



WOMEN S EMERGING TRAVEL PATTERNS



Trip-Chaining, Childcare, and Personal Safety: Critical Issues in Women's Travel Behavior

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TRIP-CHAINING, CHILDCARE, AND PERSONAL SAFETY CRITICAL ISSUES IN WOMEN'S TRAVEL BEHAVIOR

INTRODUCTION

"I have three reasons for driving. One, I must deliver children to school and childcare every morning. Two, mass transit would add an hour per day to a 12-hour class and work schedule. [In addition to working part time], I also have a full-time job taking care of two kids, cooking, cleaning, and doing laundry. I sleep that extra hour... Three, I relied on [mass transit] for several years to get to and from class, until I was assaulted one night on my way to catch a bus."

The comment above was made by a forty-year-old female student at Portland State University as a response to a travel survey in 1989. Many other women students—as well as faculty and staff—made similar comments. Their words highlight the fact that transportation issues for women differ from those for men in that women frequently face circumstances that many men do not. These circumstances weigh heavily in women's decision-making about mode choice and are less important to men's decision-making. In particular, among members of this urban university community (students, faculty, and staff) the determining factors are

- the necessity of making multiple stops (trip-chaining), for the purpose of transporting children to and from school or daycare, running errands, and grocery shopping safety concerns
- the lack of alternatives in lifestyle and transportation mode due to constraints imposed by any one or a combination of low income, single-mother status, or distance of residence

Using samples drawn from the Portland-Metropolitan region and the student and faculty-staff community at Portland State University, this paper studies the relationship between these factors and women's mode choice and propensity to trip-chain. It concludes by suggesting that many of the transportation policies currently under consideration may not fit the needs and limitations that women face and that, if implemented, may result in significant inequities.

BACKGROUND LITERATURE

This section briefly reviews the literature on trip chaining in general, gender differences in travel behavior, childcare and travel, and women and safety. Because a university sample is used for part of the analysis, literature on university transportation is also briefly reviewed.

TRIP CHAINING

The linking of nonwork trips to work trips has been studied by Adler and Ben-Akiva (1); Oster (2); Goulias and Kitamura (3); Golob (4); Kitamura (5); Oster (6); and Nishii, Kondo, and Kitamura (7). Strathman, Dueker, and Davis (8) used the concept of trip chaining to examine the propensity of households to add nonwork trips to the work commute and the allocation of nonwork trips through chaining. They found that workers who commuted in peak periods had a lower propensity to form

work/nonwork trips. They also found that certain household types contributed the largest amounts of peak period chaining behavior: single adults; dual-income couples; dual-income families with preschoolers; and multiworker households. These types of households were also the fastest growing type of household formations. Single-occupant commuters had a higher propensity to add nonwork trips to their commute. Trip-chaining analysis lead to the puzzling conclusion that even with the increase of congestion during peak periods, people continue to trip chain. This could indicate an inelastic demand for the activities and/or locations regardless of the time or monetary price to be paid due to congestion.

Downs (9) points out that many nonwork activities are concentrated in the peak commuting periods, as people take children to school or run errands before and after work. According to Gordon et al. (10), between 1977 and 1983, nonwork trips grew faster than commute trips and grew during peak periods. Richardson and Gordon (11) found that the overall growth in nonwork travel accounted for 70 to 75 percent of all weekday trips. They also determined that in every size of SMSA, nonwork travel grew three to four times faster than work trips. Davidson (12) examined the exact nature of trip chains in a study of employees. Her data defined a full work trip as including stops for meals, shopping, and daycare. The study found that the employees were twice as likely to make stops on their way home from work as they were during the morning commute.

In summary, there is evidence that the work trip has increased in complexity. Workers have incorporated activities involving their children, the need to take care of personal and household business into their commute to and from work. The trend toward including non-work trips during periods of peak congestion brings into question the ability of some workers to participate in transportation demand management programs that limit trip chaining options.

GENDER DIFFERENCES

Wachs (13) cites the history of differences between women and men with respect to transportation. Pas (14) found that gender was a significant factor in daily travel-activity behavior. Using the National Personal Transportation Survey (NPTS), Strathman and Dueker (15) found that women are more likely to form complex commute and non-work chains than men. Madden (16) found that women have a shorter commute than men. Using the NPTS surveys of 1977 and 1983-4, Gordon, Kumar, and Richardson (17) confirmed gender differences found by earlier researchers. They found that the growth of trip-making was greater in females than males, reaching 46 percent for married nonworking wives without children and 32 percent for married nonworking mothers. They rejected the "agenda-driven" explanations for differences in gender travel behavior. Holding other variables constant, they found that women make shorter commute trips and make more nonwork trips. They conclude that time is a scarce resource and that a comprehensive utility maximization model would allocate time as well as income. Thus, shorter commute trips are a result of the incentive to economize on that trip, given the need to make more nonwork trips.

Rosenbloom (18) and Rosenbloom and Burns (19), using the NPTS and numerous local studies, report that women make interconnected travel decisions involving employment and child care locations. Fox (20) looked at the characteristics of travel for working women as well. Gordon, Liao, and Richardson (21), using the 1990 NPTS data, found that in two-worker households, while the majority of the shorter commutes were made by women, men actually made 41 percent of the shorter trips.

Pazy et al. (22), recognizing the changing status of women's careers and the influence this change has on their commuting patterns, found that in their sample, single women made shorter commutes than married women and had shorter commute times. They attributed this to the increased residential mobility of single women. Single women were more likely to live in the central city, while married women were located in the suburbs. Using the NPTS data, Turner and Niemeier (23) found that marriage tended to reduce women's commute times. They also found that having children increased commute distances and times in certain household structures.

Hamed and Mannering (24) found that males were more likely to go directly home after work than females. They cited the role of females and the activities they pursue (e.g., shopping, personal business and recreation) as reasons for this difference. Golob and McNally (25), using a sub-sample of activity data, found a number of significant differences between men and women in their travel times for various purposes. Bhat (26) found that married women were more likely to make stops in their commute than married men. Niemeier and Morita (27) found that women were 1.32 times more likely than men to spend more time shopping.

It should be noted that according to Perry (28), women have a greater propensity to choose part-time employment after the birth of their first child. In addition, the longer the time spent away from employment, the greater the likelihood that when work resumes, it will be part-time rather than full-time. Therefore, transportation patterns related to part-time work will have a greater impact on women.

In summary, although there appears to be some contradictions in the exact nature of the differences in travel behavior between men and women, researchers believe these differences do exist. To the extent that these differences increase or decrease the effectiveness of transportation policies and programs, it is important to better understand the particular circumstances under which men and women make travel decisions.

THE CHILDCARE FACTOR

Using formal daycare outside of the home is an important component in women's work schedule. Caruso (29) looked at three subgroups of daycare options for mothers with two-year-olds (family setting, informal care and formal care). She found that the average number of hours worked for mothers using formal care was significantly greater than when mothers used informal care settings. Formal daycare often has fixed hours, and Presser (30) cites a study indicating that a flexible work schedule is not a solution for women workers when childcare continues to have fixed or limited hours. This situation adds to the stress a woman might feel with respect to balancing childcare and work.

Neal et al. (31) found in their sample of employees that two thirds of all families with children under the age of 18 used some form of out-of-home child care arrangements or activity other than school. In their model, extra travel time for child care had a positive effect on whether an employee was late or left early from work and on interruptions. Extra travel time also increased "caregiving stress" and "difficulty combining work and family."

Presser (32) found a relationship between the type of daycare used and the time of work (regular hours or shift-work). The type of childcare arrangement when mothers work may be both the cause and effect of shift-work status. The use of relatives as the primary caregivers is substantially greater when mothers work nonday rather than day shifts.

Johnson (33) looked at the child's need for transportation to an activity or to home during work hours as an indicator of conflict between employment and childcare for single mothers. Davidson (12) found that among a sample of employees in Brentwood, Tennessee, ten percent of the trips incorporated into the morning commute were related to childcare arrangements, with an additional ten percent attributed to taking older children to school. In the evening commute, more commuters stopped to pick up children from daycare than from school.

For most working parents with young children, at least one of the adults in the household must take the children to daycare before work and pick them up after work. The hours of operation of daycare facilities limit the options parents have and increase the need for parents to make their childcare trip during peak periods.

WOMEN AND SAFETY

SAFETY RELATED TO ENVIRONMENT

The perception of whether or not an environment is safe plays a large part in how people act and react. Klondasky and Lundy (34) found that women limited their activities on a university campus based on fears. Almost two thirds of academic and student women restricted their movements, while less than one half of the support staff did so. They noted that staff have daytime obligations only, while faculty and students have both daytime and nighttime classes. An even greater proportion of female academics (66 percent) and graduate students (68 percent) were concerned about personal safety than urban women (56 percent) about walking in their own neighborhoods at night. Only undergraduate men were as concerned as urban men (18 percent) while 4 percent of male faculty and 8 percent of graduate students restricted movement due to fear.

Among women students and faculty, age rather than academic status explained differences. Older students were more likely to curtail activity, whereas younger faculty were more cautious. Older women are more likely to take night classes while younger, junior women faculty are more likely to teach night classes.

Transit and Safety

Levine and Wachs (35) point out that nonusers of transit have greater fears than users. They also found that in Los Angeles, in their sample, women were more likely to be victimized than men. Even after controlling for the fact that more women ride the bus than men, the researchers found that women were still more likely to be victimized.

Ingalls et al. (36) found that perceptions of and experience with "problems" around buses did not differ by gender in their survey conducted in Greensboro, North Carolina. The differences in perception were between respondents to their survey who were nonriding residents and those who were bus

riders. Residents were three to four times more likely than riders to perceive that more problems existed on or near buses. Some problems, such as obscene language and drunkenness, had the same response from these two groups. Between 24 and 32.4 percent of the residents felt unsafe in transit waiting areas. More than 40 percent of residents felt unsafe in the downtown bus service areas. Only 6 to 7 percent of riders felt unsafe downtown. Women expressed greater concern than men (15 to 20 percent more than average) for personal safety. However, residents expressed two to five times more concern about personal safety using the bus than riders. The researchers also found that women expressed greater precautionary behavior than men. This was particularly true with respect to traveling alone or after dark.

Benjamin et al. (37) reaffirmed differences between users and nonusers of transit. From a sample of the general public, the situations most frequently perceived as unsafe were waiting for a bus downtown (46.8 percent), waiting at a bus stop downtown (47.7 percent), walking downtown (40.1 percent), walking in a park (37.3 percent) and transferring at a proposed bus terminal (44.4 percent). By contrast, 90 percent of bus users felt safe waiting at a bus stop downtown, walking downtown and transferring.

Lynch and Atkins (38) stated that apprehension or fear affects the travel behavior of women. In their Southampton study, women were asked about safety at bus stops. Sixteen percent of those surveyed felt unsafe by day and 35 percent at night. The authors conclude that women will avoid putting themselves into what they consider to be vulnerable situations, sometimes forgoing travel all together.

Pearlstein and Wachs (39) point out that although most crimes on transit are committed during peak ridership hours, the rates of occurrence are disproportionately high during the evening hours. Levine and Wachs (40) found that determining the real level of crime is difficult due to factors that result in under- and overestimation of transit crimes. Crimes committed at waiting areas may not be reported as transit crimes. In their study they found that 46 percent of transit crime occurred on a bus, 32 percent occurred at the bus stop, and the rest were on the way to or from the bus stop.

Sinha and Forrest (41) found in their Milwaukee, Wisconsin survey that personal safety was less of a concern to passengers than certain service characteristics. Given this, they speculated that increasing security would not be expected to lead to an increase in ridership. They also found that experiences with on-bus crimes did not impact usage in the long run, but did have some effect immediately after an incident. They looked at beliefs about personal safety by sex and found no significant differences. However, a greater percentage of men thought that security on the bus was poor. They found that response rates differed by zones, which had very different socioeconomic characteristics. However, there was a significant difference by age, with younger riders being more likely than older riders to think that bus security was satisfactory. In general, the preference not to ride the bus after dark was driven by fear of going to and from the bus rather than crime on the bus.

Although some of the research on safety as it relates to transit ridership points towards experience on transit as a major predictor, women do face the threat of violence while going to and from a transit stop or to a parking space. A self-selection bias may also play a part in determining the difference between those that use transit and those who perceive the risk as being too great.

UNIVERSITY TRANSPORTATION

As “special generators” of trips, universities have been studied to better understand the effects of various transportation programs (Burns 42; Golob 43; Williams and Petrait 44; Coontz 45). Pearlstein (46) found through a cross-tabulation of mode by gender that the percentage of those who drove alone to work at the University of California, Los Angeles, followed the split in the general population. Of the women surveyed, 14 percent used carpool, 10 percent used transit, but a higher than average, 74 percent drove alone. The author claimed that this was a statistically significant difference from men, 72 percent of whom drove alone, 12 percent carpooled and only 8 percent used transit.

Rosenbloom and Burns (47) studied employees at the University of Arizona in Tucson, and Arizona State University in Tempe, for differences by sex and income. Over 65 percent of the workers at UA and 75 percent at ASU drove alone to work in 1991, an increase from 60 percent and 74 percent, respectively in 1990. Women were more likely than men to drive alone, and fewer women switched *to* alternative modes and more women switched *from* alternative modes. Women also had longer commutes in terms of distance than men. Women spent more time commuting due to the longer distance. However, even when distance was compared with time, women took longer to travel comparable distances. This was explained as a result of women's work trip being combined with other domestic or childcare responsibilities. Women with children were more likely to drive alone than childless women of comparable incomes. Rosenbloom and Burns found that the more children a woman has, and the younger the children, the more likely she is to drive to work, regardless of income level.

In summary, women in a university setting, either as students or as faculty or staff, face transportation constraints. Universities have been viewed as “special generators” of peak period congestion. As a major employer and land holder with the authority to mandate transportation programs, universities have instituted transportation demand management programs that place further constraints on transportation options.

THE REGIONWIDE SAMPLE

Methodology

The regionwide analysis used for this study employs two days of regional activity data collected in 1994 from 4,400 households by Metro, a regional governmental agency in the Portland, Oregon metropolitan area. The 1994 Activity and Travel Survey was collected in the form of a detailed diary that recorded what each member in a household did (activity choice), where (location choice), for how long (activity duration), and with whom (activity participation). There were nineteen categories of activities (see Appendix A) in the original data set. This data could not be used as the level of detail resulted in too many sparse cells to conduct an analysis. Golob and McNally (25) aggregated the highly specific activities into broad activity types (work, maintenance, and discretionary). A more recent aggregation developed by the Portland Metro Congestion Pricing Project (48) reclassified the data such that work was combined with school activities and meals were considered discretionary. A third set of categories (limited aggregation) combines these approaches in order to disaggregate maintenance activities to allow a closer examination of gender differences with respect to peak

period participation.

In order to determine the need for travel, the data was sorted by in-the-home and out-of-the-home activities. To capture trips that occurred in the morning and evening peaks, the out-of-home activities were further sorted in to those occurring between 7:00 and 9:00 A.M. (morning peak) and those occurring between 4:00 and 6:00 P.M. (evening peak). Only those persons 17 years of age or older were used. Cross-tabulations with chi-square statistical analysis were performed based on gender. In addition, those who were employed full-time and those employed part-time were analyzed for this study. An analysis was conducted on a small subset of the sample who were adult students. It was not possible in this study to establish whether the students were attending an urban or a suburban campus.

FINDINGS

Mode of Travel

Respondents reported the number of days they used each mode of travel. The majority of travelers used single occupant vehicle (SOV), with no significant difference ($c^2 = 9.8$, 5, $p > .05$) between genders for the general sample. For full-time workers, there is a significant difference ($c^2 = 11.29$, 5, $p < .05$), with men being more likely to drive than females. However, among part-time workers, women are more likely to drive than men ($c^2 = 12.9$, 5, $p < .05$).

There was no significant difference between women and men among those who choose carpooling ($c^2 = 10.63$, 5, $p > .05$). Among full-time workers, women are more likely than men to use carpooling ($c^2 = 13.45$, 5, $p < .05$). However, for part-time workers, there are so few of either sex that the data could not be analyzed.

In the general sample, women are more likely than men to use transit ($c^2 = 16.28$, 5, $p < .05$). This is also true for full-time workers ($c^2 = 22.4$, 5, $p < .005$). Other modes, such as walking or bikes, are more likely to be used by men than women in the general sample and among full-time workers ($c^2 = 9.8$, 5, $p < .05$). Part-time workers had too few users to be analyzed for either transit or other modes.

Activity Choice during Peak Hours

Using the three major classifications of activities (work/school, maintenance, and discretionary), there are significant differences between men and women in the general sample ($c^2 = 311.83$, 3, $p < .0001$), with men being more likely to go to work or school and women more likely to do maintenance activities in the morning peak. For full-time workers, women are more likely to do maintenance activities, while men are more likely to do discretionary activities ($c^2 = 34$, 3, $p < .0001$). For part-time workers, women are twice as likely to do maintenance activities than men ($c^2 = 30.25$, 3, $p < .0001$).

In the evening peak, for the general sample, women are more likely to do maintenance activities ($c^2 = 139$, 3, $p < .0001$). For full-time workers, women are more likely to be doing maintenance activities ($c^2 = 88.5$, 5, $p < .0001$). For part-time workers, women are twice as likely to do maintenance than men ($c^2 = 28$, 3, $p < .0001$).

To better understand the exact nature of activities in the peak, a limited aggregation data, using

eleven categories, was analyzed. In the morning peak for the general sample, women are twice as likely to do household maintenance activities and to pickup or drop off a passenger ($c^2 = 411, 11, p < .0001$). For full-time workers, women are still more likely to do maintenance and pickup/drop off activities ($c^2 = 58, 11, p < .0001$). For part-time workers, the same situation occurred ($c^2 = 52, 11, p < .0001$).

In the evening peak, for the general sample, women are more likely to shop, do household maintenance activities and pickup or drop off than men ($c^2 = 243, 11, p < .0001$). For full-time workers, the same pattern occurs ($c^2 = 132, 11, p < .0001$). For part-time workers, women are more likely to shop and three times more likely to do pickup and drop-offs ($c^2 = 61, 11, p < .0001$).

For adult students, both part-time and full-time in the general sample, using the three categories of activities, women are twice as likely to do maintenance activities in the morning peak ($c^2 = 31, 3, p < .0001$). However, there is no significant difference between women and men in the evening peak ($c^2 = 7.12, 3, p > .05$). For part-time and full-time adult students who also worked full- or part-time, women are twice as likely to do household maintenance activities in the morning peak ($c^2 = 11, 3, p < .05$). Again, there is no significant difference between women and men in the evening peak ($c^2 = 1.4, 3, p > .05$).

THE UNIVERSITY SAMPLE

Methodology

The dataset used for this analysis was derived from a travel survey sent out to a random sample of 1600 students and 530 faculty and staff at Portland State University. The names were randomly selected through a computer by using social security numbers. Both full- and part-time students were included; the only restriction was that the student's current Zipcode be in Washington or Oregon. Students were drawn from the fourth-week enrollment list for fall term 1989. The staff and faculty were regularly employed, normal-status employees, both full- and part-time, and, again, Zipcodes were limited to Washington and Oregon.

A total of 963 surveys were returned, representing an overall return rate of 45 percent. The response rate for students (540/1600) was 34 percent; for faculty, it was 43 percent (230/530). Of the 963 surveys, 770 were coded and included in the analysis. The data were analyzed with spreadsheet and statistical packages, and descriptive procedures including means, cross-tabulations, and chi-square were run. Faculty, staff, and students were first analyzed together, and then faculty/staff were analyzed separately. When results for faculty/staff differ from those for the larger sample, these results are noted.

FINDINGS

Mode of Travel

Respondents were asked to identify their primary and secondary modes of travel for all trips and, not surprisingly, a large majority of both women and men indicated that their primary mode was single occupancy vehicle. For students, there was no significant difference between the two genders with respect to the primary mode of travel. There was, however, a significant difference among faculty and staff, with women being more likely to drive and men being more likely to take transit ($c^2=11.10, 6, p < .10$).¹ There was also a significant gender difference ($c^2=12.12, 7, p < .10$) among both

students and faculty-staff in secondary mode of travel, with men being more likely to indicate SOV and walking and women being more likely to indicate transit and carpool. When asked specifically about their trip to Portland State, women and men were equally likely to drive alone.

Trip Chaining

Respondents were asked if they made any stops on their way to and from Portland State; they were also asked if they left campus to perform any activity during the day. Both women and men were equally as likely to perform any additional activities either before arriving at Portland State or during the middle of the day. However, of those activities performed before arriving at Portland State, women were much more likely to drop a child off at school or daycare ($\chi^2=12.75$, 1, $p < .001$), shop or perform errands such as banking ($\chi^2=4.37$, 1, $p < .05$), or keep appointments ($\chi^2=4.38$, 1, $p < .05$). Men were more likely to go to a job ($\chi^2=8.07$, 1, $p < .01$). Men and women were equally as likely to engage in these activities during the middle of the day. When faculty-staff were singled out, however, these differences between genders in activities prior to coming to Portland State did not exist.

Unlike the trip to Portland State, the trip *from* Portland State showed a significant difference in women's and men's likelihood to perform some additional activity, with women being more likely to do so than men ($\chi^2=12.63$, 1, $p < .001$). Again, women were more likely to drop off or pick up a child from daycare or school ($\chi^2=5.58$, 1, $p < .05$). These results regarding the activities after PSU appear to be at odds with the regionwide analysis, which showed no significant difference among students in evening peak activities. One likely explanation is that the post-PSU activities are occurring at times other than the evening peak, between noon and 4 p.m. or after 8 p.m., for instance. Another likely explanation is that the regionwide analysis looked at *all* students within the region, not just those at PSU, which, as an urban university serving older students, may exhibit more differential.

Among PSU faculty-staff, there was a no significant difference between the genders with respect to picking up or dropping off a child, although, as stated above, there was a difference with respect to making *some* additional stop after PSU. On the other hand, there was a significant difference between male and female faculty-staff for the activity of picking up or dropping off someone other than a child ($\chi^2=4.40$, 1, $p < .05$), with men being more likely to pick up or drop off someone. This finding is also somewhat at odds with the regional analysis, which revealed women to be more likely than men to pick up or drop off someone else (whether or not the passenger was a child was not indicated). Again, the difference between the university results and the regionwide results may be due to the time of day for the post-PSU activity. It also may be due to the differences in lifestyle among members of a university community versus members of the general population.

In general, though, these findings, as well as those of the regionwide analysis, suggest that women—particularly students—rely on the automobile for childcare and household maintenance purposes. That women need automobiles for childcare was addressed directly with a question asking the university respondents if they were the primary caregiver of a dependent. Women were more likely than men to indicate that they were ($\chi^2=12.23$, 1, $p < .001$). There was no significant difference, however, when faculty-staff were singled out for analysis. All of those who indicated they were primary caregivers were also asked if they were responsible for most of the dependent's transportation, and women—both students and faculty-staff—were more likely than men to indicate that they were ($\chi^2=9.33$, 1, $p < .01$).

The findings also suggest that male students rely on the automobile for the worktrip, as is revealed also in the regionwide analysis. Men are more likely than women to be both full-time students and full-time

employees, although women are more likely to be both part-time students and part-time employees or to be part-time one and full-time the other ($\chi^2=15.52$, 4, $p < .01$).

Mode-Switching under Constraints

In an effort to gauge how members of the university community might respond to decreased parking availability either through pricing or regulation, respondents were asked what they would do if they could no longer park at or near the PSU campus. Of those who drive to PSU, the majority do park at or near the campus, with no significant difference between the two genders. If, by pricing or regulation, they could no longer park where they currently do, women were more likely than men to indicate that they would switch to carpooling ($\chi^2=3.73$, 1, $p < .10$), while men were more likely to indicate that they would park on-street, farther away from campus ($\chi^2=2.87$, 1, $p < .10$). This may reflect men's greater willingness to walk, as well as ability to pay somewhat more for parking. These differences were not significant, however, when faculty-staff were singled out.

Respondents were also asked what they would do if they did not have access to a car. Women were more likely than men to indicate that they would get a ride from someone else ($\chi^2=3.5$, 1, $p < .10$). Female faculty-staff, though, were not any more likely than male faculty-staff to indicate this option. This is in line with their response to the question about parking, which suggested female students, but not faculty-staff, would switch to carpooling; it is also in line with their stated secondary mode of travel.

Transit Use

The respondents who drove and parked at Portland State were asked to rank their top three reasons for not using transit for the trip to PSU. There was a significant difference between men and women for the Number 1 and 2 reasons. As their Number 1 reason, men were more likely than women to indicate that transit is too time consuming and that the auto is more pleasant than mass transit; women were more likely to indicate that they prefer the safety and security of the automobile and that they have several stops besides PSU ($\chi^2=32.64$, 11, $p < .001$). The Number 2 reasons cited showed the same trend, with men citing the additional reason that transit scheduling is too infrequent and women adding that they have too much to carry ($\chi^2=19.03$, 10, $p < .05$). These differences did not appear when faculty-staff were singled out, however.

Whether or not they used mass transit or drove and parked, all respondents were asked to rank the three most unpleasant characteristics about mass transit. Women were more likely to indicate bus exhaust, feeling unsafe on the bus, and finding other riders to be sometimes offensive as the most unpleasant characteristic, while men indicated that the scheduled frequency is too inconvenient ($\chi^2=18.64$, 12, $p < .10$). Again, these differences did not pertain to faculty-staff when singled out for analysis.

Security and Safety

As noted, women are more likely to cite safety concerns as one of their negative perceptions about mass transit or a reason why they don't use transit. Respondents in this study were also asked to evaluate certain aspects about the provision of parking both on and off campus, and, again, women were more likely to single out issues related to safety.

When asked to rate their satisfaction with the lighting and safety of structured parking on campus, women were more likely than men to indicate that they were either unsatisfied or very unsatisfied ($\chi^2=10.62$, 4, $p < .05$). When asked about their satisfaction with the safety of the walk to and from parking, women were even more likely to indicate some level of dissatisfaction ($\chi^2=27.36$, 4, $p < .0001$). Female faculty-staff did not indicate a greater likelihood than their male counterparts to indicate dissatisfaction with lighting and safety, although they did indicate such a proclivity with respect to the safety of the walk.

Slightly over a quarter of all respondents who drive to Portland State park off campus. These respondents were asked about off-campus parking, as well. Only a handful are faculty-staff, so the findings pertain primarily to students. Women were more likely than men to report paying 50 cents or more per hour, while men reported paying less than 50 cents or nothing ($\chi^2=6.82$, 3, $p < .10$). This finding may be related to men's willingness to walk, thus suggesting they are willing to park at quite a distance from campus and then walk. Women, perhaps because of concerns related to safety and/or having too much to carry, are less willing to walk long distances.

As with on-campus parking, women were more likely than men to express dissatisfaction with the lighting, safety, and security of the off-campus parking location ($\chi^2=23.5$, 4, $p < .001$). They were also much more likely to express dissatisfaction with the safety of the walk to and from off-campus parking ($\chi^2=32.93$, 4, $p < .00001$).

CONCLUSIONS

The results of this study suggest that women are more dependent on the automobile than men because of their responsibilities related to childcare and household maintenance and because of their concerns about safety. The differences appear more marked among university students than among university faculty and staff or among members of the population in general. Men are more dependent on the automobile for their trip to work because they find it more enjoyable and less time consuming than alternative modes. Women's dependency on the automobile appears stronger because they are more willing to use or consider using carpooling as an alternative to the drive-alone mode.

Men's valuation of the automobile may be related to the higher value that is placed on their time. The work men do, for which they need an automobile, is more likely to be compensated monetarily (as a job outside the home), while the work women do is less likely to be compensated monetarily (as caregiving or household work). In addition, men generally earn more than women. The analysis of the university sample used for this study showed a significant difference between the income categories of men and women, with men being more likely than women to be in the upper-income categories ($\chi^2=13.26$, 6, $p < .05$). The difference is even

more marked for faculty-staff ($\chi^2=17.62, 6, p < .01$). This is not surprising, given that, of the faculty and staff, 73 percent of the men and 33 percent of the women were full-time faculty, while 46 percent of the women and 18 percent of the men were full-time staff. There is no evidence that men are any "busier" than women, only that there is a higher value placed on both their leisure and nonleisure time.

The transportation patterns of part-time workers indicate that women are more likely to need their car. The opportunities for part-time workers to use carpooling, transit or other modes is extremely limited. In addition, there is evidence that women are more likely to choose part-time work under a variety of circumstances, including after the birth of their first child. Part-time women workers do a larger share of the pick-up and drop off activities in the evening peak. The overall trend in the economy towards part-time rather than full-time work would indicate an increase in these travel patterns.

POLICY IMPLICATIONS

Many of the policies currently being considered by planners and policy-makers involve transportation demand management (TDM) strategies that include pricing or strictly regulating automobile travel either directly via a road toll or indirectly via parking programs. The findings in this study suggest that, if implemented, such strategies may be more burdensome on women than on men. A policy that imposes a price on travel, for instance, will be harder for women to bear because they are more likely to be in the lower incomes. Yet, because of their childcare and household responsibilities, women's dependency on the automobile is so great that they will consider an alternative (carpooling) that men are less likely to consider. Men appear to be more likely to pay a higher price or to be inconvenienced in terms of distance from a destination—for example, they are more willing to park at a distance and walk to their destination—but women are disinclined to consider these options because (1) they cannot afford to pay the higher price and (2) they are unwilling, because of safety concerns, to substitute walking for automobile travel.

Men find automobile travel more pleasant and less time consuming than alternative modes, but these are not as compelling reasons to justify their continued use of automobiles as are women's stated reasons of trip-chaining needs—particularly childcare—and safety.

Thus, policies that seek to limit automobile use must either take into consideration women's special needs or compensate women for the disproportionate burden they might bear if such policies were put into place. Because it is very difficult to target and compensate policy losers—whether women or men—policies that price or otherwise restrict travel should be complemented by strategies that enhance safety and either eliminate the need for trip chains or make them easier.

TDM programs at large employers such as universities are particularly suited for implementation of such complementary programs. Onsite daycare and schooling facilities would greatly ease women's responsibility for transportation of children. In fact, Portland State University recently joined in a partnership with the local public school system and the providers of housing on campus to determine the feasibility of an "urban grammar school," located on the PSU campus, with five stories of "family-style" housing on the top floors. To begin the project, PSU surveyed its staff, faculty and students about their potential use of such a school. Sixty-one percent of all students surveyed and 22.1 percent of all faculty and staff surveyed reported being "very" or "somewhat" interested in seeing the grammar school erected. Of the students who have children under 12 years of age, 64.9 percent expressed a similar interest; of faculty/staff with children under 12 years of age, 58.2 percent expressed a similar interest.

Onsite banking, post office, and grocery shopping would also ease women's (and men's) responsibility for some of the most common household maintenance tasks requiring an automobile. Improved lighting and preferential close-proximity parking for carpoolers would begin to address some of women's concerns about safety. All of these programs are expensive, however, and would require subsidy from some source—ideally, higher priced parking for SOV commuters.

Although subsidizing complementary programs to compensate potential policy losers can enhance the equity of many transportation policies presently under consideration, such programs must not be thought of as a panacea. Any programs put into place should be evaluated carefully on an ongoing basis to make sure that necessary trips are not being foregone, that children are not being left unattended, and that women's safety concerns are not increasing.

The results of this study point towards the need for the research community to better identify the various characteristics of household structure (gender roles, household size, ages of children, etc.) and employment status with respect to travel behavior. Without this additional information, policy makers will continue to have unrealistic expectations for transportation policies and programs, especially with respect to the travel patterns of women.

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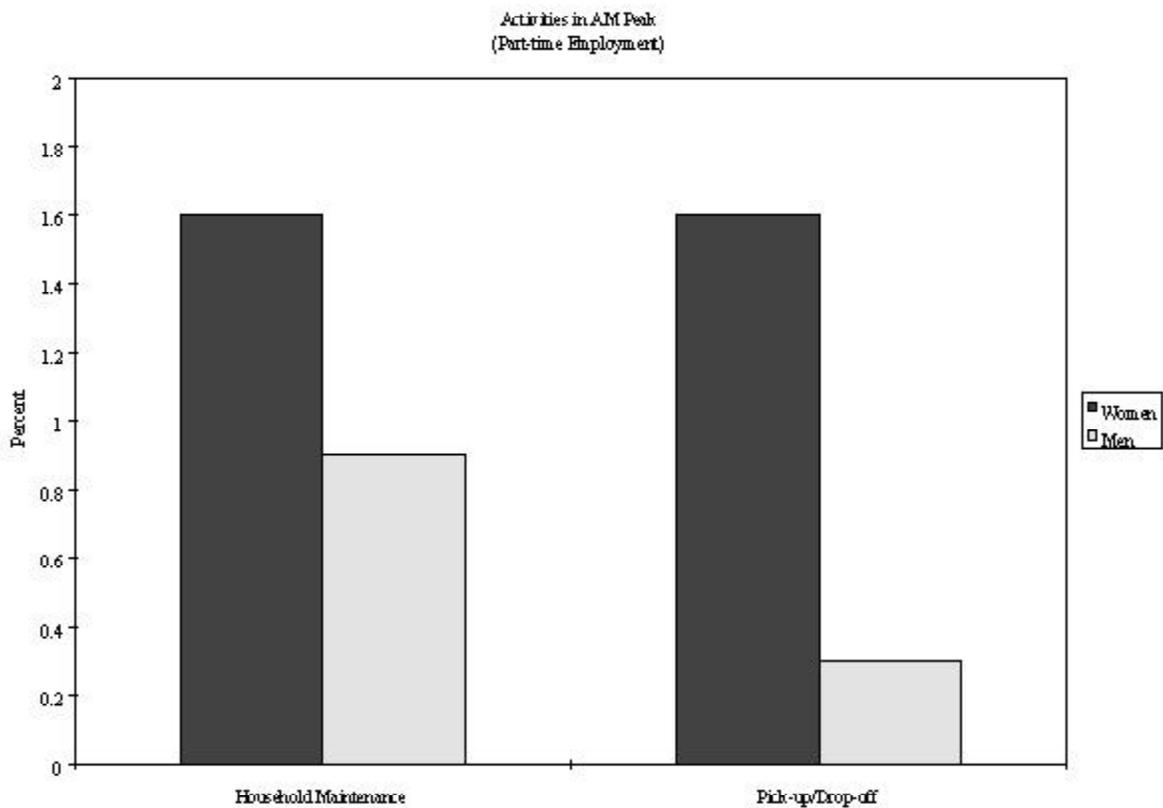
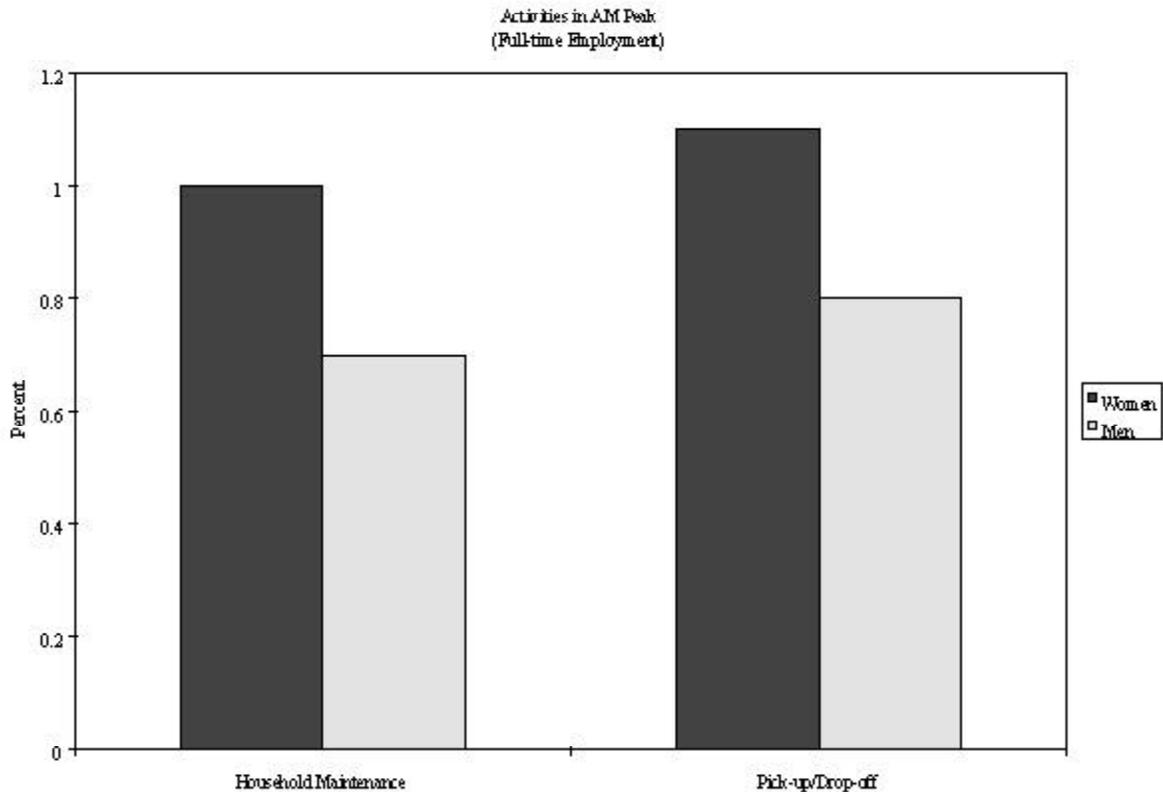
Appendix A

Activity Data Classifications Metro 1994 Analysis

Description of Activities	Aggregate Activities	Limited Aggregation
Meals	Discretionary	Meals
Work	Work/School	Work
Work-related	Work/School	Work
Shopping (general)	Maintenance activity	Shopping
Shopping (major)	Maintenance activity	Shopping
Personal Services	Maintenance activity	Personal Services
Medical care	Maintenance activity	Personal Services
Professional services	Maintenance activity	Professional services
Household/personal business	Maintenance activity	Household/personal business
Household maintenance	Maintenance activity	Household maintenance
Household obligation	Maintenance activity	Household obligation
Pick-up/drop-off passenger	Maintenance activity	Pick-up/drop-off passenger
Visiting	Discretionary activity	Discretionary activity
Casual Entertaining	Discretionary activity	Discretionary activity
Formal Entertaining	Discretionary activity	Discretionary activity
School	Work/School	School
Culture	Discretionary activity	Discretionary activity
Religion/Civil Service	Discretionary activity	Discretionary activity
Civic	Discretionary activity	Discretionary activity
Amusements (at home)	Discretionary activity	Discretionary activity
Amusements (away from home)	Discretionary activity	Discretionary activity
Hobbies	Discretionary activity	Discretionary activity
Exercise/Athletic Activity	Discretionary activity	Discretionary activity
Rest & Relaxation	Discretionary activity	Discretionary activity
Spectator Athletic Event	Discretionary activity	Discretionary activity
Incidental trip	Discretionary activity	Discretionary activity
Tag along trip	Discretionary activity	Discretionary activity

¹The faculty-staff sample size (207) was insufficient to prevent sparse observations in all cells of the chi-square analysis; thus, this finding may be suspect, although it confirms previous work (Rosenbloom and Burns, 1993).

Appendix B
 Figures of Activity in AM and PM Peak



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