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# Drivers with Low Vision: Characteristics and Transportation Issues

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**Abstract**

*Introduction:* This study provides descriptive information about low vision drivers and transportation issues, including their self-imposed driving restrictions.

*Methods:* An electronic survey administered online in late 2013/early 2014, obtained data from 592 adults with visual impairments. Of the 592 respondents, 17 had a valid driver's license. These 17 respondents provided information about their employment, activity limitations, public transportation use, services received, and transportation self-efficacy.

*Results:* Approximately half of the low vision drivers were employed. Most drivers had not received vocational rehabilitation (VR) or O&M services. Most drivers limited their night driving and over 70% noted that transportation problems limited their participation in entertainment or leisure activities. Most drivers had access to public transportation, but did not frequently use it. Drivers were generally confident in their ability to perform transportation-related tasks, though overall, bioptic drivers tended to be more confident. Drivers who did not use bioptic devices were least confident in arranging a fair price for daily transportation to work with a driver.

*Discussion:* Drivers with low vision who limit their activities and employment due to transportation issues may not be receiving the VR or O&M services that could help them compensate for these limitations. Further research examining the behaviors and service needs of low vision drivers is indicated, particularly for younger drivers. Study limitations include the small sample size, non-probability sampling method, and electronic data collection.

*Implications for Practitioners:* Low vision drivers may benefit from evaluation by O&M specialists and VR providers to determine if additional services are needed. Persons with low vision should be informed about evaluation for bioptic devices and VR providers should network

with bioptic providers and other professionals to obtain referrals of persons with low vision who are not yet VR recipients.

## Drivers with Low Vision: Characteristics and Transportation Issues

Practical obstacles are encountered and emotional difficulty experienced when a person with low vision gives up a driver's license (Rosenblum & Corn, 2002b) or is unable to get one (Corn & Sacks, 1994). Because driving is a largely visual task, many people with visual impairments stop driving for fear of causing an accident or injury to themselves or others (Justiss, 2013; Rosenblum & Corn, 2002a). However, an undefined number of persons with low vision do continue to drive. This study examines transportation issues and characteristics of drivers with low vision from a national transportation survey of persons who are blind or have low vision, including both persons who sustained vision loss before and after obtaining a driver's license.

## Low Vision Driving

In western culture, obtaining a driver's license is regarded as a major step toward personal independence and an important developmental milestone (Corn & Sacks, 1994; Huss & Corn, 2004; Rosenblum & Corn, 2002a). The ability to drive typically allows one to travel independently, thus expanding opportunities for social interaction and employment. Young people are eager to achieve this independence and once acquired, most are reluctant to surrender it (Sacks & Rosenblum, 2006). When one loses the ability to drive, depression and isolation can become more prevalent (DeCarlo, Scilley, Wells, & Owsley, 2003).

Because driving is regarded as an essential activity of daily life, vision rehabilitation providers seek to assist persons with low vision in gaining or retaining their ability to drive (DeCarlo et al., 2003). Increased knowledge and research regarding the role and use of bioptic telescopes for driving has allowed more drivers, both young and old, the opportunity to drive or to continue to drive (DeCarlo et al., 2003; Huss & Corn, 2004; Vincent, Lachance, & Deaudelin,

2012). However, of the 42 states that allow bioptic driving (International Academy of Low Vision Specialists, n.d.), some issue restricted driver's licenses to persons using bioptics (Huss & Corn, 2004; Owsley & McGwin, 2010) or require bioptic users to participate in mandatory bioptic driving training programs (Owsley & McGwin, 2010). Further, bioptics are not feasible for persons with severe loss of visual acuity or restricted visual field, thus limiting the number of persons able to use them to drive; each potential bioptic user should participate in an individualized assessment to determine if a bioptic device will be effective for driving (Owsley & McGwin, 2010).

Research about low vision drivers tends to focus on safety issues or driving behaviors (Elgin et al., 2010; McGwin et al., 2004; McGwin et al., 2005; Vincent et al., 2012; Wood et al., 2009; & Wood et al., 2011), and driving rehabilitation programs (Justiss, 2013; Strong, Jutai, Russell-Minda, & Evans, 2008). For example, many drivers with low vision, whether they use a bioptic or not, self-impose restrictions on their driving, such as avoiding driving at night or in hazardous weather (DeCarlo et al., 2003; Rosenblum & Corn, 2002a). Much less literature examines social and rehabilitation issues associated with driving with low vision.

Professionals outside of the blindness rehabilitation field are giving some attention to drivers with low vision as a part of their overall service delivery. The American Occupational Therapy Association (AOTA) regards driving and community mobility issues among persons of all ages as within their professional purview and occupational therapists (OT) provide assistance transitioning from driving to reliance on other transportation options; some OTs specialize in driver rehabilitation (AOTA, 2016). A fairly recent review of occupational therapy literature concerning driving among older persons with low vision found that simulated driver training

programs were effective in improving driving performance but the effectiveness of OT training in the use of bioptics to enhance driving safety was not established (Justiss, 2013).

The National Highway Traffic Safety Administration (NHTSA) worked with OTs to develop a resource toolkit about driving and community mobility that is available on the AOTA website (AOTA, 2016). The Association for Driver Rehabilitation Specialists (ADED), an interdisciplinary organization, recommends that driver rehabilitation specialists assess a driver's vision, perception, functional ability, reaction time, and conduct a behind-the-wheel evaluation (ADED, 2015). While neither AOTA nor ADED focus specifically on low vision drivers, both groups emphasize the needs of older drivers and recognize that vision loss typically is associated with aging.

There is a scarcity of information related to social and vocational issues that affect drivers with low vision. Use of vocational rehabilitation (VR) services, receipt of orientation and mobility (O&M) training, the impact of restricted driving on employment, and confidence regarding transportation among low vision drivers remain important areas where further investigation is warranted. Therefore, the purpose of this study is to use data from a national survey to expand the knowledge about this population and to serve as a springboard for identification of issues for further study.

## Method

In a recent national survey regarding transportation and employment issues among persons who are blind or have low vision, we identified 17 persons who had valid driver's licenses and who continued to drive. The survey was conducted by The National Research and Training Center (NRTC) on Blindness and Low Vision at Mississippi State University to assess transportation issues, particularly transportation associated with employment, impacting persons

with visual impairments. The NRTC's national advisory board, which includes both persons with visual impairments and persons with expertise in O&M, assisted in survey development. The survey included logic imbedded in it such that not every question was asked of every respondent. Consequently, persons who said they drove were asked additional questions about their driving behavior that were not asked of other respondents, such as how they might limit their driving activities. After pilot testing with at least ten people with varying levels of vision loss, and subsequent modification, the survey was disseminated via an electronic platform to a national registry maintained by the NRTC. Our university's Institutional Review Board for the Protection of Human Subjects approved the study and informed consent was obtained from each participant. Persons 18 years of age and older were offered a $25 gift card as an incentive to completing the survey. A total of 140 useable surveys were generated, including six drivers.

After analyzing results from completed surveys, revisions were made to eliminate some items and add others. In January and February 2014, the survey was disseminated again through emails to various consumer groups, through our national advisory board members, on our website, and through personal contacts. Participants 18 to 65 years of age who completed the survey were eligible to participate in a drawing for a $100 gift card; six gift cards were awarded. A total of 452 persons completed the second survey administration, including 11 drivers. Further details about survey development and administration can be found in Crudden, McDonnall, and Hierholzer (2015) and Crudden, Cmar, and McDonnall (2017), though these previous studies did not focus on drivers.

For the current study, we extracted variables from the larger survey in the following broad categories: demographics, employment, services received, driving, activity limitations, public transportation, and transportation self-efficacy. Respondents were asked about their

employment status and hours worked per week, and if they had ever received VR and O&M services. Questions about driving included whether or not respondents had a driver's license, a vehicle, and another driver in the household. In addition, respondents were asked if they used a bioptic device for driving and to identify driving problems and restrictions. The survey included a list of items asking drivers to rate their confidence, on a scale from 0 to 10, completing various tasks associated with finding and arranging transportation (i.e., transportation self-efficacy). All respondents, including drivers, were asked if the lack of transportation limited their participation in a provided list of daily activities, to which they could select more than one activity. Respondents were also asked about public transportation availability and use and to identify difficulties experienced with public transportation from a provided list. Descriptive statistics were used to summarize information related to driving and other transportation issues among the drivers with low vision, and some data were examined separately for bioptic and non-bioptic drivers. Data analysis was conducted using SPSS version 23.

## Results

Basic demographic information about the sample ($N$ = 17) is found in Table 1. The mean age of the respondents was 55.45 years ($SD$ = 12.84), with a range of 31 to 81 years. About half (52.9%, $n$ = 9) of the respondents experienced significant vision loss at 28 years of age or older, while 47.1% ($n$ = 8) had significant vision loss before the age of 12. Over half (52.9%, $n$ = 9) said they could read standard-sized print with assistive devices, such as a magnifier or closed-circuit television; 35.3% ($n$ = 6) reported being able to read standard-sized print without assistive devices; and 11.8% ($n$ = 2) reported being unable to read standard-sized print, even with assistive devices.

Of the 17 respondents, all had a valid driver's license, and 58.8% (*n* = 10) owned a car that they or someone else could drive. The majority (70.6%, *n* = 12) of respondents lived with their spouse or other family members, and some lived alone (17.6%, *n* = 3) or did not report their living situation (11.8%, *n* = 2). Almost a third (29.4%, *n* = 5) reported having someone in their household who could drive them to and from work on a regular basis. Six respondents (35.3%) used bioptic devices to drive, ten (58.8%) did not use bioptic devices, and one (5.9%) did not provide a response. The bioptic drivers' age at onset of vision loss ranged from 0 to 65 years of age, and 50% (*n* = 3) indicated that they were legally blind.

Respondents identified several ways in which their visual impairments affected their driving behavior. Fourteen of the 17 respondents (82.4%) reported having a problem driving at night. One person reported having a problem driving during the day, and two respondents reported no problems driving at night or during the day. Most respondents restricted their driving by reducing their driving speed (64.7 %, *n* = 11), limiting the length of time driving (64.7%, *n* = 11), and/or restricting their routes (58.8%, *n* = 10). For a breakdown of driving problems and restrictions of bioptic versus non-bioptic drivers (*n* = 16), see Table 2.

Respondents limited their participation in various activities due to transportation issues. The three activities affected the most were entertainment or leisure activities (70.6%, *n* = 12), visiting family or friends (47.1%, *n* = 8), and shopping that does not include grocery shopping (29.4%, *n* = 5).

About half (52.9%, *n* = 9) of the respondents reported being employed and working an average of 36.5 hours (*SD* = 14.45) per week with a median of 40.0 hours per week. The remainder were unemployed (17.6%, *n* = 3), retired (23.5%, *n* = 4), or doing volunteer work only (5.9%, *n* = 1). Of the unemployed, only one respondent reported actively searching for a job

within the last four weeks. Three of the four retired respondents were bioptic drivers. See Table 2 for more information about the employment status of the bioptic ($n$ = 6) and non-bioptic drivers ($n$ = 10). Three (17.6%) respondents (including one bioptic driver) indicated that they had received services from a state VR agency, and four (23.5%) respondents (including three bioptic drivers) received O&M training since experiencing vision loss. Only one person reported using a white cane and another used a global positioning system application.

Fourteen (82.4%) of the respondents said public transportation was available in their area; however, only six of the 14 reported using available public transportation. Of those six, three said that they most frequently used fixed route buses. Public transportation was most frequently used for work, recreation, shopping (including grocery and other shopping), and medical appointments. When public transportation was available, both users and nonusers identified difficulties with it, such as the route being too long or having poor shelter from weather, followed by unreliability, bus stops or stations not being near their homes or destinations, drivers who did not call out stops, and long wait times.

Table 3 includes means and standard deviations for the individual transportation self-efficacy items. Of the 17 respondents, 15 provided information about bioptic use and self-efficacy. The group mean was highest for ability to ride a bus or shuttle ($M$ = 8.27, $SD$ = 2.79). Bioptic drivers tended to be more confident than non-bioptic drivers in their ability to arrange a fair price for daily transportation to and from work with a driver and their ability to find transportation to and from work with a coworker.

## Discussion

In this study, we explored transportation issues among drivers with low vision who participated in a national transportation survey. Because persons who sustain significant vision

loss tend to stop driving and many persons with early onset visual impairment do not get a driver's license, the expected number of respondents who said they drive was understandably low, only 17 persons from a total pool of 592 respondents. As we would expect, drivers had considerable residual vision. The number who had less severe visual impairments was approximately three times larger than the number of persons who were legally blind, and the majority (88.2%, $n = 15$) could read standard-sized print with or without assistive devices. The age at which the drivers experienced their significant vision loss was fairly evenly divided between those who lost their vision before age 12 and those who lost it after age 28, indicating that some retained their driver's licenses after vision loss and others obtained their licenses after initial loss of vision.

Only six drivers reported using bioptic devices. Because there are no national databases tracking drivers using these devices, we cannot determine if this number is more or less than expected. The number of states that allow bioptic driving has increased to 42 (International Academy of Low Vision Specialists, n.d.) from 35 in 2010 (Owsley & McGwin, 2010) and some O&M specialists believe that bioptics are underutilized (Crudden, 2015). Consequently, these numbers suggest the potential that increased numbers of persons with low vision might retain or obtain the ability to drive if evaluated for and trained in the proper use of bioptic devices.

Similar to previous research indicating that drivers with low vision self-regulate their driving behavior (DeCarlo et al., 2003), most drivers in this study restricted their driving, usually by avoiding driving at night. Drivers also reported that transportation limited their participation in some activities, with the most frequently limited activities being entertainment or leisure activities and visiting family or friends. Many opportunities for social activities, such as entertainment/leisure and visiting friends and family members, tend to occur in the evenings. If

the respondents typically drive during daytime hours, they may not have systems in place that could provide them transportation to evening events. Thus, we cannot assume that all drivers with low vision have the opportunity to fully participate in typical life activities, particularly social activities. Because social participation is associated with good mental health (Kawachi & Berkman, 2001), drivers with low vision should be encouraged to explore alternative transportation methods for evening activities that allow them to remain or become socially active.

The ability to drive does not mean that transportation concerns are not impacting drivers' employment options. Just over half of the drivers were employed and one of the unemployed was looking for work. Six of the drivers said they had turned down jobs because of transportation concerns and three said that lack of transportation limited their employment. Public transportation could be a viable option for drivers with transportation limitations that impact their employment; however, although most respondents in our study had access to public transportation, fewer than half of those with access actually used it.

Only three drivers, including one bioptic user, received services from a state VR agency and only four received O&M services. Considering the recruitment strategies used to disseminate the survey, and the fact that most respondents were of working age or younger when they experienced significant vision loss, it was surprising that more respondents were not recipients of VR and O&M services. VR services could be helpful to drivers with low vision in exploring transportation options, and finding and retaining employment that accommodates their vision loss and their driving restrictions. O&M services could also be beneficial to drivers who need instruction and support in accessing and using public transportation.

Just under half of the drivers sustained their vision loss at an early age but still learned to drive and obtained a driver's license. Potentially, other people with early onset low vision would be able to learn to drive if they received appropriate driving instruction and/or evaluation for a bioptic device.

In rating their self-efficacy about transportation related tasks, non-bioptic drivers had the least confidence in their ability to arrange a fair price for daily transportation to and from work with a driver. This finding is somewhat surprising as we would expect drivers to be aware of the expenses associated with driving and thus able to determine appropriate compensation when purchasing the service from another driver. Conversely, those who have never hired a driver would likely lack information and experience with the process of arranging transportation with a driver, which may explain drivers' low confidence in their ability to successfully perform this task. Drivers also rated themselves with lower confidence in identifying two or more ways to get to and from work and using the internet to find transportation options. Lower scores on these items indicate that if unable to drive, these respondents may have difficulty making other transportation arrangements.

This information about drivers with low vision confirms the need for more in-depth research on this topic as there are many unanswered questions regarding the behaviors and needs of low vision drivers. Much of the existing research about low vision drivers concerns their use of bioptics to drive (Huss & Corn, 2004; Vincent, Lachance, & Deaudelin, 2012) with a primary focus on safety concerns. Future research is needed to explore how driving limitations might impact social and vocational options and choices and the consequences of those limitations. Much of the existing literature also focuses on persons who are older and had driving experience before their vision loss (Corn & Rosenblum, 2002; DeCarlo et al., 2003; Rosenblum & Corn,

2002a, 2002b). Further information about the characteristics and needs of persons who learn to drive with low vision, particularly those who drive without bioptics, is also needed to identify whether additional rehabilitation services would be helpful to these low vision drivers. Additionally, emerging smart car technology is expected to affect transportation for persons with visual impairments and its availability and use should be evaluated.

One of the challenges to conducting future research will be in identifying a sufficient sample. Researchers will have to explore multiple avenues to identify and recruit potential participants, particularly if they want to include both those who use bioptics and those who do not, and persons who experience vision loss at younger ages as well as those who lose vision later in life. In addition to working with VR and O&M professionals and bioptic providers, including low vision clinics, to generate potential participants, contacts with OTs and driving rehabilitation specialists is advised.

Several limitations should be considered when interpreting our findings. Data for this study came from a larger survey focusing on transportation issues of drivers and non-drivers who are blind or have low vision. Recruitment efforts did not target drivers specifically; thus, this study included a relatively small sample of people with low vision who had driver's licenses and who continued to drive. Respondents were volunteers recruited using a non-probability sampling method via electronic communications. All data were collected online; therefore, respondents had internet access and possessed sufficient technology skills for completion of a web-based survey. Accordingly, results of this study should be interpreted with caution as they may not generalize to the U.S. population of adult drivers who have low vision.

## Implications for Practice

A driver's license does not necessarily equate to a lack of service needs, yet few drivers in our study reported receiving VR services. Referral to VR, including independent living programs for older individuals who are blind (OIB), might help drivers identify additional low vision services that could benefit them in their daily lives and/or employment endeavors. These services could help working-age consumers perform duties associated with employment and assist them in identifying employment opportunities that accommodate driving restrictions. Both VR, including OIB, and O&M providers might assist some low vision drivers in learning to better identify and access alternate transportation options, including public transportation, for times when their driving is restricted.

Drivers with low vision who lack confidence in performing tasks related to arranging transportation may benefit from support in this area. Self-efficacy theory stresses that mastery experiences promote confidence (Bandura, 1994). Gaining successful experiences with transportation-related tasks should promote confidence in low vision drivers' ability to perform those tasks successfully in the future. Service providers can facilitate these experiences by referring drivers to services such as O&M training (as appropriate), and sharing information and resources related to local transportation options and customs. For instance, if consumers lack confidence in arranging a fair price for transportation with a driver, service providers could recommend using the government reimbursement rate. Resources for exploring transportation options include *Finding Wheels* (Corn & Rosenblum, 2000) and online resources at http://blind.msstate.edu/our-products/transportation/.

Driving may be a feasible option for some people who have low vision. However, it appears that some potential drivers are unaware of this option. Adult rehabilitation providers, both government and private, should share information about driving as a potential option with

adults who have adventitious vision loss and point them toward accurate, up-to-date resources about state driving laws (including those related to bioptics), and evaluation and training for bioptic devices, such as clinical low vision examinations and subsequent visual and driver training. Teachers of students with visual impairments, VR providers, and O&M specialists can share similar information with youth and young adults who have congenital low vision, as well as provide referrals, as appropriate, to driving rehabilitation specialists.

The relationship with bioptic providers and VR has the potential of being a reciprocal one. Just as VR personnel should explore referring persons with low vision for evaluation by bioptic providers, VR could receive referrals from persons seeking bioptics who may need VR, O&M, or other services. Establishing such a procedure would allow for each person with low vision the opportunity to be evaluated for the best array of services suitable to his or her individual needs. Further, driving rehabilitation specialists and OTs may be able to provide valuable services to persons with low vision who are attempting to gain or regain a valid driver's license, so reciprocal referrals may again be appropriate. VR and O&M providers, as well as teachers of students with visual impairments, may wish to visit the websites for AOTA and ADED to learn more about what these professions offer as well as to use some of the valuable resources they have collected regarding driving with low vision.

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Table 1

*Demographic Characteristics of the Sample*

| Variable | % | *n* |
|---|---|---|
| Race or ethnicity | | |
| White | 76.5 | 13 |
| Black or African American | 11.8 | 2 |
| Hispanic | 5.9 | 1 |
| American Indian or Alaskan Native | 5.9 | 1 |
| Age at onset of vision loss | | |
| Birth to 1 | 23.5 | 4 |
| 5-12 | 23.5 | 4 |
| 28-54 | 35.3 | 6 |
| 55-65 | 17.6 | 3 |
| Level of vision loss | | |
| Legally blind | 23.5 | 4 |
| Less severe visual impairment | 76.5 | 13 |
| Can read standard-sized print | | |
| Yes, without assistive devices | 35.3 | 6 |
| Yes, but only with assistive devices | 52.9 | 9 |
| No, not even with assistive devices | 11.8 | 2 |
| Educational level | | |
| High school graduate | 11.8 | 2 |
| Some college or Associate's degree | 29.4 | 5 |
| Bachelor's degree | 29.4 | 5 |
| Graduate or professional degree | 29.4 | 5 |
| Current household income | | |
| Less than $25,000 | 5.9 | 1 |
| $25,000-$49,999 | 17.6 | 3 |
| $50,000-$74,999 | 41.2 | 7 |
| $75,000-$99,999 | 5.9 | 1 |
| Chose not to answer | 29.4 | 5 |
| Census region | | |
| Northeast | 5.9 | 1 |
| Midwest | 17.6 | 3 |
| South | 52.9 | 9 |
| West | 23.5 | 4 |
| Employment Status | | |
| Employed | 52.9 | 9 |
| Not employed | 47.1 | 8 |

*Note.* $N = 17$

Table 2

*Driving Problems, Driving Restrictions, and Employment Status of Bioptic and Non-Bioptic Drivers*

| Variable | n (%) | |
|---|---|---|
| | Bioptic drivers ($n$ = 6) | Non-bioptic drivers ($n$ = 10) |
| Driving problems | | |
| Yes, during the day | 0 | 1 (10.0%) |
| Yes, at night | 6 (100%) | 8 (80.0%) |
| No problems | 0 | 1 (10.0%) |
| Driving restrictions[a] | | |
| Speed | 4 (66.7%) | 6 (60.0%) |
| Length of time | 3 (50.0%) | 8 (80.0%) |
| Route | 4 (66.7%) | 5 (50.0%) |
| Employment status | | |
| Employed | 1 (16.7%) | 7 (70.0%) |
| Unemployed | 1 (16.7%) | 2 (20.0%) |
| Retired | 3 (50.0%) | 1 (10.0%) |
| Volunteer work only | 1 (16.7%) | 0 |

*Note.* One respondent did not respond to the question regarding use of bioptics.

[a]Respondents could select more than one driving restriction.

Table 3
*Descriptive Statistics for Transportation Self-Efficacy Items*

| Item | Mean (*SD*) | | |
|---|---|---|---|
| | Bioptic drivers (*n* = 5) | Non-bioptic drivers (*n* = 10) | Total (*n* = 15) |
| 1. Arrange a fair price for daily transportation to and from work with a driver | 7.00 (4.47) | 3.00 (3.53) | 4.33 (4.19) |
| 2. Use the internet to find information about transportation options nearby | 5.00 (5.00) | 4.90 (4.07) | 4.93 (4.22) |
| 3. Identify two or more ways to get to and from work | 7.00 (4.47) | 4.40 (4.09) | 5.27 (4.25) |
| 4. Arrange transportation to/from work with someone who works nearby | 7.60 (4.34) | 5.00 (4.03) | 5.87 (4.17) |
| 5. Go through the process of finding and hiring a safe and reliable driver | 8.40 (3.58) | 5.10 (4.04) | 6.20 (4.09) |
| 6. Call community agencies to request and/or schedule transportation to work | 8.40 (3.58) | 6.40 (4.79) | 7.07 (4.40) |
| 7. Create back-up plan when regular transportation to/from work is unavailable | 7.00 (4.47) | 7.40 (3.63) | 7.27 (3.77) |
| 8. Arrange transportation to and from work with co-workers | 9.00 (2.24) | 6.50 (3.87) | 7.33 (3.54) |
| 9. Explain to a driver where I need to go | 6.60 (4.22) | 8.00 (3.23) | 7.53 (3.50) |
| 10. Find out about average costs of different transportation options in the area | 9.00 (2.24) | 7.30 (4.14) | 7.87 (3.62) |
| 11. If needed, ask for assistance upon arriving at a destination | 7.80 (3.03) | 7.90 (3.18) | 7.87 (3.02) |
| 12. Ride a bus or shuttle (if it were available) | 9.00 (2.24) | 7.90 (3.07) | 8.27 (2.79) |

*Note.* Two respondents had missing data.