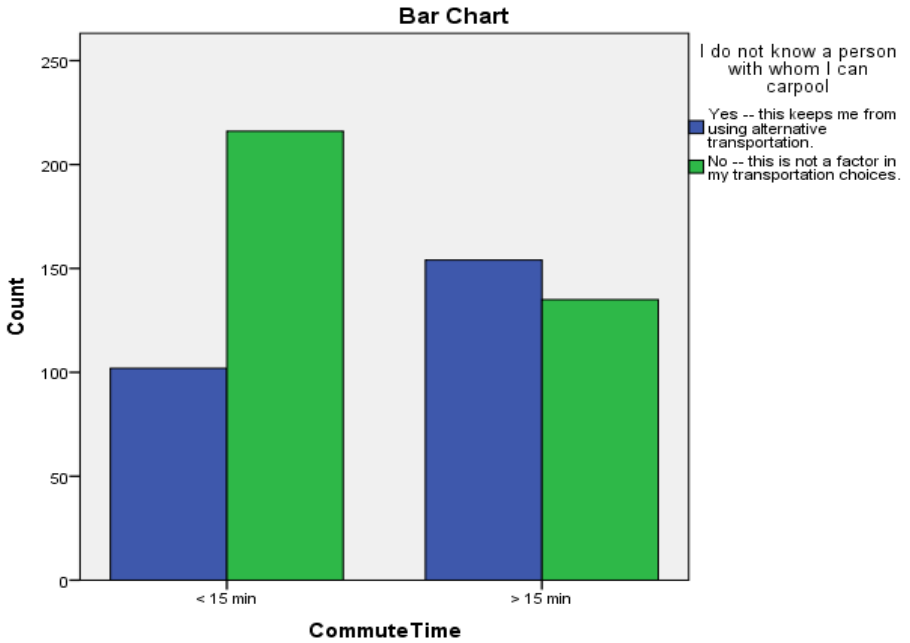

Figure 3. Association between commute time and problems encountered – finding a carpool partner (X^2 = 27.933, 1, p < 0.001)

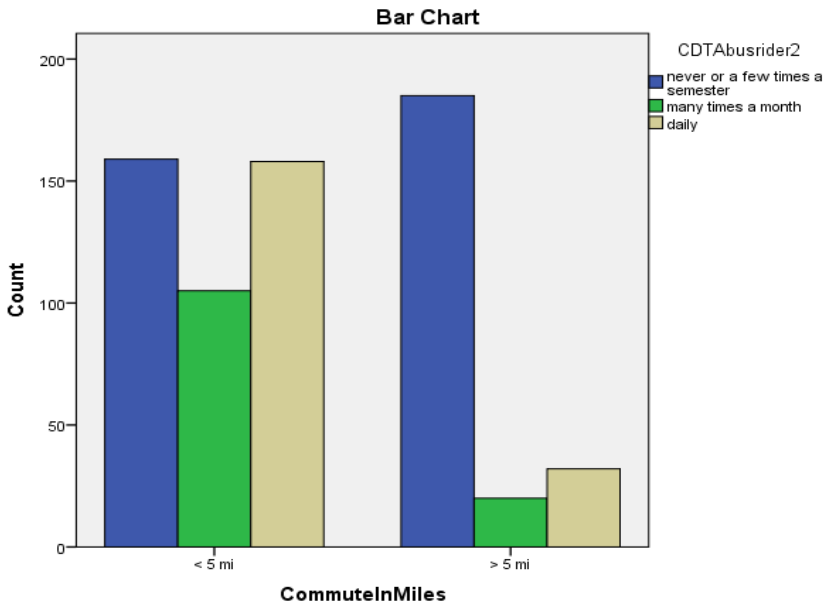

Figure 4. Association between commute distance and CDTA bus rider (X^2 = 99.207, 2, $p < 0.001$)

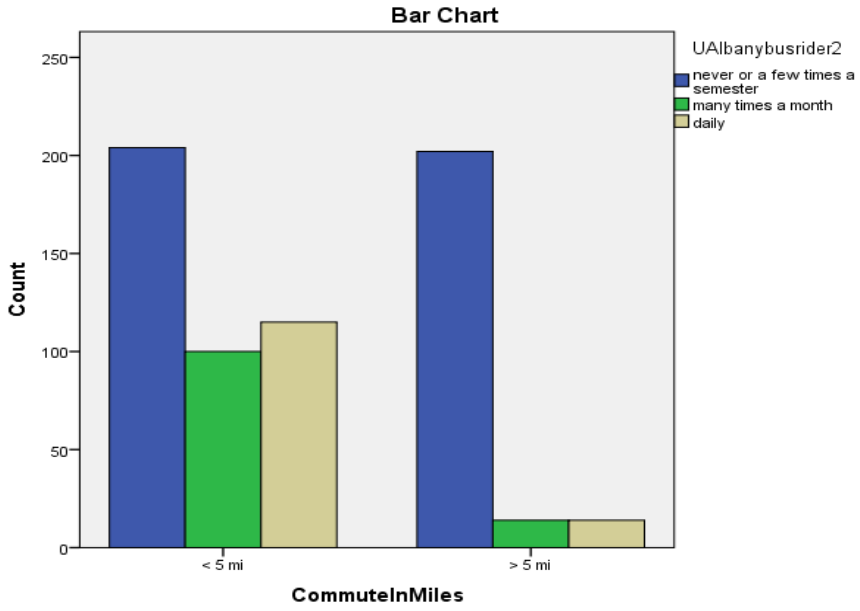

Figure 5. Association between commute distance and UAlbany shuttle bus rider (X^2 = 97.165, 2, $p < 0.001$)

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