

Variation in the Perception and Use of Public Transportation in La Plata, Argentina

Lori Parks

Abstract The city and county of La Plata, Argentina have faced many challenges to sustainable transportation. Despite a high reliance on public transit, the citizens are frustrated with the quality of bus service. To identify the variation in the frequency of bus use and opinions among different segments of the population, a survey was conducted in collaboration with the local NGO Fundación Biosfera during July and August, 2005. Over 800 people were randomly selected from public areas throughout the county of La Plata. The results show that females, students, younger people, and residents of communities surrounding the city are more likely to use the bus at least once per week. Overall, the irregular bus service is viewed as the main problem with transportation, particularly by the most reliant groups. The lack of access to public transportation is also an important issue, especially for areas surrounding the city. Safety is seen as a problem for children and the oldest age group. Furthermore, over half of the respondents between the ages of 15 and 60 identified the bus fare as expensive. The results suggest that increasing coordination over the management of the transportation system, implementing segregated bus lanes, investing in transportation infrastructure, and making the information on routes and schedules more available to current and potential users would create a more efficient, equitable and sustainable transportation system in La Plata.

Introduction

Transportation has become a significant issue throughout the county of La Plata, Argentina. Designed in 1882 to be the capital of the province of Buenos Aires, the city of La Plata was built in a perfect grid with sets of diagonal roads, in order to make transportation easy for the citizens (Dirección de Transporte 1994). The city now serves as an important center for the micro-region, as people from surrounding municipalities come for work and other services. Furthermore, the central area of the city is the destination for 50% of the trips made in the county, as there is a high concentration of commercial, entertainment, administrative, cultural, and educational activities (Giacobbe et al. 2002). As seen in Figure 1, the central area is defined as the area between the streets of: avenida 7 and calles 14, 41 and 63.

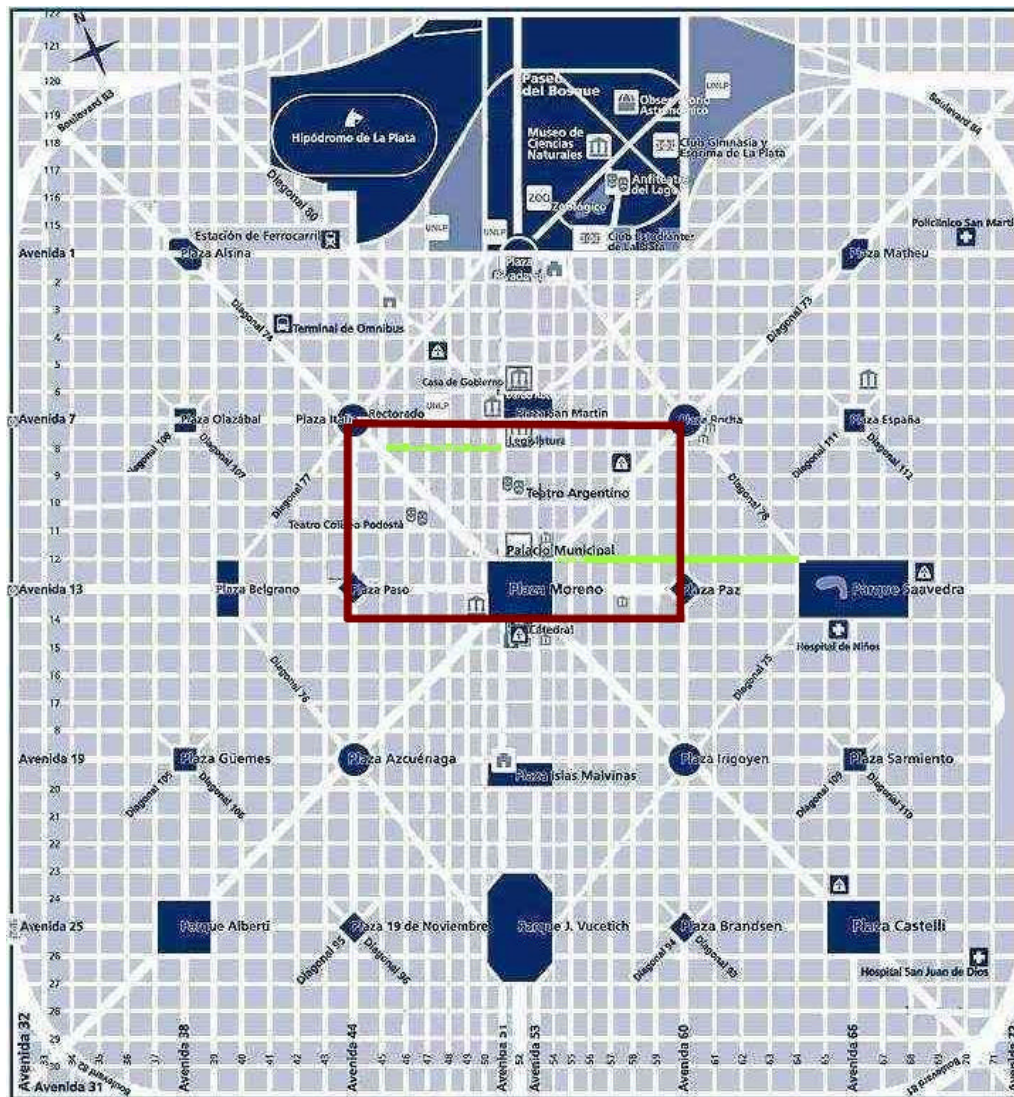


Figure 1. Map of the city of La Plata (La Plata Virtual 2005), including an outline of the central area.

In recent decades, the city began to face transportation challenges. From 1983 to 1993, private car use increased by 39.4% in the micro-region, contributing to an overflow of the capacity of the urban infrastructure (Giacobbe et al. 2002). In the following five years, trips made by public transportation declined 35% (Aón et al. 2003). Bus companies were competing for the most profitable routes, creating congestion in some areas, particularly in the central area, and limiting access in peripheral areas (Giacobbe et al. 2002). The problems forced the local government to modify the system in 2002, culminating in the development of the System of Urban Transportation (SUT). By dividing the county into four zones, each served by a different bus company, SUT was supposed to create more efficient routes and better link outer areas directly to the center (Municipalidad de La Plata 2002). However, there is still much confusion and frustration among the people who use public transportation in La Plata. Complaints of delays and routes that do not correspond with needs are among some of the principle concerns (Ravella et al. 2004).

While there is apparent discontent with public transportation in La Plata, there remains a high reliance on the bus system, with about 100,000 daily users (Giacobbe et al. 2002). In fact, 60% of trips in the county are realized by public transportation (Municipalidad de La Plata 2002). The current dependence by a significant portion of the population suggests that directing resources to improving the bus service would have the greatest positive effect. In addition, transportation systems based on public transit are often considered more sustainable than systems based on individual automobile ownership. With the potential to displace between 5 and 50 motorized vehicles, buses are an ideal mode in terms of efficiency and traffic reduction (IEA 2005). Japan's policy for sustainable transportation focused on developing the bus system, recognizing that improved fuel efficiency and stringent emissions controls are not enough to solve the problems (Ono 1993). In Latin America, the public transportation systems in Bogotá, Colombia and Curitiba, Brazil are seen as examples of high quality and low cost systems with reduced travel times and high numbers of daily passengers among other advantages (IEA 2005). These models suggest that prioritizing the bus system, through minimizing the interaction with general traffic circulation and making bus service more frequent and reliable would increase the number of passengers.

Beyond the inconvenience and perceived failure of the SUT are other serious problems correlated with the transportation predicament, including environmental, public health, and

equity issues. For example, transportation issues, such as access to employment, play an important role in preserving the inferior social position of women, yet there have been limited efforts to address gender issues in the transportation sector (Peters 1999). In addition, the United Nations Environment Programme recognizes transportation as a significant issue concerning sustainable development. The environmental impacts, including air pollution, resource consumption, high noise levels, and changes in land use, are more pressing in developing countries, since vehicles tend to be older and consequently pollute more, and there are usually less emission controls (Faiz and de Larderel 1993). Like many other cities in developing countries, La Plata also suffers from congestion, as many different modes of transport, such as cars, busses, bikes, and taxis, share the roads. Achieving sustainable transportation will involve integrating social, environmental, economic and political factors and approaching the problem from a community-based perspective (Gan 2003).

The municipal government of La Plata has been working on the issues for over a decade and non-governmental organizations, such as Fundación Biosfera, are committed to developing sustainable solutions for the problems surrounding transportation. In addition, there have been few studies on the environmental impacts of transportation in the region by the local university. An analysis of three neighborhoods in the county of La Plata provides evidence of the complex relationship between mobility and land use, showing how density, proximity to services, socio-economic status, and transportation infrastructure determines the accessibility of the populations (Ravella et al. 2004). However, the variation in travel patterns among different groups of people in the region is unclear.

In general, studies in developing countries have shown that the trips women take are shorter, more frequent, and more dispersed throughout the day (Peters 1999). While walking is the main transport mode for poor women in developing countries, females are also seen as more dependent on public transportation than males (Peters 1999). In addition, a travel survey in Sweden found that females and young people are more likely to use public transportation and that income is highly positively correlated with increasing distance traveled (Carlsson-Kanyama and Linden 1999). Students would also be more expected to use public transportation than other groups because of their relatively low incomes, flexible schedules, and ability to walk to and from bus stops (Pucher 2004).

The previous studies provide insight on how to use survey data to improve the public transportation system in La Plata. For example, the Sweden study suggests that focusing on changing the travel habits of the groups with the most unsustainable travel patterns, rather than relying on technology improvements (Carlsson-Kanyama and Linden 1999). Increasing the number of bus users and decreasing the number of vehicles on the road would not only reduce environmental impacts, but also increase the mobility and accessibility of the population. Therefore, the purposes of this study are to identify the groups of people and neighborhoods with limited access to public transportation, the reasons why certain groups of people have lower ridership, and the principle concerns of the groups most reliant on the bus system.

The study will address the following questions:

- ? Which segments of the population are most reliant on the bus system and which segments are least reliant?
- ? How do opinions regarding the bus fare, knowledge of the schedules and routes, and perceived problems with transportation in La Plata differ among groups of people based on age, sex, and neighborhood of residence?

The results should provide insight on where to direct resources, in order to increase the number of bus users and improve the quality of service. Without integrating public opinions in the planning and management process, the system will continue to neglect the needs of the citizens. This project will provide critical information that can be used to improve the transportation system and enhance the quality of life.

Methods

The staff of Fundación Biosfera assisted in designing the survey, in order to make the questions applicable in the local context. The survey asked for demographic indicators, such as age, sex, neighborhood of residence, and occupation. Because of cultural limitations against asking the question, the survey did not ask specific income levels or occupations beyond the category “employed,” consequently disguising the variation among employed people. After conducting test surveys in the community, questions found to be confusing were modified or deleted. The revised survey consisted of twelve main questions regarding the opinions on different modes of public and private transportation, including the bus, car, train, taxi, remis (another form of a rented car), bicycle, and foot. Most questions were multiple choice, although

the subjects had opportunities to elaborate on their opinions. If a person did not use a particular form of transportation, the section would be skipped and the survey would continue with the next question.

Five volunteers of Fundación Biosfera, who were also students at the National University of La Plata, conducted the survey.¹ The surveyors were each paid \$150 (ARG pesos) for obtaining 200 surveys, plus an additional \$15 to cover transportation costs.² Prior to the start of the survey, a meeting was held with the surveyors to review the questions, methodology, and study sites.

Originally, the objective was to collect 1,000 surveys over a five day period. Using demographic information available from the government (DPE 2001), the county of La Plata was divided into four zones (west, south, east, and the city), and each surveyor was assigned an area for each day. Based on the assumption that the surveyors would collect 40 surveys per day, they would then collect a number of surveys proportionate to the areas' contribution to the total population of the county. Considering that the city of La Plata is an important regional center for work and services (Giacobbe et al. 2002), the surveyors would spend about half the time within the city limits, allowing them to survey people from surrounding areas, as well as the urban population.

As the survey progressed, the surveyors were not meeting the original objectives due to time, safety, and transportation constraints. As a result, the surveyors needed more time to complete and collected a total of 842 surveys over the period of July 25 through August 9, 2005.

The surveyors were instructed to randomly select people to survey on the streets, at bus stops, stores, plazas, stations, schools, and hospitals, while attempting to match the age distribution of the population and obtain an equal amount of females and males. However, the results of the survey and a comparison with statistics on demographic information indicate the sampling procedure involved biases.

The number of males and females surveyed is evenly split, while the census indicates La Plata has a slightly higher female population at 52% (DPE 2001). The amount surveyed from the city of La Plata is approximately representative of the actual population proportion at 33%, though certain rural neighborhoods, contributing to generally less than 1% of the division's total

¹ I chose not to be a surveyor, because of my limited Spanish abilities.

² Two surveyors collected less than 200 and were paid accordingly.

population, are not represented (DPE 2001). The distribution of the remaining 38 neighborhoods appears to be relatively proportional.

Table 1. Age distribution of the sample and the population

Distribution of ages	% of sample	% of population (DPE 2001)
15 and less	11	23
16-64	84	65
65 and up	5	12

However, children under the age of 15 and people over the age of 65 were under-represented, as shown in Table 1. In fact, the age group from 15 to 30 makes up 56% of the sample. Furthermore, Figure 2 suggests that students may be over represented. While the National University of La Plata has about 76,500 students (UNLP 2005) and there are other universities located in the city, it is unlikely that 41% of the county's population is students, although no exact data were found to compare.

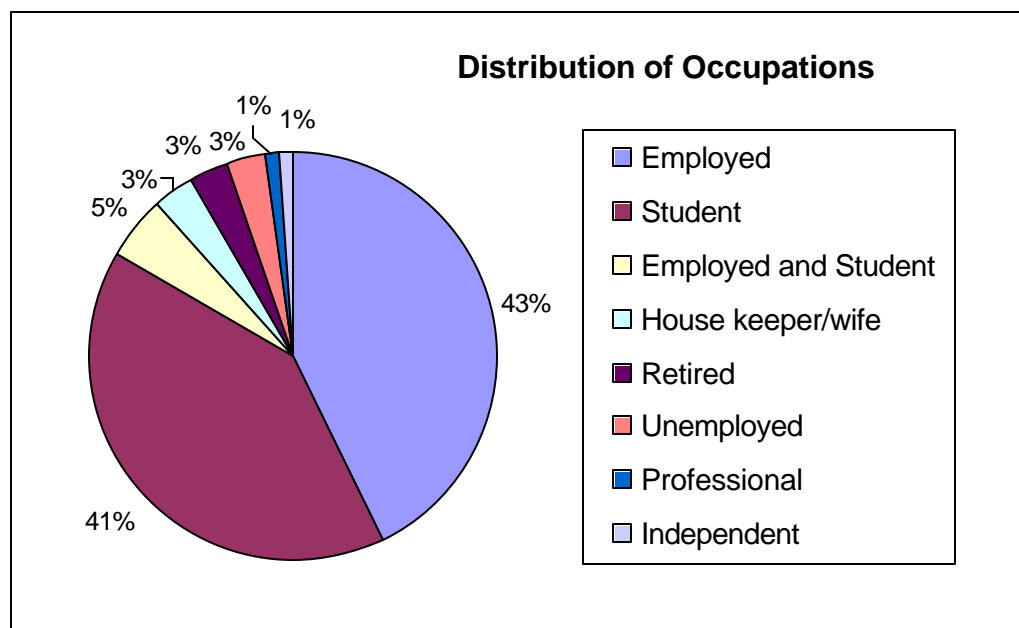


Figure 2. Distribution of respondents by occupation.

To reduce the effects of over-representation, the results are categorized into age groups of 15 years.³ To further focus on age, only the frequency of bus use by occupation is analyzed, because of the relatively low sample of housewives, retired and unemployed people. Neighborhoods are also grouped into regions according to their proximity to the city of La Plata,

³ The largest possible groups were chosen to simplify the analysis while still being representational of the data, as the results show a similar trend when broken into age groups of 5 years.

as shown in Figure 3. The categories include: La Plata (the city), bordering (areas located in the county within 10 km of the city), counties bordering La Plata to the north (Berisso and Ensenada), areas located 10-30 km from the city (within the county), and areas located greater than 30 km from the city (within the county). While the survey was not intended to cover other counties, the responses from a small number of respondents that reside in these areas were still used for comparative purposes.

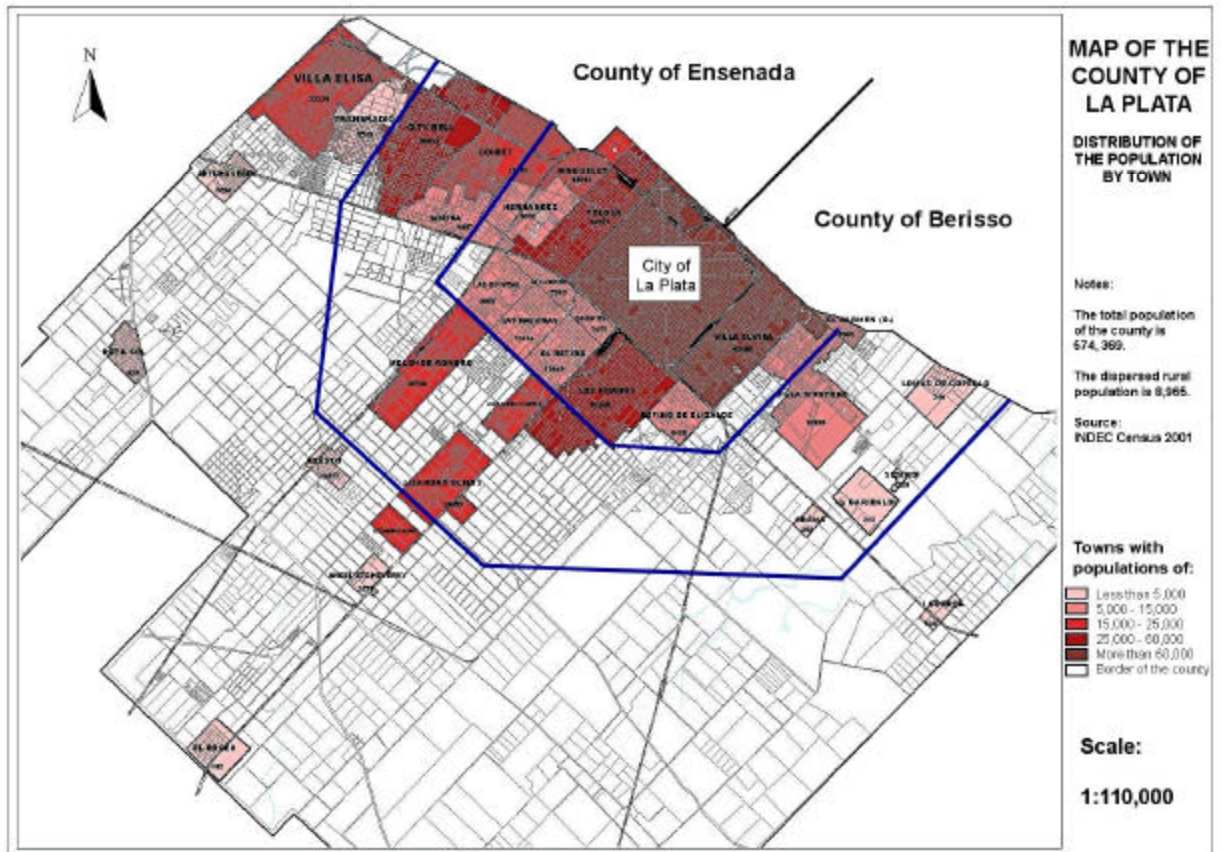


Figure 3. Map of the county of La Plata, showing the population densities of each municipality and the regions used in the analysis (Adapted from Rozas, 2005).

To detect if the associations between demographic characteristics and the responses to certain questions are statistically significant, the data was analyzed using the Chi-Square Test.

Results

The results confirm the high bus usage in La Plata, as 60% of the respondents indicate they make at least one trip per week using the bus and 54% claim the bus as one of the modes of

transportation they take to work or school. Examining how often different user groups use the bus reveals notable trends. For example, 67% of the female respondents use the bus at least once a week, compared to 55% for males. In fact, the Chi-Square Test found an extremely significant association ($p= 0.0009$) between frequency of bus use and sex.

Comparing the frequency of bus use between people of different occupations reveals another statistically significant association ($p < 0.0001$). Figure 4 shows that students, students with jobs, and house keepers/wives are more likely than employed, unemployed, or retired people to be frequent bus users. Accordingly, the results suggest that younger people are also more likely to use the bus at least once a week, as compared to older age groups (Figure 5). In particular, 70% of the 15-29 age group use the bus frequently, with the 20-24 sub-group having the highest proportion. The Chi-Square Test found a statistically significant association between frequency of bus use and age group ($p < 0.0001$).

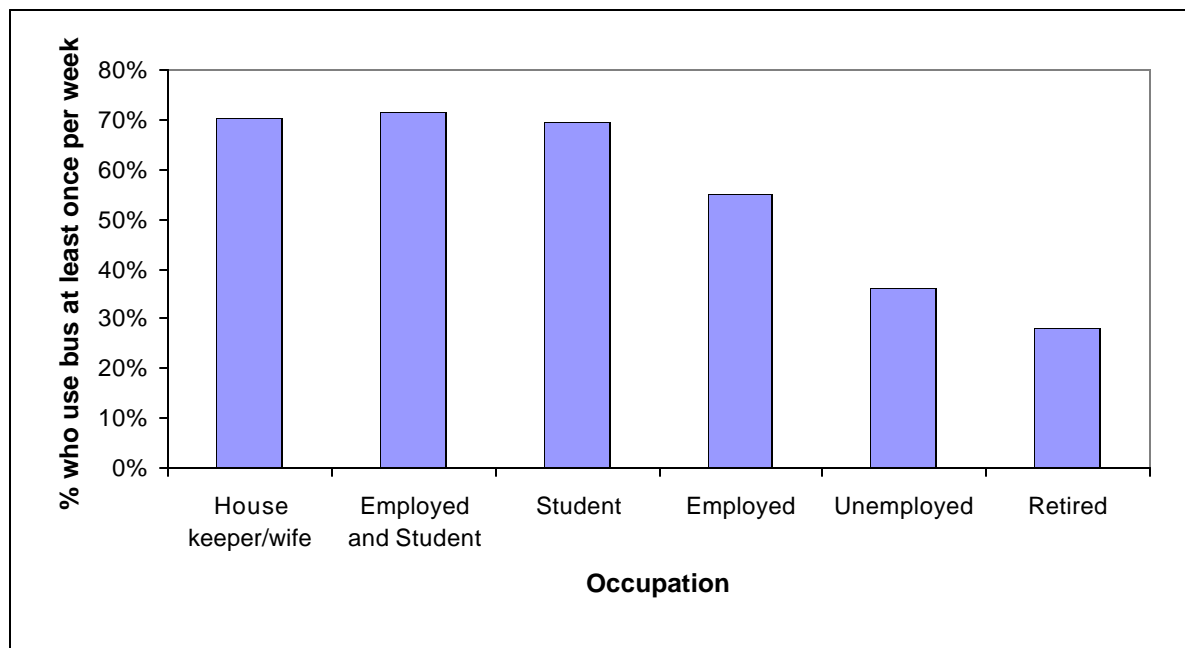


Figure 4. Proportion of the sample, divided by occupation, who use the bus at least one time per week.

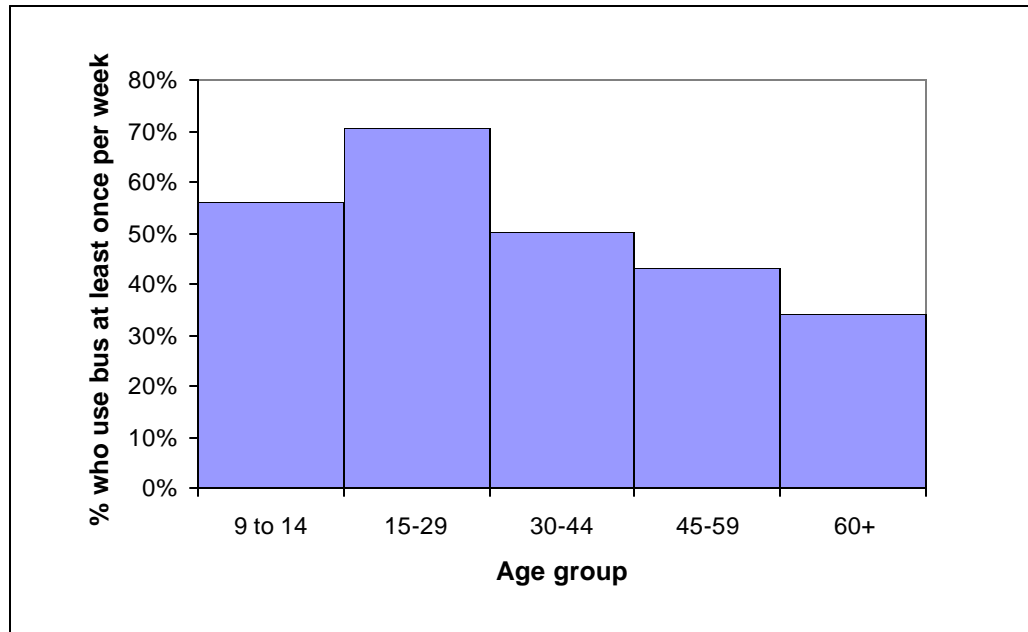


Figure 5. Proportion of the sample, divided by age group, who use the bus at least one time per week.

Comparing the frequency of bus use between respondents residing in different regions, based on the proximity to the city of La Plata, found another significant association ($p < 0.0001$). As shown in Figure 6, the neighborhoods located 10 to 30 kilometers from the city appear to have the most frequent bus users than bordering areas, although the bordering regions also have a high proportion. Conversely, the region greater than 30 km has a smaller proportion and only 46% of the respondents from the city take the bus more than one time per week.

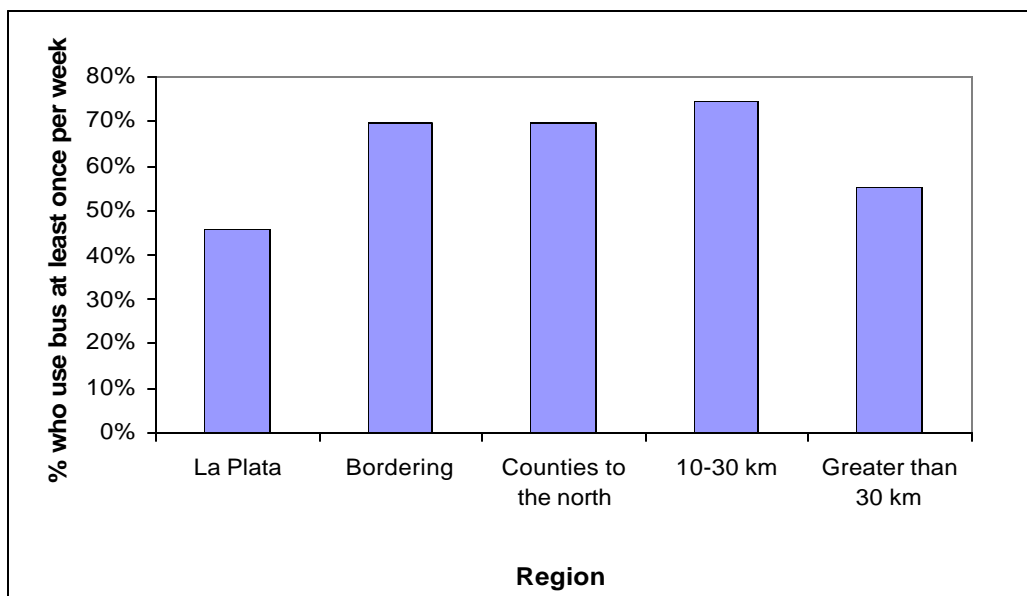


Figure 6. Proportion of the sample, divided by the neighborhood's proximity to the city of La Plata, who use the bus at least one time per week.

The results of the survey also reveal some noticeable trends regarding opinions on the quality of the transportation system. For example, 55% of the respondents cited the irregular bus service/lack of fixed bus schedules as a main problem with transportation in the county of La Plata.⁴

As shown in Figure 7, females were slightly more likely to think irregular service and lack of access are the main problems whereas males were slightly more likely to think safety, congestion or other issues are more problematic, although the association is not statistically significant ($p= 0.13$). Furthermore, there was no statistically significant difference in the response between males and females regarding neither the opinion of the bus fare nor the knowledge of bus schedules and routes.⁵ However, when comparing the proportion of respondents who feel they know the bus routes and schedules to the frequency of bus use, the percentage difference was much greater for females than for males, at 21% and 12% respectively.

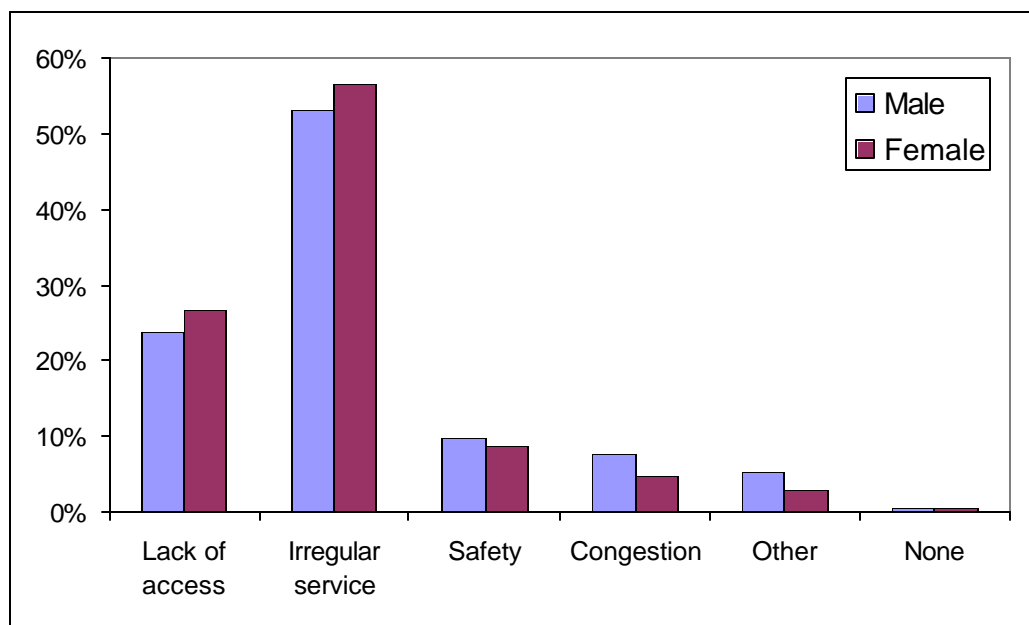


Figure 7. Proportion of the sample, divided by sex, who chose options 1-4 for the question regarding the perceived problems with transportation in La Plata.

On the other hand, as seen in Figure 8, the association between age group and the opinion of the worst transportation problem in La Plata was found to be statistically significant ($p < 0.0001$).

⁴ Because of confusion over methodology, some surveys had multiple responses to question 1. The question is still used, though surveys with over 2 responses were not analyzed.

⁵ For the analysis, the response to question 3.2 concerning the knowledge of bus schedules and routes is grouped into two categories categories (positive and negative).

The irregular bus service represented at least 43% of the responses for each age group. The 45-59 age group had the highest proportion responding with the lack of access to public transportation. The youngest and oldest age groups had higher proportions of respondents that expressed concern about safety. There was also a statistically significant association between age group and opinion of the bus fare ($p < 0.0001$), in addition to the knowledge of bus schedules and routes ($p = 0.008$). Comparing the percentage of each age group who use the bus at least once a week and who responded positively to the question regarding knowledge revealed a 22% discrepancy for the 15-29 age group. As seen in Figure 10, children were much more likely to find the fare reasonable, while over half of the respondents between the ages of 15 and 60 identified the bus fare as expensive. Furthermore, the oldest age group had the lowest proportion of respondents who find the fare to be expensive.

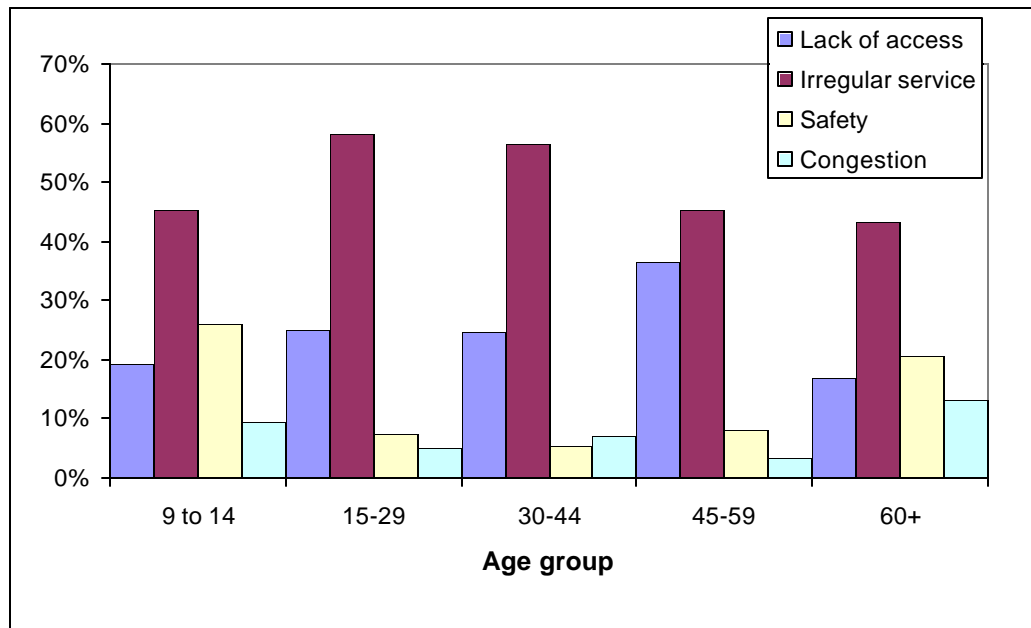


Figure 8. Proportion of the sample, divided by age group, who chose options 1-4 for the question regarding the perceived problems with transportation in La Plata.

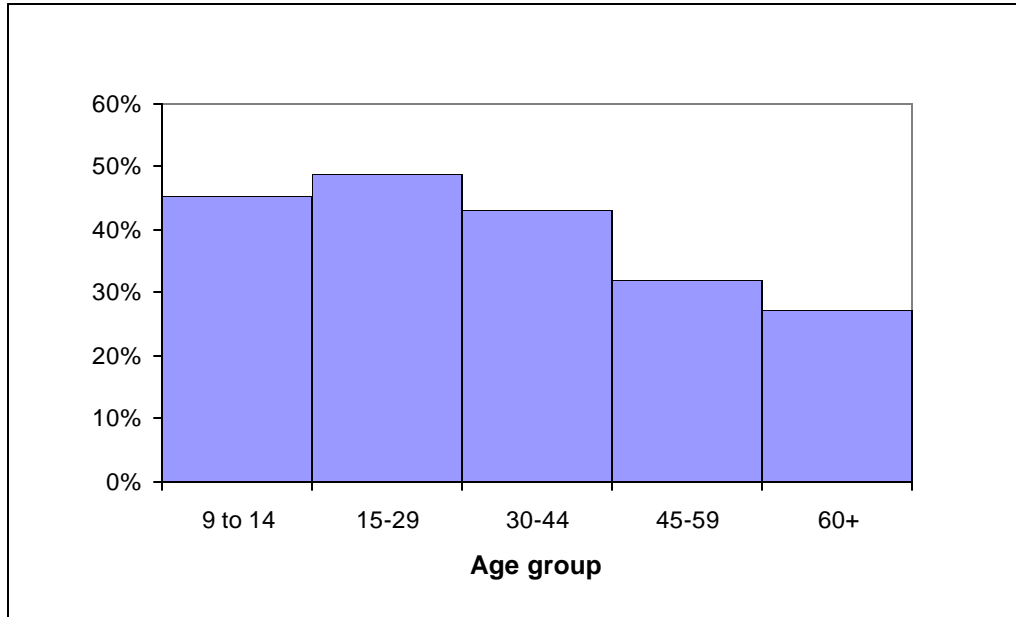


Figure 9. Proportion of the sample, divided by age group, who responded positively to question 3.2: “Do you know the schedules and routes of the buses you use?”

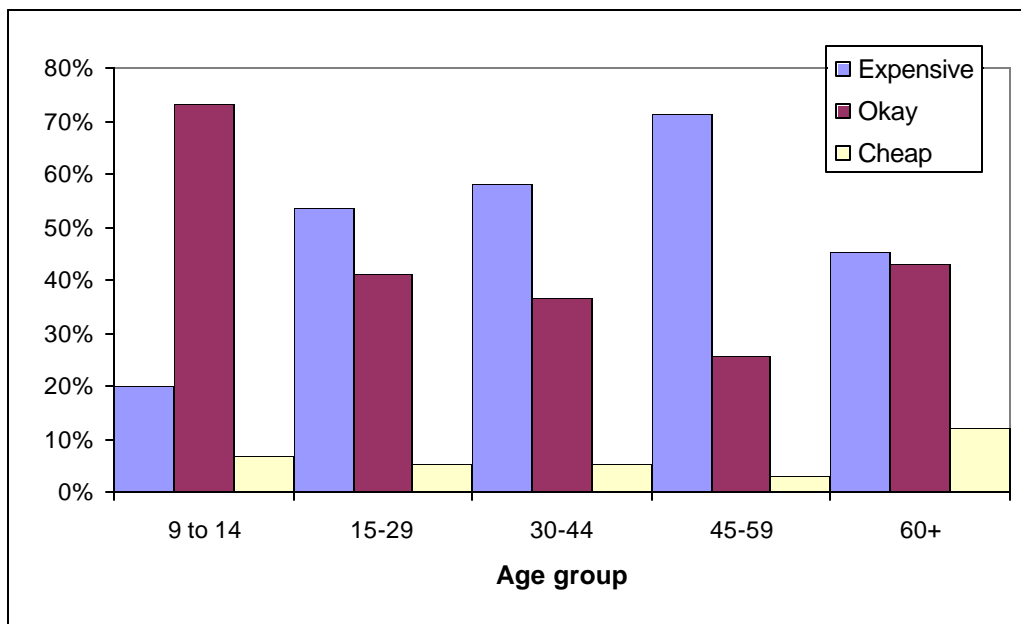


Figure 10. Responses to question 3.3 regarding the opinion of the bus fare, divided by age group.

The association between proximity to the city and the perceived problems with transportation was found to be statistically significant ($p= 0.049$). Comparing the responses among the regions shows that areas located at least 10 kilometers from the city had a higher proportion of respondents who indicated irregular bus service, although the percentage is high for all areas (Figure 11). La Plata and the counties to the north had a lower response rate for the lack of

access to public transportation and a higher response rate for safety and congestion than the regions in the county but outside of the city.

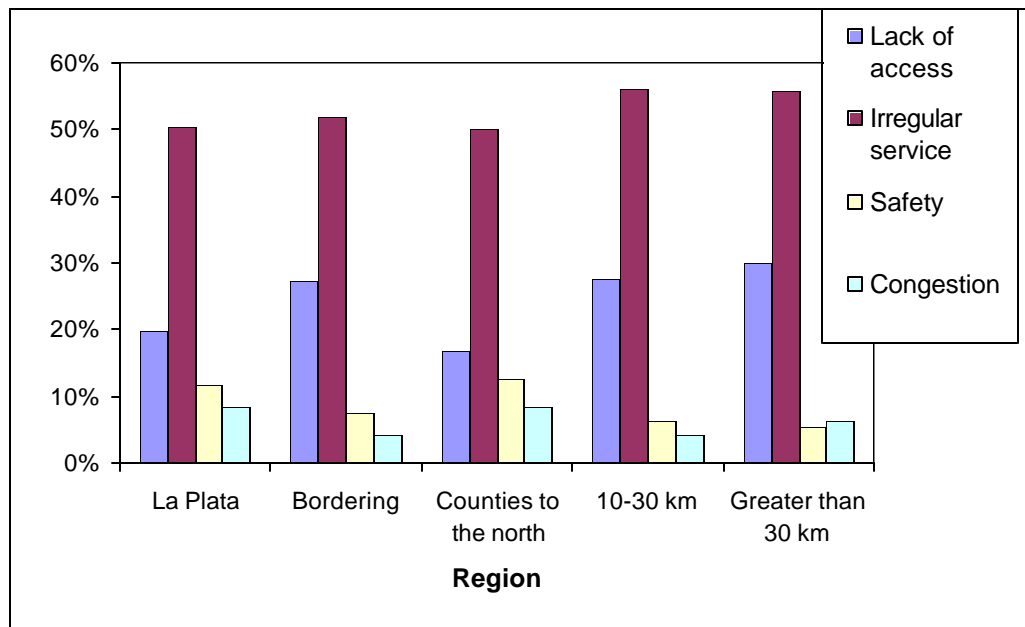


Figure 11. Proportion of the sample, divided by the neighborhood's proximity to the city of La Plata, who chose options 1-4 for the question regarding the perceived problems with transportation in La Plata.

While there was no significant difference in the opinions of the bus fare depending on proximity to the city, the association with the knowledge of the bus schedules and routes was statistically significant ($p < 0.0001$). About 32% of the people residing in La Plata and from areas greater than 30 kilometers from the city responded positively, compared to about 56% of the people from areas closer to the city (Figure 12). The differences between the frequency of bus use and knowledge of bus schedules and routes for the regions 10-30 km and greater than 30 km from the city were 18% and 22% respectively.

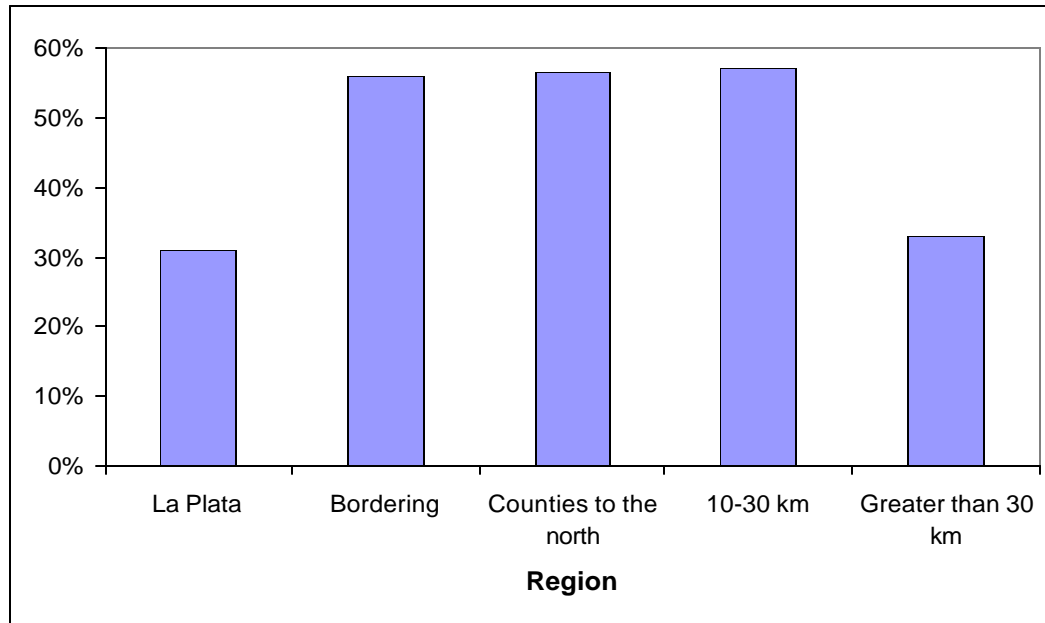


Figure 12. Proportion of the sample, divided by neighborhood of residence and categorized into regions based on proximity to the city of La Plata, who responded positively to question 3.2: “Do you know the schedules and routes of the buses you use?”

Discussion

As expected, the segments of the population most reliant on the bus system are females, students, and younger people. Areas surrounding the city, but within 30 kilometers had the highest rates of frequent bus users. The relatively least reliant groups are males, people older than age 60, and residents of the city of La Plata. One explanation for the difference in frequency of bus use between males and females is the variation in mobility needs, based on cultural gender roles in the family, labor market, and community (Peters 1999). In addition, women often do not have equal access to private motor vehicles (Peters 1999). The relatively low incomes of students and younger age groups would also help explain the higher frequency of bus use. The lower reliance of older groups likely reflects the perceived frustration with the system, the use of other modes, or increasing immobility with age. Furthermore, the concentration of middle and upper class residents and high density in the city of La Plata implies the increased likelihood for private automobile ownership and opportunities for walking. On the other hand, people from surrounding areas, which are generally less dense and have higher amounts of low-income households, need to travel farther to reach jobs and services, but are more likely to lack the

resources necessary for car ownership and consequently, are more dependent on public transportation (Ravella et al. 2004).

Females and younger people also had higher proportions of respondents who find the irregular bus service to be the worst problem with transportation in La Plata. The higher frequency of bus use implies more opportunities to be frustrated by unreliable service and experience longer wait times. The reason for the small difference in responses between males and females may be due to the variation in the purposes, timing, and locations of the trips made by women. Because women generally take more trips, especially during off-peak hours and between suburbs, the routes they use may have less frequent service than routes directed toward the city center during peak hours (Peters 1999). Younger people also tend to have more flexible schedules, which would be more likely to conflict with a system catered to people with consistent travel patterns to high traffic areas. Therefore, it seems reasonable that females and younger age groups would find public transportation more inconvenient. However, the overwhelming response from the entire sample suggests the presence of a greater, community-wide issue, as at least 50% of the respondents from each region cited irregular bus service as a problem.

The perceived problem of irregular service is also reflected in the discrepancy between the frequency of bus use and the knowledge of schedules and routes. In other words, the percentage of respondents who take the bus at least once a week is higher than the percentage of the same group that responded positively to the question asking if they know the schedules and routes of the buses they would use. While it would be expected that the most reliant groups would have the best knowledge because they would learn the schedules from frequent use, the results show that the most reliant groups (females and the 15-29 age group) actually have the highest discrepancy. The lack of knowledge, particularly by the most reliant groups, may reflect the lack of access to reliable information. Furthermore, the fact that the proportion of frequent bus users is more consistent with the proportion of knowledgeable people for less reliant groups suggests that these people may not be willing to use the bus unless they feel like they have the information. However, the frequent bus users who responded negatively to the question regarding the knowledge of schedules and routes may not be able to rely on the bus service to come on time based on the available information. This suggests that the travel demands of the relatively most reliant groups may be less compatible with the bus service. For example,

because of the greater flexibility of their schedules and the variation in travel purposes, younger people and women have to plan more random, non-daily trips and would be less likely to know the necessary bus schedules and routes. Despite frustration with the irregularity, these groups may lack other transportation options and continue to depend on public transportation. On the other hand, the relatively less reliant groups may find it easier to rely on the bus service due to their travel patterns and are more able to learn the schedules with frequent use.

The lack of access to public transportation was perceived as the second largest problem throughout the community, except for the youngest and oldest age groups. In particular, the 45-59 age group had the highest percentage identifying the lack of access as an important issue, suggesting that the bus system may not adequately serve areas where there is a high concentration of jobs or other services demanded by this age group. Although there was also a significant response in each region, the lack of access appears to be more of a problem for residents from outside of the city but within the county of La Plata. This implies that the coverage and frequency of service gets worse with decreasing density and increasing distance from the central area. The main reason for poor bus service, in terms of the geographic distribution, is that the development of the land and the transportation system in the region has led to a situation where providing public transportation is difficult. Specifically, low population densities and topographical barriers in peripheral areas created adverse conditions, contributing to a bus system with low frequencies and uncomfortable, expensive service (Dirección de Transporte 1994).

Safety, referring to the concern over accidents in the streets as opposed to security from crime, seems to be an important issue for the 9-14 and older than 60 age groups. Beyond being traditionally the most vulnerable groups, the survey reveals children and elderly do not use public transportation as much and consequently may walk more, exposing themselves to the dangers of being a pedestrian. While no data was found on the age and gender distribution of traffic-related injuries in La Plata or Argentina, pedestrians and children are at a higher risk of getting injured in an accident in developing countries compared to developed ones (Gwilliam 2003). Furthermore, males between the ages of 16 and 54 account for the majority of accidents in all countries (Gwilliam 2003), which would help explain the slightly greater concern over safety by males than by females.

The opinions of the bus fare reveal another important issue to the community. Although it was not an option for the question regarding the main problems with transportation, several people cited the expensive fare through the “other” option. The lack of a statistically significant difference between males and females in the opinion of the bus fare is interesting because women are more likely to do trip chaining (stopping at multiple destinations during one trip away from the home) and would have to buy multiple tickets in one day as a result (Peters 1999). The lack of variation among different geographic regions not only shows how different socio-economic groups are spread throughout the region, but also how the residents of La Plata, with higher income levels, perceive the fare as too expensive for the quality of service provided.

Concerning the difference in opinion by age group, children were much more likely to find the fare reasonable. While students and children have cheaper fares than the standard 1.20 pesos per trip (Municipalidad de La Plata 2002), they are not as affected since the parents are likely paying the fare or driving them around. As people get older, become financially independent, and/or rely on the bus more, they would be more likely to perceive the costs as a burden. Regarding the oldest age group, the relatively low response rate for “expensive” and high response rate for “okay” implies a willingness to pay for public transportation and suggests that concerns over service, rather than the cost of the bus fare, are the main factors explaining the low ridership of this age group.

Limitations As mentioned previously, biases in the methods used to conduct the survey limited the representation of certain segments of the population and pose challenges to making generalizations from the sample. For example, the procedure for recruiting people to participate in the survey likely contributed to the skewed age distribution of the sample. There may be a lower likelihood that elderly or young children will be present in public areas, and the methodology did not include a way to actively seek these populations. Moreover, the surveyors may have favored approaching fellow students. In addition, the surveyors did not have accessible transportation to reach some of the assigned areas, such as the rural zone southeast of the city, and they did not feel comfortable surveying alone in certain neighborhoods known for being very poor and dangerous. Applying a more structured, randomized procedure would have reduced the possibility of choosing people to survey based on convenience.

In addition to the over-representation of young adults and students, non-response bias, a small number of incomplete surveys, biases in responses due to the variation in surveying

techniques, and surveys with blank responses to specific questions pose challenges to the analysis. Consequently, questions with low response rates will not be analyzed. While the ability to extrapolate trends from the survey to represent the entire county may be limited, the results of the survey are still useful and provide insight on how to address the concerns of the citizens.

Recommendations The survey results confirm the obvious need to improve the quality of bus service, in order to not only attract more users, but to improve the quality of life for those who depend on the system. Increasing the regularity and reliability of public transportation involves improving the efficiency of the system, defined as the costs (or energy consumed) per passenger-kilometer (Aón 2003). However, the operation of a bus system depends on a high concentration of people in space and time to make the cost per passenger decrease (Pucher 2004). Accordingly, when the number of bus users declines, the revenue also decreases, forcing the operators to increase the fares in order to cover costs. The relationship between revenue and the quality of service explain why many public transit systems are caught in downward cycle (Cervero 2001). In La Plata, the bus companies have responded to the reduction in demand by reducing the frequency of service and raising fares, yet this further decreases quality of service and demand (Dirección de Transporte 1994). Furthermore, the new bus system seems to focus on using vehicles of different sizes according to the demand, yet this still encourages congestion in the city and is even less efficient, in terms of energy consumption and emissions, than the previous system (Aón 2003). While the new system aimed to increase coordination among operators, geographical connectivity, and efficiency, there is still room for consolidating management to better meet the needs of the population.

The bus service cannot be seen as an isolated entity, as it functions in a dynamic transportation system in a changing landscape. Therefore, the creation of a regional authority would allow for a more flexible, comprehensive approach to managing the system. The purpose of the body would be to oversee planning, resolve conflicts between lines, integrate information, and allocate responsibility among jurisdictions and agencies (Dirección de Transporte 1994; Gwilliam 2003; Giacobbe et al. 2002). This would allow for the effective use of information and technology to model the travel demand within the region that would optimize bus scheduling (Pucher 2004). Improving coordination among different agencies would be especially important in terms of integrating data on land use and population trends, to make sure the bus system meets

the changing needs of different groups of people and geographic areas. Specifically, taking into account the characteristics of households in each neighborhood and the distribution of services and employment opportunities could lead to more efficient route planning and scheduling. For example, incorporating the different needs of females involves considering the provision of public transportation in areas highly accessed by women and the timing of services (Peters 1999). Furthermore, collaboration between the local universities and the managers of the transportation system would help improve service to a highly reliant segment of the population. Although more research is needed to determine the ideal composition of a regional authority for La Plata, the board should include a citizens advisory committee of some kind to encourage public participation in planning and management.

Structural reform would also help the county of La Plata to incorporate the ideas of Bus Rapid Transit (BRT), a relatively low-cost, highly effective, flexible model found in Latin American cities to improve accessibility and efficiency (Pucher 2004). The main tenant of BRT is to create some form of separate roads or lanes that prioritize public transportation, which serves to reduce congestion and make it easier for buses to complete their routes on schedule (Pucher 2004). A group studying sustainable transportation at the local university also promotes the exclusive circulation for mass transit, as well as efficient inter-modal transfer nodes and the adjustment of the system around two axes' with subsidiary routes to eliminate congestion in the central area and maintain wide spatial coverage (Aón 2003). While BRT can improve the flow of traffic, investing in transportation infrastructure also improves accessibility to public transportation. In particular, directing resources to road rehabilitation on key public transportation corridors and on main roads in rural or low-income areas would improve geographic and social equity (Gwilliam, 2003). For example, the roads in Villa Garibaldi, a neighborhood southeast of the city, are either unpaved or deteriorated from heavy truck use, limiting access by motor vehicles (El Dia August, 2005). By implementing aspects of BRT and integrating main trunk lines with smaller feeder routes, the system can improve coverage while maximizing efficiency.

The use of prepaid or electric fare passes, another aspect of BRT, also encourages a more efficient system. Using magnetic or smart cards and prepaid machines minimizes time spent during boarding and makes it easier for the driver to focus on driving (Pucher 2004). Using prepaid cards also encourages a fairer pricing scheme by ensuring the proper implementation of

combination passes (paying one fare if transferring to another bus within the hour) and variable pricing for special needs groups, including children, students, disabled, and senior citizens (Dirección de Transporte 1994). Combination ticketing was part of the original plan for SUT, but was only implemented by certain lines and was abandoned altogether in the summer of 2005 (El Dia June, 2005). While prepaid, magnetic ticketing in La Plata would reduce transfer time and the bus fare for many people, it would be difficult to implement since there are different companies operating in the system. The new ticketing system would be more likely to work with integrated management (Gwilliam 2003), and therefore, it should be part of a long-term plan for improving the system, in conjunction with increasing coordination and developing BRT.

If the efficiency of the system is adequately improved, the operators can establish fixed schedules and distribute the more reliable information to the public. While information on the routes covered by the SUT lines is currently available online and through a hotline, not everyone in the community has affordable or convenient access to computers or telephones. Posting information at bus stops or providing free fliers at kiosks would provide more widespread access to information. A public campaign at venues such as the university, schools, and administrative government buildings in central La Plata would also reach a high number of current and potential bus users. Increasing the availability of information on the bus routes and schedules to the less frequent users may encourage them to ride the bus more often, whereas providing more information to frequent users may help ease frustration and make the system more convenient and accessible.

To address the safety issue and protect the most vulnerable people within the transportation system, the government should invest in relatively inexpensive infrastructure, as well as in education and enforcement. Because the occurrence of accidents decreases with the presence of traffic controls (Gwilliam 2003), more traffic signals, footways, and signs at crossings would improve safety. In addition, increasing education for drivers and pedestrians would help create awareness of safer behavior. Enforcement of traffic rules is an important issue related to safety in La Plata and throughout the developing world (Dirección de Transporte 1994; Gwilliam 2003). To strengthen enforcement, the government could impose reasonable fines for traffic violations to help offset the costs of employing more traffic control officials.

This study has shown that variations exist in the perception and frequency of bus use among different segments of the population in La Plata and has provided recommendations on ways to

improve the system. In addition to focusing on the efficiency of the bus service, the local transportation operators and officials also need to address the cost of the bus fare, access to public transportation, the availability of information on routes and schedules, and traffic safety. To further develop an understanding of the transportation system, additional research is needed on current land use and trip patterns (particularly the origins and destinations), the costs of transportation to households, variation in vehicle ownership, and public attitude concerning environmental issues, such as the desire for cleaner, alternative modes of transportation. Specifically, more research on the difference in opinions between bus users and non-users would provide a more in-depth perspective on ways to attract more users.

Acknowledgements

Thank you to the staff of Fundación Biosfera, the Foundation for Sustainable Development, Arielle Levine, John Latto, Josh Fisher, Chad White, Karen Frick, and Aaron Golub for your support, guidance, and advice throughout my research.

References

- Aón, L., H. Olivera, and O. Ravella. 2003. Evaluación de consumo energético y emisiones contaminantes en dos propuestas de transporte para el gran La Plata. *Avances en Energías Renovables y Medio Ambiente* 7(1) 23-28.
- Carlsson-Kanyama, A, and A. Linden. 1999. Travel patterns and environmental effects now and in the future: implications of differences in energy consumption among socio-economic groups. *Ecological Economics* 30 405–417.
- Cervero, R. 2001. *Informal Transit: Learning from the Developing World*. Access 18 15-22.
- Dirección Provincial de Estadística (DPE). 2001. Censo Nacional de Población, Hogares y Viviendas. <http://www.ec.gba.gov.ar/estadistica/ftp/Censo/partidos/laplata/laplata.htm>.
- Dirección de Transporte (of the Municipality of La Plata). 1994. *El Transporte en La Plata*. La Plata, Argentina. p. 65.
- El Dia (Newspaper of La Plata). June 29, 2005. “Habría nuevos recortes en el servicio de transporte.”

- El Dia (Newspaper of La Plata). August 3, 2005. "Villa Garibaldi: El peligro de vivir aislados."
- Faiz, A. and J. Aloisi de Larderel. 1993. Automotive air pollution in developing countries: outlook and control strategies. *The Science of the Total Environment* 134 325-334.
- Gan, L. 2003. Globalization of the automobile industry in China: dynamics and barriers in greening of the road transportation. *Energy Policy* 31 537-551.
- Giacobbe, N., J. Frediani, and O. Ravella. 2002. El Sistema de Transporte Urbano en el Gran La Plata: Relación entre Gestión del Transporte y Sustentabilidad.
- Gwilliam, K. 2003. Urban transport in developing countries. *Transportation Reviews* 23(2) 197-216.
- International Energy Agency (IEA). 2005. *Sistemas de Autobuses Para El Futuro: El Logro de un transporte sostenible en el mundo*. Pluralia Ediciones, Mexico. p. 225.
- La Plata Virtual. 2005. <http://www.laplata-argentina.com.ar/mapainteligente.html>.
- Municipalidad de La Plata. 2002. SUT. <http://www.sut.laplata.gov.ar/Zonas/index.html>
- Ono, Y. 1993. Japan's sustainable transport policy towards the 21st century. *Transport Policy* 1(1) 32-42.
- Peters, D. 1999. *Gender Issues in Transportation: A Short Introduction*. Institute for Transportation and Development Policy (ITDP). www.itdp.org
- Pucher, J. 2004. "Public Transportation" in *The Geography of Urban Transportation*. Ed. by S. Hanson and G. Giulano. Guilford Press, New York. p. 199-236.
- Ravella, O., N. Giacobbe, and J. Frediani. 2004. Hábitat y Movilidad en La Reestructuración Urbana del Siglo XXI: El Caso del Gran La Plata. *Avances en Energías Renovables y Medio Ambiente* 8 (1) 85-90.
- Rozas, Gabrielle. 2005. *Fundacion Biosfera*.
- Shifan, Y. and J. Suhrbier. 2002. The analysis of travel and emission impacts of travel demand management strategies using activity-based models. *Transportation* 29 145-168.
- United Nations Environment Programme. Division of Technology, Industry and Economics. *Moving Towards Sustainable Transport*. 2005. www.uneptie.org.
- Universidad Nacional de La Plata (UNLP). 2005. www.unlp.edu.ar/.

Appendix

Translated survey:

Survey of Public and Private Transportation

July 2005

Location of the survey: _____ Time: _____

Gender: Male Female Date of birth: _____

Occupation: _____ Neighborhood of residence: _____

1. Transportation

What is the worst problem with transportation in the county of La Plata?

- Lack of public transportation service
 Irregular public transportation service; lack of fixed bus schedules
 Unsafe streets; many accidents
 Congestion in certain areas: Which? _____
 Other: _____
 None
 Don't know/NA

2. If you work or study:

2.1 What mode of transportation do you use to go to work or school?

Bus Taxi Remis Train Car Bike Walk Other

2.2 How far is your home from your work or school?

Km. or Blocks: _____

2.3 How long does it take to get to work or school?

< 10 min 10-30 min 30-60 min 60-90 min > 90 min

3. Public Transportation (Bus):

3.1 How often do you use the bus? (trip = to and from)

Never less than 1 time/week 1-3 trips/week 4-6 trips/week 1 or more trips/day

If never, why? _____

3.2 Do you know the schedules and routes of the buses you would use?

Yes, very well Yes, more or less Not well No

3.3 What is your opinion of the bus fare?

Expensive Okay Cheap

3.4 Is the payment mechanism of the bus fare convenient?

Yes Yes, more or less Not really No Don't know/NA

3.5 What is your opinion of the distribution of the bus stops?

Very good Good Okay Bad Very bad Don't know/NA

3.6 Do you think the bus service provides access to important places (like hospitals, school, public administration...)?

Yes, very well Yes, more or less Not well No

What places would you specifically like to have access to by bus?

4. Quality of service of public transportation (bus):

For the next 5 questions, refer to the lines most used: Lines: _____

(Indicate if there are differences according to the time or line)

4.1 How many blocks are the bus stops from your home?

Less than 2 blocks 2-4 blocks more than 4 blocks

4.2 How much time do you generally wait for the bus?

< 5 min 5-10 min 10-20 min 20-40 min 40 min-1 hour >1 hour

4.3 Do you think the bus stops are in condition to give shelter?

Yes Yes, more or less Not really No Don't know/NA

4.4 How many people are there on the bus generally?

empty mostly empty half mostly full full/standing people

4.5 Do you feel safe on the bus, as in how well does the driver operate the bus?

Very well Well Okay Bad Very bad Don't know/NA

4.6 What is the state of cleanliness of the bus?

Very good Good Okay Bad Very bad Don't know/NA

5. Quality of service of taxis:

5.1 How often do you use the taxi?

Never less than 1 time/week 1-3 trips/week 4-6 trips/week 1 or more trips/day

If never, why? _____

5.2 What is your opinion of the cost to take the taxi?

Expensive Okay Cheap

5.3 Do you feel safe in taxis, as in how well does the driver operate the taxi?

Very well Well Okay Bad Very bad Don't know/NA

5.4 What is the state of cleanliness of the taxis?

Very good Good Okay Bad Very bad Don't know/NA

5.5 How is the accessibility of taxis in your neighborhood?

Very good Good Okay Bad Very bad Don't know/NA

6. Quality of service of remis:

6.1 How often do you use the remis?

Never less than 1 time/week 1-3 trips/week 4-6 trips/week 1 or more trips/day

If never, why? _____

6.2 What is your opinion of the cost to take the remis?

Expensive Okay Cheap

6.3 Do you feel safe in taxis, as in how well does the driver operate the remis?

Very well Well Okay Bad Very bad Don't know/NA

6.4 What is the state of cleanliness of the remis?

Very good Good Okay Bad Very bad Don't know/NA

6.5 How is the accessibility of the remis in your neighborhood?

Very good Good Okay Bad Very bad Don't know/NA

7. Quality of service of the train::

7.1 How often do you use the train?

Never less than 1 time/week 1-3 trips/week 4-6 trips/week 1 or more trips/week

If never, why? _____

7.2 What is your opinion of the cost to take the train?

Expensive Okay Cheap

7.3 Do you feel safe in taking the train?

Very well Well Okay Bad Very bad Don't know/NA

7.4 What is the state of cleanliness of the train?

Very good Good Okay Bad Very bad Don't know/NA

8. If you do not live or work in the center of the city of La Plata:

8.1 How often do you travel to the center of La Plata *per week*?

Never less than 1 time/week 1-3 trips/week 4-6 trips/week 1 or more trips/day

8.2 What mode do you *prefer* to use to travel to the center of La Plata?

Bus Taxi Remis Train Car Bike Walk Other

8.3 What days do you travel to the center of La Plata?

Monday-Thursday Friday Saturday Sunday Every day

8.4 What time usually?

6-9:00 9-12:00 12-3:00 3-6:00 6-10:00 Others

9. If you drive a car: What is your opinion of the following?

9.1 Compliance of the traffic norms by the other drivers

Very good Good Okay Bad Very bad Don't know/NA

9.2 Availability of parking the center

Very good Good Okay Bad Very bad Don't know/NA

10. If you ride a bike or motorcycle:

Do you feel safe riding in the streets?

Yes Yes, more or less Not really No Don't know/NA

11. As a pedestrian:

Do you feel safe crossing the streets?

Yes Yes, more or less Not really No Don't know/NA

12. Would you like to see more:

a. Signals at the crosswalks? Yes No Don't know/NA

b. Traffic signals? Yes No Don't know/NA

c. Bike lanes? Yes No Don't know/NA

d. Bike parking? Yes No Don't know/NA

Other comments:
